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CDDRL was founded by a generous grant from the Bill and Flora Hewlett Foundation in October in 2002 as part of the Stanford Institute for International Studies at Stanford University. The Center supports analytic studies, policy relevant research, training and outreach activities to assist developing countries in the design and implementation of policies to foster growth, democracy, and the rule of law.

### **About the Author**

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# **Do Stock Market Liberalizations Cause Investment Booms?**

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## **Abstract**

Stock market liberalizations lead private investment booms. In a sample of 11 developing countries that liberalized, 9 experience growth rates of private investment above their non-liberalization median in the first year after liberalizing. In the second and third years after liberalization this number is 10 of 11 and 8 of 11 respectively. The mean growth rate of private investment in the three years immediately following stock market liberalization exceeds the sample mean by 22 percentage points. The evidence stands in sharp contrast with recent work that suggests capital account liberalization has no effect on investment.

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## 1. Introduction

A stock market liberalization is a decision by a country's government to allow foreigners to purchase shares in that country's stock market. Standard models of international asset pricing predict that stock market liberalization may reduce the liberalizing country's cost of equity capital.<sup>1</sup> This prediction has two important empirical implications for those emerging countries that liberalized their stock markets in the late 1980s and early 1990s. First, if stock market liberalization reduces the aggregate cost of equity capital, then, holding expected future cash flows constant, we should observe an increase in a country's equity price index when the market learns that a stock market liberalization is going to occur. The second implication is that we should observe an increase in physical investment following a stock market liberalization, because a fall in a country's cost of equity capital will transform some investment projects that had a negative net present value (NPV) before liberalization into positive NPV endeavors after liberalization. Henry (1999a) shows that the data confirm the first implication. This paper examines whether the data are consistent with the second implication. Specifically, in order to determine whether stock market liberalizations are associated with increased investment, this paper analyzes the behavior of real private investment following stock market liberalization in 11 emerging market countries.

The mean growth rate of real private investment in the three years immediately following stock market liberalization exceeds the sample mean by 22 percentage points. Sign tests on medians confirm the robustness of the increase. In the first year after liberalization, 9 of 11 countries experience growth rates of private investment above their non-liberalization median. In the second and third years after liberalization this number

is 10 of 11 and 8 of 11 respectively. The relationship between private investment and stock market liberalization persists after controlling for world business cycle effects, contemporaneous economic reforms, and domestic fundamentals. However, we cannot conclude that stock market liberalizations cause investment booms, because the possibility of reverse causality cannot be ruled out.

There are three reasons why stock market liberalization might cause a fall in the liberalizing country's cost of equity capital, which consists of the risk free rate and the equity premium.<sup>2</sup> First, stock market liberalization might increase net capital inflows, and an increase in net capital inflows could reduce the risk free rate. Second, allowing foreigners to purchase domestic shares facilitates risk sharing between domestic and foreign residents; increased risk sharing should reduce the equity premium. Finally, Levine and Zervos (1998b) demonstrate that increased capital inflows may also increase stock market liquidity; increased liquidity will also reduce the equity premium (Ahimud and Mendelson (1986, 1997)).

Stock market liberalization is a specific type of a more general policy reform called capital account liberalization, which is a decision by a country's government to remove restrictions on all capital inflows and outflows. The empirical literature on capital account liberalization can be separated usefully into two strands: finance and macroeconomics. Tesar (1995), Tesar and Werner (1998), and Stulz (1995, 1999a, 1999b) provide comprehensive surveys of the finance literature on capital account liberalization and international risk sharing. The central message is that the portfolios of developed-country investors are still biased toward domestic securities, but capital account liberalization has led to greater diversification. The effects of increased financial

integration are most readily seen in emerging market stock prices. Kim and Singal (1998), Henry (1999a), and Bekaert and Harvey (1998) find evidence consistent with the hypothesis that stock market liberalization causes a one-time revaluation of emerging market stock prices and a fall in the cost of capital. Levine and Zervos (1998b) provide evidence which suggests that stock market liberalization also increases liquidity. These papers confirm that stock market liberalization has financial effects, but they do not address the investment question.

On the other hand, the empirical macroeconomic literature looks at the impact of capital account liberalization on investment. Levine and Zervos (1998a) examine whether a country experiences a permanent increase in the growth rate of its capital stock when its stock market becomes more integrated with the rest of the world. They find no evidence that increased stock market integration leads to permanently higher capital stock growth rates. This result is somewhat surprising given the evidence on the impact of stock market liberalization on countries' cost of equity capital. One possible explanation is that stock market liberalization leads to a temporary increase in the growth rate of the capital stock, not a permanent increase.

Consider a closed economy Solow (1956) model in steady state so that the capital stock and the labor force are growing at the same rate. Now suppose that the stock market is liberalized to foreign capital inflows. If stock market liberalization reduces the cost of capital, agents will respond by driving down the marginal product of capital to the new cost of capital. This can only occur if the capital stock temporarily grows faster than the labor force. Once the marginal product of capital equals the post-liberalization cost of capital,<sup>3</sup> the growth rate of the capital stock will return to its pre-liberalization rate

(i.e., the same rate as the labor force). In other words, theory suggests that stock market liberalization will induce a temporary increase in the growth rate of a country's capital stock. This paper provides a sharp test of the theory by employing an event study approach that compares the growth rate of private investment<sup>4</sup> during stock market liberalization episodes with the growth rate of private investment during non-liberalization periods.

### 1.1. Overview

The paper proceeds as follows. Section 2 briefly reviews previous work and explains the contribution of this paper relative to the existing literature. Section 3 presents a theoretical discussion of the channels through which stock market liberalization may affect aggregate valuation, the cost of capital, and investment. The central message here is not that stock market liberalization will automatically reduce the liberalizing country's cost of equity capital, but that it will probably change that country's cost of capital. Under reasonable assumptions, the theory predicts that stock market liberalization will cause a fall in the liberalizing country's cost of equity capital. If stock market liberalization reduces a country's aggregate cost of equity capital it will also cause a temporary increase in the growth rate of investment via the following mechanism:

$$(1) \quad \textit{StockMarketLiberalization} \Rightarrow \uparrow \textit{AggregateStock Prices} \Rightarrow \uparrow \textit{Investment} .$$

Thus, there are two tasks involved in determining whether the data support the theory. The first step involves examining the correlation of investment with both liberalization

and stock prices. The second step involves determining whether the correlations, if they exist, can be given a causal interpretation.

Section 4 analyzes the correlation of private investment growth and stock market liberalization. First, the existing evidence on the impact of liberalization on risk sharing, valuation, and liquidity is summarized. Next, the analysis turns to the growth rate of private investment during liberalization episodes in order to determine whether investment is unusually high following stock market liberalizations. Examination of graphs, means, and medians all convey the same message: investment booms consistently follow stock market liberalizations.

Section 5 analyzes the correlation between the growth rate of private investment and changes in stock market valuation. Although Fischer and Merton (1984), Barro (1990), Morck, Shleifer, and Vishny (1990) and others have shown that higher stock returns forecast increased future investment in the U.S., there is a paucity of evidence on this subject in less-developed countries(LDCs).<sup>5</sup> With substantial heterogeneity in the nature of the financial sector across LDCs-- financial repression, government directed credit, and the prevalence of informal financial markets-- it is not obvious that the standard investment stock return correlations will hold.<sup>6</sup> Regressions of private investment growth on stock returns demonstrate a positive and significant correlation.

Section 6 explores alternative explanations for the investment boom. Having demonstrated the plausibility of a causal link from liberalization to investment in Sections 4 and 5, the question in Section 6 is whether omitted variables or reverse causality can explain the investment liberalization correlations. The analysis here is motivated by the fact that the political decision to liberalize may be endogenous;



governments have an incentive to liberalize the stock market when there is good news about the future. Specifically, liberalizations are probably timed to coincide with (1) high points in the world business cycle, (2) the implementation of other economic reforms, and (3) positive shocks to aggregate demand and the terms of trade. Including regressors that try to capture these effects explains part of the boom, but stock market liberalization retains a statistically significant and an economically meaningful effect on the growth rate of private investment.

The issue of reverse causality is more problematic. Timing evidence is presented which suggests that stock markets are not liberalized in response to investment booms. However, the evidence cannot rule out the possibility that policymakers liberalize in anticipation of future shocks to the marginal product of capital. Therefore, we cannot conclude that stock market liberalizations cause investment booms. Section 7 concludes.

## **2. Previous Work**

For clarity, it is worth explaining the contributions of this paper relative to Levine and Zervos (1998a) and why the results here may differ from theirs. The first contribution is that this paper asks whether stock market liberalization causes a temporary increase in the growth rate of the capital stock, whereas Levine and Zervos (1998a) ask if increased stock market integration causes a permanent increase. This difference in questions leads to methodological differences. Specifically, the estimation procedure used in this paper allows for the fact that stock market liberalization dates differ across countries. Levine and Zervos use the same break point, 1985, for all of the countries in their sample. Choosing a homogenous break point does not induce important

biases into Levine and Zervos's empirical procedure since they are testing for a permanent effect. However, since this paper tests for temporary effects, it is important to capture country-specific stock market liberalization dates as accurately as possible. This paper identifies discrete, country-specific stock market liberalizations using a systematic dating procedure.<sup>7</sup> This dating procedure facilitates an event study approach which provides a transparent test of whether stock market liberalization leads to a temporary increase in the growth rate of investment.

This paper makes a second contribution by only including developing countries in the sample. Levine and Zervos' study contains both developed and developing countries. If the general consensus that developing countries have a higher autarky cost of capital than developed countries is true,<sup>8</sup> then increased stock market integration will lead to faster rates of capital accumulation in developing countries, but slower rates in developed countries. With both developing and developed countries included in their sample, Levine and Zervos' results may suggest that capital account liberalization has no effect on investment, but the results may also reflect the differing effects of liberalization in each of their subsamples.

A third contribution of this paper is that it puts together a time series of country-specific policy changes that helps disentangle the impact of stock market liberalization from the potentially confounding effects of contemporaneous economic reforms. The paper also controls for time-specific shocks such as fluctuations in the world business cycle.

The final contribution of this paper is that instead of using total investment, it focuses on private investment. Total investment is the sum of public (government),

private, and foreign direct investment (FDI). The empirical analysis in this paper is based on the theoretical relationship between investment and the shadow value of capital in the stock market. This is implicitly a theory about private, not government, investment behavior. Therefore, private investment may be more appropriate. The behavior of FDI is analyzed separately in section 4.

While it is desirable to understand the implications of stock market liberalization for general economic performance, this paper focuses on investment, because there is an unresolved debate as to whether capital account liberalization has any effect on real investment (Obstfeld 1998, Rodrik 1998, Stiglitz 1998). Levine and Zervos (1998a) provide an important first step in documenting that capital account liberalization does not lead to a permanent increase in the growth rate of the capital stock. This does not necessarily mean, however, that capital account liberalization has no effect on investment. Liberalization might lead to a temporary increase in the growth rate of the capital stock. Given the empirical complications inherent in trying to isolate the impact of capital account liberalization and the fact that there has been no formal analysis of the temporary hypothesis, it seems reasonable to focus on establishing a reliable set of facts about investment and liberalization before tackling broader issues.

### **3. Stock Market Liberalization, Stock Prices, and Investment: Theory**

#### **3.1 Autarky Stock Market Valuation**

As motivation for the empirical analysis to follow, this section presents a theoretical discussion of the channels through which stock market liberalization may influence aggregate valuation and physical investment. Assume that both the domestic

stock market and money market are closed to foreign investors. Let  $\bar{\Pi}_t$  denote expected aggregate profit per unit of capital and let  $V_t$  denote the expected present value of aggregate profit per unit of capital.<sup>9</sup> Since it is not central to the argument, ignore depreciation of the capital stock. Further, let  $r_t$  be the autarky domestic real interest rate,  $\theta_t$  the autarky equity premium, and assume that the world risk free rate,  $r_t^*$ , is less than the domestic risk free rate  $r_t$ .<sup>10</sup> For simplicity of exposition, assume that firms expect future interest rates, the equity premium, and profit per unit of capital to remain constant. Since increased risk sharing has theoretically and empirically ambiguous implications for the domestic savings rate,<sup>11</sup> assume that stock market liberalization has no effect on the domestic savings rate. Finally, assume that stock market liberalization has no effect on  $\bar{\Pi}$ .

Given these assumptions, it must be the case that in autarky the value of the stock market is given by

$$(2) \quad V_t = \frac{\bar{\Pi}}{r + \theta}.$$

Now let  $P_k$  be the price of a unit of physical capital and assume that

$$(3) \quad V_t = \frac{\bar{\Pi}}{r + \theta} = P_k$$

so that the market for capital is in equilibrium and firms are indifferent to investing. Equation (3) highlights the fact that the discount rate used in evaluating firms' existing projects consists of two components: the real risk-free rate of return and the equity

premium. Starting from this equilibrium, suppose that the stock market is liberalized to foreign investors, but the domestic money market remains closed.

### **3.2 Stock Market Valuation After Liberalization**

Consider first the impact of stock market liberalization on the equity premium. In autarky the equity premium,  $\theta$ , will be proportional to the variance of the country's aggregate cash flows. Once liberalization takes place and the country's stock market becomes fully integrated, its equity premium will be proportional to the covariance of the country's aggregate cash flows with those of a world portfolio. Therefore, the necessary condition for the equity premium to fall following liberalization is that the variance (the local price of risk) exceeds the covariance (the global price of risk). Stulz (1999b) demonstrates empirically that every emerging market satisfies this necessary condition. Tesar and Werner (1997), Errunza and Miller (1998), and Bekaert and Harvey (1998) also argue that this condition holds in practice. In keeping with the general consensus that the equity premium will fall when a completely segmented emerging country liberalizes its stock market,<sup>12</sup> let  $\theta^* < \theta$  be the equity premium which prevails following stock market liberalization.

In addition to allowing for increased risk sharing, stock market liberalization may also lead to more liquid markets where trading equities is less costly (Levine and Zervos 1998a, 1998b). Ahimud and Mendelson (1986, 1997) find that increased liquidity reduces the equity premium,<sup>13</sup> which decreases the cost of capital and raises firm value. Thus, from a valuation standpoint, the empirical implications of increased liquidity are observationally equivalent to the implications of increased risk sharing. An increase in

either, or both, reduces the equity premium. It is therefore important to bear in mind that in addition to increased risk sharing, increased liquidity plays a central role in any liberalization-induced valuation and investment boom. The relative roles of risk sharing and liquidity are discussed further in Section 5.2.

Now consider the impact of stock market liberalization on the risk-free rate. Although the assumption is that the domestic money market remains closed following the stock market liberalization, the stock market liberalization may have an indirect effect on the domestic risk-free rate. As we have assumed that the domestic savings rate is constant, the capital inflow generated by stock market liberalization increases the total stock of loanable funds. This increase could cause the domestic risk-free rate to fall. Let  $\tilde{r} < r$  be the post-liberalization risk-free rate. Finally, by assumption liberalization has no impact on the numerator,  $\bar{\Pi}$ . Therefore, after the stock market is liberalized aggregate valuation is given by:

$$(4) \quad V_t^* = \frac{\bar{\Pi}}{\tilde{r} + \theta^*} > P_k.$$

Stock liberalization drives a wedge between market valuation and the price of a new machine, thereby generating an incentive for firms to invest in physical capital.

### 3.3 Objections to the Theoretical Framework

There are two key objections to this description of the impact of a stock market liberalization on a country's aggregate valuation and investment. First, it is possible that the autarky risk-free rate might be lower than the world risk-free rate. Second, it may not

be reasonable to assume that expected future profits and stock market liberalization are uncorrelated. Each of these objections is now considered in turn.

Suppose that  $r < r^*$  and we allow for the more realistic assumption that the domestic money market is also liberalized when the stock market is opened. In this case, in addition to the capital inflow into the stock market, capital will flow out of the domestic money market until the domestic risk free rate rises to the world risk free rate. Although the equity premium still falls due to increased risk sharing, under this scenario the countervailing effect of an increase in  $r$  might lead to a net increase in the discount rate. Therefore, if  $r < r^*$  in autarky, the post-liberalization cost of capital might actually rise following stock market liberalization. If we observed internal, market-determined interest rates in these countries it would be instructive to compare pre and post liberalization interest rates. Unfortunately, all of the countries in this sample had some form of financial repression in place during the period according to Williamson and Mahar (1998).<sup>14</sup> In lieu of data on internal market rates, I now consider the plausibility of this alternative assumption that  $r < r^*$ .

The autarky interest rate is an equilibrium outcome of domestic savings and investment. Historically, a number of emerging Asian countries have had very high savings rates relative to the developed countries. In the context of high autarky savings rates, it is plausible that a poor country might have a lower autarky risk free rate than the world risk-free rate. On the other hand, high savings rate economies may also have more attractive investment opportunities. Thus it is not clear that high savings-rate countries will necessarily have autarky interest rates which are lower than the world rate. Even if its autarky risk free rate is lower than the world rate, the liberalizing country may still

experience a net capital inflow if its stock market liberalization is asymmetric in the sense that foreign portfolio inflows are liberalized but the outflow of residents' savings is still subject to barriers. Section 4 provides evidence on both stock market liberalization and restrictions on the outflow of residents' savings.

The central message from this discussion, then, is not that stock market liberalization will in all cases lead to a fall in a country's cost of capital. Rather, the point is that there are sound theoretical reasons to believe that stock market liberalization may change the liberalizing country's cost of capital, with attendant implications for physical investment. Ultimately, whether a country's cost of capital rises or falls following stock market liberalization is an empirical question that must be considered case by case. Evidence on this question is presented in Section 4.

A second objection to the theoretical framework is that it assumes expected profits do not change when the stock market is liberalized. To the extent that stock market liberalizations are correlated with events which improve a country's physical investment opportunity set, this is clearly an unrealistic assumption. Section 6 of the paper addresses this potential correlation by employing a detailed set of economic reform variables. Other possible omitted variables that could lead to higher investment absent any impact of liberalization on the cost of capital are also considered.

## **4. Stock Market Liberalization, Stock Prices, and Investment: Facts**

### **4.1. Stock Market Liberalization Dates**

Evaluating the growth rate of private investment following a country's first stock market liberalization requires a systematic procedure for identifying the date of each



country's initial stock market liberalization. Official policy decree dates are used when they are available. When policy decree dates are not available two alternatives are pursued. First, many countries initially permitted foreign ownership through country mutual funds. Since government permission is presumably a necessary condition for establishment of these funds, the date when the first country fund is established proxies for the official implementation date. The second way of indirectly capturing official implementation dates is to monitor the IFC's Investability Index. The investability index is the ratio of the market capitalization of stocks that foreigners can legally hold to total market capitalization. A large jump in the investability index is evidence of an official liberalization. In what follows, the date of a country's first stock market liberalization is defined as the first month with a verifiable occurrence of any of the following: liberalization by policy decree, establishment of the first country fund, or an increase in the investability index of at least 10 percent. Table 1 lists the date on which each of the 11 countries<sup>15</sup> first liberalized its stock market, as well as the means by which it liberalized. In particular, where the initial liberalization is through a country fund, the specific name of the country fund is given.

Importantly, Table 1 also indicates whether these countries had restrictions on capital outflows at the time they liberalized foreign inflows into their stock markets. An important point is that every country in Table 1 had restrictions on the outflow of domestic savings at the time its stock market was liberalized. Thus, even if these countries had autarky risk free rates which were lower than the world risk free rate, it is reasonable to expect them to have experienced net capital inflows following their stock market liberalizations. The simple valuation model in Section 3 predicts that a net capital

inflow should have increased these countries' stock market valuations and reduced their cost of equity capital. Section 4.2 examines whether the data support this prediction.

#### **4.2. Risk Sharing, Valuation, and Liquidity Changes Around Liberalization**

This subsection summarizes the existing evidence on the impact of stock market liberalization on risk sharing, aggregate valuation and liquidity. Stulz (1999a, 1999b) argues that looking at returns around times of changes in the capital account regime of a country can provide the best picture of the impact of capital account liberalization on risk sharing and the cost of capital. As a crude indicator of the individual response of each country's stock market to liberalization, the last column of Table 1 documents the real percentage change in the stock market over the 12 months leading up to the implementation month of the first stock market liberalization.<sup>16</sup> For example, for a country that first liberalized in December of 1991, the percentage change gives the percentage change in the dollar total return index from December 1990 to December 1991.

While the numbers in Table 1 do not account for contemporaneous reforms or changes in fundamentals, they suggest large changes in aggregate valuation associated with stock market liberalization. Henry (1999a) shows that after controlling for economic reforms, macroeconomic fundamentals, and comovements with developed-country stock markets, the valuation increases in Table 1 remain large and statistically significant. The countries in his sample experience average cumulative abnormal returns of 26 percent in real dollar terms during an 8-month window leading up to the implementation of their initial stock market liberalization.<sup>17</sup> Kim and Singal (1998),

Errunza and Miller (1998), and Bekaert and Harvey (1998) all find similar effects and argue that the numbers are consistent with a one-time revaluation of aggregate equity prices and a fall in the cost of capital. While the evidence on valuation and the cost of capital is consistent with the hypothesis that stock market liberalization increases risk sharing, Levine and Zervos (1998b) document that stock market liberalization also increases market liquidity. Therefore, the documented changes in valuation could be due to increased liquidity as well as risk sharing.

### **4.3. Private Investment Data**

The private investment series comes from the World Bank's *World Development Indicators* database. There are a total of 11 developing countries that have both liberalized their stock market and kept data on private investment. Table 2, which presents summary statistics on the growth rate of real private investment for each country, illustrates that the sample contains a total of 151 observations of private investment. Although there are a total of 151 private investment observations, it is important to keep in mind that world-wide shocks that are common to all 11 countries means that these observations may not be completely independent. The empirical analysis controls for world-wide shocks by using time dummies and other proxies for the world business cycle.

### **4.4. The Growth Rate of Private Investment Around Stock Market Liberalization**

Let  $T^* - n$  be the  $n$ th year before stock market liberalization and define  $\Delta \ln I_{it} \equiv \ln I_{it} - \ln I_{it-1}$  as the real growth rate of private investment in country  $i$  in year

$t$ . Further, let  $\Delta \ln I_t \equiv \frac{1}{11} \sum_{i=1}^{11} (\Delta \ln I_{it})$ . Thus,  $\Delta \ln I_{T^*}$  is the average growth rate of private investment across all 11 countries in the year of stock market liberalization. Figure 1, which is a plot of  $\Delta \ln I_t$  in event time, suggests a strong lagged response of private investment to stock market liberalization. The growth rate of private investment increases sharply in year  $T^*+1$ , peaks in year  $T^*+2$ , and returns to pre-liberalization magnitudes by year  $T^*+4$ .

The correlation between liberalization and investment at various dates is evaluated by estimating the following panel regression:

$$(5) \quad \Delta \ln(I_{it}) = \alpha_i + \beta_1 Lib_{it} + \beta_2 PostLib1_{it} + \beta_3 PostLib2_{it} + \beta_4 PostLib3_{it} + Year_{it} + \varepsilon_{it}.$$

$\alpha_i$  are country-specific dummies.  $Year_{it}$  are year-specific dummies which are included to control for cross-country correlation in the error terms that might be induced by common world-wide shocks.<sup>18</sup> The first difference specification reflects a well-known problem of empirical investment equations, the presence of a highly serially correlated error term when run in levels. The usual first difference specification relates  $\Delta \ln((I/K)_t)$  to stock returns (see Blanchard, Rhee, and Summers, 1993), but data on the stock of capital for each country are not available. Hence the analysis throughout the paper follows Barro (1989) in using  $\Delta \ln(I_t)$  as the left-hand-side variable.<sup>19</sup>  $Lib_i$  is a variable which takes on the value 1 in the year that country  $i$  liberalizes its stock market;  $PostLib1_i$  takes on the value 1 in the first year after liberalization;  $PostLib2_i$  takes on the value 1 in the second year after liberalization;  $PostLib3_i$  takes on the value 1 in the third year after liberalization. The results are presented in Table 3.

The first row of Table 3 illustrates that the average growth rate of private investment is 22.5 percentage points above the sample mean in the first year after stock market liberalization, 27.1 percentage points in the second year, and 17.3 percentage points in the third year. Heteroskedastic consistent (White) standard errors are given in parentheses. Although the liberalization effects appear large and significant, there are three concerns. First, in spite of the first difference specification, subsequent observations of investment growth in individual countries might be autocorrelated. Second, with 11 countries in the sample, one might worry that the results are driven by one or two large outliers. Finally, although the estimates control for country-specific effects and common world-wide shocks, the right-hand-side of the estimated equation may be missing other important variables that exert an influence on investment. Each of these issues is now discussed.

Two procedures were used to evaluate whether autocorrelated disturbance terms are corrupting the significance levels reported in Table 3. First, individual country regressions of private investment growth on a constant<sup>20</sup> were performed to test for first-order autocorrelation in the residuals. Second, equation (5) was re-estimated using feasible generalized least squares (FGLS), which allows for groupwise autocorrelation. For 7 of 11 countries the Durbin-Watson statistic indicated that there was no first-order serial correlation.<sup>21</sup> For the other 4 countries the Durbin-Watson statistic was inconclusive.<sup>22</sup> The FGLS estimates of equation (5) are reported in the second row of Table 3. The mean growth rates of private investment in years  $T^*+1$ ,  $T^*+2$ , and  $T^*+3$  are 16.2, 29.2, and 18.9 percentage points above the sample mean respectively. All three estimates are significant at the 1 percent level. The similarity of the FGLS estimates in

row 2 (in both magnitude and statistical significance) to the estimates in row 1 suggest that autocorrelation is not a major statistical concern.

In order to address the concern about outliers, the third row of Table 3 presents the results of a Wilcoxon signed rank test. Specifically each country's growth rate of investment in years  $T^*$ ,  $T^*+1$ ,  $T^*+2$ , and  $T^*+3$  is compared to that country's median growth rate of investment in non-liberalization years. The Z-statistics reject the hypothesis that the median growth rate of investment during years  $T^*+1$ ,  $T^*+2$ , and  $T^*+3$  is equal to the median growth rate in non-liberalization years. The fourth row of the table gives the results of a simple sign test. It lists the number of countries with a growth rate of private investment below their country-specific median growth rate and gives the probability of finding at most this number of countries below their median. Like row 3, row 4 of Table 3 demonstrates that the abnormally high growth rate of private investment in each of the three years immediately following stock market liberalization is a robust empirical regularity not driven by a few countries. Finally, the concern that the estimates in Table 3 are overstated because of omitted variables is deferred until Section 6 where alternative controls for world-wide factors and a host of other possible omitted variables are considered.

#### **4.5 Foreign Direct Investment**

Another question that arises from looking at Figure 1 and Table 3 is whether the increase in private investment simply replaces FDI, or whether both increase. This question is addressed by looking at the ratio of foreign direct investment to private investment. Table 4 presents summary statistics on the ratio of foreign direct investment

to private investment. The numbers indicate that the ratio of FDI to private investment tends to rise following stock market liberalization. In year  $T^*+1$ , 7 of 11 countries have a ratio of FDI to private investment in excess of their country-specific median. In years  $T^*+2$  and  $T^*+3$  this number is 8 of 11 and 9 of 11 respectively.

These numbers suggest that the increase in private investment does not simply substitute for FDI. Following stock market liberalization, private investment increases, the ratio of FDI to private investment increases, and therefore the sum of private investment and FDI increases. One explanation for why FDI increases is that stock market liberalization may be positively correlated with other changes that reduce the operating risk of foreign multinationals operating in an LDC. In this case, the multinationals' cost of capital may also fall. Holding multinationals' cost of capital constant, FDI may also increase if stock market liberalization is positively correlated with other economic reforms that increase the expected future cash flows from domestic investment. The possibility that FDI rises because of higher expected future cash flows reinforces the concern that the magnitude of the private investment-liberalization correlations in Table 3 may be overstated. Again, Section 6 of the paper directly addresses these issues.

## **5. Investment-Stock Return Correlations**

As outlined in equation (1), the theory predicts that if stock market liberalization reduces the cost of capital it will also cause higher investment via its intermediate effect on aggregate stock market prices. The correlations documented in Section 4 provide support for this transmission mechanism. However, the ultimate validity of this theory

requires the existence of an intermediate empirical link from stock prices to investment. This section of the paper examines whether such a link exists.

Figure 2 is a graph of annual stock returns and the annual growth rate of private investment in all 11 countries from 1977 to 1994. The solid line, which is plotted against the left-hand-side scale, is the simple average of the logarithmic real local currency stock market return across all 11 countries. The stock returns are constructed using the dividend-inclusive, local currency *IFC Global Index* taken from the International Finance Corporation's *Emerging Markets Data Base* (EMDB). All stock market indices are deflated by consumer price indices from the International Monetary Fund's *International Financial Statistics*. The dashed line is the simple average of the growth rate of private investment.

Figure 2 suggests that there are two components to the correlation between the stock market and investment. First, there is a cross-sectional component: in a given year the stock market and investment tend to move in the same direction. Second, there is a time series component: both investment and stock returns were higher after 1983, as the world economy moved out of recession. As in Section 4, this means that although there are a total of 151 data points, they may not be completely independent. Again, the estimation procedure controls for the possible cross-country correlation induced by common world shocks by using year-specific dummies.

Let  $I_{it}$  and  $V_{it}$  denote the real local currency value of private investment and the stock market index in country  $i$  in year  $t$ . Also, let  $v_{it} = \Delta \ln(V_{it})$ . The correlation between private investment and stock returns is evaluated by estimating panel regressions that allow for country-specific and time-specific effects:



$$(6) \quad \Delta \ln(I_{it}) = \alpha_i + \beta_1 v_{it-n} + Year_{it} + \varepsilon_{it}.$$

The growth rate of private investment is regressed on contemporaneous, one-year-lagged and two-year-lagged stock returns.<sup>23</sup> Investment is also regressed on all three lags simultaneously. Regressions (1) through (4) in Table 5 indicate a positive correlation between stock returns and private investment. The relationship is strongest between investment and one-year-lagged returns. The coefficient on  $v_{t-1}$  is 0.132; a 1 percent increase in the stock market last year is followed by a 0.21 percent increase in the growth rate of private investment. Neither the contemporaneous return on the market,  $v_t$ , or the two-year-lagged change in the value of the stock market,  $v_{t-2}$ , are significantly correlated with investment in year  $t$ . Estimating the relationship with all three return variables entering simultaneously (regression [4]) yields the same conclusion. Stock returns in year  $t-1$  strongly predict investment in year  $t$  while contemporaneous and two-year-lagged returns have little predictive power.

### 5.1. The Correlation of Investment and Liberalization-Specific Valuation Changes

It is natural to ask whether the correlation between investment and generic changes in market valuation (the evidence presented in Table 5) is the same as the correlation between investment and liberalization-specific changes in valuation. Estimating the following equation provides the most transparent means of answering that question.

$$(7) \quad \Delta \ln(I_{it}) = \alpha_i + \beta_1 v_{it-2} + \beta_2 v_{it-1} + \beta_3 v_{it} + \beta_4 (v_{it-2} * PostLib2_i) + \beta_5 (v_{it-1} * PostLib1_i) + \beta_6 (v_{it} * Lib)_i + \varepsilon_{it}$$

The interactive coefficients measure the correlation of investment in year  $t$  with a liberalization-specific valuation increase that took place in year  $t - n$ . If there is no difference in the responsiveness of private investment to liberalization-specific and generic valuation increases, then we should observe:  $\beta_1 = \beta_4$ ,  $\beta_2 = \beta_5$ ,  $\beta_3 = \beta_6$ .

The results are presented in the last column of Table 5 (regression [5]).  $\beta_4$ , the coefficient on the interactive term,  $PostLib2 * v_{t-2}$ , is positive and significant and an F-test reveals that it is statistically larger than the coefficient on  $v_{t-2}$ .<sup>24</sup> Whereas a generic one-percent increase in the stock market in year  $t - 2$  has little or negative predictive power for investment in year  $t$ , there is a positive and significant investment response in year  $t$  to a 1 percent increase in year  $t - 2$  that is associated with stock market liberalization. The fact that investment is more strongly correlated with liberalization-induced valuation increases than with generic valuation increases lends itself to two possible interpretations: (1) stock market liberalization helps firms distinguish between news-driven and noise-driven valuation increases; (2) there is an omitted variable problem. Each of these interpretations is now considered.

A firm observing a typical increase in its stock price doesn't know whether that increase is due to news or noise. Undertaking new physical investment in response to noise-driven valuation increases will make long-term shareholders worse off, because such investment drives down the marginal product of capital without an accompanying fall in the discount rate or an increase in expected future profits.<sup>25</sup> However, when the stock market is liberalized, firms know that there has been a change in the fundamentals--namely increased risk sharing. The attendant equity price boom signals to firms that they can increase shareholder welfare by investing in new capital.

Investment may also be more strongly correlated with liberalization-induced changes in valuation than with generic changes, because regression (6) is missing variables which are positively correlated with both liberalization and investment. Call this vector of variables Z. If stock market liberalizations coincide with positive shocks to Z, then subsequent investment will appear more highly correlated with liberalization-induced valuation changes, when in fact the omitted variable Z may be driving the increased capital formation. Possible omitted variables are the subject of Section 6.

## **5.2. Can Investment Stock-Return Correlations Tell us Something About the Importance of Liquidity for Investment?**

The discussion in Section 3 explained why liquidity and risk sharing have observationally equivalent valuation implications. This fact raises an important interpretation issue. Suppose we observe that a stock market liberalization generates a large increase in equity prices and a subsequent investment boom. It would be useful to know how much of the investment increase is due to increased risk sharing versus increased liquidity. Because increased risk sharing and increased liquidity both have valuation implications, we cannot disentangle their relative effects on investment by running horse races between changes in liquidity and changes in valuation. However, Levine and Zervos (1998a) argue that regressing investment on liquidity and valuation may help us understand whether liquidity has an impact on investment that operates independently of the impact of liquidity on valuation.

The absence of a significant coefficient on liquidity in a regression of investment growth on changes in valuation and changes in liquidity would suggest that all of the effect of increased liquidity on investment works through the impact of liquidity on

valuation. On the other hand, suppose there is a positive and significant correlation between investment and liquidity after controlling for valuation. Then, to the extent that stock market liberalization enhances liquidity, it is possible that part of the investment increase following stock market liberalization works through a liquidity channel that operates independently of the effect of liquidity on valuation.

Table 6 presents results from regressing the growth rate of investment on contemporaneous and lagged changes in valuation on the two measures of liquidity used in Levine and Zervos (1998a): the change in turnover and the changes in value traded as a fraction of GDP. The final specification, which includes contemporaneous, lagged, and two-year-lagged values of all three variables, is perhaps the most informative. The fact that two-year-lagged change in turnover remains significant in the presence of contemporaneous, lagged, and two-year-lagged changes in valuation suggests that increased liquidity may lead to increased investment through a channel that operates independently of the effect of liquidity on valuation. This is consistent with Levine and Zervos (1998a) who find that increased liquidity leads to higher capital stock growth after controlling for valuation.

## **6. Alternative Explanations for the Investment Boom**

Thus far this paper has documented three salient facts about the stock market and investment in developing countries. First, private investment booms follow stock market liberalizations. Second, there is a strong positive correlation between the growth rate of private investment and changes in stock market valuation. Third, this correlation is stronger for liberalization-specific valuation changes than for generic valuation changes.

Taken together with previous work which demonstrates that stock market liberalizations cause large increases in stock market valuation, these three facts constitute strong *prima facie* evidence that stock market liberalizations cause investment booms. This section of the paper argues that there are reasons to be skeptical.

### **6.1. Omitted Variables**

At least one possible alternative explanation for the temporary surge in the growth rate of private investment is that LDC policymakers timed the liberalizations to coincide with high points in the world business cycle. In the estimations ahead, in addition to using time dummies, real U.S. interest rates, and OECD output growth rates are used to try to separate the cross-sectional effects of stock market liberalization from the impact of the world business cycle.

Overstating the impact of stock market liberalization on investment could also occur because of the contemporaneous implementation of other economic reforms. Table 7 documents the major economic reforms occurring in each of the 11 countries between 1985 and 1994. With the aid of this table, four economic reform variables are created to help isolate the effects of stock market liberalization. These variables, which are given the obvious names *Stabilize*, *Trade*, *Privatize*, and *Exchange*, take on the value zero everywhere except during the years in which each of these reforms actually occur. Like the *Liberalize* variable, 3 lags of each of the reform variables are also included in each of the regressions.

In addition to controlling for the world business cycle and contemporaneous reforms it is important to account for domestic fundamentals such as the growth rate of

GDP, the terms of trade, and the external debt-to-GDP ratio. Stronger GDP growth or a positive terms of trade shock could lead to stronger sales and profits resulting in an aggregate-demand-driven investment boom that has nothing to do with stock market liberalization *per se*. Similarly, the literature on debt overhang and investment, (Krugman 1988, Sachs 1989) argues that a large external debt-to-GDP ratio acts as a drag on investment. Therefore, a large exogenous fall in the external debt-to-GDP ratio could also lead to a substantial increase in future investment that is unrelated to stock market liberalization.

The following regression uses these variables to control for world business cycle effects, contemporaneous economic reforms, and aggregate demand conditions

$$(8) \quad \Delta \ln(I_{it}) = \alpha_i + \beta_1 Lib_{it} + \beta_2 PostLib1_{it} + \beta_3 PostLib2_{it} + \beta_4 PostLib3_{it} + BCYCLE + Reforms_{it} + Fundamentals_{it} + \varepsilon_{it}$$

*BCYCLE* is an abbreviation for the variables which proxy for the world business cycle: year dummies, the real U.S. Treasury bill rate, and the logarithmic growth rate of OECD industrial production. The term *Reforms* denotes the matrix of reform variables. The *Fundamentals* are two lags of the growth rate of GDP, the contemporaneous growth rate of the terms of trade, and the contemporaneous growth rate of the external debt-to-GDP ratio.<sup>26</sup> The final specification closely resembles Fischer (1991), Warner (1992), and Cohen (1993).

Table 8 presents the results of three different variations on equation (8). The first uses only year dummies as a business cycle proxy, the second uses the real Treasury bill rate and the growth rate of OECD industrial production, and the third uses all three world business cycle measures. In order to conserve space, the estimates of the business cycle

variables, and fundamentals are not presented in the table.<sup>27</sup> Column 1 shows that when year dummies and fundamentals are included, the coefficient on *PostLib1* falls to 0.130 and is no longer significant. The coefficients on *PostLib2* and *PostLib3* actually increase to 0.326 and 0.198 respectively. It is interesting to note that the growth rate of investment is also significantly higher than the sample mean in the years following a number of the other reforms. For example, the coefficient on all of the *Stabilize* variables is positive, and the coefficients of 0.218 on *Stabilize1* and 0.165 on *Stabilize3* are both statistically significant. The relationship between investment and the other reforms is less robust. The coefficients on *Trade2*, *Privatize2*, and *Exchange2* are all positive and statistically significant, but the coefficients on *Trade1*, *Trade3*, *Privatize*, *Privatize3*, and *Exchange* are all negative.

Column 2 controls for world business cycle effects by including the contemporaneous value of the real U.S. Treasury bill rate and the growth rate of OECD industrial production as right-hand-side variables. Under this specification, the coefficient on *PostLib2* is 0.244 and again significant at the one-percent level. The coefficient on *PostLib3* falls to 0.104, but remains significant. The reform variable coefficients are qualitatively identical to those of the specification in column 1. Multiple leads and lags of the interest rate and growth rate of industrial production were also tried, but only the contemporaneous values displayed any significant effect. As a final test of robustness, year dummies, the real Treasury bill rate, and OECD growth rates were all included simultaneously. The estimates are presented in column 3. This time *PostLib1*, *PostLib2*, and *PostLib3* are all statistically significant with point estimates almost identical to those in column 1.

The evidence in Table 8 demonstrates that the investment liberalization correlations are robust to a number of potential omitted variables, but should still be interpreted with caution. Although Table 8 documents a number of significant reforms, it does not directly capture elements such as judicial reform or public sector accountability changes. These changes may be prerequisites for a successful stock market liberalization. To the extent that the stock market liberalization dummy variable inadvertently captures such changes, the estimated impact of liberalization on investment may still be overstated.

## **6.2. Reverse Causality**

The evidence in Table 8 demonstrates that the effect of stock market liberalization on investment is reasonably robust to the omitted variable critique, but it does not directly address the concern that causality might literally run in the opposite direction. There are at least three possible stories as to why the direction of causation might be reversed. First, governments might liberalize in response to abnormally high investment demand in previous years. Second, an exogenous fall in the world cost of capital relative to the local cost could cause governments to open the domestic stock market to foreigners. Third, policymakers might liberalize in anticipation of positive future shocks to the marginal productivity of capital. In the absence of suitable instruments for stock market liberalization, timing evidence is used to evaluate the plausibility of these three stories.

If past investment booms cause liberalizations, then we should see liberalizations following surges in private investment. Figure 1 is not consistent with this first story of



reverse causality. Figure 1 is, however, consistent with the second story of reverse causality. If the world cost of capital falls relative to the local cost, local businesses may lobby their governments to allow foreign capital in. In this case private investment will not rise until after the liberalization, even though the fall in the world cost of capital is causing the liberalization.<sup>28</sup> Figure 1 is also consistent with the third story of reverse causality. Suppose that policymakers liberalize because they correctly anticipate that the marginal productivity of capital will be higher in the future. In this case, the growth rate of private investment will rise following stock market liberalization, but the liberalizations clearly do not cause the increase. The future increase in the marginal productivity of capital causes both the liberalization and the investment boom.

The fact that we cannot rule out reverse causality calls for a measured interpretation of the evidence in Table 8. This sample is somewhat special, because the universe of developing countries that liberalized their stock markets did so after beginning the crucial process of economic reform and at a time of relatively low real world interest rates. Suppose at some point in the future a developing country were to liberalize its stock market before implementing other reforms and at a time when the world cost of capital is relatively high. In that case it is not clear that the liberalizing country would see investment effects on the same order of magnitude as the countries in this sample.

The general implication then is not that stock market liberalizations cause investment booms. Rather, the following seems like a more reasonable summary of the evidence. In environments where the marginal product of capital is high and the domestic cost of capital exceeds the world cost of capital, Tobin's  $q$  predicts that capital

account liberalization can lead to large increases in investment; the data are consistent with this prediction.

## **7. Conclusion**

This paper demonstrates that the developing countries in this sample experienced abnormally high growth rates of private investment after liberalizing their stock markets. Because it is possible that exogenous falls in the world cost of capital and expected shocks to the future marginal productivity of domestic capital could cause both the investment booms and the liberalizations, we cannot necessarily conclude that stock market liberalizations cause investment booms. Nevertheless, the evidence presented here is relevant for the debate on whether or not capital account liberalization has any effect on real investment.

Previous papers tested the hypothesis that capital account liberalization has permanent effects on investment and found no supporting evidence. However, standard models predict that capital account liberalization will cause a temporary increase in the growth rate of investment. This paper uses event study techniques to examine whether the data are consistent with this theoretical prediction. The fact that stock market liberalizations are consistently followed by a temporary increase in the growth rate of investment which cannot be explained away by world business cycle effects, contemporaneous economic reforms, or domestic aggregate demand conditions, suggests that capital account liberalization may matter for investment after all.

Table 1  
First stock market liberalization and controls on capital outflows

The stock market liberalization dates are based on information obtained from the following sources: Levine and Zervos (1994), *The Wilson Directory of Emerging Market Funds*, IFC Investable Indices, Park and Van Agtmael (1993), Price (1994), *The Economist Intelligence Unit* (various issues), *The Economist Guide to World Stock Markets* (1988), the IMF's *Exchange Arrangements and Restrictions* (various issues). Percentage change in total return index: the percentage change in the real dollar value of the IFC's total return index over the 12 month period leading up to the country's initial stock market liberalization. Restrictions on capital transactions using resident-owned funds: a 'Yes' entry under this column indicates that according to the International Monetary Fund's *Exchange Arrangements and Exchange Restrictions*, restrictions on the use of domestic residents' funds for capital transactions were still in place when the country's stock market was liberalized to the inward flow of foreign capital. Restrictions on domestic residents' ability to own foreign securities: a 'Yes' entry under this column indicates that according to Kim and Singal (1998) there were restrictions on domestic residents' ability to purchase foreign securities when the country's stock market was liberalized to the inward flow of foreign capital. \*, according to the table entitled, "Summary features of exchange and trade systems in member countries" (p. 557 of IMF Exchange Arrangements and Exchange Restrictions 1987), Malaysia had no restrictions on the use of resident-owned domestic funds. However, the discussion on page 333 of the same publication, which lists the rules governing capital flows in and out of Malaysia, indicates that there were some restrictions on capital outflows.

Country	Date of First Stock Market Liberalization	Details About the Liberalization	Percentage change in total return index
Argentina	November 1989	<b>Policy Decree:</b> The Liberalization began with the New Foreign Investment Regime in November 1989. Legal limits on the type and nature of foreign investments were reduced (Park and Van Agtmael, 1993, page 326).	98.7
Brazil	March 1988	<b>Country Fund Introduction:</b> "The Brazil Fund Incorporated" ( <i>The Wilson Directory of Emerging Market Funds</i> , page 17).	19.6
Chile	May 1987	<b>Country Fund Introduction:</b> "The Toronto Trust Mutual Fund" ( <i>The Wilson Directory of Emerging Market Funds</i> , page 17).	39.6
Colombia	December 1991	<b>Policy Decree:</b> Resolution 52 allowed foreign investors to purchase up to 100 percent of locally listed companies (Price, 1994).	109
India	June 1986	<b>Country Fund Introduction:</b> "The India Fund" ( <i>The Wilson Directory of Emerging Market Funds</i> , page 12).	53.1
Korea	June 1987	<b>Country Fund Introduction:</b> "The Korea Europe Fund Limited" ( <i>The Wilson Directory of Emerging Market Funds</i> , page 13).	27.7
Malaysia	May 1987	<b>Country Fund Introduction:</b> "The Wardley GS Malaysia Fund" ( <i>The Wilson Directory of</i>	62.5

*Emerging Market Funds*, page 14).

Mexico	May 1989	<b>Policy Decree:</b> Restrictions on foreign portfolio inflows were substantially liberalized (Levine and Zervos, 1994).	30.7
The Philippines	May 1986	<b>Country Fund Introduction:</b> “The Thornton Philippines Redevelopment Fund Limited” ( <i>The Wilson Directory of Emerging Market Funds</i> , page 15).	72.9
Thailand	January 1988	<b>Country Fund Introduction:</b> “The Siam Fund Limited” ( <i>The Wilson Directory of Emerging Market Funds</i> , page 16).	41.6
Venezuela	January 1990	<b>Policy Decree:</b> Decree 727 completely opens the market to foreign investors except for bank stocks (Levine and Zervos, 1994).	32.5

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## Endnotes

<sup>1</sup> See for example Stapleton and Subrahmanyam (1977), Errunza and Losq (1985), Eun and Janakiramanan (1986), Alexander *et. al.* (1987), and Stulz (1999b).

<sup>2</sup> Stock market liberalization need not always cause a fall in the cost of capital. A country's cost of equity capital has two components: the equity premium and the risk free rate. Stock market liberalization increases risk sharing and liquidity, thereby reducing the equity premium. Liberalization may also affect net capital inflows, which has implications for the risk-free rate. If the risk-free rate falls after liberalization, then the country's cost of capital unequivocally falls. If the risk-free rate rises following liberalization, then the country's cost of capital could increase. Whether the risk-free rate rises or falls following liberalization depends on whether the autarky risk-free rate, which is an equilibrium outcome of aggregate savings and investment, is above or below the world rate. Section 3 presents a detailed discussion of these issues.

<sup>3</sup> This is equivalent to saying that the economy reaches its new optimal capital labor ratio

<sup>4</sup> A temporary increase in the growth rate of the capital stock also implies a temporary increase in the growth rate of investment. A simple example will help clarify this point. Let  $K_0$  denote the initial capital stock and assume the capital stock is initially growing at rate  $g$  so that  $K_t = K_0 e^{gt}$  (i.e.  $\frac{\dot{K}_t}{K_t} = g$ ).

Investment,  $I$ , is defined as the change in the capital stock, that is,  $I_t = \dot{K}_t$  where a dot over a variable denotes the time derivative of that variable. Hence,  $I_t = \dot{K}_t \Rightarrow \frac{\dot{I}_t}{I_t} = \frac{\ddot{K}_t}{\dot{K}_t} = g$ . The growth rate of the capital stock and the growth rate of investment are the same. Therefore, a temporary increase in the growth rate of the capital stock also implies a temporary increase in the growth rate of investment.

<sup>5</sup> For a survey of this evidence, see Rama (1993).

<sup>6</sup> See Agénor and Montiel (1996) on this point.

<sup>7</sup> A complete discussion of the dating procedure is contained in Section 4.

<sup>8</sup> It is important to note that this is not necessarily the case. See the discussion in Section 3.

<sup>9</sup> Assuming no bubbles, this is precisely the value of the country's stock market. We are also making here the simplifying assumption that all profits are paid out as dividends.

<sup>10</sup> The assumption that  $r > r^*$  is the standard assumption about the autarky interest rate in developing countries relative to the rest of the world. The alternative assumption of  $r < r^*$  is considered shortly.

<sup>11</sup> Levine and Zervos (1998a) find no impact of that increased capital market integration on savings rates. See Agénor and Montiel (1996) for an extensive review of the empirical literature on financial liberalization and savings.

<sup>12</sup> Markets that are mildly segmented *ex-ante* should experience a smaller decline than fully segmented markets. See Errunza and Losq (1989).

<sup>13</sup> The fact that shareholders demand a liquidity premium means that in addition to the premium they require for bearing systematic risk they also require compensation for the frictional costs of trading equity (Ahimud and Mendelson; 1986, 1997). This is equivalent to saying that the equity premium,  $\theta$ , consists of two components: (1) the premium required for bearing systematic risk, and (2) a liquidity premium. Therefore, increased liquidity also reduces the equity premium.

<sup>14</sup> See Table 1, Table 4, and Table 5 of their paper.

<sup>15</sup> The countries are Argentina, Brazil, Chile, Colombia, India, Korea, Malaysia, Mexico, The Philippines, Thailand, and Venezuela.

<sup>16</sup> If the liberalization is anticipated then the change in valuation will occur prior to the actual implementation. A 12-month window is chosen here to capture announcement effects. For a detailed discussion of the issues involved in trying to precisely date liberalization announcements, see Henry (1997), Errunza and Miller (1998), and Bekaert and Harvey (1998).

<sup>17</sup> The countries analyzed in Henry's paper are identical to those in this paper except that he also includes Taiwan. Taiwan is not included in this study, because investment data was not available for Taiwan.

<sup>18</sup> The estimation procedure explicitly allows for heteroskedacity in computing standard errors, but with an unbalanced panel it is not possible to relax the assumption of no cross-country correlation. The year dummies are an imperfect attempt to control for cross-country correlation.

<sup>19</sup> All right-hand-side variables in this paper are also first differences of the natural log. The advantage of this is that all of the macroeconomic variables used are first-difference stationary (results not reported). Levels of variables such as stock prices and market capitalization may not be stationary (Levine and Zervos 1998b).

<sup>20</sup> The other right-hand-side variables were dropped to preserve degrees of freedom.

<sup>21</sup> The 7 countries for which the DW statistic rejects first-order autocorrelation are as follows: Argentina (2.76), Brazil (1.85), Chile (2.80), India (2.12), The Philippines (2.04), Thailand (2.17), and Venezuela (2.01). The numbers in parentheses are the DW test statistic for that country.

<sup>22</sup> The 4 countries are Colombia (1.39), Korea (1.51), Malaysia (1.21), and Mexico (1.51).

<sup>23</sup> The use of stock returns as a proxy for changes in  $q$  is another difference between this specification and those in the literature on investment in developed countries. The reason for this is that the debt variables needed to construct an aggregate measure of  $q$  are not available. This is not a major concern as Barro (1990) and Blanchard, Rhee, and Summers (1993) both find that lagged stock market returns out-perform  $q$  as a predictor of future real investment.

<sup>24</sup> The F value is 5.25. Probability  $> F = 0.024$ .

<sup>25</sup> See Blanchard, Rhee, and Summers (1993) and Stein (1996) for a more detailed treatment of this issue.

<sup>26</sup> I tried adding further lags of these right-hand-side variables, but they contribute very little explanatory power, so they were dropped. Contemporaneous values of the terms of trade and the debt-to-gdp ratio were dropped for the same reason. I don't include contemporaneous GDP on the right hand side because of the obvious simultaneity bias. In fact, if there is serial correlation in the error term, including lagged GDP introduces the same bias. However, I tested for serial correlation and there was no evidence that this is a problem.

<sup>27</sup> These are available from the author upon request. Notable points about these estimates are that the year dummies in the early 80s are negative and significant, reflecting the effects of the Volcker recession. The Treasury bill rate and OECD industrial production variables have the expected *a priori* signs.

<sup>28</sup> I thank an anonymous referee for suggesting this example.