Does Financial Liberalization Reduce Financing Constraints?

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Executive Summary

This paper explores the impact of financial liberalization on financing constraints of firms in developing countries. Although financial reform has been one of the most profound policy reforms of many developing countries in recent years and is thought to have a large potential impact on the performance of firms and on economic welfare more generally, there is no professional consensus on the net benefits of financial liberalization.

Financial 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 has been stimulated. In this paper, we focus on the effects of liberalization of banking markets.

Although the main objectives of financial deregulation should be to increase the supply and improve the allocation of funds for investment, the consequence of financial liberalization on the supply of funds for investment is theoretically ambiguous. The empirical findings to date about the effects of financial liberalization on financing
constraints in developing countries have also been inconclusive. Most theories agree that financial liberalization changes the composition and allocation of savings, but does not necessarily relax financial constraints for all classes of firms. 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. In particular, we pose the following two questions. Does financial liberalization relax the financing constraints of firms? What type of firms are most likely to benefit from financial liberalization?

We contribute to the existing literature by using annual 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, as has thus far been done in the literature. The use of data from several countries has the advantage of making our result less dependent on the specifics of a single country.

We find for our sample of firms in 13 liberalizing developing countries that, on average, firms did not face financing constraints over the sample period of 1988 to 1998. We also find that, on average, financial liberalization did not reduce the financing constraints of firms, as firms’ investment remained sensitive to changes in firms’ cash flow after financial liberalization. However, financial liberalization appears to have affected small and large firms differently. Large firms become more financially constrained as financial liberalization progresses, while small firms become less financially constrained. The effects are economically large. Financial liberalization reduces the financing constraints – as measured by the sensitivity of investment to cash flow – of small firms by around 80 percent on average. The negative effect of financial
liberalization is found to be the strongest for the group of very large firms. We hypothesize that financial liberalization has adverse effects on the financing constraints of large firms, because these firms had better access to preferential directed credit during the period before financial liberalization.

By studying the effects of financial liberalization on the financing constraints of firms, we focus on firms’ access to funds for investment rather than the allocative efficiency of total available funds. Therefore, our results cannot be used to infer whether financial liberalization has a positive impact on the overall efficiency of investment. Allocative efficiency is intrinsically hard to measure and we therefore leave this topic to future research.
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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 before financial liberalization, but become higher as financial liberalization proceeds. We hypothesize that financial liberalization has adverse effects on the financing constraints of large firms, because these firms had better access to preferential directed credit during the period before financial liberalization.

JEL Classification Codes: E22, E44, G31, O16

Keywords: Financial Liberalization, Financing Constraints, Firm Investment
In this study we explore the impact of financial market reforms on financing constraints of firms in developing countries. Although financial reform has been one of the most profound policy reforms of many developing countries in recent years and is thought to have a large potential impact on the performance of firms and on economic welfare more generally, there is no professional consensus on the net benefits of financial liberalization.

From a theoretical perspective, financing constraints may arise if there are financial frictions. Under the Modigliani and Miller theorem (1958), that is without financial frictions, a firm’s 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 financial frictions, however, the costs of internal and external finance will diverge. Financial frictions can arise from information asymmetry and from incomplete contracting. Financial frictions lead to a link between net worth, the cost of external financing, and firm investment. Within the neo-classical investment model with financial frictions, an increase in net worth independent of changes in investment opportunities leads to greater investment for firms facing high financial frictions and has no effect on investment for firms facing negligible financial frictions. Firms facing high financial frictions are thus expected to face financing constraints. It follows that financial liberalization will reduce financing constraints if it is accompanied

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1 There exists an extensive theoretical literature on potential causes of financial frictions. Information asymmetry can create adverse selection (Akerlof (1970)), and may cause credit rationing in the loan market (Stiglitz and Weiss (1981)). Myers and Majluf (1984) discuss the information asymmetry problems of equity markets. Information asymmetry can also give rise to principal-agent problems, such as incentive problems and costly monitoring. Jensen and Meckling (1976) show that in the presence of limited-liability debt agency costs can arise between equity holders and debt holders as equity holders may have the incentive to opt for excessively risky investment projects that are value destroying. Townsend (1979) discusses how debt markets are affected by costly state verification. Hart (1995) gives an overview of how incomplete contracting can affect firms’ financial structure. Modigliani and Perotti (1996) and La Porta et al. (1997) discuss how contract enforcement affects the choice between internal or external finance.
by a reduction in financial frictions, such as improved contract enforcement or a reduction of information costs.

Financial 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 has been stimulated. In this paper, we focus on the effects of liberalization of banking markets.

Although the main objectives of financial deregulation should be to increase the supply and improve the allocation of funds for investment, the consequence of financial liberalization on the supply of funds for investment is theoretically ambiguous. At the macro level, the effect of financial liberalization on the level of household savings, a major part of the total funds available for investment, is unclear. McKinnon (1973) and Shaw (1973) study the effect of interest rate liberalization, a key component of financial reform, on the supply of household savings. Starting from a repressed financial system in which governments intervene by keeping interest rates artificially low and replace market with administrative allocation of funds, they argue that interest rate liberalization is likely to lead to an increase in interest rates. As higher interest rates on deposits are likely to encourage household savings, they favor interest rate liberalization. Van Wijnbergen (1983), on the other hand, argues 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 informal market loans or cash to increase their holdings of time deposits. If time deposits are closer substitutes for informal market loans than for cash, then the supply of funds to firms could fall, given that banks are subject to reserve
requirements and informal markets are not. Devereux and Smith (1994) show that financial liberalization may also negatively affect the level of precautionary savings as a result of improved international risk sharing, thereby reducing the overall level of funds available for investment.

The consequence of financial liberalization on the efficiency of the allocation of funds for investment is also theoretically ambiguous. On the one hand, it is often thought that financial reforms improve the allocative efficiency of savings. McKinnon (1973) and Shaw (1973) argue that interest rate ceilings, another common feature of repressed financial systems, distort the allocation of credit and may lead to underinvestment in projects that are risky but have a high expected rate of return. Similarly, directed credit programs are often associated with a misallocation of funds. The liberalization of financial markets is also thought to lead to an increase in the pool of funds allocated towards risky investment projects as a result of improved risk sharing (Obstfeld (1994)). It is also often thought that financial liberalization creates efficiency gains through increased financial intermediation by the formal financial sector. Under the presence of economies of scale in information gathering and monitoring, banks and capital markets are expected to have an advantage over the informal market in allocating investment funds, which should lead to a reduction in the cost of capital. However, Gertler and Rose (1994) claim that financial liberalization has failed to meet these expected efficiency gains in a number of countries, because accompanying a general rise in interest rates was a rise in the cost of capital for a substantial class of borrowers. Gertler and Rose (1994) also argue that the elimination of subsidized credit programs, another common feature of financial reform, could increase the financing constraints of those firms that previously benefited from the directed credit system.
More generally, financial liberalization is thought to reduce the imperfections of financial markets, resulting in a reduction in the cost of capital and an increase in the level of investment (Henry (2000a,b) and Bekaert and Harvey (2000)). Financial liberalization is also often associated with increased financial development (McKinnon (1973)). Increased financial development in turn has been shown to enhance economic growth (King and Levine (1993) and Beck, Levine and Loayza (2000), among others), as well as the growth of industries that depend on external finance (Rajan and Zingales (1998)). Wurgler (2000) finds a direct link between financial development and the efficiency by which capital is allocated towards investment. Bekaert, Harvey, and Lundblad (2001) have found a direct link between financial liberalization and economic growth. The above theories have in common that financial liberalization changes the composition and allocation of savings, but will not necessarily relax financial constraints for all classes of firms.

The empirical findings to date about the effects of financial liberalization on financing constraints in developing countries has also been inconclusive. A positive effect of financial liberalization on the financing constraints of firms, as measured by a decrease in the sensitivity of firms’ investment to changes in internal cash flow, has been found for Indonesia by Harris, Schiantarelli and Siregar (1994) and for Chile by Gallego and Loayza (2001). For Mexico, Gelos and Werner (2002) find that financial constraints were eased during financial liberalization 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. For Ecuador, on the other hand, Jaramillo, Schiantarelli and Weiss (1997) find no evidence of a change in financing constraints after financial reform. This difference in the results may
be explained by the fact that financial liberalization in Ecuador was less profound than in other countries, but could also be due to the fact that financial liberalization in Ecuador benefited only certain firms. The result for Ecuador may also be explained by the use of firm-level data for a relatively short period of time, while the effects of liberalization may only be felt over a longer period of time.

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. In particular, we pose the following two questions. Does financial liberalization relax the financing constraints of firms? What type of firms are most likely to benefit from financial liberalization? We contribute to the existing 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, as has thus far been done in the literature. The use of data from several countries has the advantage of making our result less dependent on the specifics of a single country.

We find for our sample of firms in 13 liberalizing developing countries that, on average, firms did not face financing constraints over the sample period of 1988 to 1998. We also find that, on average, financial liberalization did not reduce the financing constraints of firms, as firms’ investment remained sensitive to changes in firms’ cash flow after financial liberalization. However, financial liberalization appears to have affected small and large firms differently. Large firms become more financially constrained as financial liberalization progresses, while small firms become less financially constrained. The effects are economically large. Financial liberalization
reduces the financing constraints – as measured by the sensitivity of investment to cash flow – of small firms by around 80 percent on average. The negative effect of financial liberalization is found to be the strongest for the group of very large firms.

By studying the effects of financial liberalization on the financing constraints of firms, we focus on firms’ access to funds for investment rather than the allocative efficiency of total available funds. Therefore, our results cannot be used to infer whether financial liberalization has a positive impact on the overall efficiency of investment. Although empirical work by Cho (1988) for the case of Korea and by Galindo, Schiantarelli, and Weiss (2001) for several developing countries suggests that financial liberalization has been associated with a substantial improvement in the efficiency of credit allocation in these countries, allocative efficiency is intrinsically hard to measure and we will therefore leave this topic to future research.

The paper continues as follows. Section I reviews the literature on financing constraints. Section II presents the structural model of firm investment that we use to estimate the impact of financial liberalization on financing constraints of firms. Section III describes the econometric techniques we employ to estimate our structural model of firm investment. Section IV presents the firm-level data used in our empirical work. Section V presents the results of our empirical work. Section VI concludes.

I. Review of Literature on Financing Constraints of Firms

Following the work of Fazzari, Hubbard and Petersen (1988), a large body of literature has emerged to provide evidence of financing constraints. We refer for an overview of this literature to the surveys by Schiantarelli (1995), Blundell, Bond and Meghir (1996),
Hubbard (1998), and Bond and Van Reenen (1999). This literature relies on the assumption that external finance is more costly than internal finance due to asymmetric information, agency problems, and contracting costs, and that the premium on external finance is an inverse function of a borrower’s net worth. A firm’s investment is defined to be financially constrained if a windfall increase in the supply of internal funds (i.e., a change which conveys no new information about the profitability of current investment) results in a higher level of investment spending.

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 \textit{a priori} unconstrained firms but be violated for constrained firms. This has led to different \textit{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 or contracting costs. A number of studies have grouped firms by dividend payouts (Fazzari, Hubbard and Petersen (1988), and Hubbard, Kashyap and Whited (1995)); other \textit{a priori} groupings of firms have focused on the degree of shareholder concentration, group affiliation (Hoshi, Kashyap, and Scharfstein (1991)), size and age (Devereux and Schiantarelli (1990)), the presence of bond ratings (Whited (1992)), or the pattern of insider trading (Oliner and Rudebusch (1992)).

Such \textit{a priori} classifications are usually assumed to be fixed over the sample period. This may be problematic if the characteristics of firms change over time, or if the criteria used to split the sample are not external to the investment model. In addition, Lamont (1997) and Shin and Stulz (1998) have 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 (2000) note that the firms Kaplan and Zingales (1997) classify as most financially constrained are actually firms in financial distress. From a theoretical point of view, the Kaplan and Zingales (1997) critique is limited to the claim that differing cash flow sensitivities reveal different degrees of financing constraints under the alternative hypothesis that these types of firms are both subject to significant financing constraints.

Several empirical investment models have been derived from the investment Euler equation that can be used to test empirically the presence of financing constraints. 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 certain strong assumptions, marginal \( q \) equals average \( q \). These assumptions are that the firm is a
price-taker in all markets with constant returns to scale in both production and installation. Also, the usual implementation of the $q$-model assumes that stock markets are strongly efficient. If firms operate in imperfect capital markets, average $q$ will be a poor proxy for investment opportunities. Furthermore, the $q$-model of investment is not identified if cash flow is a good proxy for future investment opportunities as well. Gomes (2001) shows that in this case significant cash-flow effects can arise even in the absence of financial frictions.

In many cases, the conditions required to equate marginal $q$ to average $q$ do not hold, or stock markets are not strongly efficient. In particular in the case of low-income countries, where capital markets tend to be imperfect, the $q$-model of investment is likely to be misspecified.

An alternative approach, introduced by Abel and Blanchard (1986), forecasts the expected present value of the current and future profits generated by an incremental unit of fixed capital. Gilchrist and Himmelberg (1995, 1998) have extended this approach by using a vector autoregression forecasting framework to decompose the effect of cash flow on investment. The advantage of the Abel and Blanchard (1986) model is that it avoids the use of share price data. The disadvantage of this approach is that it needs to assume a certain stochastic process on the variables of the investment model. As Bond and Van Reenen (1999) point out, “how well this can be done using the information available to the econometrician is not entirely clear”.

Several researchers have departed from the strategy of estimating marginal $q$ and estimate the so-called Euler investment equation describing the firm’s optimal investment directly, after using the first-order condition for investment to eliminate the shadow value of capital from the Euler equation. This is the so-called Euler model of investment
introduced by Abel (1980), and applied by Hubbard and Kashyap (1992), Whited (1992), Bond and Meghir (1994), and Hubbard, Kashyap, and Whited (1995), among others. The advantages of the Euler approach are that it avoids the use of share price data and can relax the assumption of linear homogeneity of the net revenue function. Perhaps more importantly, this approach avoids the need to parameterize the expectations-formations process as in the case of both the $q$-model of investment and the Abel and Blanchard (1986) model.

In this paper, we use the Euler equation approach. Given that our sample consists of firms from developing countries with mostly imperfect capital markets, application of the $q$-model of investment seems problematic. We do not use the Abel and Blanchard (1986) model to avoid the need to parameterize the expectations-formations process.

Empirical work has found that financial variables such as cash flow are important explanatory variables for investment. These findings are attributed to capital market imperfections that arise from informational asymmetries, costly monitoring, contract enforcement and incentive problems. Most studies of financing constraints focus on firms in one country. One of the first cross-country studies is by Bond, Elston, Mairesse and Mulkay (1997), who study firms’ investment behavior in Belgium, France, Germany and the U.K., and find that financial constraints on investment are more severe in the U.K. than in the three other countries. Mairesse, Hall and Mulkay (1999) study firms’ investment behavior in France and the U.S. and find significant changes in the investment behavior of French and US firms over the last twenty years. Love (2003) studies the relationship between financial development and financing constraints on a firm-level for a sample of 40 countries. She 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.

In related work, Demirgüç-Kunt and Maksimovic (1998) directly identify those firms that are financially constrained by estimating if the firm’s sales grow at a rate that requires long-term external financing. They investigate how differences in legal and financial systems affect firms’ use of external financing to fund growth, and show that in countries with efficient legal systems a greater proportion of firms use long-term financing.

Bond and Van Reenen (1999) point out that, although most of the results of the financing constraints literature appear to be consistent with priors on the extent of financing constraints for some types of firms in some periods, these tests could also be detecting other sources of misspecification in the underlying investment models. Our results therefore do come with provisos.

II. **Methodology to Test for the Presence of Financing Constraints**

In this section, we present a model of investment that allows for financial frictions known as the Euler model of investment. We use this model to estimate the financing constraints of firms. We follow closely the setup in Bond and Meghir (1994). For simplicity, we ignore bankruptcy costs and taxes. For a model that incorporates bankruptcy costs and taxes see Bond and Meghir (1994).
We assume that the firm maximizes its present value, which is equal to the expected value of future dividends, subject to the capital accumulation identity and external financing constraints. Let $V_t$ be the market value of the firm’s outstanding shares at time $t$, $K_t$ the firm’s capital stock at time $t$, 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, $\eta_t = \eta(B_t)$, which is increasing in the amount borrowed, $\partial \eta / \partial B > 0$, due to agency costs. The idea is that highly indebted 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 $(1 + r_t)(1 + \eta(B_t))$, where $r_t$ is the risk-free rate of return. For debt rather than equity to be the firm’s marginal source of finance, we introduce a non-negativity constraint on dividends, which implies that there is a shadow cost associated with raising new equity due to information asymmetry.

Another way to introduce financial frictions would be by limiting the amount of debt that the firm can raise at any point in time as in Whited (1992) or by introducing bankruptcy costs as in Bond and Meghir (1994). The advantage of our approach is that the equation characterizing the optimal path for investment is completely unaffected by the introduction of debt finance into the model, so that we do not need to make any specific assumptions about the firm’s optimal borrowing policy. The profit function is denoted by $\Pi_t = \Pi(K_t, L_t, I_t)$, where $L_t$ is the vector of variable inputs, and $I_t$ the firm’s investment at time $t$. The capital stock accumulation depends on the investment expenditure $I_t$ and the depreciation rate $\delta$. Dividend paid out to shareholders is denoted by $D_t$. 

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Under these assumptions, the manager’s problem is to maximize

\[ V_t = E_t \left[ \sum_{j=0}^{\infty} \beta_{t+j}^i D_{t+j} \right]. \]  \tag{1} 

subject to

\[ D_t = \Pi_t + B_t - (1 + r_{t-1})(1 + \eta(B_{t-1}))B_{t-1}, \]  \tag{2} 

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

\[ D_t \geq 0, \]  \tag{4} 

where \( E_t[. \] is the expectations operator conditional on time \( t \) information,

\[ \beta_{t+j}^i = \prod_{i=1}^{j} (1 + r_{t+i-1})^{-1} \] the \( j \)-period discount factor for \( j \geq 1 \), and \( \beta_0^i = 1 \). Let \( \lambda_t \) be the Kuhn-Tucker multiplier for the non-negativity constraint on dividends. This multiplier can be interpreted as the shadow cost of internal funds. Substituting (2) into (1) for \( D_t \), and using the identity (3) to eliminate \( I_t \) from the profit function \( \Pi_t = \Pi(K_t, L_t, I_t) \), the first-order condition for capital \( K_t \) can be calculated as (see Appendix 1)

\[ -(1 - \delta) \beta_{t+j}^i E_t \left[ (1 + \lambda_{t+j}) \left( \frac{\partial \Pi}{\partial I} \right)_{t+j-1} \right] = -(1 + \lambda_t) \left( \frac{\partial \Pi}{\partial I} \right)_t - (1 + \lambda_t) \left( \frac{\partial \Pi}{\partial K} \right)_t. \]  \tag{5}
In line with the literature on investment models we refer to equation (5) as the Euler equation for investment. The Euler equation is an intertemporal condition relating current investment to last period’s investment and marginal product of capital.

The first-order condition for debt requires that (see Appendix 1)

\[ 1 + \lambda_t = E_t \left[ \left( 1 + \lambda_{t+1} \right) \left( 1 + \eta_t + \frac{\partial \eta_t}{\partial B_t} \right) \right] \]

It follows from (6) that the marginal cost of debt determines the relationship between \( \lambda_t \) and \( \lambda_{t+1} \).

If \( D_t > 0 \), the firm generates sufficient net revenue to finance its investment from retained earnings and pay positive dividends. In this case, the Kuhn-Tucker multiplier \( \lambda_t \), which measures the shadow value of internal finance, is zero, and the Euler investment equation in (5) collapses to the one in the standard model of investment without financial frictions (see Bond and Meghir (1994) for a derivation)

\[ - (1 - \delta) \beta_{t+1} E_t \left[ \left( \frac{\partial \Pi}{\partial L} \right)_{t+1} \right] = - \left( \frac{\partial \Pi}{\partial I} \right)_t - \left( \frac{\partial \Pi}{\partial K} \right)_t \]

To obtain an empirical model of investment we follow Bond and Meghir (1994) and specify the firm’s net revenue function as

\[ \Pi_t = p_t F(K_t, L_t) - p_t G(I_t, K_t) - w_t L_t - p_t I_t, \]
where \( F(K_t, L_t) \) is a constant returns to scale production function, \( G(I_t, K_t) \) is a convex adjustment-cost function of installing \( I_t \) units of capital, which is assumed to be homogeneous in investment and capital, \( p_t \) is the price of the firm’s output, \( w_t \) is the vector of prices for the variable inputs, and \( p_t^I \) is the price of investment goods. We denote net output as \( Y_t = F_t - G_t \) and assume that \( Y_t \) is homogeneous in both \( K_t \) and \( L_t \).

To allow for imperfect competition we let \( p_t \) depend on net output \( Y_t \), with the price elasticity of demand \( \varepsilon \) assumed constant and \( \varepsilon > 1 \). Differentiating (8) with respect to \( I_t \) and \( K_t \) gives (see Appendix 2 for a derivation)

\[
\left( \frac{\partial \Pi}{\partial I} \right)_t = -\alpha p_t \left( \frac{\partial G}{\partial I} \right)_t - p_t^I 
\]

or

\[
\left( \frac{\partial \Pi}{\partial K} \right)_t = \alpha p_t \left[ \left( \frac{\partial F}{\partial K} \right)_t - \left( \frac{\partial G}{\partial K} \right)_t \right],
\]

where \( \alpha = 1 - (1/\varepsilon) > 0 \).

Following the tradition in the literature since Summers (1981), we specify \( G(I_t, K_t) = \frac{1}{2} bK_t[(I/K)_t - c]^2 \) as a symmetric adjustment-cost function, which is strictly convex in investment, and homogeneous of degree one in investment and capital.
With this adjustment-cost function it follows (see Appendix 2 for derivations) from (9a) that

\[
\left( \frac{\partial \Pi}{\partial I} \right)_t = -b\alpha p_t \left( \frac{I}{K} \right)_t + b\alpha c p_t - p'_t
\]  

(10a)

and from (9b) that

\[
\left( \frac{\partial \Pi}{\partial K} \right)_t = \alpha p_t \left( \frac{Y}{K} \right)_t - \alpha c \left( \frac{\partial F}{\partial L K} \right)_t + bc \alpha p_t \left( \frac{I}{K} \right)_t + b\alpha p_t \left( \frac{I}{K} \right)_t^2 - b\alpha c p_t \left( \frac{I}{K} \right)_t.
\]  

(10b)

Following Bond and Meghir (1994), we assume that the marginal product of variable factors \( \frac{\partial F}{\partial L} \) can be replaced from the first-order conditions by \( w/\alpha p \).

Substituting (10a) and (10b) into (5) and setting \( \lambda_t \) and \( \lambda_{t+1} \) to zero gives the empirical Euler investment equation under the null of no financial frictions

\[
\left( \frac{I}{K} \right)_{t+1} = c(1-\phi_{t+1}) + (1+c)\phi_{t+1} \left( \frac{I}{K} \right)_t - \phi_{t+1} \left( \frac{I}{K} \right)_t^2 + \frac{\phi_{t+1}}{b(\delta-1)} \left( \frac{Y}{K} \right)_t - \frac{\phi_{t+1}}{b\alpha} \left( \frac{CF}{K} \right)_t
\]

\[+ \frac{\phi_{t+1}}{b\alpha} J_t + v_{t+1}, \]

(11)

where \( \phi_{t+1} = (1+\rho_{t+1})/(1-\delta) \) with \( \rho_{t+1} = (1+r_{t+1})(p_t/p_{t+1})-1 \) being the real discount rate, \( (CF/K)_t = (p_t Y_t - w_t L_t)/(p_t K_t) \) is the ratio of cash flow (operating profit) to the
capital stock, $J_t = (p_t^I / p_t)(1 - p_t^{I+1}(1 - \delta) / [(1 + r_t)p_t^I])$ is the user cost of capital, $Y_t = F_t - G_t$ denotes net output, $\alpha = 1 - (1/\varepsilon) > 0$ and $\nu_{t+1}$ is an error term. Note that under perfect competition, the price elasticity of demand goes to infinity, $\varepsilon \to \infty$, and the output term $(Y / K)_t$ is eliminated from the Euler investment equation. Under imperfect competition, the coefficient on this term is positive and $1 < \varepsilon < \infty$.

We test for the presence of financing constraints by estimating the following empirical specification of equation (11)

$$\left( \frac{I}{K} \right)_t = \beta_1 \left( \frac{I}{K} \right)_{t-1} + \beta_2 \left( \frac{I}{K} \right)_{t-1}^2 + \beta_3 \left( \frac{Y}{K} \right)_{t-1} + \beta_4 \left( \frac{CF}{K} \right)_{t-1} + d_t + f_t + \nu_t, \quad (12)$$

where we allow for time-specific effects $d_t$ and firm-specific effects $f_t$. The subscript $i$ refers to the company, and $t$ refers to the time period. The testable implications of equation (12) are as follows. Under the null of no financial frictions, Bond and Meghir (1994) show that $\beta_1 > 1$, $\beta_2 < -1$, $\beta_3 \geq 0$, and $\beta_4 < 0$. If any of these restrictions are not met, investment does not follow its optimal path. In particular, when investment responds positively to an increase in cash flow, i.e., when $\beta_4$ is positive, the firm is financially constrained in the sense that a windfall increase in cash flow implies that a higher level of investment can be funded before internal finance is exhausted. Therefore, we consider a firm to be more financially constrained if the cash flow coefficient, $\beta_4$, is estimated to be more positive. Like Bond and Meghir (1994), we drop the user cost of capital from our empirical specification since it is difficult to measure.
As in Harris, Schiantarelli and Siregar (1994), Jaramillo, Schiantarelli and Weiss (1996) and Gelos and Werner (2002), 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. 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.

III. Estimation Techniques

Dynamic investment models are likely to suffer from an endogeneity problem arising from the presence of unobserved firm-fixed effects. Consider the following model

\[ y_{it} = \alpha y_{it-1} + \beta' x_{it} + \gamma' f_i + u_{it}, \]  

(13)

where

\[ u_{it} = \eta_i + v_{it} \]  

(14)

and

\[ E(v_{it} \mid x_{i0}, \ldots, x_{iT}, \eta_i) = 0 \]  

(15)
where \( f_i \) is an observed individual effect and \( \eta_i \) is an unobserved individual effect. In this model, the existence of unobserved individual effects implies that \( y_{it-1} \) is an endogenous variable.

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 (13) we obtain

\[
\Delta y_{it} = \alpha \Delta y_{it-1} + \beta \Delta x_{it} + \Delta v_{it}
\]  

(16)

The use of Generalized Methods of Moments (GMM) estimation is required because \( \Delta v_{it} \) is correlated with \( \Delta y_{it-1} \) by construction, and joint endogeneity of the explanatory variables might still be present. For a more detailed introduction to Generalized Methods of Moments (GMM) estimators for dynamic panel data models, we refer to Hansen (1982), Holtz-Eakin, Newey and Rosen (1988), Arellano and Bond (1991) and Arellano and Bover (1995). 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:

\[
E(y_{it-s}, \Delta v_{it}) = 0 \quad \forall s \geq 2; t = 3,\ldots,T \]  

(16)

\[
E(x_{it-s}, \Delta v_{it}) = 0 \quad \forall s \geq 2; t = 3,\ldots,T ,
\]  

(17)

so that \((y_{it-2}, y_{it-3}, \ldots, y_{it})\) and \((x_{it-2}, x_{it-3}, \ldots, x_{it})\) 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. 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.

To assess the validity of the assumptions on which the GMM difference estimator is based we consider two specification tests suggested by Arellano and Bond (1991). The first is a Sargan test of overidentifying restrictions that tests the validity of the instruments. The second is a test of second-order serial correlation of the error term. The use of endogenous variables dated \( t - 2 \) as instruments is only valid if the error term is serially uncorrelated, implying a first-order moving average error term in the differenced model.

IV. 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 and in stages.

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 (of 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 and credit ceilings), privatization of state banks (and more generally a 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.

We focus on a sample of developing countries because progress in financial liberalization has been substantial in these countries over the last decade, and because financial liberalization is expected to have a large impact on the financing constraints of firms in these countries as the financial frictions in these countries are large.

Table 1 indicates the years in which significant progress been made with respect to one of these six measures. The Annex to this paper 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.

[Tables 1 and 2 go here]
A number of clear patterns arise from the evolution of 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 1980s, 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 country’s 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.
Although we focus on the liberalization of banking markets, the period under consideration has not only been characterized by liberalization of this segment of financial markets. 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 the liberalization of the stock market. Table 4 shows the dates from which point onwards Bekaert and Harvey (2000) consider the stock markets of these countries to be open to foreigners. It follows that stock market liberalization has preceded liberalization of the banking sector in most countries, Chile being the only exception. As stock market liberalization tends to precede banking market liberalization, inclusion of stock market liberalization in our index of financial liberalization does not change our results. Another reason for focusing on the liberalization of banking markets is that liberalization of this segment of financial markets is expected to have the greatest impact on financing constraints of firms as bank loans tend to account for the majority of firm debt.

Progress in financial liberalization seems to be strongly correlated with improvements in the political climate of a country. If we use the Political Risk Index of the International Country Risk Guide (ICRG) as a measure of political risk, we find a correlation of 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 the Political Risk Service Group, ranges from zero to 100 percent, and is decreasing in the level of political risk. This suggests that financial liberalization tends to take place during periods of political stability. Laeven and Perotti (2001) provide a more extensive analysis of the link between political risk and financial liberalization.
We collect firm-level panel data from Worldscope on firms in developing countries for the years 1988-98. We collect the data from the December 1999 CD-Rom of the Worldscope database. 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, which gives 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 of time.

We focus on listed firms, since most firms in the Worldscope sample are listed, and because the quality of the accounting data is higher for listed firms. For each company we need several years of data to assess changes over time in the financing structure of the firm. Therefore, we delete firms with less than three consecutive years of data. We also delete firms in transition economies, because soft budget constraints that have been inherited from the socialistic regime may distort the analysis, and we delete firms from countries with data on less than 20 firms. Firms that operate in the financial and service industries (primary US Standard Industrial Classification codes 6, 7, 8 or 9) are also
deleted from the sample as their investment and financing behavior is not comparable with firms that operate in other industries. It is, however, necessary to delete more firms, because of outliers in the data. Such outliers can be due to revaluation of assets, divestments, acquisitions, or simply poor quality of the data. We impose a number of outlier rules. First of all, we delete observations with negative or zero fixed capital or investment. Such observations might be due to divestments or revaluations of capital, which would bias our results. Secondly, we delete investment ratios with extreme values. Such values might be due to acquisitions or revaluations of capital. In particular, we delete observations with a ratio of investment to capital that does not take a value between 0.1 and 0.5. Furthermore, we omit observations with extreme values of marginal profitability or cash flow. In particular, we restrict the sales-to-capital ratios to take values between 0.1 and 10, and we restrict the cash flow-to-capital ratios to take values between 0.01 and 1. After deleting firms according to these criteria, we have data for 394 listed firms in 13 countries.² Obviously, our sample of firms is non-random. Listed firms, for example, tend to be large in most countries.

For this set of firm-level data we generate the necessary variables to estimate equation (12). We assume that flow variables (such as investment and depreciation) during period $t$ are chosen by the firm 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 $t$.

We follow the notation in section II to define the regression variables. Let $K_t$ be net fixed assets at time $t$, which includes property, plant and equipment net of

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² 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 the results we present here (not reported).
depreciation; \( Y_t \) is net sales at time \( t \); \( I_t \) is net investment at time \( t \), which is calculated as 
\[
K_{t+1} + Depr_t - K_t(1 + \pi_t),
\]
where \( Depr_t \) is depreciation at time \( t \) and \( \pi_t \) is inflation at time \( t \); \( CF_t \) is operating cash flow at time \( t \), which is calculated as operating income at time \( t \) plus depreciation at time \( t \); and \( FLI_t \) is the financial liberalization index at time \( t \). 

The financial liberalization index takes values between zero and six, with a higher value indicating a larger degree of liberalization.

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 of one if net sales at time \( t \) is smaller than the sample median of net sales, and zero otherwise. Similarly, we construct a large size dummy that indicates large firms. In an alternative specification, the small size dummy, \( Small_t \), takes value of one if net sales at time \( t \) is smaller than the 75\(^{th} \) percentile of sales in the sample, and zero otherwise.

Table 6.a presents descriptive statistics of the regression variables for all firms. We have data for 394 firms and for the period 1988 to 1998. The average data coverage for each firm is 4.2 years, with a total number of firm-year observations of 1,645. The period coverage for specific firms ranges from three years of observations to ten years of observations. When comparing the descriptive statistics of small and large firms, we find that large firms have, on average, higher investment-to-capital ratios, higher sales-to-capital ratios, and lower cash flow-to-capital ratios than small firms (not reported). None of these differences are, however, statistically significant. We also find a strong correlation of 61 percent between operating cash-flow and sales (not reported in the
Investment appears to be mostly correlated with cash flow (with a statistically significant correlation of 18 percent) and less so with sales (with a correlation of 11 percent). These correlations suggest that firms are financially constrained in the sense that investment responds positively to cash flow. However, since cash flow is correlated with the sales measure, this conclusion may be false. Econometric techniques are needed to determine the exact effect of cash flow on investment.

[Tables 6.a to 6.d go here]

Table 6.b presents the median of the regression variables by country. Given the variation in investment ratios across countries, we allow for the presence of fixed country-effects in our empirical analysis. Table 6.c presents the median of the regression variables by industry. The industries are defined according to the Standard Industry Classification (SIC) codes of the US government. We group manufacturing companies in our sample along two-digit SIC codes and the remaining industries along one-digit SIC codes. 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 considered a “cash cow”. Differences across industries may, however, be partly due to the small sample size for some industries. In our empirical analysis we allow for the presence of fixed industry-effects.

Table 6.d 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.

V. Empirical Results

We estimate several specifications of the structural investment model in (12). We estimate all model specifications using the GMM difference estimator described in section III. We only present two-step GMM estimates, since they are more efficient than one-step estimates, and since the Sargan test of over-identifying restrictions is heteroskedasticity-consistent only if based on the two-step estimates. Further details on the one-step and two-step GMM estimators can be found in Arellano and Bond (1991). All regressions include time dummies. Industry and country dummies were completely insignificant once we controlled for fixed effects. As proxy for net output $Y_t$, we use net sales, and as proxy for cash flow $CF_t$, we use operating cash flow, defined as operating income plus depreciation.

First, we estimate model (12) in differences using the aforementioned GMM difference estimator. The results are presented in column 1 of Table 7. The instrument set includes the right-hand side variables dated $t-2$ and $t-3$. Under the null hypothesis of no financial frictions, it should be that $\beta_1 > 1$, $\beta_2 < -1$, $\beta_3 \geq 0$, and $\beta_4 < 0$. However, the first restriction is not met, as the estimated coefficient of $\beta_1$ is significantly smaller than one, and therefore investment does not follow its optimal path. Apparently, persistence in investment is not as strong as suggested by our theoretical model. The cash-flow
coefficient is not positive and therefore we do not find evidence that firms faced financing constraints on average over the whole sample period. We also find that investment reacts positively and significantly to changes in sales. The positive and significant coefficient on net output indicates imperfect competition in the product market. The Sargan test of overidentifying restrictions does not reject the validity of the instruments. The test of second-order serial correlation of the error term indicates that the error term does not exhibit second-order serial correlation.

[Table 7 goes here]

In the remainder of Table 7, we investigate the sensitivity of investment to cash-flow further. In column 2 of Table 7, we test whether financial liberalization has had an impact on the sensitivity of investment to cash flow. For this purpose, we interact the financial liberalization index (FLI) with the right-hand side variables \( \frac{Y}{K} \) and \( \frac{CF}{K} \) in model (12) and estimate the expanded model as before. We do not find that progress in financial liberalization has had a positive impact on the sensitivity of investment to cash-flow for the average type of firm. The FLI-interacted variables are statistically insignificant. As before, we find that the dynamics implied by the model are not met, because the coefficient on the lagged dependent variable is significantly smaller than one. Again, the Sargan test of overidentifying restrictions does not reject the validity of the instruments, and the test of second-order serial correlation of the error term does not indicate that the error term exhibits second-order serial correlation.
Next, we test whether firm size affects the sensitivity of investment to cash-flow and whether financial liberalization has affected small and large firms differently. To this end, we interact the variables in model (12) with both a small size dummy variable and the financial liberalization index (FLI). We define the small firms as firms with sales below the median of sales in the sample and construct the small size dummy variable accordingly. We estimate the expanded model as before using the GMM difference estimator. The estimation results are presented in column 3 of Table 7. We find that financial liberalization affects small and large firms differently. While large firms become more financially constrained (as indicated by an increased sensitivity of investment to cash-flow) as financial liberalization progresses, small firms become less financially constrained. On the other hand, before the start of financial liberalization, small firms appear more financially constrained than large firms, although the difference is not statistically significant. Again, we find that both the Sargan test of over-identifying restrictions and the test of second-order serial correlation are not rejected.

The estimated effect of cash flow on the investment of firms is economically important. Before financial liberalization, the cash-flow coefficient is \(-0.36\) for large firms and \(0.12\) for small firms. Once financial liberalization has progressed, say to the median level of the financial liberalization index, or FLI equals 4, the cash-flow coefficient increases to \(0.14\) for large firms and reduces to \(0.02\) for small firms. Although these differences are not statistically significant, they point at substantial economic differences in the effect of financial liberalization on the cash-flow sensitivity of investment between small and large firms. Financial liberalization reduces the estimated effect of cash flow on investment from around 12 percent to 2 percent for small firms. In other words, financial liberalization reduces financing constraints of small firms by
around 80 percent. On the other hand, the cash-flow sensitivity of large firms increases over the same period from –36 percent to 14 percent.

Our findings are in line with earlier work that has found that smaller companies are more likely to suffer from financing constraints before financial liberalization (see Schiantarelli (1995)). In particular, Gelos and Werner (2002) find similar results for firms in Mexico, and argue that large firms may have had better access to preferential directed credit before financial liberalization. This might also explain why we do not find that financial liberalization has an overall positive effect on large firms. The positive effect of more efficient financial markets may have been more than offset for large firms by the negative effect of a decreased access to preferential credit.

As robustness check, we assess the sensitivity of our results to the definition of firm size. Using the median of the sample to distinguish between large and small firms may not be representative, since the distribution of firms is highly skewed. Therefore, we also use the 75th percentile of net sales to distinguish between small (below the 75th percentile) and large firms (above the 75th percentile). The GMM estimates of the model with this alternative size dummy variable are presented in column 4 of Table 7. The results are qualitatively similar, but stronger from a statistical point of view, to the results based on the sample median. Again, we find that financial liberalization reduces the financing constraints of small firms, but increases the financing constraints of large firms. Comparing the results in column 3 and 4 of Table 7, we find that the latter effect is much larger for firms above the 75th percentile of sales than for firms above the median of sales, suggesting that the negative effect of financial liberalization on the reduction of financing constraints is strongest for the group of very large firms (above the 75th percentile).
VI. Conclusions

We have estimated a dynamic investment model using annual panel data for 394 listed firms in 13 developing countries for the period 1988 to 1998. We find that financial liberalization affects small and large firms differently. Before financial liberalization takes place, small firms are found to be more financially constrained than large firms. Financial liberalization then relaxes the external financing constraints of small firms, but increases the financing constraints of large firms. 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 decrease 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.

Whether financial liberalization improves the allocative efficiency of financial resources more generally, is a question beyond the scope of this paper. Using our financial liberalization index, Galindo, Schiantarelli, and Weiss (2001) find that there is a strong positive correlation between financial liberalization and improvements in allocative efficiency of investment, although not in all countries.

We also find that countries that have made substantial progress in liberalizing their financial sectors 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.
Appendix 1 Mathematical Derivation of Equations (5) and (6)

When we substitute the sources and uses of funds equation (2) into (1) for $D_t$, and use
the capital accumulation identity (3) to eliminate $I_t$ from the profit function
$\Pi_t = \Pi(K_t, L_t, I_t)$, we can write the Lagrangian for the model in equations (1) through
(4) as

$$
\max_{\{K_{t+1}, L_{t+1}, J_{t+1}, b_{t+1}\}} E_t \left[ \sum_{j=0}^{\infty} \beta_t^{j} \{ (1 + \lambda_{t+j}) \Pi_{t+j}(K_{t+j}, L_{t+j}, K_{t+j} - (1 - \delta)K_{t+j-1}) \right.

+ B_{t+j} - (1 + r_{t+j-1})(1 + \eta (B_{t+j-1}))B_{t+j-1}) \right], \quad (A.1)

where $\lambda_{t+j}$ is the Kuhn-Tucker multiplier for the non-negativity constraint on dividends.

Since $B_{t+j}$ does not depend on $K_t$ and only $\Pi_t = \Pi(K_t, L_t, K_t - (1 - \delta)K_{t-1})$ and
$\Pi_{t+j} = \Pi(K_{t+1}, L_{t+1}, K_{j-1} - (1 - \delta)K_{t+j-1})$ depend on $K_t$, the first-order condition for capital
$K_t$ can be calculated as

$$
0 = \frac{\partial}{\partial K_t}\{(1 + \lambda_j)\Pi_t(K_t, L_t, K_t - (1 - \delta)K_{t-1})

+ \beta_t^{j}E_t[\{(1 + \lambda_{t+j})\Pi_{t+j}(K_{t+j}, L_{t+j}, K_{t+j} - (1 - \delta)K_{t+j-1})]\}. \quad (A.2)

It follows that the first-order condition for capital $K_t$ is
\[
(1 + \lambda_t) \left( \frac{\partial \Pi}{\partial K_t} \right)_t + (1 + \lambda_t) \left( \frac{\partial \Pi}{\partial I_t} \right)_t - (1 - \delta) \beta'_{i+1} E_t \left[ (1 + \lambda_{i+1}) \left( \frac{\partial \Pi}{\partial I} \right)_{i+1} \right] = 0, \quad \text{(A.3)}
\]

where \( I_t = K_t - (1 - \delta) K_{i-1} \). Moving the first two terms in equation (A.3) to the right-hand sight of the equation gives equation (5) in the text.

Similarly, it follows from (A.1) that the first-order condition for debt \( B_t \) can be written as

\[
0 = \frac{\partial}{\partial B_t} \left\{ (1 + \lambda_t) B_t - E_t \left[ \beta'_{i+1} (1 + \lambda_{i+1}) (1 + r_t) (1 + \eta_t (B_t)) B_t \right] \right\}. \quad \text{(A.4)}
\]

With \( \beta'_{i+1} = \frac{1}{1 + r_t} \) it follows that the first-order condition for capital \( B_t \) is

\[
1 + \lambda_t - E_t \left[ (1 + \lambda_{i+1}) \left( 1 + \eta_t + \frac{\partial \eta_t}{\partial B_t} B_t \right) \right] = 0, \quad \text{(A.5)}
\]

which can be re-written as equation (6) in the text.
Appendix 2  Mathematical Derivation of Equations (9a), (9b), (10a) and (10b)

Since $p_i$ depends on output $Y(K_i, L_i, I_i) = F(K_i, L_i) - G(I_i, K_i)$, differentiating (8) with respect to $I_i$ gives

\[
\left( \frac{\partial \Pi}{\partial I} \right)_i = -p_i \left( \frac{\partial G}{\partial I} \right)_i + \left( \frac{\partial p}{\partial Y} \right)_i \frac{\partial Y}{\partial I} - p_i' = - \left[ 1 - \left( \frac{Y}{p} \frac{\partial p}{\partial Y} \right)_i \right] \left( \frac{\partial G}{\partial I} \right)_i - p_i'
\]

which equals equation (9a) in the text.

Similarly, differentiating (8) with respect to $K_i$ gives

\[
\left( \frac{\partial \Pi}{\partial K} \right)_i = p_i \left[ \left( \frac{\partial F}{\partial K} \right)_i - \left( \frac{\partial G}{\partial K} \right)_i \right] - \left( \frac{\partial p}{\partial Y} \right)_i \left[ \left( \frac{\partial F}{\partial K} \right)_i - \left( \frac{\partial G}{\partial K} \right)_i \right] \frac{\partial Y}{\partial K} = \left[ 1 - \frac{1}{\varepsilon} \right] p_i' \left[ \left( \frac{\partial F}{\partial K} \right)_i - \left( \frac{\partial G}{\partial K} \right)_i \right] = \alpha p_i' \left[ \left( \frac{\partial F}{\partial K} \right)_i - \left( \frac{\partial G}{\partial K} \right)_i \right]
\]

which equals equation (9b) in the text.

With the adjustment-cost function specified as $G(I_i, K_i) = \frac{1}{2} b K_i (I_i / K_i - c)^2$ we have
\[
\frac{\partial G}{\partial l} = b \left( \frac{I}{K} \right) - bc
\]  
(A.8)

Substitution of (A.8) in (9a) gives equation (10a). Under the assumption that \( Y \) is homogeneous of degree one in both \( K \) and \( L \), we have

\[
F(K_i, L_i) = \left( \frac{\partial F}{\partial K} \right) K_i + \left( \frac{\partial F}{\partial L} \right) L_i
\]

or

\[
\left( \frac{\partial F}{\partial K} \right) = \frac{F(K_i, L_i)}{K_i} - \left( \frac{\partial F}{\partial L} \right) \frac{L_i}{K_i}
\]  
(A.9)

From the adjustment-cost function it follows that

\[
\left( \frac{\partial G}{\partial K} \right) = \frac{1}{2} b \left[ \left( \frac{I}{K} \right) - c \right]^2 - b \left[ \left( \frac{I}{K} \right) - c \right] \left( \frac{I}{K} \right),
\]

\[
= \frac{G(I_i, K_i)}{K_i} - b \left( \frac{I}{K} \right)^2 + bc \left( \frac{I}{K} \right)
\]  
(A.10)

Substitution of (A.9) and (A.10) into (9b) and setting \( \frac{Y}{K} = \frac{F(K_i, L_i)}{K_i} - \frac{G(I_i, K_i)}{K_i} \) gives equation (10b) in the text.
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Schiantarelli, F., I. Atiyas, G. Caprio, J. Harris, and A. Weiss, 1994, “Credit Where It is Due? A Review of the Macro and Micro Evidence on the Real Effects of Financial


Table 1  Financial Liberalization Dates

This table presents the years in which major progress was made with respect to six aspects of financial liberalization during the period 1988 to 1998: (1) liberalization of interest rates; (2) removal of entry barriers; (3) lowering of reserve requirements; (4) removal of credit controls; (5) privatization of state-owned banks; and (6) introduction of prudential regulation. “No” indicates that no significant progress has been made during the last two decades (until 1998) in liberalizing this particular measure of financial liberalization. Our sources include various IMF country reports and working papers, various World Bank country reports and working papers, Economist Intelligence Unit Country Reports, Bandiera, Caprio, Honohan, and Schiantarelli (2000), Demirgüç-Kunt and Detragiache (1998), Galbis (1993), Gallego and Loayza (2001), Lindgren, García, and Saal (1996), and Williamson and Mahar (1998). For more details regarding the sources of data, we refer to the Annex to this paper.

<table>
<thead>
<tr>
<th>Country</th>
<th>Interest Rates</th>
<th>Entry Barriers</th>
<th>Reserve Requirements</th>
<th>Credit Controls</th>
<th>Privatization</th>
<th>Prudential Regulation</th>
</tr>
</thead>
</table>

Notes: In Argentina, interest rates were deregulated in 1987, but deregulation was reversed in 1988. In 1989, interest rates were deregulated again. In India, Malaysia and Thailand there were no significant reductions in state ownership of commercial banks during the period 1988 to 1998. The largest Indian
commercial banks are yet to be privatized. 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. In Taiwan, credit controls were still in place during 1998, and reserve requirements have remained high during the period 1988 to 1998. Reserve requirements in Pakistan have also remained high during the period 1988 to 1998.
Table 2  Financial Liberalization Index

This table presents a financial liberalization index by year and country. For each country, the index in a particular year is defined as the sum of the financial liberalization measures in Table 1 that have been implemented in the country up to that year. The index thus denotes changes in the degree of financial liberalization within a country, and ranges from 0 to 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>
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</table>
Table 3  Sequence of Financial Liberalization

The numbers in this table indicate the sequence of financial liberalization with respect to each of the six different measures in Table 1. The number 1 indicates that a particular type of liberalization was the first measure (out of a total number of six measures) to come into effect in the country. The number 2 refers to the second measure to come into effect, et cetera. Averages are used when measures were implemented in the same year.

<table>
<thead>
<tr>
<th>Country</th>
<th>Interest Rates</th>
<th>Entry Barriers</th>
<th>Reserve Requirements</th>
<th>Credit Controls</th>
<th>Privatization</th>
<th>Prudential Regulation</th>
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</table>
Table 4  Comparison of Financial Liberalization Dates

This table compares the dates of substantial banking market liberalization with the dates of stock market liberalization. FLI5 indicates the year when the banking sector became largely liberalized and is defined as the year when the financial liberalization index (FLI) in Table 1 reaches value of 5. LLI is an alternative measure that indicates the year when the banking system became largely liberalized and is taken from Williamson and Mahar (1998). The stock market liberalization dates are from Bekaert, Harvey and Lundblad (2001).

<table>
<thead>
<tr>
<th>Country</th>
<th>Largely Liberalized Banking Sector</th>
<th>Stock Market Liberalization</th>
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<td>1985</td>
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<td>India</td>
<td>1996</td>
<td>Not until 1996</td>
</tr>
<tr>
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<td>1992</td>
<td>1989</td>
</tr>
<tr>
<td>Mexico</td>
<td>1993</td>
<td>1992</td>
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<td>Not until 1996</td>
</tr>
<tr>
<td>Peru</td>
<td>1995</td>
<td>1993</td>
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<tr>
<td>Taiwan</td>
<td>Not until 1998</td>
<td>Not until 1996</td>
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Table 5   Financial Liberalization and the Political Climate

This table presents the Political Risk Index of the International Country Risk Guide (ICRG) from the Political Risk Services Group for the years 1988 and 1998 (corresponding to the first and last year of our sample period, respectively), and the correlation between the ICRG political risk index and our financial liberalization index (FLI) over the sample period 1988 to 1998. The ICRG Political Risk Index is a broad measure of the level of political risk in a country. The index ranges from 0 to 100, and is decreasing in the level of political risk. We do not have ICRG data for Pakistan and Peru.

<table>
<thead>
<tr>
<th>Country</th>
<th>ICRG Political Risk Index</th>
<th>FLI and ICRG Political Risk Index</th>
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</thead>
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<td>Chile</td>
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<td>India</td>
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<td>Mexico</td>
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<td>Philippines</td>
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<td>Rep. Korea</td>
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<td>Thailand</td>
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<td>70</td>
</tr>
<tr>
<td>Average</td>
<td>57</td>
<td>68</td>
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Table 6  Descriptive Statistics

Tables 6.a to 6.d present descriptive statistics of the key variables of the empirical part of the paper. Table 6.a presents the descriptive statistics for the whole sample of firms. Table 6.b presents the median values of the key variables by country. Table 6.c presents the median values of the key variables by industry. Table 6.d presents the median values of the key variables by year. The industry codes in Table 6.b follow the classification of the 1987 US SIC. Industry codes are at two-digit SIC levels for the manufacturing industries (SIC codes 20-39) and at one-digit SIC levels for other industries. We exclude the following sectors: finance, insurance and real estate; services; government; and others. In other words, we exclude SIC codes 6 to 9. I/K denotes the investment-to-capital ratio, Y/K denotes the sales-to-capital ratio and CF/K denotes the cash flow-to-capital ratio. The total number of firm-year observations is 1,645. The sample period is 1998 to 1998, and the source of the firm-level data is Worldscope.

a. Descriptive Statistics for All Firms in the Sample

<table>
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<th>Y/K</th>
<th>CF/K</th>
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</thead>
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<tr>
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<td>0.170</td>
<td>1.534</td>
<td>0.247</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.500</td>
<td>9.859</td>
<td>0.967</td>
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<tr>
<td>Minimum</td>
<td>0.010</td>
<td>0.147</td>
<td>0.012</td>
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<td>Standard deviation</td>
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<td>Observations</td>
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### b. Median Statistics Categorized by Country

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<th>Y/K</th>
<th>CF/K</th>
<th>Observations</th>
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</thead>
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### c. Median Statistics Categorized by Industry

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<td>5</td>
<td>5</td>
<td>Wholesale trade and retail trade</td>
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<td>Food and kindred products</td>
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<td>0.301</td>
<td>9</td>
</tr>
<tr>
<td>18</td>
<td>32</td>
<td>Stone, clay, glass, and concrete</td>
<td>0.171</td>
<td>1.017</td>
<td>0.223</td>
<td>139</td>
</tr>
<tr>
<td>19</td>
<td>33</td>
<td>Primary metal industries</td>
<td>0.123</td>
<td>1.440</td>
<td>0.209</td>
<td>106</td>
</tr>
<tr>
<td>20</td>
<td>34</td>
<td>Fabricated metal products</td>
<td>0.168</td>
<td>1.800</td>
<td>0.302</td>
<td>36</td>
</tr>
<tr>
<td>21</td>
<td>35</td>
<td>Machinery, except electrical</td>
<td>0.277</td>
<td>2.250</td>
<td>0.278</td>
<td>30</td>
</tr>
<tr>
<td>22</td>
<td>36</td>
<td>Electrical and electronic machinery, equipment and supplies</td>
<td>0.217</td>
<td>2.232</td>
<td>0.376</td>
<td>72</td>
</tr>
<tr>
<td>23</td>
<td>37</td>
<td>Transportation equipment</td>
<td>0.181</td>
<td>2.496</td>
<td>0.268</td>
<td>85</td>
</tr>
<tr>
<td>24</td>
<td>38</td>
<td>Instruments; Photographic, medical and optical goods; Clocks</td>
<td>0.276</td>
<td>1.595</td>
<td>0.251</td>
<td>10</td>
</tr>
<tr>
<td>25</td>
<td>39</td>
<td>Miscellaneous manufacturing industries</td>
<td>0.170</td>
<td>1.681</td>
<td>0.302</td>
<td>21</td>
</tr>
<tr>
<td>All</td>
<td></td>
<td></td>
<td>0.170</td>
<td>1.534</td>
<td>0.247</td>
<td>1,645</td>
</tr>
</tbody>
</table>
### d. Median Statistics Categorized by Year

<table>
<thead>
<tr>
<th>Year</th>
<th>I/K</th>
<th>Y/K</th>
<th>CF/K</th>
<th>FLI</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>0.237</td>
<td>2.028</td>
<td>0.168</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>1990</td>
<td>0.278</td>
<td>1.761</td>
<td>0.174</td>
<td>2</td>
<td>36</td>
</tr>
<tr>
<td>1991</td>
<td>0.197</td>
<td>1.802</td>
<td>0.163</td>
<td>2</td>
<td>60</td>
</tr>
<tr>
<td>1992</td>
<td>0.173</td>
<td>1.821</td>
<td>0.234</td>
<td>3</td>
<td>100</td>
</tr>
<tr>
<td>1993</td>
<td>0.181</td>
<td>1.532</td>
<td>0.221</td>
<td>4</td>
<td>165</td>
</tr>
<tr>
<td>1994</td>
<td>0.160</td>
<td>1.503</td>
<td>0.264</td>
<td>4</td>
<td>212</td>
</tr>
<tr>
<td>1995</td>
<td>0.186</td>
<td>1.538</td>
<td>0.275</td>
<td>4</td>
<td>286</td>
</tr>
<tr>
<td>1996</td>
<td>0.169</td>
<td>1.565</td>
<td>0.314</td>
<td>4</td>
<td>321</td>
</tr>
<tr>
<td>1997</td>
<td>0.169</td>
<td>1.460</td>
<td>0.313</td>
<td>5</td>
<td>275</td>
</tr>
<tr>
<td>1998</td>
<td>0.117</td>
<td>1.434</td>
<td>0.337</td>
<td>6</td>
<td>177</td>
</tr>
<tr>
<td>All</td>
<td>0.170</td>
<td>1.534</td>
<td>0.285</td>
<td>4</td>
<td>1,645</td>
</tr>
</tbody>
</table>
This table presents the main regression results based on the estimation of several specifications of the structural investment model presented in equation (12). The dependent variable in all regressions is the investment-to-capital ratio of a specific firm at time $t$, $(I/K)$. $Y/K$ denotes the sales-to-capital ratio and $CF/K$ denotes the cash flow-to-capital ratio. In regressions (1) to (3), $Small_t$ is a dummy variable that takes value one if sales of the firm is smaller than the median sales in the sample at time $t$, and zero otherwise. In regression (4), $Small_t$ is a dummy variable that takes value one if sales of the firm is smaller than the ¾ quantile of sales in the sample at time $t$, and zero otherwise. $FLI_t$ is the financial liberalization index at time $t$. All models are estimated in first differences using instrumental variables. We present two-step GMM estimates of all regressions as developed by Arellano and Bond (1991). We estimate all model specifications in first-differences. All regressions use variables at $t-2, t-3$ as instruments and assume that $Small_t$ and $FLI_t$ are exogenous variables. All regressions include year dummies, but these are not reported. Heteroskedasticity consistent standard errors are between brackets.

<table>
<thead>
<tr>
<th>Variable</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$(I/K)_{t-1}$</td>
<td>-0.0078***</td>
<td>-0.0158***</td>
<td>-0.0185***</td>
<td>-0.0195***</td>
</tr>
<tr>
<td>$(I/K)^2_{t-1}$</td>
<td>0.5660***</td>
<td>0.5316***</td>
<td>0.5385***</td>
<td>0.5543***</td>
</tr>
<tr>
<td>$(Y/K)_t$</td>
<td>0.0871***</td>
<td>0.0635***</td>
<td>0.0703*</td>
<td>0.0282</td>
</tr>
<tr>
<td>$(CF/K)_t$</td>
<td>-0.0217</td>
<td>-0.0484</td>
<td>-0.3613</td>
<td>-0.5615</td>
</tr>
<tr>
<td>$FLI_t$* $(Y/K)_t$</td>
<td>0.0027</td>
<td>-0.0038</td>
<td>-0.0034</td>
<td></td>
</tr>
<tr>
<td>$FLI_t$* $(CF/K)_t$</td>
<td>0.0343</td>
<td>0.1253**</td>
<td>0.2440***</td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td>Coefficient</td>
<td>Standard Error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>-------------</td>
<td>----------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small$_t$ (Y/K)$_t$</td>
<td>-0.0198</td>
<td>(0.0416)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small$_t$ (CF/K)$_t$</td>
<td>0.4771</td>
<td>(0.3277)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small$_t$ * FLI$_t$ (Y/K)$_t$</td>
<td>0.0140*</td>
<td>(0.0080)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small$_t$ * FLI$_t$ (CF/K)$_t$</td>
<td>-0.1485**</td>
<td>(0.0654)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Specification tests (p-values)

<table>
<thead>
<tr>
<th>Test</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. First-order serial correlation:</td>
<td>0.000***</td>
</tr>
<tr>
<td>b. Second-order serial correlation:</td>
<td>0.209</td>
</tr>
<tr>
<td>c. Sargan test:</td>
<td>0.200</td>
</tr>
</tbody>
</table>

Instruments: \( t-2, t-3 \) \( t-2, t-3 \) \( t-2, t-3 \) \( t-2, t-3 \)

Number of observations: 857 857 857 857
Number of firms: 394 394 394 394

*** indicates significance at a 1 percent level; ** indicates significance at a 5 percent level; * indicates significance at a 10 percent level.
Annex  Major Events of Banking Market Liberalization in Various Countries

This Annex presents the major events in the sampled countries during the period 1988 to 1998 related to: (1) interest rates deregulation; (2) a removal of entry barriers; (3) a decrease in reserve requirements; (4) a removal of credit controls; (5) privatization of state banks; and (6) increased prudential bank regulation. Unless otherwise noted, the source of information is Williamson and Mahar (1998). EIU denotes country reports from the Economist Intelligence Unit, IMF denotes IMF Country Reports, and World Bank denotes World Bank Country Reports.

Argentina

1. Elimination of all interest rate controls in 1989 (EIU).
2. Removal of most entry barriers and branching restrictions in 1977 (Lindgren, Garcia and Saal (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, Garcia and Saal (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).

Chile

1. Controls on interest rates are eliminated in 1985 (Gallego and Loayza (2001)).
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 abandoned in 1976 (Bandiera et al. (2000)).
5. Banks are reprivatized 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 the period 1995 to 1996, 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).


5. No major reduction yet in government ownership of public banks (World Bank).


**Indonesia**

1. Most deposit and loan rates freed in 1983.


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).


**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**

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)).

**Pakistan**

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).
6. Steps were taking during the period 1993 to 1994 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 1991 onwards.
5. All seven public commercial banks liquidated or divested over the period 1991 to 1995.
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 the period 1981 to 1985.
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).
5. Government reduced stake in PNB to 47 percent in December 1995.
6. In December 1993, Central Bank was restructured and re-capitalized (IMF).

**Rep. of 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 the period 1981 to 1983 (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.

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**


2. Since September 1994, commercial banks are allowed to invest in any business (World Bank); Finance and securities companies are permitted to set up banks outside Bangkok with approval in 1995.


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).