# Financial Development and Financing Constraints: International Evidence from the Structural Investment Model

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This article provides evidence that financial development impacts growth by reducing financing constraints that would otherwise distort efficient allocation of investment. The financing constraints are inferred from the investment Euler equation by assuming that the firm's stochastic discount factor is a function of the firm's financial position (specifically, the stock of liquid assets). The magnitude of the changes in the cost of capital is twice as large in a country with a low level of financial development as in a country with an average level of financial development. The size effect, business cycles, and legal environment effects are also considered.

The relationship between the financial and real sides of the economy has long been a topic of intense interest and debate. The potential importance of the financial sector in promoting economic growth was recognized as early as Schumpeter (1912), though this perspective was disputed by numerous economists over the decades that followed [most notably by Lucas (1988)]. Proper empirical work in assessing the relationship between financial development and the real economy began only much later, with the work of King and Levine (1993) who reported cross-country evidence which suggested that financial development affects economic growth by fostering productivity improvements. Since then, a large and growing literature has flourished that examines the relationship between financial market development and various economic outcomes. Although the early studies were almost entirely based on cross-country analysis, more recent studies use time-series dimensions to address the causality between finance

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and growth and to study the channels through which finance affects growth.[1]

The micro-level examination of the link between real and financial decisions of firms has seen considerable work since the pioneering contribution of Modigliani and Miller (1958), who showed that in a world of perfect capital markets, finance is irrelevant for real decisions. This view has been amended and disputed by richer theoretical models and empirical studies that have found a strong relationship between firms' financial health and investment [see Hubbard (1998) for a recent survey]. These financing constraints are generally attributed to capital market imperfections, stemming from such factors as asymmetric information and incentive problems, which result in differences between the costs of internal and external financing.

The results contained in this article lie at the intersection of these two broad literatures. Utilizing firm-level data while taking advantage of the cross-country variation in financial market development, I show that financing constraints decrease with financial development. I evaluate the magnitude of financing constraints by estimating investment Euler equations.[2] Financing constraints interfere with the efficient intertemporal allocation of investment by modifying the stochastic discount factor. In particular, financial frictions cause firms to substitute investment tomorrow for investment today, that is, the financially constrained firm will postpone investment until the next period. Although the "constrained" discount factor is not directly observable, it can be inferred from the Euler equation by assuming the firm's stochastic discount factor is a function of the firm's financial position (specifically, the stock of liquid assets). My estimates show that the financial factors have a larger impact on the intertemporal allocation of investment in countries with less developed financial markets.

These findings are robust to a wide variety of specifications and to the consideration of a range of alternative explanations. I also find that small

[1] Beck et al. (2000), Neusser and Kugler (1998) and Rousseau and Wachtel (1998) use time-series analysis to address the causality issues. Bekaert, Harvey, and Lundblad (2001a, 2001b) use both cross-country and time-series analysis to study the effect of financial liberalization on economic growth.

[2] The investment Euler equation is obtained by rearranging the first-order conditions for the dynamic value optimization problem. It gives the intertemporal decision rule that governs accumulation of the capital stock in adjacent time periods. The optimal level of investment is determined by equalizing the marginal cost of investment in one period and the cost of waiting to invest in the next period (see Section 1.1 for derivation and further discussion). The investment Euler equations have been estimated by numerous authors, with most studies concentrating on U.S. firms. See Whited (1992), Hubbard and Kashyap (1992), Hubbard, Kashyap, and Whited (1995), and Calomiris and Hubbard (1995) among others. The limited work utilizing international data includes Bond and Meghir (1994) for the United Kingdom; Jaramilo, Schianterelli, and Weiss (1996) for Ecuador; Harris, Schiantarelli, and Siregar (1994) for Indonesia; Gelos and Werner (1999) for Mexico, and Bond et al. (1997) for Belgium, France, Germany, and the United Kingdom.

firms are disproportionately more disadvantaged in less financially developed countries than are large firms, that is, they have relatively larger impact of financial factors on their stochastic discount factors. Together, these results provide a micro-level foundation for one of the commonly cited explanations for the observed cross-country relationship between financial development and economic growth. Namely, I provide evidence that an improvement in the functioning of financial markets will reduce firms' financing constraints. This will allow for easier access to external funds for firms with good investment opportunities and this improvement in capital allocation will in turn enhance growth.

This article builds on several recent studies that address similar issues of the role of the financial system in stimulating economic growth using microdata. Demirguc-Kunt and Maksimovic (1998) find that the proportion of firms in countries that were growing faster than they could have using only internally generated funds is positively related to financial development and to legal system indicators. Rajan and Zingales (1998) use industry-level data to show that industries that require more external finance grow faster in more developed capital markets. Wurgler (2000) finds that financial development improves capital allocation by increasing the industry-level sensitivity of investment growth to value-added growth. However, to argue that financial development improves the allocation of capital within a country requires identifying firms that "should" be growing, given their investment opportunities. The authors of the previous articles do not attempt to control for the growth opportunities available for each firm or industry at each point in time in each country. This article improves on the previous work because the structural model in the form of investment Euler equations explicitly controls for future growth opportunities and provides a theoretical framework for the identification of the financing constraints.

This article is also related to several recent studies on financial liberalizations and their effect on financing constraints and the cost of external finance. Using Euler equation methodology, Laeven (2003) finds that progress in financial liberalization reduces firms financing constraints, especially for small firms. Galindo, Schiantarelli, and Weiss (2001) find that financial reform has led to an increase in the efficiency with which investment funds are allocated. Using different methodologies, Bekaert and Harvey (2000) and Henry (2000) find that the cost of equity capital decreases significantly after financial liberalizations. In addition, Bekaert, Harvey, and Lundblad (2001a) find that equity market liberalizations are associated with increases in real economic growth of approximately 1% per year. They also find that financial liberalization affects growth partially through its effect on financial development, thus reemphasizing the importance of financial development for growth, which is consistent with the results presented in this article.

The rest of the article is as follows. Section 1 presents the structural investment model based on a dynamic optimization problem and discusses financing constraints. Section 2 discusses the empirical model and estimation methodology. Section 3 describes the data. Section 4 provides the main results including the analysis of structural parameters. Section 5 presents several tests of alternative explanations, including the size effect, business cycles, and the legal system. Section 6 presents the auxiliary results using single-country regressions. Section 7 concludes.

## 1. The Model of Investment

Numerous studies have used the Q-theory of investment[3] to study financing constraints [see Hubbard (1998) for a recent survey]. Although the Q-theory and Euler equation models of investment come from the same optimization problem (the two models are just different ways to rearrange the first-order conditions), the assumptions required to *estimate* the Q-model are stronger than those required to estimate the Euler equation model. The main difficulty with implementing the Q-theory is finding a proxy for the unobservable marginal q. A commonly used proxy is the market value of assets relative to the book value. Among other assumptions, this proxy requires the market's valuation of capital to equal the manager's valuation. However, the divergence in these valuations is likely to be related to the degree of market imperfections, that is, the measurement error would be systematically related to the level of financial development. This assumption makes the Q-model unusable in the cross-country setting. In addition, several recent articles emphasize severe problems with the Q-methodology such as measurement error and identification problems [see Kaplan and Zingales (1997), Erikson and Whited (2000), Bond and Cummins (2001), Cooper and Ejarque (2001), and Gomes (2002)]. Therefore I choose to use the Euler equation methodology.

### 1.1 The Euler equation model

The dynamic model of the firm value optimization is reproduced in this section. This model is similar to models used in previous studies (listed in note 2), and follows closely the specification in Gilchrist and Himmelberg (1998). The model is simplified here because it ignores the possibility of debt financing. However, this simplification does not affect the resulting

[3] The "Q-theory," pioneered by Tobin (1969) and further developed by Hayashi (1982), refers to the first-order condition which states that the marginal adjustment cost of investment is equal to the shadow price of capital, denoted by Q. Both the Q-model and Euler equation model are two different ways to rearrange the first-order conditions for the same optimization problem (reproduced in Section 1.1).

first-order conditions for investment, which are the focus of this article.[4] In this model, shareholders (or managers) are maximizing the present value of the firm, which is equal to the expected discounted value of dividends subject to the capital accumulation and external financing constraints. The firm value is given by

$$V_t(K_t, \xi_t) = \max_{\{I_{t+s}\}_{s=0}^{\infty}} D_t + E_t\left[\sum_{s=1}^{\infty} \beta_{t+s-1} D_{t+s}\right] \tag{1}$$

subject to

$$D_t = \Pi(K_t, \xi_t) - C(I_t, K_t) - I_t \tag{2}$$

$$K_{t+1} = (1-\delta)K_t + I_t \tag{3}$$

$$D_t \geqslant 0 \tag{4}$$

Here $D_t$ is the dividend paid to shareholders and is given by the "sources equal uses" constraint of Equation (2); $\beta_{t+s-1}$, is a discount factor from the period $t + s$ to period $t$. In the capital accumulation constraint of Equation (3), $K_t$ is the beginning of the period capital stock, $I_t$ is the investment expenditure, and $\delta$ is the depreciation rate. The restricted profit function (i.e., it is already maximized with respect to variable costs) is denoted by $\Pi(K_t, \xi_t)$, where $\xi_t$ is a productivity shock.[5] The adjustment cost of investment is given by the function $C(I_t, K_t)$, and is assumed to result in a loss of a portion of investment. The financial frictions are introduced via a nonnegativity constraint on dividends [Equation (4)], and the multiplier on this constraint is denoted $\lambda_t$. This multiplier equals the shadow cost associated with raising new equity, which implies that external (equity) financing is costly; this extra cost is due to information or contracting costs.[6]

[4] Formally including debt into the problem results in a separate Euler equation for debt, [see Gilchrist and Himmelberg (1998) for derivation]. However, the investment Euler equation is not directly related to the debt Euler equation and is not affected by adding debt into the model.

[5] The profit function depends on the beginning of period capital, and hence the implicit assumption is that investment becomes productive only in the next period (that is, a one-period time-to-build lag). I ignore the price of investment that is replaced by fixed and time effects in the estimation. I also ignore tax considerations due to data constraints.

[6] Several influential articles addressed the sources of information- or contracting-related frictions in detail (see, e.g., Jensen and Meckling (1976), Myers and Majluf (1984), Hart (1995), and others). Here these frictions are exogenous to the firm and are represented by the shadow value of external finance. Another way to introduce financial frictions is by exogenously limiting the amount of debt that the firm can raise at any point in time. This will create a shadow value of debt, which has the same effect in the Euler equation as the shadow value of equity.

The first-order conditions to the above maximization problem are rearranged to obtain the Euler equation (derivations are available on request from the author). It is given by

$$1+\left(\frac{\partial C}{\partial I}\right)_t=\beta_t E_t\left[\Theta_t\left\{\left(\frac{\partial \Pi}{\partial K}\right)_{t+1}+(1-\delta)\left(1+\left(\frac{\partial C}{\partial I}\right)_{t+1}\right)\right\}\right]. \tag{5}$$

Here $\partial C/\partial I$ is the marginal adjustment cost of investment, $\partial \Pi/\partial K$ is the marginal "profit" of capital, referred to as MPK (the contribution of an extra unit of capital to the firm's profits), and $\Theta_t=(1+\lambda_{t+1}/1+\lambda_t)$ is the relative shadow cost of external finance in periods $t$ and $t+1$, discussed in detail in the next section. The intuition behind this Euler equation is that the marginal cost of investing today on the left-hand side (given by the adjustment cost and the price of investment goods, normalized to one) is equal to the discounted marginal cost of postponing investment until tomorrow, on the right-hand side. The latter is equal to the sum of the foregone marginal benefit of an extra unit in capital, given by MPK, plus the adjustment cost and price of investment tomorrow (again normalized to one).

### 1.2 Financing constraints

The firm's intertemporal allocation of investment depends on its effective discount factor, which is given by the product of $\beta_t$, the internal discount factor, and $\Theta_t$, the discount factor associated with the external finance premium. If a firm is constrained, which in the model is equivalent to the inability to pay negative dividends (i.e., issue new equity), the shadow value of these funds rises today relative to tomorrow (i.e., $\lambda_t>\lambda_{t+1}$). Since $\Theta_t$ depends negatively on this shadow value, the firm's effective discount factor drops and the firm postpones investment to the next period.

In perfect capital markets, $\lambda_t=\lambda_{t+1}=0$ for all $t$ and hence $\Theta_t=1$, and the firm is never constrained. With capital market imperfections, $\Theta_t$ depends on a vector of state variables, and could be identified with some observable firm characteristics. Unfortunately the model does not provide a formula for this factor, and to identify it previous literature relied on ad hoc parameterization of this factor with observable indicators of a firm's financial health [see Whited (1992)].[7] Similarly, I parameterize $\Theta_t$ as a function of the stock of liquid assets, specifically stock of cash and marketable securities scaled by total assets (hereafter referred to as cash stock). One theoretical justification for this measure appears in the Myers and Majluf (1984) model, where the amount of cash holdings, which the authors call "financial slack," has a direct effect on investment in the

[7] Such ad hoc addition to the model is justified using two arguments. First, there are no rigorous testable theoretical models of the interaction of finance and investment. Second, the test of overidentifying restrictions described below is used to verify the validity of this assumption.

presence of asymmetric information. This slack allows firms to undertake positive net present value (NPV) projects, which they would pass if they do not have any internal funds.

I parameterize factor $\Theta_t$ as a linear function of the cash stock, $\text{Cash}_{it-1}$,[8] given by $\Theta_{it} = a_{0i} + a\text{Cash}_{it-1}$, where $a_{0i}$ is a firm-specific level of financing constraints, which enters in the firm fixed effect. It is important to note that this parameterization does not allow for an explicit error term. This is a strong assumption, but it can be tested with the overidentification test, which provides an important check on the validity of the model. If this test does not indicate the rejection, the omitted error term is not empirically important. I discuss this test in more detail in Section 2.1.

In this model the cash stock affects the rate of intertemporal substitution between investment today and investment tomorrow. If a firm is not constrained $\Theta_{it} = 1$, and the effective discount factor is given by $\beta_t$, the impact of cash stock on the intertemporal allocation decision will be zero. The more constrained the firm is, the larger will be the impact of the cash stock on its discount factor. Alternatively, an increase in cash stock will increase the effective discount factor, or equivalently, lower the implied cost of capital, making investment today more attractive than investment tomorrow.

The main hypothesis of this article is that financial development decreases financing constraints. This will be reflected in a decreased impact of internal funds on the stochastic discount factor, formally:

$$\Theta_{it} = a_{0i} + (a_1 + a_2 FD_c)\text{Cash}_{it-1}. \tag{6}$$

Thus, the focus is on the interaction of *FD* (country-level measure of financial development) and *Cash*, that is, the coefficient $a_2$, and it is expected to be negative.[9]

### 1.3 MPK and adjustment costs

The marginal product of capital, MPK, can easily be derived from the profit maximization problem as a function of sales to capital ratio: $\text{MPK} = \theta(S/K)$, where $\theta = \alpha_k/\mu$, $\alpha_k$ is the capital share in the production function, and $\mu$ is a markup. The derivations and arguments in support of this measure over other alternative measures can be found in Gilchrist and

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[8] I assume that the firm makes its decision for period $t$ investment at the beginning of that year (or, equivalently, the end of previous year). Therefore the appropriate timing of the cash stock is $t-1$, because the investment decision depends on how much cash a firm has before starting the investment.

[9] An alternative way to test this hypothesis is to allow each country to have its own estimate of the cash stock, $a_c$, and then regress these coefficients on the *FD* index. I present these results in Section 6. Note that in this article $FD_c$ is a country-level measure, and therefore the implicit assumption is that the level of financial development is relatively constant. This is a reasonable assumption in a sample with short time dimension, which is the case in this article. Because the *FD* index is not time-varying, its effect on the intercept is captured by the firm fixed effects.

Himmelberg (1998). In the definition used here, the parameter $\theta$ is likely to be firm specific, which is empirically captured by the firm fixed effects using the following approximation:

$$\mathrm{MPK}_{it} = \theta_i \frac{S}{K_{it}} \approx const. + \theta_i + \bar{\theta}\frac{S}{K_{it}}, \tag{7}$$

where $\bar{\theta}$ can be thought of as the average of all $\theta_i$. This representation focuses on the variation in the sales to capital level around the firm-specific mean, that is, the within-firm variation in the productivity of capital. The fixed effects alleviate concerns with the measurement error associated with the unobserved differences in the capital share and market power parameters.

I assume a linear marginal adjustment cost of investment, given by

$$\frac{\partial C}{\partial I_{it}} = \alpha\left(\frac{I}{K_{it}} - g\frac{I}{K_{it-1}} - \nu_i\right). \tag{8}$$

This adjustment cost function is slightly more general than the one used in the traditional models because it includes the lagged investment-to-capital ratio with an additional parameter $g$. It is added to capture strong persistence in investment-to-capital ratios present in the data. This extended functional form allows for the more common form with $g=0$, which could be tested empirically. The intuition for this added term is that it may be easier for the firm to continue investment at some fraction $g$ of the previous period ratio, since, for example, it has hired workers or made some other arrangements that would be costly to cancel. Parameter $\nu_i$ could be interpreted as a firm-specific level of investment at which adjustment costs are minimized.

## 2. Empirical Model and Estimation

The empirical model is obtained by substituting Equations (6)–(8) into Equation (5). However, this produces a highly nonlinear equation, which contains several firm-specific parameters: $a_{0i}$, $\theta_i$, and $\nu_i$, discussed above. To capture these parameters in a single firm fixed effect, I linearize the model. The linear model allows me to concentrate on the within-firm variation in the intertemporal allocation of investment. Similarly, linearization allows the discount factor $\beta_t$ to be captured by country- and time-specific effects. Following Gilchrist and Himmelberg (1998), I linearize the product of $\beta_t$, $\Theta_t$, and the marginal benefit of investment (the expression in curly brackets in Equation (5), here denoted as $\{.\}_t$] using a first-order Taylor approximation around the means. Since $\Theta_t$ could be above or below one, its mean should be a value around one. Denoting the unconditional mean of the expression in curly brackets as $\gamma$, and the average discount factor as $\bar{\beta}$ the approximation is given by

$$\beta_t \Theta_t \{.\}_t \approx const. + \bar{\beta}\gamma\Theta_t + \bar{\beta}\{.\}_t + \gamma\beta_t. \tag{9}$$

I assume that the conditional covariance between the financing constraints factor and the marginal benefit of investment, as well as the higher-order terms in the approximation, are captured, to a large extent, by the country-time and firm fixed effects. The overidentification tests, discussed in the next section, are used as an indication of the validity of this assumption.

After the required substitutions, linearization, and replacing the expectation with realized values plus an error term (i.e., rational expectations assumption), the empirical model is given by:

$$\begin{aligned} \frac{I}{K_{it}} = \beta_1 \frac{I}{K_{i,t+1}} + \beta_2 \frac{I}{K_{i,t-1}} + \beta_3 \frac{S}{K_{it}} + \beta_4 \mathrm{Cash}_{it-1} \\ + \beta_5 \mathrm{Cash}_{i,t-1} \mathrm{FD}_c + f_i + d_{c,t} + e_{it}, \end{aligned} \tag{10}$$

where the coefficients are related to the structural parameters as

$$\beta_1 = \frac{\bar{\beta}(1-\delta)}{d}, \quad \beta_2 = \frac{g}{d}, \quad \beta_3 = \frac{\bar{\beta}\theta}{\alpha d}, \quad \beta_4 = \frac{\bar{\beta}\gamma}{\alpha d} a_1, \quad \beta_5 = \frac{\bar{\beta}\gamma}{\alpha d} a_2, \quad \text{and} \quad d = 1 + \bar{\beta}(1-\delta)g. \tag{11}$$

Here $f_i$ denotes fixed effects and $d_{c,t}$ denotes country-time dummies that capture interest rates and aggregate macro shocks that are allowed to be different for each country.

With respect to the coefficients in Equation (10), the main hypothesis of this article is formally stated as

$$\beta_4 \geqslant 0 \quad \text{and} \quad \beta_5 < 0. \tag{12}$$

That is, financing constraints are nonzero (for at least some countries) and they decrease with financial development.[10]

## 2.1 Estimation issues

The first issue in estimating this model concerns the presence of fixed effects. Since the regressors are predetermined rather than strictly exogenous, mean-differencing would create biased estimates. To remove fixed effects I use forward mean differencing, discussed in Arellano and Bover (1995), which removes only the forward mean, that is, the mean of all the future observations available for each firm-year. The forward mean

[10] Note that $\beta_4$ and $\beta_5$ depend on previously defined structural parameters $a_1$ and $a_2$.

differencing preserves orthogonality between transformed errors and untransformed original variables, which are used as instruments.[11] The country-time dummies, $d_{c,t}$, are removed by country-time differencing prior to estimation (i.e., all instruments and all regressors are differenced by subtracting the mean for each country and each time period).

The rational expectation error, $e_{it}$, is orthogonal to any information available at the time when the investment decision is made, which I assume to be the beginning of the year. Therefore the orthogonality conditions for this model are given by $E[\mathrm{e}_t|x_{t-s}] = 0$ for $s \geqslant 1$. I estimate the model by GMM with an optimal weighting matrix,[12] using as instruments $t-1$ and $t-2$ lags of all the variables in the regression, plus cash flow, cost of goods sold, industry dummies, and the interactions of cash, sales, and investment with FD (see Table 1 for variable definitions).

As discussed in the next section, the sample is very unbalanced and the less-developed countries are underrepresented. The countries with a small number of observations will have disproportionately little influence on the interaction term. To correct for this, I use either the rank-based approach or the weighted regressions approach. The rank-based regressions include only the largest firms within each country, ranked by the size of their fixed capital. Since there is no a priori criteria to select any specific number of firms, I experiment with different cutoff points and report results for 25, 50, and 150 firms. The weighted regression approach assigns a country-specific weight, which is equal to the inverse of the number of observations in each country. This effectively balances the number of observations across countries. This method is preferable, as it uses all available observations.

To test the overidentifying restrictions of the model I use the Sargan $J$-statistic, which equals to the value of the GMM objective function evaluated at the estimated parameter values. This statistic has an asymptotic chi-square distribution with degrees of freedom equal to the difference in the number of instruments and regressors. Two caveats apply to this test statistic. First, it is commonly established that its asymptotic distribution is a poor approximation to the finite sample distributions [see Hall and Horowitz (1996)]. Second, the asymptotic distribution of this

[11] Forward mean differencing, also referred to as "orthogonal deviations," was used to estimate investment models by Bond and Meghir (1994) and Gilchrist and Himmelberg (1998).

[12] The weighting matrix takes into account the panel structure of the data. It is given by $\mathbf{W} = (\sum_{i=1}^{N} \mathbf{Z}_i' \hat{\mathbf{u}}_i \hat{\mathbf{u}}_i' \mathbf{Z}_i)^{-1}$, where $\hat{\mathbf{u}}_i = (\hat{u}_{i1}, \ldots, \hat{u}_{iT_i})'$ is a vector of first-stage residuals and $\mathbf{Z}_i = (\mathbf{z}_{i1}', \ldots, \mathbf{z}_{iT_i}')'$ is a $T_i \times K$ matrix of instruments for firm $i$. It allows for conditional heteroscedasticity and SUR effects on the firm level (i.e., temporal heteroscedasticity within the firm), but does not allow any correlation across firms (which is captured by the country-time dummies). The weighting matrix employed here is akin to the weighting matrix II used in Bekaert, Harvey, and Lundblad (2001b). However, they have relatively small cross-sectional dimension and overlapping time periods and so they stack their observations by time, while here they are stacked by firm. This allows the most efficient use of my data, which have very large cross-sectional dimensions and small temporal dimensions.

**Table 1**
**Variable definitions**

| Abbreviation | Description |
|---|---|
| *Firm-level variables (from Worldscope)* | |
| PPENT | Property plant and equipment, net of depreciation |
| CAPEX | Capital expenditure |
| DA | Depreciation and amortization expense |
| K | Beginning period capital = PPENT − CAPEX + DA |
| IK, I/K | Investment to capital ratio = CAPEX/K |
| SK, S/K | Sales to capital ratio = sales/K |
| Cash | Cash plus equivalents scaled by total assets (or scaled by K for robustness checks) |
| CF | Cash flow (net income + DA), scaled by K |
| COGS | Cost of goods sold, scaled by K |
| Size | Log of total assets in U.S. dollars |
| Rank | Ranking based on size of PPENT (first, ranked by year, then averaged over the years), largest firm in each country has rank equal to one. |
| Weight | Weight is a country-level variable equal to one over the number of valid observations per country. |
| Industry dummies | For manufacturing industries the dummies are on a two digit SIC level and for the rest of industries they are on a one digit level. |
| *Country-level variables* | |
| STKMKT | Stock market development is Index1 from Demirguc-Kunt and Levine (1996), equals to the sum of (standardized indices of) market capitalization to GDP, total value traded to GDP, and turnover (total value traded to market capitalization). |
| FININT | Financial intermediary development is Findex1 from Demurguc-Kunt and Levine (1996), equals to the sum of (standardized indices of) ratio of liquid liabilities to GDP, and ratio of domestic credit to private sector to GDP. |
| FD | Financial development = STKMKT + FININT. |
| Legal origin | Country's legal origin categorized into four groups: English, French, German or Scandinavian, from La Porta et al. (1998). |
| Efficiency, rule of law | Efficiency of legal system and rule of law are two measure of the quality of law enforcement, from La Porta et al. (1998). |
| Expropriation | Risk of expropriation is the risk of outright confiscation or forced confiscation by the government, from La Porta et al. (1998). |
| Corruption | The measure of corruption, from La Porta et al. (1998). |
| GNP PC | Log of GNP per capita in U.S. dollars in 1994, World Development Report 1996. |
| grGDP | Annual real growth rate of GDP, IFS. |

statistic with the weighted regressions approach is unknown. To overcome these caveats I perform a bootstrap simulation to obtain the empirical distributions of the $J$-statistic.[13] I report the $p$-values, that is, the probability that the model is not rejected by the data (low $p$-values indicate rejection of the model).

## 3. Data

All firm-level data come from the Worldscope database, which contains data on large, publicly traded firms in which there is an investor interest.

[13] I follow the method of Hall and Horowitz (1996), who suggested recentering the bootstrap sample moments relative to the population moments. To capture the panel nature of the data, the sampling is done on the firm level. I report $p$-values given by the bootstrap distribution based on 200 repetitions. Increasing the number of repetitions for selected models produced qualitatively similar results. The Stata code for the GMM and bootstrap of the $J$-statistic are available from the author.

**Table 2**
**Sample coverage across countries**

| Country | Country code | Number of observations | Percent of total observations | Number of firms |
|---|---|---|---|---|
| Argentina | AR | 177 | 0.003 | 21 |
| Austria | AT | 424 | 0.008 | 45 |
| Australia | AU | 1359 | 0.026 | 135 |
| Belgium | BE | 474 | 0.009 | 50 |
| Brazil | BR | 593 | 0.012 | 68 |
| Canada | CA | 2950 | 0.057 | 283 |
| Switzerland | CH | 941 | 0.017 | 102 |
| Chile | CL | 390 | 0.007 | 46 |
| Colombia | CO | 108 | 0.003 | 10 |
| Germany | DE | 3688 | 0.067 | 379 |
| Denmark | DK | 927 | 0.018 | 97 |
| Spain | ES | 838 | 0.016 | 93 |
| Finland | FI | 656 | 0.013 | 65 |
| France | FR | 2794 | 0.055 | 296 |
| United Kingdom | GB | 8038 | 0.166 | 801 |
| Indonesia | ID | 464 | 0.009 | 59 |
| Israel | IL | 125 | 0.003 | 17 |
| India | IN | 1353 | 0.025 | 131 |
| Italy | IT | 1049 | 0.019 | 104 |
| Japan | JP | 3447 | 0.078 | 291 |
| South Korea | KR | 903 | 0.021 | 60 |
| Mexico | MX | 455 | 0.008 | 55 |
| Malaysia | MY | 1216 | 0.025 | 121 |
| Netherlands | NL | 1142 | 0.021 | 117 |
| Norway | NO | 607 | 0.011 | 59 |
| New Zealand | NZ | 280 | 0.005 | 28 |
| Philippines | PH | 222 | 0.005 | 20 |
| Pakistan | PK | 385 | 0.007 | 48 |
| Portugal | PT | 206 | 0.004 | 19 |
| Sweden | SE | 977 | 0.019 | 92 |
| Singapore | SG | 617 | 0.014 | 61 |
| Thailand | TH | 855 | 0.018 | 106 |
| Turkey | TR | 97 | 0.002 | 6 |
| USA | US | 8293 | 0.175 | 800 |
| Venezuela | VE | 74 | 0.001 | 8 |
| South Africa | ZA | 1008 | 0.019 | 101 |
| Total | | 48,132 | | 4794 |
| Average number of firms per country | | | | 133 |
| Average number of firms per country, excluding U.S. and U.K. | | | | 94 |
| Median number of firms per country, excluding U.S. and U.K. | | | | 80 |

The firm data are available for 36 countries and cover about 5000 firms for the years 1988–1998 (however, the years before 1991 and the year 1998 have fewer observations). Details on the sample selection are given in Appendix A. The coverage within countries varies widely, from as little as 1% of all listed domestic firms included (for India) to as many as 82% (for Sweden), as calculated by La Porta et al. (1997) who use the same sample. Table 2 provides a list of countries in the sample, with the number of firms and observations per country, which varies widely across the countries. The United States and United Kingdom have about 800 firms each, while the average number of firms for the rest of the countries is 94.

The main firm-level variables are investment and sales, scaled by the beginning of period capital,[14] and stock of liquid assets (cash stock).

The main country-level indicator is an index of financial development, FD, which is an average of five standardized indices from Demirguc-Kunt and Levine (1996): market capitalization over gross domestic product (GDP), total value traded over GDP, total value traded over market capitalization, the ratio of liquid liabilities (M3) to GDP, and the credit going to the private sector over GDP. Thus the FD index combines five important characteristics of financial markets into a single measure, similar to the ones used in other studies. The value of this index corresponds to the beginning of my sample period and it is standardized to have mean zero and standard deviation of one.[15]

Other variables and their sources are defined in Table 1. Table 3 reports means and medians of the key variables, by country. Table 4 reports cross-country correlations of the country averages for these variables. Most of the country-level institutional characteristics are highly correlated with each other (panel B, Table 4).

## 4. Main Results

The main results are based on the model given in Equation (10) and are reported in Table 5. Models 1–3 use the rank-based approach with different cutoff points, and model 4 uses the weighted regression approach. All coefficients have their predicted signs and are significant at 1%. The coefficients in the weighted regression have the smallest standard errors because all the available observations are used, which results in efficiency gains. The main coefficients are cash and the interaction of cash with FD, and their signs are in line with the main hypothesis stated in Equation (12).

The interpretation of the magnitudes is best done in terms of the parameters of the underlying structural model, which are related to the reduced form coefficients by formulas given in Equation (11). There are five equations and eight parameters, therefore not all of the structural parameters can be identified. I choose to identify $(\bar{\beta}, g, \alpha, a_1, a_2)$ and assume the fixed values for the remaining parameters. I use the

[14] The model requires one to use the beginning of period capital stock as a scaling factor for calculating adjustment costs and MPK. One alternative is to use lagged capital stock (i.e., period $t-1$ used as the beginning of the period $t$ capital stock). However, this would not be appropriate if there are mergers, acquisitions, divestitures, or other capital-changing events, which are hard to identify. I use the approximate value given by the ending period capital, minus investment and plus depreciation in that year, which is more robust to the capital-changing events, as discussed in Love (1999).

[15] Similar indicators were used in a recent article by Bekaert, Harvey, and Lundblad (2001a). They investigate the effect of financial liberalization and financial development on subsequent growth, measuring financial development at the begining of the five-year window. Similarly, in my article the financial development measure is taken at the begining of the period and the firm-level data actually used in regressions cover a five-year period (i.e., the effective sample after losing several years for instruments and transformations is 1991–1995).

**Table 3**
**Descriptive statistics for key variables**

| | Cash | | I/K | | S/K | | Financial development | | |
|---|---|---|---|---|---|---|---|---|---|
| Country | Mean | Median | Mean | Median | Mean | Median | FD | FININT | STKMKT |
| Argentina | 0.08 | 0.04 | 0.19 | 0.13 | 1.6 | 1.2 | −1.38 | −0.79 | −0.59 |
| Austria | 0.10 | 0.07 | 0.25 | 0.20 | 4.4 | 3.0 | −0.27 | −0.12 | −0.15 |
| Australia | 0.08 | 0.05 | 0.26 | 0.18 | 3.3 | 2.3 | 0.42 | 0.23 | 0.19 |
| Belgium | 0.10 | 0.08 | 0.25 | 0.20 | 4.0 | 3.7 | −0.82 | −0.35 | −0.47 |
| Brazil | 0.08 | 0.04 | 0.12 | 0.09 | 1.7 | 1.0 | −1.04 | −0.75 | −0.29 |
| Canada | 0.07 | 0.02 | 0.23 | 0.18 | 3.1 | 1.5 | 0.03 | −0.06 | 0.09 |
| Switzerland | 0.14 | 0.11 | 0.23 | 0.15 | 3.9 | 2.6 | 2.2 | 1.45 | 0.75 |
| Chile | 0.07 | 0.04 | 0.21 | 0.16 | 1.6 | 1.3 | −0.75 | −0.29 | −0.46 |
| Colombia | 0.08 | 0.04 | 0.26 | 0.14 | 3.6 | 1.9 | −1.6 | −0.72 | −0.88 |
| Germany | 0.08 | 0.05 | 0.31 | 0.25 | 5.5 | 4.8 | 1.68 | 0.3 | 1.38 |
| Denmark | 0.15 | 0.14 | 0.24 | 0.21 | 4.4 | 3.7 | −0.49 | −0.12 | −0.37 |
| Spain | 0.06 | 0.04 | 0.14 | 0.09 | 2.8 | 1.8 | −0.14 | 0.11 | −0.25 |
| Finland | 0.09 | 0.08 | 0.38 | 0.21 | 5.0 | 3.2 | −0.41 | 0.12 | −0.53 |
| France | 0.12 | 0.09 | 0.27 | 0.21 | 6.5 | 6.0 | 0.1 | 0.31 | −0.21 |
| UK | 0.09 | 0.06 | 0.22 | 0.17 | 4.6 | 4.0 | 1.68 | 0.45 | 1.23 |
| Indonesia | 0.14 | 0.10 | 0.37 | 0.23 | 3.9 | 2.6 | −1.17 | −0.46 | −0.71 |
| Israel | 0.11 | 0.10 | 0.30 | 0.24 | 3.7 | 3.0 | 0.01 | −0.07 | 0.08 |
| India | 0.04 | 0.03 | 0.27 | 0.19 | 3.5 | 2.6 | −0.7 | −0.44 | −0.26 |
| Italy | 0.12 | 0.09 | 0.26 | 0.17 | 4.4 | 3.0 | −0.64 | −0.13 | −0.51 |
| Japan | *0.19* | *0.17* | 0.22 | 0.19 | 4.1 | 3.3 | *3.3* | 1.31 | 2.02 |
| South Korea | 0.08 | 0.06 | 0.31 | 0.23 | 3.9 | 3.0 | 0.84 | −0.21 | 1.05 |
| Mexico | 0.08 | 0.06 | 0.11 | 0.10 | 1.6 | 1.3 | −0.85 | −0.71 | −0.14 |
| Malaysia | 0.08 | 0.05 | 0.23 | 0.16 | 2.7 | 1.8 | 1.19 | 0.29 | 0.9 |
| Netherlands | 0.10 | 0.05 | 0.24 | 0.20 | 5.1 | 3.8 | 0.66 | 0.34 | 0.32 |
| Norway | 0.14 | 0.12 | 0.33 | 0.22 | 3.6 | 2.1 | −0.15 | 0.03 | −0.18 |
| New Zealand | 0.04 | 0.02 | 0.17 | 0.13 | 3.3 | 2.8 | −0.53 | −0.2 | −0.33 |
| Philippines | 0.12 | 0.07 | 0.37 | 0.22 | 2.6 | 1.4 | −1.15 | −0.61 | −0.54 |
| Pakistan | 0.11 | 0.04 | 0.26 | 0.19 | 4.8 | 2.5 | −1.28 | −0.46 | −0.82 |
| Portugal | 0.06 | 0.03 | 0.22 | 0.13 | 3.3 | 2.0 | −0.67 | −0.06 | −0.61 |
| Sweden | 0.12 | 0.08 | 0.31 | 0.19 | 4.7 | 3.8 | −0.31 | −0.21 | −0.1 |
| Singapore | *0.19* | 0.15 | 0.28 | 0.22 | 3.6 | 2.5 | 1.6 | 0.56 | 1.04 |
| Thailand | 0.06 | 0.03 | 0.40 | 0.23 | 4.5 | 2.5 | 0.36 | −0.02 | 0.38 |
| Turkey | 0.13 | 0.07 | *0.56* | *0.50* | *7.5* | 5.8 | −1.2 | −0.59 | −0.61 |
| U.S. | 0.09 | 0.04 | 0.24 | 0.19 | 4.8 | 3.8 | 1.35 | 0.14 | 1.21 |
| Venezuela | 0.09 | 0.06 | 0.21 | 0.13 | 1.5 | 1.1 | −1.26 | −0.52 | −0.74 |
| South Africa | 0.09 | 0.06 | 0.22 | 0.19 | 4.7 | 3.8 | 0.25 | −0.23 | 0.48 |
| Mean | 0.10 | 0.07 | 0.26 | 0.19 | 3.82 | 2.80 | −0.03 | −0.07 | 0.04 |
| Median | 0.09 | 0.06 | 0.25 | 0.19 | 3.87 | 2.62 | −0.29 | −0.12 | −0.20 |
| Std | 0.04 | 0.04 | 0.08 | 0.07 | 1.33 | 1.22 | 1.14 | 0.50 | 0.73 |

Summary statistics by country for main variables. Variables definitions are given in Table 1. Outliers (far away maximum or minimum) are underlined.

minimum-distance estimator described in Appendix B, which also details the assumptions on fixed parameters. The parameters of the adjustment cost function imply a marginal adjustment cost in the range 0.25–0.9. These estimates are in line with previous evidence: for example, Whited (1998) cites articles that produced estimates in the range of 1% to 80% of the investment expenditure.

The magnitude of the financing constraints is given by the impact of the cash stock on the discount factor $\Theta$, which was defined in Equation (6). The values for the structural parameters imply that for a firm in a country

**Table 4**

*Panel A. Cross-country correlations of firm level variables*

| | Country means | | | | Country medians | | | |
|---|---|---|---|---|---|---|---|---|
| | FD | Cash | IK | SK | FD | Cash | IK | SK |
| FD | | 0.15 | 0.02 | 0.34 | | 0.21 | 0.21 | 0.44 |
| | | (0.35) | (0.87) | **(0.04)** | | (0.22) | (0.22) | **(0.006)** |
| Cash | 0.21 | | 0.32 | 0.36 | 0.21 | | 0.36 | 0.32 |
| | (0.23) | | **(0.04)** | **(0.02)** | (0.22) | | **(0.02)** | **(0.04)** |
| IK | 0.09 | 0.27 | | 0.55 | 0.29 | 0.35 | | 0.59 |
| | (0.59) | *(0.099)* | | **(0.0002)** | *(0.096)* | **(0.03)** | | **(0.0001)** |
| SK | 0.41 | 0.24 | 0.49 | | 0.45 | 0.23 | 0.56 | |
| | **(0.015)** | (0.14) | **(0.002)** | | **(0.008)** | (0.15) | **(0.0003)** | |

*Panel B. Correlations of country-level institutional characteristics*

| | FD | FININT | STKMKT | Efficiency | Corruption | Expropr. | Accounting | GNPPC |
|---|---|---|---|---|---|---|---|---|
| FININT | 0.90 | | | | | | | |
| | **(0)** | | | | | | | |
| STKMKT | 0.95 | 0.73 | | | | | | |
| | **(0)** | **(0)** | | | | | | |
| Efficiency | 0.52 | 0.52 | 0.45 | | | | | |
| | **(0.001)** | **(0.001)** | **(0.005)** | | | | | |
| Corruption | 0.51 | 0.55 | 0.40 | 0.83 | | | | |
| | **(0.001)** | **(0.001)** | **(0.01)** | **(0)** | | | | |
| Expropriation | 0.57 | 0.64 | 0.39 | 0.72 | 0.83 | | | |
| | **(0.001)** | **(0)** | **(0.02)** | **(0)** | **(0)** | | | |
| Accounting | 0.34 | 0.28 | 0.34 | 0.31 | 0.41 | 0.36 | | |
| | *(0.05)* | *(0.09)* | **(0.04)** | *(0.06)* | **(0.01)** | **(0.03)** | | |
| GNP PC | 0.56 | 0.61 | 0.46 | 0.74 | 0.87 | 0.84 | 0.46 | |
| | **(0)** | **(0.0)** | **(0.004)** | **(0)** | **(0)** | **(0)** | **(0.005)** | |
| GDP US | 0.54 | 0.41 | 0.49 | 0.20 | 0.26 | 0.46 | 0.15 | 0.42 |
| | **(0)** | **(0.01)** | **(0.002)** | (0.22) | (0.11) | **(0.003)** | (0.39) | **(0.01)** |

Correlations of country-level means and medians of the firm level variables and country's institutional characteristics. Variables definitions are in Table 1. Panel A: below the diagonal are Pearson correlation coefficients, with two outlier countries excluded: JP (Japan) and TR (Turkey). Above the diagonal are Spearman correlations (robust to outliers) with all observations included. Including outliers for Pearson correlations results in significant correlation for FD and Cash (due to JP which is an outlier on both of these) and nonsignificant correlation for SK and FD (due to TR, which has very high SK and low FD). Panel B: Pearson correlations with all countries. (Excluding Japan makes correlations of GDP PC with FD and FININT significant at 6% and 2%, respectively; also correlation between FININT and log GDP becomes insignificant.) *P*-values are in parenthesis; bold are significant at 5% or better, underlined are significant at 10%.

with an average FD, such as Spain, Norway, or Israel, a one standard deviation decrease in cash stock results in a change in the cost of capital of about 7%. The estimates also suggest that firms in countries with high FD (i.e., one standard deviation above the mean), such as the United States, the United Kingdom, and Japan, are not significantly financially constrained. This is not surprising given that the sample mainly consists of large publicly traded firms. On the other side, for firms in countries with low FD (i.e., one standard deviation below the mean), such as Mexico, Brazil, or Chile, a one standard deviation decrease in cash stock implies an increase in the cost of capital of about 14%. Although these estimates appear to be on the high side, the magnitude is definitely reasonable. What

**Table 5**
**Main results on financial development and financing constraints**

| Model: | 1<br>25 largest | 2<br>50 largest | 3<br>150 largest | 4<br>All, weighted |
|---|---|---|---|---|
| $I/K_{it+1}$ | 0.733 | 0.643 | 0.638 | 0.353 |
| | (0.105)*** | (0.103)*** | (0.093)*** | (0.058)*** |
| $I/K_{it-1}$ | 0.231 | 0.219 | 0.218 | 0.203 |
| | (0.025)*** | (0.017)*** | (0.013)*** | (0.008)*** |
| $S/K_{it}$ | 0.021 | 0.017 | 0.013 | 0.033 |
| | (0.008)*** | (0.006)*** | (0.005)*** | (0.004)*** |
| $\text{Cash}_{it-1}$ | 0.189 | 0.143 | 0.138 | 0.218 |
| | (0.063)*** | (0.047)*** | (0.039)*** | (0.034)*** |
| $\text{Cash}_{it-1}{}^{*}\text{FD}_{c}$ | −0.157 | −0.113 | −0.102 | −0.183 |
| | (0.039)*** | (0.032)*** | (0.027)*** | (0.024)*** |
| Constant | 0.000 | −0.002 | −0.001 | −0.002 |
| | (0.001) | (0.001)** | (0.001) | (0.001)** |
| $N$ observations | 3533 | 6488 | 12474 | 21278 |
| $N$ firms | 755 | 1436 | 2791 | 4794 |
| $p$-value for $J$-statistic | | | | |
| Chi-square | 0.72 | 0.208 | 0.015 | NA |
| Bootstrap | 0.93 | 0.463 | 0.042 | 0.792 |

The dependent variable is $IK_t$, the model is given in Equation (10); variable definitions are in Table 1. The estimation is by GMM; country-time, and fixed effects are removed prior to estimation (see Section 2.1). Instruments are first and second lags of IK, SK, Cash, CFK, COGS, interactions of FD with IK, SK and Cash, and industry dummies. The firms are ranked based on the size of the capital stock. In the weighted regression, weights are equal to a value of one divided by the number of observations per country. $P$-values for $J$-statistic (test of overidentifying restrictions) are obtained using chi-square distribution or bootstrap simulation with 200 repetitions (the chi-square $p$-value is not available for weighted regressions). Heteroscedasticity adjusted standard errors in parentheses.

***, ** and * represent significance at 1%, 5%, and 10%, respectively.

is important is that the constraints in a country with a low FD are almost twice as large as they are in a country with an average FD.[16] Although these calculations are rough approximations and should be used with caution, they suggest that financial development has a large and economically significant effect on financing constraints.

Another way to observe this relationship is by splitting the sample into financially developed and undeveloped subsamples (based on the median level of FD), given in Table 6. For the high-FD sample, the cash coefficient is small and insignificant, while it is large and significant for the low-FD sample.

The reported overidentification tests are used to verify the validity of the model. For rank-based regressions I report $p$-values (i.e., probability

[16] The effect on the cost of capital is calculated using structural parameters obtained from model 2 in Table 5. The numbers used in this calculation are $a_1 = 1.4$, $a_2 = -1.1$, $\text{FD} = 0$ for an average country and $\text{FD} = -1$ for a low-FD country, and a standard deviation of the change in the cash stock around its firm-level mean is 0.048 (calculated for the sample used in the regression). These numbers are substituted into Equation (6) to obtain the change in the discount factor which translates to the change in the cost of capital. The reported magnitudes depend on the assumptions of the fixed parameters described in Appendix B, which also contains a discussion of the sensitivity analysis. Relative to the rest of the investment literature, the range implied by the sensitivity tests seems reasonable. In addition, no matter what the assumptions on the fixed parameters, the magnitude of the constraints is about twice as large in a country with low financial development as it is in a country with average financial development.

**Table 6**
**Sample splits**

| | High FD | | Low FD | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Model: | 50 largest | 150 largest | 50 largest | 150 largest |
| $I/K_{it+1}$ | 0.629 | 0.734 | 0.766 | 0.643 |
| | (0.064)*** | (0.094)*** | (0.105)*** | (0.126)*** |
| $I/K_{it-1}$ | 0.257 | 0.231 | 0.184 | 0.181 |
| | (0.022)*** | (0.015)*** | (0.024)*** | (0.021)*** |
| $S/K_{it}$ | 0.014 | 0.014 | 0.008 | 0.019 |
| | (0.007)*** | (0.005)*** | (0.008) | (0.009)** |
| $\text{Cash}_{it-1}$ | 0.041 | 0.035 | 0.210 | 0.258 |
| | (0.044) | (0.036) | (0.072)*** | (0.069)*** |
| Constant | 0.000 | 0.000 | −0.001 | −0.001 |
| | (0.002) | (0.001) | (0.002) | (0.002) |
| *N* observations | 4335 | 9377 | 2579 | 3596 |
| *N* firms | 861 | 1962 | 686 | 969 |
| *p*-value for J-statistic | | | | |
| Chi-square | 0.907 | 0.348 | 0.518 | 0.495 |
| Bootstrap | 0.983 | 0.528 | 0.792 | 0.593 |

The dependent variable is $IK_t$; variable definitions are in Table 1. High FD and low FD are samples split on the median FD (reported in Table 3). The estimation is by GMM; country-time and fixed effects are removed prior to estimation (see Section 2.1). Instruments are first and second lags of IK, SK, Cash, CFK, COGS and industry dummies. The firms are ranked based on the size of the capital stock. *P*-values for *J*-statistic (test of overidentifying restrictions) are obtained using chi-square distribution or bootstrap simulation with 200 repetitions. Heteroscedasticity adjusted standard errors in parentheses.

***, ** and * represent significance at 1%, 5%, and 10%, respectively.

that the model is not rejected) using asymptotic and bootstrapped distributions, described in Section 2.1. It is interesting to note that the bootstrapped probabilities are always higher than the asymptotic ones, suggesting that the asymptotic tests tend to reject the model too often. However, both tests do not reject models 1 and 2 in Table 5 and all four models in Table 6, and both tests reject model 3 in Table 5.[17] For the weighted regression (model 4 in Table 5), only the bootstrapped test is available and it does not reject the model. These tests serve as evidence that the assumptions that I make in the model and estimation are not rejected by the data.

This section establishes the main claim of this article, that financial development decreases financing constraints, measured by the impact of internal funds on the effective discount factor, which in turn affects the rate of intertemporal substitution between investment in two subsequent periods.

[17] Increasing the cutoff point makes the sample more and more unbalanced, which is probably the reason for the rejection of the model (this is also true for models with different cutoff points that are not reported). However, in the sample splits in Table 6, even with 150 firms, neither sample is rejected (this is likely because the main imbalance is between developed and developing countries).

## 5. Tests of Alternative Explanations

### 5.1 Size and business cycles

Several robustness tests of the model are performed by adding other variables to the parameterization of the discount factor. The first variable is firm size. It is likely that small firms have larger information asymmetries which could lead to larger financing constraints, however, the empirical results on the effect of size on financing constraints have been mixed [see Schiantarelli (1996) for a survey of this evidence]. To test for the size effect, I add the interaction of size (measured by the log of total assets in U.S. dollars) with cash stock to the baseline model.[18] The results presented in model 1 of Table 7 show that larger firms are less constrained, as the impact of the cash stock on their discount factor is smaller. Next, I test the robustness of the FD result to inclusion of the size effect. If more financially developed countries have larger firms, as argued by Kumar, Rajan, and Zingales (1999), the estimated FD effect could be attributed to differences in firm size rather than financial development. Model 2 shows that this is not the case, as both interactions remain significant at 1%.

This methodology allows me to address another interesting empirical question: Is the size effect equal in all countries, or is it related to financial development? The intuition is that the largest firms in less financially developed countries could have easier access to external finance obtained through external capital markets or political connections, while smaller firms will be comparatively more disadvantaged. I test this by augmenting the model to add a triple interaction of cash, size, and FD. I find in model 3 that this interaction is negative and significant; that is, financial development affects the small firms significantly more than the large firms.[19] The size effect is about 35% larger for a country with low financial development relative to a country with average financial development.

Another potential concern is that my main results could reflect different stages in the countries' business cycles rather than the average level of financial development. External financing is easier to obtain during good times (when profits are high and balance sheets are healthy) and therefore financing constraints will vary over the business cycle.[20] To test this I include the interaction of the real GDP growth rate, $\text{grGDP}_{ct}$, with the

[18] Since my size measure is not time varying, it enters the Euler equation only as an interaction with the cash stock, as the level effect is captured by the firm fixed effects.

[19] Note that model 1 is rejected at the 5% level by the overidentification test, however, models 2 and 3 are not rejected. Model 1 could be rejected because it does not contain the interaction with financial development.

[20] This intuition has been formalized and tested on U.S. data by Gertler and Hubbard (1988), Bernanke and Gertler (1989) and Gertler and Gilchrist (1994), among others.

**Table 7**
**Robustness: size effect and business cycles**

| | Size Effect | | | Business Cycles | |
|---|---|---|---|---|---|
| Model: | 1 | 2 | 3 | 4 | 5 |
| $I/K_{it+1}$ | 0.534 | 0.444 | 0.437 | 0.294 | 0.215 |
| | (0.061)*** | (0.057)** | (0.058)** | (0.071)** | (0.063)*** |
| $I/K_{it-1}$ | 0.197 | 0.200 | 0.199 | 0.189 | 0.194 |
| | (0.008)*** | (0.008)*** | (0.008)*** | (0.009)*** | (0.008)*** |
| $S/K_{it}$ | 0.026 | 0.029 | 0.029 | 0.035 | 0.037 |
| | (0.004)*** | (0.004)*** | (0.004)*** | (0.004)*** | (0.004)*** |
| $\text{Cash}_{it-1}$ | 0.443 | 0.493 | 0.617 | 0.226 | 0.254 |
| | (0.102)*** | (0.107)*** | (0.119)*** | (0.041)*** | (0.042) |
| $\text{Cash}_{it-1}{}^{*}\,\text{Size}_{\text{i}}$ | – 0.057 | – 0.059 | – 0.083 | | |
| | (0.017)*** | (0.018)*** | (0.021)*** | | |
| $\text{Cash}_{it-1}{}^{*}\,\text{FD}_{\text{c}}$ | | – 0.172 | – 0.588 | | – 0.164 |
| | | (0.024)*** | (0.112)*** | | (0.025)*** |
| $\text{Cash}_{it-1}{}^{*}\,\text{Size}_{i}{}^{*}\,\text{FD}_{\text{c}}$ | | | 0.078 | | |
| | | | (0.019)*** | | |
| $\text{Cash}_{it-1}{}^{*}\,\text{grGDP}_{\text{ct}}$ | | | | – 1.420 | – 0.973 |
| | | | | (0.622)** | (0.632)[a] |
| Constant | – 0.002 | – 0.002 | – 0.002 | – 0.002 | – 0.003 |
| | (0.001)*** | (0.001)*** | (0.001)*** | (0.001)*** | (0.001)*** |
| *N* observations | 21278 | 21278 | 21278 | 21009 | 21009 |
| *N* firms | 4794 | 4794 | 4794 | 4768 | 4768 |
| Bootstraped *p*-value for *J*-statistic: | 0.142 | 0.193 | 0.228 | 0.973 | 0.993 |

The dependent variable is $IK_t$. The size is equal to the (log of) total assets in U.S. dollars, grGDP is country-year real GDP growth rate. The estimation is by GMM; country-time and fixed effects are removed prior to estimation (see Section 2.1). Instruments are first and second lags of IK, SK, Cash, CF, COGS, size (GDP growth) and its interactions with Cash, IK and SK, interactions of FD with IK, SK, Cash, and size, and industry dummies. All the regressions are weighted regressions, weights are equal to a value of one divided by the number of observations per country. *P*-values for *J*-statistic (test of overidentifying restrictions) are obtained using bootstrap simulation with 200 repetitions. Heteroscedasticity adjusted standard errors in parentheses.

***, ** and * represent significance at 1%, 5%, and 10% level

[a]in model (5) indicates, significance at 12% level.

firm-level measure of the cash stock. Model 4 in Table 7 shows that this interaction is negative, that is, economic boom periods (periods with high GDP growth) are associated with the lower level of financing constraints. The effect of financial development is not significantly affected by the addition of the GDP growth interaction: FD interaction remains significant at 1% in model 5.

### 5.2 Legal system indicators

Recent law and finance literature has focused on the differences in the rights of minority shareholders and the enforcement of laws across countries [most notably La Porta et al. (1997, 1998)]. They argue that "the [legal] protection investors receive determines their readiness to finance firms," and show that the legal environment has large effects on the level of financial development. Therefore better legal protection of investors will reduce the cost of external finance and should be reflected in the impact of internal funds on the firms' effective discount factor.

Previous research (La Porta et al. and others) identified several legal system indicators such as the efficiency of the legal system, the rule of law, the risk of expropriation, corruption, and legal origin (see Table 1 for variable definitions and original sources for these data). These indicators measure different aspects of the legal environment. For example, efficiency and the rule of law measure the quality of the law enforcement, that is, how well the laws on the books are enforced by the courts. Corruption measures the distortions introduced by the courts and government into the functioning of the financial and real sectors of the economy. The accounting standards measure the quality of information available to investors and should therefore reduce the external financing costs associated with information availability.

I use the baseline model in Equation (10) and replace FD with each of the legal indicators. As shown in Table 8, each indicator has a negative effect on the cash coefficient and countries of English legal origin appear to be less constrained, consistent with the previous evidence. When each indicator is included together with FD (all the even-numbered models in Table 8), FD interactions remain significant at 1% in all cases, as well as most legal indicators (only efficiency and English origin lose significance when included together with FD). Since FD and legal indicators are highly correlated, both variables drop in magnitude when included together. This could be taken as evidence that there are several aspects of the underlying contracting environment which are measured imperfectly with different indicators. However, financial development remains a robust indicator of the firm's financing constraints throughout the whole exercise.

## 6. Single-Country Regressions

An alternative way to address the relationship between financial development and financing constraints is to allow each country to have its own level of financing constraints, measured by the coefficient on cash stock. That is, the discount factor is now given by $\Theta_{it} = a_{0i} + a_c \mathrm{Cash}_{it-1}$. I estimate Equation (10) without the interaction term for each country and obtain country-specific cash coefficients, $\hat{a}_c$. Then these coefficients are regressed on the country-level index of financial development:

$$\hat{a}_c = b_0 + b_1 \mathrm{FD}_c + e_c. \tag{13}$$

The main hypothesis now is that $b_1 < 0$, that is, the first-stage cash coefficients are decreasing with financial development. These single-country regressions are not as efficient as cross-country regressions because they require estimating 180 coefficients [five per country for 36

**Table 8**
**Legal system indicators and financing constraints**

| Model: | Indicator: | $\text{Cash}_{it-1}$ | $\text{Cash}_{it-1}{}^{*}$ $\text{Indicator}_c$ | $\text{Cash}_{it-1}{}^{*}\ \text{FD}_c$ | Bootstraped $p$-value for $J$-statistic: |
|---|---|---|---|---|---|
| 1 | Efficiency | 0.685*** | – 0.062*** | | 0.792 |
| | | (0.101) | (0.012) | | |
| 2 | Efficiency | 0.392*** | – 0.022 | – 0.153*** | 0.853 |
| | | (0.122) | (0.016) | (0.030) | |
| 3 | Rule of law | 0.712*** | – 0.065*** | | 0.738 |
| | | (0.100) | (0.012) | | |
| 4 | Rule of law | 0.564*** | – 0.044*** | – 0.139*** | 0.718 |
| | | (0.112) | (0.014) | (0.026) | |
| 5 | Corruption | 0.716*** | – 0.069*** | | 0.818 |
| | | (0.098) | (0.012) | | |
| 6 | Corruption | 0.507*** | – 0.039*** | – 0.133*** | 0.802 |
| | | (0.117) | (0.015) | (0.029) | |
| 7 | Expropriation | 1.510*** | – 0.149*** | | 0.643 |
| | | (0.175) | (0.019) | | |
| 8 | Expropriation | 1.210*** | – 0.112*** | – 0.111*** | 0.463 |
| | | (0.211) | (0.024) | (0.027) | |
| 9 | Accounting | 1.140*** | – 0.015*** | | 0.302 |
| | | (0.158) | (0.002) | | |
| 10 | Accounting | 0.761*** | – 0.009*** | – 0.126*** | 0.387 |
| | | (0.193) | (0.003) | (0.027) | |
| 11 | English origin | 0.263*** | – 0.223*** | | 0.313 |
| | | (0.039) | (0.061) | | |
| 12 | English origin | 0.245*** | – 0.064 | – 0.169*** | 0.568 |
| | | (0.039) | (0.066) | (0.025) | |

The dependent variable is $IK_t$, the “baseline” model is given in Equation (10) with FD interactions replaced or supplemented with each of the indicator variable interactions (the rest of coefficients are not reported). Variable definitions are in Table 1. The estimation is by GMM, country-time and fixed effects are removed prior to estimation (see Section 2.1). Instruments are first and second lags of IK, SK, Cash, CFK, COGS, interactions of FD and appropriate indicator with IK, SK and Cash, and industry dummies. All the regressions are weighted regressions, weights are equal to a value of one divided by the number of observations per country. All regressions include 21,278 observations (4794 firms) except for models with accounting standards which include 21,032 observations (4687 firms). $P$-values for $J$-statistic (test of overidentifying restrictions) are obtained using bootstrap simulation with 200 repetitions. Heteroscedasticity adjusted standard errors in parentheses.

***, ** and * represent significance at 1%, 5%, and 10% respectively.

countries, the five coefficients are $\beta_1 - \beta_4$ in Equation (10) plus a constant] rather than estimating only 6. As a result, most of the individual cash coefficients are not significant at conventional levels (results of the first-stage estimation are available on request[21]). An advantage of this approach is in allowing all the coefficients to be country specific. Since the dependent variable is estimated in the first stage, the standard errors of the second-stage regression are not correct and the following results should be considered as “informal” and complementary to the formal inference performed in the previous sections.

[21] The cash stock coefficients range from zero (25th percentile) to 0.35 (75th percentile), with a mean of 0.17 and a median of 0.11. These statistics are in line with the cash coefficients estimated in the cross-country regressions, which varied from 0.13 to 0.21 (Table 5).

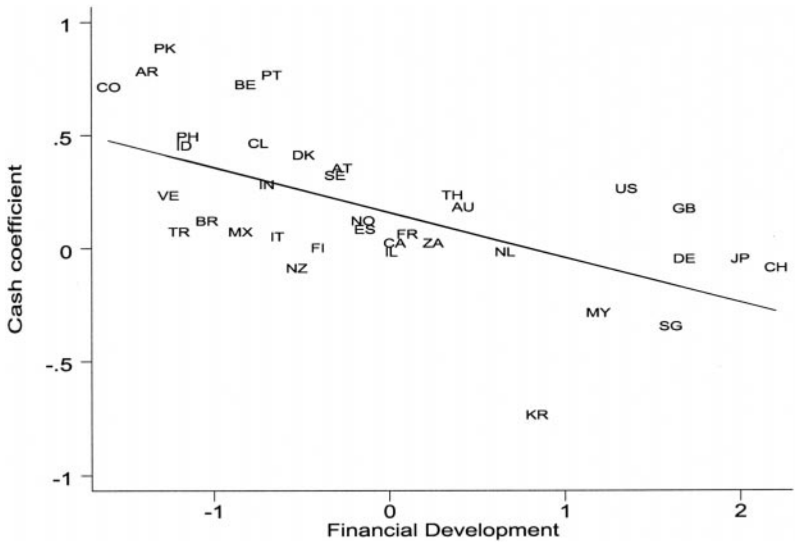


**Figure 1**
**Cash coefficients and financial development**
Regression line: $-0.18$, significant at 1% (the standard error is 0.05 and $R^2$ is 0.35). Without KR: $-0.16$, significant at 1% (the standard error is 0.04 and $R^2$ is 0.37).

In Figure 1 the cash coefficients estimated in the first stage are plotted against the FD index and a strong negative relationship is found. The OLS regression results in a coefficient of $-0.18$, significant at the 1% level with $R^2 = 0.35$. Keeping in mind the problem with standard errors in this regression, it is interesting to note that the magnitude of this coefficient (which is consistent) is much in line with the magnitude of the interaction term in cross-country regressions (see model 4 in Table 5). This makes the single-country regressions a useful robustness test, despite the problem of low efficiency of individual coefficients.

## 7. Conclusion

This article shows that financial development affects a firm's investment via their ability to obtain external finance. This effect is inferred from the investment Euler equation by assuming that the stochastic discount factor is a function of the firm's internal cash stock. I find that the impact of internal funds on the effective discount factor decreases with financial development. In other words, firms that face financing constraints behave as if they have low discount factors (i.e., high cost of capital) and tend to postpone investment to the next period. The magnitude of the changes in the cost of capital of financially constrained firms is twice as large in a country with a low level of financial development as it is in a country with an average level of financial development. The financial development effect remains significant after controlling for firm size and the country's business cycles, which also affect financing constraints. I also find that small firms are disproportionately more disadvantaged in less financially developed countries than are large firms. Finally, legal system indicators (the efficiency of the legal system, the risk of expropriation, corruption, or legal origin) are also associated with a reduction in financing constraints; however, the effect of financial development is robust to inclusion of any additional indicators.

This article makes contributions to two strands of literature. First, it contributes to the investment literature by estimating a structural investment model and confirming the presence of financing constraints for a broad range of countries. Second, and more importantly from a policy perspective, this article contributes to the economic development and growth literature by showing that financial development diminishes financing constraints by reducing information asymmetries and contracting imperfections. The decrease in financing constraints allows firms to invest according to their growth opportunities and therefore improves capital allocation.

## Appendix 1: Sample Selection

All countries in the Worldscope database (May 1999 Global Researcher CD) excluding former socialist economies are included. This results in a sample of 36 countries. The sample does not include firms for which the primary industry is either financial (one-digit SIC code of 6) or service (one-digit SIC codes of 7 or above).

In addition, I delete the following (see Table 1 for variable definitions):

- All firms with three or fewer years of coverage.
- All firm-years with missing CAPEX, PPENT, sales, and cash.
  Observations with zero PPENT (200 observations).
- Observations with negative KBEG (277 observations), cash/total assets or COGS (27 observations).
- Observations with $IK > 2.5$ (1% of all observations).
- Observations with $SK > 20$ (5% of all observations).[22]
- Observations with $Cogs/K > 20$ (80 observations).
- Observations with cash/total assets $> 0.6$ (1% of all observations).
- 50% of all U.S. firms with at least four years of data available were selected by random sample.

In addition, to eliminate influential observations, I exclude 1% on each side of the distribution for each of the variables in the regression. The resulting dataset has about 5000 firms with about 48,000 observations; the number of observations by country is given in Table 2.

[22] This rule excludes firms for which capital is not a big factor in production. Half of these were in the United States and United Kingdom; Japan, France, and Denmark totaled 25%.

## Appendix B: Identifying Structural Parameters Using Estimated Coefficients

The formulas that determine estimated coefficients as functions of the structural parameters are given in Equation (11). Denote $\boldsymbol{\beta}=(\beta_1,\beta_2,\beta_3,\beta_4,\beta_5)$, the vector of reduced-form coefficients estimated in the Euler equation. I choose to identify five parameters of interest, denoted $\boldsymbol{\sigma}=(\beta, g, \alpha, a_1, a_2)$ and assume the values for the remaining parameters. I assume a depreciation rate $\delta=0.12$, which is the sample average of the depreciation expense to capital ratio. The coefficient $\theta$, which translates the sales-to-capital ratio into MPK in Equation (7), is assumed to be equal to 0.2 (this corresponds to the values for the capital share $\alpha_k=0.3$ and markup $\mu=1.3$).[23] Finally, I assume the value for the linearization parameter $\gamma=1.2$, which is equal to the average marginal benefit of investment.[24] The sensitivity analysis performed by varying the values of the fixed parameters results in the range of estimates that is reasonable in comparison to other articles in the literature.[25]

Denote the relationship between reduced-form coefficients and structural parameters as $\beta=f(\sigma)$. The minimum distance estimator is the argument of the following minimization problem:

$$\check{\sigma}=\arg\min_{\sigma}(\check{\beta}-f(\sigma))'\check{\Sigma}^{-1}(\check{\beta}-f(\sigma)),$$

where $\check{\beta}$ is the vector of estimates for the reduced-form coefficients and $\check{\Sigma}$ is its variance-covariance matrix. Let $F\equiv \text{plim}\, \partial f(\sigma)/\partial\sigma'|_{\sigma=\check{\sigma}}$, which is a Jacobian matrix of derivatives of each of the functions with respect to each of the structural parameters. It can be shown that

$$\sqrt{N}(\check{\sigma}-\sigma_0)\rightarrow N(0,(F'\Sigma^{-1}F)^{-1})$$

where $F$ and $\Sigma$ can be consistently estimated by $\check{F}$ and $\check{\Sigma}$.


**References**

Arrelano, M., and O. Bover, 1995, "Another Look at the Instrumental Variable Estimation of Error Component Models," *Journal of Econometrics*, 68, 29–51.

Beck, T., R. Levine, and N. Loyaza, 2000, "Financial Intermediation and Growth: Causality and Causes," *Journal of Monetary Economics*, 46, 31–77.

Bekaert G., and C. Harvey, 2000, "Foreign Speculators and Emerging Equity Markets," *Journal of Finance*, 55, 565–613.


[23] The estimate of markup is taken from Hubbard, Kashyap, and Whited (1995), and it corresponds to a demand elasticity of $-4$.

[24] I assume that MPK is approximately equal to 0.2 [taken from Gilchrist and Himmelberg (1998)] and the marginal adjustment cost term is 0.2. Varying $\gamma$ from 1.1 to 1.4 results in about 20% variation in parameter estimates. Since the value of $\gamma$ depends on the values of other parameters, I experimented with an iterative procedure when $\gamma$ was determined at every stage of minimization using the parameter values at that stage. This produced qualitatively similar results.

[25] The sensitivity analysis shows that the only parameter that results in significant variation in implied cost of capital is $\theta$. For example, assuming $\theta=0.1$ implies that the change in the cost of capital in a country with average financial development is about 5% and in a country with low financial development it is about 9%. Assuming $\theta=0.3$ implies that the change in the cost of capital in a country with average financial development is about 17% and in a country with low financial development it is about 34%. Relative to the results reported in the text, this analysis implies ranges from 50% to 200%. These ranges seem reasonable relative to other articles in the investment literature, which is not known for producing precise estimates: for example Whited (1998) cites articles that estimate adjustment costs in the range from 0.01 to 0.8, that is, a difference of 8000%.

Bekaert G., C. Harvey, and C. Lundblad, 2001a, "Does Financial Liberalization Spur Growth," Working Paper W8245, NBER.

Bekaert G., C. Harvey, and C. Lundblad, 2001b, "Emerging Equity Markets and Economic Growth," *Journal of Development Economics*, 66, 465–504.

Bernanke, B., and M. Gertler, 1989, "Agency Costs, Net Worth, and Business Fluctuations," *American Economic Review*, 79, 14–31.

Bond, S., and J. G. Cummins, 2001, "Noisy Share Prices and the Q Model of Investment," working paper, Oxford University.

Bond, S., and C. Meghir, 1994, "Dynamic Investment Models and the Firm's Financial Policy," *Review of Economic Studies*, 61, 197–222.

Bond, S., J. Elston, J. Mairesse, and B. Mulkay, 1997, "Financial Factors and Investment in Belgium, France, Germany and the UK: A Comparison Using Company Panel Data," Working Paper 5900, NBER.

Calomiris, C., and G. Hubbard, 1995, "Internal Finance and Firm-Level Investment: Evidence from the Undistributed Profit Tax of 1936–1937," *Journal of Business*, 68, 443–482.

Cooper, R., and J. Ejarque, 2001, "Exhuming Q: Market Power versus Capital Market Imperfections," working paper, Boston University.

Demirguc-Kunt, A., and R. Levine, 1996, "Stock Market Development and Financial Intermediaries: Stylized Facts," *World Bank Economic Review*, 10, 291–321.

Demirguc-Kunt, A., and V. Maksimovic, 1998, "Law, Finance and Firm Growth," *Journal of Finance*, 53, 2107–2131.

Erickson, T., and T. Whited, 2000, "Measurement Error and the Relationship between Investment and q," *Journal of Political Economy*, 108, 1027–1057.

Galindo, A., F. Schiantarelli, and A. Weiss, 2001, "Does Financial Liberalization Improve the Allocation of Investment? Micro Evidence from Developing Countries," mimeo, Boston College.

Gelos, G., and A. Werner, 1999, "Financial Liberalization, Credit Constraints, and Collateral: Investment in the Mexican Manufacturing Sector," Working Paper WP/99/25, IMF.

Gertler, M., and S. Gilchrist, 1994, "Monetary Policy, Business Cycles, and the Behavior of Small Manufacturing Firms," *Quarterly Journal of Economics*, 109, 309–340.

Gertler, M., and G. Hubbard, 1988, "Financial Factors in Business Fluctuations," in *Financial Market Volatility: Causes, Consequences, and Policy Recommendations*, Federal Reserve Bank, Kansas City.

Gilchrist, S., and C. Himmelberg, 1998, "Investment, Fundamentals and Finance," *NBER Macroeconomics Annual*, MIT Press, Cambridge, Mass.

Gomes, J., 2002, "Financing Investment," forthcoming in *American Economic Review*.

Hall, P., and J. Horowitz, 1996, "Bootstrap Critical Values for Tests Based on Generalized Method-of-Moments Estimators," *Econometrica*, 64, 891–916.

Harris, J. R., F. Schiantarelli, and M. G. Siregar, 1994, "The Effect of Financial Liberalization on the Capital Structure and Investment Decisions of Indonesian Manufacturing Establishments," *World Bank Economic Review*, 8, 17–47.

Hart, O., 1995, *Firms, Contracts, and Financial Structure*, Oxford University Press, London.

Hayashi, F., 1982, "Tobin's Marginal q and Average q: A Neoclassical Interpretation," *Econometrica*, 50, 213–224.

Henry, P. B., 2000, "Stock Market Liberalization, Economic Reform and Emerging Market Equity Prices," *Journal of Finance*, 55, 529–564.

Hubbard, R. G., 1998, "Capital Market Imperfections and Investment," *Journal of Economic Literature*, 36, 193–225.

Hubbard, R. G., and A. Kashyap, 1992, "Internal Net Worth and the Investment Process: An Application to United States Agriculture," *Journal of Political Economy*, 100, 506–534.

Hubbard, R. G., A. Kashyap, and T. Whited, 1995, "Internal Finance and Firm Investment," *Journal of Money Credit and Banking*, 27, 683–701.

Jaramillo, F., F. Schianterelli, and A. Weiss, 1996, "Capital Market Imperfections Before and After Financial Liberalization: An Euler Equation Approach to Panel Data for Ecuadorian Firms," *Journal of Development Economics*, 51, 367–386.

Jensen, M., and W. Meckling, 1976, "Theory of the Firm: Managerial Behaviour, Agency Costs, and Ownership Structure," *Journal of Financial Economics*, 3, 305–360.

Kaplan, S., and L. Zingales, 1997, "Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints?" *Quarterly Journal of Economics*, 112, 169–215.

King, R. G., and R. Levine, 1993, "Finance and Growth: Schumpeter Might be Right," *Quarterly Journal of Economics*, 108, 717–737.

Kumar K. B., R. Rajan, and L. Zingales, 1999, "What Determines Firm Size," Working paper 7208, NBER.

Laeven, Luc, 2003, "Does Financial Liberalization Reduce Financing Constraints," forthcoming in *Financial Management*.

La Porta, R., F. Lopez-de-Silanes, A. Shleifer, and R. Vishny, 1997, "Legal Determinants of External Finance," *Journal of Finance*, 102, 1131–1150.

La Porta, R., F. Lopez-de-Silanes, A. Shleifer, and R. Vishny, 1998, "Law and Finance," *Journal of Political Economy*, 106, 1113–1155.

Love, I., 1999, "The Capital Accumulation Identity — How Well does it Hold in the Data: Evidence from Compustat and Worldscope Databases," working paper, Columbia University.

Lucas, R. E., 1988, "On the Mechanics of Economic Development," *Journal of Monetary Economics*, 22, 3–42.

Modigliani, F., and M. Miller, 1958, "The Cost of Capital, Corporate Finance, and the Theory of Investment," *American Economic Review*, 48, 261–297.

Myers, S., and N. Majluf, 1984, "Corporate Financing and Investment Decisions When Firms Have Information That Investors do not Have," *Journal of Financial Economics*, 13, 187–221.

Neusser, K., and M. Kugler, 1998, "Manufacturing Growth and Financial Development: Evidence from OECD countries," *Review of Economics and Statistics*, 80, 636–646.

Rajan, R., and L. Zingales, 1998, "Financial Dependence and Growth," *American Economic Review*, 88, 559–586.

Rousseau, P., and P. Wachtel, 1998, "Financial Intermediation and Economic Performance: Historical Evidence from Five Industrialized Countries," *Journal of Money Credit and Banking*, 30, 657–678.

Schiantarelli, F., 1996, "Financial Constraints and Investment: Methodological Issues and International Evidence," *Oxford Review of Economic Policy*, 12, 70–89.

Schumpeter, J. A., 1912, *The Theory of Economic Development*, trans. 1934, Harvard U.P., Cambridge, MASS.

Tobin, J., 1969, "A General Equilibrium Approach to Monetary Theory," *Journal of Money Credit and Banking*, 1, 265–293.

Whited, T., 1992, "Debt, Liquidity Constraints, and Corporate Investment: Evidence from Panel Data," *Journal of Finance*, 47, 1425–1460.

Whited, T., 1998, "Why do Investment Euler Equations Fail?" *Journal of Business and Economic Statistics*, 16, 479–488.

Wurgler, J., 2000, "Financial Markets and Allocation of Capital," *Journal of Financial Economics*, 58, 187–214.