

# **Financial Development, Government Ownership of Banks and Firm Innovation**

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## **Abstract**

Using a newly available World Bank survey of 28,000 firms from 46 countries, we examine how financial development affects firm innovation around the world. We find that while stock market development significantly enhances firm innovation, banking sector development has mixed effects. We show that the latter result can be explained by different levels of government ownership of banks. Specifically, higher government ownership of banks leads to significantly lower levels of firm innovation, and this impact is significantly stronger for smaller firms. The results are robust to various controls such as firms' human capital and ownership structures, and to estimation using instrumental variables techniques. In addition, following Acharya and Subramanian (2009), we measure firm innovation by the number of U.S. patents as well as the number of citations of those patents at the patent-class level, and find that, in a sample of 46 countries, the government ownership of banks in a country has negative and significant impact on firm innovation.

**Keywords:** Innovation, Government Ownership of Banks, Finance and Growth

**JEL Classification:** O31, D21, G32

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## 1. Introduction

How does financial development affect economic growth? In the nearly two decades since the seminal work of King and Levine (1993a), economists have identified two main channels: capital accumulation and total factor productivity (e.g., Levine and Zervos 1998). Despite abundant macroeconomic evidence, however, microeconomic evidence that identifies these channels is surprisingly lacking.<sup>1</sup> To help address this, we use a World Bank Investment Climate Survey collected from over 28,000 firms in 46 countries in 2000 to examine the effects of financial development on firm innovation, which is a key source of growth in total factor productivity. Our results show that while stock market development has positive effects on firm innovation, the impact of banking sector development is mixed.

The finding for stock markets is perhaps not surprising, given that they are forward-looking and finance many risky innovative projects that involve problems of asymmetric information, skewed and uncertain returns, and lack of collateral. The ambiguous role of banking sector development, on the other hand, is somewhat puzzling, especially since banks account for a high proportion of external finance even in “market based” financial systems.<sup>2</sup> We hypothesize that variations in government ownership of banks can account for these mixed effects. La Porta, Lopez-de-Silanes and Shleifer (2002) show with macroeconomic data for 92 countries that higher government ownership of banks in 1970 is associated with significantly lower subsequent productivity growth.

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<sup>1</sup> Beck, Demirguc-Kunt and Maksimovic (2005) is a notable exception in that these authors do offer firm-level evidence on the impact of financial development on firm growth. Rajan and Zingales (1998) provide similar evidence at the industry level.

<sup>2</sup> For example, Mishkin (2004) reports that the stock market accounted for only 9.2 percent of the external financing of American businesses over the period from 1970 to 1996 while bank loans accounted for 40.2 percent.

Motivated by their macroeconomic evidence, we merge the new World Bank dataset with that of Barth, Caprio and Levine (2006) on government and foreign ownership of banks in 151 countries and find that government ownership of banks has negative and significant effects on firm innovation. These effects turn out to be more harmful for small firms than for large firms. The conclusions are robust to controls for firms' ownership structures and the human capital of their managers and employees, and to estimation with instrumental variables. We also find that foreign ownership of banks has significant and positive effects on firm innovation. Considering the fact that most countries in our sample are developing countries, this suggests that foreign banks in those countries may be better at screening innovative projects.

Our study contributes to the literature in several ways. To our knowledge, it is the first to examine the differential impact of stock market and banking sector development on firm innovation using cross-country data. Our result that stock market development is more conducive to firm innovation is in line with the theoretical prediction of King and Levine (1993b) and the empirical findings of Brown, Fazzari and Petersen (2009). It also appears that we are the first to examine the relationship between firm innovation and government ownership of banks, allowing us to contribute to the recent debate on the impact of government ownership of banks. For example, La Porta, Lopez-de-Silanes and Shleifer (2002) offer evidence that higher levels of government ownership are associated with slower growth in a country's per capita income and productivity, while macroeconomic evidence in Andrianova, Demetriades and Shortland (2010) for 1995 to 2007 shows exactly the opposite to be the case. We focus on the impact of government ownership of banks on firm-level innovation, the micro-foundation of productivity and economic growth, and find evidence.

Our study builds upon findings by Ayyagari, Demirguc-Kunt and Maksimovic (forthcoming, ADM henceforth), who investigate the determinants of firm innovation in emerging markets using the same innovation data that we employ. They find that the use of external finance leads to greater innovation by private firms, but not by state-owned firms. In contrast to ADM, we focus on the impact of country-level financial development such as stock market development and banking sector development on firm innovation.<sup>3</sup> We also investigate how government ownership of banks affects firm innovation.

We also contribute to the literature on the finance-growth nexus. Specifically, at the cross-country macroeconomic level, King and Levine (1993a,b), Levine and Zervos (1998), Rousseau and Wachtel (2000), and Beck and Levine (2004) show that financial development promotes growth. Rajan and Zingales (1998) and Beck, Demirguc-Kunt and Maksimovic (2005) provide evidence at the industry and firm level that access to external finance contributes to industry and firm growth, respectively. Our study provides international evidence on the microeconomic channel of how finance influences growth. Specifically, financial development, especially stock market development, enhances firm innovation, which in turn accelerates the total factor productivity growth and economic growth at the macroeconomic level.

Last but not least, this study contributes to cross country studies on firm innovation. Such studies have shown that creditor rights (Acharya and Subramanian 2009), labor protection

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<sup>3</sup> Other contributions to the literature on finance and firm innovation include King and Levine (1993b), who argue that better-developed financial intermediaries can efficiently fund promising entrepreneurs and, hence, improve the society's innovation progress. Benfratello, Schiantarelli, and Sembenelli (2008) find that provincial banking development boosts local firms' innovative activities in Italy. Rajan and Zingales (2003) hypothesize that relationship-based financing in the form of bank loans tends to discourage corporate innovation, and their hypothesis is supported by evidence for US public firms in Atanassov, Nanda and Seru (2007).

(Acharya, Baghai-Wadji, and Subramanian 2010), patent laws (Moser 2005; and Qian 2007) and foreign competition (Gorodnichenko, Svejnar, and Terrell 2010) affect firm innovation across different countries, but the impact of stock market development and government ownership of banks on firm innovations has yet to be explored.

The paper is organized as follows. Section 2 discusses the theoretical motivation, section 3 discusses the data of over 28,000 firms from 46 countries, section 4 discusses the empirical models, section 5 reports the main results, section 6 reports robustness check results, section 7 reports evidence from US patents, and section 8 concludes.

## **2. Theoretical motivation**

Financial constraints are likely to be more serious for innovative projects because problems of asymmetric information and incentives tend to be more severe (Stiglitz and Weiss 1981; Stein 2003). First, the long gestation period between the conception and commercialization of innovative projects, coupled with their inherent riskiness, makes it difficult hard for investors to distinguish good projects from bad ones.<sup>4</sup> Second, on average, about half of the expenditures on innovation come in the form of wages and salaries, which makes it difficult for innovative firms to provide sufficient collateral for bank loans. Finally, though information disclosure is an effective way of mitigating information problems, innovators may be reluctant to reveal information for fear of losing ideas to competitors.

Incentive problems may also be more severe for innovative projects because risk-averse managers or insiders are often reluctant to invest in them, even if they are value enhancing to shareholders (Amihud and Lev, 1981). Such managers tend to avoid or under-invest in

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<sup>4</sup> See, for example, Hall and Lerner (2009).

innovation to protect their firm-specific human capital, which is hard to diversify, and to maintain their private benefits of control, such as perquisite consumption.

A well developed financial system may alleviate information and incentive problems. A primary function of the financial system is to produce information to improve the ex-ante assessment of investment opportunities and to facilitate monitoring, thereby improving resource allocation (Merton 1995). Because of the serious information and incentive problems in innovative activities, financial development has a vital impact on firm innovation. Next, we discuss the effects of different dimensions of a financial system on firm innovation.

First, the theoretical model of Aghion and Tirole (1994) shows that arms-length financing is better at encouraging corporate innovation than relationship-based financing. The intuition is that a financier without much information about the firm's project will give more discretion to the firm's manager to encourage initiatives. The theoretical model of Allen and Gale (1999) shows that markets may be more effective than banks in gathering and processing information in new and uncertain situations involving innovative products and processes. Studying a sample of American public firms, Atanassov, Nanda and Seru (2007) find that firms relying more on equity and public debt are more innovative as measured by the numbers of patents and citations. Brown *et al.* (2009) find that for young US firms between 1990 and 2004, greater access to equity finance significantly boosted R&D and could explain most of the aggregate R&D cycle during that period. Motivated by these studies, we hypothesize a positive relation between country-level stock market development and firm innovation.

Another important dimension of the financial system is the extent to which banks are owned by the government. La Porta, Lopez-de-Silanes and Shleifer (2002) summarize the two

views on this issue: the “development view” versus the “political view.”<sup>5</sup> The “development view” argues that state-owned banks are better at promoting economic development, especially in “strategic economic sectors,” than private banks, while the “political view” argues that the main motivation for governments to control banks is to “provide employment, subsidies, and other benefits to supporters, who return the favor in the form of votes, political contributions, and bribes.” The government ownership of banks then “allows the government extensive control over the choice of projects being financed”, but “the projects the government finances are likely to be inefficient and have an adverse effect on productivity growth.” While La Porta, Lopez-de-Silanes and Shleifer (2002)’s cross-country study supports the “political view,” Andrianova, Demetriades and Shortland (2010)’s cross-country study supports the “development view.” We believe that a microeconomic perspective might shed some light on such controversy. This motivates us to investigate how government ownership of banks affects firm innovation, which forms a micro-foundation of productivity growth and economic growth.

### **3. Data**

We get firm-level data from the World Bank Investment Climate Survey. The data consist of survey responses of over 50,000 firms in 46 countries<sup>6</sup>. The sample period is 2002 through

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<sup>5</sup> In a similar vein, Sapienza (2004) elaborates on three main views of state-owned enterprises: the social, agency and political views. While the “social view” would predict a more socially efficient allocation of resources, the latter two views would both predict some misallocation of resources.

<sup>6</sup> 18 of those countries are among the 35 countries in the List of Dow Jones Emerging Markets (2010).

2005.<sup>7</sup> Appendix 1 includes a full list of countries in our sample. The sample consists mostly of middle-income countries, but about 1/4 of the sample countries are in low-income countries as classified by the World Bank.

The information on innovation from a questionnaire in which firms are asked if they have undertaken any of the following ten innovative activities 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 is produced,
- 4) Discontinued at least one product (not production) line,
- 5) Opened a new plant,
- 6) Closed at least one existing plant or outlet,
- 7) Agreed to a new joint venture with a foreign partner,
- 8) Obtained a new licensing agreement,
- 9) Outsourced a major production activity that was previously conducted in-house, and
- 10) Brought in-house a major production activity that was previously outsourced.

The firm responses are coded as 0-1 (No-Yes) dummy variables for each of the 10 questions. Following ADM (2006, 2007), in addition to the ten individual indicators of firm innovation, we analyze four aggregate indicators. *DYNAMISM* is an aggregate index obtained by summing the number of innovative activities of firms. *INDEX8* is an aggregate index obtained by summing the number of activities in which the firm engages, excluding two of the activities, *Discontinued*

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<sup>7</sup> Many countries are only surveyed once so the data are not panel data. See ADM (forthcoming) for more discussion about the data.

*at least one product line* and *Closed at least one existing plant or outlet*. These activities are left out of INDEX8 because they are less likely to require outside financing than activities such as the introduction of new technology or the opening of a plant. They are instead represented in **INDEX2** which is obtained by summing firm responses to the two activities, *Discontinued at least one product line* and *Closed at least one existing plant or outlet*. **CORE** is an aggregate index obtained by summing firm responses to two activities, *Developed a major new product line*, and *Introduced new technology that has substantially changed the way that the main product is produced*, to reflect the narrow definition of core innovation as used in existing literature.

The Survey also reports data on firm characteristics, such as firm size (small firms employ 1-19 employees, medium firms employ 20-99 employees, and large firms employ over 100 employees), firm age (2000 minus the year when the firm was established), number of establishments, capacity utilization (which takes values 1 to 3 corresponding to capacity utilization levels below 50%, between 50% and 80%, and above 80%) and a dummy variable “Corporations” that takes the value 1 if the firm is legally incorporated and 0 if the firm is organized as a cooperative, sole proprietorship, partnership or has another legal form.<sup>8</sup>

For financial development measures, we collect stock market capitalization (as % of GDP), domestic credit provided by banking sector (as % of GDP) and GDP per capita in 2000 constant dollars from World Development Indicators. To obtain bank ownership data, following Barth, Lin, Lin and Song (2009), we further merge the above dataset with the Bank Regulation and Supervision database in Barth et al. (2006). Specifically, Barth et al. collect responses to the

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<sup>8</sup> For more details about the World Bank Investment Climate Survey, please refer to Section 3 of ADM (forthcoming).

following two questions regarding bank ownership from central banks of 151 countries in 2001: (1) “What fraction of the banking system’s assets are in banks that are 50% or more government owned?” and (2) “What fraction of the banking system’s assets are in banks that are 50% or more foreign owned?”

### **Insert Table 1**

Table 1 reports the average values of major innovation indicators for each country in our sample. The table skips two innovations “Discontinued at least 1 product” and “Closed at least 1 existing plant”, together with their sum “index2.” To maximize the sample size and statistical power, we keep the observations from a given country as long as there are at least two innovation indicators available for the country. In our sample, on average, 41% of the firms have developed a major new product line in the past three years, 59% of firms have updated an existing product line, 37% of firms have introduced new technology that has substantially changed the way that the main product is produced. It is interesting to note that in our sample, Brazil and South Africa seem to be the most innovative countries, if we focus on indicators “New product line”, “Updated existing product line”, “New technology”, “Dynamism” and “Core.”

### **Insert Table 2**

Table 2 reports the summary statistics. To lessen the impact of outliers, we Winsorize two of the control variables, “firm age” and “number of establishments,” at 1 percent level.<sup>9</sup> Table 2 shows that the average firm age is 12.85 years old, and the median firm age is 7 years old, so there firms in our sample tend to be young firms that may need external finance the most.<sup>10</sup> In

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<sup>9</sup> Before Winsorizing, the maximum firm age was 1,000, and the maximum number of establishments was 950.

<sup>10</sup> Brown *et al.* (2009) find that equity finance is most crucial for young firms’ R&D activities in the US between 1990 and 2004.

terms of firm size, 23% of firms are large firms, 31% of firms are medium-size firms, and the remaining 46% of firms are all small firms. As Beck, Demirguc-Kunt and Maksimovic (2005) and Beck, Demirguc-Kunt, and Levine (2008) find out, small firms may be affected the most by financial development because they are most financially constrained. Therefore, about half of firms in our sample may be very financially constrained and need external finance. The definitions and sources of all data items are available in Appendix 3.

#### 4. Empirical Model

The basic empirical model in the examination of the effects of financial development on firm innovation is as follows: for firm  $i$  in industry  $j$  in country  $k$ :

$$\begin{aligned} \text{Firm Innovation}_{i,j,k} = & \alpha + \beta_1 \text{Financial Development Indicator}_{i,j,k} + \beta_2 \text{Medium Firm Dummy}_{i,j,k} \\ & + \beta_3 \text{Large Firm Dummy}_{i,j,k} + \beta_4 \text{Firm Age}_{i,j,k} + \beta_5 \text{Corporation Dummy}_{i,j,k} \\ & + \beta_6 \text{Number of Establishments}_{i,j,k} + \beta_7 \text{Dummy for Capacity Utilization between [50\%,80\%]}_{i,j,k} \\ & + \beta_8 \text{Dummy for Capacity Utilization above 80\%}_{i,j,k} + \beta_9 \log(\text{GDP/Capita})_k + \beta_j + \varepsilon \end{aligned} \quad (1)$$

where the financial development indicator is either stock market capitalization/GDP or bank credit/GDP,  $\beta_j$  is industry fixed effect, and “Firm Innovation” is one of the aggregate innovation indicators or individual indicators. Given the high correlation of 0.71 between these two measures, we decide to enter them into regressions separately. To examine the effects of foreign ownership of banks, we add foreign ownership of banks to the above basic model. The correlation of -0.21 between this measure and stock market capitalization/GDP reassures us that there is no multicollinearity. Since the ten individual indicators of firm innovation are 0-1 variables, these regressions are estimated using the Logit model. For the aggregate indicators, we

use the Ordered Logit model. All regressions estimate robust standard errors and report corresponding p-values.

To test the hypothesis that the mixed effects of bank credit on firm innovation can be explained by the differential levels of government ownership of banks, we estimate the following regression equation for firm  $i$  in industry  $j$  in country  $k$  and focus our attention on the interaction term between bank credit and government ownership of banks:

$$\begin{aligned} \text{Firm Innovation}_{i,j,k} = & \alpha + \beta_1 \text{Government Ownership of Banks}_k * \text{Bank Credit}_k \\ & + \beta_2 \text{Government Ownership of Banks}_k + \beta_3 \text{Bank Credit}_k + \beta_4 \text{Medium Firm Dummy}_{i,j,k} \\ & + \beta_5 \text{Large Firm Dummy}_{i,j,k} + \beta_6 \text{Firm Age}_{i,j,k} + \beta_7 \text{Corporation Dummy}_{i,j,k} \\ & + \beta_8 \text{Number of Establishments}_{i,j,k} + \beta_9 \text{Dummy for Capacity Utilization between [50\%,80\%]}_{i,j,k} \\ & + \beta_{10} \text{Dummy for Capacity Utilization above 80\%}_{i,j,k} + \beta_{11} \log(\text{GDP/Capita})_k + \beta_j + \varepsilon \end{aligned} \quad (2)$$

The baseline empirical model in the examination of the effects of government ownership of banks on firm innovation is: for firm  $i$  in industry  $j$  in country  $k$ :

$$\begin{aligned} \text{Firm Innovation}_{i,j,k} = & \alpha + \beta_1 \text{Government Ownership of Banks}_k + \beta_2 \text{Medium Firm Dummy}_{i,j,k} \\ & + \beta_3 \text{Large Firm Dummy}_{i,j,k} + \beta_4 \text{Firm Age}_{i,j,k} + \beta_5 \text{Corporation Dummy}_{i,j,k} \\ & + \beta_6 \text{Number of Establishments}_{i,j,k} + \beta_7 \text{Dummy for Capacity Utilization between [50\%,80\%]}_{i,j,k} \\ & + \beta_8 \text{Dummy for Capacity Utilization above 80\%}_{i,j,k} + \beta_9 \log(\text{GDP/Capita})_k + \beta_j + \varepsilon \end{aligned} \quad (3)$$

Similar to Beck, Demirguc-Kunt and Maksimovic (2005) and Beck, Demirguc-Kunt, and Levine (2008), who show that financial constraints have different effects on small and large firms, we hypothesize that the government ownership of banks has differential effects on innovation for small firms and large firms. To test this hypothesis, we estimate the following regression. In this regression, to avoid multicollinearity, we include  $\log(\text{Sales})$  instead of firm size dummies as an independent variable to measure firm size.

$$\begin{aligned}
\text{Firm Innovation}_{i,j,k} = & \alpha + \beta_1 \text{Government Ownership of Banks}_k * \text{Small Firm Dummy}_{i,j,k} \\
& + \beta_2 \text{Government Ownership of Banks}_k * \text{Large Firm Dummy}_{i,j,k} + \beta_3 \log(\text{Sales})_{i,j,k} \\
& + \beta_4 \text{Firm Age}_{i,j,k} + \beta_5 \text{Corporation Dummy}_{i,j,k} + \beta_6 \text{Number of Establishments}_{i,j,k} \\
& + \beta_7 \text{Dummy for Capacity Utilization between } [50\%,80\%]_{i,j,k} \\
& + \beta_8 \text{Dummy for Capacity Utilization above } 80\%_{i,j,k} + \beta_9 \log(\text{GDP/Capita})_k + \beta_j + \varepsilon \quad (4)
\end{aligned}$$

Finally, following ADM (forthcoming), we also add firm human capital and ownership structures as two separate sets of control variables to our baseline empirical model (3) to see if our results are robust to the inclusion of these control variables.

## 5. Results

### Insert Table 3

Table 3 reports the effect of the stock market development, as measured by stock market capitalization/GDP, on firm innovation. Panel A shows that stock market development has positive and significant effects on all four aggregate innovation measures. They are all significant at 1% level. Panel B reports that stock market development has positive and significant effects on 7 out of 10 individual innovation measures. Most noticeably, it has positive and significant effects on “New product line” and “New technology”, which are among the key components of core innovation measures in existing literature. Converted to marginal effects, a standard deviation increase in the stock market capitalization/GDP leads to a 4.2% increase in the probability of developing a new product line, and a 5.1% increase in the probability of adopting a new technology that substantially changes the way that the main product is produced. These are quantitatively large effects, whose sizes are similar to those reported in Gorodnichenko,

Svejnar, and Terrell (2010) when they gauge the marginal effects of foreign competition on firm innovation in 27 emerging market economies.<sup>11</sup>

The coefficients of control variables have similar signs and sizes to those reported in ADM (forthcoming). For example, large and medium firms are significantly more likely to innovate, the number of establishments significantly increases the probability of innovation, firms organized as corporations innovate more, and younger firms tend to innovate more. In tests (untabulated) where the industry dummies are not included, we obtain similar results.

#### **Insert Table 4**

Table 4 reports that when we consider stock market development and foreign ownership of banks together, stock market development still exerts independent positive and significant effects on firm innovation. In addition, foreign ownership of banks has positive and significant effects on all 4 aggregate measures of firm innovation. The positive and significant effects of foreign ownership of banks is consistent with Bonin, Hasan and Watchtel (2005), who show that foreign-owned banks provide better service in 11 transition countries. For example, their superior expertise and rich experience in screening risky innovative projects may enable them to fund more of such projects than local banks.

#### **Insert Table 5**

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<sup>11</sup> Following footnote 19 in Gorodnichenko, Svejnar, and Terrell (2010), these marginal effects are derived as follows: the standard deviation of stock market capitalization/GDP is 0.32, and the marginal effects for “New product line” and “New technology” are 0.054 and 0.058, respectively. Hence, the increases in probability are:  $0.32*0.054=0.017$ , and  $0.32*0.058=0.019$ , respectively. Dividing these by the unconditional probabilities of “New product line” (0.41) and “New technology” (0.37) yields 4.2% and 5.1%, respectively.

Table 5 reports that banking sector development, as measured by bank credit/GDP, has mixed effects on firm innovation. It has negative and significant effects on 3 out of 4 aggregate measures of firm innovation, but positive and significant effect on 1 out of 4 aggregate measure of firm innovation. It has negative and significant effects on 5 out of 10 individual measures of firm innovation, but positive and significant effects on 4 out of 10 individual measures of firm innovation. We will try to explain such mixed effects by differentiating bank credit based on the government ownership of banks.

#### **Insert Table 6**

To explain the mixed effects of banking sector development on firm innovation, we hypothesize that credit extended by banks with higher government ownership leads to lower innovation. To test this hypothesis, we use regression equation (2) that interact bank credit with government ownership of banks. Table 6 provides strong evidence to support our hypothesis. The coefficients on the interaction term are negative and significant for all 4 aggregate innovation indicators and 8 out of 10 individual innovation indicators.

#### **Insert Table 7**

Table 7 estimates equation (3), and reports the effect of government ownership of banks on firm innovation. Higher government ownership of banks significantly reduces firm innovation for 2 out of 4 aggregate innovation indicators. We will try to tackle the potential endogeneity issue in Section 6: “Robustness check”, where we find that after controlling for endogeneity, higher government ownership of banks significantly reduces firm innovation for all 4 aggregate innovation indicators, and 7 out of 10 individual innovation indicators.

#### **Insert Table 8**

Table 8 estimates equation (4), and reports the effects of government ownership of banks on firm innovation for small firms versus large firms. Such effects are indeed more adverse for small firms. The difference between the coefficients on small\*government and large\*government is significant at 1% for 3 aggregate indicators and 6 individual indicators. This result is consistent with Sapienza (2004), who concludes that in Italy, “state-owned banks mostly favor large firms”. In general, governments and state-owned banks, out of concern for full employment, social stability and political support, tend to favor large firms. This result also echoes Hennessey and Whited (2007), who conclude that “small firms appear to face large financial frictions, consistent with theories emphasizing adverse selection.”

#### **Insert Table 9**

Table 9 reports similar effects of government ownership of banks on firm innovation when we consider the human capital of firm managers and employees. For example, the highest level of manager’s education takes values 1 to 6 according to the following categories: (1) did not complete secondary school, (2) completed secondary school, (3) vocational training, (4) some university training, (5) graduate degree and (6) post-graduate degree. For the definitions of other human capital variables, please refer to Appendix 3. Consistent with ADM (forthcoming), the highest level of manager’s education has positive and significant effect on all 4 aggregate measures of firm innovation and 7 out of 10 individual measures of firm innovation, attesting to the importance of human capital in firm innovation. We also add other control variables to the baseline regression (3), and Appendix 2 reports the results when we consider the ownership structures of firms. Specifically, we add a control variable “State ownership of firm”, which is a dummy variable that takes the value 1 if the state owns 50% or more of the company and 0 otherwise. The coefficients on government ownership of banks are consistent with the results in

Table 7 from the baseline regression (3), and the coefficients on the control variables are consistent with ADM (forthcoming). For example, “State ownership of firm” is negatively and significantly correlated with innovation in Appendix 2.

## 6. Robustness check

Based on the above results, it seems that government ownership of banks has negative and significant effects on firm innovation. Since government ownership of banks is determined mostly by governments, it is unlikely that the level of firm innovation can cause changes in government ownership of banks. Therefore, reverse causality does not seem to be an issue. However, there might be a third factor that affects both government ownership of banks and firm innovation. To address this possible endogeneity, we use instrumental variables for a two-stage-least-squares estimation. Andrianova, Demetriades and Shortland (2008) find that regulatory quality, rule of law, disclosure index and banking crisis dummy are significant determinants of government ownership of banks. In the first stage, we estimate a Tobit model, where we use regulatory quality, rule of law, disclosure index and banking crisis dummy as the instrumental variables. As expected, regulatory quality and disclosure index have negative and significant effects on government ownership of banks, while banking crisis dummy has positive and significant effects.

In stage 2, we use the predicted government ownership of banks from stage 1 to estimate the following Ordered Logit model (for aggregate indicators of firm innovation) and Logit model (for individual indicators of firm innovation):

$$\begin{aligned}
 \text{Firm Innovation}_{i,j,k} = & \alpha + \beta_1 \text{Predicted Government Ownership of Banks}_k + \beta_2 \text{Medium Firm Dummy}_{i,j,k} \\
 & + \beta_3 \text{Large Firm Dummy}_{i,j,k} + \beta_4 \text{Firm Age}_{i,j,k} + \beta_5 \text{Corporation Dummy}_{i,j,k} \\
 & + \beta_6 \text{Number of Establishments}_{i,j,k} + \beta_7 \text{Dummy for Capacity Utilization between [50\%,80\%]}_{i,j,k} \\
 & + \beta_8 \text{Dummy for Capacity Utilization above 80\%}_{i,j,k} + \beta_9 \log(\text{GDP/Capita})_k + \beta_j + \varepsilon \quad (5)
 \end{aligned}$$

### **Insert Table 10**

Table 10 reports the results from the second-stage estimation. After controlling for potential endogeneity, government ownership of banks still has negative and highly significant effects on firm innovation in almost all cases.

## **7. Evidence from U.S. Patents**

The cross-country study results in sections 5 and 6 are based on data from a World Bank survey, which may be subject to each country's own interpretation of some survey questions. To complement previous results, we study the U.S. patents filed by 46 countries in 2001 and their citations at the patent-class level.<sup>12</sup> The main advantage of using such data is that U.S. Patent Office (USPTO) uses consistent criteria to judge the merits of patent applications from all over the world and makes decisions based on those criteria.

Our main measures of innovative activities are the number of patents and the number of citations. Table 11 lists their summary statistics for the countries in our sample.

### **Insert Table 11**

Similar to Acharya and Subramanian (2009), we focus on the numbers of patents and citations filed by a country at the patent-class level. We obtain U.S. patent data from the National Bureau of Economic Research (NBER) Patents File (Hall, Jaffe, and Trajtenberg 2001). Then we merge U.S. patent data with our government ownership of banks dataset and estimate the following regression equations:

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<sup>12</sup> See Acharya and Subramanian (2009) for more discussions about the research methodology. Patent classification of USPTO is similar to industrial classification. The USPTO classifies all U.S. patents into 462 3-digit classes. The detailed classification system can be found at <http://www.uspto.gov/web/patents/classification/>.

$$\begin{aligned} \text{Number of patents } i,k,2001 &= \alpha + \beta_1(\text{Government } k,2001 * \text{Innovation Intensity } i,2000) \\ &+ \beta_2\text{Government } k,2001 + \beta_3\text{Innovation Intensity } i,2000 + \beta X_k + \beta_i + \varepsilon_{i,k,2001} \end{aligned} \quad (6)$$

$$\begin{aligned} \text{Number of citations } i,k,2001 &= \alpha + \beta_1(\text{Government } k,2001 * \text{Innovation Intensity } k,2000) \\ &+ \beta_2\text{Government } k,2001 + \beta_3\text{Innovation Intensity } k,2000 + \beta X_k + \beta_i + \varepsilon_{i,k,2001} \end{aligned} \quad (7)$$

where “Government” refers to government ownership of banks, “Innovation Intensity” refers to an industry’s (patent class’s) propensity to innovate, measured by the number of patents filed by the median U.S. firm in the industry, “*i*” refers to industry and “*k*” refers to country. “*X*” are control variables, such as “Education” and “Bank asset concentration.” The OLS regression results are reported in Table 11.

### **Insert Table 11**

Table 11 reports that  $\beta_1$  is negative and significant at 1% level, therefore confirming our hypothesis that government ownership of banks is detrimental to firm innovation. Bank concentration, as measured by the proportion of assets controlled by the largest 5 banks in the country, has negative and significant effects on firm innovation in all models, which is consistent with Benfratello, Schiantarelli, and Sembenelli (2008). Creditor rights have negative and significant effects on firm innovation in models 3 and 4, which is consistent with Acharya and Subramanian (2009). Education has positive and significant effects on firm innovation in models 1 and 2, confirming the importance of human capital in firm innovation.

## 8. Conclusion

Abundant empirical evidence has shown that financial development promotes economic growth at the macroeconomic level, mainly through the capital accumulation and total factor productivity (TFP) channels. But microeconomic evidence in this field is quite limited. We focus on the TFP channel and investigate how financial development affects firm innovation in 46 countries. Our results show that stock market development promotes firm innovation, while banking sector development has mixed effects.

To explain the latter result, we hypothesize that government ownership of banks has negative effects on firm innovation, and the different levels of government ownership of banks may account for the mixed effects of banking sector development on firm innovation. Our results support this hypothesis, even after controlling for firms' human capital and ownership structures. Government ownership of banks is more harmful for small firms than for large firms in terms of spurring firm innovation. To overcome possible endogeneity problem, we use instrumental variables for the government ownership of banks, and our results support our hypothesis too. In addition, to take advantage of the consistent criteria used to grant U.S. patents, we study U.S. patents filed by 46 countries in 2001, and find that government ownership of banks in a country has negative and significant effects on the number of patents filed by the country at the patent-class level, as well as the number of their citations.

Taken as a whole, we conclude that stock market development has positive and significant effects on firm innovation, but banking sector development has mixed effects, which can be explained by different levels of government ownership of banks. Higher government ownership of banks has been robustly associated with lower levels of firm innovation, especially for small firms. Therefore, our exploration on how financial development affects firm innovation sheds

light on the micro-foundation of the important relationship between finance and growth, especially productivity growth.

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**Table 1. Indicators of Firm Innovation**

Countryname	New product line	Updated existing product line	New technology	Opened a new plant	New JV with foreign partner	New licensing agreement	Outsourced a major activity	Brought in outsourced activity	Dynamism	Core	Index8
Albania	0.4	0.45	0.37	0.02	0.03	0.09	0.03	0.09	1.58	0.77	1.44
Armenia	0.38	0.53	0.43	0.04	0.07	0.09	0.16	0.1	1.69	0.81	1.45
Azerbaijan	0.45	0.32	0.41	0.06	0.08	0.27	0.09	0.04	1.64	0.84	1.42
Belarus	0.43	0.67	0.31	0.06	0.12	0.31	0.16	0.11	2.64	0.74	2.41
Benin	0.4	0.68									
Bosnia and Herzegovina	0.41	0.61	0.4	0.16	0.11	0.1	0.07	0.09	2.08	0.81	1.88
Brazil	0.68	0.95	0.68	0.16	0.04	0.07	0.28	0.21	3.56	1.36	3.07
Bulgaria	0.45	0.46	0.29	0.14	0.05	0.19	0.03	0.07	2.42	0.74	2.02
Cambodia	0.53	0.9	0.6	0.18	0.21	0.21	0.33	0.41	3.44	1.14	3.38
Chile	0.47	0.69	0.27		0.13	0.07	0.19			0.74	
Costa Rica	0.53	0.83	0.29		0.09	0.06	0.25			0.83	
Croatia	0.47	0.79	0.41	0.27	0.08	0.12	0.07	0.13	2.76	0.88	2.32
Czech Republic	0.23	0.39	0.23	0.28	0.06	0.08	0.04	0.12	1.9	0.47	1.61
Ecuador	0.52	0.84	0.51	0.06	0.11	0.08	0.2	0.1	2.97	1.04	2.44
El Salvador	0.62	0.82	0.51	0.06	0.09	0.04	0.11	0.08	2.83	1.13	2.33
Estonia	0.29	0.57	0.25	0.22	0.04	0.15	0.09	0.06	2.2	0.53	1.76
Germany	0.17	0.45	0.23		0.03	0.07	0.06	0.02		0.41	
Greece	0.25	0.36	0.38		0.08	0.09	0.06	0.04		0.63	
Guatemala	0.53	0.81	0.43	0.08	0.12	0.04	0.13	0.14	2.83	0.96	2.28
Guyana	0.49	0.61	0.4							0.89	
Honduras	0.47	0.72	0.46	0.07	0.09	0.04	0.08	0.09	2.43	0.92	2.02
Hungary	0.27	0.39	0.15	0.2	0.02	0.07	0.13	0.09	1.66	0.42	1.29
Ireland	0.38	0.54	0.38		0.11	0.12	0.11	0.11		0.76	
Kazakhstan	0.3	0.44	0.28	0.05	0.04	0.17	0.07	0.03	1.77	0.57	1.43
Kyrgyzstan	0.42	0.58	0.4	0.1	0.11	0.17	0.08	0.04	2.41	0.82	1.92
Latvia	0.37	0.56	0.29	0.23	0.05	0.26	0.06	0.03	2.29	0.66	1.87
Lithuania	0.41	0.49	0.29	0.08	0.04	0.15	0.12	0.06	2.14	0.69	1.74
Madagascar	0.41	0.71	0.63							1.04	
Mali	0.6	0.73	0.6	0.2	0.13	0	0.07	0.07	2.67	1.2	2.4

Countryname	New product line	Updated existing product line	New technology	Opened a new plant	New JV with foreign partner	New licensing agreement	Outsourced a major activity	Brought in outsourced activity	Dynamism	Core	Index8
Mauritius	0.65	0.66	0.65							1.3	
Moldova, Republic of	0.5	0.61	0.39	0.36	0.09	0.24	0.08	0.15	2.94	0.89	2.46
Nicaragua	0.47	0.85	0.53	0.05	0.09	0.02	0.1	0.08	2.68	1	2.19
Oman	0.42	0.38	0.25	0.18	0	0.08	0.02	0.06	1.49	0.67	1.39
Philippines	0.49	0.64	0.42	0.14	0.06	0.13	0.21	0.14	2.77	0.92	2.23
Poland	0.38	0.53	0.32	0.08	0.01	0.08	0.02	0.02	1.77	0.7	1.51
Portugal	0.14	0.21	0.25		0.04	0.04	0.03	0.05		0.4	
Romania	0.36	0.61	0.38	0.31	0.05	0.17	0.08	0.14	2.69	0.74	2.35
Russia	0.37	0.51	0.3	0.12	0.03	0.27	0.07	0.02	2.23	0.67	1.8
Slovakia	0.33	0.73	0.28	0.24	0.07	0.11	0.06	0.08	2.49	0.62	2.04
Slovenia	0.21	0.35	0.31	0.12	0.09	0.13	0.11	0.09	2.09	0.52	1.77
South Africa	0.68	0.84	0.6	0.2	0.09	0.11	0.2	0.34	3.62	1.29	3.07
South Korea	0.37	0.54	0.16		0.12	0.12	0.18	0.1		0.54	
Spain	0.29	0.33	0.31		0.05	0.11	0.09	0.06		0.59	
Thailand	0.5	0.71	0.52	0.08	0.04	0.11	0.18	0.11	2.44	1.02	2.23
Turkey	0.3	0.48	0.33	0.06	0.06	0.04	0.13	0.04	0.92	0.63	0.81
Ukraine	0.47	0.62	0.34	0.1	0.11	0.18	0.13	0.13	2.36	0.81	2.1
Full sample	0.41	0.59	0.37	0.13	0.07	0.12	0.12	0.1	2.57	0.78	2.2

**Table 2. Summary Statistics**

Variable	N	Mean	Median	Min	Max	Standard Deviation
<b><i>Innovation variables</i></b>						
<b><i>Individual Innovation Indicators</i></b>						
New_product_line	28598	0.41	0	0	1	0.49
Updated_existing_product_line	28585	0.59	1	0	1	0.49
New_technology	28387	0.37	0	0	1	0.48
Discontinued_at_least_1_product	26936	0.23	0	0	1	0.42
Opened_a_new_plant	13041	0.13	0	0	1	0.33
Closed_at_least_1_existing_plant	13037	0.1	0	0	1	0.29
New_JV_with_foreign_partner	28222	0.07	0	0	1	0.25
New_licensing_agreement	26934	0.12	0	0	1	0.33
Outsourced_a_new_plant	28228	0.12	0	0	1	0.33
Brought_in_outsourced_activity	25421	0.1	0	0	1	0.3
<b><i>Aggregate Innovation Indicators</i></b>						
Dynamism	13001	2.57	2	0	10	1.92
Core	28387	0.78	1	0	2	0.8
Index8	13008	2.2	2	0	8	1.66
Index2	13034	0.37	0	0	2	0.58
<b><i>Control variables</i></b>						
<b><i>Firm-level control variables</i></b>						
Firm age	28598	12.85	7	0	80	15.81
Number of establishments	28598	1.88	1	0	21	2.8
Corporations	28598	0.45	0	0	1	0.5
Medium-size firm	28598	0.31	0	0	1	0.46
Large-size firm	28598	0.23	0	0	1	0.42
High capacity utilization (capacity utilization>80%)	28598	0.46	0	0	1	0.5
Medium capacity utilization(capacity utilization [50%,80%])	28598	0.43	0	0	1	0.49
<b><i>Macroeconomic variables</i></b>						
Stock market capitalization/GDP	46	0.23	0.13	0	1.54	0.32
Bankcredit/GDP	46	0.51	0.39	0.06	1.52	0.41
Government ownership of banks	43	0.18	0.12	0	0.74	0.19
Foreign ownership of banks	43	0.38	0.25	0.04	0.99	0.31
Per capita GDP in 2000 dollars	46	4324.64	2088.79	230.21	25383.86	5513.07

**Table 3. Stock market development and firm innovation**

**Panel A. Aggregate Innovation Measures**

	1	2	3	4
	dynamism	core	index8	index2
Stock market capitalization/GDP	0.373*** [0.000]	0.278*** [0.000]	0.369*** [0.000]	0.197*** [0.003]
Medium	0.415*** [0.000]	0.471*** [0.000]	0.418*** [0.000]	0.214*** [0.000]
Large	0.668*** [0.000]	0.742*** [0.000]	0.701*** [0.000]	0.284*** [0.000]
Firm Age	-0.001 [0.559]	-0.002*** [0.002]	-0.003*** [0.001]	0.009*** [0.000]
Corporation	0.337*** [0.000]	0.129*** [0.000]	0.399*** [0.000]	-0.013 [0.778]
Number of establishments	0.074*** [0.000]	0.025*** [0.000]	0.060*** [0.000]	0.065*** [0.000]
High Capacity Utilization	0.011 [0.824]	0.123*** [0.002]	0.156*** [0.002]	-0.444*** [0.000]
Medium Capacity Utilization	0.144*** [0.003]	0.230*** [0.000]	0.237*** [0.000]	-0.174*** [0.002]
Log(GDP/Capita)	-0.268*** [0.000]	-0.237*** [0.000]	-0.282*** [0.000]	-0.003 [0.920]
Industry dummies	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes
Number of firms	12929	28304	12936	12965
Number of countries	34	45	34	34
Pseudo R-squared	0.044	0.067	0.048	0.043

This table reports estimation results for the regression equation: for firm  $i$  in industry  $j$  in country  $k$

$$\text{FirmInnovation}_{i,j,k} = \alpha + \beta_1 \text{Stock Market Capitalization/GDP}_k + \beta_2 \text{Medium Firm Dummy}_{i,j,k} + \beta_3 \text{Large Firm Dummy}_{i,j,k} + \beta_4 \text{Firm Age}_{i,j,k} + \beta_5 \text{Corporation Dummy}_{i,j,k} + \beta_6 \text{Number of Establishments}_{i,j,k} + \beta_7 \text{Dummy for Capacity Utilization between [50\%, 80\%]}_{i,j,k} + \beta_8 \text{Dummy for Capacity Utilization above 80\%}_{i,j,k} + \beta_9 \log(\text{GDP/Capita})_k + \beta_j + \varepsilon \quad (1)$$

Robust standard errors are estimated, and corresponding p-values are reported in the brackets. \* p<0.1, \*\* p<0.05, \*\*\* p<0.01. For variable definitions and sources, please see Appendix 3.

p-values in brackets

\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

**Panel B. Individual Innovation Measures**

	1	2	3	4	5	6	7	8	9	10
	New product line	Updated existing product line	New technology	Discontinued at least 1 product	Opened a new plant	Closed at least 1 existing plant	New JV with foerign partner	New licensing agreement	Outsourced a major activity	Brought in outsourced activity
Stock market capitalization/GDP	0.237*** [0.000]	-0.045 [0.387]	0.229*** [0.000]	0.109* [0.060]	0.426*** [0.000]	0.042 [0.703]	0.175** [0.047]	-0.077 [0.348]	0.275*** [0.000]	0.869*** [0.000]
Medium	0.453*** [0.000]	0.412*** [0.000]	0.401*** [0.000]	0.223*** [0.000]	0.392*** [0.000]	0.220*** [0.007]	0.416*** [0.000]	0.468*** [0.000]	0.379*** [0.000]	0.424*** [0.000]
Large	0.641*** [0.000]	0.557*** [0.000]	0.685*** [0.000]	0.359*** [0.000]	0.775*** [0.000]	0.451*** [0.000]	1.062*** [0.000]	0.787*** [0.000]	0.598*** [0.000]	0.545*** [0.000]
Firm Age	-0.002* [0.051]	0.001 [0.216]	-0.002*** [0.003]	0.005*** [0.000]	-0.009*** [0.000]	0.008*** [0.000]	-0.001 [0.319]	-0.002 [0.135]	-0.001 [0.574]	-0.006*** [0.000]
Corporation	0.117*** [0.000]	0.269*** [0.000]	0.107*** [0.000]	0.237*** [0.000]	0.186*** [0.003]	-0.232*** [0.001]	0.144*** [0.010]	0.163*** [0.000]	0.486*** [0.000]	0.367*** [0.000]
Number of establishments	0.027*** [0.000]	0.018*** [0.000]	0.019*** [0.000]	0.027*** [0.000]	0.115*** [0.000]	0.085*** [0.000]	0.048*** [0.000]	0.024*** [0.000]	0.031*** [0.000]	0.007 [0.372]
High Capacity Utilization	0.002 [0.969]	0.029 [0.502]	0.242*** [0.000]	-0.657*** [0.000]	0.184** [0.047]	-0.535*** [0.000]	-0.230*** [0.005]	0.044 [0.525]	-0.257*** [0.000]	-0.153** [0.044]
Medium Capacity Utilization	0.152*** [0.000]	0.240*** [0.000]	0.269*** [0.000]	-0.171*** [0.000]	0.081 [0.373]	-0.324*** [0.000]	-0.043 [0.592]	0.169** [0.013]	-0.012 [0.838]	0.135* [0.064]
Log(GDP/Capita)	-0.238*** [0.000]	-0.164*** [0.000]	-0.193*** [0.000]	-0.023 [0.204]	0.010 [0.813]	0.028 [0.518]	-0.266*** [0.000]	-0.294*** [0.000]	-0.160*** [0.000]	-0.358*** [0.000]
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	28514	28510	28317	26869	12974	12969	28146	26861	28149	25353
Number of countries	46	46	45	42	34	34	42	42	42	40
Pseudo R-squared	0.071	0.087	0.075	0.069	0.053	0.047	0.061	0.052	0.065	0.068

p-values in brackets

\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

**Table 4. Stock market development, foreign ownership of banks and firm innovation**

**Panel A. Aggregate Innovation Measures**

	1	2	3	4
	dynamism	core	index8	index2
Stock market capitalization/GDP	0.454*** [0.000]	0.243*** [0.000]	0.426*** [0.000]	0.360*** [0.000]
Foreign ownership of banks	0.776*** [0.000]	0.101** [0.023]	0.647*** [0.000]	0.785*** [0.000]
Medium	0.475*** [0.000]	0.506*** [0.000]	0.475*** [0.000]	0.237*** [0.000]
Large	0.714*** [0.000]	0.784*** [0.000]	0.739*** [0.000]	0.332*** [0.000]
Firm Age	0.000 [0.900]	-0.003*** [0.001]	-0.003** [0.011]	0.010*** [0.000]
Corporation	0.346*** [0.000]	0.139*** [0.000]	0.411*** [0.000]	-0.017 [0.708]
Number of establishments	0.068*** [0.000]	0.024*** [0.000]	0.056*** [0.000]	0.058*** [0.000]
High Capacity Utilization	-0.033 [0.523]	0.118*** [0.004]	0.123** [0.019]	-0.479*** [0.000]
Medium Capacity Utilization	0.134*** [0.008]	0.240*** [0.000]	0.237*** [0.000]	-0.190*** [0.001]
Log(GDP/Capita)	-0.219*** [0.000]	-0.211*** [0.000]	-0.187*** [0.000]	-0.171*** [0.000]
Industry dummies	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes
Number of firms	11974	26857	11981	12010
Number of countries	32	42	32	32
Pseudo R-squared	0.050	0.070	0.055	0.041

This table reports estimation results for the regression equation:  
for firm  $i$  in industry  $j$  in country  $k$ :

$$\text{Firm Innovation}_{i,j,k} = \alpha + \beta_1 \text{Stock Market Capitalization/GDP}_k + \beta_2 \text{Foreign Ownership of Banks}_k + \beta_3 \text{Medium Firm Dummy}_{i,j,k} + \beta_4 \text{Large Firm Dummy}_{i,j,k} + \beta_5 \text{Firm Age}_{i,j,k} + \beta_6 \text{Corporation Dummy}_{i,j,k} + \beta_7 \text{Number of Establishments}_{i,j,k} + \beta_8 \text{Dummy for Capacity Utilization between [50\%,80\%]}_{i,j,k} + \beta_9 \text{Dummy for Capacity Utilization above 80\%}_{i,j,k} + \beta_{10} \log(\text{GDP/Capita})_k + \beta_j + \varepsilon$$

Robust standard errors are estimated, and corresponding P-values are reported in the brackets.. \* p<0.1, \*\* p<0.05, \*\*\* p<0.01. For variable definitions and sources, please see Appendix 3.

p-values in brackets \* p<0.1, \*\* p<0.05, \*\*\* p<0.01

**Panel B. Individual Innovation Measures**

	1	2	3	4	5	6	7	8	9	10
	New product line	Updated existing product line	New technology	Discontinued at least 1 product	Opened a new plant	Closed at least 1 existing plant	New JV with foerign partner	New licensing agreement	Outsourced a major activity	Brought in outsourced activity
Stock market capitalization/GDP	0.266*** [0.000]	0.004 [0.938]	0.138** [0.012]	0.223*** [0.000]	0.729*** [0.000]	0.230** [0.038]	0.009 [0.930]	-0.187** [0.038]	0.138* [0.052]	0.940*** [0.000]
Foreign ownership of banks	0.283*** [0.000]	0.344*** [0.000]	-0.133*** [0.008]	0.527*** [0.000]	1.783*** [0.000]	0.807*** [0.000]	-0.240** [0.018]	-0.157** [0.034]	-0.324*** [0.000]	0.673*** [0.000]
Medium	0.472*** [0.000]	0.454*** [0.000]	0.449*** [0.000]	0.240*** [0.000]	0.471*** [0.000]	0.236*** [0.006]	0.418*** [0.000]	0.454*** [0.000]	0.438*** [0.000]	0.555*** [0.000]
Large	0.675*** [0.000]	0.600*** [0.000]	0.728*** [0.000]	0.383*** [0.000]	0.850*** [0.000]	0.496*** [0.000]	1.030*** [0.000]	0.751*** [0.000]	0.631*** [0.000]	0.629*** [0.000]
Firm Age	-0.002** [0.045]	0.001 [0.131]	-0.003*** [0.001]	0.007*** [0.000]	-0.011*** [0.000]	0.009*** [0.000]	-0.001 [0.665]	-0.002* [0.098]	0.000 [0.771]	-0.004*** [0.005]
Corporation	0.116*** [0.000]	0.306*** [0.000]	0.130*** [0.000]	0.219*** [0.000]	0.196*** [0.003]	-0.258*** [0.000]	0.173*** [0.003]	0.133*** [0.002]	0.535*** [0.000]	0.430*** [0.000]
Number of establishments	0.025*** [0.000]	0.016*** [0.002]	0.018*** [0.000]	0.022*** [0.000]	0.111*** [0.000]	0.079*** [0.000]	0.050*** [0.000]	0.025*** [0.000]	0.032*** [0.000]	0.002 [0.800]
High Capacity Utilization	-0.019 [0.674]	0.021 [0.636]	0.257*** [0.000]	-0.668*** [0.000]	0.140 [0.158]	-0.572*** [0.000]	-0.257*** [0.003]	0.021 [0.762]	-0.282*** [0.000]	-0.238*** [0.003]
Medium Capacity Utilization	0.151*** [0.001]	0.249*** [0.000]	0.289*** [0.000]	-0.173*** [0.000]	0.070 [0.469]	-0.348*** [0.000]	-0.047 [0.578]	0.147** [0.035]	-0.032 [0.607]	0.080 [0.303]
Log(GDP/Capita)	-0.246*** [0.000]	-0.116*** [0.000]	-0.140*** [0.000]	-0.123*** [0.000]	-0.177*** [0.001]	-0.149*** [0.003]	-0.194*** [0.000]	-0.294*** [0.000]	-0.048* [0.053]	-0.280*** [0.000]
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	27067	27063	26870	25422	12016	12011	26699	25414	26702	23903
Number of countries	43	43	42	39	32	32	39	39	39	37
Pseudo R-squared	0.075	0.091	0.079	0.072	0.078	0.051	0.061	0.053	0.072	0.074

p-values in brackets

\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

**Table 5. Bank credit and firm innovation**

**Panel A. Aggregate Innovation Measures**

	1	2	3	4
	dynamism	core	index8	index2
Bank credit/GDP	-0.360*** [0.000]	0.116*** [0.001]	-0.266*** [0.000]	-0.463*** [0.000]
Medium	0.444*** [0.000]	0.473*** [0.000]	0.444*** [0.000]	0.240*** [0.000]
Large	0.735*** [0.000]	0.746*** [0.000]	0.759*** [0.000]	0.342*** [0.000]
Firm Age	-0.001 [0.565]	-0.003*** [0.001]	-0.004*** [0.000]	0.011*** [0.000]
Corporation	0.441*** [0.000]	0.142*** [0.000]	0.485*** [0.000]	0.099** [0.027]
Number of establishments	0.070*** [0.000]	0.026*** [0.000]	0.057*** [0.000]	0.061*** [0.000]
High Capacity Utilization	0.028 [0.561]	0.124*** [0.001]	0.172*** [0.001]	-0.426*** [0.000]
Medium Capacity Utilization	0.170*** [0.000]	0.232*** [0.000]	0.260*** [0.000]	-0.146*** [0.010]
Log(GDP/Capita)	-0.189*** [0.000]	-0.217*** [0.000]	-0.214*** [0.000]	0.073*** [0.006]
Industry dummies	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes
Number of firms	12929	28304	12936	12965
Number of countries	34	45	34	34
Pseudo R-squared	0.044	0.067	0.048	0.046

This table reports estimation results for the regression equation:  
for firm  $i$  in industry  $j$  in country  $k$

$$\text{FirmInnovation}_{i,j,k} = \alpha + \beta_1 \text{Bank Credit/GDR}_k + \beta_2 \text{Medium Firm Dummy}_{i,j,k} + \beta_3 \text{Large Firm Dummy}_{i,j,k} + \beta_4 \text{Firm Age}_{i,j,k} + \beta_5 \text{Corporation Dummy}_{i,j,k} + \beta_6 \text{Number of Establishments}_{i,j,k} + \beta_7 \text{Dummy for Capacity Utilization between [50\%, 80\%]}_{i,j,k} + \beta_8 \text{Dummy for Capacity Utilization above 80\%}_{i,j,k} + \beta_9 \log(\text{GDP/Capita})_k + \beta_j + \varepsilon$$

Robust standard errors are estimated, and corresponding P-values are reported in the brackets.. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . For variable definitions and sources, please see Appendix 3.

p-values in brackets \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

**Panel B. Individual Innovation Measures**

	1	2	3	4	5	6	7	8	9	10
	New product line	Updated existing product line	New technology	Discontinued at least 1 product	Opened a new plant	Closed at least 1 existing plant	New JV with foerign partner	New licensing agreement	Outsourced a major activity	Brought in outsourced activity
Bank credit/GDP	-0.027 [0.489]	0.081* [0.051]	0.197*** [0.000]	-0.310*** [0.000]	-0.388*** [0.000]	-0.643*** [0.000]	-0.169** [0.018]	-0.444*** [0.000]	0.118** [0.025]	0.244*** [0.000]
Medium	0.458*** [0.000]	0.409*** [0.000]	0.400*** [0.000]	0.232*** [0.000]	0.420*** [0.000]	0.232*** [0.004]	0.421*** [0.000]	0.473*** [0.000]	0.379*** [0.000]	0.428*** [0.000]
Large	0.653*** [0.000]	0.549*** [0.000]	0.681*** [0.000]	0.382*** [0.000]	0.841*** [0.000]	0.488*** [0.000]	1.077*** [0.000]	0.816*** [0.000]	0.596*** [0.000]	0.548*** [0.000]
Firm Age	-0.002** [0.029]	0.001 [0.166]	-0.003*** [0.001]	0.007*** [0.000]	-0.011*** [0.000]	0.009*** [0.000]	-0.002 [0.269]	-0.003** [0.026]	-0.000 [0.684]	-0.005*** [0.002]
Corporation	0.135*** [0.000]	0.263*** [0.000]	0.113*** [0.000]	0.277*** [0.000]	0.308*** [0.000]	-0.109 [0.123]	0.174*** [0.002]	0.191*** [0.000]	0.499*** [0.000]	0.421*** [0.000]
Number of establishments	0.027*** [0.000]	0.019*** [0.000]	0.020*** [0.000]	0.024*** [0.000]	0.112*** [0.000]	0.081*** [0.000]	0.047*** [0.000]	0.022*** [0.000]	0.032*** [0.000]	0.007 [0.388]
High Capacity Utilization	0.005 [0.907]	0.028 [0.519]	0.242*** [0.000]	-0.652*** [0.000]	0.207** [0.026]	-0.517*** [0.000]	-0.226*** [0.006]	0.039 [0.574]	-0.253*** [0.000]	-0.127* [0.094]
Medium Capacity Utilization	0.158*** [0.000]	0.236*** [0.000]	0.266*** [0.000]	-0.155*** [0.001]	0.114 [0.208]	-0.298*** [0.001]	-0.031 [0.695]	0.175*** [0.010]	-0.009 [0.883]	0.164** [0.024]
Log(GDP/Capita)	-0.194*** [0.000]	-0.191*** [0.000]	-0.198*** [0.000]	0.063*** [0.001]	0.105*** [0.009]	0.108*** [0.009]	-0.204*** [0.000]	-0.206*** [0.000]	-0.141*** [0.000]	-0.280*** [0.000]
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	28514	28510	28317	26869	12974	12969	28146	26861	28149	25353
Number of countries	46	46	45	42	34	34	42	42	42	40
Pseudo R-squared	0.070	0.088	0.075	0.070	0.053	0.052	0.061	0.055	0.065	0.060

p-values in brackets

\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

**Table 6. Bank credit, government ownership of banks and firm innovation**

**Panel A. Aggregate Innovation Measures**

	1	2	3	4
	dynamism	core	index8	index2
Government*Bank credit	-3.328*** [0.000]	-1.019*** [0.000]	-3.001*** [0.000]	-2.814*** [0.000]
Government ownership of banks	1.120*** [0.000]	0.461*** [0.000]	1.297*** [0.000]	-0.032 [0.870]
Bank credit	0.162** [0.017]	0.311*** [0.000]	0.212*** [0.002]	-0.101 [0.195]
Medium	0.514*** [0.000]	0.508*** [0.000]	0.501*** [0.000]	0.314*** [0.000]
Large	0.815*** [0.000]	0.783*** [0.000]	0.813*** [0.000]	0.475*** [0.000]
Firm Age	-0.001 [0.212]	-0.002*** [0.002]	-0.004*** [0.000]	0.008*** [0.000]
Corporation	0.527*** [0.000]	0.128*** [0.000]	0.550*** [0.000]	0.225*** [0.000]
Number of establishments	0.066*** [0.000]	0.024*** [0.000]	0.055*** [0.000]	0.054*** [0.000]
High Capacity Utilization	0.005 [0.927]	0.118*** [0.004]	0.155*** [0.003]	-0.438*** [0.000]
Medium Capacity Utilization	0.173*** [0.001]	0.242*** [0.000]	0.267*** [0.000]	-0.137** [0.021]
Log(GDP/Capita)	-0.011 [0.675]	-0.179*** [0.000]	-0.014 [0.594]	0.059** [0.050]
Industry dummies	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes
Number of firms	11974	26857	11981	12010
Number of countries	32	42	32	32
Pseudo R-squared	0.052	0.070	0.056	0.051

This table reports estimation results for the regression equation:  
for firm  $i$  in industry  $j$  in country  $k$ :

$$\begin{aligned} \text{Firm Innovation}_{i,j,k} = & \alpha + \beta_1 \text{Government Ownership of Banks}_k * \text{Bank Credit}_k \\ & + \beta_2 \text{Government Ownership of Banks}_k + \beta_3 \text{Bank Credit}_k + \beta_4 \text{Medium Firm Dummy}_{i,j,k} \\ & + \beta_5 \text{Large Firm Dummy}_{i,j,k} + \beta_6 \text{Firm Age}_{i,j,k} + \beta_7 \text{Corporation Dummy}_{i,j,k} \\ & + \beta_8 \text{Number of Establishments}_{i,j,k} + \beta_9 \text{Dummy for Capacity Utilization between [50\%,80\%]}_{i,j,k} \\ & + \beta_{10} \text{Dummy for Capacity Utilization above 80\%}_{i,j,k} + \beta_{11} \log(\text{GDP/Capita})_k + \beta_j + \varepsilon \quad (2) \end{aligned}$$

Robust standard errors are estimated, and corresponding P-values are reported in the brackets.. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . For variable definitions and sources, please see Appendix 3.

p-values in brackets \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

**Panel B. Individual Innovation Measures**

	1	2	3	4	5	6	7	8	9	10
	New product line	Updated existing product line	New technology	Discontinued at least 1 product	Opened a new plant	Closed at least 1 existing plant	New JV with foerign partner	New licensing agreement	Outsourced a major activity	Brought in outsourced activity
Government*Bank credit	-1.499*** [0.000]	0.536*** [0.003]	-0.514*** [0.007]	-0.931*** [0.000]	-2.771*** [0.000]	-3.501*** [0.000]	-1.204*** [0.002]	-1.205*** [0.000]	-0.402 [0.133]	-2.936*** [0.000]
Government ownership of banks	0.687*** [0.000]	-0.216* [0.054]	0.218* [0.059]	-0.283** [0.039]	0.152 [0.545]	0.003 [0.991]	0.323 [0.167]	1.247*** [0.000]	0.524*** [0.003]	0.663*** [0.000]
Bank credit	0.305*** [0.000]	-0.174*** [0.003]	0.257*** [0.000]	-0.201*** [0.004]	0.053 [0.600]	-0.314*** [0.008]	-0.018 [0.865]	-0.069 [0.496]	0.209** [0.012]	0.761*** [0.000]
Medium	0.477*** [0.000]	0.447*** [0.000]	0.449*** [0.000]	0.263*** [0.000]	0.469*** [0.000]	0.293*** [0.000]	0.432*** [0.000]	0.458*** [0.000]	0.438*** [0.000]	0.566*** [0.000]
Large	0.681*** [0.000]	0.587*** [0.000]	0.725*** [0.000]	0.427*** [0.000]	0.882*** [0.000]	0.604*** [0.000]	1.064*** [0.000]	0.776*** [0.000]	0.634*** [0.000]	0.637*** [0.000]
Firm Age	-0.002* [0.061]	0.001 [0.100]	-0.003*** [0.001]	0.006*** [0.000]	-0.011*** [0.000]	0.008*** [0.000]	-0.001 [0.438]	-0.002 [0.106]	0.001 [0.679]	-0.004*** [0.004]
Corporation	0.101*** [0.000]	0.313*** [0.000]	0.123*** [0.000]	0.295*** [0.000]	0.396*** [0.000]	0.001 [0.994]	0.198*** [0.001]	0.115*** [0.009]	0.524*** [0.000]	0.453*** [0.000]
Number of establishments	0.025*** [0.000]	0.018*** [0.000]	0.018*** [0.000]	0.020*** [0.000]	0.111*** [0.000]	0.075*** [0.000]	0.047*** [0.000]	0.024*** [0.000]	0.032*** [0.000]	0.002 [0.856]
High Capacity Utilization	-0.011 [0.804]	0.040 [0.372]	0.246*** [0.000]	-0.653*** [0.000]	0.223** [0.024]	-0.526*** [0.000]	-0.269*** [0.002]	0.010 [0.889]	-0.295*** [0.000]	-0.228*** [0.005]
Medium Capacity Utilization	0.160*** [0.000]	0.255*** [0.000]	0.283*** [0.000]	-0.145*** [0.003]	0.132 [0.172]	-0.293*** [0.001]	-0.040 [0.639]	0.145** [0.037]	-0.040 [0.519]	0.107 [0.168]
Log(GDP/Capita)	-0.180*** [0.000]	-0.109*** [0.000]	-0.147*** [0.000]	0.042** [0.043]	0.206*** [0.000]	0.106** [0.022]	-0.130*** [0.000]	-0.238*** [0.000]	-0.059** [0.024]	-0.125*** [0.000]
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	27067	27063	26870	25422	12016	12011	26699	25414	26702	23903
Number of countries	43	43	42	39	32	32	39	39	39	37
Pseudo R-squared	0.076	0.090	0.079	0.075	0.065	0.064	0.063	0.058	0.072	0.073

p-values in brackets

\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

**Table 7. Government ownership of banks and firm innovation**

**Panel A. Aggregate Innovation Measures**

	1	2	3	4	
	dynamism	core	index8	index2	
Government ownership of banks	-0.380*** [0.000]	0.008 [0.908]	-0.060 [0.583]	-1.421*** [0.000]	This table reports estimation results for the regression equation: for firm $i$ in industry $j$ in country $k$ :  $\text{Firm Innovation}_{i,j,k} = \alpha + \beta_1 \text{Government Ownership of Banks}_k + \beta_2 \text{Medium Firm Dummy}_{i,j,k} + \beta_3 \text{Large Firm Dummy}_{i,j,k} + \beta_4 \text{Firm Age}_{i,j,k} + \beta_5 \text{Corporation Dummy}_{i,j,k} + \beta_6 \text{Number of Establishments}_{i,j,k} + \beta_7 \text{Dummy for Capacity Utilization between [50\%,80\%]}_{i,j,k} + \beta_8 \text{Dummy for Capacity Utilization above 80\%}_{i,j,k} + \beta_9 \log(\text{GDP/Capita})_k + \beta_j + \varepsilon \quad (3)$
Medium	0.468*** [0.000]	0.507*** [0.000]	0.464*** [0.000]	0.264*** [0.000]	
Large	0.706*** [0.000]	0.785*** [0.000]	0.727*** [0.000]	0.362*** [0.000]	
Firm Age	0.001 [0.586]	-0.002*** [0.004]	-0.002** [0.044]	0.010*** [0.000]	
Corporation	0.405*** [0.000]	0.152*** [0.000]	0.456*** [0.000]	0.081* [0.070]	Robust standard errors are estimated, and corresponding P-values are reported in the brackets.. * $p < 0.1$ , ** $p < 0.05$ , *** $p < 0.01$ . For variable definitions and sources, please see Appendix 3.
Number of establishments	0.072*** [0.000]	0.024*** [0.000]	0.060*** [0.000]	0.060*** [0.000]	
High Capacity Utilization	0.006 [0.913]	0.127*** [0.002]	0.157*** [0.003]	-0.439*** [0.000]	
Medium Capacity Utilization	0.157*** [0.002]	0.247*** [0.000]	0.256*** [0.000]	-0.160*** [0.007]	
Log(GDP/Capita)	-0.071*** [0.003]	-0.172*** [0.000]	-0.058** [0.015]	-0.024 [0.406]	
Industry dummies	Yes	Yes	Yes	Yes	
Constant	Yes	Yes	Yes	Yes	
Number of firms	11974	26857	11981	12010	
Number of countries	32	42	32	32	
Pseudo R-squared	0.047	0.070	0.053	0.043	

p-values in brackets

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

**Panel B. Individual Innovation Measures**

	1	2	3	4	5	6	7	8	9	10
	New product line	Updated existing product line	New technology	Discontinued at least 1 product	Opened a new plant	Closed at least 1 existing plant	New JV with foerign partner	New licensing agreement	Outsourced a major activity	Brought in outsourced activity
Government ownership of banks	0.047 [0.545]	0.019 [0.807]	-0.021 [0.790]	-0.684*** [0.000]	-1.194*** [0.000]	-1.468*** [0.000]	-0.136 [0.426]	0.838*** [0.000]	0.316*** [0.009]	-0.792*** [0.000]
Medium	0.469*** [0.000]	0.447*** [0.000]	0.453*** [0.000]	0.238*** [0.000]	0.441*** [0.000]	0.252*** [0.003]	0.421*** [0.000]	0.449*** [0.000]	0.443*** [0.000]	0.571*** [0.000]
Large	0.668*** [0.000]	0.586*** [0.000]	0.735*** [0.000]	0.372*** [0.000]	0.812*** [0.000]	0.516*** [0.000]	1.038*** [0.000]	0.749*** [0.000]	0.646*** [0.000]	0.646*** [0.000]
Firm Age	-0.001 [0.124]	0.001 [0.123]	-0.003*** [0.002]	0.006*** [0.000]	-0.010*** [0.000]	0.009*** [0.000]	-0.001 [0.552]	-0.002 [0.163]	0.001 [0.627]	-0.004** [0.020]
Corporation	0.123*** [0.000]	0.300*** [0.000]	0.143*** [0.000]	0.256*** [0.000]	0.297*** [0.000]	-0.188*** [0.007]	0.185*** [0.002]	0.102** [0.019]	0.543*** [0.000]	0.525*** [0.000]
Number of establishments	0.026*** [0.000]	0.018*** [0.000]	0.017*** [0.000]	0.024*** [0.000]	0.116*** [0.000]	0.081*** [0.000]	0.049*** [0.000]	0.027*** [0.000]	0.031*** [0.000]	0.002 [0.822]
High Capacity Utilization	-0.002 [0.973]	0.035 [0.435]	0.254*** [0.000]	-0.650*** [0.000]	0.222** [0.024]	-0.534*** [0.000]	-0.267*** [0.002]	0.016 [0.819]	-0.289*** [0.000]	-0.190** [0.019]
Medium Capacity Utilization	0.161*** [0.000]	0.253*** [0.000]	0.291*** [0.000]	-0.160*** [0.001]	0.116 [0.227]	-0.324*** [0.000]	-0.049 [0.557]	0.136* [0.051]	-0.032 [0.604]	0.132* [0.087]
Log(GDP/Capita)	-0.202*** [0.000]	-0.114*** [0.000]	-0.120*** [0.000]	-0.059*** [0.001]	0.148*** [0.001]	-0.025 [0.573]	-0.198*** [0.000]	-0.331*** [0.000]	-0.036 [0.101]	-0.107*** [0.000]
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	27067	27063	26870	25422	12016	12011	26699	25414	26702	23903
Number of countries	43	43	42	39	32	32	39	39	39	37
Pseudo R-squared	0.074	0.090	0.078	0.071	0.059	0.053	0.061	0.056	0.071	0.066

p-values in brackets

\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

**Table 8. Government ownership of banks, firm size and firm innovations**

**Panel A. Aggregate Innovation Measures**

	1	2	3	4
	dynamism	core	index8	index2
Small*Government	-1.435*** [0.000]	-1.073*** [0.000]	-1.403*** [0.000]	-0.810** [0.025]
Large*Government	-0.090 [0.702]	0.844*** [0.000]	0.288 [0.227]	-1.094*** [0.000]
Log(Sales)	0.031** [0.011]	0.030*** [0.000]	0.045*** [0.000]	-0.018 [0.219]
Firm Age	0.007*** [0.000]	-0.001 [0.326]	0.003* [0.065]	0.016*** [0.000]
Corporation	0.302*** [0.000]	0.209*** [0.000]	0.343*** [0.000]	0.073 [0.242]
Number of establishments	0.111*** [0.000]	0.029*** [0.000]	0.094*** [0.000]	0.086*** [0.000]
High Capacity Utilization	0.075 [0.298]	0.135*** [0.006]	0.228*** [0.002]	-0.362*** [0.000]
Medium Capacity Utilization	0.122* [0.071]	0.273*** [0.000]	0.213*** [0.002]	-0.134* [0.075]
Log(GDP/Capita)	0.295*** [0.000]	-0.151*** [0.000]	0.383*** [0.000]	-0.074 [0.149]
Industry dummies	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes
Number of firms	6169	17886	6171	6182
Number of countries	32	42	32	32
Pseudo R-squared	0.020	0.068	0.028	0.023
Difference (Small-Large)	-1.345***	-1.917***	-1.691***	0.284

This table reports estimation results for the regression equation: for firm  $i$  in industry  $j$  in country  $k$ :

$$\begin{aligned} \text{Firm Innovation}_{i,j,k} = & \alpha + \beta_1 \text{Government Ownership of Banks}_k * \text{Small Firm Dummy}_{i,j,k} \\ & + \beta_2 \text{Government Ownership of Banks}_k * \text{Large Firm Dummy}_{i,j,k} + \beta_3 \log(\text{Sales})_{i,j,k} \\ & + \beta_4 \text{Firm Age}_{i,j,k} + \beta_5 \text{Corporation Dummy}_{i,j,k} + \beta_6 \text{Number of Establishments}_{i,j,k} \\ & + \beta_7 \text{Dummy for Capacity Utilization between } [50\%, 80\%]_{i,j,k} \\ & + \beta_8 \text{Dummy for Capacity Utilization above } 80\%_{i,j,k} + \beta_9 \log(\text{GDP/Capita})_k + \beta_j + \varepsilon \quad (4) \end{aligned}$$

Robust standard errors are estimated, and corresponding p-values are reported in the brackets. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . For variable definitions and sources, please see Appendix 3.

p-values in brackets \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

**Panel B. Individual Innovation Measures**

	1	2	3	4	5	6	7	8	9	10
	New product line	Updated existing product line	New technology	Discontinued at least 1 product	Opened a new plant	Closed at least 1 existing plant	New JV with foerign partner	New licensing agreement	Outsourced a major activity	Brought in outsourced activity
Small*Government	-0.835*** [0.000]	-0.294** [0.016]	-1.283*** [0.000]	-0.257 [0.107]	-0.912 [0.160]	-0.390 [0.589]	-0.598* [0.075]	-0.944*** [0.000]	-0.553** [0.011]	-1.495*** [0.000]
Large*Government	0.469*** [0.002]	0.648*** [0.000]	1.021*** [0.000]	-0.492*** [0.008]	-0.307 [0.462]	-1.253** [0.015]	0.358 [0.196]	1.172*** [0.000]	0.298 [0.109]	-1.210*** [0.000]
Log(Sales)	0.037*** [0.000]	0.045*** [0.000]	0.010 [0.124]	0.020** [0.015]	0.103*** [0.000]	0.055** [0.030]	0.142*** [0.000]	0.050*** [0.000]	0.066*** [0.000]	0.086*** [0.000]
Firm Age	0.000 [0.904]	0.004*** [0.001]	-0.002* [0.090]	0.008*** [0.000]	-0.004 [0.189]	0.015*** [0.000]	0.001 [0.617]	0.002 [0.377]	0.003* [0.053]	-0.000 [0.825]
Corporation	0.184*** [0.000]	0.277*** [0.000]	0.198*** [0.000]	0.235*** [0.000]	0.243** [0.013]	-0.104 [0.334]	0.037 [0.638]	0.183*** [0.003]	0.598*** [0.000]	0.486*** [0.000]
Number of establishments	0.032*** [0.000]	0.013* [0.055]	0.019*** [0.003]	0.027*** [0.000]	0.199*** [0.000]	0.124*** [0.000]	0.050*** [0.000]	0.033*** [0.000]	0.036*** [0.000]	-0.012 [0.346]
High Capacity Utilization	-0.013 [0.808]	0.033 [0.551]	0.275*** [0.000]	-0.610*** [0.000]	0.100 [0.452]	-0.690*** [0.000]	-0.360*** [0.001]	-0.031 [0.737]	-0.289*** [0.000]	-0.155 [0.109]
Medium Capacity Utilization	0.158*** [0.003]	0.248*** [0.000]	0.334*** [0.000]	-0.102* [0.077]	-0.031 [0.806]	-0.473*** [0.000]	-0.235** [0.023]	0.019 [0.838]	-0.090 [0.211]	0.146 [0.110]
Log(GDP/Capita)	-0.166*** [0.000]	-0.156*** [0.000]	-0.105*** [0.000]	-0.116*** [0.000]	-0.051 [0.595]	-0.212** [0.023]	-0.135*** [0.002]	-0.267*** [0.000]	-0.055* [0.051]	-0.116*** [0.000]
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	18009	18008	17893	16852	6170	6166	17689	16840	17690	15415
Number of countries	43	43	42	39	32	32	39	39	39	37
Pseudo R-squared	0.074	0.094	0.074	0.073	0.061	0.053	0.070	0.045	0.074	0.073
Difference (Small-Large)	-1.304***	-0.942***	-2.304***	0.235	-0.605	0.863	-0.956**	-2.116***	-0.851***	-0.285

p-values in brackets

\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

**Table 9. Government ownership of banks, human capital and firm innovation**

<b>Panel A. Aggregate Innovation Measures</b>					
	1	2	3	4	This table reports estimation results for the regression equation: for firm $i$ in industry $j$ in country $k$ : $\text{Firm Innovation}_{i,j,k} = \alpha + \beta_1 \text{Government Ownership of Banks}_k + \beta_2 \text{Medium Firm Dummy}_{i,j,k} + \beta_3 \text{Large Firm Dummy}_{i,j,k} + \beta_4 \text{Firm Age}_{i,j,k} + \beta_5 \text{Corporation Dummy}_{i,j,k} + \beta_6 \text{Number of Establishments}_{i,j,k} + \beta_7 \text{Dummy for Capacity Utilization between [50\%,80\%]}_{i,j,k} + \beta_8 \text{Dummy for Capacity Utilization above 80\%}_{i,j,k} + \beta_9 \log(\text{GDP/Capita})_k + \beta_j + X_{i,j,k} + \varepsilon$
	dynamism	core	index8	index2	
Government ownership of banks	-2.137*** [0.000]	-1.027*** [0.000]	-1.821*** [0.000]	-2.050*** [0.000]	where "X" is the vector of human capital variables.  Robust standard errors are estimated, and corresponding P-values are reported in the brackets.. * p<0.1, ** p<0.05, *** p<0.01. For variable definitions and sources, please see Appendix 3.
Highest level of education of manager	0.131*** [0.000]	0.075*** [0.000]	0.119*** [0.000]	0.103*** [0.000]	
Top Mgr's total years of experience	-0.008 [0.307]	-0.013* [0.098]	-0.016* [0.059]	0.017* [0.064]	
Mid-level experience	0.171* [0.061]	0.094 [0.292]	0.225** [0.016]	-0.104 [0.334]	
Highly experienced	0.214 [0.192]	0.211 [0.210]	0.367** [0.031]	-0.321 [0.108]	
Skilled foreign workers	-0.027*** [0.000]	-0.012*** [0.002]	-0.027*** [0.000]	-0.022*** [0.002]	
% workforce with >12 years' education	-0.001 [0.762]	0.000 [0.880]	0.001 [0.615]	-0.006** [0.014]	
Medium	0.324*** [0.000]	0.392*** [0.000]	0.372*** [0.000]	0.057 [0.594]	
Large	0.654*** [0.000]	0.840*** [0.000]	0.800*** [0.000]	-0.033 [0.775]	
Firm Age	0.003 [0.116]	-0.003* [0.089]	-0.001 [0.572]	0.013*** [0.000]	
Corporation	0.395*** [0.000]	0.360*** [0.000]	0.370*** [0.000]	0.294*** [0.009]	
Number of establishments	0.053** [0.012]	0.010 [0.579]	0.042** [0.046]	0.058*** [0.008]	
High Capacity Utilization	-0.058 [0.563]	0.255*** [0.008]	0.085 [0.396]	-0.453*** [0.000]	
Medium Capacity Utilization	0.005 [0.961]	0.302*** [0.001]	0.128 [0.166]	-0.321*** [0.002]	
Log(GDP/Capita)	1.009*** [0.000]	0.678*** [0.000]	1.028*** [0.000]	0.538*** [0.000]	
Industry dummies	Yes	Yes	Yes	Yes	
Constant	Yes	Yes	Yes	Yes	
Number of firms	3962	4469	3964	3966	
Number of countries	9	11	9	9	
pseudo R-squared	0.035	0.052	0.039	0.042	

p-values in brackets

\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

<b>Panel B. Individual Innovation</b>	1	2	3	4	5	6	7	8	9	10
<b>Measures</b>	New product line	Updated existing product line	New technology	Discontinued at least 1 product	Opened a new plant	Closed at least 1 existing plant	New JV with foerign partner	New licensing agreement	Outsourced a major activity	Brought in outsourced activity
Government ownership of banks	-0.521** [0.041]	0.240 [0.502]	-1.250*** [0.000]	-0.125 [0.620]	-1.200** [0.027]	-2.264*** [0.001]	0.358 [0.539]	0.362 [0.426]	0.891*** [0.002]	-3.346*** [0.000]
Highest level of education of manager	0.108*** [0.000]	0.145*** [0.000]	0.023 [0.314]	0.097*** [0.000]	0.117*** [0.003]	0.199*** [0.000]	0.365*** [0.000]	0.029 [0.519]	0.128*** [0.000]	0.048 [0.137]
Top Mgr's total years of experience	-0.019** [0.029]	-0.019* [0.089]	-0.005 [0.556]	0.011 [0.175]	0.008 [0.546]	0.020 [0.240]	0.011 [0.473]	0.004 [0.765]	-0.012 [0.267]	-0.024** [0.025]
Mid-level experience	0.165* [0.093]	0.256** [0.049]	0.032 [0.740]	-0.078 [0.436]	-0.012 [0.936]	-0.028 [0.892]	0.583*** [0.003]	0.155 [0.353]	0.245** [0.035]	0.335** [0.012]
Highly experienced	0.441** [0.019]	0.495** [0.050]	-0.007 [0.971]	-0.158 [0.395]	-0.272 [0.343]	-0.527 [0.175]	0.413 [0.243]	-0.019 [0.951]	0.289 [0.190]	0.827*** [0.000]
Skilled foreign workers	-0.007* [0.100]	-0.016*** [0.000]	-0.014*** [0.002]	-0.010** [0.022]	-0.012* [0.099]	-0.005 [0.599]	-0.011 [0.422]	0.005 [0.465]	-0.005 [0.360]	-0.034*** [0.001]
% workforce with >12 years' education	-0.001 [0.631]	-0.005* [0.060]	0.001 [0.746]	-0.002 [0.308]	-0.002 [0.514]	-0.016*** [0.003]	-0.002 [0.682]	0.007** [0.019]	0.001 [0.542]	-0.004 [0.212]
Medium	0.321*** [0.000]	0.114 [0.324]	0.380*** [0.000]	-0.132 [0.158]	0.557*** [0.003]	-0.109 [0.598]	0.225 [0.332]	0.771*** [0.001]	0.267** [0.016]	0.487*** [0.001]
Large	0.620*** [0.000]	0.458*** [0.001]	0.856*** [0.000]	-0.209** [0.047]	0.982*** [0.000]	-0.098 [0.654]	0.689*** [0.003]	1.622*** [0.000]	0.216* [0.078]	0.572*** [0.000]
Firm Age	-0.001 [0.588]	0.008** [0.011]	-0.004 [0.108]	0.012*** [0.000]	-0.005 [0.129]	0.013*** [0.001]	0.007 [0.110]	0.003 [0.446]	0.002 [0.411]	-0.004 [0.146]
Corporation	0.283*** [0.003]	0.427*** [0.000]	0.356*** [0.000]	0.160 [0.122]	-0.106 [0.520]	0.242 [0.287]	-0.147 [0.520]	0.239 [0.258]	0.183 [0.142]	0.237 [0.105]
Number of establishments	0.002 [0.928]	0.013 [0.644]	0.018 [0.330]	0.033* [0.069]	0.162*** [0.000]	0.123*** [0.000]	0.082*** [0.001]	0.082*** [0.000]	0.032 [0.106]	-0.072** [0.036]
High Capacity Utilization	0.273*** [0.009]	0.213 [0.103]	0.156 [0.133]	-0.444*** [0.000]	-0.150 [0.358]	-0.673*** [0.001]	-0.675*** [0.002]	0.029 [0.884]	-0.132 [0.287]	0.077 [0.618]
Medium Capacity Utilization	0.257*** [0.007]	0.255** [0.032]	0.257*** [0.007]	-0.256*** [0.008]	-0.375** [0.014]	-0.757*** [0.000]	-0.547*** [0.003]	0.002 [0.992]	-0.059 [0.600]	0.172 [0.234]
Log(GDP/Capita)	0.757*** [0.000]	0.862*** [0.000]	0.424*** [0.000]	0.592*** [0.000]	1.011*** [0.000]	0.311 [0.215]	-0.434** [0.043]	-0.130 [0.435]	0.212* [0.068]	1.023*** [0.000]
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	4450	4458	4467	4456	3950	3945	4428	4457	4429	3936
Number of countries	11	11	11	11	9	9	11	11	11	9
Pseudo R-squared	0.052	0.094	0.059	40 0.042	0.074	0.080	0.092	0.081	0.045	0.082

**Table 10: Government ownership of banks and firm innovations--2SLS Results**

**Panel A. Aggregate Innovation Measures**

	1	2	3	4
	dynamism	core	index8	index2
Predicted government ownership of banks	-1.398***	-0.465***	-1.133***	-1.781***
Medium	[0.000]	[0.000]	[0.000]	[0.000]
Large	0.443***	0.498***	0.459***	0.182***
	[0.000]	[0.000]	[0.000]	[0.008]
Firm Age	0.782***	0.812***	0.828***	0.338***
	[0.000]	[0.000]	[0.000]	[0.000]
Corporation	0.001	-0.001	-0.003*	0.010***
	[0.723]	[0.228]	[0.067]	[0.000]
Number of establishments	0.508***	0.245***	0.574***	0.058
	[0.000]	[0.000]	[0.000]	[0.333]
High Capacity Utilization	0.070***	0.014***	0.059***	0.057***
	[0.000]	[0.010]	[0.000]	[0.000]
Medium Capacity Utilization	0.078	0.159***	0.218***	-0.353***
	[0.242]	[0.002]	[0.001]	[0.000]
Log(GDP/Capita)	0.178***	0.310***	0.270***	-0.117
	[0.005]	[0.000]	[0.000]	[0.123]
Industry dummies	-0.149***	-0.212***	-0.075	-0.270***
	[0.003]	[0.000]	[0.128]	[0.000]
Constant	Yes	Yes	Yes	Yes
Number of firms	Yes	Yes	Yes	Yes
Number of countries	7593	17031	7596	7602
Pseudo R-squared	13	20	13	13
	0.055	0.078	0.063	0.048

This table reports estimation results for the regression equation: for firm  $i$  in industry  $j$  in country  $k$ :

$$\text{Firm Innovation}_{i,j,k} = \alpha + \beta_1 \text{Predicted Government Ownership of Banks}_k + \beta_2 \text{Medium Firm Dummy}_{i,j,k} + \beta_3 \text{Large Firm Dummy}_{i,j,k} + \beta_4 \text{Firm Age}_{i,j,k} + \beta_5 \text{Corporation Dummy}_{i,j,k} + \beta_6 \text{Number of Establishments}_{i,j,k} + \beta_7 \text{Dummy for Capacity Utilization between [50\%,80\%]}_{i,j,k} + \beta_8 \text{Dummy for Capacity Utilization above 80\%}_{i,j,k} + \beta_9 \log(\text{GDP/Capita})_k + \beta_j + \varepsilon$$

The predicted government ownership of banks is derived from a first-stage Tobit model that uses regulatory quality, rule of law, disclosure index, and banking crisis dummy as the instrumental variables. Robust standard errors are estimated, and corresponding P-values are reported in the brackets.. \* p<0.1, \*\* p<0.05, \*\*\* p<0.01. For variable defintions and sources, please see Appendix 3.

p-values in brackets \* p<0.1, \*\* p<0.05, \*\*\* p<0.01

**Panel B. Individual Innovation Measures**

	1	2	3	4	5	6	7	8	9	10
	New product line	Updated existing product line	New technology	Discontinued at least 1 product	Opened a new plant	Closed at least 1 existing plant	New JV with foerign partner	New licensing agreement	Outsourced a major activity	Brought in outsourced activity
Predicted government ownership of banks	-0.909*** [0.000]	-0.219* [0.096]	0.054 [0.657]	-1.604*** [0.000]	-0.593*** [0.009]	-0.797*** [0.002]	-1.548*** [0.000]	0.852*** [0.000]	-1.365*** [0.000]	-1.957*** [0.000]
Medium	0.508*** [0.000]	0.491*** [0.000]	0.403*** [0.000]	0.314*** [0.000]	0.350*** [0.001]	-0.007 [0.953]	0.364*** [0.000]	0.497*** [0.000]	0.497*** [0.000]	0.544*** [0.000]
Large	0.763*** [0.000]	0.650*** [0.000]	0.687*** [0.000]	0.473*** [0.000]	0.775*** [0.000]	0.283** [0.020]	1.100*** [0.000]	0.863*** [0.000]	0.780*** [0.000]	0.633*** [0.000]
Firm Age	-0.001 [0.383]	0.003*** [0.007]	-0.001 [0.235]	0.005*** [0.000]	-0.010*** [0.000]	0.014*** [0.000]	-0.002 [0.434]	0.000 [0.886]	-0.002 [0.292]	-0.006*** [0.002]
Corporation	0.151*** [0.000]	0.274*** [0.000]	0.275*** [0.000]	0.166*** [0.000]	0.375*** [0.000]	-0.258*** [0.008]	0.266*** [0.003]	0.027 [0.667]	0.666*** [0.000]	0.658*** [0.000]
Number of establishments	0.019*** [0.002]	0.016** [0.010]	0.008 [0.194]	0.019** [0.010]	0.138*** [0.000]	0.086*** [0.000]	0.057*** [0.000]	0.031*** [0.000]	0.031*** [0.000]	-0.010 [0.429]
High Capacity-Utilization	0.033 [0.572]	0.110* [0.056]	0.273*** [0.000]	-0.521*** [0.000]	0.113 [0.342]	-0.468*** [0.000]	-0.219* [0.070]	-0.120 [0.233]	-0.252*** [0.003]	-0.092 [0.393]
Medium Capacity-Utilization	0.194*** [0.001]	0.324*** [0.000]	0.359*** [0.000]	-0.035 [0.598]	-0.064 [0.581]	-0.408*** [0.001]	-0.078 [0.508]	0.029 [0.770]	-0.028 [0.724]	0.170* [0.093]
Log(GDP/Capita)	-0.316*** [0.000]	-0.181*** [0.000]	-0.088*** [0.002]	-0.373*** [0.000]	0.169** [0.044]	-0.224** [0.015]	-0.101 [0.101]	-0.276*** [0.000]	-0.143*** [0.001]	-0.377*** [0.000]
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	17126	17126	17041	15678	7604	7603	16967	15677	16971	14736
Number of countries	20	20	20	19	13	13	19	19	19	18
Pseudo R-squared	0.089	0.111	0.084	0.089	0.063	0.056	0.080	0.052	0.093	0.092

**Table 11. Government ownership of banks and U.S. patents in different industries in 2001**

This table reports estimation results for the regression equations: for firm  $i$  in industry  $j$  in country  $k$ , where "X" is the vector of control variables. Column 1 and column 3:

$$\text{Number of patents}_{i,k,2001} = \alpha + \beta_1(\text{Government}_{k,2001} * \text{InnovationIntensity}_{i,2000}) \\ + \beta_2 \text{Government}_{k,2001} + \beta_3 \text{InnovationIntensity}_{i,2000} + \beta X_k + \beta_i + \varepsilon_{i,k,2001}$$

Column 2 and column 4:

$$\text{Number of citations}_{i,k,2001} = \alpha + \beta_1(\text{Government}_{k,2001} * \text{InnovationIntensity}_{k,2000}) \\ + \beta_2 \text{Government}_{k,2001} + \beta_3 \text{InnovationIntensity}_{k,2000} + \beta X_k + \beta_i + \varepsilon_{i,k,2001}$$

Robust standard errors are estimated, and corresponding P-values are reported in the brackets.. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

For variable definitions and sources, please see Appendix 3.

	1	2	3	4
	Number of patents	Number of citations	Number of patents	Number of citations
Government*Innovation intensity	-0.337*** [0.000]	-0.762*** [0.000]	-0.328*** [0.000]	-0.747*** [0.000]
Government ownership of banks	0.336 [0.806]	-0.832 [0.762]	-4.128*** [0.003]	-7.668*** [0.006]
Innovation intensity	0.046 [0.836]	0.053 [0.906]	0.017 [0.940]	0.005 [0.992]
Education	4.684*** [0.000]	6.651*** [0.000]	0.815 [0.307]	0.696 [0.666]
Foreign ownership of banks	-4.529*** [0.000]	-6.970*** [0.000]	-10.644*** [0.000]	-16.036*** [0.000]
Bank asset concentration	-22.751*** [0.000]	-31.816*** [0.000]	-21.010*** [0.000]	-29.448*** [0.000]
Log(GDP/capita)	3.484*** [0.000]	4.942*** [0.000]	4.138*** [0.000]	6.017*** [0.000]
Creditor rights (2000)			-3.784*** [0.000]	-6.023*** [0.000]

Creditor rights (2000)*Innovation intensity			0.013	0.022
			[0.214]	[0.311]
One if English origin*Innovation intensity			2.126***	3.346***
			[0.000]	[0.000]
One if French origin*innovation intensity			1.359***	2.126***
			[0.000]	[0.005]
One if German origin*Innovation intensity			5.812***	8.833***
			[0.000]	[0.000]
U.S. patent class dummies	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes
Number of unique country-industry combinations	18584	18584	18584	18584
Number of countries	46	46	46	46
Adjusted R-squared	0.063	0.040	0.086	0.053

p-values in brackets, \*p<0.1, \*\*p<0.05, \*\*\*p<0.01

### Appendix 1. Countries in the sample

Country	Number of Firms
Albania	374
Armenia	521
Azerbaijan	519
Belarus	575
Benin	40
Bosnia and Herzegovina	376
Brazil	1,640
Bulgaria	550
Cambodia	503
Chile	941
Costa Rica	341
Croatia	420
Czech Republic	606
Ecuador	447
El Salvador	465
Estonia	389
Germany	1,196
Greece	546
Guatemala	454
Guyana	152
Honduras	450
Hungary	860
Ireland	492
Kazakhstan	835
Kyrgyzstan	476
Latvia	380
Lithuania	629
Madagascar	75
Mali	15
Mauritius	88
Moldova, Republic of	616
Nicaragua	452
Oman	50
Philippines	679
Poland	1,579
Portugal	505
Romania	855
Russia	1,098
Slovakia	390
Slovenia	411
South Africa	600
South Korea	598
Spain	605
Thailand	1,384
Turkey	2,365
Ukraine	1,056
<b>Total</b>	<b>28,598</b>

## Appendix 2. Government ownership of banks, firm ownership and firm innovation

### Panel A. Aggregate Innovation Measures

	1	2	3	4
	dynamism	core	index8	index2
Government ownership of banks	-0.341*** [0.002]	0.032 [0.644]	-0.015 [0.891]	-1.424*** [0.000]
State ownership of firm	-0.429*** [0.000]	-0.502*** [0.000]	-0.506*** [0.000]	0.019 [0.852]
Medium	0.495*** [0.000]	0.529*** [0.000]	0.495*** [0.000]	0.263*** [0.000]
Large	0.750*** [0.000]	0.829*** [0.000]	0.779*** [0.000]	0.360*** [0.000]
Firm Age	0.002* [0.091]	-0.001 [0.322]	-0.001 [0.532]	0.010*** [0.000]
Corporation	0.358*** [0.000]	0.148*** [0.000]	0.400*** [0.000]	0.083* [0.071]
Number of establishments	0.073*** [0.000]	0.025*** [0.000]	0.062*** [0.000]	0.060*** [0.000]
High Capacity Utilization	-0.000 [0.996]	0.122*** [0.003]	0.150*** [0.004]	-0.439*** [0.000]
Medium Capacity Utilization	0.152*** [0.003]	0.240*** [0.000]	0.251*** [0.000]	-0.160*** [0.007]
Log(GDP/Capita)	-0.075*** [0.001]	-0.185*** [0.000]	-0.063*** [0.008]	-0.024 [0.411]
Industry dummies	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes
Number of firms	11974	26857	11981	12010
Number of countries	32	42	32	32
Pseudo R-squared	0.048	0.071	0.053	0.043
p-values in brackets	* p<0.1, ** p<0.05, *** p<0.01			

This table reports estimation results for the regression equation: for firm  $i$  in industry  $j$  in country  $k$ :

$$\begin{aligned} \text{Firm Innovation}_{i,j,k} = & \alpha + \beta_1 \text{GovernmentOwnershipof Banks}_k + \beta_2 \text{MediumFirmDummy}_{i,j,k} \\ & + \beta_3 \text{Large Firm Dummy}_{i,j,k} + \beta_4 \text{Firm Age}_{i,j,k} + \beta_5 \text{Corporation Dummy}_{i,j,k} \\ & + \beta_6 \text{Numberof Establishments}_{i,j,k} + \beta_7 \text{Dummyfor Capacity Utilization between[50\%,80\%]}_{i,j,k} \\ & + \beta_8 \text{Dummyfor Capacity Utilization above80\%}_{i,j,k} + \beta_9 \log(\text{GDP/Capita})_k + \beta_j \\ & + \beta_{10} \text{Stateownershipof firm}_{i,j,k} + \varepsilon \end{aligned}$$

Robust standard errors are estimated, and corresponding P-values are reported in the brackets.. \* p<0.1, \*\* p<0.05, \*\*\* p<0.01. For variable definitions and sources, please see Appendix 3.

**Panel B. Individual Innovation Measures**

	1	2	3	4	5	6	7	8	9	10
	New product line	Updated existing product line	New technology	Discontinued at least 1 product	Opened a new plant	Closed at least 1 existing plant	New JV with foerign partner	New licensing agreement	Outsourced a major activity	Brought in outsourced activity
Government ownership of banks	0.067 [0.387]	0.040 [0.597]	-0.000 [0.995]	-0.671*** [0.000]	-1.152*** [0.000]	-1.494*** [0.000]	-0.096 [0.574]	0.861*** [0.000]	0.332*** [0.006]	-0.778*** [0.000]
State ownership of firm	-0.457*** [0.000]	-0.627*** [0.000]	-0.421*** [0.000]	-0.238*** [0.002]	-0.484*** [0.002]	0.199 [0.144]	-0.495*** [0.000]	-0.364*** [0.000]	-0.237** [0.013]	-0.196* [0.067]
Medium	0.488*** [0.000]	0.475*** [0.000]	0.470*** [0.000]	0.247*** [0.000]	0.468*** [0.000]	0.239*** [0.005]	0.442*** [0.000]	0.467*** [0.000]	0.453*** [0.000]	0.578*** [0.000]
Large	0.706*** [0.000]	0.649*** [0.000]	0.770*** [0.000]	0.389*** [0.000]	0.856*** [0.000]	0.492*** [0.000]	1.082*** [0.000]	0.790*** [0.000]	0.664*** [0.000]	0.660*** [0.000]
Firm Age	0.000 [0.998]	0.004*** [0.000]	-0.002* [0.084]	0.007*** [0.000]	-0.009*** [0.000]	0.008*** [0.000]	0.000 [0.809]	-0.001 [0.690]	0.001 [0.347]	-0.003* [0.051]
Corporation	0.120*** [0.000]	0.299*** [0.000]	0.139*** [0.000]	0.253*** [0.000]	0.241*** [0.000]	-0.159** [0.029]	0.176*** [0.003]	0.099** [0.023]	0.540*** [0.000]	0.523*** [0.000]
Number of establishments	0.027*** [0.000]	0.019*** [0.000]	0.018*** [0.000]	0.025*** [0.000]	0.118*** [0.000]	0.081*** [0.000]	0.050*** [0.000]	0.028*** [0.000]	0.032*** [0.000]	0.003 [0.747]
High Capacity Utilization	-0.006 [0.891]	0.029 [0.519]	0.249*** [0.000]	-0.652*** [0.000]	0.215** [0.029]	-0.531*** [0.000]	-0.272*** [0.002]	0.012 [0.867]	-0.291*** [0.000]	-0.193** [0.017]
Medium Capacity Utilization	0.154*** [0.000]	0.244*** [0.000]	0.285*** [0.000]	-0.164*** [0.001]	0.112 [0.245]	-0.322*** [0.000]	-0.056 [0.504]	0.130* [0.062]	-0.036 [0.565]	0.129* [0.096]
Log(GDP/Capita)	-0.213*** [0.000]	-0.130*** [0.000]	-0.130*** [0.000]	-0.065*** [0.000]	0.146*** [0.001]	-0.023 [0.609]	-0.212*** [0.000]	-0.340*** [0.000]	-0.043* [0.055]	-0.112*** [0.000]
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	27067	27063	26870	25422	12016	12011	26699	25414	26702	23903
Number of countries	43	43	42	39	32	32	39	39	39	37
Pseudo R-squared	0.075	0.093	0.080	0.072	0.060	0.053	0.062	0.057	0.072	0.066

p-values in brackets

\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

### Appendix 3. Variable Definition and Sources

Variable	Definition	Source
<b><i>Individual Innovation Indicators</i></b>		
New product line	Has your company developed a new product line in the last three years? Yes (1) No (0)	Investment Climate Survey (World Bank)
Upgraded existing product line	Has your company upgraded an existing product line in the last three years? Yes (1) No (0)	Investment Climate Survey (World Bank)
New Technology	Has your company introduced new technology that has substantially changed the way that the main product is produced, in the last three years? Yes (1) No (0)	Investment Climate Survey (World Bank)
Discontinued at least 1 product	Has your company discontinued at least one product (not production) line in the last three years? Yes (1) No (0)	Investment Climate Survey (World Bank)
Opened a new plant	Has your company opened a new plant in the last three years? Yes (1) No (0)	Investment Climate Survey (World Bank)
Closed at least one existing plant	Has your company closed at least one existing plant or outlet in the last three years? Yes (1) No (0)	Investment Climate Survey (World Bank)
New JV with foreign partner	Has your company agreed a new joint venture with a foreign partner in the last three years? Yes (1) No (0)	Investment Climate Survey (World Bank)
New Licensing Agreement	Has your company obtained a new licensing agreement in the last three years? Yes (1) No (0)	Investment Climate Survey (World Bank)
Outsourced a major activity	Has your company outsourced a major production activity that was previously conducted in-house in the last three years? Yes (1) No (0)	Investment Climate Survey (World Bank)
Brought in-house a previously out-sourced activity	Has your company brought in-house a major production activity that was previously outsourced in the last 3 years? Yes (1) No (0)	Investment Climate Survey (World Bank)
<b><i>Aggregate Innovation Indicators</i></b>		
Dynamism	An aggregate measure of firm innovation that is formed by adding 1 if the value of the individual innovation indicator is "Yes" (1). The Index ranges from 0 to 10 with 10 indicating the firm is most innovative.	Investment Climate Survey (World Bank)
INDEX8	An aggregate measure of firm innovation that is formed by adding 1 if the value of an individual innovation indicator is "Yes" (1) in the above questions except "Discontinued at least 1 product" and "Closed at least one existing plant." The Index ranges from 0 to 8 with 8 indicating the firm is most innovative.	Investment Climate Survey (World Bank)
INDEX2	An aggregate measure of firm innovation that is formed by adding 1 if the firm has discontinued at least one product , or closed at least one existing plant. The Index ranges from 0 to 2 and is meant to capture activities that do not require external financing.	Investment Climate Survey (World Bank)
CORE	An aggregate measure of innovation that is formed by adding 1 if the firm has developed a new product line or introduced a new technology. The Index ranges from 0 to 2 and is meant to capture core innovation.	Investment Climate Survey (World Bank)
<b><i>Financial Development Indicators</i></b>		
Stock market capitalization/GDP	The total market capitalization of listed companies as a percentage of GDP	World Development Indicators
Bank credit/GDP	Domestic credit provided by banking sector as a percentage of GDP	World Development Indicators
<b><i>Banking Sector Characteristics</i></b>		
Government ownership of banks	What fraction of the banking system's assets are in banks that are 50% or more government owned?	Barth et al. (2006)
Foreign ownership of banks	What fraction of the banking system's assets are in banks that are 50% or more foreign owned?	Barth et al. (2006)
Bank asset concentration	The fraction of total assets held by the five largest banks in the country.	Barth et al. (2006)

<b>Variable</b>	<b>Definition</b>	<b>Source</b>
<b><i>Firm Characteristics</i></b>		
Firm Size Dummies	Firm Size Dummies consist of three dummies corresponding to small, medium, and large firms. Small firms have 1-19 employees, Medium firms have 20-99 employees, Large firms have over 100 employees.	Investment Climate Survey (World Bank)
Number of establishments	The number of separate operating facilities of a firm.	Investment Climate Survey (World Bank)
Age	Age is the year of the survey (2000) -the year in which the firm is established.	Investment Climate Survey (World Bank)
Corporations	Corporations is a dummy variable that takes the value 1 if the firm is organized as a corporation and 0 if the firm is organized as a Cooperative, Sole Proprietorship or Partnership or some other legal form.	Investment Climate Survey (World Bank)
Capacity Utilization Dummies	Capacity Utilization Dummies consist of three dummies corresponding to the establishment's average capacity utilization levels below 50%, between 50% and 80% and above 80%, over the last year. Capacity utilization is defined as the amount of output actually produced relative to the maximum amount that could be produced with the firm's existing machinery and equipment and regular shifts.	Investment Climate Survey (World Bank)
<b><i>Human Capital</i></b>		
Highest level of education of the manager	Highest education level of the manager takes values 1 to 6 according to the following categories-did not complete secondary school (1), secondary school (2), vocational training (3), some university training (4), graduate degree (5) and post graduate degree (6).	Investment Climate Survey (World Bank)
Top Mgr's total years of experience	How many years of experience working in this sector did the top manager have before running this establishment?	Investment Climate Survey (World Bank)
Mid-level experience	Dummy variable that takes the value 1 if the top manager has had between 3-10 years of experience working in this sector before running the establishment	Investment Climate Survey (World Bank)
Highly experienced	Dummy variable that takes the value 1 if the top manager has had more than 10 years of experience working in this sector before running the establishment	Investment Climate Survey (World Bank)
Skilled foreign workers	Percentage of permanent skilled workers that are foreign nationals	Investment Climate Survey (World Bank)
% workforce with >12 years of education	Percentage of workforce that has more than 12 years of education.	Investment Climate Survey (World Bank)
<b><i>Firm Ownership</i></b>		
State Ownership	Dummy variable that takes the value 1 if the state owns 50% or more of the company and 0 otherwise.	Investment Climate Survey (World Bank)
<b><i>External Financing</i></b>		
External Financing	Proportion of new investments financed externally. It is computed as 100 minus the proportion of new investments financed through internal funds or retained earnings.	Investment Climate Survey (World Bank)
Bank loan dummy	Dummy variable that takes the value 1 if the firm had a bank loan approved prior to 2001 and 0 otherwise.	Investment Climate Survey (World Bank)
<b><i>Macroeconomic variables for cross-country study</i></b>		
GDP/per capita	Real GDP per capita in US dollars in 2000.	World Development Indicators
Education	Proportion of workers with at least secondary education in the labor force	World Development Indicators
Creditor rights	An index aggregating creditor rights, ranging from 0 (weak creditor rights) to 4 (strong creditor rights).	Djankov et al. (2007)

Legal origin

A dummy variable that identifies the legal origin of the Company law or Commercial Code of each country.  
Following Acharya and Subramanian (2009), we focus on English origin, French origin and German origin.

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Djankov et al. (2007)