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The quality effect: Does financial liberalization improve the allocation of capital? ☆

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Abstract

We document evidence of a "quality effect" of financial liberalization on allocative efficiency, as measured by dispersion in Tobin's *Q* across firms. We predict that financial liberalization, by equalizing access to credit, is associated with reduced variation in expected marginal returns. We test this prediction using a new financial liberalization index and firm-level data for five emerging markets: India, Jordan, Korea, Malaysia, and Thailand. We find robust evidence that financial liberalization, rather than financial deepening, is associated with improved allocative efficiency.

Keywords: Tobin's *Q*; Financial liberalization; Investment; Allocative efficiency
JEL Classification: D61; E44; G14; G18; O16

1. Introduction

Is financial liberalization associated with improved capital allocation? We find robust evidence of a "quality effect" of financial liberalization, using a newly developed measure of efficiency in allocating capital across firms. The measure is essentially the variation in expected returns to investment. If financial liberalization is efficiency enhancing, this variation should be lower when markets–rather than governments–determine the allocation of credit. The hypothesis is that when government controls are reduced or removed, credit is reallocated from firms with low expected returns to firms with higher expected returns, raising expected returns for the former and reducing them for the latter.

We measure the variation in expected returns by the dispersion in Tobin's *Q*, after controlling for industry, age, and leverage effects. We calculate this "*Q*-dispersion" for firms in five emerging-market economies–India, Jordan, Korea, Malaysia, and Thailand–from 1980 to 1994. Simple descriptive statistics show that *Q*-dispersion decreased in all five countries

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following financial liberalization. In panel regressions of *Q*-dispersion, we find that the coefficient on liberalization is negative.

The regression results are robust, even when we include financial deepening as a control. Indeed, financial liberalization is strongly associated with improved allocative efficiency but financial deepening is associated with *lower* allocative efficiency. Note that this distinction between financial liberalization and financial deepening is not often made in the literature. Financial liberalization, on the one hand, refers to a reduction in the role of government, and an increase in the role of the market. We measure this using the financial liberalization index of Abiad and Mody (2005), which summarizes de jure changes in credit controls, interest rate controls, entry barriers for banks, regulations, privatization, and restrictions on international financial transactions. Financial deepening, on the other hand, refers to an increase in the volume of financial activity and is typically measured by indicators such as M2, credit to the private sector, or stock market capitalization relative to GDP. Although the two will tend to be related, they are not equivalent.[1]

Unlike our paper, much of the literature on financial liberalization has focused on whether it has a positive "quantity effect," as manifested in higher levels of savings and investment. Theoretically, however, financial liberalization can improve the functioning of the financial sector without necessarily increasing savings and investment. It is not surprising, then, that the empirical evidence of a quantity effect is mixed.

A positive theoretical prediction, going back to McKinnon (1973) and Shaw (1973), is that higher interest rates, following the removal of interest rate ceilings, will generate greater savings. Higher rates of return may also result from better insurance against risk, which, as Obstfeld (1994) argues, may induce a shift toward higher-risk, higher-return projects. Finally, a positive quantity effect on investment may be expected because increased competition among banks can lead firms to internalize production externalities when making investment decisions (Ueda, 2006).

However, there are also reasons to expect a negative, or at least an ambiguous, effect on savings and investment. First, even if rates of return increase with improved risk sharing or the removal of interest rate ceilings, the effect on savings will depend on whether income or substitution effects prevail. Second, if liberalized financial sectors provide for better insurance against risk, this may lower the need for precautionary savings (Devereux and Smith, 1994).

The theoretical ambiguity of the quantity effect is reflected in empirical studies. Using both a cointegration and an augmented Euler equation approach, Bandiera and others (2000) show that, in a sample of eight developing countries, financial liberalization is not associated with an increase in savings. In fact, certain aspects of liberalization–those that reduce liquidity constraints for household consumption–are associated with a fall in savings. Jayaratne and Strahan (1996) find that the deregulation of bank branches in the United States in the 1970s did not increase the volume of bank lending.

Thus far, only a few studies have attempted to estimate quality effects, and they have generally found positive results. In an early study, Cho (1988) finds that financial liberalization in Korea led to a decrease in the variation in borrowing costs, which he interprets as an improvement in allocative efficiency.[2] Galindo, Schiantarelli, and Weiss (2007) also report a positive and significant effect of liberalization on a measure of allocative efficiency, using firm-level data for 12 developing countries.[3] In a somewhat different context, Chari and Henry (2003) find that capital account liberalization improves the allocation of capital across countries, just as financial liberalization would improve the allocation of capital within countries.

In our view, the main problem with existing studies on quality effects has been their definition of allocative efficiency. For example, Cho's (1988) definition of allocative efficiency as a reduction in the variation in borrowing costs is almost tautological, as this variation naturally decreases when governments eliminate directed credit and interest rate controls. More importantly, even if all firms faced identical borrowing costs, the allocation of capital would still not be efficient if access to credit were determined by noneconomic factors. Galindo, Schiantarelli, and Weiss (2007) use a more

[1] For example, during the 1970s and up into the early 1980s, Japan and France had financially deep markets that were highly repressed. Conversely, several Latin American countries in the 1990s (e.g., Peru, Argentina, and Brazil) had liberalized financial markets that were relatively shallow.

[2] Bekaert and Harvey (2000) find that the average firm-level cost of capital declines in many emerging market economies after the opening of equity market for foreign investors.

[3] Wurgler (2000) finds that in countries with deeper financial sectors (but perhaps without liberalization), capital is better allocated in the sense that it tends to flow to growing industries. However, this is not necessarily an evidence of a quality effect, since governments can artificially stimulate growth in certain industries using directed credit and differential interest rates.

sophisticated definition and argue that, if capital is allocated more efficiently after financial liberalization, more capital should flow to firms with a higher marginal product of capital. They test this hypothesis by assessing whether an investment-weighted average of ex post marginal returns *increases* relative to a naïve size-weighted average of ex post marginal returns.[4] However, a problem with this definition is that, as they themselves note, "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" (p. 567). In other words, in a perfectly efficient economy, the investment-weighted average should be equal to the size-weighted average. But this implies that the ratio of investment-weighted to size-weighted average ex post marginal returns should converge to one, not diverge away from one, which is the case for several countries in their sample. Moreover, while it is correct that ex ante (expected) marginal returns should be equal across firms in equilibrium, the effect of financial liberalization on the ex post (realized) marginal returns is uncertain. As Obstfeld (1994) suggests, the improved availability of risk insurance may lead firms to adopt higher-risk, higher-return projects, thus creating a larger dispersion of ex post returns.[5]

The rest of the paper is organized as follows. Section 2 presents a simple model that explains our rationale for using Q-dispersion as our measure of variation in expected marginal returns. Section 3 discusses data sources and a simple bivariate analysis. Section 4 presents regression results and robustness checks and Section 5 concludes.

2. Financial liberalization and Q-dispersion: theory and measurement

We incorporate the classical Marshallian view that each firm has an optimal, industry-specific operating size. We thus write the profit function for a firm at time t as follows:

$$\pi(K_t, L_t) = f(K_t, L_t) - wL_t - \phi(I_t) - RK_t, \tag{1}$$

with a standard law of motion for capital:

$$K_t = (1-\delta)K_{t-1} + I_t, \tag{2}$$

where K denotes capital, L denotes labor, w is the real market wage, I is investment, and R is the gross interest rate. The function f is a constant-returns-to-scale (CRS) production function with partial derivatives $f_1>0$, $f_2>0$, $f_{11}<0$, $f_{22}<0$, and $f_{12}>0$. The function $\phi(I_t)$ measures the adjustment cost of investment, and satisfies $\phi'>0$ and $\phi''>0$.[6]

Profit maximization gives the unique steady state optimal policy (K^*, I^*, L^*) by

$$f_1(K^*, L^*) - \phi'(I^*) = R, \tag{3}$$

$$f_2(K^*, L^*) = w, \quad \text{and} \tag{4}$$

$$\delta K^* = I^*. \tag{5}$$

Also, the transition path of (K, L) to the steady state is uniquely determined.[7]

In a fully liberalized financial sector, each firm faces the market interest rate, R, implying that the marginal returns to capital, given by Eq. (3), are equal across firms. However, in a repressed financial sector, governments may impose price controls (e.g., interest rate floors or ceilings) or quantity controls (e.g., directed credit) and both controls generate a variation in marginal returns across firms. Consider the case where a government controls interest rates and applies different rates to different firms. As is clear from Eq. (3), the variation in interest rates faced by firms generates variation in returns across firms. Alternatively, consider the case where interest rates are equal, but the investment amount I is

[4] They proxy ex post marginal returns by the sales-to-capital ratio and the operating-profits-to-capital ratio, under the assumption of a constant-returns-to-scale technology.

[5] A related strand of the literature has analyzed the effect of financial liberalization on firm-level credit constraints (e.g., Laeven, 2003; Love, 2003; Sancak, 2002). However, from a general equilibrium perspective, Gomes (2001) argues that investment regressions on cash flows may not provide meaningful measures of credit constraints both with and without Tobin's Q as a control variable for potential growth opportunities. Tobin's Q itself is affected by the presence of credit constraints so that it should not be used as a control variable; However, without controlling for Tobin's Q, there will be an omitted variable bias, as unobserved productivity shocks (e.g., growth opportunities) affect both cash flow and investment. Our approach is based on a general equilibrium framework and is not subject to Gomes's critique. Moreover, our approach, by looking at Q-dispersion, accounts for the effects of liberalization not just on credit-constrained firms but also on over-investing (e.g., privileged) firms.

[6] Allowing for the presence of low fixed-adjustment costs would not change the results.

[7] We assume, for now, that these adjustments are quick–i.e., can be completed within a year–so that the steady state values can be approximated with annual data. We relax this assumption in Section 4.

determined by the government–either directly, via control of firms' investment plans, or indirectly, via credit allocation. Let us denote this amount by $\hat{I}$. In this case, firms maximize their profit function (1) subject to Eq. (2) and the additional constraint $I=\hat{I}$. Letting λ denote the Lagrange multiplier associated with this constraint, the capital market condition (3) can then be rewritten as

$$f_1\left(K^{**}, L^{**}\right) - \phi'\left(\widehat{I}\right) = R + \lambda. \qquad (3')$$

If firms are constrained with respect to the amount they can invest ($\hat{I}<I^*$), λ is positive. Conversely, if firms overinvest ($\hat{I}>I^*$), as may happen, for example, when a government identifies specific industries for development or employment objectives, λ becomes negative.

Elimination of government controls leads to smaller variation of marginal returns, as the market reallocates credit from the overinvesting firms to underinvesting firms. This analysis can be generalized to a dynamic stochastic case,[8] where the real wage, the interest rate, and productivity are allowed to vary over time. In this case, our predictions apply to the ex ante, expected marginal returns to capital, rather than the ex post, realized marginal returns. As previously noted, the dispersion in ex post marginal returns may actually increase after liberalization, if a better financial system leads firms to select higher-risk, higher-return projects (Obstfeld, 1994).

An imperfect but nevertheless frequently used measure of expected marginal returns to capital is Tobin's Q, which measures the discounted sum of expected future profits per asset.

More precisely, the numerator of Tobin's Q is the market value of its equity and debt, while the denominator is the replacement costs of tangible and nontangible assets. It should equal unity in perfectly functioning markets and in the absence of measurement errors.[9] We construct our measure of Tobin's Q by making four approximations that are common in the literature. First, even though marginal Q (the ratio of the increment of market valuation to the cost of the associated investment) provides the best estimate of the expected marginal return to capital (Hayashi, 1982), data constraints require us to proxy marginal Q by average Q. Second, since data on nontangible assets are not available, we follow the convention of using only tangible assets in the denominator (e.g., Blanchard et al., 1993; Bond and Cummins, 2001; Chari and Henry, 2003). Third, data constraints require the use of book value rather than market value of debt.[10] Fourth, in the absence of data on the replacement cost of tangible assets, we approximate replacement costs by adjusting book values for cumulative inflation.[11]

We attempt to correct for measurement errors (e.g., proxying marginal Q with average Q) and other factors that may affect the Q-dispersion by adjusting our estimates of Q for industry, age, and leverage effects. We adjust for industry effects to correct for the disparity between marginal and average Q that can arise from industry-specific production or adjustment cost functions—we thus focus on intra-industry allocation of capital.[12] In addition, controlling for industry effects allows us to correct for differences in Tobin's Q due to differences in wages across industries. We also adjust for differences in the age of firms to correct for the fact that firms of different ages have different vintages of machines and factories. Controlling for age also allows us to correct for the possibility that younger firms may not yet be correctly valued in the stock market, as well as any measurement errors in estimating capital stock

[8] For a more thorough discussion of this case, see Appendix I of Abiad, Oomes, and Ueda (2007). The prediction would also follow from more complicated models with informational problems. That is, even with informational problems, the variation in marginal returns before financial liberalization would still reflect an inefficient allocation of capital, to the extent that governments allocate capital based on considerations beyond marginal productivity.

[9] If the market valuation per unit of capital is different from the replacement cost of a unit of capital, firms have an incentive to adjust capital stock instantly. This discrepancy may also be quickly arbitraged away by investment firms looking for mergers or acquisitions (Jovanovic and Rousseau, 2002).

[10] While there is a standard approach to convert book values of debt to market values (Blanchard, Rhee, and Summers, 1993), this cannot be applied in our case because data on corporate bond rates are not available for the relevant period. According to Chari and Henry (2003), estimating the market value of debt would require further assumptions about unobservable corporate bond rates, which may be a cure worse than the ailment.

[11] Specifically, if K is the reported value of tangible assets in year t, the inflation-adjusted value of tangible assets is given by $K_t+(1-\delta)\cdot K_{t-1}\cdot\pi_t$, where $\delta=0.05$ is an assumed depreciation rate and π_t is the inflation rate. Here, we eliminate any additional measurement errors arising from inflation rate through different investment levels each year among firms, though we cannot correct the measurement errors in valuation at the initial year. As long as we look at changes in Q-dispersion, the initial measurement errors will not create any problem in panel regressions. All our empirical results hold when we do not adjust for inflation.

[12] We ignore possible differences arising from patent holdings, because our focus is on developing countries, while most blueprints are produced by firms in industrial countries. Also, we ignore often observed, potentially bigger distortion of government interventions at industry level.

Table 1
International finance corporation (IFC) corporate financial database coverage (Number of firms per year)

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
India	40	64	76	79	85	85	83	78	63	79	84	79	75		
Jordan	27	24	30	32	33	33	35	33	33	33	31	33	32	31	31
Korea	90	89	90	87	90	89	88	89	88	87	87	84	84	73	74
Malaysia				85	90	93	94	96	86	87	94	87	89	91	88
Thailand					33	36	38	47	59	62	62	61	60	57	58
Total	157	177	196	283	331	336	338	343	329	348	358	344	340	252	251

resulting from accumulated differences in consumer-goods and investment-goods prices.[13] Finally, there may be measurement error stemming from underinvestment as a result of debt overhang (Hennessy, 2004).[14] Specifically, if high leverage increases default probability, a firm's managers (who are assumed to represent equity holders) will invest less than is optimal since the firm may be taken over by creditors in the event of default. This creates an additional discrepancy between the observed average Q and the true marginal Q. Because the default probability may also be affected by liberalization, unlike the other sources of measurement error, the debt overhang problem may change the variance of the measurement errors systematically before and after the liberalization.

In order to control for industry, age, and debt overhang effects, we run the following regression for each country and year:

$$q_h = \sum_{j=1}^{J} \xi_j \cdot \text{Industry}_{hj} + \varphi_1 \cdot \text{Age}_h + \varphi_2 \frac{\text{Liability}_h}{\text{Asset}_h} + \varphi_3 \left(\frac{\text{Liability}_h}{\text{Asset}_h}\right)^2 + e_h, \quad (6)$$

where q_h is the logarithm of Q for firm $h=1,\ldots,H$,[15] Age_h is the difference between the current year and the year of establishment [16] of firm h, and Industry_{hj}, is the binary variable, taking a value of 1 if firm h belongs to industry j, and a value of 0 otherwise.[17] Both the linear and squared terms of the liability-to-asset ratio are included to allow for the possibility that the default probability increases nonlinearly with the leverage ratio.

Running this regression gives us a residual, e_h, which captures the component of q_h that is unexplained by the age, industry, and leverage effects,[18] and we construct an adjusted measure of Q for each firm:

$$\hat{q}_h = \text{mean}(q_h) + e_h = \left(\frac{1}{H}\sum_{h=1}^{H} q_h\right) + e_h. \quad (7)$$

While it is unlikely that all the measurement errors in Tobin's Q are eliminated, a change in our measured Q-dispersion will reflect a change in dispersion of true marginal product of capital so long as the distribution of any remaining measurement error is uncorrelated with financial liberalization.

Finally, we calculate the dispersion in $\hat{q}_h$ by using four inequality measures: the Gini coefficient, mean logarithm of deviations, Theil index, and the coefficient of variation. A comparison of these is useful because each index has different sensitivities to different ranges of the distribution. In particular, the Gini coefficient is most sensitive to changes in $\hat{q}_h$ around the mean; the mean log deviation is most sensitive to changes in $\hat{q}_h$ at the bottom of the distribution; the coefficient of variation is most sensitive to changes at the top end of the distribution; and the Theil index has constant sensitivity across the range of the distribution. The precise definitions of the four inequality indices are given in Appendix II of Abiad, Oomes, and Ueda (2007).

3. Data description and bivariate analysis

Our measure of financial liberalization, described in detail in Abiad and Mody (2005), captures the various

[13] While it is common to also control for firm size, this is not appropriate in our case because, according to our model, the firm size distribution depends directly on the extent to which financial sectors are liberalized.

[14] We thank a referee for pointing this out.

[15] We use the logarithm rather than the level of Q, because given a concave production function, the distribution of $\log(Q)$ better reflects the underlying distribution of capital than the distribution of Q itself. Indeed, in our data set, the distribution of Q itself is skewed to the right, while the distribution of the logarithm of Q is close to normal.

[16] In the absence of data on the year of establishment for Thai firms, we measure their age as the difference between the current year and the year in which the firm was first listed at the Thai stock exchange.

[17] We use 2-digit ISIC (rev. 2) classifications.

[18] As the first stage regressions are run for each country and each year, we do not report the results here.

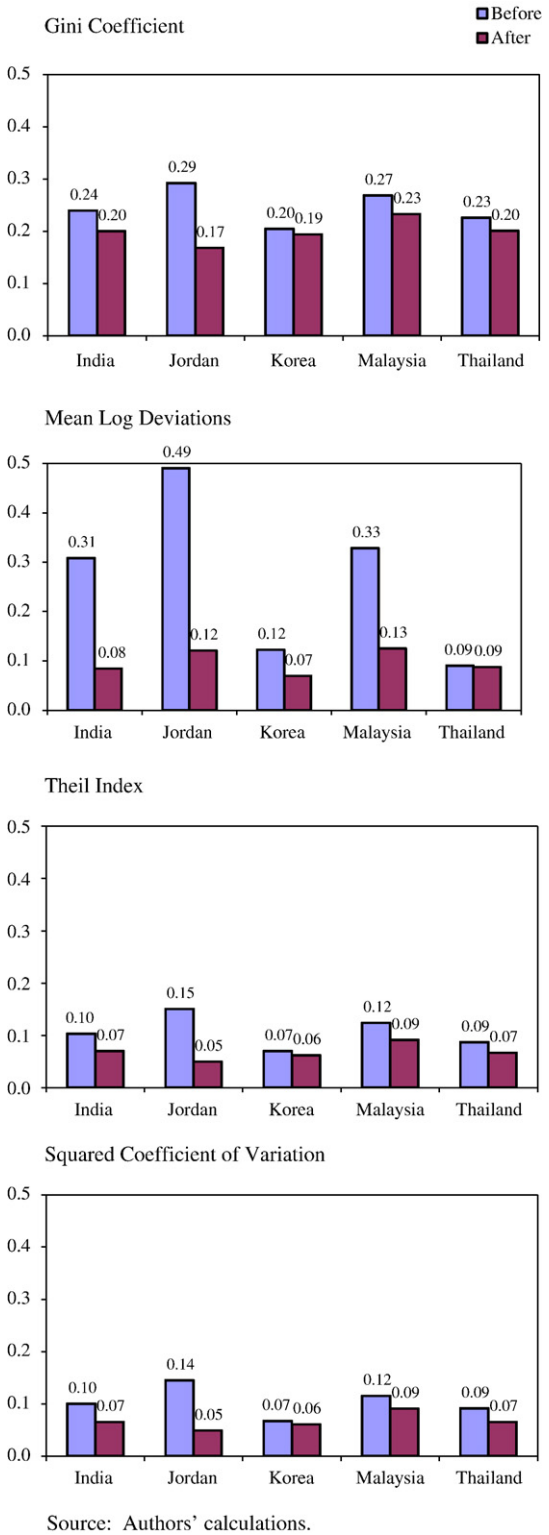

Fig. 1. Dispersion measures, pre- and post-liberalization.

facets and gradations of financial reform. Specifically, the financial liberalization index takes as inputs the following six policy dimensions: *credit controls*, including directed credit toward favored sectors or industries, ceilings on credit toward other sectors, and excessively high reserve requirements; *interest rate controls*, including cases where the government directly controls interest rates or where floors, ceilings, or interest rate bands exist; *entry barriers*, including licensing requirements, limits to the participation of foreign banks, and restrictions relating to bank specialization or the establishment of universal banks; *regulations*, including operational restrictions (e.g., on staffing, branching and advertising) which are considered repression, as well as prudential regulations, which are considered reforms; *state ownership in the financial sector*; and *restrictions on international financial transactions*, including restrictions on capital and current account convertibility, and the use of multiple exchange rates.[19]

To compute Tobin's Q, we use firm-level data from the International Finance Corporation's (IFC) Corporate Finance Database, which is unique in that it covers emerging markets for most of the 1980s, during which time much of the financial liberalization took place. From the original set of countries in the database, we eliminated countries that experienced hyperinflation, as this introduces large errors in balance sheet data. We also eliminated countries with insufficient time coverage, particularly around the period of financial liberalization. Thirdly, we dropped countries that lacked the data required to compute Tobin's Q or our control variables. Finally, we dropped country-years with fewer than ten firms. This left us with five countries: India, Jordan, Korea, Malaysia and Thailand—the same five countries used by Chari and Henry (2003) for evaluating the impact of capital market liberalization. The data coverage for each country is summarized in Table 1.[20]

[19] In the theoretical analysis, we considered only the cases of credit control and interest control. However, the analysis can be easily extended to other areas of financial liberalization listed here. State ownership can be viewed as a more direct method of price and quantity control. Restrictions on international transactions can be viewed as to preserve effectiveness of the state control over domestic financial system. Entry barriers may protect the monopolistic power of existing banks, possibly resulting in price and quantity distortions. Operational regulations can be viewed as a way to protect the existing system of allocating capital.

[20] We used slightly fewer observations than mentioned in Table 1 because of the need to remove some outliers. We eliminated outliers by first taking the logarithm of Q, the distribution of which is close to normal, and then removing all observations further than three standard deviations from the mean. Our results were robust to using different procedures for removing outliers, e.g., excluding all observations with $Q>50$ before calculating the standard deviations.

Table 2
Fixed Effects Regressions

	Fixed Effects				Memo: Random Effects			
	Gini	Theil	M.L.D.	C.V.Sq.	Gini	Theil	M.L.D.	C.V.Sq.
Financial Liberalization ($t-1$)	−0.199	−0.419	−0.911	−0.398	−0.059	−0.1432	−0.5354	−0.1259
	[4.98]***	[5.02]***	[4.78]***	[5.03]***	[1.48]	[1.77]*	[3.40]***	[1.58]
Stock market turnover	−0.084	−0.177	−0.272	−0.154	−0.1041	−0.218	−0.3576	−0.2072
	[2.79]***	[2.81]***	[1.89]*	[2.58]**	[3.64]***	[3.76]***	[3.16]***	[3.62]***
Trade openness	−0.403	−0.755	−0.816	−0.876	−0.0219	−0.0487	0.0424	−0.0511
	[3.35]***	[2.99]***	[1.42]	[3.67]***	[0.46]	[0.50]	[0.22]	[0.54]
Observations	65	65	65	65	65	65	65	65
Number of countries	5	5	5	5	5	5	5	5
R-squared	0.57	0.56	0.43	0.58	0.31	0.35	0.43	0.32
			Hausman Test Statistic:		50.32	37.43	41.43	51.75
			Hausman Test p-value		0.00	0.00	0.00	0.00

Absolute value of *t* statistics in brackets.
*Significant at 10%; **Significant at 5%; ***Significant at 1%.
In the Hausmann Test of FE vs. RE, the null hypothesis is that the Random Effects model is valid.

The fact that the IFC database only includes large publicly listed firms creates a bias against detecting a positive effect of liberalization on allocative efficiency, and therefore would strengthen any finding of such a positive effect. Large firms are more likely to be well connected and less likely to be financially constrained, even under financial repression. Hence, if we observe a decrease in *Q*-dispersion even among these large firms, then the efficiency gains are likely to be even larger if one could measure *Q*-dispersion across firms of all sizes. Another advantage of focusing on publicly listed firms is that information on the activities of these firms is easy for investors to obtain, and therefore informational problems should be smaller.

The unbalanced sample also biases us against finding a decrease in *Q*-dispersion. A balanced sample contains only those firms that survived throughout the sample period; hence, biasing the sample toward firms that did not face financing constraints over sample periods. Using an unbalanced sample should eliminate this bias. Moreover, while financial liberalization may allow more marginal firms with severe credit constraints to enter the market, a better functioning financial system should decrease *Q*-dispersion even in the presence of new entrants.[21]

Let us now compare *Q*-dispersion before and after financial liberalization, using the liberalization dates specified by Demirgüç-Kunt and Detragiache (2001), which are based solely on interest rate liberalization. The liberalization dates are 1991 for India, 1988 for Jordan, 1984 for Korea, 1987 for Malaysia,[22] and 1989 for Thailand. The results are supportive of a quality effect: in all cases, *Q*-dispersion declined following financial liberalization, although the degree of decline varied across countries. As Fig. 1 shows, efficiency increased most strongly in Jordan and India. The Gini coefficient for Jordan, for example, dropped by 41 percent, while in India it decreased by 19 percent. Interestingly, the East Asian countries in our sample showed smaller gains following financial liberalization, with the Gini coefficient decreasing by 11 percent in Malaysia, 7 percent in Thailand, and by only 2 percent in Korea. The other dispersion measures show the same tendency.

4. Panel regressions

4.1. Fixed effects regressions

In this section, we employ both time and cross-country dimensions of the data on *Q*-dispersion and financial liberalization, and control for other factors that

[21] When more heterogeneous firms in production and cost functions enter after the liberalization, a possible increase in *Q*-dispersion could happen only if the technology is linear and heterogeneous across firms (e.g., $y_i=A_ik_i$). However, as we assume, with more standard production function with decreasing marginal product of capital, the dispersion in marginal product of capital must decline by more flexible adjustment of the size of capital, even with potentially more heterogeneous firms in total factor productivity (e.g., $y_i=A_ik_i^{\alpha}l_i^{1-\alpha}$). Heterogeneity in the cost side can be similarly analyzed.

[22] Interest rate decontrol in Malaysia occurred in October 1978, which predates both Demirgüç-Kunt and Detragiache's sample and ours. However, Malaysia reimposed controls in 1985 before liberalizing them again in 1987.

Table 3
Fixed effects regressions with financial deepening indicators

Dependent variable: Gini coefficient						
Financial liberalization ($t-1$)	−0.199			−0.254	−0.263	−0.275
	[4.98]***			[6.47]***	[5.94]***	[6.48]***
Private credit		0.103		0.345		0.277
		[0.91]		[3.64]***		[2.55]**
Stock market capitalization			−0.011		0.084	0.042
			[0.33]		[2.78]***	[1.26]
Stock market turnover	−0.084	−0.110	−0.095	−0.121	−0.097	−0.120
	[2.79]***	[2.90]***	[2.63]**	[4.15]***	[3.37]***	[4.14]***
Trade openness	−0.403	−0.561	−0.550	−0.330	−0.506	−0.396
	[3.35]***	[4.10]***	[3.67]***	[2.97]***	[4.22]***	[3.24]***
Observations	65	66	66	65	65	65
Number of countries	5	5	5	5	5	5
R-squared	0.57	0.39	0.39	0.65	0.62	0.66
Dependent variable: Theil index						
Financial liberalization ($t-1$)	−0.419			−0.535	−0.544	−0.571
	[5.02]***			[6.52]***	[5.84]***	[6.41]***
Private credit		0.214		0.724		0.607
		[0.90]		[3.66]***		[2.66]**
Stock market capitalization			−0.032		0.164	0.072
			[0.47]		[2.58]**	[1.03]
Stock market turnover	−0.177	−0.231	−0.199	−0.254	−0.203	−0.253
	[2.81]***	[2.91]***	[2.62]**	[4.18]***	[3.33]***	[4.16]***
Trade openness	−0.755	−1.089	−1.047	−0.601	−0.956	−0.714
	[2.99]***	[3.79]***	[3.33]***	[2.59]**	[3.78]***	[2.78]***
Observations	65	66	66	65	65	65
Number of countries	5	5	5	5	5	5
R-squared	0.56	0.37	0.37	0.64	0.61	0.65
Dependent variable: mean log deviation						
Financial liberalization ($t-1$)	−0.911			−1.210	−1.105	−1.191
	[4.78]***			[6.68]***	[5.04]***	[6.00]***
Private credit		0.765		1.861		1.921
		[1.44]		[4.26]***		[3.78]***
Stock market capitalization			−0.119		0.255	−0.037
			[0.78]		[1.70]*	[0.24]
Stock market turnover	−0.272	−0.422	−0.308	−0.470	−0.312	−0.470
	[1.89]*	[2.38]**	[1.80]*	[3.50]***	[2.18]**	[3.47]***
Trade openness	−0.816	−1.525	−1.365	−0.420	−1.127	−0.362
	[1.42]	[2.37]**	[1.93]*	[0.82]	[1.89]*	[0.63]
Observations	65	66	66	65	65	65
Number of countries	5	5	5	5	5	5
R-squared	0.43	0.23	0.21	0.57	0.46	0.57
Dependent variable: squared coefficient of variation						
Financial liberalization ($t-1$)	−0.398			−0.506	−0.522	−0.546
	[5.03]***			[6.48]***	[5.94]***	[6.46]***
Private credit		0.182		0.674		0.544
		[0.80]		[3.58]***		[2.52]**
Stock market capitalization			−0.030		0.163	0.080
			[0.46]		[2.71]***	[1.21]
Stock market turnover	−0.154	−0.202	−0.175	−0.225	−0.179	−0.224
	[2.58]**	[2.67]***	[2.41]**	[3.90]***	[3.12]***	[3.89]***
Trade openness	−0.876	−1.194	−1.153	−0.733	−1.075	−0.858
	[3.67]***	[4.34]***	[3.84]***	[3.31]***	[4.51]***	[3.52]***
Observations	65	66	66	65	65	65
Number of countries	5	5	5	5	5	5
R-squared	0.58	0.40	0.39	0.66	0.63	0.67

Absolute value of *t* statistics in brackets. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

can influence the variation in expected returns. Our benchmark equation is as follows:

$$D_{it} = \alpha_i + \beta FLI_{it-1} + \gamma X_{it} + \varepsilon_{it}, \quad (8)$$

where i denotes country and t denotes time; D_{it} denotes Q-dispersion, FLI_{it-1} the financial liberalization index with one-year lag,[23] X_{it} the vector of control variables, and ε_{it} the error term. Our hypothesis is that β is negative.

Two obvious candidates should be included in the set of control variables. The first is the ratio of stock market turnover to market capitalization, a measure of stock market liquidity. Although we have thus far assumed that markets are pricing stocks efficiently, it is not uncommon for stock prices to deviate from fundamentals, especially in thin markets typically observed in developing countries and emerging markets. At any point in time, this deviation creates an additional source of Q-dispersion across firms that does not reflect the underlying capital allocation. Hence, we need to distinguish this source of dispersion from the dispersion caused by improved efficiency in capital allocation for each country and each year. The second one is trade openness, the ratio of the sum of exports and imports to GDP. Exports and imports are directly affected by product market reforms that involve price or quantity restrictions on goods and services. As such, trade openness acts as a proxy for other reforms that may affect Q-dispersion through effects on firms' profitability.

Table 2 reports the fixed-effect panel regression results, which shows that the coefficient on financial liberalization is negative and highly significant. This result is robust to using different measures of dispersion. Note that the effect of stock market liquidity is negative as predicted and is always significant. In addition, the effect of trade openness is negative and is almost always significant.

Now we try to separate the effects of financial liberalization and financial deepening, by including two different measures of financial deepening (FD) typically used in the literature. The first is bank credit to the private sector relative to GDP, an indicator of the depth of the banking sector, and the second is stock market capitalization relative to GDP, an indicator of stock market development. Data for these indicators (as well as for stock market turnover) were taken from the World Bank's (2001) Financial Development and Structure database. The regression is now expressed as

$$D_{it} = \alpha_i + \beta FLI_{i,t-1} + \gamma X_{it} + \delta FD_{it} + \varepsilon_{it}. \quad (9)$$

Table 3 presents these regression results, with one panel for each inequality measure. When the financial liberalization index and the two financial deepening indicators are included separately in the regressions (columns 1 through 3), financial liberalization is always correctly signed (negative) and strongly significant. The valuation effect, measured by stock market turnover, is also correctly signed (negative) and significant in almost all cases. However, the two financial deepening indicators are insignificant.

When liberalization is combined with the two financial deepening indicators (columns 4 through 6), financial liberalization remains strongly significant and correctly signed. Surprisingly, private credit now becomes significant, but with a positive sign, implying that private credit expansion without financial liberalization worsens the efficiency of capital allocation. Although stock market capitalization alone with financial liberalization also shows a positive sign, it is not significant when private credit is also added as a regressor (column 6). This is consistent with our view that capital allocation through credit is distorted under financial repression, and that credit booms without sufficient liberalization may harm an economy.

4.2. Allowing for adjustment lags

So far, we have assumed that the adjustment is quick and the capital level is adjusted to the optimal level within one year after the policy change. If adjustment is slower, however, Q-dispersion may improve gradually over a few years. In this case, the current Q-dispersion should also be explained partially by the lagged values of Q-dispersion. To take this slow adjustment into account, the test equation needs to be revised to

$$D_{it} = \alpha_i + \beta FLI_{it-1} + \gamma X_{it} + \delta FD_{it} + \phi D_{it-1} + \varepsilon_{it}. \quad (10)$$

To estimate this revised test equation, we conduct a GMM dynamic panel estimation following Arellano and Bond (1991).[24] Our main results are unchanged for this

[23] We use the lagged index of financial liberalization, because of timing—some balance sheet information at the end of the firm-specific fiscal year may be dated before a regulatory change within a calendar year. Note, however, that we obtained similar results using the contemporaneous financial liberalization index.

[24] This estimation takes the first difference of the test equation and then applies GMM using instrumental variables, which are based on lagged dependent and independent variables (implemented using the *xtabond* command in Stata 9). Specification tests reject the null hypothesis of second-order serial correlation, and the Sargan test does not reject the validity of the overidentifying restrictions. As such, the Arellano-Bond estimation of Eq. (10) is valid.

Table 4
Arellano-bond dynamic panel regressions

Dependent variable: Gini coefficient						
Financial liberalization ($t-1$)	−0.189			−0.199	−0.178	−0.188
	[3.15]***			[3.35]***	[3.23]***	[3.75]***
Private credit		0.255		0.284		0.215
		[1.84]*		[1.95]*		[1.97]**
Stock market capitalization			0.102		0.092	0.071
			[1.74]*		[1.70]*	[1.38]
Stock market turnover	−0.077	−0.076	−0.054	−0.094	−0.070	−0.084
	[2.35]**	[2.32]**	[1.91]*	[3.00]***	[2.64]***	[3.39]***
Trade openness	−0.243	−0.158	−0.327	−0.161	−0.328	−0.246
	[1.93]*	[1.78]*	[3.61]***	[1.84]*	[5.83]***	[3.68]***
Lagged dependent variable	0.498	0.506	0.511	0.448	0.467	0.436
	[11.23]***	[11.86]***	[6.91]***	[7.83]***	[5.37]***	[4.84]***
Observations	56	56	56	56	56	56
Number of countries	5	5	5	5	5	5
Second-order serial correlation (p-value):	0.45	0.42	0.36	0.46	0.40	0.44
Sargan test statistic (p-value):	0.97	0.99	1.00	0.99	1.00	1.00
Dependent variable: Theil index						
Financial liberalization ($t-1$)	−0.389			−0.412	−0.367	−0.390
	[3.33]***			[3.61]***	[3.35]***	[4.02]***
Private credit		0.565		0.632		0.493
		[2.21]**		[2.27]**		[2.45]**
Stock market capitalization			0.210		0.191	0.142
			[1.75]*		[1.71]*	[1.35]
Stock market turnover	−0.167	−0.167	−0.120	−0.205	−0.152	−0.185
	[2.52]**	[2.57]**	[2.10]**	[3.33]***	[2.87]***	[3.93]***
Trade openness	−0.481	−0.294	−0.650	−0.301	−0.656	−0.471
	[1.76]*	[1.63]	[3.78]***	[1.64]	[6.55]***	[4.81]***
Lagged dependent variable	0.454	0.458	0.471	0.394	0.422	0.384
	[7.62]***	[11.08]***	[5.50]***	[5.92]***	[4.27]***	[3.80]***
Observations	56	56	56	56	56	56
Number of countries	5	5	5	5	5	5
Second-order serial correlation (p-value):	0.76	0.94	0.97	0.52	0.69	0.53
Sargan test statistic (p-value):	0.99	1.00	1.00	1.00	1.00	1.00
Dependent variable: mean log deviations						
Financial liberalization ($t-1$)	−0.766			−0.886	−0.708	−0.851
	[4.14]***			[6.84]***	[3.18]***	[6.43]***
Private credit		2.481		2.670		2.463
		[4.22]***		[4.11]***		[4.45]***
Stock market capitalization			0.480		0.439	0.195
			[2.25]**		[2.02]**	[1.38]
Stock market turnover	−0.287	−0.365	−0.188	−0.446	−0.247	−0.416
	[1.67]*	[2.03]**	[1.19]	[2.95]***	[1.84]*	[3.46]***
Trade openness	−0.871	−0.201	−1.245	−0.197	−1.245	−0.415
	[0.96]	[0.48]	[4.20]***	[0.36]	[3.10]***	[1.40]
Lagged dependent variable	0.069	−0.044	0.092	−0.114	0.049	−0.108
	[0.55]	[0.41]	[0.65]	[1.14]	[0.37]	[0.98]
Observations	56	56	56	56	56	56
Number of countries	5	5	5	5	5	5
Second-order serial correlation (p-value):	0.54	0.66	0.56	0.56	0.50	0.54
Sargan test statistic (p-value):	0.99	1.00	1.00	1.00	1.00	1.00
Dependent variable: squared coefficient of variation						
Financial liberalization ($t-1$)	−0.385			−0.403	−0.363	−0.382
	[3.11]***			[3.33]***	[3.14]***	[3.60]***
Private credit		0.487		0.545		0.409
		[2.00]**		[2.10]**		[2.20]**
Stock market capitalization			0.199		0.180	0.138
			[1.77]*		[1.75]*	[1.42]
Stock market turnover	−0.150	−0.146	−0.104	−0.182	−0.135	−0.162
	[2.42]**	[2.40]**	[1.99]**	[3.18]***	[2.80]***	[3.82]***
Trade openness	−0.533	−0.362	−0.690	−0.376	−0.699	−0.542
	[2.40]**	[2.17]**	[3.39]***	[2.60]***	[6.22]***	[4.20]***
Lagged dependent variable	0.494	0.511	0.514	0.449	0.466	0.439
	[14.41]***	[14.12]***	[8.65]***	[10.01]***	[6.96]***	[6.04]***
Observations	56	56	56	56	56	56
Number of countries	5	5	5	5	5	5
Second-order serial correlation (p-value):	0.18	0.22	0.18	0.20	0.17	0.19
Sargan test statistic (p-value):	0.98	0.99	1.00	1.00	1.00	1.00

Robust t statistics in brackets. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

specification. Table 4 shows that the coefficient on financial liberalization remains correctly signed and statistically significant in all the regressions. Stock market turnover is also correctly signed and significant. Private credit is wrongly signed and often significant. As before, stock market capitalization is significant on its own but is not significant when also controlling for private credit.

We also explored interactions between financial liberalization and financial deepening to allow for the possibility of nonlinear effects. In particular, we tested whether both financial liberalization *and* financial deepening are required to realize a significant improvement in allocative efficiency. Including these interactions, however, produced no interesting results.

4.3. Different aspects of financial liberalization

Different components of financial liberalization may have different effects on Q-dispersion. To find out whether the results are driven by a specific type of financial liberalization, we ran the regressions with each of the six subcomponents of the financial liberalization index. High correlations precluded the inclusion of all six at once, so the subcomponents are tried one at a time, with the other five components aggregated into a separate control (to avoid omitted variable bias).

Table 5 shows that each component is always correctly signed and often significant, even when controlling for the aggregate of the five other components, implying that all of the components seem to be associated with improved allocative efficiency. Specifically, interest rate liberalization and changes in regulations (both operational and prudential) are always significant, while removal of credit controls and liberalization of the capital account are significant for three of the four dispersion measures. Bank privatization and entry barriers seem to matter least for allocative efficiency, being significant for only two out of the four dispersion measures. Moreover, the package of reforms also appears important, as the coefficient on the aggregate of five other components is always correctly signed and statistically significant in most cases.

4.4. Other robustness checks

We conducted five robustness checks based on the Arellano–Bond regression specification.[25] The first robustness check we conducted was to drop one country at a time, in order to investigate whether a single country was driving the results. This could have been the case since the sample contains only five countries, and Fig. 1 seems to indicate that effects of financial liberalization were stronger in some countries than in others. We found, however, that our results held up in all cases.

As a second robustness check, we included a crisis dummy variable in our regressions to control for potential temporary effects on Q-dispersion. The crisis dummy was set equal to one if the country had experienced a currency crisis or banking crisis, based on the crisis database of Bordo and others (2001). Theoretically, the effect of a currency or banking crisis on allocative efficiency is unclear. The coefficient on the crisis dummy was found to be positive, suggesting that crises widen the variation in returns. However, the signs are almost always insignificant, and including the crisis dummy does not change any of our main results.

Third, we tried interacting the financial liberalization index with country dummies, i.e., allowing the coefficient on financial liberalization to vary across countries; however, this did not generate any interesting patterns either. The financial liberalization coefficient for India (which we used as the uninteracted coefficient) was negative but insignificant; the coefficient for Jordan was significantly more negative than for India; the coefficients for Korea and Malaysia were insignificantly more negative than for India; and the coefficient for Thailand was significantly more positive than for India.

Fourth, when liberalizing the financial sector, a country might also improve closely related institutions such as law enforcement. Specifically, increased recovery of non-performing loans implies a reduction of ex ante, equilibrium borrowing constraints (e.g., Albuquerque and Hopenhayn, 2004). Our regressions might pick up the effects of this potential omitted variable, so we added law enforcement measures from the International Country Risk Guide[26] to our set of controls. None of these measures was significant, and their inclusion did not change the financial liberalization effect found previously.

Lastly, we repeated all regressions while controlling for 3- or 5-year cumulative inflation to eliminate any measurement errors in Tobin's Q, possibly remained even after adjusting for inflation when constructing capital stock estimates. There are two possible offsetting effects: on the one hand, across-the-board inflation "lifts

[25] These robustness results are not reported but are available from the authors.

[26] Specifically, we use "Law and Order," "Investment Profile," and "Repudiation (Risk) of Contracts by Government." Measures of creditor rights from Djankov and others (2005) were also considered, but show no variation for our countries over the sample period and hence get absorbed in the country fixed effect.

Table 5
Regressions using financial liberalization components

	Dependent variable: Gini coefficient						Dependent variable: Theil index					
	Credit	Interest	Entry	Reg.	Priv.	Intl.	Credit	Interest	Entry	Reg.	Priv.	Intl.
FLI component ($t-1$)	−0.135	−0.338	−0.055	−0.109	−0.057	−0.085	−0.665	−0.568	−0.267	−2.171	−0.364	−0.407
	[5.81]***	[2.08]**	[1.18]	[3.83]***	[0.89]	[8.04]***	[1.96]*	[2.36]**	[1.94]*	[2.43]**	[2.76]***	[1.90]*
Remainder of FLI ($t-1$)	−0.219	−0.099	−0.398	−0.315	−0.466	−0.306	−1.626	−1.99	−2.488	−0.325	−2.751	−1.964
	[1.25]	[5.31]***	[7.07]***	[6.03]***	[3.46]***	[1.31]	[8.23]***	[5.54]***	[6.82]***	[5.59]***	[0.94]	[7.35]***
Trade openness	−0.327	−0.266	−0.313	−0.289	−0.316	−0.331	−1.119	−1.093	−1.442	−1.116	−1.469	−1.55
	[3.34]***	[2.71]***	[3.37]***	[2.93]***	[4.61]***	[3.45]***	[1.91]*	[1.56]	[3.21]***	[1.43]	[2.88]***	[3.02]***
Stock market turnover	−0.044	−0.064	−0.068	−0.057	−0.063	−0.04	−0.176	−0.259	−0.277	−0.271	−0.227	−0.114
	[2.27]**	[2.10]**	[3.06]***	[2.47]**	[2.07]**	[1.35]	[2.01]**	[2.44]**	[3.63]***	[2.60]***	[1.49]	[0.84]
Lagged dependent variable	0.395	0.452	0.394	0.429	0.39	0.434	0.071	0.089	−0.052	0.098	−0.077	0.069
	[5.52]***	[15.91]**	[3.82]***	[8.02]***	[36.18]**	[10.90]***	[0.85]	[1.02]	[0.63]	[1.04]	[1.51]	[0.74]
Observations	43	43	43	43	43	43	43	43	43	43	43	43
Number of country_id	4	4	4	4	4	4	4	4	4	4	4	4
	Dependent variable: mean log deviation						Dependent variable: Squared coeff. of variation					
	Credit	Interest	Entry	Reg.	Priv.	Intl.	Credit	Interest	Entry	Reg.	Priv.	Intl.
FLI component ($t-1$)	−0.28	−0.217	−0.134	−0.205	−0.141	−0.668	−0.273	−0.678	−0.789	−0.652	−0.92	−0.184
	[6.86]***	[2.29]**	[7.78]***	[4.58]***	[1.00]	[11.48]***	[1.33]	[4.75]***	[1.60]	[3.69]***	[3.29]***	[1.41]
Remainder of FLI ($t-1$)	−0.504	−0.731	−0.84	−0.708	−0.951	−0.18	−0.468	−0.207	−0.133	−0.212	−0.131	−0.623
	[1.39]	[6.49]***	[1.46]	[5.83]***	[3.40]***	[1.34]	[5.51]***	[2.10]**	[6.11]***	[5.55]***	[1.16]	[6.46]***
Trade openness	−0.65	−0.543	−0.646	−0.585	−0.661	−0.685	−0.685	−0.571	−0.66	−0.616	−0.67	−0.699
	[3.31]***	[2.70]***	[3.60]***	[2.80]***	[4.74]***	[3.61]***	[3.82]***	[3.51]***	[3.94]***	[3.81]***	[6.46]***	[4.01]***
Stock market turnover	−0.098	−0.138	−0.143	−0.127	−0.132	−0.087	−0.075	−0.112	−0.118	−0.101	−0.11	−0.067
	[2.36]**	[2.32]**	[3.47]***	[2.76]***	[2.21]**	[1.44]	[2.25]**	[2.22]**	[3.40]***	[2.65]***	[2.06]**	[1.27]
Lagged dependent variable	0.37	0.426	0.359	0.406	0.349	0.409	0.351	0.41	0.355	0.385	0.353	0.388
	[6.38]***	[12.51]**	[3.94]***	[7.42]***	[13.25]**	[6.36]***	[6.49]***	[42.91]**	[4.40]***	[9.89]***	[12.21]**	[10.90]***
Observations	43	43	43	43	43	43	43	43	43	43	43	43
Number of country_id	4	4	4	4	4	4	4	4	4	4	4	4

Robust t statistics in brackets. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

all boats" and reduces inequality when measured in a log scale, while on the other hand, dispersion increases with heterogeneous inflation variation (in location and equipments), which in turn is likely correlated with across-the-board inflation. When we included inflation (the GDP deflator) in the regressions, we found that the coefficient on inflation was negative and occasionally significant, indicating that the first effect is stronger than the second is. However, all key results remained the same.

5. Conclusions

Although recent studies have found little or no effect of liberalization on the level of savings and investment, we found robust evidence that liberalization is associated with improved efficiency in allocating capital. With a simple general equilibrium model, we predicted that financial liberalization, by equalizing access to credit, reduces the variation in expected returns across firms, which we measured by the dispersion in Tobin's Q. In testing this prediction, we found that financial liberalization was negatively associated with Q-dispersion, and hence, positively associated with allocative efficiency. In other words, the benefits of liberalization appear to be realized mainly through its effect on the quality, not the quantity, of investment. In addition, we found that financial liberalization, rather than financial deepening, mattered the most for allocative efficiency. In fact, increasing private credit typically worsened efficiency, suggesting that credit growth without liberalization may lead to a misallocation of credit.

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