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Institutions and financial frictions: Estimating with structural restrictions on firm value and investment

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ABSTRACT

Using an enhanced version of the standard investment model, we estimate how institutions affect financial frictions at the firm (micro) level and, through the required rate of return, at the country (macro) level. Based on some 78,000 firm–year observations from 40 countries over the period 1990–2007, we show that good shareholder rights lower financial frictions, especially for firms with large external finance relative to their capital stock (e.g., small, growing or distressed firms). However, creditor rights generally do not affect financial frictions. It thus appears that in explaining cross-country differences in firm investment, frictions related to shareholder rights (e.g., shirking or "tunneling") are more relevant than debt-related frictions (e.g., limited liability or collateral constraints).

1. Introduction

Various financial frictions have long been identified as key factors driving countries' long-run growth and affecting short-run economic fluctuations. But, which financial frictions matter most and which institutional reforms can be most effective in reducing them? While past research has tried to address this question, most of the existing literature has relied on reduced-form regressions of investment on indicators of institutional quality (controlling for other factors).[1] This, we will argue, is not the most appropriate technique.

We develop a novel estimation strategy using structural restrictions and firm level data to assess the extent to which institutions affect financial frictions and, in turn, actual investment. Specifically, we start from a standard investment theory with adjustment costs (Abel and Eberly, 1994) and introduce financial transaction costs which can be seen as generalized variants of those of Gomes (2001) or Hennessy et al. (2007). We then allow country-specific institutions to affect financial frictions via two channels. The first channel relates institutions to firm-specific financial transaction costs, which are also allowed to vary with firm characteristics, such as industry and age. The second channel operates through the equilibrium rate of return required by investors, which consists of a country-specific cost of capital and a firm-specific risk premium, where the first component may depend on country-level institutions and the second on firm characteristics. We apply our approach to a large data set of listed firms with about 78,000 firm–year observations from about 40 advanced and emerging market economies over the period 1990–2007.

We find two key results. First, well-defined and well-enforced shareholder rights reduce the overall cost of capital, especially for growing or distressed firms (and, more generally, for firms whose volume of external finance is large relative to their size). This effect occurs through both channels of financial frictions. This result suggests that good corporate governance, in its various dimensions, leads to relatively equal access to finance across firms. Second, creditor rights do not have robustly significant effects on financial frictions. This suggests that frictions related

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[1] A large literature, using cross-country regressions, finds that institutions, especially those related to the financial system, help explain countries' financial and economic development as well as productivity (see reviews by Demirguc-Kunt and Levine, 2001; La Porta et al., 2008; Levine, 2005; Morck et al., 2005). This line of research includes country-level studies (e.g., Beck et al., 2000; De Nicolo et al., 2008) and industry-level studies (e.g., Rajan and Zingales, 1998, and many subsequent such as Wurgler, 2000).

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to debt finance, such as those emanating from limited liability or collateral constraints, are of little importance in explaining cross-country differences in firm investment. The exception to the generally insignificant effect of creditor rights is the efficiency of bankruptcy procedures that has effects similar to that of shareholder rights, although bankruptcy efficiency does not necessarily mean more protection for creditors, as in the case of U.S. Chapter 11.

Our finding that good corporate governance matters especially for firms with large volumes of external finance relative to their size suggests an institutional reason for investment inefficiencies in less developed countries, where small firms have been found to invest too little and large firms too much. This result relates to Hsieh and Klenow (2009) who find a much larger dispersion in the (ex post) marginal product of capital in industrial plants in China and India than in the financially and institutionally more developed U.S. Also related is Abiad et al. (2008) who show that the cross-sectional dispersion of Q, which, under certain conditions, can be used as a measure of the ex ante efficiency of capital allocation, improves with financial liberalization.[2]

Our finding that various shareholder rights affect frictions, but only some specific creditor rights do, provides insights on the plausibility of various theories of financial frictions. Here, our results are at contrast with work that attributes the dispersion in productivity across countries to tight credit constraints in developing countries. For example, Buera et al. (2011) show that collateral constraints, combined with heterogeneous talents among entrepreneurs, can explain why productivity dispersion improves (i.e., declines) with development. Better selection of productive activities by entrepreneurs as countries develop is also found to relate to the availability of financial services (Greenwood et al., 2010, 2013; Townsend and Ueda, 2006, 2010). In general, theories related to corporate governance and shareholder rights, such as those based on moral hazard and tunneling, receive empirical support, while theories based on the ease of default and those related to risk shifting with limited liability find less support, except for those focusing on the speed of bankruptcy procedures.[3]

Our paper is also of relevance for modeling macro-finance fluctuations, where frictions are often used to explain endogenous fluctuations in investment, which, in turn, create or amplify macroeconomic cycles. Seminal papers in this line of research include Kiyotaki and Moore (1997), who, assuming a simple collateral constraint, explain how drops (increases) in asset values lead to tighter (more relaxed) credit conditions, and Bernanke and Gertler (1989), who show how costly-state-verification (in the spirit of Townsend, 1979), an informational friction, amplifies productivity shocks by affecting investment volumes. Motivated by the recent crisis, Gertler and Kiyotaki (2010) show how misconduct by bank managers can create principal–agent problems, which, in turn, alters firms' access to finance and investment, and generates economic cycles. Empirical work has investigated the validity of these assumptions, albeit largely using aggregate data (e.g., Chari et al., 2006; Christiano et al., 2010). We contribute to this literature by providing firm-level evidence on the effects of institutional differences on financial frictions.

In terms of techniques, we contribute in a few ways. Importantly, we relate the differences between realized values of Q and the model-based one-period-ahead predictions to structural parameters that are hypothesized to drive firm-specific financial transaction costs and countries' required rates of return. The one-period-ahead forecast errors, by definition, satisfy the orthogonality condition and thus produce unbiased estimators. Estimation is also easily implemented using panel least square regressions and the effects of institutions on financial frictions via the two channels can be identified separately.

Our approach overcomes the identification problem associated with the standard investment–cash-flow regression framework, including studies that utilize stock price information. The investment–cash-flow regression framework – first introduced by Fazzari et al. (1988) and since then followed by many studies – proxies for financing constraints using the sensitivity of investment to firm cash flows, while controlling for growth opportunities using Q. However, as Gomes (2001) shows, in the presence of financial transaction costs, such regressions face serious identification problems because Q reflects not only growth opportunities but also frictions (e.g., external financing constraints). Furthermore, with auto-correlated productivity shocks ("growth opportunities"), current profits contain information about future profitability, so that the sensitivity of investment to current profits may be a response to expected future profitability, in addition to difficulties in financing. This could potentially bias the results.

To overcome these identification problems, some recent studies have modeled the effects of frictions from first principles (e.g., asymmetric information or limited contract enforcement). Applications of these models, however, have proven difficult, in part due to computational challenges. So far, these types of studies have largely relied on calibration exercises (e.g., Lorenzoni and Walentin, 2007) or simulation-based estimations using restricted samples and limited control variables (Karaivanov et al., 2010). Accordingly, it is difficult in such models to statistically compare the relative importance of various financial frictions, especially across countries and in relation to institutional differences.

An alternative approach, on which we build, is that of Hennessy et al. (2007), who include generic transaction costs in their model and then empirically test for the presence of such costs using data for large U.S. firms. However, studies typically use firm-level data from a single country with well-developed institutions (mostly the U.S.). The present study extends this line of research by adding a cross-country dimension (and, in addition, by using a different estimation method).

A paper closely related in approach is McLean et al. (2012). They argue that, if the cash flow sensitivity of investment proxies for growth opportunities, then growth rates should be high in countries with a high cash flow sensitivity of investment; and, if it reflects financing constraints, then growth rates should be high in countries with a low cash flow sensitivity of investment. McLean et al. (2012) find evidence for the latter conjecture, but this does not necessarily imply that institutions affect investment only by mitigating external financing constraints. As noted, and confirmed in our tests, Q always reflects both growth opportunities and financing constraints. Without a structural model, reduced-form analyses of proxies for countries' institutions, growth rates and cash flow sensitivity cannot be interpreted easily.

Two other related papers are Laeven (2003) and Love (2003). Estimating investment Euler equations (as in Bond and Meghir, 1994), Laeven (2003) shows that small firms gain more from financial liberalization as their investment behavior is farther off from the frictionless benchmark before liberalization and closer afterwards. Also, estimating investment Euler equations, Love (2003) shows that financial development and high-quality institutions (such as the rule of law) are associated with lower required rates of return. Laeven (2003), however, does not consider explicitly the links between liberalization and financial frictions and Love (2003) only considers the link through the required rate of return. Including explicitly the two channels for financial frictions, as we do, is important because both can affect Q and

[2] Another related study is Acharya et al. (2011), who show that, following financial deregulation, U.S. states moved closer to an efficient mean-variance frontier of industrial outputs. A similar measure cannot easily be used for cross-country comparisons, however, because the efficient frontiers are country-specific.

[3] Borrowing constraints can still be important for unlisted small firms, especially startups (Cagetti and De Nardi, 2006; Klapper and Love, 2011; Paulson and Townsend, 2008). In addition, some studies document a "debt overhang problem" for listed companies in the U.S. (Hennessy et al., 2007). However, cross-country panel data of unlisted firms is of limited availability and not (yet) useful for conducting a "horse race" study like ours, which can gauge the relative importance of creditor and shareholder rights as "causes" of financial frictions.

omitting one can thus produce biased estimates.[4] Moreover, the Euler equation approach uses derivatives, which may exhibit a discrete "jump" near switching points at which investment becomes zero (and there are no adjustment costs), or when external financing becomes zero (and there are no financial transaction costs). By using the value function itself, which straightforwardly relates to average Q, our approach overcomes this problem.[5]

Besides the usual checks of sample size, data definitions, and econometric specifications, we confirm the robustness of our results to possible measurement errors. This is important because Q can be a "noisy" measure of firm value (e.g., due to stock market inefficiencies or poor accounting information). Measuring institutional differences can also be challenging. We therefore develop a test to identify the size of possible measurement errors. While significant, we find these errors to be relatively small compared to the one-period-ahead forecast errors. Nevertheless, using an instrumental variable estimation, we confirm the key findings of our benchmark specification.

The paper proceeds as follows. Section 2 presents the model; Section 3 describes the estimation strategy; Section 4 presents the main results and examines measurement error issues; and Section 5 concludes.

2. Theoretical model

Our discrete-time model closely follows the well-known investment models of Hayashi (1982), Abel and Blanchard (1986), Abel and Eberly (1994), and Barnet and Sakellaris (1999) but introduces financial frictions using a generalized version of the models of Gomes (2001) and Hennessy et al. (2007). This theory-based evolution of the value of the firm provides the structural restrictions for our empirical estimation procedures.

The value function V for any firm can be expressed as follows:

$$rV(k,\varepsilon) = \max_{k'} e(k,k',\varepsilon) + E\left[V(k',\varepsilon')|\varepsilon\right] - V(k,\varepsilon), \tag{1}$$

where r denotes the required rate of return; k capital; e gross payments to providers of external financing; ε a productivity shock to investment opportunities that occurs at the beginning of the period, and prime superscripts denote next-period values. We closely follow the standard investment literature in the timing of shocks, investments, and payments. The left-hand side denotes the gross required return over the period. We assume, in line with the economic literature, that a firm maximizes its total value, i.e., not (just) shareholder value. Accordingly, the first term on the right-hand-side, e, denotes the cash flow provided in this period to all external financiers, i.e., the profits distributed to shareholders, "dividends," as well as the interest paid to debt holders. The last two terms on the right-hand-side describe the expected capital gain, i.e., the end-of-period value minus the beginning-of-period value of the firm.

The firm's capital stock evolves as follows:

$$k' = (1-\delta)k + i, \tag{2}$$

where i denotes investment and δ the rate of depreciation. Note that, in Eq. (1) above, a firm maximizes its value by choosing next-period capital k', which is analogous to choosing investment i given current-period capital k.

Overall payments to external sources of finance, e, depend on earnings and on the amounts of new investment and external financing. With no new investment or external financing, payments are equal to the firm's internal cash flow, π. In accounting terms, π is the firm's after-tax earnings plus interest, with depreciation and amortization added back[6]:

$$e(k,k',\varepsilon) = \pi(k,\varepsilon). \tag{3}$$

If investment is positive but external finance is zero, payments to financiers are:

$$e(k,k',\varepsilon) = \pi(k,\varepsilon) - i - \phi(i,k,\varepsilon), \tag{4}$$

where ϕ denotes the (real) adjustment costs of investment and where, i, investment, satisfies the law of motion for capital (2). We do not distinguish between subcategories of investment, i.e., investment can be in fixed capital ("plant and equipment") or in marketable securities (in accounting terms called "cash equivalents").[7]

We next introduce the adjustment costs of external finance. External finance, x, is positive if investment is larger than the firm's current cash flow:

$$x = i - \pi(k,\varepsilon). \tag{5}$$

Note that, given cash flow π, choosing investment i determines the amount of external financing x, therefore making x not a decision variable. External financing comes with financial transaction costs λ. Net payments from (or to) external financers for a firm with positive investments and positive external finance are then:

$$e(k,k',\varepsilon) = \pi(k,\varepsilon) - \lambda(x,k,\varepsilon) - i - \phi(i,k,\varepsilon). \tag{6}$$

The financial transaction cost function, λ, is modeled in a similar way to the standard adjustment cost of investment, that is, as a linear-quadratic and homogeneous of degree one function in external finance and capital. It is thus a generalized version of the specification used in other models with financial frictions (e.g., Gomes, 2001):

$$\lambda(x,k,\varepsilon) = b_1 x + b_2 k + \frac{b_3}{2}\left(\frac{x}{k}\right)^2 k. \tag{7}$$

As for the adjustment costs of investment, we use the standard function (e.g., Abel and Eberly, 1994)[8]:

$$\phi(i,k,\varepsilon) = c_1 i + c_2 k + \frac{c_3}{2}\left(\frac{i}{k}\right)^2 k. \tag{8}$$

[4] Mussa (1977) is a seminal paper arguing that it is necessary to consider both firm- and aggregate-level adjustment costs. Note also that Love (2003) uses "cash" as a key proxy for credit constraints, although cash per se does not appear in her theoretical model. We treat "cash" as another form of investment.

[5] Theoretically, the value function (i.e., firm market capitalization) is uniquely determined, even when there can be multiple solutions for optimal firm behavior (e.g., its investment level). For example, in the presence of fixed costs, large or zero investments could both produce the same firm value (and hence financiers would be indifferent between them). Near this indifference point, however, the first order condition (or the Euler equation) may "jump" (for a more general discussion, see e.g., Townsend and Ueda, 2006).

[6] Depreciation and amortization (and depletion) are added back, as they are part of the current cash flows, even though they reduce the next period's capital stock, as in (2) above. Amortization refers here to the spread over time of the acquisition costs of intangible assets and not to the repayment of the principal on loans or bonds.

[7] This is, in part, because some investment in securities may be core to the firm's strategy and are not carried out solely for cash management purposes (for example, investment in minority stakes in other companies). As a robustness check, however, we also use investment in fixed capital only in one specification. See also Footnote 9 for econometric difficulties which arise if we treat cash as a buffer stock which is not part of firm investment.

[8] Although there are no "pure" fixed costs in Eqs. (7) and (8), the terms involving the capital stock, k, can be seen as reflecting costs which are proportional to firm size, and are independent of the size of external finance or investment. Note that the real business cycle literature with representative agents typically uses convex adjustment costs for *increases* in investment, not for investment itself, to achieve smooth investment patterns over time. Although movements in aggregate investment are relatively smooth, firm level investment is known to vary considerably. Therefore, in a firm level study as in this paper, adjustment costs are commonly defined in terms of investment, not in terms of increases in investment (for a reconciling effort, see Khan and Thomas, 2008). Although Eq. (8) ignores the potentially important effect of costly disinvestment, we assume zero adjustment costs for non-positive investment. This assumption is in line with much of the literature (Abel et al., 1996; Abel and Eberly, 1994). Another reason we make this assumption is that information on asset sales is not widely available for countries other than the U.S.

As both cost functions affect the firm value only when they are positive, we use two indicator functions defined as:

$$\chi = 1, \text{if } x > 0;$$
$$= 0, \text{otherwise; and}$$

$$\Psi = 1, \text{if } i > 0,$$
$$= 0, \text{otherwise.}$$

In summary, we can write the firm's value function as follows:

$$(1+r)V(k,\varepsilon) = \max_{k'} \pi(k,\varepsilon) - \chi\lambda(x,k,\varepsilon) - \Psi(i+\phi(i,k,\varepsilon)) + E\left[V(k',\varepsilon')|\varepsilon\right]. \quad (9)$$

The last element in our model is the effects of institutions on financial frictions. These effects are assumed to run through both the individual firm's transaction costs and the macro-required rate of return. Specifications are discussed in detail in the estimation section.

Note that under the linear-quadratic and homogeneous of degree one functions for the adjustment cost of investment and financial transaction costs, firm value becomes homogenous of degree one in investment, external financing, and capital. Thus, we can normalize the value function (9) by k and focus on the per-asset value of the firm, V/k, which is the firm's average Q.[9]

While, because of the constant returns to scale assumptions, firm size does not matter in the non-stochastic steady state, it does matter away from the steady state due to the adjustment costs. For example, a firm may use large amounts of external financing relative to its capital stock because of a large negative shock (i.e., a distressed firm) or because its initial capital stock is small (i.e., a young, growing firm). In Eq. (7), we allow for a premium for such large-financing through the (to be estimated) parameters of the financial transaction cost function. Importantly, this premium is allowed to vary across countries with institutional characteristics.

3. Estimation methodology

3.1. One-period-ahead forecast errors

In the data, we only observe the realized values of V and Q. The difference between the expected and realized values is the one-period-ahead forecast error. This forecast error is serially uncorrelated even if the underlying productivity shocks are serially correlated, making OLS estimates unbiased and consistent. To show this, we rewrite Eq. (9) with the optimally-chosen next-period capital k' as:

$$\begin{aligned} E[V'|\varepsilon] &= (1+r)V - \pi(k,\varepsilon) + \chi\lambda(x,k,\varepsilon) + \Psi(i+\phi(i,k,\varepsilon)),\\ E[Q'|\varepsilon]\frac{k'}{k} &= (1+r)Q - \frac{\pi(k,\varepsilon)}{k} + \chi\frac{\lambda(x,k,\varepsilon)}{k} + \Psi\frac{i+\phi(i,k,\varepsilon)}{k}, \quad \text{or}\\ E[Q'|\varepsilon]\frac{k'}{k} + \frac{\pi}{k} &= (1+r)Q + \chi\left(b_1\frac{x}{k} + b_2 + \frac{b_3}{2}\left(\frac{x}{k}\right)^2\right) + \Psi\left(c_1\frac{i}{k} + c_2 + \frac{c_3}{2}\left(\frac{i}{k}\right)^2\right). \end{aligned} \quad (10)$$

Note that we divide both sides in the first row by k to obtain the second row and thus move from V to Q. Also, for simplicity, we denote $V(k', \varepsilon')$ as V' and V'/k' as Q'. To obtain the expression in the third row, we substitute the financial transaction costs and the adjustment costs of investment by their respective parametric forms.[10] We also move the cash flow term from the right-hand to the left-hand side because theoretically it should always have a coefficient of one.

For the estimation, we use the observed Q' rather than the expected E[Q']. This means that for the estimations that we need to add the one-period ahead forecast error ξ on the right hand side:

$$Q'\frac{k'}{k} + \frac{\pi(k,\varepsilon)}{k} = (1+r)Q + \chi\left(b_1\frac{x}{k} + b_2 + \frac{b_3}{2}\left(\frac{x}{k}\right)^2\right) + \Psi\left(c_1\frac{i}{k} + c_2 + \frac{c_3}{2}\left(\frac{i}{k}\right)^2\right) + \xi. \quad (11)$$

While on average, productivity *shocks* are zero and shocks are uncorrelated with country-specific institutions, the expected productivity *levels* may well be correlated with institutions. For example, investment may be limited because of financing constraints resulting from poor shareholders rights. As such, both the current and future values of Q, and their serial correlations, may be affected by institutions. By definition, however, the forecast errors in Eq. (11) should not be serially correlated and their mean should not be affected by institutions. Still, to address any potentially remaining risks of correlated errors, we use robust standard errors with clustering at the country level, the level at which the institutional variables are measured.

3.2. Estimation equation

We hypothesize that firm characteristics, X, and country institutions, W, linearly affect the relevant coefficients in the financial transaction cost function (Eq. (7)), b_1, b_2, and b_3; as well as the real investment adjustment costs function (Eq. (8)) c_1, c_2, and c_3. We also allow the intercept γ to vary with firm characteristics and macro variables as well as institutions. Moreover, we include country, industry, and year fixed effects in the intercept term.

Combining the firm- and country-specific factors, the coefficient vector on Q, $a(X, W)$, for the i-th firm in the k-th country in period t, can be written as:

$$\begin{aligned} a\left(X_{j,k,t}, W_k\right) = {} & \textstyle\sum_j a_{1j} IndustryDummy_j + a_2 Age_{i,j,k,t}\\ & + a_3 RiskFreeRate_k + a_4 Inflation + a_5 Macro\\ & + a_6 CorpGov + a_7 Creditor + a_8 Institution + a_9 Compet + a_{10} FinMkt, \end{aligned} \quad (12)$$

where firm characteristics (industry and age effects) are controlled for, *Macro* refers to macroeconomic volatility, which together with the time-varying risk free rate and inflation are control variables at the country level, and the institutional variables are country-specific and treated as time invariant. Using all coefficients expressed in vector

[9] Under the standard assumptions of adjustment costs that are linear-quadratic and homogeneous of degree one, Hayashi's (1982) result that the marginal value of Q equals the average value of Q holds for a firm which always invests and borrows (and, trivially, for a firm which never invests or borrows). The formal proof, omitted here, is based on a system of homogeneous-of-degree-one functions, as studied in Alvarez and Stokey (1998). More generally, however, a firm may switch between having positive and zero investment or external financing. In this case, near the non-stochastic steady state, the average Q is still the same as the marginal Q, but in the transition to the steady state (e.g. when, i/k or x/k are larger or smaller than their average values), the average and marginal Qs may differ, especially near the point where zero investment or zero borrowing becomes optimal. With this property, if we require the structural model to include cash as a buffer stock (which is separate from investment), then the model would need two state variables of capital and cash (unlike the Bolton et al., 2011, study of cash and investment) and it becomes difficult to analyze institutional differences econometrically. Note that several papers have looked at the underlying factors which determine firm cash holdings (e.g., Dittmar et al., 2003), but they tend to be based on reduced-form regressions which are likely to suffer from similar identification problems.

[10] The coefficient c_1 also includes *one* (i in the second row).

Table 1a
Variables: Definition, sources and descriptive statistics.

Variable	Definition/source	Mean	Std.Dev	25%	Median	75%	Obs
Firm level data (from Worldscope)							
Q	Tobin's Q	1.46	1.25	0.95	1.16	1.55	78,128
Profit/asset	After-tax income	0.09	0.14	0.05	0.09	0.14	781,286
	Before-tax income	0.10	0.14	0.05	0.10	0.16	7810
Investment/asset	Capital expenditure plus change in cash over total assets	0.08	0.10	0.01	0.05	0.10	78,128
	Capital expenditure over assets	0.06	0.07	0.02	0.04	0.08	78,118
External finance/asset	Capital expenditure plus change in cash (correcting for inventories and trade credits) over total assets	0.05	0.11	0.00	0.00	0.04	78,128
	Change in total debt plus new cash from equity sales over total assets	0.06	0.13	0.00	0.01	0.07	67,476
Age	Company age	51.15	39.35	22.00	43.00	70.00	78,128
Country-year level data							
Interest rate	Interest rate/IFS	8.28	10.93	3.08	5.27	9.44	617
Inflation	Inflation rate/IFS	10.00	84.26	1.78	2.92	5.98	617
Country-level data							
	Antidirector Rights Index/La Porta et al. (1998)	3.13	1.38	2.00	3.00	4.00	40
Corporate governance	Corporate Governance Quality Index/De Nicolo et al. (2008)	0.56	0.06	0.51	0.57	0.60	39
	Self Dealing Index/Djankov et al. (2008b)	0.52	0.25	0.34	0.46	0.69	40
	Strength of Legal Right Index/Doing Business (2007)	6.30	2.34	4.00	7.00	8.00	40
Creditors' right	Creditor rights/Djankov et al. (2007)	1.95	1.16	1.00	2.00	3.00	38
	Efficiency of bankruptcy law/Global Competitiveness Report (2004)	5.33	0.97	4.75	5.60	6.15	40
General institutional quality	Property rights/Heritage Foundation and Wall Street Journal Index of Economic Freedom (1997)	4.30	0.79	4.00	4.50	5.00	40
	Rule of law in 2000/Kaufmann et. al. (2004)	1.03	1.02	0.21	1.36	1.97	40
	Trust in people/World Values Survey 1990–1993	0.38	0.16	0.29	0.35	0.51	26
Product Market Competition	Barriers to trade in 2007/World Economic Forum Global Competitiveness Report (2007)	5.03	0.75	4.60	5.05	5.55	40
	Business entry rate in 2005 (New Registrations as % of Total)/WDI	9.87	3.66	6.75	9.82	12.43	32
	Cost of starting a Business in 2007 (% of income per capita)/Doing Business	13.19	18.43	1.45	7.05	19.75	40
Financial Development	Market capitalization to GDP in 2006/WDI	107.26	86.30	55.76	85.72	130.04	40
	Foreign ownership restrictions/World Economic Forum Global Competitiveness Report (2007)	5.45	0.60	5.10	5.50	6.00	40
	Sum of stock market capitalization and private bond market capitalization and bank credit over GDP in 2007/IFS	2.37	1.31	1.57	2.31	3.11	37
Macro Volatility	Standard deviation of GDP growth/WDI	2.60	1.51	1.40	2.07	3.40	40
	Coefficient of variation of exchange rate/WEO	0.36	0.58	0.13	0.16	0.36	40
	Standard deviation of inflation/WDI	25.34	113.05	1.27	2.78	5.32	40

Note: Statistics are calculated for the sample used in the benchmark regressions and therefore vary (slightly) with other regression specifications. Outliers (i.e., negative and more than one value) of investment/asset ratio and external finance/asset ratio are removed except that negative external finance with cash (used in the benchmark) is treated as zero.

notation as in Eq. (12) above, the full estimation equation can be expressed as:

$$Q_{i,j,k,t+1}\frac{k_{i,j,k,t+1}}{k_{i,j,k,t}}+\frac{\pi_{i,j,k,t}}{k_{i,j,k,t}}=\gamma\left(X_{j,k,t},W_k\right)+a\left(X_{j,k,t},W_k\right)Q_{i,j,k,t}+\chi_{i,j,k,t}\left\{b_1\left(X_{j,k,t},W_k\right)\left(\frac{x_{i,j,k,t}}{k_{i,j,k,t}}\right)+b_2\left(X_{j,k,t},W_k\right)+b_3\left(X_{j,k,t},W_k\right)\left(\frac{x_{i,j,k,t}}{k_{i,j,k,t}}\right)^2\right\}+\Psi_{i,j,k,t}\left\{c_1\left(X_{j,k,t}\right)\left(\frac{i_{i,j,k,t}}{k_{i,j,k,t}}\right)+c_2\left(X_{j,k,t}\right)+c_3\left(X_{j,k,t}\right)\left(\frac{i_{i,j,k,t}}{k_{i,j,k,t}}\right)^2\right\}+\xi_{i,j,k,t+1}. \quad (13)$$

Note that Eq. (13) follows closely from Eq. (11). The only difference is that the intercept term, γ, is added and that the coefficients are expressed in vector form, indicating that many variables potentially affect them (and the intercept). The last term on the right-hand-side remains the one-period-ahead forecast error.

The effects of institutions on the financial transaction costs and the required rate of return can be identified from the coefficients on the interaction terms. The coefficients on the financial transaction costs and investment adjustment costs are identified separately because external finance and investment can differ in magnitudes.[11] We also assume in the benchmark specification that institutional factors do not affect the investment adjustment costs, although we revisit this assumption below.

4. Data and estimation results

4.1. Data

In this section we describe the data set in detail. The specific firm and country variables we use with summary statistics are presented in Table 1a, the sample size by country in Table 1b, and the correlation coefficients in Table 1c.

For firm level data, we use the Worldscope database of Thomson Reuters, with data covering the period 1990 to 2007 for 48 countries. The sample contains about 380,000 firm–year observations for which Q can be constructed.[12] We eliminate observations for a number of reasons, with each criterion applied sequentially to the remaining data.[13] After these eliminations, about 300,000 firm–year observations remain.

[11] For example, positive investment does not necessarily require positive external finance, as firms may finance investment internally. In addition, firms with negative profits and no new net investment may still need external funds for working capital needs or to maintain their capital.

[12] The number of original firm-year observations, including those for which Q cannot be constructed, is about one million, although those without Q may well include inactive firms.

[13] First, we drop financial firms. Second, we eliminate observations if values are economically not meaningful (e.g., when values for capital expenditures are negative). Third, observations in excess of three standard deviations from the mean for that variable in the U.S. sample are eliminated. Fourth, we eliminate countries having fewer than 15 non-financial companies per country with non-missing values for Q in the year 2000. And fifth, 2-digit SIC industries with less than five firms with non-missing values for age and Q in 2000, as well as all unclassified companies (SIC 99) are deleted.

Table 1b
Observations by country for the benchmark regression.

Country	Obs
Argentina	310
Australia	951
Austria	455
Belgium	771
Brazil	904
Canada	1922
Chile	851
Colombia	185
Denmark	903
Finland	713
France	5322
Germany	4727
Greece	811
Hong Kong	728
India	387
Indonesia	1530
Ireland	43
Israel	284
Italy	1668
Japan	22,076
Korea	4648
Malaysia	117
Mexico	754
Netherlands	1280
New Zealand	124
Norway	659
Pakistan	52
Peru	163
Philippines	134
Portugal	240
Singapore	335
South Africa	585
Spain	994
Sweden	1160
Switzerland	1754
Thailand	2052
Turkey	899
United Kingdom	951
United States	15,603
Venezuela	83
Total	78,128

Note: Statistics are calculated for the sample used in the benchmark regressions and therefore vary (slightly) with other regression specifications.

For the benchmark regression, because of unavailability of lagged *Q* and other variables, the sample shrinks to about 78,000 firm–year observations from 40 countries.[14]

For earnings, π, we use a cash flow measure, defined as *Net Income before Extraordinary Items and Preferred Dividends + Interest Expense on Debt + Depreciation and Amortization* (variable names correspond to those of Worldscope unless otherwise noted). Since this measure is susceptible to tax and other accounting adjustments possibly hiding the true performance of a firm – some adjustments (e.g., tax credits for R&D expenditures or future losses) are of course legitimate – for robustness, we also use a before-tax measure, *Operating Income + Depreciation and Amortization*.

For investment, *i*, we use *Capital Expenditure + Change in Cash and Short-Term Investment*. This broad definition includes cash and equivalents, e.g., holdings of bonds and equity investments in other companies. As a robustness check, we use a narrower definition with physical investment only, *Capital Expenditure*.

[14] The variable *Age* reduces the sample size considerably, from about 150,000 to 80,000. Even though firm age can be constructed for about 270,000 observations out of the original one million, the sample for which both *Q* and age are available is much smaller. We verify the robustness of our results by excluding firm age and estimating the parameters using a bigger sample (results not reported). Missing values for other variables halve the sample size from 300,000 to 150,000; only when it is appropriate due to common accounting practices, do we replace missing data with zeros (for example, *Net Proceeds from Sale/Issue of Common and Preferred Stocks*).

External finance, *x*, follows closely the Rajan and Zingales (1998) definition, which is *Capital Expenditure + Change in Cash and Short-Term Investment − Cash Flow from Operation − Decrease in Inventory − Decrease in Receivables − Increase in Payables*. Here, the change in cash is included, consistent with the broad concept of investment, but we also examine a narrower definition below.

We define *Q*, as is common in cross-country studies in corporate finance, as the *Market Capitalization + Total Assets − Total Equity* over *Total Assets*. The short time dimension of our data – only 16 years – makes more elaborate capital stock calculations based on the permanent inventory method (Blanchard et al., 1993) not feasible. Also, debt is valued at par since corporate bond prices are not available for most firms in our sample. *Q* is measured at the end of each fiscal-year, usually right after the ex-dividend date.

As for firm characteristics, we include industry dummies and firm age which have been shown to affect financing constraints. Firm size is not included as a control variable, because it is endogenous and depends in part on financial frictions and investment adjustment costs. Also, firm size closely relates to the firm's capital stock, which is used in the regressions to identify the effects of institutional and real factors on financial frictions and investment adjustment costs.

The required rate of return consists of the risk free rate plus a risk premium. The real "risk free" rate in a country is measured as the short-term government Treasury bill rate minus CPI inflation. An unobservable risk premium is assumed to vary with firm characteristics and country level institutions, as well as with the country's macroeconomic conditions, for which we include CPI inflation and macroeconomic volatility, measured as the standard deviation of real GDP growth over the period 1995–2006. Short-term Treasury bill rates are from the IMF's International Financial Statistics, and CPI and real growth rates are from the World Development Indicators. Note that we also allow these macro variables to affect the financial transaction cost function (e.g., a higher GDP volatility may increase transaction costs).

The specific country level institutions we analyze are corporate governance (*CorpGov*), creditor rights (*Creditor*), general institutional quality (*Institution*), product market competition (*Compet*), and financial market development (*FinMkt*). For each of these, we cover both the de jure and de facto arrangements and examine several alternative measures. In the benchmark regression, we use for *CorpGov*, the original shareholder (anti-director) rights (La Porta et al., 1998), a measure very commonly used in the literature on shareholder protection; for *Creditor*, the strength of legal protection for lenders (World Bank, 2008a); for *Institution*, the property rights measure of Heritage Foundation, cited in La Porta et al. (1998); for *Compet*, a measure of trade barriers (World Economic Forum, 2007); and for *FinMkt*, stock market-capitalization-to-GDP for 2005 (World Bank, 2008b).

The correlations among possible alternatives to the five institutional variables are mostly high (Table 1c). For example, the correlation between property rights and rule of law indexes is 0.83. However, there are correlations which are smaller than 0.5 (e.g., between barriers to trade and business entry rate).

4.2. Benchmark regression

Table 2 shows the benchmark regression results. Specifically, it shows the estimated coefficients for the interaction terms of interest, where each of the cells represents the interaction between the corresponding row and column.[15]

In the first column, the coefficients on lagged *Q* capture the effects of institutions and firm variables on the required rate of return.[16]

[15] Because the number of coefficients for the benchmark regressions with all the institutional variables is large, we do not present the other coefficients (e.g., country and industry fixed effects) or interaction terms involving industry dummies.

[16] More precisely, they are the coefficients on the interaction terms of institutions and firm characteristics with lagged *Q*, denoted by $a(X,W)$, see Eqs. (12) and (13).

Table 1c
Correlation among country-level variables.

			[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]
Corporate governance	Antidirector Rights Index/La Porta et al. (1998)	[1]	1.00																	
	Corporate Governance Quality Index/De Nicolo et al. (2008)	[2]	0.12	1.00																
	Self Dealing Index/Djankov et al. (2008b)	[3]	0.56	0.24	1.00															
Creditors' rights	Strength of Legal Right Index/Doing Business (2007)	[4]	0.40	0.51	0.63	1.00														
	Creditors' Rights/Djankov et al. (2007)	[5]	0.12	0.14	0.45	0.51	1.00													
	Efficiency of Bankruptcy Law/Global Competitiveness Report (2004)	[6]	0.13	0.87	0.38	0.68	0.34	1.00												
Institutional quality	Property rights/Heritage Foundation and Wall Street Journal Index of Economic Freedom (1997)	[7]	0.11	0.58	0.28	0.48	0.41	0.67	1.00											
	Rule of law in 2000/Kraay and Kaufman (2003)	[8]	0.16	0.81	0.24	0.57	0.32	0.86	0.83	1.00										
	Trust in people/World Values Survey, 1990–1993	[9]	0.10	0.54	0.11	0.51	0.09	0.67	0.51	0.70	1.00									
Product market competition	Barriers to trade in 2007/World Economic Forum Global Competitiveness Report (2007)	[10]	0.12	0.54	0.37	0.41	0.36	0.60	0.42	0.61	0.26	1.00								
	Business Entry Rate in 2005 (New Registrations as % of Total) WDI	[11]	0.10	0.18	0.54	0.39	0.55	0.36	0.41	0.28	0.05	0.33	1.00							
	Cost of starting a business in 2007 (% of income per capita)/ Doing Business	[12]	−0.08	−0.62	−0.10	−0.36	−0.13	−0.61	−0.62	−0.66	−0.31	−0.27	−0.29	1.00						
Financial development	Market capitalization to GDP in 2006/WDI	[13]	0.39	0.53	0.44	0.58	0.30	0.47	0.30	0.42	0.27	0.30	0.03	−0.30	1.00					
	Economic Forum Global Competitiveness Report (2007)	[14]	0.24	0.46	0.40	0.58	0.25	0.63	0.40	0.59	0.48	0.66	0.19	−0.22	0.41	1.00				
	Sum of stock market capitalization and private bond market capitalization and bank credit over GDP in 2007/IFS	[15]	0.25	0.73	0.33	0.64	0.46	0.69	0.50	0.68	0.57	0.41	0.12	−0.46	0.85	0.43	1.00			
Macro volatility	Standard deviation of GDP growth/WDI	[16]	−0.09	−0.69	0.07	−0.29	0.02	−0.56	−0.34	−0.56	−0.33	−0.36	0.08	0.35	−0.16	−0.26	−0.34	1.00		
	Coefficient of variation of exchange rate/WEO	[17]	−0.19	−0.32	−0.28	−0.46	−0.15	−0.45	−0.51	−0.52	−0.60	−0.38	−0.06	0.22	−0.29	−0.41	−0.40	0.31	1.00	
	Standard deviation of inflation/WDI	[18]	−0.03	−0.07	−0.18	−0.25	−0.18	−0.15	−0.33	−0.26	−0.44	−0.25	−0.06	0.02	−0.11	−0.25	−0.19	0.01	0.83	1.00

Note: Statistics are calculated for the sample used in the benchmark regressions and therefore vary (slightly) with other regression specifications

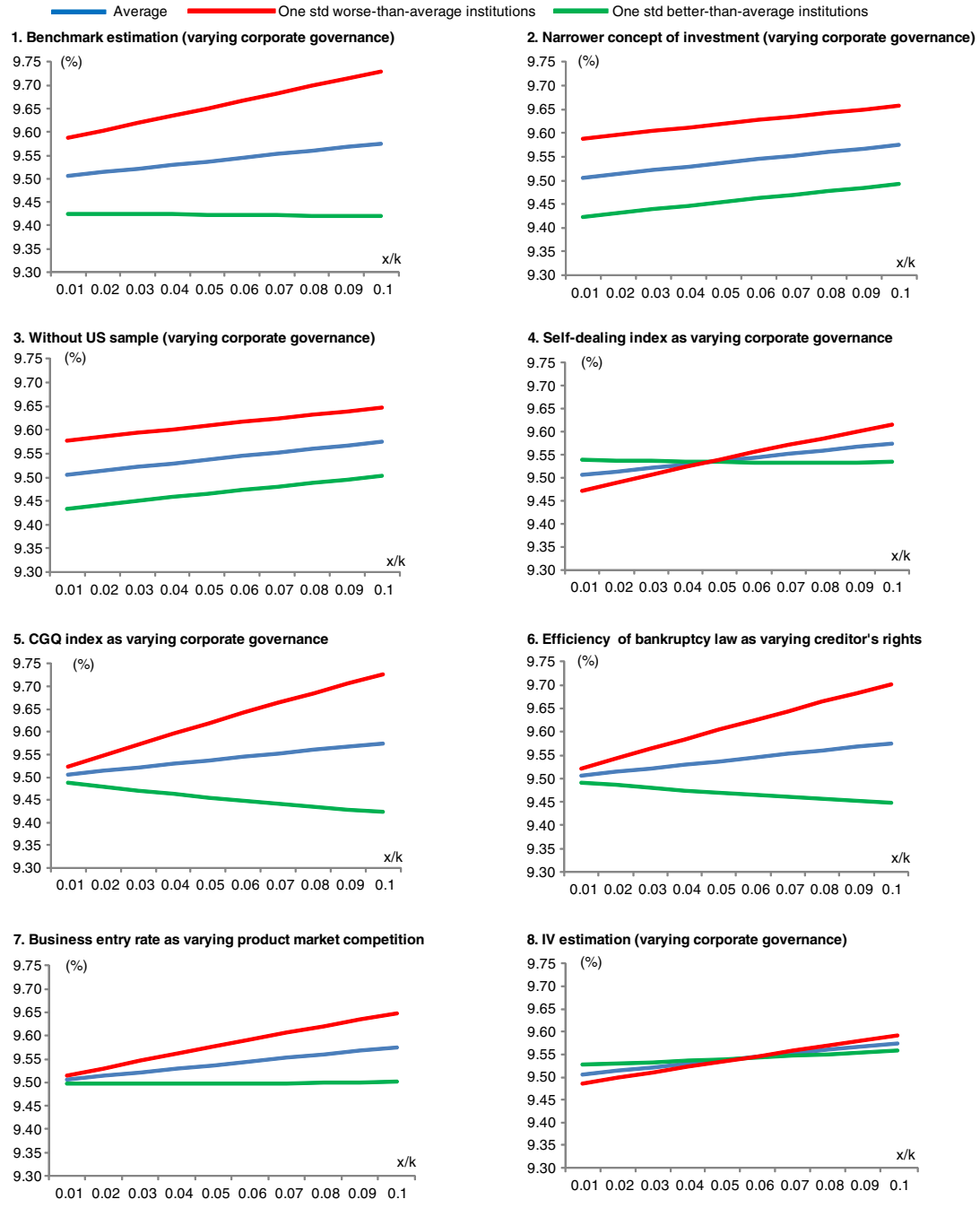
Table 2
Benchmark regressions.

	a	b1	b2	b3	c1	c2	c3
	Required return	Fin. friction coeff. ext. fin.	Fin. friction coeff. capital	Fin. friction curvature	Inv. adj. coeff. investment	Inv. adj. coeff capital	Inv. adj. curvature
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Institutional factors							
Corporate governance	−0.0562***	−0.6015**	0.0299***	0.8593			
	[−4.021]	[−2.382]	[4.598]	[1.627]			
Creditor rights	0.0229	0.0619	0.0086	−0.0857			
	[0.809]	[0.329]	[1.007]	[−0.255]			
Institution	−0.1297	−0.3123	−0.0200	0.4096			
	[−1.316]	[−0.501]	[−0.670]	[0.424]			
Competitiveness	0.0741**	−0.2238	−0.0088	0.3319			
	[2.204]	[−0.576]	[−0.461]	[0.532]			
Financial markets	0.0001	−0.0006	−0.0002	−0.0020			
	[0.520]	[−0.139]	[−0.913]	[−0.345]			
Real factors							
Firm age	0.0030***	0.0021	−0.0012***	−0.0295*	0.0211***	0.0009	0.0125
	[3.395]	[0.407]	[−3.604]	[−2.008]	[4.079]	[1.508]	[0.611]
Risk free rate	−0.0013	−0.0325	−0.0010	0.0574	−0.0681**	0.0029	0.0224
	[−0.562]	[−0.873]	[−0.389]	[1.241]	[−2.533]	[0.732]	[0.659]
Inflation	0.0000	−0.0011	0.0000	0.0047	0.0045***	−0.0003***	−0.0059***
	[0.067]	[−0.929]	[0.442]	[1.300]	[4.515]	[−4.882]	[−3.469]
Macro Volatility	−0.0545	0.0267	0.0037	−0.2680	0.1785	0.0121	0.7283*
	[−1.622]	[0.126]	[0.274]	[−0.658]	[0.811]	[0.573]	[1.694]
Observations							78,128
R-squared							0.488

Note: The dependent variable is the next-period Tobin's *Q* multiplied by the growth of the firm's capital stock, plus the after-tax income per asset as in left-hand-side of Eqs. (11) and (13). This table shows the coefficient estimates on key interaction terms. Column 1 presents the effects of institutions and real factors on the country-specific required rate of return. Columns 2 to 4 present the effects on the financial transaction costs: Column 2 shows how institutions and other variables affect the slope of the cost function with respect to investment. Column 3 shows how the effect differs with the firm's capital stock. Column 4 shows the effect on the curvature of the financial transaction cost function. Columns 5 to 7 present similar effects for the technological (non-financial) investment adjustment cost function. Country, industry, and year fixed effects are included but not reported. *t*-statistics are presented in parenthesis using standard errors clustered at the country level due to the use of country-level variables: * denotes significance at 10%, ** at 5%, and *** at 1%.

Corporate governance, in row 1, is negatively and significantly associated with the required rate of return, with a coefficient of −0.0562. The magnitude of the effect is such that a one-standard-deviation improvement in corporate governance (an increase of 1.38) would lower the required rate of return, and thereby the funding cost, by 0.078 percentage points. Intense product market competition (and firm age) is associated with a high required rate of return. Other factors do not affect the required rate of return in the benchmark regression (and in most of the specifications discussed below).

The second to fourth columns present the effects of institutions and other variables on firm-level financial transaction costs as shown in Eq. (11). The second column (b_1) shows how institutions affect the slope of the cost function. The third column (b_2) describes how the



Note: The figures show the overall predicted effects of corporate governance and other institutions on the ratio of financial transaction costs to assets plus the required rate of return on assets based on significant coefficients in the various regressions.The figures are drawn to be consistent with sample averages of firm-and country-level variables shown in Table 1a.

Fig. 1. The financial friction curve. (For interpretation of the references to color in this figure, the reader is referred to the web version of this article.)

Table 3a
Regressions using before-tax income.

	a	b1	b2	b3
	Required return	Fin. friction coeff. ext. fin.	Fin. friction coeff. capital	Fin. friction curvature
	[1]	[2]	[3]	[4]
Institutional factors				
Corporate governance	−0.0569***	−0.6369**	0.0311***	0.8895
	[−4.067]	[−2.482]	[4.656]	[1.674]
Creditor rights	0.0237	0.0262	0.0110	−0.0041
	[0.838]	[0.136]	[1.292]	[−0.012]
Institution	−0.1290	−0.2834	−0.0219	0.3327
	[−1.302]	[−0.443]	[−0.732]	[0.342]
Competitiveness	0.0721**	−0.1356	−0.0107	0.1603
	[2.138]	[−0.352]	[−0.555]	[0.256]
Financial markets	0.0001	0.0000	−0.0002	−0.0028
	[0.450]	[0.000]	[−1.006]	[−0.479]
Observations				78,110
R-squared				0.490

Note: The dependent variable is the next-period Tobin's *Q* multiplied by the growth of the firm's capital stock, plus the *before*-tax income per asset as in left-hand-side of Eqs. (11) and (13), whereas in Table 2 *after*-tax income is used. Column 1 presents the effects of institutions on the country-specific required rate of return. Columns 2 to 4 present the effects on the financial transaction costs: Column 2 shows how institutions affect the slope of the cost function with respect to investment. Column 3 shows how the effect differs with the firm's capital stock. Column 4 shows the effect on the curvature of the financial transaction cost function. Investment adjustment cost as well as real factors and country, industry, and year fixed effects are included but not reported. *t*-statistics are presented in parenthesis using standard errors clustered at the country level due to the use of country-level variables: * denotes significance at 10%, ** at 5%, and *** at 1%.

Table 3b
Regressions using investment in fixed assets only (excluding investment in cash and securities).

	a	b1	b2	b3
	Required return	Fin. friction coeff. ext. fin.	Fin. friction coeff. capital	Fin. friction curvature
	[1]	[2]	[3]	[4]
Institutional factors				
Corporate governance	−0.0528***	−0.2228	0.0176**	0.2005
	[−2.992]	[−1.566]	[2.337]	[0.665]
Creditor rights	0.0305	0.0510	0.0039	−0.1475
	[0.893]	[0.394]	[0.388]	[−0.663]
Institution	−0.1153	−0.1571	−0.0186	0.5215
	[−1.040]	[−0.304]	[−0.490]	[0.645]
Competitiveness	0.1177**	0.0783	−0.0141	0.5852
	[2.404]	[0.240]	[−0.657]	[0.947]
Financial markets	0.0002	−0.0048	−0.0000	0.0043
	[0.427]	[−1.656]	[−0.333]	[0.988]
Observations				78,194
R-squared				0.490

Note: The dependent variable is the next-period Tobin's *Q* multiplied by the growth of the firm's capital stock, plus the after-tax income per asset as in left-hand-side of Eqs. (11) and (13). In this table, investment is defined as investment in fixed capital only, excluding investment in securities which is included in the benchmark regressions in Table 2. Column 1 presents the effects of institutions on the country-specific required rate of return. Columns 2 to 4 present the effects on the financial transaction costs: Column 2 shows how institutions affect the slope of the cost function with respect to investment. Column 3 shows how the effect differs with the firm's capital stock. Column 4 shows the effect on the curvature of the financial transaction cost function. Investment adjustment cost as well as real factors and country, industry, and year fixed effects are included but not reported. *t*-statistics are presented in parenthesis using standard errors clustered at the country level due to the use of country-level variables: * denotes significance at 10%, ** at 5%, and *** at 1%.

effect differs with the firm's capital stock. The fourth column (b_3) shows the effect of institutions on the curvature of the financial transaction cost function.

The shape of the financial transaction cost function is determined by the coefficients b_1, b_2, and b_3. Because the production and cost functions are otherwise of constant returns to scale, a large volume of external finance relative to a firm's capital characterizes either young and growing firms, or firms that are subject to large adverse shocks (i.e., distressed firms). If the cost of capital of such firms is very high, then the allocation of capital across firms is likely to be inefficient. Therefore, the shape of the financial transaction cost function, especially the extent to which it is not flat, provides a measure of the extent to which small, young, or distressed firms are disadvantaged in their access to external finance.

Fig. 1, panel 1, illustrates the effects of changes in corporate governance (shareholder rights) on the overall financial transaction cost function scaled by firm assets. Because it affects all firms within a country, the required rate of return shifts up or down the overall financial friction. Together with the intercept (b_2), the required rate of return determines the overall level of the cost of external financing. The middle (blue) line shows the average cost for an external finance to asset ratio (x/k) which varies from 0.01 to 0.1.[17] The mid-point, 0.05, is the sample mean. The panel average risk free rate (8.28%) is used to construct this cost function. The function is slightly upward sloping, indicating that the cost of capital increases with the firm's reliance on external finance (i.e., there is a positive large financing premium).

The main takeaway from Fig. 1, panel 1, is that good corporate governance is associated with a lower cost of capital for all firms and with a relatively more equal access to finance for growing or distressed firms. The bottom (green) curve shows the same cost function for a hypothetical country whose characteristics are average, except that corporate governance is better than the sample average by one standard deviation. In such a country, the financial friction function is flatter and lower everywhere than in an average corporate governance country. The top (red) curve presents the opposite case, where corporate governance is worse than average by one standard deviation. Here the function is higher and steeper than in an average corporate governance country, so that the cost of capital of firms with relatively large volumes of external finance is high.

[17] To draw the average line, we run a regression without institutional factors but with other variables, that is, real factors and country, industry, and year dummies.

4.3. Robustness checks

To verify that the results are not driven by the specific firm and country measures we use, as well as by the characteristic of the sample, we examine a number of alternative specifications. In Table 3a, we use before-tax income rather than after-tax income. The results almost exactly replicate the ones in the benchmark specification. The effects of real factors are not tabulated here (or in any following table) as they are not very different from the benchmark regression. In Table 3b, we use a narrower concept of investment, which excludes financial investment. The regression results are similar to the benchmark results, except for good corporate governance which is now only associated with a low required rate of return a and with a high fixed cost per capital b_2. In Table 3c, we used a narrower concept of external finance, excluding trade credit from the benchmark specification. Here, corporate governance affects primarily the required rate of return. In these two regressions, however, the key result holds: overall financial frictions are lower with better corporate governance (see Fig. 1, panel 2 for the narrower concept of investment).

Our findings may be affected by the sample composition where U.S. firms are well-represented (Table 1b). In Table 4, we therefore use a sample without U.S. firms. The results are similar: corporate governance affects the required rate of return, a, and the fixed cost component of financial transaction costs, b_2 in opposite directions, but lowers the overall cost function (Fig. 1, panel 3). A slight difference is observed: now the general institutional quality contributes to lower the required rate of return, albeit only at a 10% significance level, and the opposite effect of product market competition disappears.

Table 3c
Regressions using debt and equity finance only (excluding trade credit).

	a	b1	b2	b3
	Required return	Fin. friction coeff. ext. fin.	Fin. friction coeff. capital	Fin. friction curvature
	[1]	[2]	[3]	[4]
Institutional factors				
Corporate governance	−0.0994***	−0.1879	−0.0094	0.1527
	[−5.063]	[−1.247]	[−1.226]	[0.556]
Creditor rights	−0.0024	0.0662	−0.0171*	−0.0034
	[−0.114]	[0.479]	[−1.723]	[−0.013]
Institution	0.0110	−0.1042	0.0113	−0.0627
	[0.263]	[−0.371]	[0.412]	[−0.122]
Competitiveness	−0.0642	−0.2390	−0.0241	−0.5479
	[−1.113]	[−0.634]	[−1.186]	[−0.785]
Financial markets	−0.0002	0.0017	−0.0000	−0.0115**
	[−0.511]	[0.417]	[−0.241]	[−2.617]
	−0.0540	0.0433	0.0082	−0.5146
	[−1.268]	[0.259]	[0.702]	[−1.460]
Observations	86,475			
R-squared	0.196			

Note: The dependent variable is the next-period Tobin's *Q* multiplied by the growth of the firm's capital stock, plus the after-tax income per asset as in left-hand-side of Eqs. (11) and (13). In this table, external finance is defined as debt and equity finance only, excluding trade credit which is included in the benchmark regressions in Table 2. Column 1 presents the effects of institutions on the country-specific required rate of return. Columns 2 to 4 present the effects on the financial transaction costs: Column 2 shows how institutions affect the slope of the cost function with respect to investment. Column 3 shows how the effect differs with the firm's capital stock. Column 4 shows the effect on the curvature of the financial transaction cost function. Investment adjustment cost as well as real factors and country, industry, and year fixed effects are included but not reported. *t*-statistics are presented in parenthesis using standard errors clustered at the country level due to the use of country-level variables: * denotes significance at 10%, ** at 5%, and *** at 1%.

Next, we check if the effects of any individual institutional measure are affected by other institutional measures which are correlated with it. We therefore estimate the effects of each institutional measure without including any other measure. Each row of Table 5 shows these one-by-one regressions. The results are virtually the same as in the benchmark regression.[18] This suggests that the correlations among the institutional measures do not generally lead to an over- or under-estimation of the effects. In what follows, we always include all five institutional measures, as in the benchmark regression.

We next examine alternative proxies for the institutional measures in Table 6, where each row presents results for one alternative institutional proxy for the benchmark regressions. The difficulty of coding laws and regulations has led some researchers to construct de facto, rather than de jure measures of corporate governance.[19] When we use the anti-self-dealing index of Djankov et al. (2008b), which is based on surveys of lawyers and is meant to reflect actual practices, not just the law on the books (and is also more up-to-date), the benchmark results are mostly replicated, except that corporate governance no longer matters for the required rate of return. Fig. 1, panel 4, shows that, in this specification too, good corporate governance flattens the overall financial friction curve as in the benchmark regression. Note, however, that since governance does not lower the overall required return for all firms, the lines cross each other.

We also use the De Nicolo et al. (2008) measure of de facto corporate governance quality (CGQ) reflecting actual disclosure practices and transparency of firms at the country level.[20] The benchmark results are, again, broadly replicated, except for the insignificant effect of governance on the required rate of return. However, Fig. 1, panel 5, presents a very similar picture to that of the benchmark regression: better governance implies a flatter financial friction curve which is also lower throughout. We conclude that alternative corporate governance measures broadly support the conclusion that good corporate governance is associated with easier access to finance, especially for small firms with (relatively) large volumes of external finance.

As an alternative measure of *Creditor*, we use a variable that captures the ability of creditors to seize collateralized assets (Djankov et al., 2007). This is a narrower concept of creditor rights than the one used in the benchmark specification. We find that this variable does not affect the financial friction curve at all, as in the benchmark specification.

In contrast, when we use a de facto, survey-based measure of the overall efficiency of bankruptcy procedures (from Djankov et al., 2008a), we find that it affects the financial friction curve in a way similar to the benchmark effect of corporate governance. As shown in Fig. 1, panel 6, efficient bankruptcy procedures flatten the curve and can even reduce the costs associated with relatively large financing. The different findings are, in part, due to the fact that strong creditor rights and speedy resolution of financial distress are not highly correlated. For example, U.S. style Chapter 11 is not favorable to creditors, and is thus associated with low creditor rights in the original index, yet it provides speedy resolutions of financial distress.

As alternative measures of *Institution* we use the Rule of Law (from Kaufmann et al., 2004) and Trust in People (from the World Values Survey) indexes. Overall, general institutional quality does not robustly affect financial frictions, possibly because the important institutions for financial frictions are sufficiently captured in the corporate governance and creditor rights variables. Rule of Law has a negative and statistically significant effect on the required rate of return. Trust in People is mostly insignificant, except for a positive effect on the required rate of return.

As alternative measures of *Compet*, we use the degree of new business entry (World Bank, 2008b) and the cost of business start-ups (World Bank, 2008a). Both lower the large financing premium, with the effect of easy firm entry being similar to that of corporate governance in the benchmark regressions (Fig. 1, panel 7). This finding may be because easy firm entry is a result, not a cause, of low financial frictions for small and young firms, due to for example good corporate governance.

As alternative measures of *FinMkt*, we use private credit to GDP and the absence of restrictions on foreign ownership (both from World

[18] Notice that the effect of general institutional quality on the required rates of return is now statistically significant.

[19] A *de jure* index can be quite subjective and may vary by specific researcher. Spamann (2010) presents a version of the anti-director rights, which, as he admits, it is quite different from the benchmark measure. Consequently, different regression results are obtained. Instead, to check the robustness of our results, we rely on alternative de facto measures of corporate governance.

[20] This index measures country-level corporate governance using firm-level data in three dimensions: disclosure (number of accounting items disclosed), transparency (disparity of earnings between before and after ad hoc accounting adjustments), and stock price comovement. Following Doidge et al. (2007) who find that country-level corporate governance matters much more than firm-level corporate governance, only country-level corporate governance measures are used.

Table 4
Regressions without U.S. firms.

	a	b1	b2	b3
	Required return	Fin. friction coeff. ext. fin.	Fin. friction coeff. capital	Fin. friction curvature
	[1]	[2]	[3]	[4]
Institutional factors				
Corporate Governance	−0.0500**	0.0268	0.0212***	−0.3470
	[−2.477]	[0.176]	[2.993]	[−1.054]
Creditor Rights	0.0404	0.1624	0.0058	−0.1790
	[1.406]	[1.133]	[0.823]	[−0.835]
Institution	−0.1530*	−0.0572	−0.0207	−0.0448
	[−1.783]	[−0.129]	[−0.785]	[−0.078]
Competitiveness	0.0491	−0.1526	0.0029	0.2720
	[1.260]	[−0.618]	[0.163]	[0.560]
Financial Markets	0.0001	−0.0054*	0.0000	0.0057
	[0.299]	[−1.824]	[0.112]	[1.301]
Observations				62,525
R-squared				0.492

Note: The regressions are identical to those in Table 2 except that U.S. firms are excluded from the sample. The dependent variable is the sum of the next-period Tobin's *Q* multiplied by the growth of the firm's capital stock, plus the after-tax income per asset as in left-hand-side of Eqs. (11) and (13). Column 1 presents the effects of institutions on the country-specific required rate of return. Columns 2 to 4 present the effects on the financial transaction costs: Column 2 shows how institutions affect the slope of the cost function with respect to investment. Column 3 shows how the effect differs with the firm's capital stock. Column 4 shows the effect on the curvature of the financial transaction cost function. Investment adjustment cost as well as real factors and country, industry, and year fixed effects are included but not reported. *t*-statistics are presented in parenthesis using standard errors clustered at the country level due to the use of country-level variables: * denotes significance at 10%, ** at 5%, and *** at 1%.

Economic Forum, 2007). These different measures produce results which are similar to those in the benchmark regression.

We also conduct robustness checks for our measure of macroeconomic volatility (*Macro*). When we use the coefficient of variation of the exchange rate and the standard deviation of inflation rate, both from the World Development Indicators, we find that the results are qualitatively similar to the benchmark results (not tabulated).

4.4. Real adjustment costs of investment and institutions

Institutional factors may also affect investment by changing the adjustment costs associated with real investment.[21] We therefore examine if our main results hold if we also allow the institutional variables to affect the coefficients that characterize the real adjustment costs of investment (not only the financial transaction costs). The results regarding financial transactions costs and the required rate of return remain broadly the same as in the benchmark regressions (Table 7).

4.5. Sources of measurement errors for Tobin's Q

Measurement errors can arise from multiple sources. Stock markets may not always reflect fundamental values (see e.g., Duffie, 2010). For the U.S., Abel and Blanchard (1986) address this issue by constructing a time series for *Q* based on a long time series of past marginal products of capital. Philippon (2009) utilizes a long time series of corporate bond prices, also for U.S. firms. Because our cross-country data are short in the time dimension and bond prices are often not available, we cannot utilize these strategies. Note that, because stock prices are quite volatile, measurement errors in *Q*, if at all, should exhibit little auto-correlation.

Measuring institutional quality is difficult and often subjective (as discussed above). Accounting items are also subject to measurement errors. We presented already several robustness checks using different proxies for the major variables other than *Q* (Tables 3a–3c). We further address the possibility of mis-measurement of debt (in the numerator of *Q*) and the replacement cost of capital (in the denominator) by using country fixed effects which can capture persistent measurement errors related to country-specific accounting conventions.

[21] Managerial entrenchment (e.g., Gaudet et al., 1998; Myers and Majluf, 1984) or worker sabotage (Parente and Prescott, 2000) may give rise to institutions affecting real investment adjustment costs.

4.6. Testing for measurement errors

If sizeable measurement errors affect the observed firm value, then the OLS errors will exhibit serial correlation. To see this, write the observed *Q* as the sum of the true *Q* (denoted by "hat") and the measurement error, that is, $Q = \hat{Q} + \nu$. Using Eq. (10), the errors can then be expressed (in vector notation) as:

$$u_{OLS} = (\xi' + \nu') - \nu * a_{OLS}(X, W), \tag{13}$$

where the measurement errors ν are assumed to have a mean of zero and to be serially uncorrelated, that is, $E[\nu] = 0$ and $E[(\nu')^T\nu] = 0$, and a_{OLS} denote the coefficients on *Q*. In this case, the OLS errors have serial correlations equal to:

$$E\left[{u_{OLS}}^T u'_{OLS}\right] = -\left\{E\left[v^T v\right]\alpha_{1OLS} + E\left[v^T(X * v)\right]\alpha_{2OLS} + E\left[v^T(W * v)\right]\alpha_{3OLS}\right\}. \tag{14}$$

where a_{1OLS} denote coefficients on "pure" *Q* terms, a_{2OLS} the coefficients on interaction terms of firm characteristics, *X*, and *Q*, and a_{3OLS} the coefficients on interaction terms of institutional factors, *W*, and *Q*. These serial correlations are expected to be non-zero in the presence of measurement errors. If the measurement errors, ν, are also serially correlated, more terms will be included in Eq. (14) and the serial correlation of the OLS errors is likely to be (even) larger. Similarly, if measurement errors in the institutional variables also exist, serial correlations will be larger.[22]

By testing for serial correlation in the OLS errors, we can evaluate the severity of the measurement error problem. When doing so, we find serial correlation to be significant but relatively small (0.069 according to OLS estimates with robust standard errors, and 0.009 according to GLS estimates).[23] This means measurement errors exist but they are relatively small compared to one-period-ahead forecast errors.

[22] Note that we use country-level static measures of institutions, which actually may evolve over time. This could cause measurement error. We address this, at least partially, in the benchmark regressions by reporting standard errors robust for clustering at the country level.

[23] We test for autocorrelation in Eq. (14) using robust errors to correct for both the theoretical possibility of varying serial correlations due to the fixed effect estimation and potential heteroskedasticity (Wooldridge, 2002). We therefore provide results using OLS estimation with robust standard errors and GLS estimation.

Table 5
One-by-one regressions.

	a	b1	b2	b3		
	Required return	Fin. friction coeff. ext. fin.	Fin. friction coeff. capital	Fin. friction curvature	Obs	R-squared
	[1]	[2]	[3]	[4]		
Corporate governance	−0.0670***	−0.5825***	0.0373***	0.7713*	78,181	0.483
	[−6.213]	[−2.803]	[5.126]	[1.765]		
Creditor rights	−0.0220	−0.1731	0.0073	0.1655	79,856	0.482
	[−1.573]	[−1.209]	[0.698]	[0.653]		
Institution	−0.1552***	−0.3687	−0.0108	0.4609	78,128	0.482
	[−2.885]	[−0.674]	[−0.232]	[0.513]		
Product market competition	0.1155**	−0.0555	−0.0157	0.2121	79,856	0.483
	[2.681]	[−0.128]	[−0.545]	[0.319]		
Financial market	−0.0003	−0.0069*	0.0002	0.0081	79,856	0.482
	[−0.916]	[−1.719]	[0.951]	[1.327]		

Note: Each row presents a separate regression with interaction terms with one institutional variable only. The dependent variable is the next-period Tobin's *Q* multiplied by the growth of the firm's capital stock, plus the after-tax income per asset as in left-hand-side of Eqs. (11) and (13). Column 1 presents the effects of institutions on the country-specific required rate of return. Columns 2 to 4 present the effects on the financial transaction costs: Column 2 shows how institutions affect the slope of the cost function with respect to investment. Column 3 shows how the effect differs with the firm's capital stock. Column 4 shows the effect on the curvature of the financial transaction cost function. Investment adjustment cost as well as real factors and country, industry, and year fixed effects are included but not reported. *t*-statistics are presented in parenthesis using standard errors clustered at the country level due to the use of country-level variables: * denotes significance at 10%, ** at 5%, and *** at 1%.

4.7. Instrumental variable estimation

While measurement errors may be small, we can nevertheless check the robustness of our findings to measurement errors by using instrumental variable estimation.[24] Allowing the one-period-ahead forecast errors to potentially include measurement errors in *Q* can be handled by instrumental variable estimation. The usual requirement for instrumental variables is that they need to be orthogonal to the original one-period-ahead forecast errors ξ. Here, they also need to be orthogonal to the measurement errors. For the interaction terms that include *Q* with measurement errors, following Wooldridge (2002, p. 237), we construct instruments using the fitted value of lagged *Q* (i.e., lagged $E[Q]$ in the theoretical, large sample limit), that is, $(X * E[Q^{-}])$ and $(W * E[Q^{-}])$. These fitted values are obtained from OLS estimations. Otherwise, the procedure is a standard two-stage least-squares estimation using lagged values as in many other studies (e.g., Almeida and Campello, 2010).[25]

Table 8 shows the results for the benchmark specification using instrumental variables.[26] The results broadly replicate those of the OLS-fixed effects estimations. A notable difference is that the required rate of return is no longer affected by corporate governance; instead, the curvature of financial frictions, b_3, becomes significant, albeit at the 10% level. Fig. 1, panel 8, confirms one main result: a flatter financial friction curve for growing or distressed firms, although good corporate governance is no longer associated with lower costs for all firms. Instead, with good governance, there is a "tilting" of the curve which makes access to finance more equal across firms. The effect of product market competition on the required rate of return is again positive and significant, as in the benchmark specification. Financial market development has a similar effect. General institutional quality is negatively related to the required rate of return but this effect too is only significant at the 10% level. As shown already, however, the effects of factors other than corporate governance are not always robust to other specifications.

5. Concluding remarks

We find that good corporate governance improves the economy-wide allocation of capital in the sense that it typically lowers the overall financial frictions and in the sense that small and growing firms, as well as distressed firms, can often raise funds at costs which are not much higher than those of "normal" firms. Both results are supported by many different regression specifications and various samples, as summarized also in Table 9. We do not find robust effects of most other institutional variables, except for the efficiency of bankruptcy procedures and the ease of new firm entry, both of which have effects similar to corporate governance.

The fact that creditor rights generally do not play a major role in explaining movements in *Q* appears to be inconsistent with many collateral constraint-based macroeconomic models, where strong creditor rights are associated with socially desirable outcomes (as they improve access to finance). One interpretation is that good corporate governance (in our case, shareholder rights) is necessary to guarantee an efficient use of funds, regardless of whether the source of funding is debt or equity. Also, the lack of evidence on the importance of creditor rights may be a feature of our sample of listed firms, which can relatively easily raise both debt and equity finance. For these firms, the cost of external finance, and its effects on investment, may be determined at the margin by equity finance and so, naturally, shareholder rights matter more than creditor rights. Moreover, the result that efficient bankruptcy procedures have similar effects as good corporate governance may imply that the speedy resolution of the debt overhang problem is economically more important than strict protection of creditor rights.

[24] If our test had indicated the presence of large measurement errors, a better technique might have been the measurement-error-robust GMM estimation developed by Erickson and Whited (2000). However, this is not the case. Therefore, we use the simpler IV estimation strategy.

[25] In theory, we should have used the twice-lagged Q as the instrumental variable for lagged *Q*, because it is well correlated with lagged *Q*, but orthogonal to the one-period-ahead forecast error in the current period and has a measurement error which is (empirically) orthogonal to the one associated with lagged *Q*. However, because we include *Q* interaction terms with industry dummies, the *Q*-only term becomes redundant. By construction, the equation is just-identified and the error term is not subject to serial correlation. Hence, the TSLS procedure is both consistent and efficient. We do correct for potential heteroskedasticity (i.e., correlation in error terms) among firms in each country by clustering at the country level. Theoretically, any *n*-times lagged *Q*'s (n > 2) can be used as an instrumental variable to form an over-identified system (Arellano and Bond, 1991). As we have a not-so-small time dimension and a very large cross-section of firms, the computational burden forces us to use only the fitted interactions (and the twice lagged *Q*) with the just-identified system.

[26] The instruments include approximation errors because they are not perfectly correlated with the original variables (weak instruments). There are no well-established tests for the weak instrument problem in the case of heteroskedasticity, but following Baum et al. (2007), we conduct three tests. According to the Kleinbergen–Paap LM p-value test, it is possible to reject the null hypothesis of under-identification, while the Kleinbergen–Paap *rk p*-value test does not reject the null of identification (weakly). Moreover, the Anderson-Rubin *F*-statistic *p*-value test rejects the null hypothesis of under-identification, confirming that the instruments are not weak. Note that the latter test is considered stronger than the others.

Table 6
Alternative Proxies of Institutions.

	a	b1	b2	b3		
	Required Return	Fin. Friction Coeff. Ext. Fin	Fin. Friction Coeff. Capital	Fin. Friction Curvature	Obs	R-Squared
	[1]	[2]	[3]	[4]		
Corporate Governance						
Self-Dealing Index	−0.0061	−4.2313**	0.1787**	8.4068**	78,128	0.487
	[−0.028]	[−2.188]	[2.633]	[2.335]		
CGQ Index	−1.2786	−29.2996***	−0.1706	42.2759*	77,400	0.486
	[−1.472]	[−3.207]	[−0.442]	[2.010]		
Creditor Rights						
Narrower Definition	0.0146	0.4378	0.0128	−0.6716	77,689	0.516
	[0.651]	[1.494]	[1.101]	[−1.121]		
Bankruptcy Efficiency	0.0188	−1.4677**	−0.0046	1.6393**	78,128	0.488
	[0.430]	[−2.664]	[−0.183]	[2.056]		
Institution						
Rule of Law	−0.1755*	0.1083	−0.0260	−1.0687	78,181	0.489
	[−1.996]	[0.168]	[−0.763]	[−1.160]		
People's Trust	0.0918***	−0.4070	−0.0057	0.5965	70,579	0.486
	[2.868]	[−0.693]	[−0.214]	[0.636]		
Product Market Competition						
New Firm Entry	0.0032	−0.2355***	−0.0014	0.3449***	71,392	0.486
	[0.516]	[−4.670]	[−0.499]	[3.562]		
Business Start-Up Cost	0.0049*	−0.0147	0.0036***	0.0426	78,128	0.489
	[1.790]	[−0.574]	[3.995]	[1.156]		
Financial Market						
Private Credit/GDP	0.0136	−0.3519	−0.0122	0.0503	77,102	0.488
	[0.506]	[−0.950]	[−0.747]	[0.102]		
Absence of Foreign	0.0192	−0.2068	0.0256	−0.4213	78,128	0.488
Ownership Restrictions	[0.330]	[−0.362]	[1.093]	[−0.426]		

Note: The dependent variable is the next-period Tobin's *Q* multiplied by the growth of the firm's capital stock, plus the after-tax income per asset as in left-hand-side of Eqs. (11) and (13). Column 1 presents the effects of institutions on the country-specific required rate of return. Columns 2 to 4 present the effects on the financial transaction costs: Column 2 shows how institutions affect the slope of the cost function with respect to investment. Column 3 shows how the effect differs with the firm's capital stock. Column 4 shows the effect on the curvature of the financial transaction cost function. Investment adjustment cost as well as other institutional variables, real factors, and country, industry, and year fixed effects are included but not reported. *t*-statistics are presented in parenthesis using standard errors clustered at the country level due to the use of country-level variables: * denotes significant at 10%, ** at 5%, and *** at 1%.

We introduce a simple and robust empirical approach to the empirical investment literature. By explicitly modeling structural restrictions on the links between institutions and financial frictions on the basis of a standard theory of investment, we can disentangle the channels by which institutional factors affect financial frictions and, through them, investment. Rather than just documenting statistical associations or conducting simple reduced-form regressions, our approach can provide a more accurate identification of the sources of financial frictions, which vary at the firm level. Also, by using the value function itself, rather than the Euler equation, our approach overcomes potential difficulties associated with cases of near zero borrowing (and investment). At the same time, our approach is, of course, not without caveats.

Table 7
Allowing for Institutional Effects on the Real Investment Adjustment Costs.

	a	b1	b2	b3	c1	c2	c3
	Required Return	Fin. Friction Coeff. Ext. Fin.	Fin. Friction Coeff. Capital	Fin. Friction Curvature	Inv. Adj. Coeff. Investment	Inv. Adj. Coeff. Capital	Inv. Adj. Curvature
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Institutional Factors							
Corporate Governance	−0.0605***	−0.3210	0.0304***	1.0772**	−0.1897	0.0134	−1.0256***
	[−4.371]	[−1.172]	[3.829]	[2.169]	[−0.927]	[1.428]	[−3.153]
Creditor Rights	0.0214	0.1551	0.0145*	−0.2770	−0.3762*	−0.0082	0.6910*
	[0.771]	[0.720]	[1.727]	[−0.790]	[−1.781]	[−0.720]	[1.852]
Institution	−0.1255	−0.4094	−0.0287	0.5367	0.4681	0.0009	−0.8461
	[−1.291]	[−0.582]	[−0.975]	[0.489]	[0.924]	[0.028]	[−0.893]
Competitiveness	0.0739**	−0.0938	0.0045	−0.1296	−0.3467	−0.0507*	0.9892
	[2.149]	[−0.194]	[0.213]	[−0.203]	[−0.775]	[−1.848]	[1.653]
Financial Markets	0.0002	−0.0043	−0.0002	0.0004	0.0060	−0.0002	−0.0021
	[0.665]	[−0.900]	[−0.883]	[0.052]	[1.344]	[−1151]	[−0.313]
Observations							78,128
R-squared							0.490

Note: The regressions are identical to those in Table 2, except that institutions are allowed to affect the non-financial investment adjustment costs. The dependent variable is the sum of the next-period Tobin's *Q* multiplied by the growth of the firm's capital stock, plus the after-tax income per asset as in left-hand-side of Eqs. (11) and (13). Column 1 presents the effects of institutions and real factors on the country-specific required rate of return. Columns 2 to 4 present the effects on the financial transaction costs: Column 2 shows how institutions and other variables affect the slope of the cost function with respect to investment. Column 3 shows how the effect differs with the firm's capital stock. Column 4 shows the effect on the curvature of the financial transaction cost function. Columns 5 to 7 present similar effects for the technological (non-financial) investment adjustment cost function. Real factors and country, industry, and year fixed effects are included but not reported. *t*-statistics are presented in parenthesis using standard errors clustered at the country level due to the use of country-level variables: * denotes significant at 10%, ** at 5%, and *** at 1%.

Table 8
Instrumental variable estimation.

	a	b1	b2	b3
	Required Return	Fin. Friction Coeff. Ext. Fin.	Fin. Friction Coeff. Capital	Fin. Friction Curvature
	[1]	[2]	[3]	[4]
Institutional factors				
Corporate governance	−0.0150	−0.3728**	0.0187**	0.7022*
	[−1.525]	[−2.381]	[2.221]	[1.835]
Creditor rights	0.0220	0.0619	0.0086	0.0656
	[1.453]	[0.429]	[0.747]	[0.205]
Institution	−0.0699*	−0.6230	−0.0114	1.2244
	[−1.782]	[−1.547]	[−0.304]	[1.426]
Competitiveness	0.0999***	−0.5576*	0.0133	0.9226
	[3.816]	[−1.762]	[0.733]	[1.282]
Financial markets	0.0004**	−0.0022	−0.0001	−0.0014
	[2.035]	[−0.830]	[−0.748]	[−0.400]
Observations				64,940
R-squared				0.543
Kleibergen–Paap Wald rk LM statistic p-value				0.116
Kleibergen-Paap Wald rk F statistic p-value				0.042
Anderson-Rubin Wald test p-value				0.000

Note: The regressions are identical to those in Table 2, except that terms involving lagged Q are instrumented using the predicted lagged Q. The dependent variable is the sum of the next-period Tobin's Q multiplied by the growth of the firm's capital stock, plus the after-tax income per asset as in left-hand-side of Eqs. (11) and (13). Column 1 presents the effects of institutions on the country-specific required rate of return. Columns 2 to 4 present the effects on the financial transaction costs: Column 2 shows how institutions affect the slope of the cost function with respect to investment. Column 3 shows how the effect differs with the firm's capital stock. Column 4 shows the effect on the curvature of the financial transaction cost function. Investment adjustment cost as well as real factors and country, industry, and year fixed effects are included but not reported. t-statistics are presented in parenthesis using standard errors clustered at the country level due to the use of country-level variables: * denotes significance at 10%, ** at 5%, and *** at 1%.

We do have to rely on a somewhat reduced form of financial frictions because it is almost impossible to design a "horse race" between institutional variables from first principles (e.g., explicit modeling of moral hazard or collateral constraints). This suggests an agenda for future research.

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Table 9
Summary table for significant impacts.

	Table	Panel in Fig. 1	Effect on the overall funding costs for all firms	Effect on the funding costs for firms with large external financing
Effect of corporate governance				
Benchmark	2	1	Lower	Flatter
Before-tax income	3a		Lower	Flatter
Narrower concept of investment	3b	2	Lower	Unchanged
Narrower concept of external finance	3c		Lower	Unchanged
Without US sample	4	3	Lower	Unchanged
One by one regression	5		Lower	Flatter
Self-dealing index	6	4	Unchanged	Flatter
CGQ index	6	5	Lower	Flatter
Adding institutions in inv. adj. cost	7		Lower	Unchanged
IV estimation	8	8	Unchanged	Flatter
(Memorandum items)				
Effects of creditor rights				
Benchmark	2		Unchanged	Unchanged
Narrower concept of creditor rights	6		Unchanged	Unchanged
Efficiency of bankruptcy law	6	6	Lower	Flatter
Effects of product market competition				
Benchmark	2		Unchanged	Unchanged
New firm entry	6	7	Lower	Flatter
Business start-up cost	6		Unchanged	Unchanged

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