Financial Liberalization and Financing Constraints: Evidence from Panel Data on Emerging Economies

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Comments Welcome

Abstract

We use panel data on a large number of firms in 13 developing countries to find out whether financial liberalization relaxes financing constraints of firms. We find that liberalization affects small and large firms differently. Small firms are financially constrained before the start of the liberalization process, but become less so after liberalization. Financing constraints of large firms, however, are low both before and after financial liberalization. The initial difference between large and small firms disappears over time. We also find that financial liberalization reduces financial market imperfections, particularly the informational asymmetries with respect to the financial leverage of firms. We hypothesize that financial liberalization has little effects on the financing constraints of large firms, because these firms had better access to preferential directed credit during the period before financial liberalization.

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1 Introduction

In this study we explore the impact of financial reforms on financial constraints of firms in developing countries. These reforms have consisted mainly of the removal of administrative controls on interest rates and the scaling down of directed credit programs. Barriers to entry in the banking sector have often been lowered as well and the development of securities markets was stimulated. Although the main objective of financial deregulation should be to increase the supply of funds for investment, the consequence of financial liberalization on the supply of funds for investment is theoretically ambiguous. In a repressed financial system, governments often intervene by keeping interest rates artificially low and replace market with administrative allocation of funds. Interest rate liberalization is likely to lead to an increase in interest rates. McKinnon (1973) and Shaw (1973) argue that low interest rates on deposits discourage household savings, and thus favor interest rate liberalization. They also argue that interest rate ceilings distort the allocation of credit and may lead to under-investment in projects that are risky, but have a high expected rate of return. The neo-structuralists (see Van Wijnbergen (1982, 1983a, 1983b, 1985)) argue that the existence of informal credit markets can reverse the effect of an increase in interest rates on the total amount of savings. The effect of an increase in the deposit rate on the amount of loanable funds depends on whether households substitute out of curb market loans or out of cash to increase their holdings of time deposits. If time deposits are closer substitutes for curb market loans than for cash, then the supply of funds to firms will fall, given that banks are subject to reserve requirements and curb markets are not. Both theories have in common that financial liberalization changes the composition of savings and will not necessarily relax financial constraints for all classes of firms.

Some authors claim that in a number of developing countries financial liberalization has failed to meet expected efficiency gains, because accompanying the rise in loan rates was a rise in the required external finance premium for a substantial class of borrowers[2], and others say that financial liberalization has led to crises. However, to the extent that there are economies of scale in information gathering and monitoring it is expected that banks have an advantage over the curb or informal market in allocating

investment funds, and this should lead to an increase in the access of external finance and a reduction in the "premium" of external finance over internal finance. At the same time, the elimination of subsidized credit programs could increase the financing constraints on those firms that previously benefited from the directed credit system.

Evidence about the effects of financial liberalization on financing constraints in developing countries has been provided by Harris, Schiantarelli and Siregar (1994) for Indonesia, Jaramillo, Schiantarelli and Weiss (1997) for Ecuador, Gelos and Werner (1999) for Mexico, and Gallego and Loayza (2000) for Chile. For Indonesia, Harris, Schiantarelli and Siregar (1994) find evidence that the sensitivity to cash flow decreases for small firms after financial liberalization and that borrowing costs have increased, while for Ecuador, Jaramillo, Schiantarelli and Weiss (1997) find no evidence of a change in borrowing constraints after financial reform. This may be the result of the fact that in Ecuador financial liberalization was less profound than in Indonesia, or benefited only certain firms. The findings may also be the result of using relatively short panels, while the effects of liberalization are only felt over a long period of time. Gelos and Werner (1999) examine the impact of financial liberalization on financing constraints in Mexico and find that financial constraints were eased for small firms but not for large ones. They argue that large firms might have had stronger political connections than small firms and hence better access to preferential directed credit before financial deregulation. Gallego and Loayza (2000) examine the impact of financial liberalization on financing constraints in Chile and find that financial constraints were eased during the period of liberalization in the following sense: firm investment became more responsive to changes in Tobin's *q*, less tied to internal cash flow, and less affected by the debt-to-capital ratio.

From the above it is clear that there can be distributional consequences to programs of financial liberalization, and whether they relax financing constraints for different categories of firms is ultimately an empirical question. This paper aims to address this question. We contribute to the literature by using panel data for a large number of firms in 13 developing countries to analyze the effects of financial liberalization on firm investment and financing constraints, rather than focusing on one single country.

[2] See Gertler and Rose (1994).

Closely related to our paper is the work by Love (2000) who studies the relationship between financial development and financing constraints by estimating Euler equations on a firm level for a sample of 40 countries. Love (2000) finds a strong negative relationship between the sensitivity of investment to the availability of internal funds and an indicator of financial market development, and concludes that financial development reduces the effect of financing constraints on investment. This result provides evidence for the hypothesis that financial development reduces informational asymmetries in financial markets which leads to an improvement in the allocation of capital and ultimately to a higher level of growth.

Section 2 reviews the literature on financing constraints. Section 3 presents the structural model of firm investment that we use to estimate the impact of financial liberalization on financing constraints of firms. Section 4 describes the econometric techniques we employ to estimate our structural model of firm investment. Section 5 presents the firm-level data used in our empirical work. Section 6 presents the results of our empirical work. Section 7 assesses the robustness of our results. Section 8 concludes.

2 Literature Review

Following the work of Fazzari, Hubbard and Petersen (1988) a large body of literature has emerged to provide evidence of such financing constraints. This literature relies on the assumption that external finance is more costly than internal finance due to asymmetric information and agency problems, and that the "premium" on external finance is an inverse function of a borrower's net worth. It has been found that financial variables such as cash flow are important explanatory variables for investment. These findings are usually attributed to capital market imperfections as described above (see the surveys by Schiantarelli (1995), Blundell, Bond and Meghir (1996) and Hubbard (1998)). Following Fazzari, Hubbard and Petersen (1988) it is usually assumed that there are cross-sectional differences in effects of internal funds on firms' investment, so that the investment equation should hold across adjacent periods for *a priori* unconstrained firms but be violated for constrained firms. This has led to different *a priori* classifications of firms that have tried to distinguish financially constrained and not-constrained firms. From a theoretical point of view such sorting criteria should focus on a firm's

characteristics that are associated with information costs. A number of studies have grouped firms by dividend payouts[3]; other *a priori* groupings of firms have focused on group affiliation[4], size and age[5], the presence of bond ratings[6], the degree of shareholder concentration, or the pattern of insider trading[7]. The problems with such *a priori* classifications is that they are usually assumed to be fixed over the entire sample period, and that the criteria used to split the sample are likely to be correlated with both the individual and time-invariant component of the error term, as well as with the idiosyncratic component, which creates an endogeneity problem (see Schiantarelli (1995)). In addition, Lamont (1997) has shown that the finance costs of different parts of the same corporation can be interdependent, in such a way that a firm subsidiary's investment is significantly affected by the cash flow of other subsidiaries within the same firm.

Kaplan and Zingales (1997) question the usefulness of *a priori* groupings of firms. They divide the firms studied by Fazzari, Hubbard and Petersen (1988) into categories of "not financially constrained" to "financially constrained" based upon statements contained in annual reports, and find no support for the presence of financing constraints. The problem with their analysis is that it is difficult to make such classifications. Fazzari, Hubbard and Petersen (1996) note that the firm-years Kaplan and Zingales (1997) classify as most financially constrained are actually observations from years when firms are financially distressed.

Most studies on financing constraints since Fazzari, Hubbard and Petersen (1988) estimate a *q*-model of investment, pioneered by Tobin (1969) and extended to models of investment by Hayashi (1982). Financial variables such as cash flow are then added to the *q*-model of investment to pick up capital market imperfections. If markets are perfect, investment should depend on marginal *q* only. Marginal *q* is usually measured by average *q* (see Fazzari, Hubbard and Petersen (1988), Hayashi and Inoue (1991), and Blundell, Bond, Devereux and Schiantarelli (1992)). Hayashi (1982) has shown that only under

[3] See Fazzari, Hubbard and Petersen (1988), and Hubbard, Kashyap and Whited (1995).
[4] See Hoshi, Kashyap, and Scharfstein (1991).
[5] See Devereux and Schiantarelli (1990).
[6] See Whited (1992).
[7] See Oliner and Rudebusch (1992).

certain strong assumptions[8], marginal q equals average q. Also, using q as a measure for investment opportunities may be a poor proxy because of a breakdown traceable to efficient markets or capital market imperfections. For these reasons several researchers have departed from the strategy of using proxies for marginal q and estimate the so-called Euler equation describing the firm's optimal capital stock directly (see Whited (1992), Bond and Meghir (1994), Hubbard and Kashyap (1992), Hubbard, Kashyap, and Whited (1995)). The disadvantage of the Euler approach is that it relies on the period-by-period restriction derived from the firm's first-order conditions.

An alternative approach bypasses using proxies for marginal q by forecasting the expected present value of the current and future profits generated by an incremental unit of fixed capital, as introduced by Abel and Blanchard (1986). Gilchrist and Himmelberg (1995, 1998) have extended this approach by using a vector autoregression (VAR) forecasting framework to decompose the effect of cash flow on investment.

Most studies of financing constraints focus on firms in one country. One of the few cross-country studies is by Bond, Elston, Mairesse and Mulkay (1997), who study firms' investment behavior in Belgium, France, Germany, and the UK, and find that financial constraints on investment are more severe in the UK than in the three other countries. Mairesse, Hall and Mulkay (1999) study firms' investment behavior in France and the US and find significant changes in the investment behavior of French and US firms over the last twenty years.

3 Methodology

In this section we present a model of investment with financial frictions that is similar to models that have been explored in the literature. In particular, the model follows closely Gilchrist and Himmelberg (1998). We use this model to estimate the financing constraints of firms. The model allows for imperfect capital markets. Under the Modigliani and Miller theorem (1958), that is if capital markets are perfect, a firm's

[8] These assumptions are that the firm is a price-taker with constant returns to scale in both production and installation (the production function and the installation function should be homogeneous). In addition, models of investment based on that use Tobin's q or stock market valuation as a proxy for the expected future profitability of invested capital require additional strong assumptions about the efficiency of capital markets.

capital structure is irrelevant to its value. In this case internal and external funds are perfect substitutes and firm investment decisions are independent from its financing decisions. With imperfect capital markets, however, the costs of internal and external finance will diverge due to informational asymmetries[9], costly monitoring[10], contract enforcement, and incentive problems[11], so that internal and external funds generally will not be perfect substitutes. Also, informational asymmetries lead to a link among net worth, the cost of external financing, and investment. Within the neoclassical investment model with financial frictions, an increase in net worth independent of changes in investment opportunities leads to greater investment for firms facing high information costs and has no effect on investment for firms facing negligible information costs. It follows that certain firms are expected to face financing constraints, in particular firms facing high information costs.

We assume that the firm maximizes its present value, which is equal to the expected value of future dividends, subject to capital accumulation and external financing constraints. Let K_t be the firm's capital stock at the beginning of period t, x_t a productivity shock to the firm's capital stock, and B_t the firm's net financial liabilities. Financial frictions are incorporated via the assumption that debt is the marginal source of external finance, and that risk-neutral debt holders demand an external finance premium, $h_t = h(K_t, B_t, x_t)$, which is increasing in the amount borrowed, $\partial h / \partial B > 0$, due to agency costs. The idea is that highly leveraged firms have to pay an additional premium to compensate debt holders for increased costs due to information asymmetry problems. We assume that the gross required rate of return on debt is $(1+r_t)(1+h(K_t, B_t, x_t))$, where r_t is the risk-free rate of return. The profit function is denoted by $\Pi(K_t, x_t)$. The capital stock accumulation depends on the investment expenditure I_t and the depreciation rate d. The convex adjustment cost function of installing I_t units of capital is given by $C(I_t, K_t)$. Dividend paid out to shareholders is denoted by D_t.

[9] Myers and Majluf (1984) present the informational asymmetry problems of equity financing, and Stiglitz and Weiss (1981) show that informational asymmetries may cause credit rationing in the loans market.
[10] See Townsend (1979) for a model of costly state verification.
[11] Jensen and Meckling (1976) show that in the presence of limited-liability debt the firm may have the incentive to opt for excessively risky investment projects that are value destroying.

For debt rather than equity to be the firm's marginal source of finance, we need either to assume a binding non-negativity constraints on dividends, or to assume that equity holders prefer to have dividends paid out rather than re-invested. We follow Gilchrist and Himmelberg (1998)'s implementation by introducing a non-negativity constraint on dividends, which implies that there is a shadow cost associated with raising new equity due to information asymmetry.[12] For simplicity we ignore taxes. Then the manager's problem is

$$V(K_t, B_t, x_t) = \max_{\{I_{t+s}, B_{t+s+1}\}_{s=0}^{\infty}} D_t + E_t\left[\sum_{s=1}^{\infty} b_{t+s} D_{t+s}\right] \tag{1}$$

subject to

$$D_t = \Pi(K_t, x_t) - C(I_t, K_t) - I_t + B_{t+1} - (1+r_t)(1+h(B_t, K_t, x_t))B_t, \tag{2}$$

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

$$D_t \geq 0, \tag{4}$$

where $E_t[.]$ is the expectations operator conditional on time t information, and $b_{t+s} = \prod_{k=1}^{s}(1+r_{t+k})^{-1}$ is the s-period discount factor, which discounts period $t + s$ to t.

Let l_t be the Lagrange multiplier for the non-negativity constraint on dividends. This multiplier can be interpreted as the shadow cost of internal funds. Then the Euler equation for investment is[13]

[12] Another way to introduce financial frictions is by limiting the amount of debt that the firm can raise at any point in time as in Whited (1992), Hubbard, Kashyap and Whited (1995), and Jaramillo, Schiantarelli and Weiss (1996).

[13] Note that $(\partial D/\partial K)_{t+1} = (\partial \Pi/\partial K)_{t+1} - (\partial C/\partial K)_{t+1}$. For simplicity, we ignore the derivative of the adjustment cost function with respect to the capital stock, $(\partial C/\partial K)_{t+1}$, because it is a small (second order) effect relative to $(\partial \Pi/\partial K)_{t+1}$ equal to the difference in I/K ratios at time $t + 1$ and t.

$$1+\frac{\partial C(I_t,K_t)}{\partial I_t}=E_t\left[b_{t+1}\left(\frac{1+l_{t+1}}{1+l_t}\right)\left\{\frac{\partial \Pi(K_{t+1},x_{t+1})}{\partial K_{t+1}}+(1-d)\left(1+\frac{\partial C(I_{t+1},K_{t+1})}{\partial I_{t+1}}\right)\right\}\right] \quad (5)$$

The first-order condition for debt requires that

$$E_t\left[\left(\frac{1+l_{t+1}}{1+l_t}\right)\left(1+h_{t+1}+\frac{\partial h_{t+1}}{\partial B_{t+1}}B_{t+1}\right)\right]=1 \quad (6)$$

Since the first-order condition for debt does not relate in any specific way to the Euler investment equation, we can focus on the investment decision and make the choice of debt implicit.

Let MPK_t denote the marginal profit function. For simplicity, assume the one-period discount rate b_{t+1} is constant over time and across firms. Then the first-order condition for investment can be written as

$$1+\frac{\partial C(I_t,K_t)}{\partial I_t}=E_t\left[\sum_{s=1}^{\infty}b^{\,s}(1-d)^s\left(\prod_{k=1}^{s}\left(\frac{1+l_{t+k}}{1+l_{t+k-1}}\right)\right)MPK_{t+s}\right] \quad (7)$$

Gilchrist and Himmelberg (1998) use a first-order Taylor approximation around the means to linearize the term with Lagrange multipliers to get

$$1+\frac{\partial C(I_t,K_t)}{\partial I_t}=c+E_t\left[\sum_{s=1}^{\infty}b^{\,s}(1-d)^s MPK_{t+s}\right]+fE_t\left[\sum_{s=1}^{\infty}\sum_{k=1}^{s}b^{\,s}(1-d)^s FIN_{t+k}\right] \quad (8)$$

where FIN_t is a financial variable that affects the shadow discount term $\frac{1+l_{t+1}}{1+l_t}$.

We follow the tradition in the literature since Summers (1981) and Hayashi (1982) by specifying an adjustment cost function that is linearly homogeneous in investment and capital, so that average q equals marginal q. An example of such a specification as

proposed by Summers (1981) would be $C(I_t, K_t) = \frac{a}{2}\left(\frac{I_t}{K_t} - n\right)^2 K_t$. Instead, we follow Love (2000) and specify $C(I_t, K_t) = \frac{a}{2}\left(\frac{I_t}{K_t} - g\frac{I_{t-1}}{K_{t-1}} - n\right)^2 K_t$ as adjustment cost function. This specification includes lagged investment to capital to capture strong persistence in investment to capital ratios. In a perfect world, current investment should not depend on lagged investment. However, in reality there may be a link between current and lagged investment since firms often times make arrangements that are costly to cancel. Under this specification of the adjustment cost technology, the relationship between investment, the present value of future FIN_t, and the present value of future MPK_t is given by[14]

$$\frac{I_t}{K_t} = c + g\frac{I_{t-1}}{K_{t-1}} + \frac{1}{a}E_t\left[\sum_{s=1}^{\infty} b^s (1-d)^s MPK_{t+s}\right] + \frac{f}{a}E_t\left[\sum_{s=1}^{\infty}\sum_{k=1}^{s} b^s (1-d)^s FIN_{t+k}\right] \quad (9)$$

The standard *q* model of investment is a special case of the above model where $f = 0$, and the model is typically estimated using Tobin's *q* as a proxy for the present value of future marginal profits.

We assume that MPK_t and FIN_t follow a vector autoregressive (VAR) process. Rather than using a large number of variables to forecast the future marginal profitability of investment as in Gilchrist and Himmelberg (1998), we use current values of MPK_t and FIN_t only. Let the variable x_{it} be a vector containing current values of MPK_t and FIN_t. We assume that this vector follows an autoregressive progress of order one, $x_{it+1} = Ax_{it} + u_{it+1}$, where *i* indicates firm $i = \{1,\ldots,n\}$. If we assume that $E(u_{it+1} \mid x_{it}) = 0$, then by recursive substitution it follows that $E(x_{it+s} \mid x_{it}) = A^s x_{it}$. The expected present value of marginal profits MPK_{it} at time *t* for firm *i* is then given by

[14] Here, we use that $(\partial C / \partial I)_t = a\left(\frac{I_t}{K_t} - g\frac{I_{t-1}}{K_{t-1}} - n\right)$.

$$
\begin{aligned}
PV_{it}^{MPK} &= E_{it}\sum_{s=1}^{\infty} b^{s}(1-d)^{s} MPK_{it+s} \\
&= i_1'\sum_{s=1}^{\infty} b^{s}(1-d)^{s} A^{s} x_{it} \\
&= i_1'(I - b(1-d)A)^{-1} b(1-d)Ax_{it},
\end{aligned}
\tag{10}
$$

where $i_1' = (1 \quad 0)$ and I is the identity matrix. Similarly, the expected present value of financial factors FIN_{it} is given by

$$
\begin{aligned}
PV_{it}^{FIN} &= E_{it}\sum_{s=1}^{\infty}\sum_{k=1}^{s} b^{s}(1-d)^{s} FIN_{it+s} \\
&= i_2'\sum_{s=1}^{\infty}\sum_{k=1}^{s} b^{s}(1-d)^{s} A^{k} x_{it} \\
&= i_2'(1-b(1-d))^{-1}(I - b(1-d)A)^{-1} b(1-d)Ax_{it},
\end{aligned}
\tag{11}
$$

where $i_2' = (0 \quad 1)$. Since these present value expressions are linear combinations of the underlying variables MPK_{it} and FIN_{it}, we can specify a reduced-form model of investment that is linear in MPK_{it} and FIN_{it}

$$
\frac{I_{it}}{K_{it}} = c + b_1\frac{I_{it-1}}{K_{it-1}} + b_2 MPK_{it} + b_3 FIN_{it} + f_i + d_t + e_{it} \tag{12}
$$

where f_i and d_t are fixed and year effects, and e_{it} is an error term.

Assuming a Cobb-Douglas production function, Gilchrist and Himmelberg (1998) show that the marginal profitability of fixed capital equals the ratio of sales to capital (up to a scale parameter). We therefore take the ratio of net sales to capital $\frac{S_{it}}{K_{it}}$ as a proxy for MPK_{it}. For listed firms we proxy MPK_{it} by Tobin's q as well. We proxy the financial

factors FIN_{it} by the cashflow-to-capital ratio $\frac{CF_{it}}{K_{it}}$. The problem with the cash flow measure is that it might be a good proxy for future investment opportunities as well.

In the face of imperfect financial markets, the degree of leverage of the firm may deter the availability of external financing even after controlling for Tobin's *q*. The basic model of investment we estimate is thus as follows:

$$\frac{I_{it}}{K_{it}} = c + b_1 \frac{I_{it-1}}{K_{it-1}} + b_2 MPK_{it} + b_3 FIN_{it} + b_4 LEV_{it} + f_i + d_t + e_{it} \qquad (13)$$

where LEV_{it} is the leverage of the firm, which we measure by the ratio of long-term debt-to-capital $\frac{D_{it}}{K_{it}}$.

We have mentioned before that, in the absence of financial restrictions and agency problems, firm investment depends exclusively on the marginal profitability of capital (*MPK*). However, to the extent that the firm faces constraints on external financing, its investment will be determined in part by its internal resources (*FIN*). Furthermore, in the face of imperfect financial markets, the degree of leverage of the firm (*LEV*) may deter the availability of external financing. Therefore, we consider that a firm faces a better functioning financial system when, first, its investment is more responsive to changes in *MPK*; second, investment is less determined by the internal resources; and, third, investment is less negatively affected by the firm's leverage.

As in Harris, Schiantarelli and Siregar (1994), Jaramillo, Schiantarelli and Weiss (1996) and Gelos and Werner (1999) we test whether small firms are more financially constrained than large firms. In addition, we test whether both small and large firms have become less financially constrained during the process of financial liberalization. Large firms are likely to be less financially constrained than small firms, because lenders are likely to have more information about large firms. Those borrowers also are likely to have relatively more collateralizable wealth. Another reason why large firms may have less informational problems is that they often belong to industrial groups with bank associations. Size considerations may also affect the access to directed credit programs at

subsidized rates, because such programs often favor exporting firms, which are often large firms, and because large firms often have stronger political connections.

4 Estimation Techniques

Dynamic investment models are likely to suffer from both endogeneity and heterogeneity problems. In a standard *q* model of investment the error term is a technology shock to the profit function. *q* is a function of the technology shock and hence is endogenous. Hayashi and Inoue (1991) argue that a wide range of variables pertaining to the firm such as output and cash flow also depend on the technology shock, and are thus endogenous as well. When estimating a structural investment model, substantial differences across individuals in their investment behavior may lead to a heterogeneity problem reflected by the presence of unobserved individual effects. Hsiao and Tahmiscioglu (1997) argue that pooling data, using appropriate estimation techniques, and grouping individuals according to certain *a priori* criteria can help overcome this heterogeneity problem.

In this section we describe the Generalized Methods of Moments (GMM) estimators for dynamic panel data models as introduced by Hansen (1982), Holtz-Eakin, Newey and Rosen (1988), Arellano and Bond (1991) and Arellano and Bover (1995), which we use to estimate the structural model of firm investment in the previous section. These estimators allow to control for unobserved individual effects, endogeneity of explanatory variables, and the use of lagged dependent variables. Consider the following model

$$y_{it} = a y_{it-1} + b' x_{it} + g' f_i + u_{it}, \tag{14}$$

where

$$u_{it} = h_i + v_{it} \tag{15}$$

and

$$E(v_{it} \mid x_{i0}, ..., x_{iT}, h_i) = 0 \tag{16}$$

where f_i is an observed individual effect and h_i is an unobserved individual effect. In this model, regardless of the existence of unobserved individual effects, unrestricted serial correlation in v_{it} implies that y_{it-1} is an endogenous variable.

In estimating the investment model (13) we want to allow for the possibility of simultaneous determination and reverse causality of the explanatory variables and the dependent variable. We therefore relax the assumption that all explanatory variables are strictly exogenous[15] and assume weak exogeneity of the explanatory variables in the sense that they are assumed to be uncorrelated with future realizations of the error term.[16] The joint endogeneity of the explanatory variables calls for an instrumental variable procedure to obtain consistent estimates of the coefficients of interest.

For the moment we assume that unobserved individual effects are not present. In that case we can apply a GMM estimator to equation (14) in levels. This estimator overcomes the potential problem of endogeneity of the explanatory variables and the use of lagged dependent variables. Under the assumption that the error term v_{it} is serially uncorrelated or, a least, follows a moving average process of finite order, and that future innovations of the dependent variable do not affect current values of the explanatory variables, the following observations can be used as valid instruments in the GMM estimation: $(y_{it-2}, y_{it-3},..., y_{i1})$ and $(x_{it-2}, x_{it-3},..., x_{i1})$. We call this the GMM *level* estimator.

In the presence of unobserved individual effects the GMM *level* estimator produces inconsistent estimates. An indication that unobserved individual effects are present is a persistent serial correlation of the residuals. To solve the estimation problem raised by the potential presence of unobserved individual effects one can estimate the specific model in first-differences. If we remove the unobserved individual effect by first-differencing equation (14) we obtain

$$Dy_{it} = aDy_{it-1} + b'Dx_{it} + Dv_{it} \qquad (17)$$

[15] An explanatory variable is strictly exogenous if it is uncorrelated with the error term at all leads and lags.
[16] In the setting of the investment model in (13) the assumption of weak exogeneity of the explanatory variables means that current explanatory variables may be affected by past and current investment-to-capital ratios, but not by future ones.

The use of instruments is again required because Dv_{it} is correlated with Dy_{it-1} by construction, and joint endogeneity of the explanatory variables might still be present. Under the assumptions that the error term v_{it} is not serially correlated and the explanatory variables are weakly exogenous, the following moment conditions apply to the lagged dependent variable and the set of explanatory variables:

$$E(y_{it-s}Dv_t) = 0 \qquad \forall s \geq 2; t = 3,...,T \tag{18}$$

$$E(x_{it-s}Dv_t) = 0 \qquad \forall s \geq 2; t = 3,...,T\,, \tag{19}$$

so that $(y_{it-2}, y_{it-3},..., y_{i1})$ and $(x_{it-2}, x_{it-3},..., x_{i1})$ are valid instruments. We refer to this estimator as the *difference* estimator. Arellano and Bond (1991) have shown that under the above assumptions the *difference* estimator is an efficient GMM estimator for the above model. Although the *difference* estimator solves the problem of the potential presence of unobserved individual effects, the estimator has some statistical shortcomings. Blundell and Bond (1997) show that when the dependent variable and the explanatory variables are persistent over time, lagged levels of these variables are weak instruments for the regression equation in differences.

Blundell and Bond (1997) suggest the use of Arellano and Bover's (1995) *system* estimator to overcome the statistical problems associated with the *difference* estimator. Arellano and Bover's (1995) show that, when there are instruments available that are uncorrelated with the individual effects h_i, these variables can be used as instruments for the equations in levels. They develop an efficient GMM estimator for the combined set of moment restrictions relating to the equations in first differences and to the equations in levels. This so-called *system* estimator makes the additional assumption that the differences of the right-hand side variables are not correlated with the unobserved individual effects[17]

$$E(y_{it}h_i) = E(y_{is}h_i) \qquad \forall t, s\,, \tag{20}$$

[17] Note that there may be correlation between the *levels* of the right-hand side variables and the unobserved individual effects.

$$E(x_{it}h_i) = E(x_{is}h_i) \qquad \forall t,s\,, \tag{21}$$

These assumptions may be justified on the grounds of stationarity. Arellano and Bover (1995) show that combining equations (18)-(19) and (20)-(21) gives the following additional moment restrictions[18]

$$E(u_{it}Dy_{it-1}) = 0 \tag{22}$$

$$E(u_{it}Dx_{it-1}) = 0 \tag{23}$$

Thus, valid instruments for the regression in levels are the lagged differences of the corresponding variables.[19] Hence, we use $(y_{it-2}, y_{it-3},..., y_{i1})$ and $(x_{it-2}, x_{it-3},..., x_{i1})$ as instruments for the equations in first differences, and Dy_{it-1} with Dx_{it-1} as instruments for the equations in levels. Again, these are appropriate instruments only under the above assumption of no correlation between the right-hand side variables and the unobserved individual effect.

To assess the validity of the assumptions on which the three different estimators are based we consider four specification tests suggested by Arellano and Bond (1991). The first is a Sargan test of over-identifying restrictions, which tests the validity of the instruments. The second is a test of second-order serial correlation of the error term, which tests whether the error term in the differenced model follows a first-order moving average process[20]. The third is the so-called Difference Sargan test, which tests the validity of the extra instruments used in the levels equations of the system estimator. And the fourth is a Hausman specification test, which is another test for the validity of the additional instruments used in the levels equations of the system estimator.

The Difference Sargan test statistic compares the Sargan statistic for the system estimator and the Sargan statistic for the corresponding first-differenced estimator. The difference Sargan test statistic is asymptotically distributed as c^2 under the null

[18] Moment restrictions based on other lagged differences are redundant (see Arellano and Bover, 1995).
[19] The instruments for the regression in differences are the same as before, that is, the lagged levels of the corresponding variables.
[20] The use of endogenous variables dated $t-2$ as instruments is only valid if n_{it} is serially uncorrelated, implying a first-order moving average error term in the differenced model.

hypothesis of validity of the instruments. The number of degrees of freedom of the difference Sargan test statistic is given by the number of additional restrictions in the system estimator, which equals the difference between the number of degrees of freedom of the system estimator and that of the difference estimator.

The Hausman statistics tests the difference between the coefficients of the GMM system estimates and the corresponding GMM first-differenced estimates, that is the estimates without the additional levels equations. The Hausman test statistic is a Wald test of the hypothesis that the distance between the coefficients is zero, and the degrees of freedom is given by the number of additional level equations.

We also introduce multiplicative dummies to assess differences across firms along certain criteria. If we define D_{it} to be a firm-specific dummy variable, then introducing this variable as a multiplicative dummy changes equation (14) as follows

$$y_{it} = a y_{it-1} + b' x_{it} + d' D_{it} x_{it} + g' f_i + u_{it}, \qquad (14')$$

If the multiplicative dummy is an exogenous variable and x_{it-2} is a valid instrument for the endogenous variable x_{it}, then $D_{it} x_{it-2}$ is a valid instrument for $D_{it} x_{it}$. In estimating the investment model in equation (13) we treat the weakly exogenous variables as endogenous variables and potential multiplicative dummies as exogenous variables. If we interact the weakly exogenous variables with the multiplicative dummies we use the aforementioned appropriate transformations of these interacted variables as instruments.

5 Data

To explore the impact of financial reforms on financial constraints of firms we need a measure of financial liberalization and firm-level data. We construct an index of domestic financial liberalization of the banking sector based upon country reports from various sources. The problem of constructing such an index is that financial liberalization often takes place in various ways.

We construct the financial liberalization variable as follows. We collect data on the implementation of reform packages related to six different measures. The liberalization

variable is simply the sum of six dummy variables that are each associated with one of the six reform measures. The dummy variables take value one in the years characterized by the liberalized regime. Hence, our index of financial liberalization can take values between 0 and 6. The index is not strictly comparable across countries in absolute terms For example, there is likely to be a significant difference in the initial stage of financial liberalization among the countries in our sample. However, since increases in our index of financial liberalization capture progress in financial liberalization within a country, the index is comparable across countries in relative terms. The six reform measures we focus on are: interest rates deregulation (both lending and deposit rates), reduction of entry barriers (both for domestic and foreign banks), reduction of reserve requirements, reduction of credit controls (such as directed credit, credit ceilings), privatization of state banks (and more generally reduction of government control), and strengthening of prudential regulation (such as independence of the Central Bank or adoption of capital adequacy ratio standards according to the Basle Accord guidelines). These measures correspond to the domestic financial liberalization measures in Bandiera, Caprio, Honohan and Schiantarelli (2000), who use principal components to construct an index of financial liberalization for eight developing countries.

Table 1 indicates the years in which significant progress been made with respect to one of these six measures. Annex 1 describes in more detail what types of progress have been made in these years with respect to one of these six measures. Table 2 presents the financial liberalization index (FLI) for a number of countries.

A number of clear patterns arise from the financial liberalization index. First of all, all developing countries in our sample have made substantial progress in liberalization of their banking sectors. A number of countries had repressed financial systems in the 80s, but could be considered liberalized in 1996. Secondly, the index suggests that countries liberalize their financial systems gradually and in stages. In most countries, interest rates are liberalized and reserve requirements are reduced in the first stage of liberalization. In a second stage entry barriers are removed and directed credit systems (and other forms of credit control) are eliminated. Only in the final stage are state banks privatized and is prudential regulation put into place. This sequence of financial liberalization is presented in Table 3 in more detail.

Williamson and Mahar (1998) have found a similar progress in financial liberalization for these countries. In fact, if we define a countries financial system to be largely liberalized in the year when significant progress has been made with respect to five of our six measures of financial liberalization, that is when *FLI* takes value 5, we find a similarity with the years in which Williamson and Mahar (1998) consider a country's financial system to be largely liberalized. Table 4 presents this comparison.

The period under consideration has not only been characterized by liberalization of the banking sectors. Developing countries have implemented many different types of reform programs during this period under changing political climates. In addition to liberalization of the banking sector, one key component of financial reform in most developing countries has been liberalizing of the stock market. Table 4 shows the dates on which IFC considers the stock markets of these countries to be open to foreigners. The table suggests that stock market liberalization has preceded liberalization of the banking sector in most countries, Chile being the only exception.

Furthermore, progress in financial liberalization seems to be strongly correlated with improvements in the political climate of a country. If we use the ICRG political risk index as a measure of political risk, we find a correlation as high as 66% between the political risk rating and our financial liberalization index (see Table 5). The ICRG political risk index is constructed by Political Risk Service, ranges between 0 and 100%, and is decreasing in the level of political risk. The result suggests that political stability is a pre-requisite for financial liberalization.

We collect firm-level panel data from World Scope on firms in developing countries for the years 1988-98. Using panel data has certain advantages. First, it allows to differentiate across firms. As explained before, it is likely that firms are treated differently in a regime of financial repression (for example, due to directed credit programs). It is also likely that the effects of liberalization differ across firms according to their size and other factors. This is so because, as explained by Schiantarelli, Atiyas, Caprio and Weiss (1994), the alternative to a financially repressed system is not a perfect capital market, but a market for funds characterized by informational asymmetries and less than complete contract enforceability, giving rise to agency problems, whose severity varies for different types of firms. Second, the availability of panel data allows to identify

more precisely the effects of financial liberalization over time, which is attractive since financial reform is often a process over a longer period.

We focus on listed firms, since most firms in the World Scope sample are listed, and because the quality of the accounting data is expected to be higher for listed firms. Focusing on listed firms has the additional advantage that we can compare the performance of the two different measures of marginal profitability of capital, that is Tobin's *q* versus the sales-to-capital ratio. For each company we need a certain minimum coverage of the data to assess the changes in the financing structure of the firm. We set this coverage to three years and therefore delete firms with less than three consecutive years of observations. It is, however, necessary to delete more firms, because of outliers in the data. Such outliers can be explained by revaluation of assets, divestments, acquisitions, or simply poor data. We impose a number of outlier rules. First of all, we delete observations with negative fixed capital or investment. Such observations might be due to divestments or revaluations of capital. Secondly, we restrict investment ratios from taking high values. Such values might be due to acquisitions or revaluations of capital. Furthermore, we restrict variables to take extreme values in terms of leverage, marginal profitability or cash flow. We also delete firms in transition economies, because soft budget constraints that have been inherited from the socialistic regime may distort the analysis. Table 6 gives the details of the deletion criteria. After deleting firms according to these criteria we have data on 394 listed firms in 13 countries.[21] Obviously, our sample of firms is non-random. Listed firms, for example, tend to be large in most countries. This non-randomness can be partly controlled for by allowing fixed effects.

For this set of firm-level data we generate the necessary variables to estimate equation (13). We assume that flow variables (such as investment and depreciation) during period *t* are decided upon at the beginning of period *t*. Since accounting data only provides end-of-period data, we use end-of-period *t*-1 figures to construct variables at the beginning of period *t*.

To test for a difference in financing constraints between firms of different size, we split our sample according to firm size. As measure of firm size we use net sales, reported in US dollars for comparability across countries. We construct a small size dummy,

$Small_t$, that takes value one if net sales is smaller than the sample median of net sales in US, and zero otherwise. Similarly, we construct a large size dummy that indicates large firms. Together with the financial liberalization indices (*FLI*) these size dummies are used to construct multiplicative dummies of the weakly exogenous variables. Such dummies have been used before by Gallego and Loayza (2000) in a similar context. The financial liberalization and size dummies are treated as exogenous variables in the levels estimation. Table 7 gives a overview of the definition of variables used in the empirical analysis.

Table 8 presents the descriptive statistics for all firms. We have data for the years 1988-98 on 394 firms. The average data coverage for each firm is 4.2 years, hence the total number of observations is 1645. In comparing the descriptive statistics of small versus large firms, we find that large firms invest more, have a lower *q*, have higher sales, generate less cash flow, and borrow more (all in relative terms). None of these apparent differences is, however, statistically significant. Table 8.e reports the correlation matrix of the main variables. We find a high correlation between our measure of the importance of financial factors, i.e. operating cash flow, and our measures of MPK, either *q* or the sales-to-capital ratio. In the first case the correlation is 44%; in the second case even 61%. The correlation between *q* and the sales-to-capital ratio is 26%. Investment appears to be mostly correlated with cash flow (correlation of 18%) and less so with *q*, or sales, and hardly at all with debt. These correlations suggest that firms are financially constrained in the sense that investment responds mostly to cash flow instead of to *q* only. However, since cash flow is highly correlated with both our measures of *MPK*, this conclusion may be false. Econometric techniques are needed to determine the exact effect of cash flow on investment.

Table 8.f presents the median of the variables by country. In our sample of firms, we find significant differences in the size of firms across countries, where size is defined by the level of sales. Firms in Argentina, Brazil, Mexico and Korea appear to be, while firms in Indonesia, Pakistan, the Philippines and Thailand are relatively smaller in our sample. In our empirical analysis we include country dummies to correct for such differences among countries.

[21] We also created a larger set of firms by applying less strict outlier rules. This set includes firms from Colombia, Sri Lanka, Turkey and Venezuela. Our empirical results for this larger set of firms are similar to

Table 8.g presents the median of the variables by industry. The industries are defined according to the Standard Industry Classification (SIC) codes of the U.S. government. We group manufacturing companies in our sample along two-digit SIC codes and the remaining industries along one-digit SIC codes. More details on the SIC codes can be found in Table 8.h. For our sample of firms, we find significant differences in the variables across the different industries. Some of these differences are not a surprise. For example, cash flow is highest in the tobacco industry – not a surprise given that the tobacco industry is in general believed to be a cash cow. Differences across industries may, however, be partly due to the small sample size for some industries. In our empirical analysis we include industry dummies to correct for such differences across industries.

Table 8.i presents the median of the variables by year. In general, we see no dramatic changes in the variables over time. One exception is the level of investment in 1998, which is significantly lower than before. This can be explained by the fact that a number of countries in our sample faced a financial crisis in 1998 which might have reduced the number of investment opportunities for some firms. In our empirical analysis we include year dummies to correct for such differences over time.

For our empirical work we need to define when a country has liberalized its financial sector. In deciding upon such a definition we take the following into consideration. Firstly, we have noted earlier that countries have followed a certain sequence in liberalizing their banking sectors with some important measures for liberalization such as a reduction of entry barriers and improved enforcement of prudential regulation being implemented in a later stage. Secondly, we believe that a combination of the aforementioned measures is necessary for effective financial liberalization. For these reasons we consider a country liberalized if it has taken a relatively large number of measures. In our empirical work, we consider several, related definitions of financial liberalization. Our basic classification of financial liberalization uses the level of the financial liberalization index (*FLI*) that splits our data set in two equal sets to establish a cut-off rule. Table 8.j presents the distribution of *FLI* in terms of observations. Let *FLI5* be a dummy variable that takes value one if the country has taken 5 measures, and zero otherwise. Table 8.j shows that 47% of observations have *FLI5=1*,

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the results we present here.

while 53% of observations have *FLI5=0.* Our basic classification thus defines a financial sector to be liberalized if the country has taken 5 out of the 6 aforementioned measures.

6 Empirical Results

We estimate several specifications of the structural investment model in (13). First, we estimate a simple OLS model with Tobin's *q* as measure for the marginal profitability of capital and cash flow-to-capital as measure for the financial factors terms (see Table 9, Model 1). We find firms to be severely financially constrained over the whole period. Also, we find a strong persistence in investment, which justifies our choice for the adjustment cost function. We do not find evidence for significant unobserved firm specific effects in the simple OLS regression, since we do not find serial correlation in the error terms. The OLS results may, however, suffer from an endogeneity problem.

We therefore estimate model (13) in levels using the aforementioned GMM techniques (see Table 9, Model 2). We only present two-step GMM estimates, since they are more efficient than one-step estimates, and since only the Sargan test of over-identifying restrictions is heteroskedasticity-consistent only if based on the two-step estimates. Further details on the one and two-step GMM estimators can be found in Arellano and Bond (1991). Again, we do not find significant unobserved firm specific effects in the GMM level estimation, as indicated by the tests for serial correlation in the error terms.

The coefficients of the GMM level estimates are quite similar in magnitude to the OLS estimates, which indicates that there is no strong endogeneity problem. According to the GMM results there are substantial financial frictions. First, investment is not responsive to changes in Tobin's *q*, which indicates that firm's with better investment opportunities do not investment more. Second, investment is determined to a large extent by the internal sources of the firm, as measured by the firm's cash flow, which indicates the presence of financing constraints. Third, investment is negatively affected by a firm's leverage, which indicates that there are informational asymmetries in the debt markets. The estimated effect of cash flow on the investment of firms is economically important. All else being equal, a 10 percent decline in cash flow implies a decrease in investment of around 1.5 percent. Such strong links between investment and cash flow are common in

the literature. Blundell et al. (1992) find a similar estimated effect of cash flow on the investment of UK firms during the period 1975-86, while Gallego and Loayza (2000) find twice as large estimates for Chilean firms.

Since the GMM level estimation does not show persistent serial correlation in the residuals it is not necessary to control for potential unobserved firm-specific effects by estimating the model in first-differences, especially since, as noted earlier, the difference estimator has some statistical shortcomings. We nevertheless present the estimates for model (13) in first-differences (see Table 9, Model 3). The model is supported both by a test for higher-order serial correlation and by the Sargan test for over-identifying restrictions. This provides further evidence of the absence of strong unobserved firm-specific effects. The coefficients of the model in first-differences have similar order of magnitude as the coefficients of the model estimated in levels, but some coefficients of the model in first-differences are less significant. Overall, the results of both models are similar.

To overcome the statistical problems of the difference estimator we have also used the system estimator proposed by Arellano and Bover (1995). Use of this estimator results in an improvement only if the instruments used are uncorrelated with the unobserved firm-specific effects. In generating the system estimator, we use weakly exogenous variables at time t-2, t-3, t-4 as instruments for the equation in first-differences and differenced variables at t-1 as instruments for the equation in levels (see Table 9, Model 4). Although the results of the system estimates are similar to those generated by the model specified in levels, both the Hausman test and the Difference Sargan test for the validity of the additional instruments do not support the use of the GMM system estimator. These results imply that differences in the right-hand side variables are correlated with the unobserved firm-specific effects, so that we cannot assume that the additional moment restrictions used in the system estimation hold. The GMM difference and system estimates thus supports the statement that our level results do not suffer from major endogeneity problems or strong unobserved firm specific effects.

Overall, we find for the whole period that companies' investment is not very responsive to changes in q, and is driven positively by the firm's cash flow and negatively by its level of indebtedness. These findings indicate that companies were

severely financially constrained over the whole period, but that there were strong informational asymmetries in the debt markets.

In a second specification of the investment model we distinguish between small and large firms to identify whether investment behavior and finance constraints differ between firms of different size. Small firms are firms with sales below the median of sales in the sample. We have generated both OLS and GMM level estimates (see Table 9, Model 5 and 6), and do not find major differences between firms of different size during the whole sample period. Both types of firms appear to be financially constrained over the period 1988-98 in the sense that investment is highly sensitive to cash flow. Also, both types of firms do not respond to changes in Tobin's q and do not suffer from leverage costs. Again, we do not find any evidence for the presence of unobserved firm specific effects. We therefore do not use the GMM difference or GMM system estimator.

Thirdly, we test whether financial liberalization has changed financing constraints. For this purpose, we interact the variables of model (13) with a dummy variable that indicates whether the country has liberalized its banking sector or not. This dummy variable is *FLI5*, which has been defined earlier. We have generated both OLS and GMM level estimates (see Table 9, Model 7 and 8), and find that, although firms have been severely financially constrained over the period, they have become less financially constrained as financial liberalization progresses. The estimated effect is economically significant. Financial liberalization reduces the estimated effect of cash flow on investment from around 15 percent to 3 percent. In other words, financial liberalization reduces financing constraints by 80 percent. We also find some evidence that investment has become less negatively affected by the leverage of firms. All else being equal, a 10 percent increase in leverage implies a decrease in investment of around 1.3 percent before financial liberalization, and of only 0.4 percent after liberalization. This suggests that debt markets have become more perfect in the sense that firms appear to have suffered less from information asymmetries after financial liberalization than before. Again, we do not find any evidence for the presence of unobserved firm specific effects.

To identify whether financial liberalization has had a positive impact on firms of all size we combine the previous model specifications and interact the variables of model (13) with both size and financial liberalization dummy variables. OLS and GMM level estimates of this rich specification again do not suffer from unobserved firm specific

effects (see Table 9, Model 9 and 10). Looking at the coefficients of the multiplicative terms, we find that financial liberalization has a different impact on firms of different size. The previous result no longer holds for large firms. Financial liberalization does not reduce financing constraints for large firms. Large firms are moderately financially constrained throughout the whole period, in the sense that investment of large firms is driven only slightly positively by the firm's cash flow. On the other hand, financial liberalization has been good for small firms. Small firms face severe financing constraints before financial liberalization, and face financing constraints of the same order as large firms after financial liberalization. In addition, we find some evidence that the negative impact of financial leverage on investment reduces for small firms during the process of financial liberalization, and that small firm's investment becomes slightly more responsive to changes in q. The reduction for small firms in the estimated effect of cash flow on investment is economically significant. Before financial liberalization, a 10 percent increase in leverage implies a decrease in investment of around 3 percent, all else being equal. After liberalization, the impact of such an increase on investment reduces to 0.7 percent, the same level as for large firms. In other words, financial liberalization reduces financing constraints for small firms by 80 percent.

To summarize, we find (1) strong persistence of investment-to-capital ratios in the data; (2) financial liberalization has no positive effect on the investment behavior of large firms; (3) financial liberalization is good for small firms in the sense that it increases the responsiveness of investment to changes in q, it decreases the dependence on internal resources, and it reduces informational asymmetries with respect to debt, that is it makes debt markets more perfect.

Our findings are in line with earlier work that has found that smaller companies are more likely to suffer from financing constraints (see Schiantarelli (1995)), and are similar to those of Gelos and Werner (1999) in the case of Mexico who argue that large firms may have had better access to preferential directed credit before financial liberalization. This might explain why financial liberalization has had no overall positive effect on large firms. The positive effect of more efficient financial markets may have been offset for large firms by the negative effect of a decreasing access to preferential credit. Alternatively, large firms might suffer less from informational asymmetries, and thus have better access to credit in general.

7 Robustness of Results

As robustness checks we look at the impact of a number of changes to our model specification. We only present OLS estimates for these different model specifications, since these estimates do not suffer from major endogeneity problems or strong unobserved firm specific effects. First of all, we assess the sensitivity of our results to our definition of firm size. Instead of using sales to distinguish between small and large firms we use total assets. We construct a small size dummy variable that takes value one if the firm has less assets than the median asset size in the sample. Similarly, we construct a large size dummy variable on the basis of the median of total assets. The OLS estimates are presented in Table 10 (Model 1). The results are similar to our basic specification that uses net sales to distinguish between firms of different size (Table 9, Model 9). Only small firms benefit from financial liberalization.

Using the median of the sample to distinguish between large and small firms may not be representative, since our sample consist of listed firms only, and listed firms tend to be large. Therefore, we have also used the 1/3 quantile of net sales to distinguish between small (below 1/3 quantile) and large firms (above 1/3 quantile). The OLS estimates are presented in Table 10 (Model 2). The results are similar, if not stronger, to our basic results.

Secondly, we assess the sensitivity of our results to the proxy for *MPK*. Instead of using Tobin's *q*, we use sales-to-capital as proxy for *MPK*. The results can be found in Table 10 (Model 3). Again, the results are very similar to our basic specification.

Thirdly, we assess the sensitivity to our definition of when a country has made substantial progress in liberalizing its financial sector. Instead of requiring 5 measures to be implemented (*FLI5*) we define a financial sector to be largely liberalized if 4 measures have been put into place (*FLI4*). The estimation results are presented in Table 10 (Model 4). The results are weaker than our basic specification. Although the coefficient estimates indicate that small firms gain from financial liberalization, these results are not statistically significant at a 10% level. This confirms our view that substantial progress has to be made (in the sense that most of the measures need to have been implemented) before financial liberalization becomes effective. Another way to assess the sensitivity to

our financial liberalization classification is to look at the components of our financial liberalization index. Of particular interest is impact of the reduction of credit control, in particular the removal of directed credit systems. Of all six measures, this measure is thought to have the most significant direct impact on the financing constraints of firms, especially if access to preferential credit differed among different types of firms. We therefore construct a dummy variable (*CRE*) that indicates whether the country has made substantial progress in abolishing its directed credit system, and reduced the adverse effects of credit control in general. The OLS estimates are presented in Table 10 (Model 5). We find similar, if not stronger, results as with our basic specification. The removal of directed credit systems has had a positive impact on the financing constraints of small firms only.

Since our classification of financial liberalization may suffer from the problem to time liberalization dates we also simply compare financing constraints of firms during the first half and the second half of our sample period. Since financial liberalization has been a gradual and progressive process, the two sub-periods are comparable across countries, in the sense that the financial sectors of all countries in our sample were more liberalized in the second half than in the first half of the period. If financial liberalization does have a positive effect on the financing constraints of (some) firms, we should find this by comparing the two periods, even though the initial level of financial liberalization may differ across countries, so that the magnitude of the effect may differ across countries. We split our sample in the period 1989-94 versus 1995-98. Table 2 shows that most countries in our sample had made substantial progress with liberalizing their banking sectors in the year 1994. The OLS estimates of these two additional specifications are presented in Table 10 (Model 6). Our basic results that use our index of financial liberalization are confirmed. Small firms became less financially constrained during the period 1989-98, a period that has been characterized by substantial progress in financial liberalization in our sample of countries.

8 Conclusions

We have estimated a dynamic investment model using panel data on 394 firms in 13 developing countries for the years 1988-98. Using different specifications of the

investment model we find that financial liberalization reduces the imperfections that firms face when dealing with financial markets. Firm's investment becomes less dependent on its financial leverage. Furthermore, we find that financial liberalization affects small and large firms differently. Before financial liberalization takes place, small firms are found to be much more financially constrained than large firms. Financial liberalization then relaxes the external financing constraints for small firms, but has little impact on the financing constraints of large firms. Eventually, the difference between large and small firms disappears. It seems that only small firms in developing countries gain from financial liberalization. We hypothesize that in many developing countries large firms had access to preferential directed credit during the period before financial liberalization. This form of favoritism is likely to disappear during financial liberalization. In the case of large firms, the efficiency benefits of financial liberalization thus seem to be offset by the adverse effects of loosing access to preferential credit. Another explanation is that large firms might suffer less from informational asymmetries, and thus have better access to credit in general. We also find that countries that have made substantial progress in liberalizing their financial sector have shown dramatic improvements in their political climate as well. Successful financial liberalization seems to require both the political will and ability to stop the preferential treatment of well-connected firms, firms that often tend to be large.

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Appendix

Table 1 Years of financial liberalization with respect to six measures

Country	*Interest Rates*	*Entry Barriers*	*Reserve Requirements*	*Credit Controls*	*Privatization*	*Prudential Regulation*
Argentina	89	77	93	93	95	94
Brazil	89	91	88	94	97	98
Chile	85	97	80	76	86	86
India	96	93	93	94	no	96
Indonesia	83	88	88	90	92	97
Malaysia	91	94	94	91	no	89
Mexico	89	93	89	91	92	94
Pakistan	95	93	no	95	97	94
Peru	91	96	91	92	95	93
Philippines	85	94	94	83	96	93
Rep. Korea	93	89	96	96	83	92
Taiwan	92	92	no	no	98	97
Thailand	92	95	92	92	no	97

Notes: In Argentina, interest rates were deregulated in 1987, but deregulation was reversed in 1988. In 1989, interest rates were deregulated again. In the above table, *No* indicates no significant improvement in this measures of financial liberalization. In Malaysia and Thailand there were no significant reductions in state ownership of commercial banks during 1988-1997. The major Malaysian commercial banks have been private since they started operations. Most Thai commercial banks are also privately held, although one of the largest banks, Krung Thai Bank is still controlled by the government.
Sources: Various IMF country reports and working papers, various World Bank country reports, working papers, and discussion papers, various BIS Policy Papers, various Economist Intelligence Unit Country Reports and Profiles, Caprio et al. (1994) Chapter 5, Demirgüç-Kunt and Detragiache (1998), Galbis (1993), Gallego and Loayza (2000), Lindgren et al. (1996), Williamson and Mahar (1998).

Table 2 Financial Liberalization Index by year and country

Country	*1988*	*1989*	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*
Argentina	1	2	2	2	2	4	5	6	6	6	6
Brazil	1	2	2	3	3	3	4	4	4	5	6
Chile	5	5	5	5	5	5	5	5	5	6	6
India	0	0	0	0	0	2	3	3	5	5	5
Indonesia	3	3	4	4	5	5	5	5	5	6	6
Malaysia	1	2	2	4	4	4	6	6	6	6	6
Mexico	0	2	2	3	4	5	6	6	6	6	6
Pakistan	0	0	0	0	0	1	2	4	4	5	5
Peru	0	0	0	2	3	4	4	5	6	6	6
Philippines	2	2	2	2	2	3	5	5	6	6	6
Rep. Korea	1	2	2	2	3	4	4	4	6	6	6
Taiwan	0	0	0	0	2	2	2	2	2	3	4
Thailand	1	1	1	1	4	4	4	5	5	6	6

Notes: The above figures focus on changes in the degree of financial liberalization within a country. The figure indicates the number of measures that has been implemented with respect to six different types of financial sector liberalization. The index ranges thus from 0-6, with 6 indicating the highest level of financial liberalization. The index is constructed as of year-end status. In our empirical work we use figures at year-end of period *t-1* for the level of financial liberalization at the beginning of period *t*.

Table 3 Sequence of Financial Liberalization

Country	*INT*	*ENT*	*RES*	*CRE*	*PRI*	*PRU*
Argentina	2	1	3.5	3.5	6	5
Brazil	2	3	1	4	5	6
Chile	3	6	2	1	4.5	4.5
India	4.5	1.5	1.5	3	-	4.5
Indonesia	1	2.5	2.5	4	5	6
Malaysia	3.5	5.5	5.5	3.5	1	2
Mexico	1.5	5	1.5	3	4	6
Pakistan	3.5	1	-	3.5	5	2
Peru	1.5	6	1.5	3	5	4
Philippines	2	4.5	4.5	1	6	3
Rep. Korea	4	2	5.5	5.5	1	3
Taiwan	1.5	1.5	-	-	4	3
Thailand	3	5	3	3	1	6
Average	2.5	3.4	2.9	3.2	4.0	4.2
Median	2	3	2.5	3.3	4.8	4.5

Notes: The figures indicate the sequence of financial liberalization with respect to each of the six different measures. The number 1 therefore indicates that the type of liberalization in question was the first measure (out of 6) to come into effect. The number 2 indicates the second measure to become effective, et cetera. Averages are used when measures were implemented in the same year.

Table 4 Comparison of Financial Liberalization Dates

Country	*Largely Liberalized Banking Sector*		*Stock Market Liberalization*
	FLI	*LLI*	
Argentina	1994	1993	1989.11
Brazil	1997	Not until 1996	1991.05
Chile	1986	1985	1988.12
India	1996	Not until 1996	1992.10
Indonesia	1992	1989	1989.09
Malaysia	1994	1992	1988.12
Mexico	1993	1992	1989.05
Pakistan	1997	Not until 1996	1991.02
Peru	1995	1993	1993.06
Philippines	1994	1994	1989.10
Rep. Korea	1996	Not until 1996	1992.02
Taiwan	Not until 1998	Not until 1996	1991.01
Thailand	1995	1992	1988.12

Notes: FLI5 indicates liberalization of bank sector and is defined as the year when FLI hits 5; the "largely liberalized financial system" dates (LLI) are from Williamson and Mahar (1998); the stock market liberalization dates are from IFC.

Table 5 Link between Financial Liberalization and the Political Climate

Country	*ICRG Political Risk Index*		*FLI and ICRG Political Risk Index*
	1988	*1998*	*Correlation Between 1988-98*
Argentina	57	76	89%
Brazil	67	66	29%
Chile	56	73	49%
India	45	59	85%
Indonesia	39	42	45%
Malaysia	58	66	77%
Mexico	66	69	16%
Philippines	40	74	90%
Rep. Korea	64	75	75%
Taiwan	77	82	81%
Thailand	58	70	86%
Average	*57*	*68*	*66%*

Notes: The ICRG index ranges between 0 and 100%, and is decreasing in the level of political risk.
Source: The ICRG political risk index is constructed by Political Risk Service. We do not have ICRG data on Pakistan and Peru.

Table 6 Deletion Criteria

Sample selection: All developing countries in the World Scope database (April 1999 CD-Rom and December 1999 CD-Rom) with at least 20 firms and with at least some firms with at least seven years of data during 1988-98. We exclude transition economies.

In addition, we establish the following deletion criteria:

- Firms that operate in the financial or service industries (primary SIC industry code 6, 7, 8 or 9)
- All firms with 3 or less years coverage
- All firms with depreciation values missing
- All firms with zero net value of property, equipment and plant (often due to hyperinflation)
- All firms with Investment/Capital>0.5 (due to acquisitions or revaluation of assets)
- All firms with Investment/Capital<0.1 (due to divestments)
- All firms with Sales/Capital<0.1
- All firms with Sales/Capital>10 (this excludes sales companies)
- All firms with Q<0.2 (due to firms in distress)
- All firms with Q>10 (due to start-ups or due to problems to measure capital)
- All firms with Cashflow/Capital<0.01 (due to negative operating income)
- All firms with Cashflow/Capital>1 (due to problems to measure capital)
- All firms with Debt/Capital>2
- All firms with Cash/Capital>0.5 (this excludes mostly financial holdings)

These deletion criteria result in a sample of 13 countries.

Table 7 Variable Definition

MPK_t	=	Marginal profitability of capital at the beginning of period t
	=	$\frac{S_t}{K_t}$ or Q_t
K_t	=	Capital at the beginning of period t[22].
	=	Net tangible assets[23] at end of period t-1 minus capital expenditure during period t-1 plus accumulated depreciation and amortization until the end of period t-1.
S_t	=	Net sales at the end of period t-1.
I_t	=	Investment during period t
	=	$K_{t+1} + Depr_t - K_t(1+p_t)$.
$Depr_t$	=	Depreciation during period t
	=	$d_t K_t$
p_t	=	Inflation over the period t.
Q_t	=	Average q at the beginning of period t
	=	$\frac{D_t + MV_t}{K_t}$.
D_t	=	Book value of long-term[24] debt at the beginning of period t.
MV_t	=	Market value of equity at the beginning of period t[25].
FIN_t	=	Financial variable related to financing constraint
	=	$\frac{CF_t}{K_t}$.
CF_t	=	Operating cash flow during the period t-1
	=	Operating income during period t-1 plus depreciation during period t-1.
$Small_t$	=	1, if the firm is small in terms of either net sales during the period period t-1 or total assets at the beginning of period t, and 0 otherwise. In the base case model, $Small_t$ equals 1 if the firm's sales are smaller than the median sales of firms in the sample.
$Large_t$	=	1, if the firm is large, i.e. if $Small_t$ is 0, and 0 otherwise.
FLI_t	=	Financial Liberalization Dummy, which takes value one if banking sector is liberalized at the beginning of period t. In the base case model, FLI_t equals 1, if the financial liberalization index FLI takes value 5 or 6, and equals 0 otherwise.

[22] Note that variables at the beginning of period t are estimated by figures at the end of period t-1.
[23] Property, plant and equipment net of depreciation.
[24] Maturity over one year.
[25] Calculated as number of shares outstanding at the end of period t-1 times the market price of one share at the end of period t-1.

Table 8 Descriptive Statistics

a. Panel data structure

Years	3	4	5	6	7	8	9	10	*Total*
Firms	180	101	43	30	22	11	6	1	394
Observations	540	404	215	180	154	88	54	10	1645

Notes: Number of firms with given number of years data.

b. All firms

	I/K	*Q*	*S/K*	*CF/K*	*D/K*
Mean	0.189	2.443	2.002	0.280	0.341
Median	0.170	1.988	1.534	0.247	0.285
Maximum	0.500	9.999	9.859	0.967	1.83
Minimum	0.010	0.216	0.147	0.012	0.000
Std. Dev.	0.125	1.642	1.621	0.155	0.310
Observations	1645	1645	1645	1645	1645

c. Small firms

	I/K	*Q*	*S/K*	*CF/K*	*D/K*
Mean	0.186	2.620	1.965	0.302	0.291
Median	0.161	2.222	1.494	0.275	0.195
Maximum	0.500	9.243	9.859	0.967	1.599
Minimum	0.010	0.216	0.147	0.013	0.000
Std. Dev.	0.129	1.651	1.568	0.172	0.303
Observations	822	822	822	822	822

Notes: 'Small' is defined as sales being smaller than the median of firm sales in the sample.

d. Large firms

	I/K	*Q*	*S/K*	*CF/K*	*D/K*
Mean	0.192	2.265	2.039	0.258	0.392
Median	0.177	1.766	1.582	0.228	0.345
Maximum	0.495	9.999	9.487	0.932	1.826
Minimum	0.010	0.231	0.217	0.012	0.000
Std. Dev.	0.120	1.614	1.672	0.133	0.309
Observations	823	823	823	823	823

Notes: 'Large' is defined as sales being larger than the median of firm sales in the sample.

e. Correlation matrix

	I/K	*Q*	*S/K*	*CF/K*	*D/K*
I/K	1				
Q	0.126	1			
S/K	0.106	0.262	1		
CF/K	0.184	0.437	0.610	1	
D/K	0.044	-0.033	0.051	-0.011	1

f. Median statistics by country

Country	*Sales*	*I/K*	*Q*	*CF/K*	*D/K*	*Obs.*
Argentina	885600	0.157	1.417	0.203	0.236	51
Brazil	858049	0.140	0.740	0.167	0.174	30
Chile	167555	0.161	1.977	0.252	0.180	149
India	152012	0.163	2.363	0.288	0.537	300
Indonesia	57130	0.176	1.584	0.310	0.185	55
Malaysia	123013	0.147	2.694	0.242	0.093	335
Mexico	708980	0.194	2.427	0.217	0.199	99
Pakistan	90356	0.154	1.376	0.379	0.291	17
Peru	114960	0.148	1.440	0.288	0.199	10
Philippines	56288	0.250	2.626	0.219	0.063	32
Rep. Korea	650390	0.194	1.128	0.220	0.503	249
Taiwan	249028	0.121	2.720	0.211	0.240	114
Thailand	73738	0.177	1.931	0.302	0.191	204
All	*198752*	*0.170*	*1.988*	*0.247*	*0.285*	*1645*

g. Median statistics per industry

Industry	*I/K*	*Q*	*S/K*	*CF/K*	*D/K*	*Obs.*
1	0.144	2.380	0.974	0.288	0.113	26
2	0.146	1.785	0.871	0.203	0.249	54
3	0.208	2.374	0.898	0.201	0.377	26
4	0.175	1.682	0.616	0.211	0.272	161
5	0.218	1.950	2.137	0.239	0.308	148
6	0.153	2.050	2.038	0.254	0.148	185
7	0.190	3.632	2.042	0.500	0.099	12
8	0.154	1.059	1.414	0.221	0.168	70
9	0.192	2.127	3.049	0.363	0.100	44
10	0.108	1.838	0.848	0.189	0.064	36
11	0.135	2.936	2.690	0.419	0.000	8
12	0.158	1.901	1.387	0.242	0.290	63
13	0.163	3.318	1.589	0.368	0.154	20
14	0.157	1.969	1.541	0.279	0.454	201
15	0.187	2.858	3.141	0.275	0.212	45
16	0.114	1.916	2.026	0.218	0.214	38
17	0.120	1.968	4.724	0.301	0.000	9
18	0.171	1.890	1.017	0.223	0.314	139
19	0.123	1.571	1.440	0.209	0.250	106
20	0.168	2.213	1.800	0.302	0.383	36
21	0.277	2.996	2.250	0.278	0.619	30
22	0.217	2.737	2.232	0.376	0.279	72
23	0.181	2.430	2.496	0.268	0.508	85
24	0.276	1.443	1.595	0.251	0.614	10
25	0.170	1.756	1.681	0.302	0.255	21
All	*0.170*	*1.988*	*1.534*	*0.247*	*0.285*	*1645*

h. Translation of industry codes

Industry Code	(Primary) SIC code	Industry Name
1	0	Agriculture, forestry and fishing
2	1	Mining
3	2	Construction
4	4	Transportation, communication, electric, gas and sanitary services
5	5	Wholesale trade and retail trade
6	20	Food and kindred products
7	21	Tobacco manufactures
8	22	Textile mill products
9	23	Apparel and other finished products made from fabrics and similar materials
10	24	Lumber and wood products, except furniture
11	25	Furniture and fixtures
12	26	Paper and allied products
13	27	Printing, publishing and allied products
14	28	Chemicals and allied products
15	29	Petroleum refining, and related industries
16	30	Rubber and miscellaneous plastics products
17	31	Leather and leather products
18	32	Stone, clay, glass, and concrete products
19	33	Primary metal industries
20	34	Fabricated metal products, except machinery and transportation equipment
21	35	Machinery, except electrical
22	36	Electrical and electronic machinery, equipment and supplies
23	37	Transportation equipment
24	38	Measuring, analyzing and controlling instruments; photographic, medical and optical goods; watches and clocks
25	39	Miscellaneous manufacturing industries

Notes: The industry codes follow the classification of the US government. Industry codes can be at 1-digit levels called SIC codes, or at two-digit levels called Primary SIC (PSIC) codes. PSIC 20-39 indicates the manufacturing industry at a two-digit level. The SIC code for the manufacturing sector is 3. Only the manufacturing industry codes are at the two-digit level. We exclude SIC codes 6-9 (which include the following sectors: finance, insurance and real estate; services; government; other).

i. Median statistics categorized by *Year*

Year	*Sales*	*I/K*	*Q/K*	*CF/K*	*D/K*	*FLI*	*Obs.*
1989	250446	0.237	1.797	0.168	0.168	1	13
1990	500108	0.278	1.705	0.174	0.174	2	36
1991	356645	0.197	2.162	0.163	0.163	2	60
1992	300391	0.173	2.430	0.234	0.234	3	100
1993	170138	0.181	2.073	0.221	0.221	4	165
1994	152150	0.160	2.762	0.264	0.264	4	212
1995	154747	0.186	2.359	0.275	0.275	4	286
1996	187041	0.169	1.852	0.314	0.314	4	321
1997	222373	0.169	1.665	0.313	0.313	5	275
1998	220474	0.117	1.431	0.337	0.337	6	177
All	*198752*	*0.170*	*1.988*	*0.285*	*0.285*	*4*	*1645*

j. Distribution of the financial liberalization index in terms of observations

FLI	*Number of Observations*	*Percentage of Total Number of Observations*
0	60	4%
0-1	85	5%
0-2	309	19%
0-3	490	30%
0-4	877	53%
0-5	1268	77%
0-6	1645	100%

Table 9 OLS and Two-step GMM estimates of investment model

Variable	(i) *OLS-levels*	(ii) *GMM-levels*	(iii) *GMM-FD*	(iv) *GMM-System*
Constant	0.1331**	0.1076**	-0.0024	0.1214***
	(0.0564)	(0.0469)	(0.0021)	(0.0098)
$(I/K)_{t-1}$	0.2009***	0.2389***	0.1609***	0.1850***
	(0.0276)	(0.0488)	(0.0318)	(0.0155)
$(Q/K)_t$	0.0053*	-0.0017	0.0109***	0.0113***
	(0.0029)	(0.0043)	(0.0029)	(0.0023)
$(CF/K)_t$	0.1282***	0.1551***	0.1961**	0.0973***
	(0.0268)	(0.0475)	(0.0907)	(0.0309)
$(D/K)_t$	-0.0137	-0.0573***	-0.0220	-0.0823***
	(0.0135)	(0.0247)	(0.0422)	(0.0155)
Specification Tests (p-values)				
First-order serial correlation:	0.496	0.769	0.000***	0.000***
Second-order serial correlation:	0.651	0.851	0.694	0.747
Wald test of joint significance:	0.000***	0.000***	0.000***	0.000***
Sargan test:	-	0.149	0.299	0.192
Hausman test:	-	-	-	0.000***
Difference Sargan test:	-	-	-	0.000***
Instruments:	-	*t*-2, *t*-3, *t*-4	*t*-2, *t*-3, *t*-4	*t*-2, *t*-3, *t*-4
Adjusted R^2:	0.14	-	-	-
Number of observations:	1251	1251	857	1251
Number of firms:	394	394	394	394

Notes:
Dependent variable is $(I/K)_t$. Model (i)-(ii) include country, industry and year dummies (not reported). Model (iv) is a system of orthogonal deviations and levels. Model (ii) uses variables at *t*-2, *t*-3, *t*-4 as instruments. Heteroskedasticity consistent standard errors are between brackets. Model (iii) uses variables at *t*-2, *t*-3, *t*-4 as instruments. Model (iv) uses variables at *t*-2, *t*-3, *t*-4 as instruments for the equation in orthogonal deviations and orthogonal deviations of variables at *t*-1 for the equation in levels. The realization of the Hausman test statistic for model (iv) is 54.3, which is c^2 distributed with 4 degrees of freedom. *** indicates significance at 1% level; ** indicates significance at 5% level; * indicates significance at 10% level.

Table 9 OLS and Two-step GMM estimates of investment model (continued)

Variable	(v) *OLS-levels*	(vi) *GMM-levels*	(vii) *OLS-levels*	(viii) *GMM-levels*
Constant	0.1327**	0.1048**	0.1361***	0.1517***
	(0.0564)	(0.0543)	(0.0564)	(0.0486)
$(I/K)_{t-1}$	0.2015***	0.3304***	0.2013***	0.2303***
	(0.0277)	(0.0625)	(0.0277)	(0.0471)
$(Q/K)_t$	0.0064	0.0051	0.0021	-0.0044
	(0.0042)	(0.0081)	(0.0037)	(0.0057)
$(CF/K)_t$	0.1376***	0.1631***	0.1716***	0.1565**
	(0.0474)	(0.0669)	(0.0356)	(0.0678)
$(D/K)_t$	-0.0230	-0.0600	-0.0302	-0.1303***
	(0.0169)	(0.0389)	(0.0182)	(0.0255)
$Small_t * (Q/K)_t$	-0.0022	0.0069	-	-
	(0.0049)	(0.0117)		
$Small_t * (CF/K)_t$	-0.0135	-0.0922	-	-
	(0.0510)	(0.1106)		
$Small_t * (D/K)_t$	0.0172	0.0081	-	-
	(0.0222)	(0.0473)		
$FLI_t * (Q/K)_t$	-	-	0.0066	0.0076
			(0.0048)	(0.0068)
$FLl_t * (CF/K)_t$	-	-	-0.0788*	-0.1251*
			(0.0419)	(0.0698)
$FLI_t * (D/K)_t$	-	-	0.0290	0.0878***
			(0.0213)	(0.0260)
Specification Tests (p-values)				
First-order serial correlation:	0.572	0.106	0.632	0.797
Second-order serial correlation:	0.639	0.455	0.667	0.996
Wald test of joint significance:	0.000***	0.000***	0.000***	0.000***
Sargan test:	-	0.246	-	0.216
Instruments:	-	*t*-3	-	*t*-2, *t*-3
Adjusted R^2:	0.14	-	0.14	-
Number of observations:	1251	1251	1251	1251
Number of firms:	394	394	394	394

Notes:
Dependent variable is $(I/K)_t$. *Small* is a dummy variable that takes value one if sales of the firm is smaller than the median sales in the sample, and zero otherwise. FLI_t is a dummy variable that takes value one if *FLI* is 5 or 6, and zero otherwise. Model (v)-(viii) include country, industry and year dummies (not reported). Model (vi) uses variables at *t*-3 as instruments and assumes that *Small* is an exogenous variable. Model (viii) uses variables at *t*-2, *t*-3 as instruments and assumes that FLI_t is an exogenous variable (for interaction terms only variables at *t*-2 are used as instruments). Heteroskedasticity consistent standard errors are between brackets. *** indicates significance at 1% level; ** indicates significance at 5% level; * indicates significance at 10% level.

Table 9 OLS and Two-step GMM estimates of investment model (continued)

Variable	(ix) *OLS-levels*	(x) *GMM-levels*
Constant	0.1409***	0.1192**
	(0.0563)	(0.0511)
$(I/K)_{t-1}$	0.1985***	0.3178***
	(0.0277)	(0.0778)
$Large_t * Q_t$	0.0067	0.0037
	(0.0051)	(0.0146)
$Large_t * (CF/K)_t$	0.1170**	0.0730
	(0.0551)	(0.1897)
$Large_t * (D/K)_t$	-0.0338	-0.0470
	(0.0222)	(0.0457)
$Small_t * Q_t$	-0.0013	-0.0047
	(0.0044)	(0.0136)
$Small_t * (CF/K)_t$	0.2012***	0.3038**
	(0.0415)	(0.1464)
$Small_t * (D/K)_t$	-0.0181	-0.1381*
	(0.0267)	(0.0794)
$Large_t * FLI_t * Q_t$	0.0021	0.0010
	(0.0077)	(0.0145)
$Large_t * FLI_t * (CF/K)_t$	0.0218	0.0413
	(0.0778)	(0.1752)
$Large_t * FLI_t * (D/K)_t$	0.0155	0.0196
	(0.0276)	(0.0418)
$Small_t * FLI_t * Q_t$	0.0095*	0.0113
	(0.0060)	(0.0131)
$Small_t * FLI_t * (CF/K)_t$	-0.1250***	-0.2357*
	(0.0499)	(0.1344)
$Small_t * FLI_t * (D/K)_t$	0.0228	0.1340*
	(0.0334)	(0.0710)
Specification Tests (p-values)		
First-order serial correlation:	0.867	0.186
Second-order serial correlation:	0.691	0.629
Wald test of joint significance:	0.000***	0.000***
Sargan test:	-	0.384
Adjusted R^2:	0.14	-
Instruments	-	*t*-3
Number of observations:	1251	1251
Number of firms:	394	394

Notes:
Dependent variable is $(I/K)_t$. $Small_t$ is a dummy variable that takes value one if sales of the firm is smaller than the median sales in the sample, and zero otherwise. $Large_t$ is a dummy variable that takes value one if sales of the firm is larger than or equal to the median sales in the sample, and zero otherwise. FLI_t is a dummy variable that takes value one if *FLI* is 5 or 6, and zero otherwise. Model (ix) and (x) include country, industry and year dummies (not reported). Model (x) uses variables at *t*-3 as instruments and assumes that FLI_t is an exogenous. Heteroskedasticity consistent standard errors are between brackets. *** indicates significance at 1% level; ** indicates significance at 5% level; * indicates significance at 10% level.

Table 10 OLS estimates of several specifications of investment model

Variable	(i) *Size*	(ii) *Size*	(iii) *MPK*
Constant	0.1357**	0.1367**	0.1363**
	(0.0569)	(0.0575)	(0.0555)
$(I/K)_{t-1}$	0.1959***	0.1952***	0.2026***
	(0.0279)	(0.0278)	(0.0281)
$Large_t * MPK_t$	0.0057	0.0056	-0.0028
	(0.0060)	(0.0047)	(0.0046)
$Large_t * (CF/K)_t$	0.1333**	0.1369***	0.1823***
	(0.0634)	(0.0484)	(0.0532)
$Large_t * (D/K)_t$	-0.0277	-0.0440**	-0.0298
	(0.0267)	(0.0199)	(0.0223)
$Small_t * MPK_t$	-0.0004	-0.0006	-0.0022
	(0.0037)	(0.0046)	(0.0080)
$Small_t * (CF/K)_t$	0.1898***	0.1848***	0.1956***
	(0.0381)	(0.0440)	(0.0676)
$Small_t * (D/K)_t$	-0.0330	0.0263	-0.0208
	(0.0232)	(0.0316)	(0.0261)
$Large_t * FLI_t * MPK_t$	0.0055	0.0028	-0.0030
	(0.0082)	(0.0064)	(0.0059)
$Large_t * FLI_t * (CF/K)_t$	0.0105	-0.0175	0.0444
	(0.0803)	(0.0563)	(0.0705)
$Large_t * FLI_t * (D/K)_t$	0.0152	0.0351	0.0183
	(0.0302)	(0.0233)	(0.0274)
$Small_t * FLI_t * MPK_t$	0.0069	0.0091	0.0106
	(0.0052)	(0.0063)	(0.0095)
$Small_t * FLI_t * (CF/K)_t$	-0.1006**	-0.1213**	-0.1277*
	(0.0474)	(0.0551)	(0.0754)
$Small_t * FLI_t * (D/K)_t$	0.0191	-0.0390	0.0255
	(0.0324)	(0.0406)	(0.0332)
Specification Tests (p-values)			
First-order serial correlation:	0.679	0.963	0.778
Second-order serial correlation:	0.706	0.804	0.708
Wald test of joint significance:	0.000***	0.000***	0.000***
Adjusted R^2:	0.14	0.15	0.14
Number of observations:	1251	1251	1251
Number of firms:	394	394	394

Notes:
Dependent variable is $(I/K)_t$. Model (i)-(iii) include country, industry and year dummies (not reported). In model (i), $Small_t$ is a dummy variable that takes value one if assets of the firm is smaller than the median assets in the sample, and zero otherwise. In model (ii), $Small_t$ is a dummy variable that takes value one if sales of the firm is smaller than the 1/3 quantile of sales in the sample, and zero otherwise. In model (iii)-(iv), $Small_t$ is a dummy variable that takes value one if sales of the firm is smaller than median of sales in the sample, and zero otherwise. In models (i)-(iii), $Large_t$ is a dummy variable that takes value one if $Small_t$ takes value zero, and zero otherwise. In model (iii) MPK_t is $(S/K)_t$. In the other three models MPK_t is $(Q/K)_t$. FLI_t is a dummy variable that takes value one if *FLI* is 5 or 6, and zero otherwise.
Heteroskedasticity consistent standard errors are between brackets. *** indicates significance at 1% level; ** indicates significance at 5% level; * indicates significance at 10% level.

Table 10 OLS estimates of several specifications of investment model (continued)

Variable	(iv) *FLI4*	(v) *CRE*	(vi) *Post-94*
Constant	0.1258**	0.1261**	0.1204**
	(0.0576)	(0.0573)	(0.0581)
$(I/K)_{t-1}$	0.1992***	0.2003***	0.1975***
	(0.0276)	(0.0274)	(0.0275)
$Large_t * Q_t$	0.0088	0.0094	0.0068
	(0.0057)	(0.0051)	(0.0054)
$Large_t * (CF/K)_t$	0.1389**	0.1353**	0.1296**
	(0.0615)	(0.0615)	(0.0611)
$Large_t * (D/K)_t$	-0.0263	-0.0426*	0.0064
	(0.0273)	(0.0253)	(0.0263)
$Small_t * Q_t$	0.0058	0.0004	-0.0051
	(0.0058)	(0.0073)	(0.0052)
$Small_t * (CF/K)_t$	0.1751***	0.2553***	0.2367***
	(0.0503)	(0.0746)	(0.0531)
$Small_t * (D/K)_t$	-0.0137	-0.0419	0.0124
	(0.0369)	(0.0410)	(0.0365)
$Large_t * FLI_t * Q_t$	-0.0036	-0.0041	0.0004
	(0.0076)	(0.0065)	(0.0067)
$Large_t * FLI_t * (CF/K)_t$	0.0012	0.0049	0.0146
	(0.0794)	(0.0740)	(0.0816)
$Large_t * FLI_t * (D/K)_t$	0.0053	0.0266	-0.0435
	(0.0298)	(0.0289)	(0.0292)
$Small_t * FLI_t * Q_t$	-0.0016	0.0048	0.0131**
	(0.0070)	(0.0080)	(0.0060)
$Small_t * FLI_t * (CF/K)_t$	-0.0655	-0.1490*	-0.1468**
	(0.0575)	(0.0797)	(0.0604)
$Small_t * FLI_t * (D/K)_t$	0.0073	0.0404	-0.0253
	(0.0417)	(0.0441)	(0.0398)
Specification Tests (p-values)			
First-order serial correlation:	0.714	0.999	0.990
Second-order serial correlation:	0.715	0.704	0.684
Wald test of joint significance:	0.000***	0.000***	0.000***
Adjusted R^2:	0.14	0.14	0.14
Number of observations:	1251	1251	1251
Number of firms:	394	394	394

Notes:
Dependent variable is $(I/K)_t$. Model (iv)-(vi) include country, industry and year dummies (not reported). $Small_t$ is a dummy variable that takes value one if sales of the firm is smaller than the median sales in the sample, and zero otherwise. $Large_t$ is a dummy variable that takes value one if $Small_t$ takes value zero, and zero otherwise. In model (iv) FLI_t is a dummy variable that takes value one if *FLI* is 4, 5 or 6, and zero otherwise. In model (v) FLI_t is a dummy variable that takes value one if *CRE* is 1, and zero otherwise. In model (vi) FLI_t is a dummy variable that takes value one if year is 1995-1998, and zero otherwise. Heteroskedasticity consistent standard errors are between brackets. *** indicates significance at 1% level; ** indicates significance at 5% level; * indicates significance at 10% level.

Annex 1 Major Events of Liberalization of the Banking Sector for Various Countries

Major events related to: (1) Interest rates; (2) Entry barriers; (3) Reserve requirements; (4) Credit Controls; (5) Privatization; (6) Prudential regulation.

Argentina
1. Elimination of all interest rate controls in 1989 (EIU).
2. Removal of most entry barriers and branching restrictions in 1977 (Lindgren et al. 1996).
3. Reserve requirements lowered in 1993 (Galbis, 1993).
4. Credit controls were substantially reduced in 1993.
5. Start to privatize banks in 1995 (Lindgren et al. 1996).
6. Central Bank starts to enforce Basle capital adequacy standards in 1994 (Galbis, 1993).

Brazil
1. Deposit rates are fully liberalized in 1989.
2. Entry barriers are reduced after 1991.
3. Reserve requirements are rationalized after 1988.
4. Start to reduce directed credit especially to agricultural sector in 1994 (IMF).
5. Begin of privatization of state-owned banks in 1997 (IMF).
6. Central Bank modernizes its supervision practices in December 1997 (IMF).

Chile
1. Controls on interest rates are eliminated in 1985 (Gallego and Loayza, 2000)
2. Banks are allowed to expand abroad and to enter new business areas at home since 1997 (EIU).
3. Reserve requirements on both demand and time deposits are reduced in 1980 (Bandiera et al., 2000).
4. Directed credit and credit ceilings are definitely abandoned in 1976 (Bandiera et al., 2000).
5. Banks are re-privatized in 1986 (Bandiera et al., 2000).
6. Revision of banking law to strengthen the supervisory system in 1986 (Bandiera et al., 2000).

India
1. Most interest rates deregulated during 1995-96, except those on deposits of less than one year and on small commercial bank loans (IMF).
2. Entry restrictions for banks eased in 1993.
3. After 1992, reserve requirements were reduced in stages (World Bank).
4. Priority credit scheme made more flexible for banks in 1994 (IMF).
5. No major reduction yet in government ownership of public banks (World Bank).
6. New prudential norms in line with Basle Accord become operational in 1996 (World Bank).

Indonesia
1. Most deposit and loan rates freed in 1983.
2. Monopoly of state banks over deposits of state enterprises removed in 1988. Entry of new banks is allowed (Bandiera et al., 2000). Activities of financial institutions broadened in 1988. Foreign banks allowed to establish joint ventures in 1988.
3. Reserve requirements drastically lowered in 1988 (Bandiera et al., 2000).
4. New reform package announced in 1990 which took on the directed credit program; Most of the liquidity credit arrangements for priority loans are eliminated in 1990 (World Bank).
5. Reduction of government ownership of state banks (World Bank).
6. Improved bank supervisory legislation in 1997 including new loan classification and loan loss provisioning rules (World Bank).

Malaysia
1. Interest rate controls completely eliminated in 1991.
2. A two-tier banking framework was introduced for commercial banks in December 1994 (IMF).
3. Reserve requirements were reduced in 1994 (World Bank).
4. The number of priority sectors and the required loan amount is reduced in 1991 (Bandiera et al., 2000).
5. There have been no privatizations of banks. Most large banks have been private since they started operations. Government, however, is majority shareholder in two largest banks (World Bank).

6. New regulation extends and strengthens Central Bank's supervisory powers (Bandiera et al., 2000).

Mexico
1. Deposit rates liberalized in 1988-89. Loan rates liberalized after 1988, except at development banks.
2. New entry of banks permitted in 1991.
3. Reduction of reserve requirements in 1988-89 (IMF and Bandiera et al., 2000).
4. Abolition of directed lending to preferential sectors in 1989 (IMF). Elimination of the liquidity coefficient requiring that 30% of deposits be invested in T-bills in 1991 (Bandiera et al., 2000).
5. Authorities nationalized 18 commercial banks in 1982. Nationalized banks re-privatized in 1991-1992.
6. The Central Bank became autonomous in April 1994 (EIU).

Pakistan
1. Most lending rates freed in 1995.
2. Eleven new private banks, including three foreign, established since 1991.
3. No significant reductions in reserve requirements (World Bank).
4. The credit-deposit ratio mechanism, which required banks to keep their credit to the private sector within limits related to their deposits base, was abolished in 1995 (IMF).
5. Muslim Commercial Bank privatized in 1991. Allied bank privatized in stages between 1991-93. First Women Bank privatized in 1997. Comprehensive reforms in 1997 reduced government interference in public-sector banks.
6. Steps were taking during 1993-94 to increase the autonomy of the Central Bank (IMF); Coverage of bank supervision increased in 1994 (IMF).

Peru
1. Interest rate controls abolished in 1991.
2. In December 1996, entry requirements were eased (IMF).
3. Reserve requirements on domestic deposits reduced from 1991onwards.
4. Subsidized lending eliminated in 1992.
5. All seven public commercial banks liquidated or divested over 1991-95.
6. In 1993, the banking law was modified to strengthen prudential regulations that apply to banks (IMF).

Philippines
1. Interest rate controls mostly phased out over 1981-85.
2. Restrictions on the entry and operation of banks were eased in 1994 (IMF); Restrictions on foreign bank branching were lifted in 1994 (IMF); Foreign banks were allowed to purchase up to 60 percent of the equity of local banks in 1994 (IMF).
3. Reserve requirements lowered in 1993.
4. Directed credit partly abolished in 1983.
5. Government reduced stake in PNB to 47% in December 1995.
6. In December 1993, Central Bank was restructured and re-capitalized (IMF).

Rep. Korea
1. In 1993, deregulation of interest rates on deposits with maturities of two years and on most loans (IMF).
2. Entry barriers are lowered in again in 1989. The establishment of new financial institutions is approved in 1989 (Bandiera et al., 2000).
3. Reserve requirements lowered in 1996 (IMF)
4. Most policy-based lending phased out in 1996; In 1996, the Central Bank removed the restriction on the premium a bank could charge over its prime lending rate, and revised its rules for credit control (IMF).
5. Commercial banks were privatized during 1981-83 (IMF).
6. General Banking Act of 1991 introduces new prudential measures and imposes supervisory regulations (Bandiera et al., 2000); In 1992, measures were introduced to increase transparency of regulations and procedures on bank supervision (IMF).

Taiwan
1. Interest rates nominally liberalized in 1989, but prices remained uncompetitive until new banks were established in 1992.

2. Deregulation on the entry of new private commercial banks in 1991-92. Establishment of 16 new banks in 1992 (EIU).
3. Directed credit still prevalent. Budgets for subsidized credit continually modified in recent years.
4. No significant reductions in reserve requirements (World Bank).
5. In January 1998, three of the largest commercial banks are partly privatized (EIU).
6. In May 1997, the Central Bank of China (Taiwan) Act was amended to improve bank regulation (IMF).

Thailand
1. Interest-rate ceilings on all types of deposits abolished in 1990. Ceiling on loan rates removed in 1992.
2. Since September 1994, commercial banks re allowed to invest in any business (World Bank); Finance and securities companies permitted to set up banks outside Bangkok with approval in 1995.
3. Reduction of reserve requirements in 1992 (IMF).
4. Government gradually eliminated directed credit after 1980. The ceiling on commercial bank loans was lifted in 1992. Commercial banks and finance companies were permitted to issues certificates of deposits in 1992. Relaxation of rural credit requirement in 1992 (IMF).
5. No privatization efforts. Most large Thai commercial banks are private, but one of the largest banks, Krung Thai bank, is still public (World Bank).
6. In 1997, banking law was amended to strengthen prudential regulations (IMF).

Notes:
Unless otherwise noted, the source of information is: Williamson, J. and M. Mahar (1998). *IMF* indicates IMF Country Reports, and *World Bank* indicates World Bank Country Reports.