Capital Account Liberalization, Investment, and the Invisible Hand

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Abstract

Using a new dataset of 369 manufacturing firms in developing countries, we present the first firm-level analysis of capital account liberalization and investment. In the three-year period following liberalizations, the growth rate of the typical firm's capital stock exceeds its pre-liberalization mean by an average of 4.1 to 5.4 percentage points per year. We use a simple model of Tobin's *q* to decompose the firms' post-liberalization changes in investment into: (1) the country-specific change in the risk-free rate; (2) firm-specific changes in equity premia; and (3) firm-specific changes in expected future earnings. Panel data estimations show that an increase in expected future earnings of 1 percentage point predicts a 2.9 to 4.1 percentage point per-year increase in capital stock growth. The country-specific shock to firms' cost of capital predicts a 2.3 percentage point per-year increase in investment, but firm-specific changes in risk premia are not significant. The results stand in contrast to the view that investment and fundamentals are unrelated during liberalization episodes.

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Introduction

Broadly speaking, there are two views of capital account liberalization and the invisible hand. The first view sees the invisible hand as discerning. Removing restrictions on international capital movements permits financial resources to flow from capital-abundant countries, where expected returns are low, to capital-scarce countries, where expected returns are high. The flow of resources into the capital-scarce countries reduces their cost of capital, increases investment, and raises output (Fischer, 2003; Summers, 1998).

The second view sees the first as unsubstantiated and regards the invisible hand as indiscriminate. Indiscriminate hand proponents argue that liberalization does not produce a more efficient international allocation of capital. Instead, liberalizations generate speculative capital flows that are divorced from the fundamentals and have no discernible positive effects on investment, output, or any other real variable with nontrivial welfare implications (Bhagwhati, 1998; Stiglitz 1999, 2003).

While opinions about liberalization are abundant, facts are scarce (Fischer, 1998). This paper attempts to increase the ratio of facts to opinions. It does so by confronting the two views of liberalization with a new data set on investment, sales, and stock prices for 369 firms in a sample of developing countries that liberalized their stock markets—opened them to foreign investment—during the late 1980s and early 1990s.

Stock market liberalization may seem like a narrow way of defining capital account liberalization relative to the broad indices of capital account openness that are widely used in the literature. But there are several reasons why stock market liberalizations may be better suited to estimating the effects of capital account liberalization on investment. First, broad indices change gradually over time and therefore offer little variation with which to identify things. Second,

broad indices are based on the restrictions applied to an exhaustive list of possible capital transactions. So, when the index does change, it is not clear which of the myriad possible restrictions has been eased. Without knowing which restriction has been eased, it is unclear how to map the change in the index to a well-articulated model for the purpose of empirical estimation.

Since measurement error reduces the statistical power of any regression, it is important to focus on a setting where the true variation is large relative to any noise in the data. Stock market liberalizations provide just such a setting, because they constitute a radical shift in the degree of capital account openness. In addition to providing episodes of large changes in the degree of capital account openness, focusing narrowly on stock market liberalization offers another empirical advantage. Theory delivers clean predictions about the effect of stock market liberalization on the cost of capital and investment of the firms in the liberalizing countries. These predictions help confront the two opposing views of capital account liberalization with new empirical facts.

Figure 1 presents the first fact. Investment booms in the aftermath of liberalizations. For the average firm in our sample, the growth rate of the real value of the capital stock exceeds its pre-liberalization mean by 3.8 percentage points in the first year after liberalization, 5.4 percentage points in the second year, and 2.2 percentage points in the third. The fact is uncontroversial. Its interpretation is not.

The boom in Figure 1 could be driven by a discerning invisible hand allocating capital in response to the changes in economic fundamentals brought on by liberalization. Alternatively, Figure 1 could be evidence of an indiscriminate invisible hand permitting firms to engage in wasteful investment binges. The paper attempts to distinguish between these two competing

interpretations by analyzing whether firms' post-liberalization investment decisions reflect a rational response to the signals embedded in the stock price changes we also see when countries liberalize (Martell and Stulz, 2003; Stulz 1999). A change in a firm's stock price signals a change in one or both of the following fundamentals: (1) the firm's cost of capital; (2) the firm's expected future earnings.

In the pristine world of theory, stock market liberalization affects only the cost of capital, and the liberalization-induced change in the cost of capital works through two channels.[1] The first is a common shock to all firms in the economy—a fall in the risk-free rate as the country moves from financial autarky to integration with the rest of the world. The second is a firm-specific "beta" effect. With liberalization, the relevant benchmark for pricing the risk of individual stocks switches from the local stock market index to the world market index. Consequently, the equity premium falls for firms whose returns are less correlated with the world market than they are with the local market and *vice versa*. All else equal, the common shock to the cost of capital increases the average investment rate of all firms. The firm-specific shock implies that firms whose equity premia fall should invest even more than those whose premia rise. In other words, the beta effect of liberalization is more than an asset pricing result. The switch from financial autarky to optimal international risk sharing also requires the reallocation of physical capital in accordance with changes in systematic risk (Obstfeld and Rogoff, 1998). We use firm-level data to provide the first empirical test of this prediction.

In the murky world of empirical work stock market liberalizations coincide with other reforms such as trade liberalizations that will primarily affect firms' expected future earnings. Therefore, it is important to control for the possibility that any post-liberalization changes in

[1] Levine and Zervos (1998) argue that the link from liberalization to growth works through liquidity. We do not have firm-level liquidity data such as turnover and value traded to test for this channel.

investment may be driven by reform-induced changes in expected future earnings. We use a simple open-economy model of Tobin's *q* to decompose firms' post-liberalization changes in investment into: (1) changes in expected future earnings; (2) the change in the risk-free rate; and (3) changes in equity premia. We then use the cross sectional variation in the data for our 369 firms to identify the economic and statistical significance of each of the three effects.

Our identification strategy yields the second empirical fact. The cross-sectional variation in post-liberalization changes in investment is significantly correlated with the cross-sectional variation in changes in fundamentals. Panel data estimations show that a one percentage point rise in our measure of expected future earnings results in a 2.9 to 4.1 percentage point increase in the growth rate of the capital stock, depending on the specification. The common shock to firms' cost of capital is also important, as it generates a 2.3 percentage point per-year increase in investment. Firm-specific changes in the cost of capital—changes in equity premia—have no explanatory power.

In addition to providing the first attempt to use firm-level data to distinguish between opposing views of capital account liberalization, the paper makes two additional contributions. First, our data set provides a valuable new source of information to economists conducting research on the real effects of the economic reforms that spanned the late 1980s and early 1990s. Publicly available datasets such as Global Vantage and Worldscope contain virtually no data on firms in developing countries before the early 1990s and are therefore not suitable for studying the impact of these reforms on the economic decisions of firms in developing countries. In contrast, our firm-level dataset spans a sufficiently long period of time to provide an empirical

picture of developing countries before and after capital account liberalization.[2]

Second, firm level data may provide a more reliable empirical picture of the effects of capital account liberalization than previous studies that rely exclusively on macro data. For example, we know that aggregate investment rises in the aftermath of stock market liberalizations (Henry, 2000b). But it is not clear how much confidence we can have in an empirical result that attributes an economy-wide investment boom to a policy change that directly affects only those firms that are listed on the stock market. Similarly, the growth rate of GDP per capita increases in the aftermath of liberalizations (Levine, 2001). But since the link from liberalization to growth works through investment, it too, must be treated with skepticism. This point is reinforced by the implausibly large existing estimates of the effect of liberalization on growth (Henry, 2003).

Instead of using aggregate investment data as a proxy for the investment of the firms affected by liberalization, we use the investment of only those firms that are listed on the stock market. Instead of using GDP growth as a proxy for the effects of contemporaneous economic reforms on the expected future profitability of investment, we control directly for changes in profitability with the real value of sales taken from firms' income statements. With more reliable data we provide a small step towards more reliable inferences about the effects of liberalization on the reallocation of real resources.

[2] There are, however, important studies of reforms in developing countries, which use firm-level data that do not span the stock market liberalization period. For example, Harrison (1999) analyzes the effects of foreign direct investment (FDI) on the productivity of Venezuelan firms from 1976-89; Venezuela liberalized its stock market in 1990. Pavcnik (2002) analyzes the impact of trade liberalization on the productivity of Chilean firms from 1979-86; Chile liberalized its stock market in 1987.

1. Liberalization, Stock Prices and Firm-Level Investment

Figure 1 shows that firms increase their investment in the aftermath of liberalizations. The key question is whether the investment boom represents the profit-maximizing responses of a collection of firms, in line with a discerning invisible hand, or, an indiscriminate waste of real resources? Figure 2 begins to address the question—firms experience a large increase in Tobin's *q* when a liberalization takes place in the country in which they reside. The increase in Tobin's *q* comes from the increase in stock prices that occurs at liberalization (see Section 2). In turn, the increase in stock prices could be the result of an increase in expected future profitability and (or) a decrease in the cost of capital.

This section of the paper uses a simple model of investment to generate empirically testable, cross-sectional predictions about the connection between liberalization, stock prices, and investment. It does so by analyzing what happens to the investment of an all equity-financed firm when the country in which that firm resides moves from a regime where foreigners are not permitted to own shares and domestic residents are not permitted to invest abroad, to one where all stocks are fully tradable.[3]

1A. Firm-Level Investment Before the Liberalization

Consider a small country whose stock market is completely segmented from the world stock market and make all of the perfect capital markets assumptions that are necessary for the

[3] In practice, few countries go from being completely closed to being completely open. None of our results hang on this assumption, which is made for expositional convenience. See Chari and Henry (2004) for a detailed treatment of alternative assumptions.

Capital Asset Pricing Model (CAPM) to hold.[4] Next, consider the standard firm-level investment equation:

$$\left(\frac{I}{K}\right)_i = a + bq_i \tag{1}$$

Where a and b are constants both greater than zero and q is Tobin's q. The goal is to derive an expression of the form

$$\Delta\left(\frac{I}{K}\right)_i = b\Delta q_i \tag{2}$$

Where Δq_i is the change in Tobin's q that occurs when the country liberalizes. In order to do so, it is useful to express q_i as the capital market value of the firm divided by the replacement cost of the firm's capital stock in the goods market:

$$q_i = \frac{V_i}{P_{K_i} K_i} \tag{3}$$

Where P_{K_i} is the replacement cost of one unit of firm i's physical capital—the price of a new machine in the goods market; V_i is the capital market value of the firm, and K_i is the number of machines in place. Making the standard normalization, $P_{K_i} = 1$, yields the familiar textbook expression:

$$q_i = \frac{V_i}{K_i}.^{5} \tag{4}$$

Next, assume that the firm is 100 percent equity financed so that the capital market value of the firm is equal to the stock market value of its equity. We also assume that r is the risk-free

[4] Specifically, we assume that all investors in the world are identically risk averse, with a coefficient of relative risk aversion γ and care only about the expected return and variance of their investment. Further, we assume no transactions costs, homogeneous expectations, the existence of a safe asset, and perfectly competitive markets.

[5] See for example Obstfeld and Rogoff (1996) p. 112.

interest rate in the domestic economy and the firm generates a stochastic earnings stream, $\tilde{\pi}_i$, which is expected to grow at the rate g_i in perpetuity. It follows from our assumptions that the stock market value of the firm is:

$$V_i = \frac{\bar{\pi}_i}{[r + \theta_i - g_i]} \tag{5}$$

Where $\bar{\pi}_i$ is the expected value of $\tilde{\pi}_i$ and θ_i is the risk premium required to hold a share of firm *i*'s stock. Finally, substitute equation (5) for V_i in equation (4) to express q_i in terms of its primitives as follows:

$$q_i = \frac{\bar{\pi}_i}{K_i[r + \theta_i - g_i]} \tag{6}$$

1B. Firm-Level Investment After the Liberalization

Now suppose that the country opens its stock market to the rest of the world and also allows its residents to invest abroad. What is the impact of this policy change on firm *i*'s investment? Equation (6) shows that the answer depends on the effect that liberalization has on the fundamentals that determine stock prices—interest rates, risk premia, and the growth rate of earnings. So, let r^* be the world interest rate that prevails in the domestic economy following the liberalization, θ_i^* the risk premium required to hold a share of firm *i*'s stock, and g_i^* the expected future growth rate of earnings.

Interest rates, risk premia, and expected future growth rates may all change instantaneously in response to the news of liberalization. In contrast, the stock of capital, K_i, adjusts more slowly because it takes time to buy and install new capital goods. Hence, define "on-impact" as a period of time that is long enough for asset prices to adjust to liberalization but

too short for the capital stock, and let q_i* denote the on-impact value of Tobin's q for firm i. From this definition it follows that

(7) $$q_i^* = \frac{\overline{\pi}_i}{K_i\left[r^* + \theta_i^* - g_i^*\right]}$$

and the "on-impact"change in q_i is given by the following expression:

(8) $$\Delta q_i \equiv q_i^* - q_i = \lambda_i\left[\left(r - r^*\right) + \left(\theta_i - \theta_i^*\right) + \left(g_i^* - g_i\right)\right]$$

Where $\lambda_i = \dfrac{\overline{\pi}_i}{K_i\left[\left(r + \theta_i - g_i\right)\left(r^* + \theta_i^* - g_i^*\right)\right]}$

The on-impact change in Tobin's q will drive the subsequent adjustment in the capital stock. Assume that no further shocks occur after the liberalization has been implemented. In order to re-establish equilibrium, the cumulative change in the capital stock must equal the on-impact change in q.[6] In other words, we can substitute equation (8) for the Δq_i term on the RHS of equation (2) to obtain the desired expression for the liberalization induced change in investment:

(9) $$\Delta\left(\frac{I}{K}\right)_i = \lambda_i\left[\left(r - r^*\right) + \left(\theta_i - \theta_i^*\right) + \left(g_i^* - g_i\right)\right]$$

Because the pre and post liberalization risk premia (θ_i and θ_i^*) are not directly observable, we perform one more step of algebra to deliver an empirically testable equation. To do so, we use the following fact. In the context of the CAPM, $\theta_i = \{Cov(R_{i,}R_M)/Var(R_M)\}\overline{R}_M$ where R_M is the excess return on the domestic market portfolio and $\overline{R}_M$ is its expected value.

[6] In reality, adjustment costs may deter firms from installing capital until q is driven all the way back down to its pre-liberalization levels. This does not alter the general point that the general direction and magnitude of the adjustment in the capital stock depends on the change in q.

Similarly, $\theta_i^* = \{Cov(R_{i,}R_W)/Var(R_W)\}\overline{R}_W$ where R_W is the excess return on the world market portfolio and $\overline{R}_W$ is its expected value. Using these two definitions it is straightforward to show that:

$\theta_i - \theta_i^* = \gamma[COV(R_i, R_M) - COV(R_i, R_W)]$, where $COV(R_i, R_M)$ is the historical covariance of firm *i*'s stock return with the local market and $COV(R_i, R_W)$ is the historical covariance of firm *i*'s stock return with the local market (Chari and Henry, 2004). Throughout the rest of the paper, define $DIFCOV_i = COV(R_i, R_M) - COV(R_i, R_W)$.

It follows that equation (8) may be written as

$$\Delta\left(\frac{I}{K}\right)_i = \lambda_i\left[\left(r - r^*\right) + \gamma DIFCOV_i + \left(g_i^* - g_i\right)\right] \tag{10}$$

Discount Rates Cash Flows

The λ_i term in front of the brackets on the right-hand-side of (10) is a firm-specific scaling factor that has some technical implications for empirical estimation. We will discuss these implications in Section 5. But first we pause to understand the terms in brackets on the right-hand-side of equation (10), because they highlight the forces that drive the reallocation of capital following liberalization.

The first term, $(r - r^*)$ signifies that in the aftermath of liberalization, the benchmark risk-free rate for determining the hurdle rate for individual investment projects changes from r, the autarky rate to r^*, the world risk free rate. All else equal, investment will rise if $r^* < r$ and vice versa.[7] Importantly, this first term has no subscript, because it is a common shock that occurs to all firms when the country moves from autarky to financial integration.

[7] Since developing countries typically have lower capital to labor ratios than developed countries, we would expect *r* to exceed *r**But this need not be the case. See Henry (2000b) for a detailed discussion of the reasons why the autarky risk-free rate might be lower than the world risk free rate.

The second term, $DIFCOV_i$, does have a subscript. It indicates that the firm-specific change in investment that occurs with liberalization varies inversely with the change in the equity premium. When liberalization occurs, it alters the set of systematic risks faced by the representative investor; the relevant benchmark for pricing the risk of individual stocks switches from the local stock market index to a world market index. Consequently, liberalization reduces the equity premium for firms whose returns are more correlated with the local market than they are with the world market and increases the equity premium for firms whose returns are less correlated with the local market than they are with the world market.

Given the first term, $(r - r^*)$, the second implies that high $DIFCOV_i$ firms will experience a larger fall in the cost of capital than low $DIFCOV_i$ firms. All else equal, firms that experience a larger fall in their cost of capital should also experience more investment. In other words, while liberalization reduces the risk-free rate, and all firms should invest more on average, we should also observe larger increases in investment by firms that become less risky to hold following liberalization and vice versa.

The third term in equation (10), $(g_i^* - g_i)$, predicts that a firm's post-liberalization change in investment will depend positively on the change in its expected future growth rate of earnings. All else equal, the larger the increase in expected earnings, the more it will invest. Figure 3 demonstrates the empirical relevance of the $(g_i^* - g_i)$ term. Sales growth—our best proxy for earnings (see Section 2)—increases sharply following liberalizations. In the three-years preceding liberalization, the average growth rate of the real value of sales is negative 1.1 percent per year. In the three-year period following liberalization, the average growth rate rises to 10.1 percent.

All else equal, if capital account liberalization has any impact on resource allocation, it

does so primarily through its effect on the cost of capital—the common shock increases the average investment rate of all firms in the economy; the firm-specific shock means that high *DIFCOV* firms should experience even faster capital stock growth than low *DIFCOV* firms. However, capital account liberalizations coincide with important reforms (e.g. trade liberalization) that may increase economic growth and drive up the profitability of investment for some firms (Henry, 2000a).[8] In other words, investment could be increasing due to a fall in the cost of capital (driven by stock market liberalization) or because of an increase in sales growth (driven by other reforms). Distinguishing between alternative explanations requires further empirical investigation, but first we describe the data in more detail.

2. Data

Between 1980 and 1994, the IFC collected annual balance sheet and income statement data for a maximum of the 100 largest publicly traded, non-financial firms in eleven developing countries: Argentina, Brazil, India, Jordan, Korea, Malaysia, Mexico, Pakistan, Thailand, Turkey, and Zimbabwe. When deciding in which countries it would collect data, the IFC employed two screening criteria: (1) quality data had to be available for a reasonably large sample of firms; and (2) developing countries from each continent had to be represented. For several countries the sample begins after 1980, because the early years did not contain data of sufficiently high quality. In order for a country in the IFC database to be included in our sample, it must satisfy one additional criterion. The IFC's data for the country must exist before and after the year in which the country liberalized its stock market.

[8]While trade opening may increase growth on average, it will have heterogenous effects on firms. We do not explore the factors that drive the cross-sectional variation in the changes in sales growth, but the variation in changes in sales growth due to the heterogeneous effects of trade opening should be reflected in the stock price changes we use as right-hand-side variables (Grossman and Levinsohn 1989).

The before-and-after criterion, in combination with the short length of some countries' time series reduces our sample to 369 firms spread across five countries: India, Jordan, Korea, Malaysia, and Thailand. Despite its modest size, this sample of firms is better suited to addressing the question of whether liberalization affects firms' investment decisions than competing databases such as Worldscope and Global Vantage. The reason is that Data from Worldscope and Global Vantage do not satisfy the before-and-after criterion. The median stock market liberalization date in the sample is 1988 (see Table 1) and Worldscope and Global Vantage contain virtually no company data before that time.

The IFC database reports the nominal value of property, plant, and equipment on an annual basis. We divide the annual values by the local consumer price index (CPI) to create an index of each firm's real capital stock.[9] Although the data contain information about earnings before interest and taxes, we use sales as a proxy for earnings. Our reason for doing so is as follows. The data on earnings growth exhibit wild year-to-year fluctuations. In comparison, the sales growth numbers are relatively stable. Since sales revenue is relatively stable, the fluctuations in earnings imply either: (1) implausibly large year-to year fluctuations in unit costs; or (2) that firms manipulate their earnings numbers.[10] In light of concern about point (2), we feel more comfortable using sales growth as a proxy, albeit an imperfect one, for earnings growth. We divide the nominal value of each firm's sales by the CPI to create a real index.

For each firm in the sample, we also construct Tobin's *q*. For the numerator we use the sum of the market value of equity and the book value of debt (current and long-term liabilities).[11]

[9] Ideally, we would deflate each firm's capital stock by the rate of inflation of the set of the capital goods specific to each firm. We know of no such data.

[10] Firms have little incentive to manipulate sales, because corporate taxes are based on earnings not sales.

[11] In the absence of market values of debt, some U.S. studies convert book values to market values by capitalizing net interest payments using the yield on Moody's corporate A bond (Blanchard, Rhee, and Summers 1993). This

We use book values of debt because the IFC database does not contain information on market values. The denominator is the book value of total assets. The level of Tobin's *q* may not be directly comparable across countries, because of differences in accounting practices. For example, firms in India, Malaysia, and Jordan value assets using the practice of fair-market valuation in accordance with North American Generally Accepted Accounting Principles (GAAP). In contrast, Korea and Thailand rely on strict historic-cost accounting as in Germany and Japan. In light of these differences, changes in *q* provide more compatible cross-country measures (see Figure 2).

Table 1 summarizes the essential characteristics of the data. Column 1 provides the name of the country. Column 2 lists the year in which the country's stock market was liberalized.[12] Column 3 gives the number of firms in each country. Column 4 lists the ratio of stock market capitalization of the firms in the IFC sample to the total stock market capitalization of all publicly traded firms. The stock market capitalization of the 369 firms in our sample constitutes 40 percent of total stock market capitalization, confirming that these firms account for a significant fraction of economic activity in their respective countries. Having said that, the point should not be overstated, because publicly traded corporations in these countries make up a smaller fraction of the economic base than they do in the U.S. A reasonable summary is that the firms in our sample account for a significant and growing fraction of economic activity.

Although this paper is principally concerned with the cross-sectional variation in firms' investment during the post-liberalization period, it is useful to get a quick sense of the economic significance of the time series magnitudes as well. To do so we run a simple panel regression

conversion method cannot be applied in this paper, because we do not have data on corporate bond rates in these countries for the relevant time period.

[12] Henry (2000a), Martell and Stulz (2003) and the references therein provide an extensive discussion of stock market liberalization-dating methodology. Instead of repeating that discussion here, we simply use their dates.

that estimates the average firm's investment response to liberalization:

$$(11) \qquad \Delta(\ln K)_{ijt} = \alpha + Lib[0] + Lib[+1] + Lib[+2] + Lib[+3] + FIRM_i + \varepsilon_{ijt}$$

The left-hand-side variable in equation (11) is the growth rate of the capital stock of firm i in country j in year t. The variable $Lib[0]_j$ equals one in the year that country j liberalizes its stock market. The coefficient on $Lib[0]_j$ measures the abnormal increase in capital stock growth in year [0]. The variables $Lib[+1]_j$, $Lib[+2]_j$, and $Lib[+3]_j$ have analogous definitions and interpretations. *FIRM* is a set of firm-specific dummy variables, which means that the intercept term, α, measures the average change in the growth rate of the capital stock after removing firm-specific fixed effects. The estimation adjusts for the statistical concerns that arise about the error term, ε_{ijt}, because all firms in a given country share the same liberalization date.[13]

Table 2 presents the results. The growth rate of firms' capital stocks increase sharply in the aftermath of liberalizations and the effects are statistically significant at almost every time horizon. Column (1) presents estimates that include firm-fixed effects. Column (2) presents estimates that include country-fixed effects. Column (3) presents the estimates that control for fluctuations in the world business cycle.[14] Column (4) re-estimates the country-fixed effects model, but also includes controls for fluctuations in the world business cycle. All four regression specifications yield the same central result.

[13] Since all firms in a given country are "clustered' around the same liberalization date, the standard distributional assumptions about the error term may no longer obtain. We adjust for clustering by allowing the off-diagonal elements in the variance-covariance matrix, to be different from zero. The estimation procedure also corrects for potential heteroscedasticity across firms.

[14] The controls are: the contemporaneous growth rate of OECD industrial production, the three-month real US Treasury bill rate, and the 10-year real US government bond rate. Estimates using various leads and lags of all three business cycle controls were also tried but did not yield significantly different results.

It is useful to think about the economic significance of the estimates. Row 4 of Table 3 shows that the growth rate of the capital stock exceeds the pre-liberalization mean by 4.7 percentage points in years [0] and [+1], 8.2 percentage points in year [+2], and 6.9 percentage points in year [+3]. To get a rough sense of the output growth deviations that would be generated by the investment boom, multiply the estimated capital stock growth deviations by the elasticity of output with respect to capital. Assuming an elasticity of one-third yields the following output growth deviations: 1.6 percentage points in years [0] and [+1], 2.7 percentage points in year [+2], and 2.3 percentage points in year [+3]. Rough as they may be, these are large numbers with non-trivial implications for aggregate welfare given the size of these firms.

Keeping the time series magnitudes in mind, we now turn to the unresolved questions about the cross-sectional variation lurking behind the time series graphs: How much cross-firm variation do we see in the post-liberalization changes in investment? What are the liberalization-induced changes in fundamentals that drive the cross-firm variation in changes in Tobin's *q*? And, is there any systematic relation between these changes in firms' fundamentals and their post-liberalization investment decisions?

3. Investment and the Invisible Hand: A First Look at the Cross-Section

Since changes in stock prices are a summary statistic for changes in the fundamentals, we begin by analyzing the correlation between changes in stock prices and changes in investment. In principle, we should analyze the correlation between changes in Tobin's *q* and changes in investment. In practice, changes in our measure of Tobin's *q* are driven almost exclusively by changes in stock prices, because we only have data on the book value of the firms' debt and not the market value. Therefore, in this section and all that follow, we will use changes in firms'

stock prices as a proxy for changes in q.

3A. Are the Changes in Stock Prices Correlated With the Changes in Investment?

Are the liberalization-induced changes in stock prices correlated with the post-liberalization changes in investment? To the extent that a firm's stock price response at the time of liberalization reflects the unexpected change in the present value of current and future earnings, the stock price responses should have some predictive power for the post-liberalization changes in investment. To that end, define the variable $DELTAPLIB_i$ as the unexpected percentage change in firm i's real stock price during the liberalization year.

For purposes of measuring the investment response to stock market liberalization, the variable of interest is the abnormal growth rate in the capital stock relative to some benchmark. For each firm in the sample, let $KHATDEV_{it}$ be the growth rate of firm i's capital stock in year t minus the average growth rate of firm i's capital stock in the three-year period preceding the liberalization (years [-3, -1]). If the sample mean of a firm's capital stock growth rate is taken as a proxy of its expected future growth rate, then the deviation of capital stock growth from its firm-specific sample mean is a reasonable metric of the shock to capital stock growth.[15] Next, define the variable $SUMKHATDEV_i$ as the sum of the deviations over the four-year window that includes the liberalization year and the three subsequent years (i.e. for t in [0, +3]).

We test whether the variable $DELTAPLIB_i$ helps predict the unexpected increase in firm level investment post liberalization by considering the set of all ordered pairs ($DELTAPLIB_i$, $SUMKHATDEV_i$). If the discerning invisible hand view is correct, then these points should lie

[15] Our results are not sensitive to the definition of the pre-liberalization period. We obtain similar results when *KHATDEV* is defined as *KHAT*(*t*) minus the average growth rate of *K* over the entire pre-liberalization period.

on an upward sloping line. Figure 4 shows that they do. The graph exhibits a positive relation between abnormal capital stock growth in the post liberalization period and the on-impact change in stock prices (Standard errors in parentheses; Adjusted R-Squared=0.02; N= 369):

(12) $$SUMKHATDEV_i = 0.004 + 0.185\, DELTAPLIB_i$$
$$(0.062)\ \ (0.072)$$

The variable $DELTAPLIB_i$ has the predicted sign, and a simple numerical calculation illustrates the economic significance of equation (12). The average firm in our sample experiences a stock price change of 51percent during liberalization. Multiplying this number by the coefficient on $DELTAPLIB_i$ (0.185) yields a number of .094. This means that over the four-year-liberalization window, the cumulative deviation of the growth rate of the average firm's capital stock from its pre-liberalization mean is 9.4 percentage points.

Turning from economic to statistical significance, $DELTAPLIB_i$ is significant at the one percent level, but the point should not be overstated. The data are noisy and the low R-Squared indicates that there is much unexplained variation. Nevertheless, it does appear that, on average, the larger the impact of liberalization on a firm's stock price, the larger is its post-liberalization increase in capital stock growth.

Having observed that the on-impact changes in stock prices are positively correlated with the post-liberalization changes in investment, the next task is to determine the extent to which the positive correlation stems from changes in the underlying fundamentals that drive the changes in stock prices. Following equation (10) we begin by examining the data for evidence that changes in sales growth drive changes in investment.

3B. Do Changes in Expected Future Profitability Drive the Changes in Investment?

Does cross-firm variation in the growth rate of sales explain the cross-firm variation in the post-liberalization changes in investment? As before, we are interested in the shock—the abnormal change in the growth rate of sales during the post-liberalization period. So, define $SHATDEV_{it}$ as the growth rate of firm *i*'s sales growth in year *t* minus the average growth rate of firm *i*'s sales in the three-year period preceding the liberalization. Next, define the variable $SUMSHATDEV_i$ as the sum of the deviations over the four-year window that includes the liberalization year and the three subsequent years (i.e. for *t* in [0, +3]) and consider the set of all ordered pairs of [$SUMSHATDEV_i$, $SUMKHATDEV_i$]. Again, if the theory is correct, these points should lie on an upward sloping line. Figure 5 illustrates that there is indeed a positive relation between the post-liberalization growth rate of the capital stock and the change in the expected future growth rate of sales (Standard errors in parentheses; Adjusted R-Squared=0.081; N=369):

(13)
$$SUMKHATDEV_i = \underset{(0.048)}{0.070} + \underset{(0.050)}{0.289}\, SUMSHATDEV_i$$

Again, a simple numerical calculation illustrates the economic significance of the results. First, suppose a firm experiences an average sales surprise of 10 percent per year during liberalization. The coefficient on the sales surprise variable in the panel estimations is 0.3. Multiplying the coefficient with the average sales surprise suggests that the growth rate of the capital stock for this firm will deviate from its pre-liberalization mean by 3 percent. The firms in the sample used in this paper experienced an average sales surprise of 7.1 percent per year during the liberalization window. A sales surprise of this magnitude suggests that, for an average firm in the sample, the deviation of the growth rate in the capital stock from its pre-liberalization mean during liberalization is 2.36 percent.

3C. Do Changes in Risk Sharing Drive Changes in Investment?

The first step in determining whether changes in risk premia drive the changes in investment is to provide an empirical measure of the $DIFCOV_i$ variable in equation (10). We define $DIFCOV_i$ as the historical covariance of firm *i*'s returns with the local market minus its historical covariance with the world market. If the discerning invisible hand view is correct, then high $DIFCOV$ firms should experience faster capital stock growth than low $DIFCOV$ firms in the aftermath of liberalizations. Figure 6 presents a scatter plot with $DIFCOV_i$ on the x-axis and $SUMKHATDEV_i$ on the y-axis (Standard errors in parentheses; R-Squared=0.00; N=369):

$$SUMKHATDEV_i = \underset{(0.048)}{0.087} + \underset{(0.852)}{0.512}\ DIFCOV_i . \tag{14}$$

There is no significant correlation between *DIFCOV* and investment, but it is important to interpret the data properly. Equation (14) says that changes in risk premia do not drive firms' post-liberalization changes in investment. This does not imply that all changes in the cost of capital are irrelevant, because there are two components to the change in a firm's cost of capital—the common shock and the change in its risk premium. Determining whether the common shock to the cost of capital matters for firms' investment requires a bit more work. A quick review of the facts helps make the point.

Firms increase their investment in the aftermath of liberalizations (Figure 1). The increases in investment are positively correlated with the liberalization-induced stock price changes (Figure 4). Since stock prices change for three reasons—changes in cash flows, risk premia, and interest rates—we decomposed the cross-sectional correlation between changes in investment and changes in stock prices into the correlation between changes in investment and

changes in the fundamentals that drive the stock price changes. This decomposition reveals that changes in expected future sales growth are positively correlated with changes in investment (Figure 5), but changes in risk premia are not (Figure 6). Taken together, these facts beg the following question: Is the increase in investment that cannot be explained by changes in sales growth driven by the common shock to the cost of capital? Or are changes in sales growth the only thing that matters? This is the question to which we now turn.

4. Estimating the Investment Response: Methodology and Empirical Results

The goal is to decompose the changes in investment that occur at liberalization into the fundamentals that drive the changes in investment. Recall equation (10)

$$\Delta\left(\frac{I}{K}\right)_i = \lambda_i\left[\left(r - r^*\right) + \gamma DIFCOV_i + \left(g_i^* - g_i\right)\right] \tag{10}$$

Where $\lambda_i = \dfrac{\overline{\pi}_i}{K_i\left[\left(r + \theta_i - g_i\right)\left(r^* + \theta_i^* - g_i^*\right)\right]}$, the firm-specific scaling factor.

The terms inside the brackets on the right-hand-side say that changes in risk sharing, the common shock, and sales growth are the fundamentals that will drive firms' post-liberalization-changes in investment. Equations (12) through (14) exploit these predictions, but are subject to the potential concern that they do not account for the firm-specific scaling factor, λ_i, that appears in front of the brackets. The presence of the λ_i's does not change the qualitative interpretation of the results thus far, but it does calls for a more nuanced interpretation of equation (9) in its entirety. Specifically, we need to assess whether the λ_i's play an important quantitative role that is not captured by equations (12) through (14).

4A. Methodology

If the λ_i's were observable, we could transform the terms in brackets to yield an equation with constant-coefficients on the variables of interest. The problem is that the λ_i's are not observable, which leaves us with two choices for empirical estimation. The first option would be to estimate equation (10) using a random coefficients model that accounts for the firm-specific regression coefficients on sales growth, the common shock, and $DIFCOV_i$.

The Random Coefficients model produces estimates using a two-step procedure. The first step adjusts for firm scale effects in the following fashion. For a given firm and right-hand-side variable (e.g. sales growth), random coefficients uses the time variation in the right-hand-side variable to generate an Ordinary Least Squares (OLS) regression coefficient. This coefficient measures the firm-specific effect of that right hand side variable (e.g. sales growth) on investment. The first step is then repeated for each firm in the sample. The second step in the procedure uses the entire set of firm-specific OLS estimates to create a single estimate of the effect of the right-hand-side variable on investment. It does so by using the λ_i's to generate a weighted average of the firm-specific OLS coefficients.

The problem with the random coefficients procedure is that it requires time variation in the right-hand-side variables. By definition, one of our central right-hand-side variables, *DIFCOV*, does not exhibit any time series variation. For each firm, $DIFCOV_i$ is simply one number—the historical covariance of firm *i* with the local market minus its historical covariance with the world market.

Because the data do not admit the use of a random coefficients model to account for the scale effects in (10), we begin by estimating a more parsimonious panel specification:

(15) $$KHATDEV_{ijt} = \alpha_i + CNTRY_j + \beta_2 SHATDEV_{ijt} + \beta_1 DIFCOV_{ij} + \varepsilon_{ijt},\ t \in [0,+3]$$

The extent to which equation (15), our empirical approximation to equation (10), hinders interpretation largely depends on what one wants to do with the results. Since the data do not permit strict adherence to equation (10) it is important not to overstate the quantitative relations we uncover. On the other hand, equation (15) captures all of the essential qualitative elements present in the structural decomposition of equation (10). As the goal is to provide a first step towards understanding whether there is any significant qualitative relation between changes in fundamentals and the post-liberalization changes in investment, the approach seems reasonable. In Section 5C we will analyze whether ignoring the scale effect has a large quantitative effect on the results. We will do so by estimating the effect of sales growth on investment using a random coefficients specification. If the scale effects are significant, then the random coefficients estimate of sales growth on investment should differ substantially from the estimates we get using equation (15).

The logic of our empirical specification (15) is transparent. Post-liberalization investment is driven by changes in three key fundamentals: changes in sales growth, changes in risk premia, and the common shock. Since *DIFCOV* controls for the effect of changes in firm-specific risk premia and *SALESURP* controls for firm-specific shocks to sales growth, it follows that the constant α captures the common shock to the cost of capital $(r - r^*)$. The country-specific dummy variable $CNTRY_j$ accounts for the possibility that the magnitude of the common shock differs across countries. Recalling the discussion in Section 3, it bears repeating that, by definition, *SALESURP* controls for all shocks to cash flows: those incidental to stock market liberalization, those resulting from the effects of other reforms such as trade liberalization, and those due to any other unexpected shocks.

The left-hand-side variable in (15) is the deviation of firm *i*'s capital stock growth from

its firm-specific mean. The subscript *t* indicates the time variation in that variable. We are estimating the investment response over the years [0, +3]. The panel regression pools all firms together, so even though $DIFCOV_i$ does not vary over time for any given firm, it does vary across firms for any given time period. Equation (15) uses precisely this cross firm variation in $DIFCOV_i$ for any given time period to estimate the coefficient on $DIFCOV_i$. Again, it is worth noting that the absence of within firm (time series) variation in $DIFCOV_i$ makes it impossible to estimate the firm-specific effects of *DIFCOV* using random coefficients estimation. In contrast to $DIFCOV_i$, Equation (15) estimates the beta coefficient on *SALESURP* by making use of both the time series variation in sales growth within a firm and the cross-sectional variation in sales growth among firms. To see this, simply note that the *SALESURP* variable has both a firm and time subscript.

The usual assumption that the error term is random and uncorrelated across firms also requires further discussion. When aggregating across firms, event studies typically assume that the deviations of the left-hand-side variable are not correlated. Under this assumption, standard distributional results may be used to calculate the variance of the aggregated deviations. The assumption of no correlation across firms is reasonable if the event dates for individual firms do not overlap in calendar time. In the case of a liberalization event, however, all firms in a country share an identical event date. The clustering of firms around a common event date means that the covariances between individual firm capital stock growth rate deviations may not be zero, in which case the standard distributional results no longer obtain.

We address the problem of clustering in the standard fashion—by relaxing the assumption that abnormal returns are not correlated across firms. Specifically, we allow the off-diagonal (covariance) elements in the variance-covariance matrix, to be different from zero. In

short, the clustering procedure produces standard errors that are appropriately adjusted to reflect the cross-firm correlation of deviations of capital stock growth rates. The estimation procedure also corrects for potential heteroscedasticity across firms.

4B. Results

Table 3 reports the estimations of equation (15). All the regressions include country-fixed effects. Column (1) reports the regression of *KHATDEV* on a constant and country fixed effects with no other controls. The coefficient on the constant is 0.041 and is significant at the one percent level. This means that in the post-liberalization period (years [0, +3]) the growth rate of the capital stock is on average 4.1 percentage points higher than its average pre-liberalization growth rate.

Column (2) reports the regression of *KHATDEV* on a constant and SHATDEV—the shock to expected future sales growth. Again, the constant remains economically significant (0.020) and is statistically significant at the five-percent level. The coefficient on *SHATDEV* is 0.292 and is significant at the one-percent level. A numerical example illustrates the economic significance of the results from the panel estimations. First, suppose a firm experiences an average sales surprise of 10 percent per year during liberalization. The coefficient on the sales surprise variable in the panel estimations is 0.292. Multiplying the coefficient with the average sales surprise suggests that the growth rate of the capital stock for this firm will deviate from its pre-liberalization mean by 2.92 percentage points.

The firms in the sample used in this paper experienced an average sales surprise of 7.1 percent per year during the liberalization window. A sales surprise of this magnitude suggests that, for an average firm in the sample, the deviation of the growth rate in the capital stock from its pre-liberalization mean during liberalization is 2.43 percentage points. The size of the

coefficient on *SHATDEV* indicates the importance of controlling for shocks to expected future cash flows that may be induced by other reforms.

Column (3) of Table 3 reports the regression of *KHATDEV* on a constant and *DIFCOV*. The constant in this specification is 0.028 and significant at the one percent level. The coefficient on DIFCOV, 0.037, is positive as predicted by the theory, but the effect is statistically insignificant.

Column (4) reports the regression of *KHATDEV* on a constant with both sales growth and *DIFCOV* included simultaneously. This regression provides the full decomposition suggested by equation (15). The only statistically significant variable in this regression is *SHATDEV*, which has a coefficient of 0.289 that is significant at the 1 percent level.

The variable *DIFCOV*, is not significant in any of the first four regressions in Table 3. The lack of a significant coefficient on *DIFCOV* indicates that firm-specific changes in the cost of capital do not drive the post-liberalization changes in investment, but this does not necessarily mean that the cost of capital does not matter. Since the constant is significant in 3 of the 4 regressions above, there is some evidence that the common shock to the cost of capital matters.

On the other hand, interpreting a significant constant as the effect of the common shock on investment is not without difficulties. In theory, the constant measures that part of the post-liberalization increase in investment that is due to the common shock to the cost of capital (the fall in the risk-free rate). While the constant may be capturing the common shock, it could also be picking up the effect of an unobserved regime shift that has nothing to do with the cost of capital—a spike in investment due to some omitted variable that is important for investment but lies outside of our model, for example. Therefore, it is important to scrutinize whether the constant in particular, and the cost of capital in general, really matter for investment.

In order to do so we run a series of regressions that take the form of equation (15) but now include *DELTAPLIB* on the right-hand side. Recall that *DELTAPLIB* is the unexpected percentage change in the real stock price of firm *i* during the liberalization year.

First, we examine whether there is any evidence that changes in the overall cost of capital drive changes in investment, without trying to disentangle whether it is the common or firm-specific shock that matters. We do so by regressing *KHATDEV* on a constant, *SHATDEV* and *DELTAPLIB*. The logic of this regression is straightforward. Theory says that *DELTAPLIB* is driven by changes in earnings and changes in the cost of capital. Since we are controlling for changes in expected future sales growth with *SHATDEV*, it follows that a significant coefficient on *DELTAPLIB* indicates a significant effect of the cost of capital on investment. Column (5) of Table 3 reports the results. The coefficient on *DELTAPLIB* is 0.029 and significant at the 5 percent level. This is a smaller coefficient than the one in Figure 4 (0.072), but it is still economically significant and suggests that firms post-liberalization changes in investment are significantly related to changes in their overall cost of capital.

Next, we scrutinize the constant. By definition, the variable *DELTAPLIB* measures the change in investment that is due to both the common shock and the firm-specific shock to the cost of capital. If the constant in specifications (1) through (3) is picking up some spurious regime shift in investment that is unrelated to the common shock to the cost of capital, then the constant should be unaffected by the inclusion of *DELTAPLIB* on the RHS. But the constant is no longer significant in specification (5). We also ran an additional regression that only includes *DELTAPLIB* (without *SHATDEV*) on the right-hand side. Column (6) of Table 3 reports the results this regression. The coefficient on DELTAPLIB is significant—the constant is not.

To confirm that there is no significant role for the firm-specific change in the cost of

capital, we run one final benchmark specification. We regress *KHATDEV* on a constant, *SHATDEV*, *DIFCOV* and *DELTAPLIB*. Column (7) of Table 3 reports the results. The coefficient on *DELTAPLIB* is 0.042 and significant at the 5 percent confidence level. The coefficient on *SHATDEV* is 0.317 and significant at the one percent level. The coefficient on *DIFCOV* remains economically and statistically insignificant.

4C. Are the Results Sensitive to the Definition of The Capital Stock Growth Shocks?

The results in Table 3 are not sensitive to the definition of *KHATDEV*. Recall that for the regressions in Table 3 $KHATDEV_{it}$ is defined as the growth rate of firm *i*'s capital stock in year *t* minus the average growth rate of firm *i*'s capital stock in the three-year period preceding the liberalization (years [-3, -1]). Instead, now define $KHATDEV1_{it}$ as the growth rate of firm *i*'s capital stock in year *t* minus the average growth rate of firm *i*'s capital stock in the entire pre-liberalization period. We ran all of the specifications in Table 3 using *KHATDEV1* instead of *KHATDEV*. Table 4 shows that the results are essentially the same as those in Table 3. SHATDEV is always significant, *DELTAPLIB* is usually significant and *DIFCOV* never matters.

As additional robustness checks, we also ran two additional sets of regressions. The first uses the variable $SUMKHATDEV_i$ as the left-hand-side variable. For a given firm, $SUMKHATDEV_i$ is defined as the sum of $KHATDEV_{it}$ over the four-year post-liberalization window, which includes the liberalization year and the three subsequent years (i.e. for *t* in [0, +3]). The second uses the variable $SUMKHATDEV1_i$ as the left-hand-side variable. For a given firm, $SUMKHATDEV1_i$ is defined as the sum of $KHATDEV1_{ijt}$ over the four-year post-liberalization window. Table 5 presents the results that use *SUMKHATDEV*. Table 6 presents the results that use *SUMKHATDEV1*. In reading these tables, the interpretation of the

coefficients changes because the left-hand-side variable now measures the cumulative sum of the capital stock growth shocks (explain). Other than that, the results in both Table 5 and Table 6 corroborate the benchmark evidence in Table 1.

4D. Does Random Coefficients Estimation Alter the Results?

All of the regression specifications in Tables 3 through 6 estimate some version of equation (15), but none of the specifications adjust for the firm-specific scale effects suggested by equation (10). So it is important to investigate whether using equation (15), instead of random coefficients, introduces important qualitative biases into the results. If scale effects are significant, the random coefficients estimate will differ from the earlier panel regressions that do not adjust for the firm-specific scale effects. Hence, we further examine the robustness of our results by regressing deviations of capital stock growth on deviations of sales growth using the following random coefficients specification:

$$KHATDEV_{ijt} = \alpha + CNTRY_j + \beta_i SHATDEV_{ijt} + \varepsilon_{ijt},\ t \in [0,+4]. \tag{16}$$

It is important to remember that the coefficient on *SHATDEV* is firm specific. For the reasons outlined in the earlier methodological discussion, we cannot include the variables DIFCOV and DELTAPLIB because they are purely cross-sectional in nature. Hence (16) basically amounts to running the same specification as the one used to produce the estimates reported in Row (2) of Table 3, except that we are now using random coefficients.

The random coefficients estimate of the effect of sales growth on investment using equation (16) delivers the same qualitative message as the specification in equation (15). A shock to expected future sales growth has a positive and statistically significant effect on investment. Using the definition of *KHATDEV* as the left-hand-side variable yields the

following results. The coefficient on *SHATDEV* is 0.167 (with a standard error of 0.036) and is significant at the 1 percent level; the constant is 0.015 (with a standard error of 0.007) and is significant at the 5 percent level. We also ran the procedure using *KHATDEV1* as the left-hand-side variable and obtained almost identical results. The coefficient on *SALES* is 0.167 with a standard error of 0.036; the constant is 0.013 with a standard error of 0.006.

The central message of this subsection can be summarized as follows. Qualitatively, the random coefficients estimate of the coefficient on *SHATDEV* has the same sign as the coefficient from the panel regression. Quantitatively, the random coefficients estimate of the coefficient on *SHATDEV* is also similar to the coefficient from the panel regression. The fact that the coefficient on sales and the constant in the random coefficients regression are not very different than the coefficients in the strictly cross-sectional regression suggests that not adjusting for the λ_i does not radically bias our results.

5. Why Does Risk Sharing (DIFCOV) Not Matter For Investment?

After controlling for expected future sales growth, stock prices matter for investment in almost every specification. Yet *DIFCOV* is statistically and economically insignificant in every single specification. The unavoidable conclusion would seem to be that if changes in the cost of capital do drive investment, the common shock to the cost of capital matters far more than changes in risk premia. The empirical result that risk sharing does not seem to matter for the allocation of real resources stands in sharp contrast with the predictions of models in open economy macro. For example, by enabling domestic residents to engage in international risk sharing, capital account liberalization should encourage firms to adopt high growth projects that were too risky to adopt in autarky (Obstfeld, 1994).

The expression for the liberalization-induced change in a firm's cost of capital provides a simple explanation for why *DIFCOV* does not seem to matter:

$$\Delta\rho_i = (r - r^*) + \gamma DIFCOV_i \quad . \tag{17}$$

Equation (17) once again makes the point that the change in the cost of capital following stock market liberalization stems from two shocks. The first is the common shock, which is the change in the interest rate and is the same across all firms. The second is the firm-specific shock to the equity premium, which is driven by the sign and magnitude of $DIFCOV_i$. By definition, firm-specific shocks are the only source of cross-sectional variation in changes in the cost of capital. If the common shock dominates the firm-specific shocks then there will be little cross-sectional variation in changes in the cost of capital and $DIFCOV_i$ will not have much explanatory power.

A simple numerical example underscores the point. The common shock associated with liberalization is typically about 7 percentage points (Chari and Henry, 2004). The average value of $DIFCOV_i$ in our sample is 0.015. Assuming that the coefficient of relative risk aversion, γ, takes a reasonable value such as 2, the firm-specific change in the cost of capital is 3 percentage points (2 times 0.015). So, the total change in the cost of capital for the average firm in the sample is 10 percentage points. These calculations imply that the fall in the risk free rate accounts for 70 percent of the fall in the cost of capital.

An alternative explanation is that risk sharing only affects the cost of capital for those firms that actually become eligible for purchase by foreigners. When countries liberalize, some publicly listed firms become eligible for foreign ownership (investible), while others remain off limits (non-investible). Using data from the IFC's Emerging Markets Database, Chari and Henry (2004) show that *DIFCOV* robustly explains the change in the cost of capital for investible firms,

but is never significant for non-investible firms. It is possible that the cross-sectional reallocation of capital is significantly correlated with *DIFCOV* for the investible firms in our sample, but the relation is masked because the investible and non-investible firms are grouped together.

The investible and non-investible firms are grouped together in our sample, because data limitations prevent us from doing otherwise. Unlike the Emerging Markets Database, The IFC Corporate Finance Database we employ here does not identify investible and non-investible firms. Our attempts to merge the two databases yielded a small sample of 61 investible and 28 non-investible firms on which we were reluctant to pursue formal statistical testing.

6. Conclusion

Typical analyses of the gains from trade in risky assets calibrate the hypothetical welfare losses associated with the lack of international risk sharing. This paper adopts a different tack. It estimates the extent to which an actual change in the ability of a country to share risk changes its allocation of real resources. The evidence seems roughly consistent with the discerning view of the invisible hand. While there is much unexplained variation in investment, it is hard to argue that the invisible hand behaves in a completely indiscriminate manner when it allocates capital to firms on the basis of changes in the cost of capital and expected future sales growth.

Yet there are reasons to be circumspect. Country-specific changes in the cost of capital are significant. This suggests that the invisible hand efficiently moves capital from low to high-return countries. But the insignificant effect of firm-specific changes means that the invisible hand may not achieve an efficient reallocation of capital across firms within a given country. While there are many questions still unanswered, the paper does bring us a step closer to

understanding whether capital account liberalization promotes efficient resource allocation. Applied to better data in the future, the firm-level identification strategy developed here may bring us yet nearer.

References

Bekaert, Geert, Harvey, Campbell and Lundblad, Christian (2001). "Does Financial Liberalization Spur Growth?" NBER Working Paper No. 8245, 2001.

Bhagwati, Jagdish (1998). "The Capital Myth" *Foreign Affairs*, May/June pp. 7-12.

Blanchard, Olivier J., Rhee, C., and Lawrence Summers (1993). "The Stock Market, Profit, and Investment" *Quarterly Journal of Economics*, Vol. 108, pp. 115-36

Chari, Anusha and Peter Blair Henry (2003). Risk Sharing Asset Prices: Evidence From a Natural Experiment, *Journal of Finance*, Forthcoming.

Fischer, Stanley (1998). Capital Account Liberalization and the Role of the IMF *Princeton Essays in International Finance* 207, 1-10.

Fischer, Stanley (2003). "Globalization and Its Challenges" *American Economic Review* Vol. 93, No. 2, 1-30. May 2003

Frankel, Jeffrey, 1994, "Introduction" in Jeffrey A. Frankel, ed. *The Internationalization of Equity Markets*, 231-271 (University of Chicago Press: Chicago and London).

Henry, Peter Blair 2003. Capital Account Liberalization, The Cost of Capital, and Economic Growth. *American Economic Review*, Vol. 93, No. 2, 91-96.

Henry, Peter Blair. (2000a). "Stock Market Liberalization, Economic Reform, and Emerging Market Equity Prices," *Journal of Finance*, Vol. 55, No. 2, pp. 529-64.

Henry, Peter Blair. (2000b). "Do Stock Market Liberalizations Cause Investment Booms?" *Journal of Financial Economics*, Vol. 58, Nos. 1-2, pp. 301-334.

Johnson, Simon, John McMillan and Christopher Woodruff (2002). "Property Rights and Finance," *American Economic Review*, 92, 5, pp. 1335-1356.

Johnson, Simon, Rafael La Porta, Florencio Lopez-De-Silanes and Andrei Shleifer (2000). "Tunneling," *American Economic Review*, 90, 2, pp. 22-27.

Johnson, Simon and Todd Mitton (2003). "Cronyism and Capital Controls: Evidence From Malaysia," *Journal of Financial Economics*, 67,2, pp. 351-382.

Johnson, Simon, Peter Boone, Alasdair Breach and Eric Friedman (2000). "Corporate governance in the Asian financial crisis, 1997-98," 58,1-2, pp. 141-186

LaPorta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny (1997). "Legal Determinants of External Finance," *Journal of Finance*, 52, pp. 1131-50.

LaPorta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer and Robert Vishny (1998). "Law and Finance," *Journal of Political Economy*, Vol. 106, pp. 1113-1155.

LaPorta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny (2002) "Investor Protection and Corporate Valuation," *Journal of Finance*.

Levine, R. and S. Zervos, (1998). "Stock markets, banks, and economic growth," *American Economic Review*, 88, pp. 537-558.

Levine, Ross (1997). "Financial Development and Growth: Views and Agenda" *Journal of Economic Literature*, 35, 2, pp. 688-726.

Levine, Ross (2001). "International Financial Liberalization and Economic Growth" Review of International Economics, 9, 4, pp. 688-702.

Morck, Randall and Bernard Yeung (2003). "Value Enhancing Capital Budgeting and Firm Specific Stock Returns" *Journal of Finance,* Forthcoming.

Morck, Randall, Andrei Shleifer, and Robert Vishny (1990). "The Stock Market and Investment: Is the Market a Sideshow?" *Brookings Papers on Economic Activity*, pp. 157-215.

Morck, Randall, Bernard Yeung, and Wayne Yu. (2000). "The Information Content of Stock Markets: Why Do Emerging Markets Have Synchronous Stock Price Movements?" *Journal of Financial Economics*, Vol. 58, pp. 215-260

Obstfeld, Maurice (1994). "Risk-Taking, Global Diversification and Growth," American Economic Review, Vol. 84, No. 5, pp. 1310-1329.

Obstfeld, Maurice (1998). "The Global Capital Market: Benefactor or Menace?" *Journal of Economic Perspectives*, Vol. 12, No.4, pp. 9-30.

Obstfeld, Maurice and Ken Rogoff (1996). Foundations of International Macroeconomics. MIT Press, Cambridge, MA.

Rajan, Raghuram and Luigi Zingales (1998a). "Financial Development and Growth." *American Economic Review*, 88, pp. 559-86.

Rajan, Raghuram and Luigi Zingales (2001). "The Great Reversals: The Politics of Financial Development in the 20th Century," *Journal of Financial Economics*, 69, 1, pp. 3-34.

Rajan, Raghuram and Luigi Zingales (1998b). "Which Capitalism? Lessons from the East Asian Crisis," *Journal of Applied Corporate Finance,* 11, 2, pp. 40-48.

Rogoff, Kenneth (1999). "International Institutions for Reducing Global Financial

Instability," *Journal of Economic Perspectives*, Vol. 13, No. 4, pp.21-42.

Stiglitz, Joseph (2002). *Globalization and Its Discontents*, W.W. Norton, New York.

Stiglitz, J., 1999. Reforming the global economic architecture: lessons from recent crises. Journal of Finance 54, 1508-1521.

Stulz, René M. and Rodolfo Martell (2003a). "Equity Market Liberalizations as Country IPOs" American Economic Review Vol. 93, No.2, 97-101

Stulz, René M. (2003b). "Should We Fear Capital Flows?" in Leonardo Auernheimer, ed. *International Financial Markets: The Challenge of Globalization*. University of Chicago Press, Forthcoming.

Stulz, René M. (1999). "International Portfolio Flows and Security Markets" in Martin Feldstein, ed. *International Capital Flows.* Chicago: University of Chicago Press.

Summers, Lawrence H. "International Financial Crises: Causes, Prevention, and Cures," *American Economic Review*, 2000, Vol. 90, No.2, pp. 1-16.

Summers, Lawrence (1985). "On Economics and Finance," *Journal of Finance*, Vol. 40, No.3, pp. 633-35.

Wurgler, Jeffrey (2000). "Financial Markets and the Allocation of Capital," *Journal of Financial Economics*, Vol. 58, pp. 187-214.

Figure 1.
The Growth Rate of Firms' Capital Stocks Increases Following Stock Market Liberalizations.

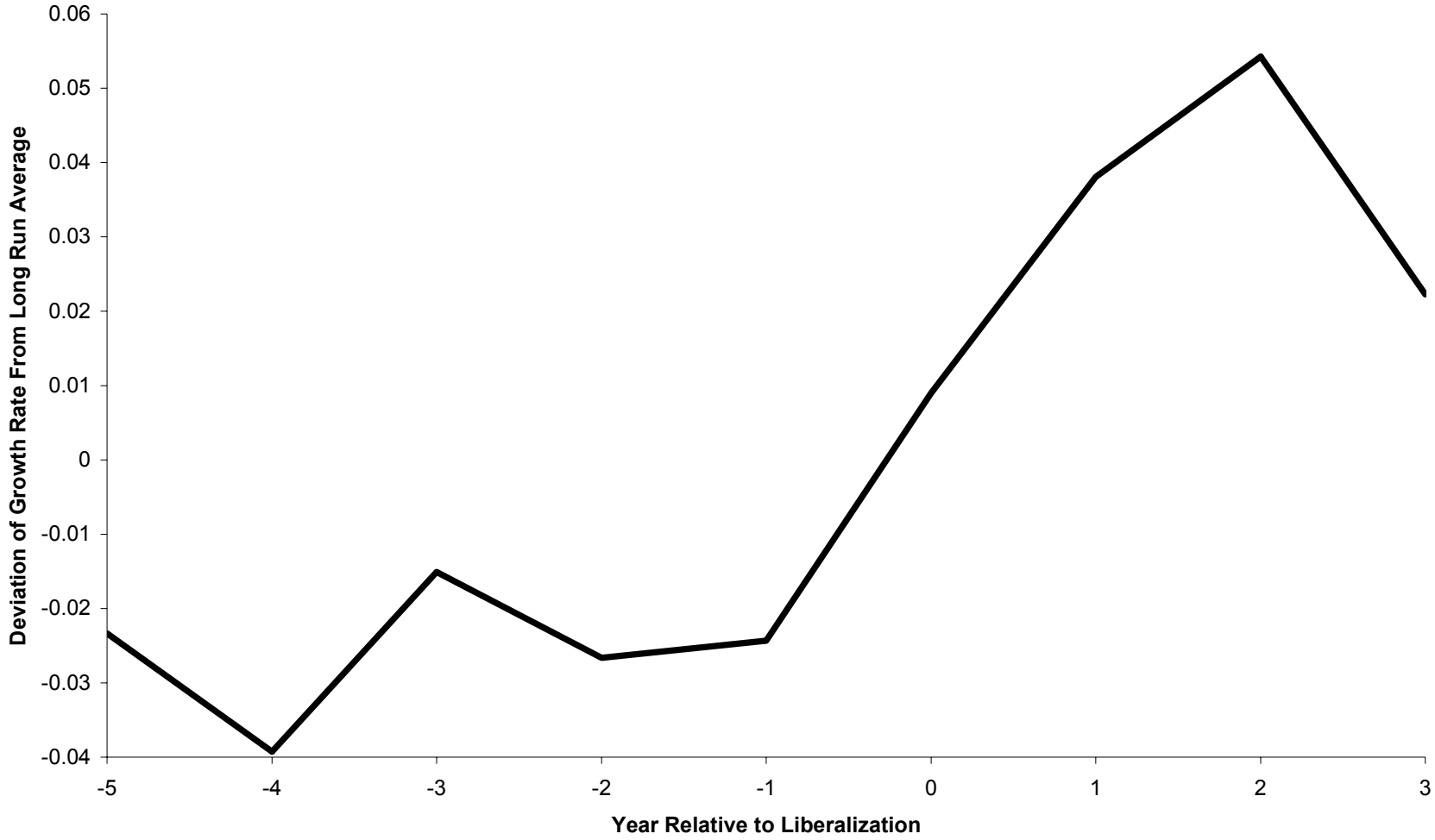

Figure 2.
The Growth Rate of Tobin's Q Rises When Countries Liberalize The Stock Market.

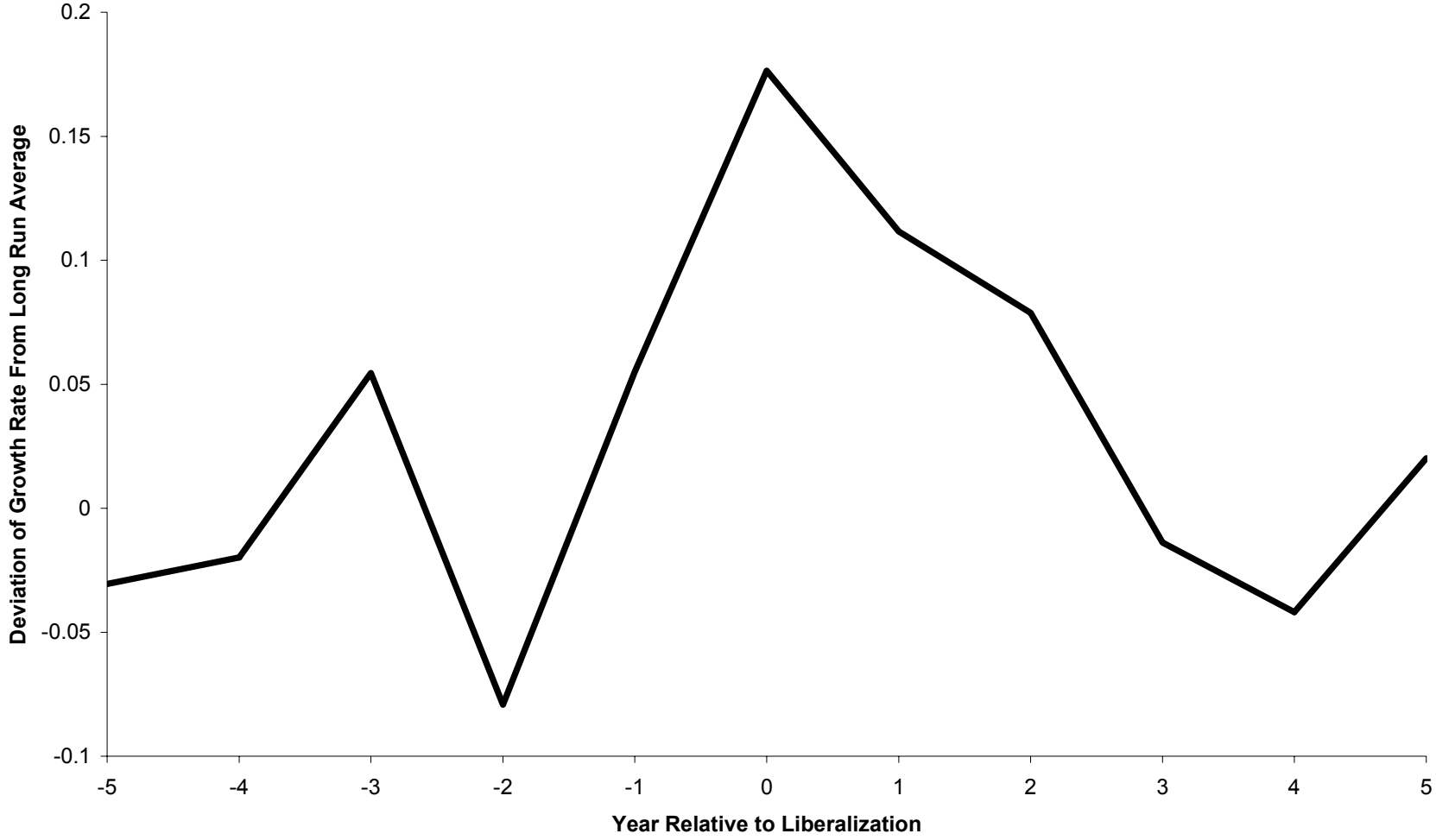

Figure 3.
The Growth Rate of Firms' Sales Increases Following Stock Market Liberalizations.

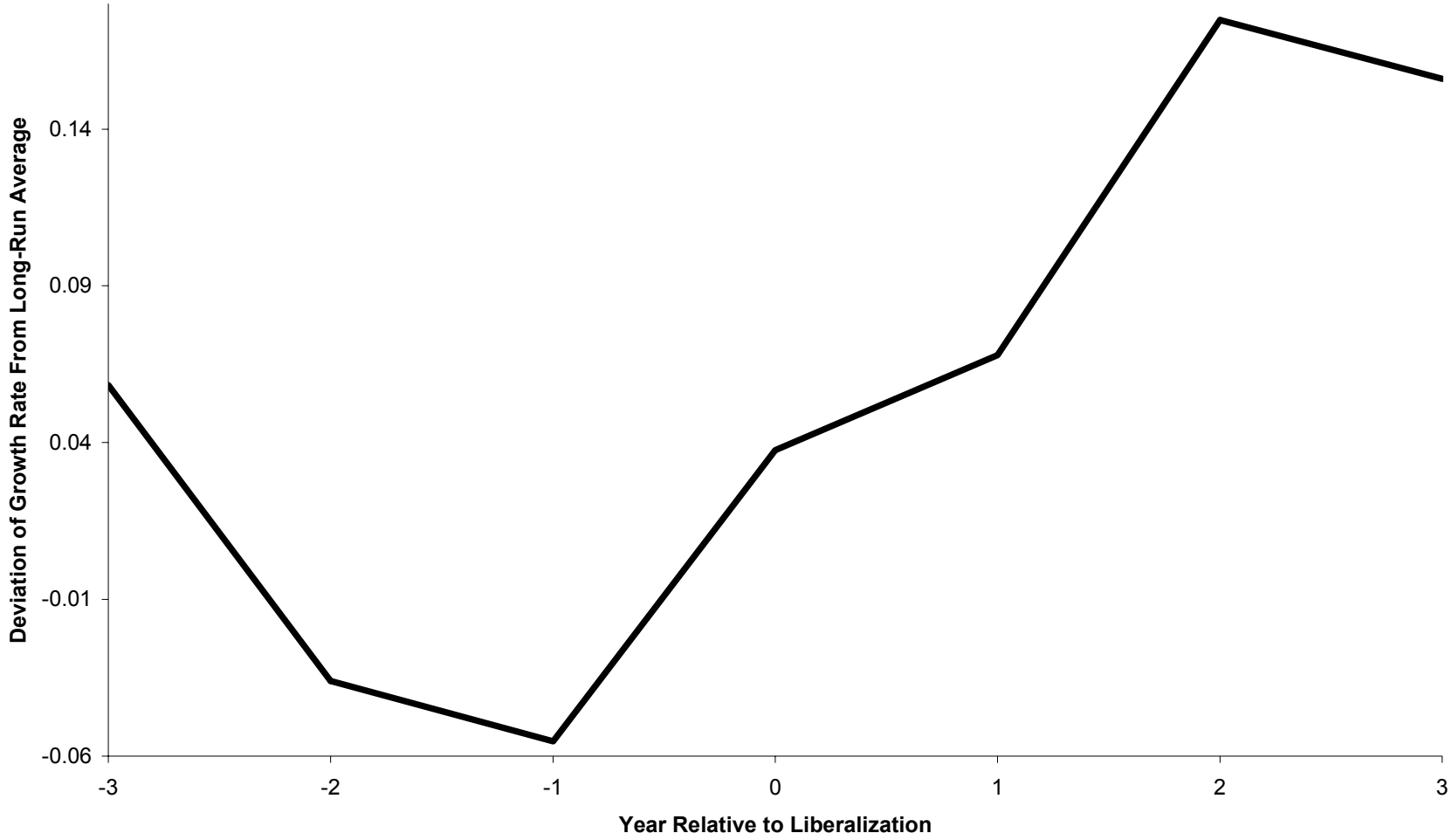

Figure 4.
Stock Price Changes at Liberalization Predict the Post-Liberalization Changes in Investment.

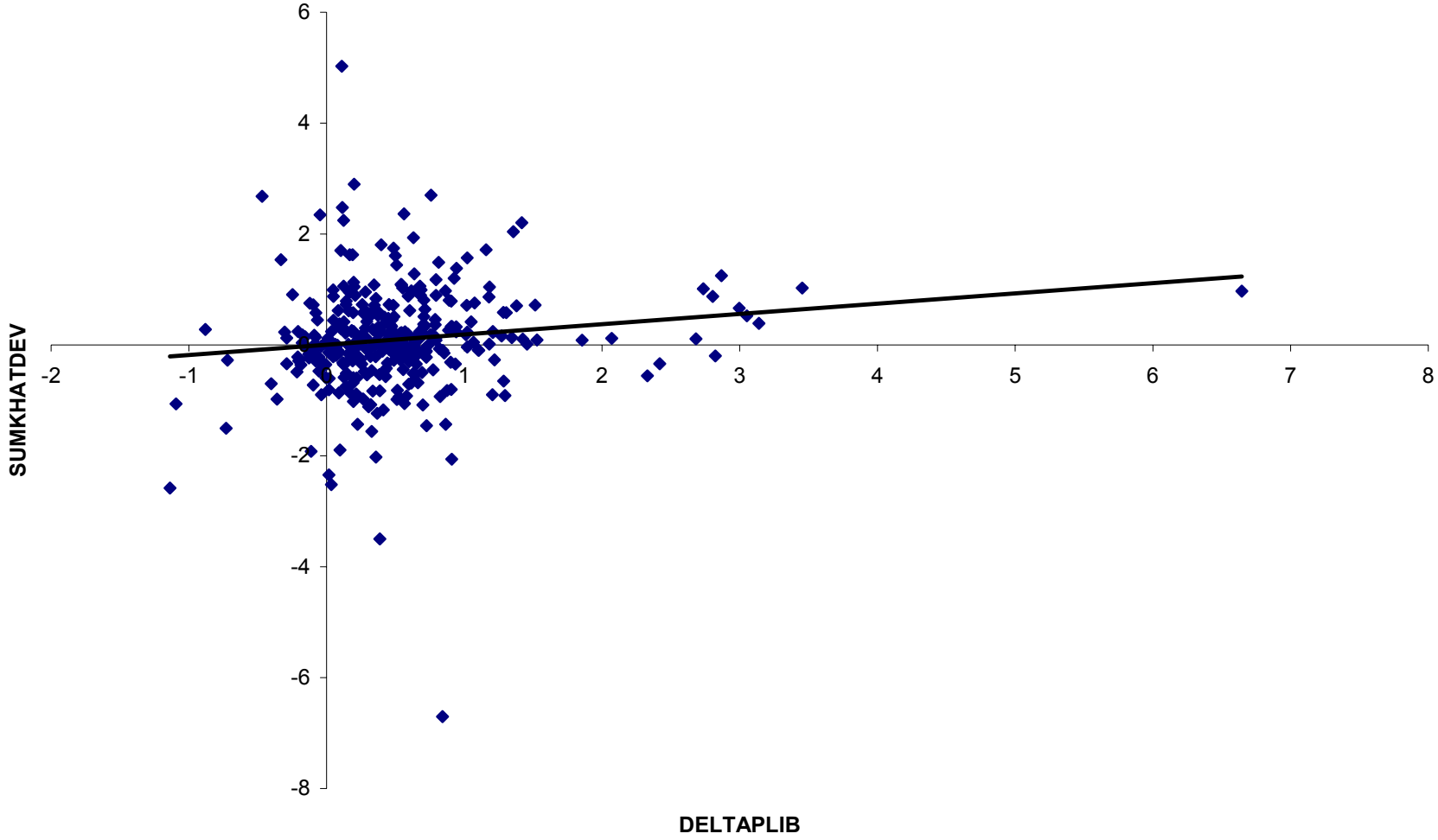

Figure 5.
Changes in Expected Future Earnings Predict the Post-Liberalization Changes in Investment.

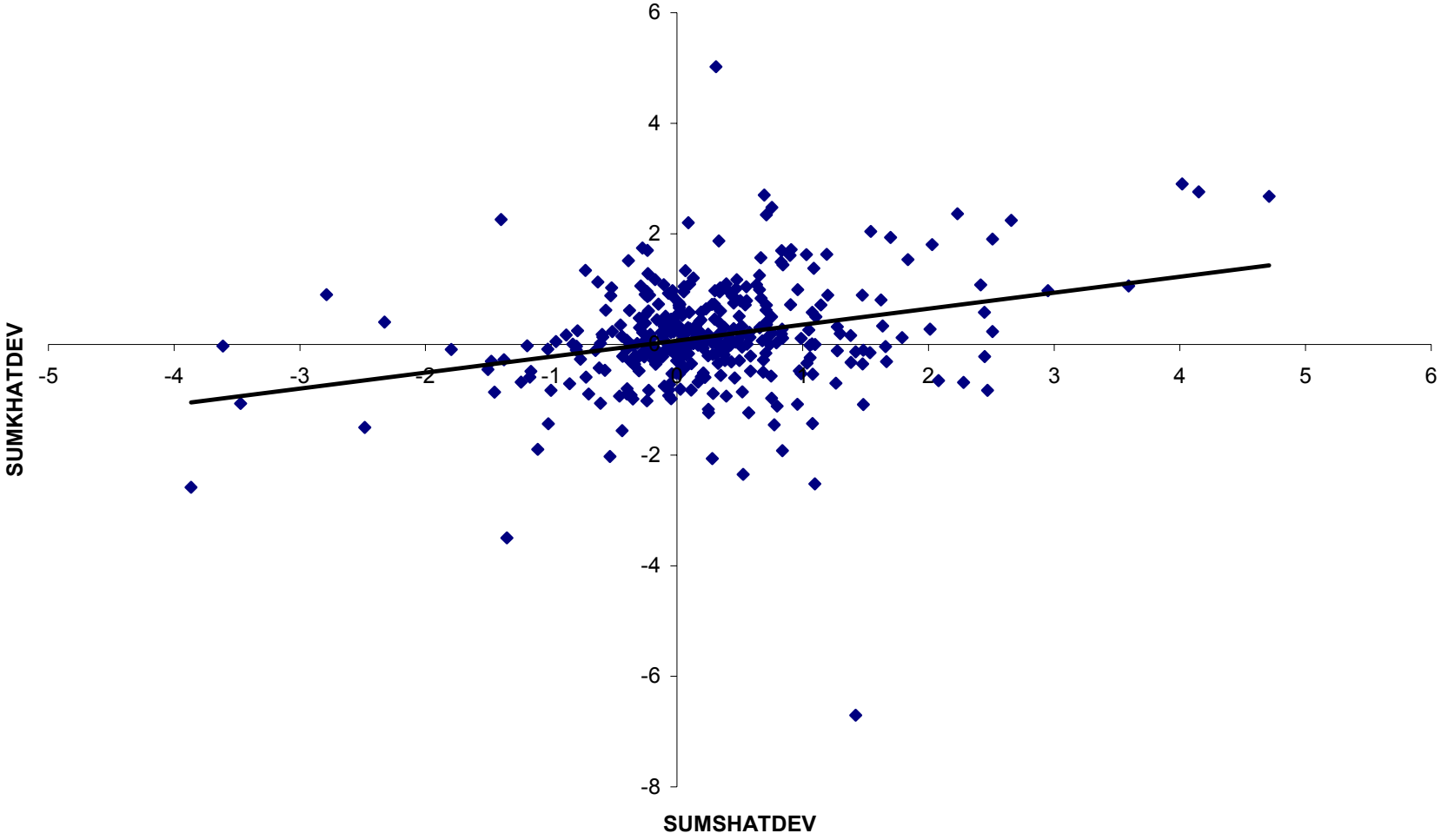

Figure 6.
Changes in Systematic Risk Do Not Predict the Post-Liberalization Changes in Investment.

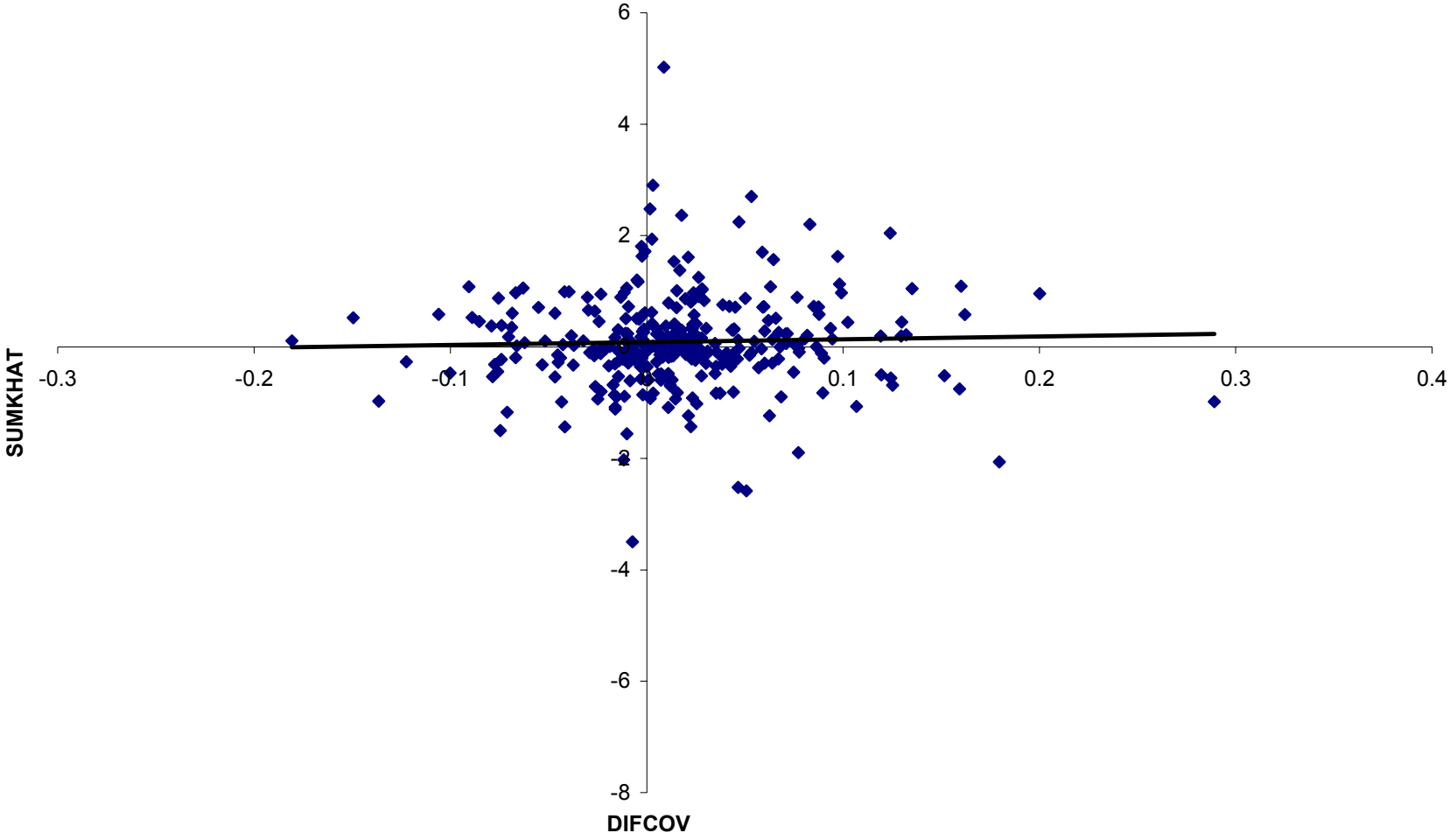

Table 1. Summary Statistics

Country	Liberalization Year	Number of Firms	Market Capitalization of Firms as a Fraction of Total Market Capitalization
India	1992	99	0.25
Jordan	1987	35	0.14
Korea	1987	89	0.38
Malaysia	1987	85	0.45
Thailand	1988	61	0.66
Full Sample	NA	369	0.40

Notes: Column 2 contains the liberalization date for each country in our sample. Column 3 gives the number of firms in each country. Column 4 presents the fraction of total market capitalization that the firms in our sample represent as a fraction of Total Market Capitalization in the respective countries. The total market capitalization represents the value of all publicly traded companies on the domestic exchange in the liberalization year.

Table 2, Panel B: The Post-Liberalization Increases in Investment are Robust.

Right-Hand-Side Variables	(1)	(2)	(3)	(4)
Year [0]	0.018	0.023	0.041*	0.047**
	(0.017)	(0.018)	(0.021)	(0.022)
Year [+1]	0.055***	0.062***	0.044*	0.047*
	(0.020)	(0.021)	(0.024)	(0.025)
Year [+2]	0.069***	0.077***	0.077***	0.082***
	(0.020)	(0.021)	(0.025)	(0.026)
Year [+3]	0.039**	0.047**	0.063**	0.069**
	(0.020)	(0.021)	(0.032)	(0.033)
Sum Years [0, +3]	0.041***	0.048***	0.049***	0.054***
	(0.013)	(0.013)	(0.017)	(0.018)

Notes: Table 2 presents results for alternative specifications of the benchmark regression, which is given by the following equation: $\Delta(\ln K)_{ijt} = \alpha + Lib[0] + Lib[+1] + Lib[+2] + Lib[+3] + Firm_i + \varepsilon_{ijt}$. Rows 1, 2, 3, and 4, present the coefficient estimates for the liberalization year and years 1, 2 and 3 post-liberalization, respectively. Row 5 presents the cumulative coefficient estimate for the four years taken together. The left-hand-side variable is the first difference of the log of the capital stock (investment). Column (1) presents the coefficient estimates for the regression specification that controls for firm-fixed effects. Column (2) presents the coefficient estimates for the regression specification that controls for country-fixed effects. Column (3) controls for world business cycle effects: the contemporaneous growth rate of OECD industrial production, the three-month real US Treasury bill rate, and the 10-year real US government bond rate Column (4) incorporates controls for both firm-fixed effects and world business cycle effects. All specifications control for clustering in the error structure. The symbols (***), (**) and (*) represent significance at the 1%, 5% and 10% levels, respectively. Standard errors are in parentheses.

Table 3. Changes in Firms' Fundamentals Significantly Predict Their Post-Liberalization Changes in Investment.

Right-Hand-Side Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CONSTANT	0.041*** (0.010)	0.020** (0.010)	0.028*** (0.011)	0.01 (0.010)	-0.008 (0.012)	0.000 (0.013)	-0.013 (0.012)
SHATDEV		0.292*** (0.025)		0.289*** (0.026)	0.305*** (0.027)		0.317*** (0.028)
DIFCOV			0.037 (0.195)	-0.008 (0.185)			-0.051 (0.184)
DELTAPLIB					0.029** (0.015)	0.057*** (0.016)	0.042*** (0.014)
Adjusted R-Squared	0.01	0.09	0.00	0.10	0.11	0.01	0.12
Number of Obs.	1476	1476	1476	1476	1476	1476	1476

The regression is: $KHATDEV_{ijt} = \alpha + CNTRY_j + \beta_1 SALESURP_{ijt} + \beta_2 DIFCOV_{ijt} + \varepsilon_{ijt}$. All deviations are defined as the growth rate of the variable in year *t* minus the average growth rate of the variable in the three-year period prior to the liberalization.

Table 4. Changes in Firms' Fundamentals Significantly Predict Their Post-Liberalization Changes in Investment.

Right-Hand-Side Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CONSTANT	0.038*** (0.009)	0.0142* (0.009)	0.021** (0.010)	0.000 (0.010)	-0.008 (0.011)	0.004 (0.012)	-0.014 (0.012)
SHATDEV		0.316*** (0.0245)		0.297*** (0.027)	0.320*** (0.027)		0.324*** (0.028)
DIFCOV			-0.016 (0.186)	-0.034 (0.177)			-0.04 (0.177)
DELTAPLIB					0.020 (0.014)	0.046*** (0.015)	0.028** (0.014)
Adjusted R-Squared	0.00	0.10	0.00	0.10	0.10	0.01	0.11
Number of Obs.	1476	1476	1476	1476	1476	1476	1476

The regression is: $KHATDEV1_{ijt} = \alpha + CNTRY_j + \beta_1 SHATDEV1_{ijt} + \beta_2 DIFCOV_{ijt} + \varepsilon_{ijt}$. All deviations are defined as the growth rate of the variable in year *t* minus the average growth rate of the variable in the entire pre-liberalization period.

Table 5. Changes in Firms' Fundamentals Significantly Predict Their Post-Liberalization Changes in Investment.

Right-Hand-Side Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CONSTANT	0.140*** (0.047)	0.063 (0.046)	0.093** (0.048)	0.012 (0.047)	-0.033 (0.059)	0.003 (0.062)	-0.049 (0.056)
SHATDEV		0.319*** (0.049)		0.370*** (0.051)	0.356*** (0.056)		0.39*** (0.055)
DIFCOV			0.176 (0.899)	-0.074 (0.835)			-0.158 (0.830)
DELTAPLIB					0.079 (0.073)	0.188*** (0.074)	0.116* (0.065)
Adjusted R-Squared	0.00	0.08	0.00	0.13	0.11	0.02	0.16
Number of Obs.	369	369	369	369	369	369	369

The regression is: $SUMKHATDEV_{ijt} = \alpha + CNTRY_j + \beta_1 SUMSHATDEV_{ijt} + \beta_2 DIFCOV_{ijt} + \varepsilon_{ijt}$. All deviations are defined as the growth rate of the variable in year *t* minus the average growth rate of the variable in the three-year period prior to the liberalization. All summations are defined over the entire four-year liberalization window [0, +3].

Table 6. Changes in Firms' Fundamentals Significantly Predict Their Post-Liberalization Changes in Investment.

Right-Hand-Side Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CONSTANT	0.131*** (0.041)	0.031 (0.040)	0.068* (0.043)	-0.028 (0.042)	-0.037 (0.051)	0.016 (0.054)	-0.055 (0.051)
SHATDEV		0.386*** (0.049)		0.410*** (0.055)	0.412*** (0.056)		0.426*** (0.058)
DIFCOV			0.003 (0.817)	-0.140 (0.754)			-0.113 (0.754)
DELTAPLIB					0.041 (0.062)	0.150** (0.065)	0.063 (0.060)
Adjusted R-Squared	0.00	0.08	0.00	0.12	0.11	0.02	0.14
Number of Obs.	369	369	369	369	369	369	369

The regression is: $SUMKHATDEV1_{ijt} = \alpha + CNTRY_j + \beta_1 SUMSHATDEV1_{ijt} + \beta_2 DIFCOV_{ijt} + \varepsilon_{ijt}$. All deviations are defined as the growth rate of the variable in year *t* minus the average growth rate of the variable in the entire pre-liberalization period. All summations are defined over the entire four-year liberalization window [0, +3].