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the Allocation of Investment? Micro
Evidence from Developing Countries

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**DOES FINANCIAL LIBERALIZATION IMPROVE THE ALLOCATION
OF INVESTMENT?**

Micro Evidence from Developing Countries¹

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Abstract

Has financial liberalization improved the efficiency with which investment funds are allocated to competing uses? In this paper, we address this question using firm level panel data from twelve developing countries. We develop a summary index of the efficiency of investment allocation that measures whether, and to which extent, investment funds are going to firms with a higher marginal return to capital. We then examine the relationship between this index and various measures of financial liberalization. The results suggest that in the majority of cases financial reform has led to an increase in the efficiency with which investment funds are allocated.

Keywords: Financial Liberalization, Investment, Efficiency

JEL Classification: E22, E44, G28, O16

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I. INTRODUCTION

Since the mid 80's several developing countries have liberalized their financial systems. This liberalization has been characterized by greater scope granted to market forces in the determination of interest rates and in the allocation of credit. One crucial question that needs to be addressed is whether the financial reforms that have been implemented have lead to an improvement in the allocation of resources.

It is curious that while governments were moving away from state control toward a free market orientation, economists were focusing their research effort on the negative consequences caused by informational imperfections in a market system. Financial liberalization in general involves replacing one deeply flawed system characterized by heavy government intervention with another with different flaws. Whether these changes will improve the allocation of savings and investment is fundamentally an empirical question.

Several studies based on cross-country aggregate data find evidence of positive effects of various measures of financial development on growth.² Note that financial liberalization tends to be accompanied by an improvement in various measures of financial depth. At the same time, there is no evidence that financial reform increases private savings. Actually in some countries the effect may even be significantly

² Most of the studies are based on cross sectional growth regressions (see, for instance, King and Levine (1993a), King and Levine (1993b), Levine (1997), Levine and Zervos (1998)), others on pooled time series-cross sectional country level data (see Beck et al. (2000) and Levine et al.(2000)). For a different approach see Rajan and Zingales (1998) who rely on industry level data to show that industries with the greater need of external finance, grow faster in more financially developed countries. Demirguc-Kunt and Maksimovic (1998), instead, show that firms grow at a faster rate, relative to a benchmark growth rate that would hold in the absence of external finance, in countries with a more developed financial system. See also Galindo et al (2002) for evidence on the impact of financial liberalization on growth, and Bekaert et

negative.³ All this suggests that, therefore, if there is a beneficial effect of financial reform on growth, this is not likely to go through its effect on the quantity of saving. Moreover, cross-country growth regressions also reveal that measures of financial development do not have a significant impact on the quantity of investment, but they positively and significantly affect measures of total factor productivity growth.⁴ So, if financial liberalization has a positive effect on financial development and hence on growth, the most important channel is likely to be to be the effect of financial reform on the efficiency with which investment is allocated across firms and across sectors.⁵

However there is very little direct evidence on the effect of financial liberalization on the efficiency of resource allocation.⁶ Using a panel of Ecuadorian firms during the 80's, Jaramillo, Schiantarelli and Weiss (1992) find that there was an increase in the flow of credit accruing to more efficient firms after liberalization, controlling for other firms' characteristics. Efficiency is defined in a narrow sense as purely technical efficiency, and it is calculated using panel data estimates of a Cobb Douglas production function. Similar results are also obtained by Siregar (1992) for Indonesian establishments in the 80's. Using firm level data for Jordan, Korea, Malaysia and Thailand, Chari and Henry (2002) show that the typical firm experiences an increase in both Tobin's q and investment after account liberalization. However the reallocation of investment is not significantly correlated to changes in systematic risk or investment opportunities. Other papers based

al. (2001) and Henry (2000) for evidence on the effect of stock market liberalization on growth and investment respectively.

³ See Bandiera et al. (1999).

⁴ See Beck et al. (1999)

⁵ Financial liberalization may have also contributed to faster technological progress. See King and Levine (1993)

⁶ See Schiantarelli et al. (1994) for a more detailed review. See also Atiyas et al. (1994) and Fry (1995) for a comprehensive review of financial liberalization.

on firm level data address the related, but distinct question of whether financial constraints have been relaxed following financial liberalization (or financial development) and find that in most, but not all cases, smaller firms have improved their access to external resources following financial reform.⁷ However, it is not obvious, without further considerations, what effect a relaxation of financial constraints for small firms has on the efficiency of resource allocation.

Wurgler (2000), using industry level data provides evidence that the rate of growth in investment is more closely associated with contemporaneous growth in value added, in countries with more developed financial systems. Country level financial development is measured by the average size of credit and equity markets relative to GDP. More specifically, countries which have a more developed financial system, both increase investment more in their growing industries and decrease investment more in their declining industries. The emphasis of that paper is on cross-country variation in time invariant measures of financial development and not on the changes resulting from the process of financial reform. Finally, other papers (see Cho (1988) for Korea)) have focused on the change in the variance of expected marginal returns to capital across industries, as measured by an industry specific user cost of capital, before and after liberalization. A decrease in the variance is interpreted as suggesting that liberalization facilitates the process by which flows of capital equate returns.

Although these approaches provide useful insights on some of the consequences of financial development or of financial reform in different countries, they do not address

⁷ This is the case for Indonesia in the 80's (see Harris et al. (1994)), but not for Ecuador (see Jaramillo et al. (1994)). See also Gelos and Werner (1999) for Mexico and Gallego and Loayza (2000) for Chile. See also Love (2003) and Laeven (2003) for micro evidence for several countries. The former focuses on financial development, the latter on financial reform

directly and comprehensively the question of whether financial liberalization has resulted in a more efficient allocation of investment funds in developing countries.

In this paper, we develop a novel approach to evaluate whether financial liberalization has increased the share of investment going to firms with a higher marginal return to capital. More specifically, we develop a new summary index of the efficiency of allocation of investment. The index compares different measures of the marginal returns of investment summed across firms in each year with the hypothetical returns in a benchmark economy where investment funds had been allocated to firms in proportion to their share of capital in the economy. To implement this approach, we use a firm level panel data from twelve developing countries: Argentina, Brazil, Chile, India, Indonesia, Korea, Malaysia, Mexico, Pakistan, Philippines, Taiwan, and Thailand. We discuss at length the simplifying assumptions needed to construct the index, as well as its potential drawbacks.

We then relate this index with different measures of financial liberalization based on a careful reconstruction of the timing of liberalization measures along several dimensions of financial development (see Laeven (2003)). These measures focus mainly on the banking sector. The methods used range from "ocular econometrics" to panel estimation, using the country-year specific measures of our efficiency index. We also control for other potential determinants of changes in the efficiency of resource allocation, such as trade liberalization and macroeconomic/financial shocks. Finally we allow the coefficient of financial reform to differ with country specific characteristics.

The results suggest that financial liberalization in the majority of cases leads to an improvement in resource allocation, although there are interesting exceptions. Panel

estimation suggests that on average there is a significant positive association between measures of liberalization and our index, which is robust to the inclusion of other controls. The econometric evidence on the determinants of cross-country differences in the efficacy of financial reform is less clear-cut.

The structure of the paper is as follows. In section II, we discuss the construction of the index of efficiency we propose. In Section III we describe the panel data set we use, we calculate the index for twelve developing countries, and we provide descriptive and econometric evidence on the relationship between the index and various measures of financial liberalization. Section IV concludes the paper.

II. MEASURING THE EFFICIENCY IN THE ALLOCATION OF INVESTMENT

In assessing the effect of financial liberalization we want to see whether it succeeds in directing resources towards those uses with the higher marginal returns. This is the concept of efficiency we focus on. In order to develop a synthetic measure of efficiency in the allocation of investment, we first need to measure the marginal return to investment. Our index approach measures marginal returns either by the sales to capital ratio or by the ratio of operating profits to capital. The former is appropriate if the production function is Cobb-Douglas in capital, labor and materials. In this case the marginal return to capital is proportional to the sales to capital ratio. The constant of proportionality equals the product between the elasticity of output with respect to capital

and the inverse of one plus the markup of prices over marginal costs.⁸ The operating profit-based measure is an appropriate proxy for the marginal return to capital under a generic constant return to scale production function and perfect competition in the output market. We then estimate the total return on investment for each firm by multiplying the firm's investment in a particular year by one of our measures of the firm's marginal return to investment. We sum the total return to investment for each firm across all firms to get an estimate of the total return to investment for the economy in a particular year.

To measure the efficiency of the allocation of investment in a year, each of our estimates of the total return on investment must be compared to a benchmark. The benchmark we use is an estimate of total return if investment funds had been allocated to firms in proportion to their share of capital in the economy. In every case we use the same estimates of the marginal product of capital for each firm to estimate actual returns, and returns for the benchmark allocation. We divide our measure of total return actually achieved, by this benchmark to obtain a measure of the efficiency with which investment funds were allocated in each year.

This approach generates two different measures of the efficiency of the allocation of investment funds: one where sales per unit of capital is used as a measure of the marginal product of investment, the other where operating profits per unit of capital is used as the appropriate measure. Let us assume that investment becomes productive with one period delay. Moreover, let us use an individual firm's capital stock at the beginning of year t , as a fraction of total capital for all firms at the beginning of the same year, to measure the proportion of investment funds that the firm would receive if investment

⁸ See Abel and Blanchard (1986) and Gilchrist and Himmelberg (1998) for details.

funds were assigned in the same proportion as in the past. The two versions of our index for year t are:

$$EI_t^S = \frac{\sum_i \frac{S_{i,t+1}}{K_{i,t+1}} I_{i,t}}{\sum_i \frac{S_{i,t+1}}{K_{i,t+1}} \cdot \frac{K_{i,t}}{K_t^T} \cdot I_t^T} \quad (1)$$

or:

$$EI_t^\pi = \frac{\sum_i \frac{\pi_{i,t+1}}{K_{i,t+1}} I_{i,t}}{\sum_i \frac{\pi_{i,t+1}}{K_{i,t+1}} \cdot \frac{K_{i,t}}{K_t^T} \cdot I_t^T} \quad (2)$$

where S_{it} denotes firm i sales at time t, π_{it} operating profits, I_{it} investment, and $K_{i,t}$ beginning of period capital. I_t^T and K_t^T represent, instead, aggregate investment and aggregate capital at time t, respectively. Note that each unit of investment in year t increases the capital stock, and hence generates a return, in year t+1⁹.

There are a set of reasons that make the sales based index preferable to the profit-based index. First and foremost, sales are probably measured more accurately in the balance sheets than operating profits. Calculation of the latter requires a valuation of cost of goods sold, and hence of changes in inventories of raw materials, which is a tricky exercise, particularly in inflationary environments. Second, the sales based measure allows for a departure from perfect competition. However, the markup of prices over marginal costs is allowed to vary over time but not across firms, and the departure comes at the cost of making a parametric (Cobb Douglas) assumption about the production

function. There is a third potential problem with the profit based measure of efficiency. Due to unionization or efficiency wage considerations, workers may be paid more than the reservation wage for their jobs. To the extent that the reallocation of capital induces a reallocation of labor, our profit measure may underestimate the gain in total surplus generated by such a reallocation.

A final problem with using operating profits as a measure of the return to capital is that operating profits are correlated with cash flow. Prior to financial liberalization, the correlation between cash flow and investment may be higher than after liberalization. Thus we would expect the operating profit measure of the efficiency of the allocation of investment might be biased in favor of the pre-liberalization periods. In fact, the previous literature in this field tends to find that financing constraints are relaxed for small establishments after financial liberalization. For medium and large establishments there is no significant change in the severity of constraints. However, if in spite of all this, we find that our profit based measure of efficiency increases after financial reform, this is a strong indication that there has been an improvement in the allocation of resources.

Both measures of efficiency in the allocation of investment funds have common potential drawbacks. First, we make the implicit assumption that the same marginal return to capital applies for the same firm in a given year to all units of investment. Second, we have ignored so far adjustment costs of investment. Given our procedure for computing the efficiency of the allocation of investment funds, allocative efficiency

⁹ We also explored the possibility of using average Q as a measure of returns. However the information on stock market capitalization was not available for more than two thirds of the observations in our sample, rendering the exercise very uninformative.

would be greatest if the firm with the highest ratio of operating profits or value added to capital were to get all the investment funds available for a given year. However, the discrepancy due to omitting adjustment costs may not be large. For instance, if adjustment costs are internal and additive, and take the form $(b/2)(I/K)^2 K$, the omitted term is $(b/2)(I/K)^2$, which should be relatively small for a large range of realistic values of the investment rate.¹⁰

A third drawback is the implicit assumption that market prices reflect the social value of outputs and inputs. Presumably, there were social, political or even economic reasons for why governments favored particular industries or regions prior to liberalization. That bias in the allocation of investment funds *could* have been (2nd best) socially efficient given other distortions in the economy. For instance, if favored industries were producing exports, and if the currency was overvalued, then the domestic market price of their outputs, would understate the true value of their products (correct valuations would use the shadow price of foreign currency). Using the “wrong” exchange rate would lead the private return on investment in the export sector to be less than the social return. Therefore favoring export industries whose private returns are relatively low could actually increase the social productivity of investment. Similarly, government policies that encouraged investment with positive spillovers and discouraged investment with negative spillovers would enhance social efficiency. Finally, governments may want to favor particular regions in order to improve inter-regional income distribution. Programs of directed credit might be more efficient means of aiding those regions than would other programs intended to reduce inter-regional income disparities such as tax

¹⁰ See, for instance, Abel and Blanchard (1986), footnote 5.

holidays for investments in economically depressed regions. Those tax exemptions encourage vertically integrated firms to use transfer prices to move profits into the subsidized region. In general programs of directed credit may be a second best solution to problems for which the first best solution is not politically feasible. Although we are well aware of the difference between market and social values we are convinced that our efficiency index is worth pursuing, because it contains interesting information and also because of the difficulty in measuring social returns to investment.

A fourth problem involves interpreting differences in the allocation of capital. In equilibrium, the marginal product of capital of a perfectly efficient economy would be the same in all firms. Consequently, random allocations of capital would do as well as any other allocation. No banking system could do better. This would be a serious problem for us if we were looking at the results of a financial liberalization that had been in effect for many years. However, we are observing the allocation of capital for the years immediately following the implementation of financial liberalization. For financial liberalization to eventually result in an equalization of the returns to capital across firms, it must have redirected investment funds toward the firms where the marginal product of capital was highest. This reallocation of investment is precisely what we are seeking to measure. In addition, even a cursory look at the data suggests that the potential problem outlined above is not a serious one in practice, since we observe great differences in the marginal revenue product of capital across firms.

III. EMPIRICAL RESULTS

Has financial reform lead to an improvement in the allocation of resources as measured by our index? In order to answer this question we need firm level panel data to construct the index, and we need to be more precise in defining the evolution of financial reform. After providing some background on the data used, we will present a set of empirical results that provide some answers to our central question.

III.1. The Data

Our empirical investigation is based on firm level panel data for 12 developing countries that have introduced various measures of financial reform over the last several years: Argentina, Brazil, India, Indonesia, Korea, Malaysia, Mexico, Pakistan, Philippines, Taiwan, and Thailand. The source of the firm level information is the Worldscope database, which provides balance sheet information on publicly traded firms. The advantage of this data set is the cross-country comparability of the accounting information. The obvious drawback is the absence of information on non-publicly traded, which are, on average, smaller firms. Another limitation is that prior to the 90's, very little data is available for the subset of countries of interest to us.¹¹

We use an unbalanced panel, but we require at least three consecutive years of observation on each firm, and a minimum of fifteen observations (firms) for each

¹¹ Although for some countries data are available also for the second half of the 80's, the number of firms included is very small.

country-year. Moreover we have deleted outliers following the criteria summarized in the Data Appendix. Descriptive statistics for the main variables of interest are presented in Table A1, while the total number of firms available for each country is reported in Table A2.

We will rely on different measures of liberalization. They are all based on analysis of the timing of the introduction of various aspects of financial reform as discussed in Laeven (2003). Laeven provides a dating of interest rate deregulation, reduction of entry barriers, reduction of reserve requirements, reduction of credit controls, privatization of state banks, and strengthening of prudential regulation. These measures focus on the banking sector and correspond to the classification used also in Bandiera et al.(2000) for a smaller subset of countries.¹² Assume we associate a dummy equal to one (zero) to the years characterized by the more (less) liberalized regime. A first cardinal measure of liberalization is obtained by summing the six dummies (so that the index varies between zero and six). We will denote this measure by *fli*. Another measure is meant to distinguish in a discrete fashion country-years characterized by a more or less fully liberalized regime, versus one still characterized by many restrictions. As in Laeven (2003) we will divide observations depending upon whether the overall index is less than five, versus equal to five or six. This yields a partition of the years that is similar to the one proposed by Williamson and Mahar (1998). We will denote this dummy by *Libdummy1*.

In addition, we have experimented with alternative measures of liberalization that focus on different aspects of financial reform. We report here the results obtained when

we construct a dummy variable, denoted by *Libdummy2* that equals one the year following the removal of the main restrictions on interest rates and credit allocation (the latter in the form of directed credit or credit ceilings). This measure enables us to focus on two of the dimensions of financial liberalization that are most likely to affect the allocation of investment funds. Since in all countries, but two, the removal of interest rate controls precedes or is contemporaneous to the removal of controls on credit flows, a dummy meant to capture only the latter aspect would be almost identical to *Libdummy2*.¹³

Finally note that all these measures of liberalization focus on financial intermediaries. All the countries in our sample have also introduced changes designed to promote the development of stock markets. However, stock market liberalization takes place in most countries at the end of the 80's and in the remaining countries in the very early nineties, while our firm level data set is basically limited to the nineties¹⁴. This is one of the reasons we have focused on the liberalization measures regarding financial intermediaries. Further investigation of the role of stock market development requires firm level data for the 80's as well, and is left for future research.

III.2. Descriptive evidence

In this section we will present descriptive evidence on the effect of financial liberalization on the allocation of investment. We start by plotting in Figure 1 (a through

¹² Bandiera et al. (2000) also include information on securities market developments and international financial liberalization.

¹³ We have also explored the possibility of using the index of liberalization of the domestic financial sector proposed by Kaminsky and Schmukler (2001), however for most countries in our sample their index reaches its maximum value in the late 80s or very early 90s, and therefore, it would not help us in explaining the reallocation of investment during our sample period.

m) our efficiency index for sales, EI_t^S , against the financial liberalization index, fli_t . The vertical line in the graphs represents the year in which both interest rate and credit controls were removed. This exercise in “ocular econometrics” reveals some very interesting patterns. First, for a subset of countries, Brazil, Chile, India, Pakistan and Thailand, there is a clear and positive association between EI_t^S and fli_t , suggesting that financial liberalization is associated with an improvement in the allocation of resources. One caveat is in order for Chile: by the beginning of the 90's many aspects of financial reforms have already been implemented, so that the most informative experiment would have been to analyze the behavior of the efficiency index over the 80's. It is interesting to note that the value of the index in Chile, a country with one of the most liberalized financial systems, tends to be higher than for the other countries.

For another group of countries, there is also evidence of an improvement of the efficiency index following the introduction of liberalization measures. This is true for Argentina, Korea and Mexico. For instance, in Korea, the index is below one (indicating an efficiency in investment allocation actually worse than one based purely on size) in the initial years and increases above one with the introduction of liberalization measures. However, in all these cases, there are significant reversals in the improvement, around periods of financial and currency crisis: 1995 for Argentina, 1998 for Korea and 1994 and 1998 for Mexico, and 1998 for Brazil. Finally, for a subset of countries, such as

¹⁴ See for example Bekaert et al (2001) who report that stock market liberalization for the countries of our sample took place between 1987 and 1992.

Indonesia, Malaysia, Philippines, the index shows no clear trend, while it is decreasing over time for Taiwan.¹⁵

The efficiency index based on profits, EI_t^π , paints a picture largely similar to the one for EI_t^S . Brazil, Chile India, Pakistan and Thailand are the countries for which one observes the clearer improvements. However, now EI_t^π decreases over time for Argentina and there is a worsening of the allocation of resources around periods of financial/currency crises in Mexico and Korea. Again, no clear pattern emerges for Indonesia, Malaysia, and Philippines, while the index shows a decrease in the latter years for Taiwan.

The overall pattern described above is confirmed and made more quantitatively precise by comparing the mean value of the index over sub-periods, defined as pre- and post- liberalization. The results are reported in Tables 1 (in part 1 for EI_t^S and in part 2 for EI_t^π). In the first set of columns we use *Libdummy1*, to divide the 90's, i.e. the pre-liberalization (post-liberalization) period is the one for which the value of the overall index is less than five (equal to five or more). In the second set of columns, we use *Libdummy2*, so that the pre-liberalization period is the one up to and including the year in which both interest rate and credit controls are removed. Looking at the sales based index, using *Libdummy1*, there are large and positive increases in its mean value in the post-reform period in six countries (Argentina, Brazil, India, Pakistan, Thailand and

¹⁵ Schiantarelli and Weiss, with Siregar, in preliminary past research using a similar methodology to the one proposed in this paper, found that financial liberalization did not have a positive effect on the efficiency of the allocation of investment in Indonesia in the 80's. There are several reasons that could account for these results for Indonesia. For instance, Indonesian conglomerates, many owned by ethnic Chinese entrepreneurs, had access to overseas capital markets, which may have allowed them to

Korea). In three cases (Malaysia, Mexico and the Philippines) the means are virtually unchanged. In one case (Taiwan) one observes a decrease. When the interest rate and credit control dummy is used to partition the period, one observes an increase in the mean value of the efficiency index for Argentina, Brazil, India, Mexico and Pakistan, while there is basically no change for Korea. Note that for some countries, such as Chile, the difference in mean is not available, since the major changes in the financial deregulation process had already occurred by the beginning of the 90's. These results are strongly supportive of an improvement in the allocation of resources for the majority of countries, after financial reform. The results for the profit-based index confirm this overall pattern, but are not as strong as the ones based on sales. For instance, using *Libdummy2*, one observes an improvement in Brazil, Mexico, Pakistan and Thailand, but the increase is smaller than before. Moreover, the profit based index for India does not reveal any noticeable change in efficiency.

III.3. Econometric evidence

We now provide more formal econometric evidence on the effect of financial liberalization on the efficiency of resource allocation by utilizing the entire panel of firm-year observations. More specifically we regress our efficiency index on different measures of liberalization, allowing for country specific constants. Results are reported in Table 2. In Part 1, column I, we regress EI_t^S on the Laeven (2003) index. The results are very supportive of the idea that financial liberalization leads to an improvement in resource allocation: The coefficient of the liberalization index is positive and significant

circumvent the problems of a restricted domestic financial system. This may contribute to explain why internal financial liberalization has not generated large gains.

at the 5% level. Moreover the quantitative effects are quite large: the coefficient estimate suggest that going from a financially repressed index ($fli_t = 0$) to a fully liberalized system ($fli_t = 6$) leads to an increase in EI_t^S of 19.8%.¹⁶ In column II and III, the explanatory variables are *Libdummy1* and *Libdummy2*, respectively. The coefficients on the liberalization dummies are positive and significant at the 1% level. Again the effects are quantitatively significant. For instance, the efficiency index increases by 14.5 % when interest rate and credit controls are relaxed.

Table 2, Part 2 contains the results for the profit-based measure of efficiency, EI_t^P . The results continue to suggest that financial liberalization improves efficiency, but the effect is not as strong and precisely estimated as the one observed using the sales based measure, EI_t^S . The coefficients of the liberalization dummies are always positive, but somewhat smaller now. The coefficients of fli_{t-1} and *Libdummy2* are now significant at the 5% and 1% level, respectively, while the one for *Libdummy1* is not significant. Still, the results in column I imply that going from a completely repressed system to a fully liberalized one leads to a sizeable increase in efficiency of 12.6%.

One may legitimately wonder whether what we are capturing in these regressions is not only the effect of financial reform, but also the effect of other liberalization measures, such as trade liberalization or changes in macroeconomic conditions. Actually, it is not obvious a priori how trade liberalization should affect our particular measure of efficiency. Moreover, the main steps in trade liberalization were undertaken before the

¹⁶ If we include in the calculation of the liberalization index also a dummy for stock market liberalization, the results are virtually unchanged.

period we use for estimation.¹⁷ However, in many countries, a decrease in trade barriers, continues during the 1990's, and in at least one country (India), trade liberalization is accompanied by internal industrial deregulation, which can have a positive effect on the efficiency of resource allocation. In order to address these issues, we return to the full sample and we add to each specification the mean tariff rate as a measure of the degree of trade barriers. The results for EI_t^S are reported in Table 3. Its coefficient is negative, but not significant. Most importantly, from our point of view, the coefficients on two of the three proxies for financial reform (fli_{t-1} and $Libdummy2$) remain positive and statistically significant, although their magnitude is now a bit smaller.

In order to check the robustness of our results to the inclusion of other explanatory variables, we have conducted four other experiments (see Table 3 again). These exercises are also prompted by the observations that for some countries there are fluctuations in our efficiency index that occur at business cycle frequencies and in correspondence of financial crisis (see Figure 1). In the first experiment, we have included in the panel regression changes in the real exchange rate (an increase denotes an appreciation). These variables may capture general macro instability and the effects of financial and currency crisis that have occurred over the 90's. Moreover, since it is correlated with changes in the relative price of tradables versus non-tradables, it controls for changes in markups that may occur unevenly in the tradable and non-tradable sectors. Second, we have used a different and possibly more specific measure of the existence of speculative pressure that has resulted in currency crises in the last decade. This variable

¹⁷ For a review of empirical evidence of the effect of trade liberalization on growth see Edwards (1993). For more recent analysis, see Sachs and Warner (1995), Edwards (1998) and Rodriguez and Rodrik (2000). See also Lora (1997) for a discussion on trade liberalization in Latin America.

is the average of the percentage change in the nominal exchange rate, in reserves and in the interest rate (see Eichengreen et al. (1995) and Sachs et al. (1996)). Third, we have included as an additional regressor the inflation rate as a general proxy for macroeconomic instability. During periods of macroeconomic instability it may be more difficult to identify where the good investment opportunities are and this may adversely affect the efficiency of allocation of investment funds.¹⁸ Finally we include GDP growth in the equation to control for the effect of business cycles on the efficiency of resource allocation. It is not clear what the sign of the GDP growth coefficient should be. For instance, during recession credit risk increases and banks may become more careful in selecting the projects to be financed. At the same time uncertainty may be greater during recession, making it more difficult to identify good investment opportunities.

The crucial result here is that financial liberalization continues to exert a significant effect on the sales based index of efficiency. Across all specifications, the coefficients of all the proxies for financial liberalization remain significant at least at the 5% level in all cases, but two. Of the four additional variables, the coefficients on two of them (the measure of speculative pressure and the inflation rate) are negative and significant, while those of the remaining two (real appreciation and GDP growth) are insignificant. This suggests that lack of macroeconomic instability and financial crises are associated with a worsening of the allocation of resources.

The robustness of the link between allocative efficiency and financial liberalization, when we use the sales based measure of efficiency, does not carry over to

¹⁸ See Beaudry, Caglayan and Schiantarelli (2000) for an analysis of the effects of monetary uncertainty on the allocation of investment, using a different approach.

the profit based measure of efficiency. More specifically, addition to the basic specification of the mean tariff rate, of real depreciation, of the measure of speculative pressure, of the inflation rate or of GDP growth, leaves the coefficient of the proxies for financial liberalization positive but insignificant at conventional levels.¹⁹ However, the problems associated with the profit-based measure of efficiency suggest that more attention should be given to the results based on the sales based index.

It is worth assessing robustness of the results in other dimensions, such as estimation methods, and the definition of the capital stock. In evaluating the effect of financial liberalization one may want to attribute more weights to those observations on the country-year efficiency index, when the latter is based on a larger number of firm-level observations, since in this case efficiency is measured more accurately. This could be achieved by weighting each country year observations of the variables included in the regression by the square root of the number of firm level observations available in each year in each country. However, this means attributing, *de facto*, greater weight to larger countries. In Table 4 we report the results for the weighted least square regressions for EI_t^S . Our conclusion is largely unchanged, with the variables capturing liberalization exerting a positive and significant effect on the value of the efficiency index.

Moreover, one may wonder whether the results obtained so far are robust to changes in the definition of the capital stock. In Table 5 we report the regression results for EI_t^S , for a definition of the capital stock, identical to the one used in Love (2003). In this case beginning of period capital is measured as end of period capital minus

¹⁹ Of the additional variables, inflation, the average tariff and the speculative pressure measure remain significant and have negative signs. Results available from the authors upon request.

investment plus depreciation. As Love suggests, this measure may be a better measure, in those years in which firms undergo mergers or acquisitions. However, it may exacerbate measurement problems in years in which firms are allowed to revalue their capital stock in order to take account of inflation. Although the coefficients tend to be somewhat smaller, they remain significant for all the three measures of financial liberalization at least at the 5% level, independently from whether or not one weights the observations. The fundamental conclusions we have reached so far are, therefore, robust to changes in the definition of the capital stock.

A very interesting question one may ask is whether the changes in the efficiency index are due to a intra or inter-sectorial reallocation of investment, that is a reallocation of investment funds between firms in the same sector or in different sectors. Our data set includes publicly traded firms in agriculture, mineral industries, construction, manufacturing, transportation, communication and utilities, wholesale and retail trade. Unfortunately the coverage at the sectoral level is quite spotty and makes comparisons across time or countries a very dubious exercise. Even for manufacturing, for some of the countries in some of the years we do not have enough information to make the construction of the efficiency index meaningful. The investigation of this issue, therefore, will have to be postponed until data sets richer, and with more extensive coverage than the one used here become available to researchers.

Finally, the descriptive evidence presented in Table 1 suggests that country level changes in the mean value of the efficiency index between the pre and post liberalization period differs across countries. This could occur for many reasons. First, other factors, besides financial liberalization affect the efficiency of resource allocations. Second, the

intensity of the liberalization measures may differ across countries, and this is not fully captured by our index. Third, the effect of financial liberalization may differ depending upon initial conditions, upon other liberalization measures, and upon the macro context and the general institutional environment in which it takes place. The results presented in Table 4 have already suggested that measures of speculative pressure and of macro instability (such as the inflation rate) have an independent adverse effect on the allocation of investment. We have also experimented with interacting all the additional variables included in Table 3 (average tariffs,²⁰ change in the real exchange rate, speculative pressure, inflation, and GDP growth) with our measures of financial reform, but the interaction terms are never significant. We have also experimented with introducing interactions of the liberalization measures with measures of dispersion of the macro variables over the period used for estimation. Again we have not had much success

Moreover, we have investigated whether the effectiveness of financial reform depends upon initial conditions and other variables that reflect institutional quality and political stability. For instance, one may think that the effect of financial reform may be more beneficial in countries with a well-developed legal system that affords a better protection to creditor rights. Moreover, when incentives are highly distorted, financial liberalization might tend to hurt the allocation of credit, not improve it. For this reason we have interacted our liberalization measures with the initial level of financial development, the initial black market premium, initial GDP per capita, and several institutional variables, such as rule of law, creditor rights, risk of expropriation, risk of contract repudiation, efficiency of the judiciary, country of origin of the legal system,

²⁰ On the issue of the sequencing of reforms see, for instance, McKinnon (1991). See also Arteta et al.

quality of accounting standards, measures of supervisory power and quality, corruption, and political risk.²¹

Again, it is difficult to find statistically significant differences in the financial liberalization coefficients, due probably to the limited number of countries in our sample. The only statistically significant interaction is the one with the measure of official supervisory power over financial intermediaries from Barth et al (2001a).²² Results are reported in Table 6. A greater degree of supervisory power is associated with a stronger effect of financial liberalization and the differences are economically significant. At low levels of supervision the effect of financial liberalization is basically zero, while it becomes large and positive at mean levels of supervision (or higher). Finally, we also report the regression results when the effect of financial reform is allowed to differ between countries with a legal system based on the English one and the rest. The coefficient of financial liberalization is twice as larger for the former and more precisely determined (.043 versus .022, with a t-ratio equal to 2.39 and 1.16 respectively). This is consistent with the contention that protection of investor's rights tends to be better in the English common law system (see La Porta et. al.(1998)). However, one cannot reject the hypothesis that the two coefficients are identical. This is also the case when more direct measures of property right protection, creditor right protection, etc. are used.

(2001) for growth regression results.

²¹ See la Porta et al (1997) and (1998) on the relationship between institutions and finance. Note that all the institutional variables we use are country specific, but time invariant and that all our regressions contain country specific constants.

²² The data in Barth et al. (2001a) reflect the situation at the end of the 90's. The measure of official supervisory power varies in our sample between nine and fifteen. See also Barth et al. (2001b) for an analysis of the effects of regulation and supervision.

IV. CONCLUSIONS

The results presented in this paper provide empirical support for the idea that financial liberalization has led to an improvement in the efficiency with which investment funds have been allocated. Both the informal "ocular econometric" exercise and the comparison of mean values of our efficiency index in the pre- and post-liberalization regimes suggests that the index has improved for many (although not for all) countries, following the introduction of financial reform. Moreover, the econometric results on the panel of country-years observations strongly supports a positive, significant and sizeable effect of financial liberalization on the efficiency with which investment funds are allocated. This conclusion holds for different measures of marginal returns and of financial liberalization, although are stronger when returns are assumed to be proportional to the sales to capital ratio. Moreover, the results for the sales based index are robust to the inclusion of other potential determinants of the efficiency of resource allocation, such as trade liberalization, and macro or financial stability.

We have also found evidence that there is a negative relationship between efficiency of investment allocation, on the one hand, and inflation and speculative pressure, on the other. There is also evidence that its efficacy is enhanced by greater official supervisory power, and some indication that the effects may be greater in countries whose legal system is based on the English one. However, the statistical significance of the interaction terms with various measure of institutional quality tends to be weak

Obviously more works needs to be done. Extending the number of developing countries included in the analysis would obviously be useful. Moreover, one could gain additional insights on this issue by conducting a similar analysis on larger data sets for individual countries that contain also observations on smaller establishments. The use of larger data sets would allow one to assess more fully whether the improvement in the efficiency in the allocation of investment funds is due to an intra-industry or inter-industry reallocation. The main difficulty in pursuing these extensions is the lack of good quality, firm level data, over long enough periods. Still, the evidence presented here provides the first comprehensive micro-based answer concerning the effect of financial liberalization on the allocation of investment in developing countries.

DATA APPENDIX

Variable definitions

Firm level variables

K_t : Beginning of period capital stock, measured as the lagged value of end of period value of property plant and equipment, net of depreciation.

I_t : Capital expenditure.

S_t : Gross sales and other operating revenue during the period, less discounts, returns and allowances.

$cogs_t$: cost of goods sold.

π_t : operating profits = $S_t - cogs_t$.

Country level variables

fli_t : Financial liberalization index, based on Laeven (2003), see Table 1 his Appendix and Annex 1. It is calculated as the sum of zero-one dummies representing six dimensions of liberalization (interest rate deregulation, reduction of entry barriers, reduction of reserve requirements, reduction of credit controls, privatization of state banks, strengthening of prudential regulation). One (zero) denotes the post (pre) reform regime.

$libdummy1$: A dummy variable that equals one (zero), when fli_t equals or exceeds five (is less than five).

$libdummy2$: A dummy variable that equals one in the year following the introduction of interest rate liberalization and the removal of credit controls. It is zero otherwise.

Average Tariff: Un-weighted average of tariff rates. Source: World Bank - World Development Indicators.

Δ *Real exchange rate*: domestic prices divided by US prices multiplied by the exchange rate (in units of domestic currency per US Dollar). Source: International Financial Statistics.

Inflation: $\log(1 + \text{CPI inflation rate})$. Source: International Financial Statistics.

Real GDP Growth: Real GDP growth rate. Source: World Development Indicators

Supervision: Measure of official supervisory power. Source: Barth et al. (2001).

Speculative pressure: Average of exchange rate depreciation, real interest rate variation and the negative of the variation in international reserves. Source: Eichengreen et al. (1995) and Sachs et al (1996)

Sample selection criteria

We deleted the following observations:

- Financial sector firms, that is firms with SIC codes 60 and higher.
- Years with less than 15 firms
- Firms with less than 3 years of observations.
- Observations without investment, capital stock, profits or sales data.
- Observations with $I \leq 0$
- Observations with $S/K \leq 0$
- Observations with $K \leq 0$
- Observations with cost of goods sold ≤ 0
- Observations where $S/K > 20$
- Observations where Cost of goods sold > 20
- Observations where $I/K > 2.5$
- Observations where Profits/ $K > 5$

Table A1: Descriptive Statistics

Variable	Observations	Mean	Median	Std.Dev	Min	Max
I/K	9495	0.257	0.164	0.294	0.000	2.482
S/K	9495	2.988	1.934	3.082	0.000	19.968
Profits/K	9495	0.654	0.434	0.715	-2.925	5.000

Table A2: Number of Firms, by Country

Country	Total Non - financial Firms ^a	Manufacturing Firms ^b
Argentina	40	31
Brazil	141	120
Chile	73	58
India	296	284
Indonesia	115	91
Korea	256	195
Malaysia	287	204
Mexico	74	55
Pakistan	87	83
Philippines	67	47
Taiwan	202	173
Thailand	184	139

Notes: ^a Total number of firms excluding those with SIC codes greater than 60. ^b Firms with SIC codes between 20 and 50.

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Tables

Table 1 : Differences in Mean Value of EI^S and EI^π Between Pre and Post liberalization Periods.

Country	Libdummy1 ^a			Libdummy2 ^b		
	Pre Liberalization	Post Liberalization	Difference	Pre Liberalization	Post Liberalization	Difference
Part 1: EI^S [Index Based on Sales]						
Argentina	0.996	1.105	0.109	0.996	1.105	0.109
Brazil	1.072	1.357	0.285	0.964	1.323	0.359
Chile						
India	1.072	1.247	0.175	1.101	1.261	0.159
Indonesia						
Korea	0.985	1.033	0.048	1.000	1.005	0.005
Malaysia	1.096	1.064	-0.032	1.213	1.056	-0.157
Mexico	1.208	1.185	-0.023	1.050	1.211	0.160
Pakistan	0.859	1.077	0.217	0.886	0.968	0.081
Philippines	1.071	1.063	-0.008			0.000
Taiwan						
Thailand	0.973	1.174	0.202	0.883	1.137	0.254
Part 2: EI^π [Index Based on Profits]						
Argentina	1.124	1.063	-0.061	1.124	1.063	-0.061
Brazil	1.061	1.273	0.212	0.972	1.256	0.284
Chile						
India	1.056	1.080	0.024	1.064	1.073	0.008
Indonesia	0.941	1.116	0.175			
Korea	1.074	1.040	-0.034	1.082	0.996	-0.086
Malaysia	1.046	1.017	-0.029	1.031	1.027	-0.004
Mexico	1.292	1.165	-0.127	1.147	1.203	0.056
Pakistan	0.817	1.045	0.227	0.848	0.927	0.079
Philippines	1.121	1.137	0.016			
Taiwan						
Thailand	0.938	1.182	0.244	0.880	1.120	0.239

Notes: ^a Libdummy1 = 1 (0) when at least 5 of the following requirements were met (not met): interest rate deregulation, entry barriers removed, reserve requirements reduced, credit controls eliminated, privatization, prudential regulation adopted. ^b Libdummy2 = 1 starting from the year after the liberalization of interest rates and the removal of credit controls (0 otherwise). Source: Laeven (2000).

Table 2: Panel Regression for EI^S and EI^π : Basic Specification ^a

Part 1: Dependent Variable: EI^S [Index based on sales]				
	I	II	III	
$FLI(t-1)^b$	0.033 <i>0.013</i>	**		
$Libdummy1^c$		0.107 <i>0.040</i>	***	
$Libdummy2^d$			0.145 <i>0.050</i>	***
R2	0.33	0.32	0.34	
Obs	90	90	90	
Part 2: Dependent Variable: EI^π [Index based on Profits]				
	I	II	III	
$FLI(t-1)^b$	0.021 <i>0.012</i>	*		
$Libdummy1^c$		0.058 <i>0.039</i>		
$Libdummy2^d$			0.087 <i>0.044</i>	**
R2	0.35	0.34	0.34	
Obs	90	90	90	

Notes: ^a i) All specifications include country dummies; ii) Standard errors reported in *italics*; iii) *** Significant at 1%, ** Significant at 5%, * Significant at 10%. ^b Source: Laeven(2000) ^c $Libdummy1 = 1$ (0) when at least 5 of the following requirements were met (not met): interest rate deregulation, entry barriers removed, reserve requirements reduced, credit controls eliminated, privatization, prudential regulation adopted. Source: Laeven(2000). ^d $Libdummy2 = 1$ starting from the year after the liberalization of interest rates and the removal of credit controls (0 otherwise). Source: Laeven(2000).

Table 3 : Panel Regression for EF^S :

Controlling for Trade Liberalization, Real Exchange Rate Changes, Speculative Pressure, Inflation and GDP Growth^a

Dependent Variable: EI^S [Index based on sales].									
	I	II	III	IV	V				
FLI (t-1)^b	0.028 **	0.035 ***	0.032 **	0.029 **	0.034 ***				
	<i>0.013</i>	<i>0.013</i>	<i>0.012</i>	<i>0.012</i>	<i>0.012</i>				
Average Tariff^c	-0.004								
	<i>0.004</i>								
Δ Real Exchange Rate^d		0.161							
		<i>0.156</i>							
Speculative Pressure^e			-0.014 ***						
			<i>0.005</i>						
Inflation^f				-0.014 ***					
				<i>0.004</i>					
GDP Growth^g								-0.326	
								<i>0.437</i>	
R2	0.37	0.42	0.43	0.43	0.37				
Obs	83	80	80	83	83				
Libdummy1^h	0.070	0.102 **	0.098 **	0.083 **	0.095 **				
	<i>0.044</i>	<i>0.039</i>	<i>0.039</i>	<i>0.038</i>	<i>0.039</i>				
Average Tariff^c	-0.006								
	<i>0.005</i>								
Δ Real Exchange Rate^d		0.123							
		<i>0.168</i>							
Speculative Pressure^e			-0.016 ***						
			<i>0.004</i>						
Inflation^f				-0.014 ***					
				<i>0.004</i>					
GDP Growth^g								-0.418	
								<i>0.451</i>	
R2	0.37	0.40	0.42	0.42	0.35				
Obs	83	80	80	83	83				
Libdummy2ⁱ	0.110 **	0.118 **	0.106 **	0.093 *	0.134 **				
	<i>0.048</i>	<i>0.049</i>	<i>0.049</i>	<i>0.051</i>	<i>0.051</i>				
Average Tariff^c	-0.005								
	<i>0.004</i>								
Δ Real Exchange Rate^d		0.073							
		<i>0.159</i>							
Speculative Pressure^e			-0.011 ***						
			<i>0.004</i>						
Inflation^f				-0.011 **					
				<i>0.005</i>					
GDP Growth^g								-0.398	
								<i>0.051</i>	
R2	0.38	0.40	0.41	0.42	0.38				
Obs	83	80	80	83	83				

Notes:^a i) All specifications include country dummies; ii) Standard errors reported in *italics*; iii) *** Significant at 1%, ** Significant at 5%, * Significant at 10%. ^b Source: Laeven(2000) ^c Average import tariff. Source: World Bank WDI. ^d Depreciation of real exchange rate against US dollar (Negative values=depreciation). Source:IFS/IMF. ^e Speculative pressure index equal to average of changes in nominal exchange rate, changes in the interest rate and the negative of changes in international reserves. Source: Sachs et al. (1996). ^f Inflation is defined as the rate of change of CPI. Source: IFS/IMF. ^g GDP growth is defined as the rate of change of real GDP. Source:WDI/World Bank. ^h Libdummy1 = 1 (0) when at least 5 of the following requirements were met (not met): interest rate deregulation, entry barriers removed, reserve requirements reduced, credit controls eliminated, privatization, prudential regulation adopted. Source: Laeven(2000).ⁱ Libdummy2 = 1 starting from the year after the liberalization of interest rates and the removal of credit controls (0 otherwise). Source:Laeven (2000) .

Table 4: Panel Regression for EF^S : Weighted Least Squares^a

Dependent Variable: EI^S [Index based on sales].			
	I	II	III
<i>FLI (t-1)</i> ^b	0.037 *** 0.012		
<i>Libdummy1</i> ^c		0.091 ** 0.037	
<i>Libdummy2</i> ^d			0.095 ** 0.046
R2	0.40	0.38	0.04
Obs	90	90	90

Notes: ^a i) All specifications include country dummies; ii) Standard errors reported in *italics*; iii) *** Significant at 1%, ** Significant at 5%, * Significant at 10%; iv) The square root of the number of firms in each country-year is used as weight. ^b Source: Laeven(2000) ^c Libdummy1 = 1 (0) when at least 5 of the following requirements were met (not met): interest rate deregulation, entry barriers removed, reserve requirements reduced, credit controls eliminated, privatization, prudential regulation adopted. Source: Laeven(2000). ^d Libdummy2 = 1 starting from the year after the liberalization of interest rates and the removal of credit controls (0 otherwise). Source: Laeven (2000).

Table 5: Panel Regression for EF^S : Alternative definition of the capital stock^a

Dependent Variable: EI^S [Index based on sales].			
Part 1: Unweighted			
	I	II	III
<i>FLI (t-1)</i> ^b	0.019 ** 0.010		
<i>Libdummy1</i> ^c		0.074 ** 0.003	
<i>Libdummy2</i> ^d			0.081 ** 0.040
R2	0.57	0.58	0.58
Obs	90	90	90
Part 2: Weighted			
	I	II	III
<i>FLI (t-1)</i> ^b	0.029 *** 0.010		
<i>Libdummy1</i> ^c		0.102 *** 0.035	
<i>Libdummy2</i> ^d			0.085 ** 0.043
R2	0.54	0.55	0.53
Obs	90	90	90

Notes: ^a i) All specifications include country dummies; ii) Standard errors reported in *italics*; iii) *** Significant at 1%, ** Significant at 5%, * Significant at 10%; iv) The square root of the number of firms in each country-year is used as weight; v) The capital stock is defined as in Love(2000). ^b Source: Laeven(2000) ^c Libdummy1 = 1 (0) when at least 5 of the following requirements were met (not met): interest rate deregulation, entry barriers removed, reserve requirements reduced, credit controls eliminated, privatization, prudential regulation adopted. Source: Laeven(2000). ^d Libdummy2 = 1 starting from the year after the liberalization of interest rates and the removal of credit controls (0 otherwise). Source: Laeven (2000)

**Table 6: Panel Regression for EP^S :
Interactions with, Supervisory Power
and Legal Origin^a**

Dependent Variable: EI^S [Index based on sales].		
	II	III
<i>FLI (t-1)</i> ^b	-0.170 *	
	<i>0.105</i>	
<i>FLI(t-1)*SUPERVISOR</i> ^c	0.019 **	
	<i>0.010</i>	
<i>FLI(t-1)*English Origin</i> ^d		0.043 **
		<i>0.018</i>
<i>FLI(t-1)*Non English Origin</i> ^d		0.022
		<i>0.019</i>
R2	0.33	0.32
Obs	83	90

Notes: ^a i) All specifications include country dummies; ii) Standard errors reported in *italics*; iii) *** Significant at 1%, ** Significant at 5%, * Significant at 10%; iv) The square root of the number of firms in each country-year is used as weight. ^b Source: Laeven(2000). ^c Supervisor power. Source Caprio (et.al) 2001. ^d Legal origin of country. Source: La Porta et al.(1998).

Figures

Figure 1: Efficiency Index Based on Sales (IE^S) vs Financial Liberalization

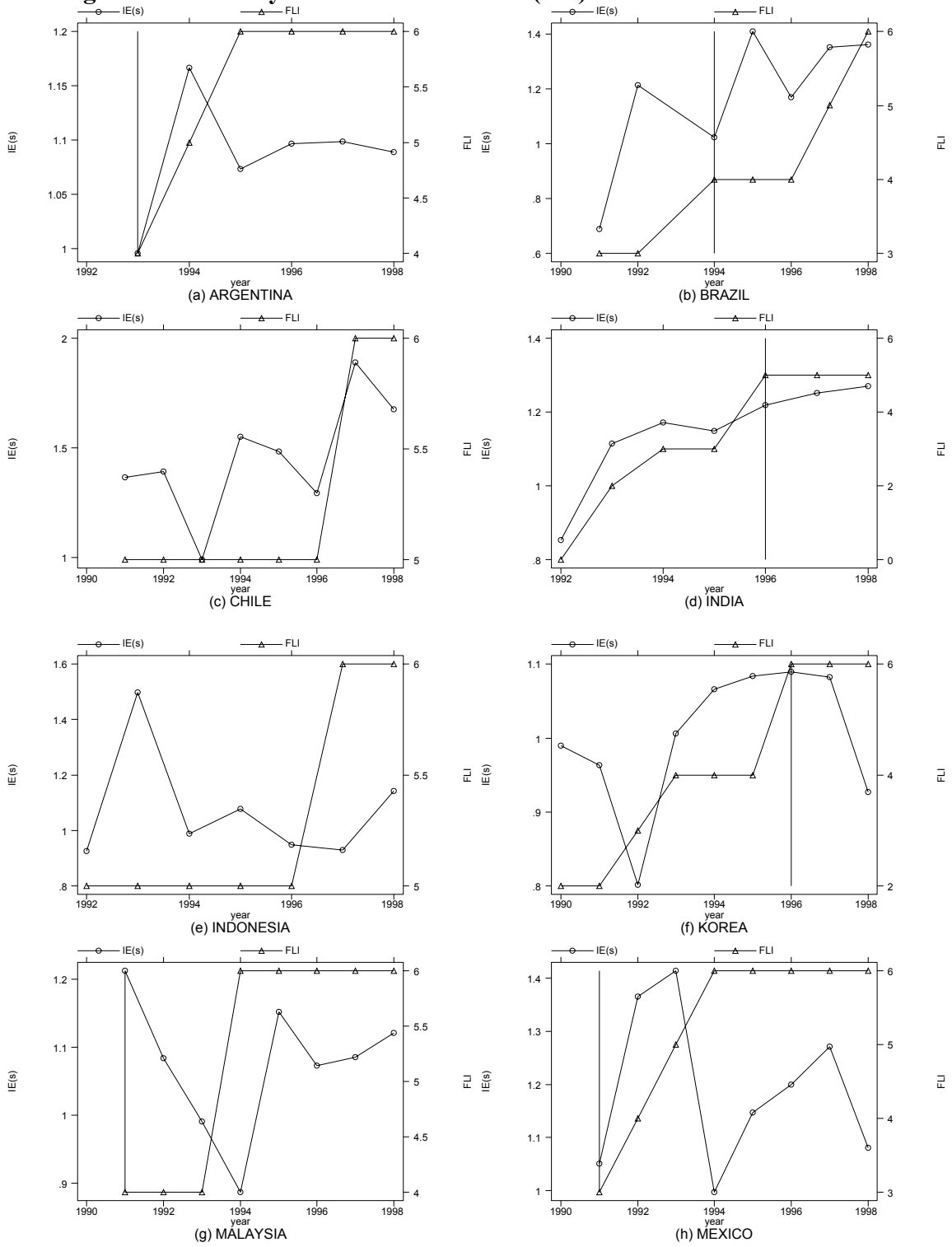


Figure 1(cont.): Efficiency Index Based on Sales (IE^S) vs Financial Liberalization

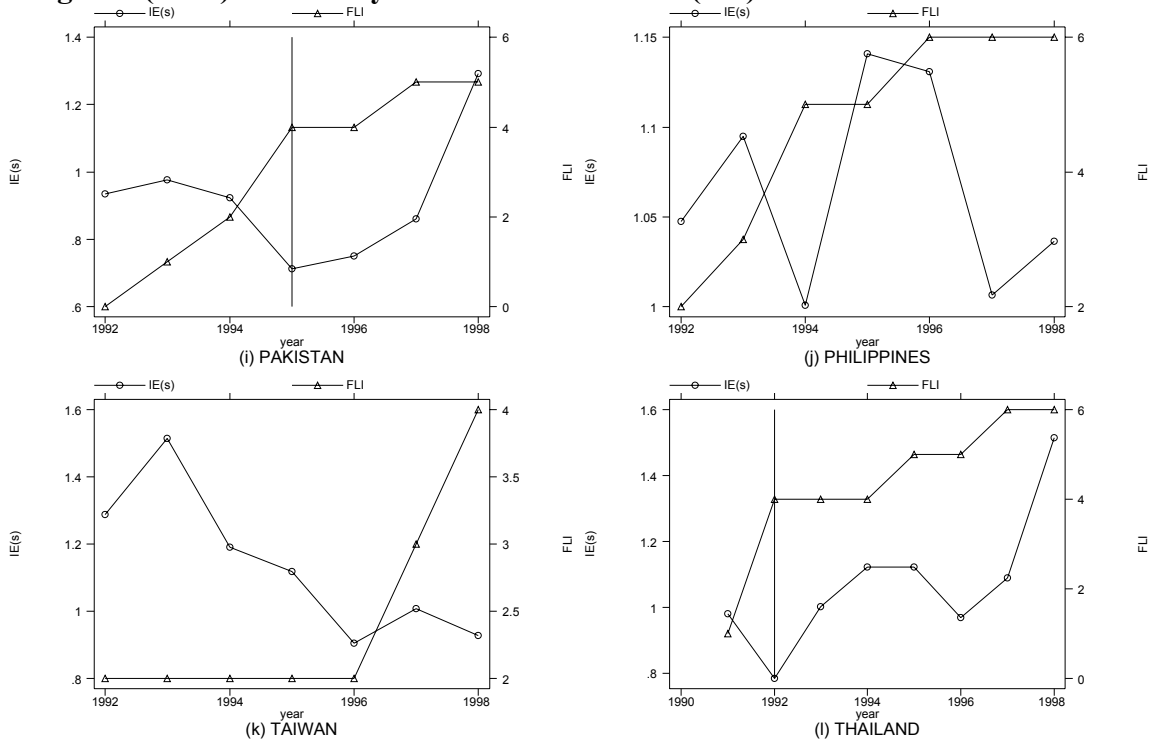


Figure 2: Efficiency Index Based on Profits (IE^{π}) vs Financial Liberalization

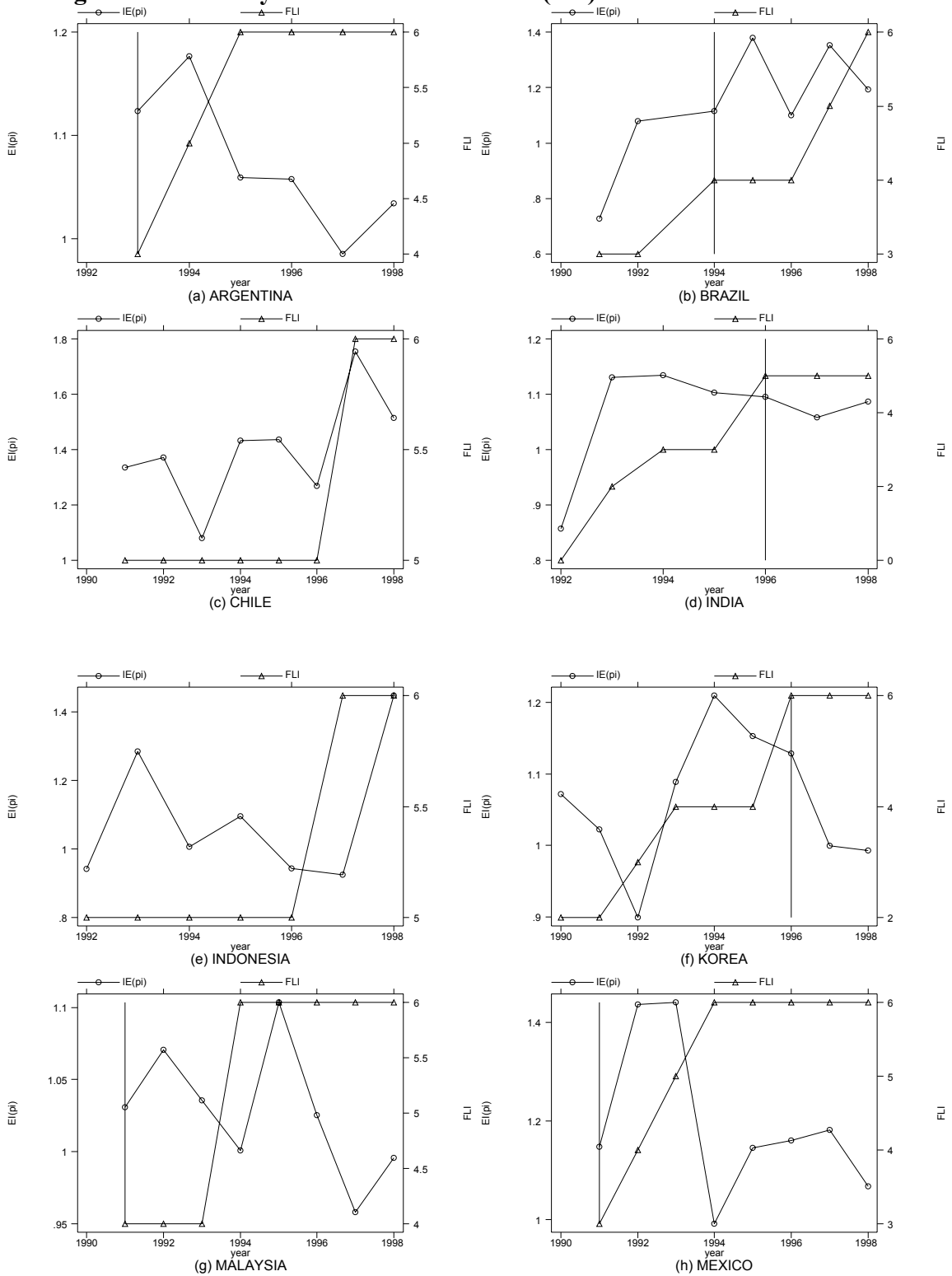


Figure 2(Cont.): Efficiency Index Based on Profits (IE^{π}) vs Financial Liberalization

