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Thresholds in the Process of International Financial Integration

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Abstract

The financial crisis has re-ignited the fierce debate about the merits of financial globalization and its implications for growth, especially for developing countries. The empirical literature has not been able to conclusively establish the presumed growth benefits of financial integration. Indeed, a new literature proposes that the indirect benefits of financial integration may be more important than the traditional financing channel emphasized in previous analyses. A major complication, however, is that there seem to be certain "threshold" levels of financial and institutional development that an economy needs to attain before it can derive the indirect benefits and reduce the risks of financial openness. This paper develops a unified empirical framework for characterizing such threshold conditions. The analysis finds that there are clearly identifiable thresholds in variables such as financial depth and institutional quality—the cost-benefit trade-off from financial openness improves significantly once these threshold conditions are satisfied. The findings also show that the thresholds are lower for foreign direct investment and portfolio equity liabilities compared with those for debt liabilities.

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I. Introduction

The worldwide financial crisis has dramatically driven home the downside of financial globalization. Many emerging market and developing economies had to grapple with surges of capital inflows earlier in this decade and are now experiencing a sharp reversal of those inflows. Financial linkages have served as a channel for the global financial turmoil to reach their shores. This will no doubt re-ignite the fierce debate about the merits of financial globalization and its implications for growth and volatility, especially for developing countries.

In theory, financial globalization should facilitate efficient international allocation of capital and promote international risk sharing. These benefits should be much greater for developing countries. These countries are relatively capital scarce and labor rich, so access to foreign capital should help them increase investment and grow faster. Developing countries also have more volatile output growth than advanced industrial economies, which makes their potential welfare gains from international risk sharing much greater.

However, the empirical literature has not been able to conclusively establish the growth and stability benefits of financial integration. In particular, cross-country studies have not yielded robust evidence that financial openness has a positive effect on growth. Studies using microeconomic (firm- or industry-level) data or those that look at specific events such as equity market liberalizations do detect significant growth effects, but it remains an open question whether these effects scale up when one considers the more general concept of financial openness and its effects on growth. Moreover, for developing countries with low to intermediate levels of financial openness, there is equally sparse evidence that financial integration has delivered its other presumed benefit--improved risk sharing and better consumption smoothing.

Kose, Prasad, Rogoff, and Wei (2009) survey this extensive literature and propose an alternative framework for analyzing the macroeconomic implications of financial globalization in order to pull together the different strands of evidence. These authors point out that in theory financial globalization should catalyze domestic financial market development, improve corporate and public governance, and provide incentives for greater macroeconomic policy discipline. Such indirect benefits may be more important than the traditional financing channel emphasized in previous analyses. Indeed, recent work stimulated by the phenomenon of global current account imbalances suggests that developing countries that are more open to certain types of financial flows but overall are less reliant on foreign capital and finance more of their investment through domestic savings have on average experienced better growth performance.[2]

A major complication, however, is that there seem to be certain "threshold" levels of financial and institutional development that an economy needs to attain before it can get the full indirect benefits and reduce the risks of capital account liberalization. It has generally been the case that industrial countries—which typically have better institutions, more stable macro policies, and deeper financial markets than developing countries—have been the main beneficiaries of financial globalization. This has led many authors to argue that

[2] See Aizenman, Pinto and Radziwill (2007), Gourinchas and Jeanne (2007) and Prasad, Rajan, and Subramanian (2007).

developing countries should focus on building up their institutional capacity and strengthening their financial markets before opening up their capital accounts (e.g., Rodrik and Subramanian, 2009). How to balance these considerations against the potential benefits to be gained from financial integration is a pressing policy question, now that developing countries again face difficult choices about whether and how to liberalize capital account transactions further.

Framing the issue this way generates a set of pointed questions that are relevant for translating academic analysis of financial globalization into implications for policies toward capital account liberalization. How can countries improve the benefit-risk trade-off associated with integration into international capital markets? Is there a well-defined threshold level of economic characteristics beyond which the trade-off improves and makes opening of the capital account beneficial and less risky for a developing country?

There is a substantial theoretical and empirical literature, mostly of recent vintage, suggesting that financial sector development, institutional quality, trade openness, and the stability of macroeconomic policies all play important roles in realizing the benefits of financial openness. For instance, a deep and well-supervised financial sector is essential for efficiently intermediating foreign finance into productive investments. It can also be helpful in reducing the adverse effects of capital flow volatility. Similarly, countries with better institutions (less corruption and red tape, better corporate and public governance) attract relatively more FDI and portfolio equity flows, which are more stable than debt flows and are also more likely to promote indirect benefits. The existing literature points to the existence of such threshold effects but lacks a unifying framework that can be used to interpret the results and derive policy implications.

Our main contribution is to provide a unified empirical framework for studying the concept of thresholds in the process of financial integration and for analyzing the policy implications of this framework for the process of capital account liberalization. We then provide a new set of results on thresholds in different dimensions using a common empirical approach. In the process, we tackle a number of complex measurement issues that need to be dealt with in order to provide more coherence to the existing literature. We also make a modest methodological contribution by showing how to adapt semiparametric estimation techniques to estimate key interaction relationships in growth regressions in a flexible manner.

We report some initial progress on framing and addressing a more difficult set of practical questions directly related to various policy choices. For instance, what are the confidence intervals around different threshold conditions? This is important for determining the policy relevance of the estimated thresholds and for identifying zones that are clearly hazardous or clearly safe for undertaking financial opening. We take an agnostic approach towards various measurement issues on which there is no consensus in the literature, including how best to measure financial development and financial openness. We also try to account for possible differences in threshold conditions across different types of cross-border flows.

Based on an analysis of data over a period of three decades prior to the recent financial crisis, we find that there are indeed clearly identifiable thresholds in variables such as financial depth and institutional quality. Although there are differences in the results we obtain from various methodologies and the confidence intervals tend to be large, some of the key thresholds are fairly precisely estimated and have practical empirical content. We

also find that the thresholds are lower for foreign direct investment and portfolio equity liabilities compared to those for debt liabilities.

We begin, in Section II, by reviewing some of the existing literature and providing a synthesis that enables us to map out some of the key issues that need to be addressed in analyzing threshold effects. In Section III, we tackle a number of measurement issues, including how to measure financial openness and the different threshold variables. In Section IV, we discuss the empirical strategy to get at the issue of thresholds. Our basic results, including some stylized facts to motivate the more detailed analysis, are in Section V. In Section VI, we conduct a variety of sensitivity tests on our baseline results. We then present a number of extensions in Section VII. We conclude, in Section VIII, by highlighting the main findings and discussing their policy implications.

II. Synthesis of Theory and Evidence

In prior research, a number of avenues have been explored to reconcile the strong theoretical prediction that financial integration should boost long-run growth in developing economies with the weak empirical evidence. Some authors have argued that countries that do not have the right initial conditions can experience growth surges due to financial integration but they inevitably experience crises, which pulls down their long-run growth. Others have argued that countries that lack certain structural features are not able to derive the full benefits of financial integration even if they can escape crises.[3]

Kose et al. (2009) synthesize these two lines of argument into a framework that characterizes variables that influence the relationship between financial integration and growth as a set of "threshold conditions." Figure 1 schematically depicts this framework and lists the main threshold conditions. These include an economy's structural features--the extent of financial sector development, institutional quality, and trade integration--and also the macroeconomic policy framework.

In theory, financial development enhances the growth benefits of financial globalization and reduces vulnerability to crises. Domestic and international collateral constraints play a particularly important role in financially underdeveloped low-income economies where access to arm's length financing is limited. A number of recent studies show how, in different theoretical settings, the interaction of these constraints can lead to unpredictable and possibly adverse effects of capital account liberalization.[4] Shifts in the direction of capital flows can induce or exacerbate boom-bust cycles in developing countries that lack deep financial sectors (Aghion and Banerjee, 2005). Moreover, mismanaged domestic financial sector liberalizations have been a major contributor to crises associated with financial integration (Mishkin, 2006).

Cross-sectional studies generally find significant positive interaction effects between foreign direct investment (FDI) and financial depth (ratio of private credit to GDP) on growth. However, the implied financial depth thresholds for obtaining a positive coefficient

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[3] For a comprehensive review of the related literature see Literature Appendix Tables 1-4 in the supplementary material for this paper available online at http://www.nber.org/data-appendix/w14916/Supplementary%20material.pdf.

[4] See Caballero and Krishnamurthy (2001), Aghion, Bacchetta, and Banerjee (2004), Mendoza, Quadrini and Rios-Rull (2007) and Aoki, Benigno, and Kiyotaki (2006).

on financial openness vary substantially within and across studies. For example, across Hermes and Lensink (2003), Alfaro et al. (2004), and Carkovic and Levine (2005) the estimated credit-to-GDP thresholds vary from 13 percent to 48 percent. There are mixed results from studies where financial depth is interacted with other financial openness measures. Bekaert et al. (2005) and Hammel (2006) find higher growth following equity market liberalizations in countries with higher private credit/stock market turnover and stock market capitalization, respectively (also see Bekaert et al., 2009; Mukerji, 2009). Using broader measures of financial openness, Prasad et al. (2007) find evidence of high/low interaction effects among non-industrial countries (also see Klein and Olivei, 2001; Chinn and Ito, 2006; Coricelli et al., 2008) but Kraay (1998) and Arteta et al. (2003) do not.

The quality of corporate and public governance, the legal framework, the level of corruption, and the degree of government transparency can affect the allocation of resources in an economy. Some authors argue that precursors of crises such as flawed macroeconomic and structural policies can also be traced back to weak institutions (Acemoglu et al., 2003). Since capital inflows make more resources available, the quality of institutions matters more for financially open economies. Post-mortems of the Asian financial crisis have pinned a large portion of the blame on crony capitalism that reflected corruption and weak public governance (Haber, 2002; Krueger, 2002). Indeed, an intermediate degree of financial openness with selective capital controls may be most conducive to crony capitalism, as it gives politically well-connected firms preferential access to foreign capital (Johnson and Mitton, 2003). Weak protection of property rights in poor countries means that foreign financing may not be directed to long-gestation, investment-intensive, and low-initial profitability projects (including infrastructure) where such financing could be particularly useful given domestic financing constraints (Rajan and Zingales, 1998).

Bekaert et al. (2005) and Chanda (2005) find interaction effects between institutional quality and financial openness in promoting growth but Kraay (1998) and Quinn and Toyoda (2008) do not. Klein (2005) finds that only intermediate levels of institutional quality are associated with a positive correlation between growth and capital account liberalization, hinting at the possibility of nonlinear threshold effects. Countries with better corporate and public governance receive more of their inflows in the form of FDI and portfolio equity; these are more stable than debt flows and also confer more of the indirect benefits of financial integration (Wei, 2001). Some authors have used a country's level of income as a proxy for overall institutional development and interacted that with financial openness. Edwards (2001) and Edison et al. (2004) find evidence of a positive linear interaction and an inverted U-shaped relationship, respectively. However, Arteta et al. (2003), Carkovic and Levine (2005) and Quinn and Toyoda (2008) do not find robust evidence of such relationships.

Trade openness reduces the probability of crises associated with financial openness and mitigates the costs of crises if they do occur. Economies that are more open to trade have to undergo smaller real exchange rate depreciations for a given current account adjustment, face less severe balance sheet effects from depreciations and, as a result, are less likely to default on their debt. This makes them less vulnerable to sudden stops and financial crises (Calvo et al., 2004; Frankel and Cavallo, 2004). Trade integration puts an economy in a better position to continue servicing its debt and export its way out of a recession (Edwards, 2004). Eichengreen (2001) notes that financial integration without trade integration could

lead to a misallocation of resources as capital inflows may go to sectors in which a country does not have a comparative advantage (also see Aizenman and Noy, 2008).

Capital account liberalization is more likely to be successful if it is supported by good fiscal, monetary and exchange rate policies. Weak or incompatible policies can increase the risk of crises from an open capital account. For instance, the combination of a fixed exchange rate and an open capital account has been implicated in a number of currency crises (Obstfeld and Rogoff, 1995; Wyplosz, 2004). Similarly, managing capital inflows can be especially complicated in developing economies with large fiscal deficits and procyclical fiscal policy (Ishii et al., 2002; Calvo, Reinhart, and Vegh, 2004; IMF, 2007). These findings have been used to argue that capital account liberalization can serve as a commitment device for sound macroeconomic policies (Bartolini and Drazen, 1997; Gourinchas and Jeanne, 2006). Arteta et al. (2003) report evidence of threshold effects related to macro policies in generating positive growth effects of financial openness. Mody and Murshid (2005) find that better macro policies enhance the impact of financial openness on investment growth.

In summary, there is a substantial theoretical and empirical literature that serves as a basis for positing the existence of threshold conditions. However, this literature is disparate and does not provide clear guidance about the precise nature of the threshold relationship or how one would translate the theory into a reduced-form empirical framework. Some models suggest the existence of nonlinear threshold effects but the form of nonlinearity is not clear.

The empirical literature has reported many interesting results but the robustness of these results and the estimated thresholds vary widely. Moreover, each of these studies typically focuses on one conditioning variable and one indicator of financial openness, and most of them use a simple linear interaction specification. The extent to which countries satisfy different potential thresholds or the trade-offs between different threshold variables has not been examined, nor has the economic significance of the threshold levels. Finally, the potentially wide confidence intervals around the thresholds have not been emphasized. Thus, while there is a great deal of evidence that threshold conditions matter, the existing literature is not organized around a consistent framework, making it difficult to draw policy conclusions about capital account liberalization.

III. Measurement and Data

In this section, we discuss our approach to several key measurement issues and present our dataset. We take an agnostic approach to some of the complex measurement issues. Our approach will be to pick baseline measures of certain variables and then conduct extensive robustness tests of those baseline results using alternative measures. A detailed description of the variables in our dataset, as well as their sources, is presented in the Data Appendix.

There is an important distinction between traditional de jure measures of openness, i.e., restrictions on capital account transactions, and de facto openness. Capital controls are the relevant policy tool, but there can be differences in their degree of enforcement over time. Besides, when analyzing how financial openness influences growth, what matters is how much an economy is actually integrated into international capital markets.

We use as our baseline measure of financial openness the sum of a country's total stocks of external assets and liabilities, expressed as a ratio to nominal GDP. This is a summary measure of a country's total exposure to international financial markets. We also look at

stocks of liabilities—cumulated measures of inflows into a country—that may be most relevant for developing economies as well as various measures of gross and net flows. In some of our analysis, we also look at de jure capital account openness based on an indicator of the proportion of years in which the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions indicates the absence of capital account restrictions.

For each of the threshold categories, we have to choose an appropriate measure that is conceptually sound and for which data are available for our broad sample of countries.

a. Financial depth: We use the ratio of private credit to GDP as a proxy for financial depth, recognizing that this is a narrow definition of financial development. We also examine a range of alternative measures of de facto financial depth and development, such as the sum of stock market capitalization and credit to GDP, the ratio of M2 to GDP etc., as well as institutional measures such as creditors' rights.

b. Institutional quality: The World Bank Governance Indicators (WBGI) cover six aspects of institutional quality: voice and accountability; political instability and violence; government effectiveness; regulatory quality; rule of law; and control of corruption (Kaufmann et al., 2005). We use a simple average of these six indices as a proxy for aggregate institutional quality. These data are available only from 1996 and show strong persistence across time for each country; hence, we use the average of the available data as a fixed institutional variable.

c. Regulation: We use an index of the rigidity of labor regulations from the International Finance Corporation's Doing Business Database. It captures an economy's ability to adapt to changing business conditions, including financial flows. These data are available only from 2003, so we use the average for each country as a fixed regulation variable.

d. Trade openness: We use the sum of exports and imports of goods and services, expressed as a ratio to GDP. We also include a measure of policy openness to trade, defined as the proportion of years for which the trade regime is an open one (Wacziarg and Welch, 2003).

e. Macro policies: The monetary and fiscal policy stances are measured by the degree of variation in consumer price inflation and the average ratio of government revenue to expenditure, respectively, over the relevant period. Whilst these macroeconomic outcomes are subject to exogenous shocks, their measurement over five-year periods can provide a broad indication of the policy stance.

f. Overall development: We use the level of initial per capita GDP (either at the beginning of the sample or the initial year of each five-year period measure).

Our dataset comprises a total of 84 countries. We do not include the transition economies of Eastern Europe since their data for the pre-transition years are suspect and we need longer time series for our analysis. We also exclude small economies (population under 1 million) and a number of poor economies for which data availability, especially on capital flows, is limited. The dataset covers the period 1975-2004, giving us a maximum of six non-overlapping five year-averaged observations for each country.

When presenting basic stylized facts, we group the countries into industrial (21), emerging market (21), and other developing countries (42) (see Appendix Table A.1). The emerging

market countries are those from the group of non-industrial countries that are most financially open.[5] This group accounts for the vast majority of capital flows (either net inflows or gross inflows plus outflows) into or out of the non-industrial countries. In the formal empirical analysis, we do not use these coarse distinctions; instead, we directly control for the level of development and the degree of financial openness. Our econometric analysis includes the full sample of countries as it is based on a framework that should be consistent across industrial and developing countries. Indeed, for identifying threshold effects, it is best to include as many countries as possible at different stages of development.

IV. Empirical Strategy

We now discuss some issues that we need to confront in our formal empirical analysis and describe how we tackle them. Our empirical framework builds on standard cross-country growth regressions as we are interested in capturing threshold effects at the national level.[6] Our focus is on medium- and long-run growth rather than business cycle and other short-run fluctuations. Hence, we use five-year averages of the underlying data for our baseline results. Business cycles are more persistent in developing economies than in industrial ones but a five-year window is a reasonable compromise for filtering out cycles in both types of countries (Agenor et al., 2000; Aguiar and Gopinath, 2006). Time averages of the annual data also smooth out year-to-year fluctuations in variables such as capital flows.

We use two broad categories of cross-country econometric models to investigate potential thresholds in the relationship between financial openness and growth. Both methods attempt to explain a country's growth over a five-year period, Δy_{it}, as a function of a set of standard controls for growth models, x_{it}, country and time period specific effects, δ_i and γ_t respectively, financial openness, FO_{it}, and its relationship with a threshold variable, TH_{it}:

$$\Delta y_{it} = f(x_{it}, FO_{it}, TH_{it}, \delta_i, \gamma_t) + \varepsilon_{it}$$

where i indexes the country and t the time period, and ε_{it} is an idiosyncratic error term.

The first approach we consider is parametric--a standard linear dynamic panel data model with various interaction functions between the threshold and financial openness variables. The second approach is a semi-parametric one--a partial linear model wherein the relationship between growth and the standard controls plus fixed effects is assumed to be linear but the relationship between growth and the financial openness and threshold variables is modelled as a nonparametric function.

A. Parametric approach

The dynamic linear panel data model is of the following form:

$$\Delta y_{it} = \delta_i + \gamma_t + x'_{it}\theta + g(FO_{it}, TH_{it}) + \varepsilon_{it}$$

[5] The countries in the group of emerging markets roughly correspond to those included in the MSCI Emerging Markets Index. The main differences are that we drop the transition economies because of limited data availability and add Singapore and Venezuela.

where θ is a vector of coefficients on the set of standard controls and where the vector of standard controls x_{it} includes the initial income per capita levels. A key empirical issue is how to define the thresholds relationship in the function $g(FO_{it},TH_{it})$. Based on the literature cited earlier, we explore three specific parametric assumptions for this function:[7]

a. A linear interaction between financial openness and the threshold variable:

$$g(FO_{it}, TH_{it}) = \beta_{FO}\, FO_{it} + \beta_{TH}\, TH_{it} + \beta_{FOTH}\, FO_{it} TH_{it}$$

This approach tests if the level of a particular variable affects the marginal effect of financial openness on growth. The specification we employ implies that the marginal effect (either positive or negative) of financial openness on growth is larger at higher levels of the threshold variable.

b. A quadratic interaction that allows for nonlinear effects of the threshold variable:

$$g(FO_{it}, TH_{it}) = \beta_{FO}\, FO_{it} + \beta_{TH}\, TH_{it} + \beta_{FOTH}\, FO_{it} TH_{it} + \beta_{THsq}\, TH^2_{it} + \beta_{FOTHsq}\, FO_{it} TH^2_{it}$$

This allows for the possibility that, beyond a certain level, the threshold variable becomes more or less important in determining the marginal effect of financial openness on growth.

c. A high-low cut-off based on the sample median of a threshold variable:

$$g(FO_{it}, TH_{it}) = \beta_{FO}\, FO_{it} + \beta_{FOTHhigh}\, FO_{it} \mathbf{D}(TH_{it} > THmedian_t) + \beta_{TH}\, TH_{it}$$

where $\mathbf{D}(TH_{it} > THmedian_t)$ is an indicator variable that takes the value of 1 if the threshold variable for a country is above the median value for all countries in that time period.

This approach sets the threshold exogenously and provides a simple way of testing if the level of a particular variable matters in terms of the quantitative effect of openness on growth outcomes. We also examine the impact of varying the high-low cut-off to check the appropriateness of the median approach.[8]

The interpretation of reduced-form growth regressions is typically bedevilled by concerns about endogeneity and the direction of causality. For instance, capital may flow disproportionately to fast-growing economies, making financial integration dependent on growth rather than the reverse. Similarly, financial development and growth may both be

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[6] We are aware of concerns of authors such as Durlauf, Johnson and Temple (2005) about cross-country growth regressions. Our view is that, despite their limitations, these regressions can help develop some useful policy messages related to threshold conditions for financial integration.

[7] These are among the most widely used parametric specifications in the literature. Other approaches include interactions of capital account openness with cubic terms in institutional quality, with a quadratic spline or with quantile dummies for institutional quality (Klein, 2005).

[8] An alternative approach would be to use sample-splitting methodologies to endogenously determine the threshold (Hansen, 2000). Unfortunately, however, such models cannot be applied to the dynamic panel approach that we employ.

driven by common factors such as the legal or broader institutional frameworks. It is difficult to come up with convincing and effective instruments to deal with these issues.

Hence, we use system generalized method of moments (GMM) techniques for dynamic panels to get around these problems. This involves estimating a system comprising a first-differenced equation to eliminate country fixed effects and an additional equation in levels. Appropriately lagged values of levels and first-differences, respectively, can then be used as instruments in these equations to address endogeneity concerns. This approach is increasingly being used in a variety of related contexts.[9] In addition to the system GMM estimation we also provide basic fixed effects estimates as a consistency check.

B. Semi-parametric approaches

Next, we turn to a nonparametric technique that allows us to model in a more flexible manner the relationship between growth, on the one hand, and the financial openness and threshold variables on the other. To keep the model tractable, we assume that the relationship between growth and the standard controls plus fixed effects is linear as before. The resulting semiparametric model is written as follows:

$$\Delta y_{it} = \delta_i + \gamma_t + x'_{it}\,\theta + h(FO_{it}, TH_{it}) + \varepsilon_{it}$$

where we estimate the parametric coefficients and the nonparametric relationship $h(FO_{it}, TH_{it})$.

A few recent papers in the growth literature have used partial linear models to examine the relationship between growth and a regressor of interest. For example, Banerjee and Duflo (2003) examine the nonparametric effects of inequality on growth while Imbs and Ranciere (2007) look at the relationship between external debt and growth. However, these papers focus on the relationship between growth and a nonparametric function of a single variable rather than a function of two variables as is the case with the interaction effects we consider.

Yatchew (1998, 2003) provides a detailed guide to a variety of methods that can be employed to estimate the parametric coefficients and the nonparametric function $h(FO_{it}, TH_{it})$.[10] In particular, as in Banerjee and Duflo (2003) and Imbs and Ranciere (2007), we focus on Robinson's (1988) double residuals approach. This involves two stages. First, nonparametric regressions of growth and each of the other control variables on financial openness and the threshold variable are estimated to give $E(\Delta y_{it} \mid FO_{it}, TH_{it})$ and $E(z_{it} \mid FO_{it}, TH_{it})$ where z_{it} denotes the matrix of x_{it} plus the fixed effects with corresponding vector of coefficients κ. Various nonparametric estimation methodologies can be employed, for example local regression or kernel estimation. The residuals from

[9] See Bond et al., 2001, for a detailed technical discussion of its application to empirical growth models. In related work, Chang et al. (2005) use this methodology to explore linear interaction effects of institutional features and trade openness. Aghion et al. (2005) look at interaction effects between financial development and the exchange rate regime. Roodman (2006, 2008) provides a detailed review of the practical implementation of this methodology in a manner that highlights potential concerns related to its somewhat mechanical application and small sample problems.

[10] See also Yatchew and No (2001) for estimation of a partial linear model with two variables entering the nonparametric expression. We implement these partial linear estimations using S-plus coding following the examples in Yatchew (2003).

these regressions are then used to estimate the parametric coefficients κ using an OLS regression:

$$\Delta y_{it} - E(\Delta y_{it} \mid FO_{it}, TH_{it}) = \Delta y_{it} - E(z_{it} \mid FO_{it}, TH_{it})'\kappa - h(FO_{it}, TH_{it})$$
$$= (z_{it} - E(z_{it} \mid FO_{it}, TH_{it}))'\kappa + \varepsilon_{it}$$

These OLS estimates of $\hat{\kappa}$ can then be used to construct an expression for the residual growth with the estimated parametric effects removed:

$$\Delta y_{it} - z'_{it}\hat{\kappa} \approx h(FO_{it}, TH_{it}) + \varepsilon_{it}$$

The nonparametric form of $h(FO_{it}, TH_{it})$ can be estimated using standard methods such as local regression. For details on the required assumptions and convergence properties, see Robinson (1988) and Yatchew (2003). We use OLS regressions in the different stages of the partial linear estimation, with time and country fixed effects included where appropriate.[11]

The use of semi-parametric methods allows for a more flexible examination of the nature of threshold effects in the relationship between financial openness and growth than is possible with parametric approaches. However, there are trade-offs among different approaches. For example, the flexibility of the semi-parametric estimates comes with other assumptions, such as that of a linear relationship for other control variables and the choice of the nature of the nonparametric estimation approach. More importantly, nonparametric relationships are somewhat more difficult to interpret and to translate into policy implications.

A key issue concerns the significance and empirical content of the estimated thresholds. To have policy relevance, our analysis requires more than just a demonstration of statistically significant conditional correlations between certain variables and growth. We need to construct confidence intervals around our estimates of the marginal effects of openness on growth, conditional on a particular level of a given threshold variable. We also need to know if the magnitudes of the threshold effects are economically significant and if the estimated thresholds lie within the range of the sample used in the estimation (otherwise, the thresholds would be of little practical value in terms of understanding differential growth outcomes).

V. Basic Results

We motivate our empirical analysis by documenting a set of stylized facts for data averaged over the full sample period. We then present our baseline econometric results that rely on a finer temporal breakdown of the data. As much of the existing literature has analyzed the interaction between financial openness and financial development, we will focus our initial exposition on the latter as a threshold variable in order to illustrate our framework.

V.1 Stylized facts

We begin by exploring if there are obvious threshold effects in the data. For this exercise, we limit the sample to non-industrial countries split into two groups—emerging markets

[11] As discussed below, in the case of the non time-varying institutional quality index we do not include country dummies in the nonparametric estimation.

(EMs) and other developing countries (ODCs). Our interest is in whether, within each of these groups, the levels of certain variables are associated with differences in average growth rates. Table 1 compares unconditional and conditional growth rates over the period 1975-2004 for countries that are above or below the within-group sample medians for different variables that have been posited as threshold variables. After sorting countries within each group by these group-specific thresholds, we then report cross-sectional averages within each cell.

There are three main results that can be gleaned from this table. First, EMs, which are more integrated into international capital markets than ODCs, have a higher average growth rate than ODCs over the period 1975-2004, but this effect becomes smaller when we control for other standard variables that influence growth. Second, unconditional growth rates in EMs are greater for those countries with higher (within-group above-median) levels of the illustrative threshold indicators for financial depth, trade openness, institutional quality, regulation and macro policies, although this difference is not always statistically significant. These effects are less pronounced in ODCs, except that the institutional quality threshold is even more important for ODCs than for EMs. The picture is less clear when looking at overall development and financial openness as threshold variables. Growth rates are higher for countries with lower initial GDP per capita, reflecting convergence effects. In both groups, growth rates are higher for countries with lower relative financial openness.

Third, for conditional growth rates the patterns are less pronounced, although the positive association of growth with higher values of certain threshold variables persists (e.g., private credit, trade, reduced regulation and lower inflation variability among EMs). Table 1 also suggests that the difference between the growth rates of EMs and ODCs is generally more pronounced at higher levels of the threshold variables (except for institutional quality, GDP per capita and financial openness). These stylized facts are suggestive of systematic threshold or conditioning effects in the relationship between financial openness and growth. We now turn to a more formal empirical analysis of these effects.

V.2 Basic empirical analysis

Our regression analysis is based on five-year averages of the underlying annual data. We begin with a limited set of controls that have been identified in the literature as being relatively robust determinants of long-term per capita GDP growth—initial income (at the start of each five-year period), which picks up convergence effects; the level of investment to GDP; a proxy for human capital; and population growth.

We report the results of baseline growth regressions using these controls in the first panel of Table 2. The first column shows the results of OLS regressions with country fixed effects (FE). The population growth rate does not seem to matter for medium-term growth. However, when we switch to generalized method of moments (GMM) estimation to deal with endogeneity issues (column 2), only the level of investment remains statistically significant. Nevertheless, we retain these four controls in the first stage of our analysis. FE and GMM are the two basic specifications that we will build upon in our further analysis.[12]

[12] Both specifications always include time effects to capture common factors affecting growth across all countries in each five-year period.

V.2.1 Financial depth as a threshold

In panel 2, we include a broad measure of de facto financial openness. As is typical in the literature, we find that the correlation between financial integration and growth is weak or even slightly negative. This highlights the key discrepancy between theory and evidence on the growth effects of financial integration. Consider a simple exercise where we look at whether the correlation is different between countries with high and low levels of financial depth (above or below the sample median). The third panel of Table 2 shows that there is a striking difference. When we interact the indicator for a high degree of financial depth with the financial openness variable, the coefficient on the interaction term is strongly positive and nearly the same in magnitude as the negative coefficient on the financial openness variable itself. In other words, the effect of financial openness is negative for economies with comparatively low levels of financial depth and slightly positive but insignificant for those with higher levels.[13] Repeating the experiment using different percentiles of the financial depth variable rather than the median as the cutoff yields similar positive significant interaction coefficients for cutoffs from the 15th to the 60th percentile with FE estimates and from the 30th to the 65th percentile with GMM estimates (see Figure 2).

In panel 4, we allow for a linear interaction term between domestic financial depth and financial openness. Neither the coefficient on financial openness nor the one on the interaction term is significantly different from zero. The level of financial depth does not seem to matter for the correlation between financial openness and growth. Could this non-result be driven by the fact that, once a country has attained a certain level of financial depth, further improvements do not matter that much?

In panel 5, we allow for an additional interaction of financial openness with the square of the financial depth variable. The coefficients on both the linear and quadratic interactions are now strongly significant in both the FE and GMM estimates, with the first coefficient being positive and the second negative in both cases. That is, greater financial depth leads to an improvement in the growth effects of financial integration but only up to a certain level of financial depth.

Where is the threshold and is it an economically reasonable one? We can calculate the level of the threshold, for a given level of credit to GDP, from the interaction terms. The overall financial openness coefficient in this case takes an inverted U-shape as the threshold variable rises. It is thus possible to calculate the cutoffs at which its sign changes. Based on the FE estimates, the threshold level below which the marginal effect of financial openness on growth is negative corresponds to a credit to GDP ratio of 71 percent (-0.0825 + 0.1761*0.71 – 0.0845*0.71^2 = 0). Above this level, the coefficient is positive before turning negative for credit to GDP above 137 percent. Based on the GMM estimates, the corresponding threshold levels are credit to GDP ratios of 50 percent and 126 percent, respectively. For reference, the median levels of credit to GDP for industrial countries, EMs and ODCs are 0.71, 0.32 and 0.19, respectively (calculated across all period-country observations for each group).

[13] The median levels of financial development that determine the high-low cutoffs are calculated separately for each period.

With both estimation methods, the vast majority (over 90%) of ODC observations lie below the lower threshold and have a negative financial openness coefficient. For emerging and industrial economies, a much higher fraction of observations lie between the lower and upper thresholds and have a positive financial openness coefficient: about two-fifths for emerging economies and four-fifths for industrial countries (relative to the GMM-based threshold). Thus, the threshold level seems plausible and of practical relevance for developing countries contemplating capital account liberalization. In the remaining discussion, we focus on the lower threshold, which is the relevant one for developing and emerging economies.[14]

Since the threshold we have derived is static, it is interesting to see how different groups of countries are doing relative to this threshold over time.[15] In 1975-79, the proportion of countries in each group above the GMM-based lower threshold (private credit to GDP ratio of 0.50) was as follows: industrial countries—62 percent; emerging markets—25 percent; and ODCs—2 percent. By 2000-04, the proportions had increased to 100 percent, 48 percent and 14 percent, respectively. Figure 3 shows how the credit to GDP ratio has changed for each of the emerging market countries from 1985-89 to 2000-04, and how these levels match up against the estimated FE and GMM thresholds. For most of the emerging markets, the data points lie above the 45-degree line, implying increases in financial depth over time by this measure. The fraction of emerging markets above the GMM threshold rises from 25% in 1975-79 to 48% in 2000-04, while the number above the FE threshold goes from 0% to 38%. It is worth noting that a country like China comes out looking very good by this measure despite the weaknesses in its financial sector, which is dominated by state-owned banks. This is a useful reminder of the potential pitfalls of using a particular uni-dimensional measure of financial development. And of course the worldwide crisis that first hit the U.S. and then spread to other industrial countries has shown that financial depth is not equivalent to financial stability.

V.2.2 Robustness of financial depth threshold

We test the sensitivity of our baseline results for the financial depth threshold in a number of ways. First, we use a different set of basic controls and redo the regressions in Table 2. We retain log initial income and the education variable, and add the following controls—trade openness, CPI inflation, and the logarithm of the number of phone lines per capita (a proxy for the level of infrastructure). We do not present the results here, but they were quite similar in terms of the signs and magnitudes of the coefficients of interest. The implied upper and lower thresholds from the FE specification with quadratic interactions are private credit to GDP ratios of 63 percent and 148 percent, respectively (compared to 71 percent and 137 percent based on the results in Table 2). For the GMM specification the results are such that, while the estimated overall financial openness coefficient retains an inverted U-shape, it remains positive and does not cut the x-axis.

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[14] The upper threshold is an artifact of the quadratic specification. We experimented with the inclusion of higher order polynomials of the threshold variable (and corresponding interactions with financial openness). The coefficients on the higher order terms were usually not statistically significant but their magnitudes generally showed a flattening out of (rather than a decline in) the implied marginal effect of financial openness on growth at high levels of the threshold variable. This is another reason why we focus on the lower threshold.

[15] An important issue here is whether the thresholds themselves change over time. This is not an easy question to address in an empirical framework that uses cross-country data and, therefore, comes up against obvious data limitations. We leave this for future work and note that our exercise here is meant only to be illustrative of the empirical content of the thresholds concept.

Second, we use an alternative measure of financial depth—the sum of private credit and stock market capitalization as a ratio to GDP. Unfortunately, given the absence of stock markets in many of the developing countries, especially in the early years of the sample, the sample drops to about half the original size. In the specification with quadratic interactions, the estimated coefficients on the interaction terms have the same sign as in our baseline, but they are smaller and not statistically significant. Given the low levels of stock market development in ODCs and, until recently, in emerging markets as well, this broader measure of financial depth does not seem to be useful for constructing thresholds.

Third, we check if the results are driven by the choice of countries in our sample. We test for robustness to the exclusion of three groups of countries (dropping one group at a time): (i) OPEC countries (Algeria, Ecuador, Indonesia, Iran, Kuwait, UAE and Venezuela); (ii) offshore financial centers (Ireland, Panama, Singapore); and (iii) countries hit by the Asian financial crisis (Indonesia, Korea, Malaysia, Philippines and Thailand). The results with the high-low interactions and linear interactions were broadly similar when we excluded these sub-samples. Table 3 shows that the signs and magnitudes of the coefficients, as well as the implied thresholds, are relatively stable when we drop each of these groups of countries, suggesting that the results are not being driven by outliers or any specific group of countries.

Fourth, we go back to the original financial depth variable but look at alternative measures of financial openness (FO). The threshold value of private credit to GDP is almost unchanged when we use the stock of gross external liabilities as a ratio to GDP—rather than the sum of external assets and liabilities--as the measure of FO (0.51 in the GMM estimates, which is almost identical to the baseline result from Table 2).

V.3 Breaking down the nature of financial integration

The literature on financial flows makes a distinction between FDI and portfolio equity flows, on the one hand, and debt on the other. It is generally believed that the former types of flows generate more of the indirect benefits of financial integration and also have fewer risks than debt. Does the composition of external liabilities (or flows) influence the threshold level of financial depth? Here we obtain a very interesting result (Table 4, Part A). When we measure FO as the stock of FDI plus portfolio equity liabilities, the threshold is lower (credit to GDP ratios of 58 percent and 34 percent for the FE and GMM estimates, respectively). By contrast, when we use debt liabilities, the threshold is much higher (credit to GDP ratios of 75 percent and 55 percent for the FE and GMM estimates, respectively). That is, the risks of financial integration seem to be lower when it takes the form of FDI or portfolio equity liabilities. When debt liabilities constitute the primary form of financial integration, the level of financial depth necessary for financial integration to have growth benefits is much higher.

The results with flows are more mixed (Table 4, Part B). When we use total inflows, the signs of the interaction effects are such that the overall financial openness coefficient has a U-shape as credit to GDP rises, the reverse of the results with the stock measures of openness. Again, there is a dramatic difference between the results when we use FDI plus portfolio equity inflows versus debt inflows. In the former case, the inverted U-shape of the overall financial openness coefficient remains (although insignificant with the GMM estimates). By contrast, the results with debt inflows correspond to those for total inflows

(as expected, given the high share of debt to total inflows over the sample period). In this case, the impact of financial openness on growth is estimated to be positive for lower or particularly high levels of financial depth but negative at intermediate levels. This result is consistent with models of potential instability induced by greater capital inflows in economies at an intermediate level of financial development (e.g., Aghion et al., 2004).

VI. Alternative Thresholds

Our focus has so far been on the financial depth threshold. We now examine threshold effects based on a range of other indicators suggested by the discussion of theoretical models in Section 2. We maintain the FE and GMM specifications as our benchmarks and focus on the quadratic interaction specifications.

The first panel of Table 5 repeats the results for the financial depth variable. The second panel looks at a composite measure of institutional quality (IQ). Many authors have argued that IQ is a crucial determinant of growth and volatility, especially crises (e.g., Acemoglu et al., 2003). There is indeed a clear threshold effect that we can identify; the interactions of financial openness with the level and squared level of the IQ variable are statistically significant. All of the industrial country observations (five-year averages) exceed the estimated threshold, while only 29 percent of emerging market observations and about 20 percent of ODC observations do. By this measure, most developing countries are below the level of IQ at which the marginal benefits of increasing financial openness become apparent.

We also looked at some of the constituents of the composite measure of institutional quality—level of corruption, cost of enforcing debt contracts etc.—but could not identify any strong threshold effects based on these components of the IQ indicator (results not shown). The level of per capita income (on an internationally comparable basis) is often seen as a composite index that proxies for a variety of factors that have been found to boost growth. But there is no clear threshold effect based on this variable.

We can identify a threshold based on trade openness (the ratio of the sum of imports and exports to GDP) but the estimated threshold is so high that few countries meet this threshold. We also experimented with a policy measure of trade openness (results not reported here). The relevant interaction coefficients were significant in the FE regressions but not in GMM. We also looked at thresholds based on a measure of structural policies—labor market flexibility—and two measures of macro policies—inflation volatility and the ratio of government revenues to expenditures. There are a number of significant interaction terms in the regressions with these variables, but they are in general not robust, so we choose not to focus on the implied thresholds.

To visually examine how the estimated thresholds look for a few key variables, Figure 4 plots the overall (including interactions) financial openness coefficient estimates against different values of the relevant threshold variable. Private credit and IQ illustrate the inverted U-shaped relationship, with the standard error bands often encompassing zero but still leaving some empirical content in this threshold measure. When we use trade openness or the log of initial income, the threshold effects are essentially linear in the relevant range.

The analysis in this section suggests that, at a first pass, the results for financial and institutional development are more supportive of the presence of threshold effects. Other variables we have looked at also hint at threshold effects, particularly for high/low

interactions, although the estimates from other specifications are less robust ant not always statistically significant.[16]

VII. Results Based on Semi-parametric Approaches

We now explore the relationship between financial openness and growth using the semi-parametric methods outlined in Section IV. To illustrate these methods, we first start with a univariate nonparametric specification in the partial linear setup. That is, we look at the potential nonlinear relationship between growth and financial openness itself. We then examine interaction effects between financial openness and various threshold variables.[17]

VII.1 Semiparametric estimation of the effects of financial openness on growth

The regressions of growth against the baseline controls plus gross financial openness to GDP indicate an insignificant negative coefficient on the latter from both the FE and system GMM estimation (Table 4). However, unconditional plots suggest that the level and shape of the relationship between financial openness and growth vary by quintile of financial openness. To investigate this in more detail, we employ the partial linear model with the gross financial openness variable alone entering the specification nonparametrically.

First, we run a regression to eliminate the baseline parametric effects (including country and time fixed effects) from the growth data.[18] Figure 5 plots growth residuals from this regression against the gross financial openness variable. Next, we use nonparametric methods to estimate the form of the relationship between these two variables. Specifically, we employ the Robinson residual method, first using local regression with two different spans (the percentage of data points included in the local regression) and then a kernel estimator (with a triangular kernel) as the nonparametric technique. We also use an alternative "differencing approach" (for details, see the Semi-Parametric Appendix in the online supplementary materials as described in footnote 17). If we demean the growth estimates from the first-stage parametric regressions, we obtain "purged" or demeaned growth residual values that illustrate the nonparametric relationship at the mean of the parametric variables (Yatchew, 2003). These different relationships are illustrated in the bottom panel of Figure 5.

These plots illustrate a similar pattern in the results from different approaches, with an increasing relationship between growth and financial openness at low levels of the latter, which then turns negative and reverts to being positive at the highest levels of financial openness. However, the estimated relationship becomes insignificant as financial openness rises. The plots also highlight the potential roles of outliers on financial openness in influencing the results and the relatively large confidence intervals attached to the point estimates. The variations in the effects across financial openness values may contribute to the overall negative insignificant coefficient in the standard linear parametric estimation.

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[16] We also experimented with using the de jure measure of financial openness as a threshold variable in place of the de facto measure. The coefficient on gross financial openness is positive at higher levels of financial openness, although the coefficient is significant only in the FE estimates.

[17] To conserve space, we present only the key results in figures. Figures for all other results referred to in this section are in the Semi-Parametric Appendix in the supplementary material for this paper available online at http://www.nber.org/data-appendix/w14916/Supplementary%20material.pdf.

[18] Note that the baseline parametric effects exclude the indirect influence of the financial openness on these variables.

We replicated the above analysis for different measures of financial openness. As with the parametric results, there are marked differences across these measures. For example, the stock of FDI and portfolio equity liabilities, which has a positive but insignificant linear coefficient in the parametric setup (see Table 4), has a relationship that is broadly flat at positive values of the demeaned growth residuals and then increases with the financial openness measure. In contrast, the relationship of the debt measure with the demeaned growth residuals has a marked downward slope above a certain value of debt (Imbs and Ranciere, 2007, discuss the external debt Laffer curve).

VII.2 Semiparametric interactions between financial openness and threshold variables

The double residuals approach is applied in a similar manner when looking at interaction effects, i.e., when both financial openness and a threshold variable enter nonparametrically. As before, we first obtain growth residuals by eliminating the baseline parametric effects. To conduct the nonparametric smoothing, we then focus on the local regression estimator.[19]

Unconditional plots of growth against financial openness reveal patterns that vary by the level of credit to GDP. At low levels of credit to GDP, the relationship tends to be negative, then moving towards a flat relationship at higher levels of credit to GDP. Using the double residual approach with a local regression span of 0.75, the estimated nonparametric relationship between growth residuals and financial openness is illustrated in Figure 6.[20] This figure is similar to Figure 6 but, rather than showing the univariate nonparametric relationship between growth residuals and financial openness, it shows the multivariate relationship of growth residuals with financial openness and the credit to GDP ratio. Thus, it represents one nonparametric approach to illustrating the interaction between financial openness and a threshold variable in their relationship with growth residuals. For relatively low levels of credit to GDP and low levels of financial openness, the estimated relationship between growth and financial openness is indeed negative. This is the range in which most country observations actually fall.

An alternative way to examine this relationship is to look at how the relationship of the demeaned growth residuals with financial openness varies with the level of the threshold variable (and vice versa). Figure 7 shows such relationships and their confidence intervals for different slices of the corresponding 3D plot. Figure 7a illustrates the negative relationship between demeaned growth residuals and financial openness at low levels of credit to GDP. Figure 7b shows that the inverted U-shaped relationship between these residuals and credit-to-GDP tends to be more prevalent at higher levels of financial openness. One point to note concerning these plots is that the slices are taken at equally spaced splits across the full range rather than at percentile values of the distribution of observations. Thus, given the skewed distribution of both credit to GDP and financial openness most country data points lie in the bottom and left-hand side plots. Again, these plots illustrate the wide confidence intervals around the estimated effects, which in many cases are not significantly different from zero.

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[19] This fits a local quadratic regression including the threshold and financial openness variables, their squares and cross-products. Insightful Corporation (2007) has details on local regression procedures.

[20] The results were not greatly sensitive to alternative regression spans.

This analysis can be repeated for different measures of financial openness. As with the parametric estimates, the results for total liabilities are similar to those for the gross measures. There are again marked differences between the estimates using FDI and portfolio equity liabilities versus debt liabilities (results not shown here). With the former, the unconditional relationship between growth and financial openness is mostly flat or slightly positive throughout different sub-samples based on levels of credit to GDP. By contrast, with debt liabilities the relationship with growth is downward sloping for half of the sub-samples with lower levels of credit to GDP.

Turning to the nonparametric model, Figures 8 and 9 compare the fitted nonparametric interaction effects and the demeaned growth residuals. For low to medium levels of credit to GDP, the relationship between growth and the financial openness measure based on FDI and portfolio equity liabilities is flat or increasing. However, at these low levels of credit to GDP, the relationship between growth and debt liabilities is negative. Again, when analyzing these results it is important to note that the confidence intervals around these estimates tend to be relatively large and that most observations lie at lower levels of financial openness and credit to GDP.

We now apply this methodology to a few other threshold variables.[21] Unconditional growth plots illustrate that the relationship between growth and financial openness is negative for samples with lower trade openness ratios. This effect disappears once we control for other growth determinants and fixed effects in estimating the nonparametric interaction relationship with the relationship between residual growth and financial openness broadly flat at different levels of trade.

Turning to institutional quality, again unconditional plots indicate a negative relationship between growth and financial openness at lower levels of the threshold variable. At low levels of institutional quality, the relationship between gross financial openness and growth is U-shaped. However, at higher levels of institutional quality the relationship becomes more linear. In line with the quadratic parametric estimation, for a given level of financial openness, residual growth increases with institutional quality at a decreasing rate. Once again, the interpretation of these results is subject to caveats on the size of confidence intervals and also on the actual distribution of observations by institutional quality and financial openness.[22]

VIII. Summary and Implications

Recent advances in the theoretical and empirical literatures indicate that the benefits of financial integration may be far subtler than had been presumed earlier. A new framework for analyzing financial globalization highlights the tension between the indirect benefits of

[21] See Semi-Parametric Appendix Figures 14-15 and 16-19 for trade openness and institutional quality as the threshold variables, respectively (see footnote 17).

[22] The double residual estimation process is complicated in this case by the non time-varying nature of the threshold variable. In the first stage nonparametric estimation we have been conducting nonparametric regression of each of the baseline controls, including country dummy variables, on the threshold and financial openness variables. Applying this technique with institutional quality would mean that the country dummy variables are regressed on institutional quality, which is also a country-specific time invariant variable. This leads to a singular regressor matrix in the second stage regression. To get around this problem, we remove fixed effects from the first stage regression. We then estimate the second stage nonparametric interaction effects also without the country dummy variables (although we obtain similar results if we then include them).

financial integration and the potential risks if a country opens up to capital flows without the right initial conditions in place. From a practical policy perspective, however, a reasonable evaluation of the cost-benefit trade-off requires a better understanding of what these initial conditions are and how exactly they matter. This is an essential component of an analytical framework that can take account of country-specific features and initial conditions in designing a pragmatic approach to capital account liberalization (Prasad and Rajan, 2008).

In this paper, we have tried to put some empirical structure on the concept of threshold conditions in order to give policymakers guidance on this issue. For instance, our results support the widely held conjecture that FDI and portfolio equity flows are safer than debt flows at low levels of financial and institutional development. We do not claim to have identified definitive thresholds. Our main contribution, instead, has been to develop an empirical structure to address this issue and frame it in a more concrete and tractable manner. Our analysis has already generated a number of interesting findings, which we now briefly summarize before discussing what policymakers should make of them.

Based on different methodologies and different definitions of thresholds, we conclude that there are threshold levels of certain variables that are important determinants of the relationship between financial integration and growth. In our empirical work, we have focused on a few variables motivated by the existing theoretical literature. These include domestic financial market development (in particular, the depth of credit markets), institutional quality, trade openness, labor market rigidities, and the overall level of development. All of these seem to be relevant threshold variables, with varying degrees of importance—the most clearly-defined thresholds are based on the financial depth and institutional quality variables. We find that many of these thresholds are much lower when we measure financial integration by the stocks of FDI and portfolio equity liabilities rather than debt liabilities.

The confidence intervals around some of the estimated thresholds are large, but in many cases the estimated coefficients yield reasonably tight estimates of the threshold conditions. Do the thresholds have empirical content? Our results generally indicate that the estimated thresholds are reasonable and well within the ranges of the data samples. For instance, most industrial countries and a few emerging markets are above the estimated threshold levels of financial depth, while a majority of emerging markets and nearly all other developing countries are below them. This result is consistent with observed differences in growth outcomes associated with financial integration across these groups of countries. Of course, the recent global crisis shows that financial depth is not a reliable measure of financial stability, which should also take into account regulatory and supervisory structures.

Indeed, there is a rich research agenda that comes out of our work. Future theoretical studies in this area should focus on the precise nature of the threshold relationship and provide testable predictions in the context of reduced form solutions. On the empirical front, our results show that focusing on individual threshold variables could lead to misleading conclusions. Some of the open questions prompted by our analysis are as follows. Are there trade-offs among different threshold conditions, such that a high level of one variable can

lower the threshold on another variable?[23] If the level of financial integration itself acts as a threshold, how can it be integrated into the framework based on other thresholds laid out in this paper? Have the levels of different thresholds been changing over time as virtually all countries become more financially open in de facto terms, irrespective of their capital control regimes? How do circumstances in global financial markets affect the thresholds?

[23] We find preliminary evidence that financial depth matters less in countries that have high IQ levels. We also checked if a simple composite measure derived from the different threshold variables in our analysis could serve as a composite threshold indicator. Preliminary analysis suggests that there are indeed threshold effects in the data based on this composite indicator. We have not, however, developed a procedure to find the optimal composite indicator that captures the complementarity and substitutability among different threshold conditions and leave that for future work.

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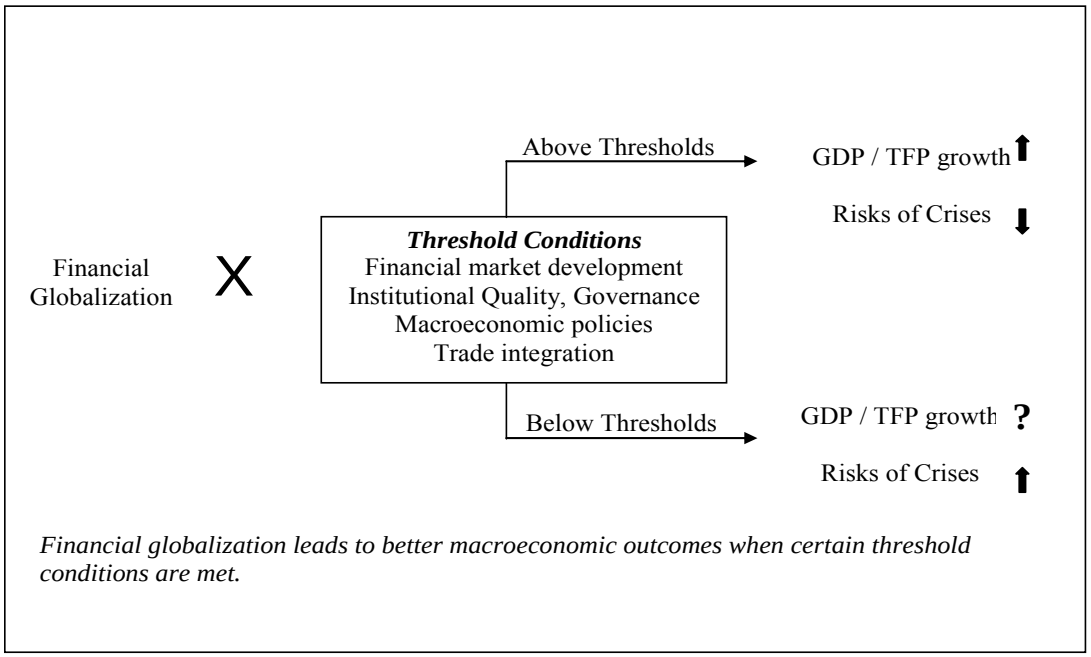
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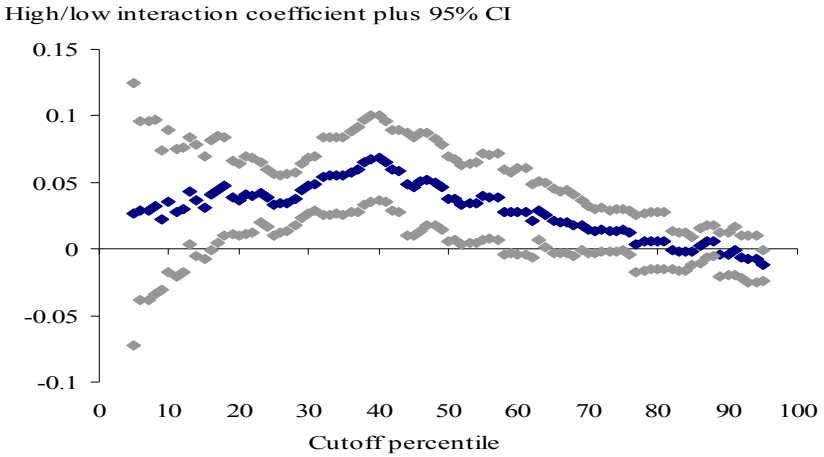
Figure 1. Thresholds in the Process of Financial Integration



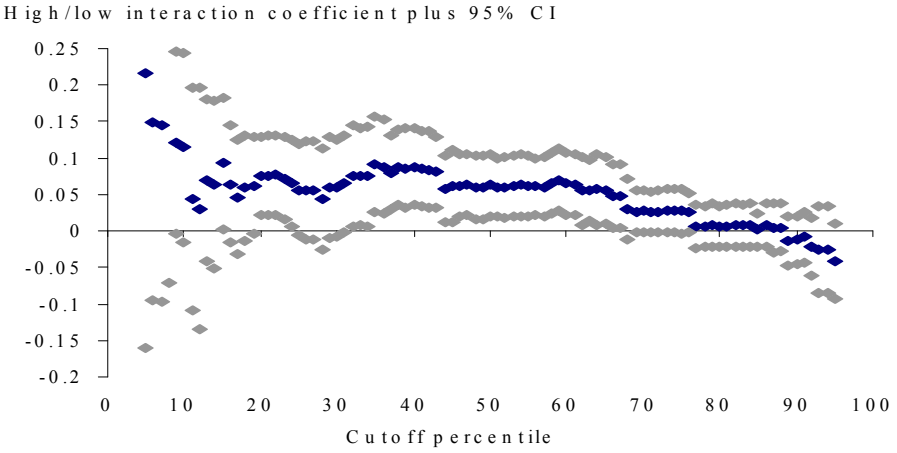
Source: Kose, Prasad, Rogoff and Wei (2009)

Figure 2. High/Low Interaction Coefficients for Gross Financial Openness and Private Credit to GDP at Different Sample Splits

A. Fixed effects specification

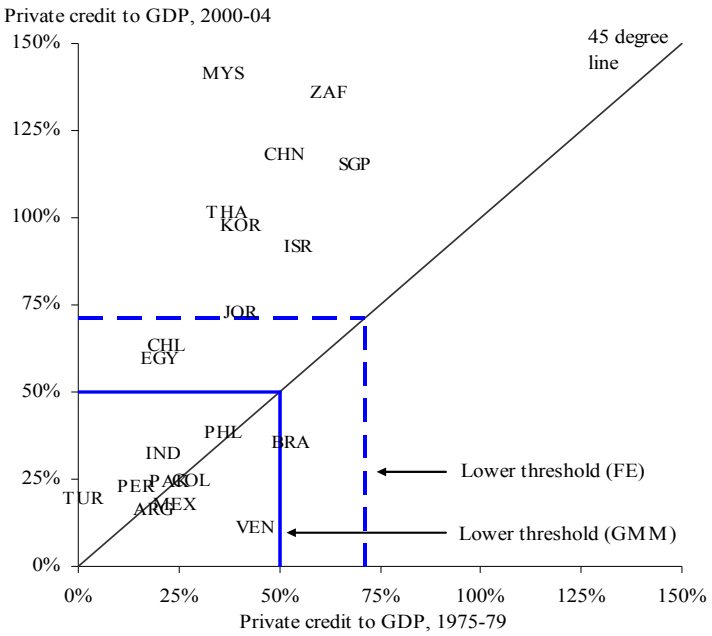


B. System GMM specification



Notes: Specifications include base controls of Panel 3 of Table 2. Percentile cutoffs calculated for each period on the basis of the distribution of private credit observations in that period.

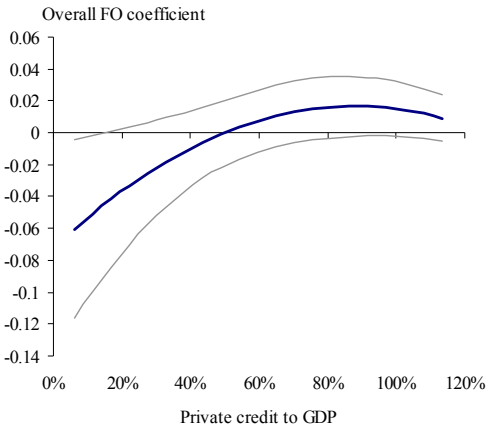
Figure 3. Average Private Credit to GDP Relative to Estimated Thresholds: Emerging Market Economies, 1975-79 and 2000-04



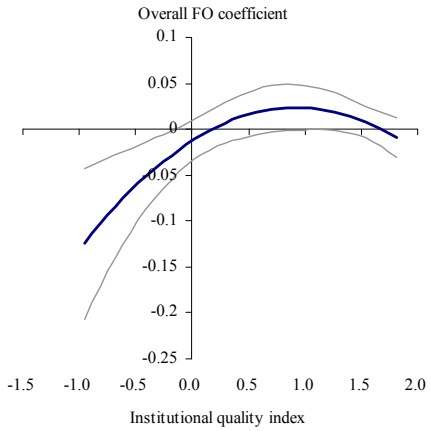
Notes: Thresholds taken from quadratic interaction specification in Table 2, Panel 5.

Figure 4. Overall Financial Openness Coefficient against Alternative Threshold Variables (based on GMM estimation)

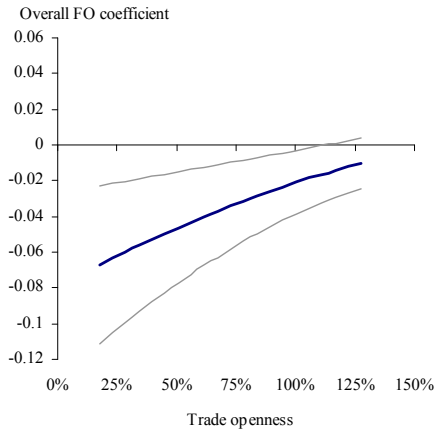
a) Private credit to GDP as threshold variable



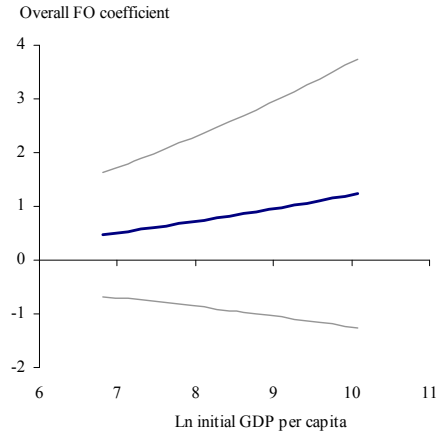
b) Institutional quality index as threshold variable



c) Trade openness to GDP as threshold variable

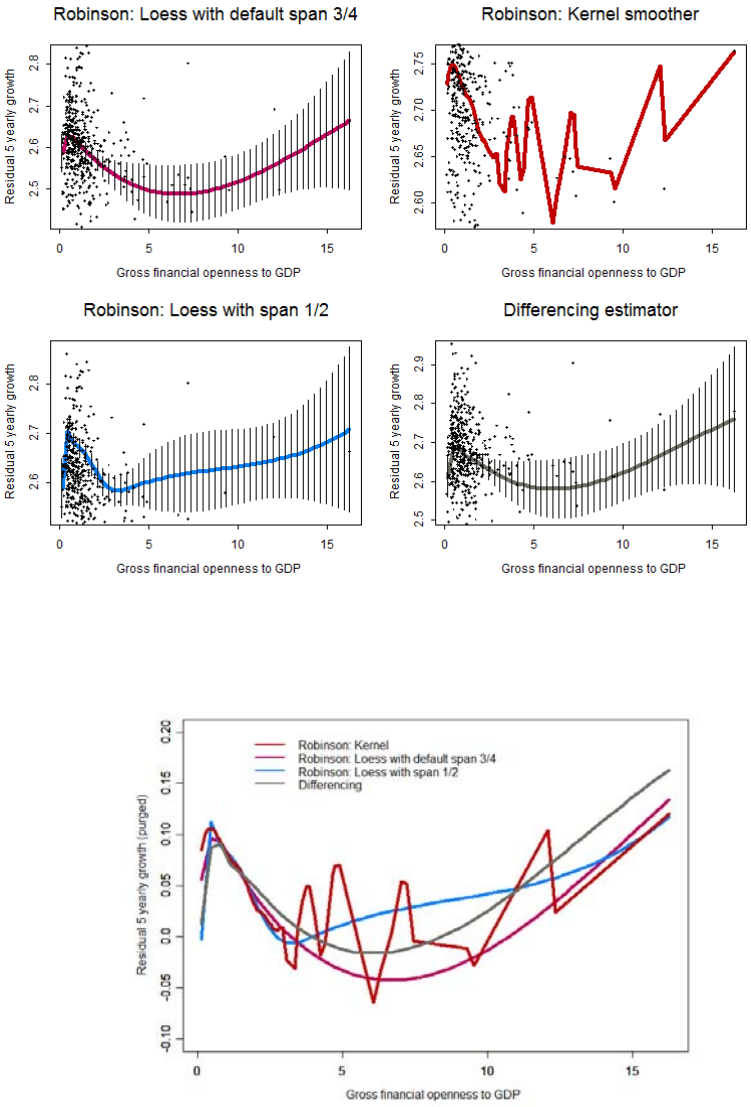


d) Ln initial GDP per capita as threshold variable



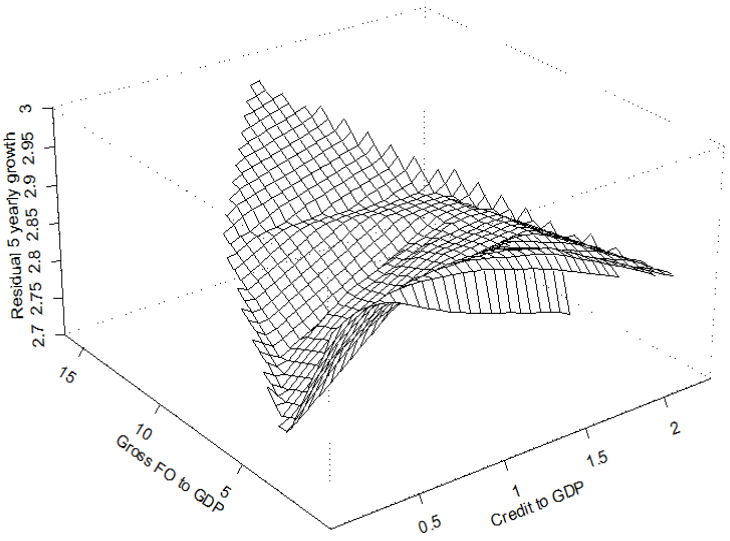
Notes: See Table 5 for estimation details. The lighter lines indicate 95 percent confidence intervals.

Figure 5. Gross Financial Openness and Growth Residuals



Notes: The plots illustrate the relationship between five-year growth rates--once standard controls and dummy variables have been controlled for (excluding the indirect effect of gross financial openness on these controls--and gross financial openness. A nonparametric relationship is then estimated and illustrated on the graph with 95% confidence intervals indicated by vertical lines. Four alternative methods are illustrated. Three employ the Robinson double residual estimator including local regression estimator (loess) using various spans of the observations and a kernel smoother. The final one employs the differencing estimator described in the online Semi-Parametric Appendix (see footnote 17).

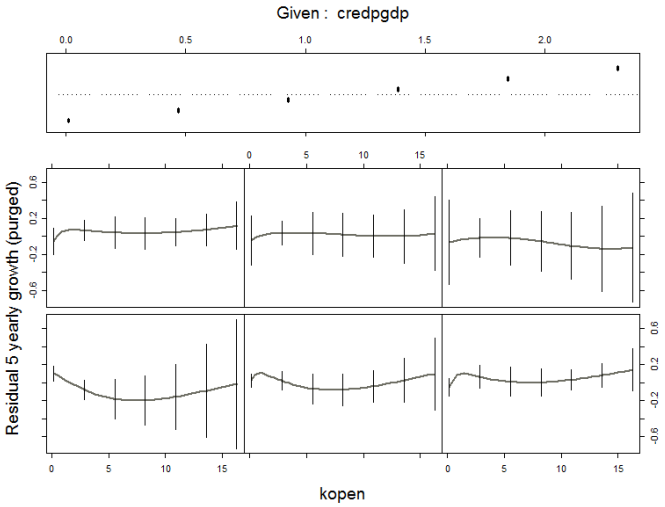
Figure 6. Double Residual Nonparametric Interaction Effects
(Credit to GDP as the threshold variable, interacted with gross financial openness to GDP)



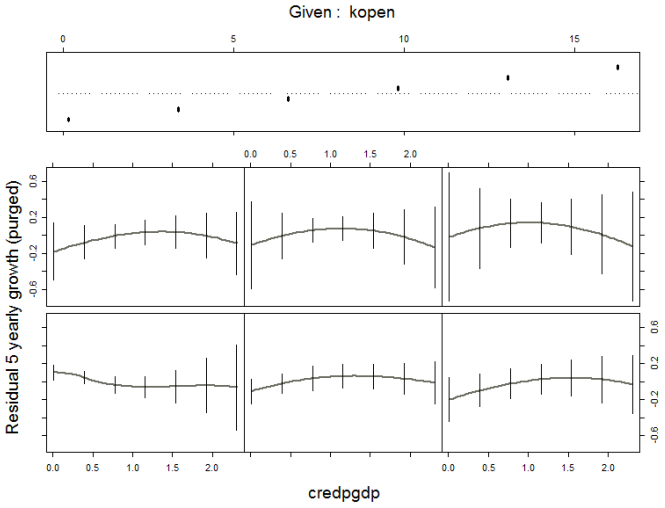
Notes: This plot illustrates the estimated nonparametric relationship between conditional growth once standard controls and dummy variables have been controlled for (excluding the indirect effect of gross financial openness and credit-to-GDP on these controls) and gross financial openness and credit-to-GDP. The Robinson double residual estimator is employed using a local regression estimator (loess) with a span of 0.75.

Figure 7. Cross-Sections of Double Residual Nonparametric Interaction Effects
(Credit to GDP as the threshold variable, interacted with gross financial openness to GDP)

A. Sliced at different values of credit to GDP



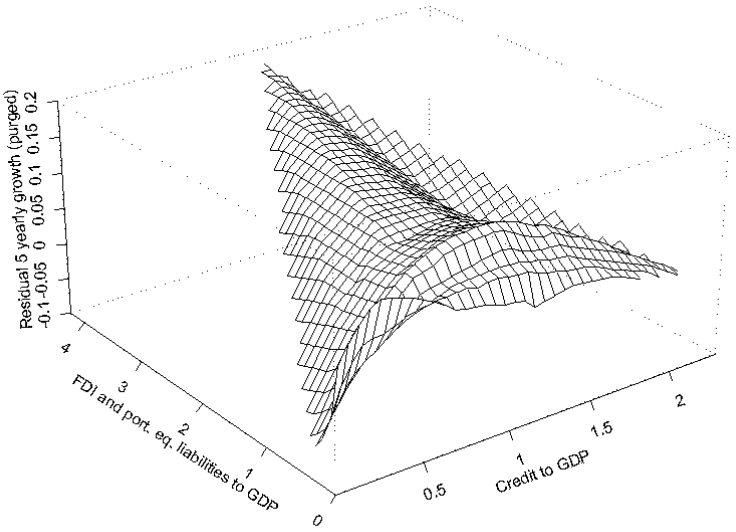
B. Sliced at different values of financial openness to GDP



Notes: The six lower panels show the relationship between residual growth and financial openness in part (a) and credit to GDP in part (b) with 95% confidence intervals indicated by the vertical lines. The six plots are taken at six equally spaced levels of credit-to-GDP and financial openness to GDP in parts A and B, respectively. The lowest value of the given variable is represented in the bottom left-hand panel with the level rising in subsequent panels as one moves from left to right and then up and long the second panel. The corresponding values of the given variable at which the slices are made are indicated by the dots in the uppermost plot across the width of the figure.

Figure 8. Double Residual Nonparametric Interaction Effects

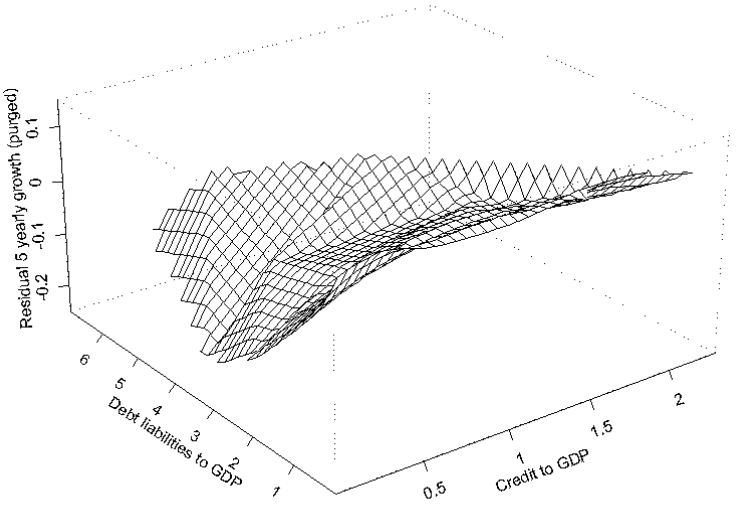
(Credit to GDP as the threshold variable, interacted with gross FDI and portfolio equity liabilities to GDP)



Note: Similar to Figure 6 but with FDI and portfolio equity liabilities to GDP as the financial openness variable rather than gross financial openness to GDP.

Figure 9. Double Residual Nonparametric Interaction Effects

(Credit to GDP as the threshold variable, interacted with gross external debt liabilities to GDP)



Note: Similar to Figures 6 and 8 but with external debt liabilities to GDP used as the financial openness variable.

Table 1. Long-term Growth in Emerging Markets and Other Developing Countries

		Unconditional growth (% per annum)		Conditional growth (% per annum)	
		EM	ODCs	EMs	ODCs
Overall		2.284 (1.937)	0.820 (0.650)	0.441 (0.533)	-0.159 (-0.043)
Splitting sub-samples:					
By private credit to GDP	High	3.158 (3.113)	0.656 (0.451)	0.733 (0.673)	-0.255 (-0.197)
	Low	1.490 (1.410)	0.983 (0.877)	0.176 (0.503)	-0.064 (0.139)
Difference in means		1.668*	-0.327	0.557	-0.191
By average WBGI institutional quality index	High	2.416 (1.878)	1.217 (0.853)	0.394 (0.418)	0.369 (0.127)
	Low	2.165 (1.937)	0.422 (0.451)	0.483 (0.633)	-0.688 (-0.117)
Difference in means		0.251	0.795*	-0.089	1.057**
By trade openness	High	2.923 (3.017)	1.074 (0.710)	0.644 (0.583)	0.129 (0.127)
	Low	1.704 (1.096)	0.566 (0.493)	0.256 (0.503)	-0.448 (-0.094)
Difference in means		1.218	0.508	0.388	0.577
By rigidity of employment index	Less rigid	2.958 (2.440)	0.787 (0.493)	0.563 (0.533)	-0.012 (-0.094)
	More rigid	1.544 (1.253)	0.790 (0.927)	0.306 (0.568)	-0.344 (-0.168)
Difference in means		1.414	-0.003	0.257	0.333
By st. dev of CPI inflation	Low	3.381 (3.365)	1.509 (1.542)	1.074 (0.968)	0.398 (0.379)
	High	1.078 (1.147)	0.215 (0.346)	-0.255 (-0.242)	-0.841 (-0.810)
Difference in means		2.303***	1.294***	1.329***	1.239***
By initial GDP per capita	High	1.105 (1.085)	0.798 (1.034)	-0.166 (-0.098)	0.146 (0.276)
	Low	3.357 (3.155)	0.842 (0.493)	0.993 (0.968)	-0.464 (-0.506)
Difference in means		-2.253***	-0.044	-1.159**	0.611
By de jure financial openness (IMF measure)	High	1.537 (1.211)	0.730 (0.452)	0.048 (-0.098)	0.026 (-0.043)
	Low	2.964 (2.431)	0.901 (0.927)	0.799 (0.813)	-0.327 (-0.183)
Difference in means		-1.427	-0.171	-0.751	0.353
By de facto gross financial openness	High	1.502 (1.262)	0.738 (0.853)	0.036 (-0.248)	-0.163 (0.009)
	Low	2.995 (2.440)	0.902 (0.493)	0.810 (0.660)	-0.155 (-0.094)
Difference in means		-1.493*	-0.164	-0.774	-0.008

Notes: The numbers shown are average annual growth rates (medians are shown in parentheses below the means). The symbols *, ** and *** indicate statistical significance at the 10 percent, 5 percent and 1 percent levels, respectively, of a t-test of mean equality across sub-samples. High/low sub-samples are defined relative to medians within groupings. See Appendix Table A.1 for definition of emerging market (EM) and other developing country (ODC) sub-samples and Appendix Table A.2 for variable definitions. Conditional growth indicates residuals from a cross-section regression of growth on log initial GDP per capita, average investment to GDP, average years of schooling and average population growth rate.

Table 2. Interactions of Private Credit and Gross Financial Openness to GDP

	[1] Base		[2] With FO		[3] High/low interaction		[4] Linear interaction		[5] Quadratic interaction	
	FE	**Sys GMM**	**FE**	**Sys GMM**	**FE**	**Sys GMM**	**FE**	**Sys GMM**	**FE**	**Sys GMM**
Ln initial income per capita	-0.2769	-0.0505	-0.3028	-0.0529	-0.3122	-0.1028	-0.3096	-0.0762	-0.3196	-0.0847
	[0.0560]***	[0.0657]	[0.0460]***	[0.0533]	[0.0473]***	[0.0483]**	[0.0468]***	[0.0530]	[0.0479]***	[0.0484]*
Av investment to GDP	0.8079	0.9852	0.8029	0.942	0.7534	0.8505	0.7521	0.9384	0.6835	0.9112
	[0.3064]***	[0.2806]***	[0.3110]**	[0.3097]***	[0.3126]**	[0.2842]***	[0.3243]**	[0.2862]***	[0.3025]**	[0.2946]***
Years schooling	0.0286	-0.0022	0.0305	0.0039	0.0301	0.0196	0.0301	0.0108	0.0252	0.011
	[0.0140]**	[0.0193]	[0.0143]**	[0.0168]	[0.0145]**	[0.0161]	[0.0145]**	[0.0161]	[0.0148]*	[0.0143]
Pop growth	4.7321	-0.9328	4.8012	-0.1238	4.7648	-0.9325	4.7266	-0.8469	4.7277	-1.9786
	[3.1908]	[1.7681]	[3.1706]	[2.6259]	[3.1514]	[2.0722]	[3.2036]	[2.2271]	[3.1587]	[3.1068]
Gross FO to GDP			-0.0008	-0.005	-0.0371	-0.0612	-0.0191	-0.0057	-0.0825	-0.0724
			[0.0082]	[0.0074]	[0.0169]**	[0.0221]***	[0.0187]	[0.0228]	[0.0277]***	[0.0325]**
Private credit to GDP (PC)					-0.0241	-0.0627	-0.0147	-0.0145	-0.1687	-0.2476
					[0.0358]	[0.0394]	[0.0410]	[0.0596]	[0.0986]*	[0.1535]
Gross FO*high PC					0.0380	0.0628				
					[0.0160]**	[0.0215]***				
Gross FO*PC							0.0174	0.0018	0.1761	0.2024
							[0.0152]	[0.0195]	[0.0518]***	[0.0814]**
PC squared									0.0798	0.157
									[0.0436]*	[0.0832]*
FO* PC squared									-0.0845	-0.115
									[0.0242]***	[0.0464]**
Constant	2.1202	0.41	2.3375	0.3923	2.4632	0.8071	2.4252	0.5727	2.6252	0.7355
	[0.4557]***	[0.4255]	[0.3676]***	[0.3350]	[0.3815]***	[0.3137]**	[0.3802]***	[0.3393]*	[0.3915]***	[0.3319]**
Observations	460	460	457	457	456	456	456	456	456	456
Adj R-squared	0.2915		0.3131		0.3259		0.3149		0.338	
AR2 test p-value		0.3191		0.2498		0.2323		0.3333		0.4474
Hansen p-value		0.264		0.3873		0.4966		0.406		0.5246

Notes: All specifications include base controls in Table 2 and period effects, which are not reported. Standard errors in parentheses. The symbols *, **, *** indicate significance 10%, 5% and 1% levels, respectively. FE: country fixed effects with robust standard errors clustered by country. GMM system (sys GMM) estimation: Two step using Windmeijer standard errors with small sample correction and control variables treated as endogenous (instrumented using 2nd lag).

Table 3. Sub-sample Sensitivities: Private Credit and Gross Financial Openness to GDP Interaction Coefficients

		[1] Full sample		[2] Ex OPEC		[3] Ex OFCs		[4] Ex Asian crisis countries	
		FE	Sys GMM	FE	Sys GMM	FE	Sys GMM	FE	Sys GMM
A. No interaction	Gross FO	-0.0008	-0.0050	-0.0007	-0.0041	-0.0235	-0.0267	0.0000	-0.0040
		[0.0082]	[0.0074]	[0.0080]	[0.0071]	[0.0080]***	[0.0138]*	[0.0081]	[0.0074]
B. High/low interaction	Gross FO	-0.0371	-0.0612	-0.0404	-0.0482	-0.0632	-0.0586	-0.045	-0.0499
		[0.0169]**	[0.0221]***	[0.0169]**	[0.0196]**	[0.0163]***	[0.0231]**	[0.0177]**	[0.0200]**
	Gross FO*high PC	0.038	0.0628	0.042	0.0513	0.0415	0.0355	0.0472	0.0521
		[0.0160]**	[0.0215]***	[0.0164]**	[0.0188]***	[0.0138]***	[0.0231]	[0.0176]***	[0.0198]**
C. Linear interaction	Gross FO	-0.0191	-0.0057	-0.0157	-0.0026	-0.0526	-0.0479	-0.0204	-0.0027
		[0.0187]	[0.0228]	[0.0179]	[0.0188]	[0.0161]***	[0.0231]**	[0.0187]	[0.0222]
	Gross FO*PC	0.0174	0.0018	0.0147	-0.0002	0.0258	0.0188	0.0194	-0.0002
		[0.0152]	[0.0195]	[0.0144]	[0.0156]	[0.0119]**	[0.0155]	[0.0159]	[0.0198]
	PC cutoff for positive overall gross FO coeff.	>1.10	>3.22	>1.07	n.a.	>2.04	>2.55	>1.05	n.a.
D. Quadratic interaction	Gross FO	-0.0825	-0.0724	-0.0789	-0.0653	-0.0958	-0.0658	-0.0893	-0.0746
		[0.0277]***	[0.0325]**	[0.0269]***	[0.0294]**	[0.0267]***	[0.0488]	[0.0281]***	[0.0365]**
	Gross FO*PC	0.1761	0.2024	0.1722	0.1844	0.1507	0.0673	0.1927	0.2195
		[0.0518]***	[0.0814]**	[0.0512]***	[0.0799]**	[0.0542]***	[0.1002]	[0.0532]***	[0.0957]**
	Gross FO* PC squared	-0.0845	-0.115	-0.0835	-0.1048	-0.0639	-0.0246	-0.0924	-0.1251
		[0.0242]***	[0.0464]**	[0.0241]***	[0.0457]**	[0.0244]**	[0.0494]	[0.0247]***	[0.0551]**
	PC cutoffs at which overall gross FO coeff. is zero:[a]	0.711 1.372	0.500 1.260	0.688 1.375	0.492 1.268	n.a. n.a.	n.a. n.a.	0.694 1.391	0.461 1.294
	% observations above lower cutoff								
	Industrial countries	60%	80%	62%	80%	n.a.	n.a.	62%	81%
	Emerging economies	21%	42%	25%	46%	n.a.	n.a.	20%	43%
	Other developing countries	1%	10%	1%	8%	n.a.	n.a.	1%	12%

[a] Cutoff is not available if the overall FO coefficient estimated as a function of the threshold variable does not have a quadratic root.

Notes: All specifications include base controls in Table 2 and period effects, which are not reported. Standard errors in parentheses. The symbols *, **, *** indicate significance at the 10%, 5% and 1% levels, respectively. FE: country fixed effects with robust standard errors clustered by country. GMM system estimation: Two step using Windmeijer standard errors with small sample correction and control variables treated as endogenous (instrumented using 2nd lag).

Table 4A. Interaction Coefficients with Private Credit to GDP and Different Financial Openness Measures

Stock Measures (relative to GDP)

		[1] Gross measure		[2] Total liabilities		[3] FDI + portfolio equity		[4] Debt liabilities	
		FE	Sys GMM	FE	Sys GMM	FE	Sys GMM	FE	Sys GMM
A. No interaction	FO	-0.0008	-0.005	-0.0174	-0.0202	0.0352	0.0051	-0.0366	-0.031
		[0.0082]	[0.0074]	[0.0168]	[0.0175]	[0.0272]	[0.0315]	[0.0177]**	[0.0237]
B. High/low interaction	FO	-0.0371	-0.0612	-0.0722	-0.1025	-0.1764	-0.2233	-0.0839	-0.1231
		[0.0169]**	[0.0221]***	[0.0205]***	[0.0286]***	[0.1135]	[0.1756]	[0.0213]***	[0.0332]***
	FO*high PC	0.038	0.0628	0.0619	0.1066	0.2205	0.2518	0.0574	0.1248
		[0.0160]**	[0.0215]***	[0.0189]***	[0.0303]***	[0.1119]*	[0.1819]	[0.0189]***	[0.0367]***
C. Linear interaction	FO	-0.0191	-0.0057	-0.0672	-0.0362	0.021	0.1107	-0.0792	-0.0581
		[0.0187]	[0.0228]	[0.0253]***	[0.0315]	[0.1032]	[0.1234]	[0.0268]***	[0.0247]**
	FO*PC	0.0174	0.0018	0.0591	0.024	0.0114	-0.084	0.0692	0.0477
		[0.0152]	[0.0195]	[0.0256]**	[0.0305]	[0.0777]	[0.0985]	[0.0357]*	[0.0502]
	PC cutoff for positive overall FO coefficient	>1.10	>3.22	>1.14	>1.31	n.a.	<1.97	>1.14	>-0.31
D. Quadratic interaction	FO	-0.0825	-0.0724	-0.1495	-0.1341	-0.3502	-0.1694	-0.1454	-0.159
		[0.0277]***	[0.0325]**	[0.0330]***	[0.0402]***	[0.1622]**	[0.2421]	[0.0381]***	[0.0366]***
	FO*PC	0.1761	0.2024	0.3258	0.3715	0.8555	0.6364	0.3125	0.4258
		[0.0518]***	[0.0814]**	[0.0792]***	[0.1014]***	[0.2794]***	[0.4204]	[0.1048]***	[0.1202]***
	FO* PC squared	-0.0845	-0.115	-0.1596	-0.2099	-0.4381	-0.3969	-0.1585	-0.249
		[0.0242]***	[0.0464]**	[0.0413]***	[0.0602]***	[0.1288]***	[0.1994]**	[0.0548]***	[0.0715]***
	PC cutoffs at which overall FO coefficient zero:	0.711	0.500	0.697	0.505	0.584	0.337	0.752	0.551
		1.372	1.260	1.345	1.264	1.369	1.266	1.220	1.159
	% observations above lower cutoff								
	Industrial countries	60%	80%	62%	80%	71%	91%	56%	75%
	Emerging economies	21%	42%	22%	42%	33%	58%	17%	37%
	Other developing countries	1%	10%	1%	9%	5%	20%	1%	7%

Notes: All specifications include the same base controls as in Table 2 and period effects, which are not reported. Standard errors in parentheses. The symbols *, **, *** indicate significance at the 10%, 5% and 1% levels, respectively. Also see notes to Table 3.

Table 4B. Interaction Coefficients with Private Credit to GDP and Different Financial Openness Measures

Flow Measures (relative to GDP)

		[1] Gross flows		[2] Total inflows		[3] FDI + port. eq. inflows		[4] Debt inflows	
		FE	Sys GMM	FE	Sys GMM	FE	Sys GMM	FE	Sys GMM
A. No interaction	FO	0.0539	0.0277	0.1025	0.1343	0.3307	0.3683	0.0911	0.173
		[0.0368]	[0.0440]	[0.0808]	[0.0616]**	[0.0916]***	[0.1962]*	[0.0919]	[0.1203]
B. High/low interaction	FO	0.3931	0.1229	0.8829	0.9599	-0.1891	0.1585	0.9959	1.4456
		[0.2046]*	[0.6629]	[0.2255]***	[0.5288]*	[0.6742]	[1.6524]	[0.1858]***	[0.5775]**
	FO*high PC	-0.3495	-0.0659	-0.8278	-0.8475	0.5464	0.2146	-0.9642	-1.3112
		[0.2049]*	[0.6572]	[0.2305]***	[0.5197]	[0.6829]	[1.7114]	[0.1901]***	[0.5558]**
C. Linear interaction	FO	0.1447	0.189	0.3186	0.4339	0.9633	2.0915	0.456	0.6122
		[0.1168]	[0.2165]	[0.2057]	[0.3120]	[0.8197]	[1.2152]*	[0.2332]*	[0.3992]
	FO*PC	-0.1038	-0.1269	-0.2997	-0.3059	-0.6054	-1.5512	-0.582	-0.6076
		[0.0929]	[0.1724]	[0.2214]	[0.2691]	[0.7299]	[1.0439]	[0.3666]	[0.5376]
	PC cutoff for positive overall FO coefficient	<1.39	<0.26	<1.06	<10.12	<1.59	<12.35	<0.78	<0.99
D. Quadratic interaction	FO	0.2085	-0.2087	0.9311	0.9015	-1.1963	-0.4571	1.1183	1.706
		[0.2317]	[0.4957]	[0.3238]***	[0.6844]	[1.1833]	[2.0809]	[0.2762]***	[0.7045]**
	FO*PC	-0.2824	0.6634	-2.0279	-1.7388	6.1905	6.5172	-2.5299	-3.8141
		[0.5078]	[0.9660]	[0.8380]**	[1.8620]	[2.5132]**	[5.4541]	[0.6619]***	[1.8492]**
	FO* PC squared	0.108	-0.3839	1.0608	0.8488	-4.2428	-5.0065	1.2849	1.9293
		[0.2636]	[0.4801]	[0.4637]**	[1.0722]	[1.3188]***	[3.2263]	[0.3488]***	[1.1016]*
	PC cutoffs at which overall FO coefficient zero:	n.a.	0.41	0.77	n.a.	0.23	0.07	0.67	0.68
		n.a.	1.31	1.15	n.a.	1.23	1.23	1.30	1.29
	% observations above lower cutoff								
	Industrial countries	n.a.	87%	50%	n.a.	98%	100%	64%	63%
	Emerging economies	n.a.	50%	16%	n.a.	78%	98%	25%	24%
	Other developing countries	n.a.	14%	1%	n.a.	48%	88%	2%	2%

Notes: Port. eq. denotes portfolio equity. All specifications include the same base controls as in Table 2 and period effects, which are not reported. Standard errors in parentheses. The symbols *, **, *** indicate significance at the 10%, 5% and 1% levels, respectively. Also see notes to Table 3.

Table 5. Alternative Threshold Variables: Interaction Coefficients with Gross Financial Openness to GDP

		[1] Private credit to GDP as threshold		[2] Institutional quality index as threshold		[3] Trade openness to GDP as threshold		[4] Ln initial GDP per capita as threshold	
		FE	Sys GMM	FE	Sys GMM	FE	Sys GMM	FE	Sys GMM
A. High/low interaction	Gross FO	-0.0371	-0.0612	-0.0657	-0.0773	-0.0155	-0.0618	-0.0383	-0.0774
		[0.0169]**	[0.0221]***	[0.0196]***	[0.0396]*	[0.0083]*	[0.0254]**	[0.0146]**	[0.0322]**
	Gross FO*high threshold	0.038	0.0628	0.0721	0.0782	0.0143	0.0598	0.0419	0.0794
		[0.0160]**	[0.0215]***	[0.0208]***	[0.0396]*	[0.0074]*	[0.0247]**	[0.0161]**	[0.0327]**
B. Linear interaction	Gross FO	-0.0191	-0.0057	-0.0282	-0.0148	-0.0156	-0.0302	-0.1171	-0.266
		[0.0187]	[0.0228]	[0.0154]*	[0.0197]	[0.0102]	[0.0189]	[0.0785]	[0.1185]**
	Gross FO*threshold variable	0.0174	0.0018	0.0236	0.0113	0.0077	0.0154	0.0121	0.0263
		[0.0152]	[0.0195]	[0.0099]**	[0.0106]	[0.0048]	[0.0122]	[0.0079]	[0.0117]**
	Threshold cutoff for positive FO coefficient	>1.10	>3.22	>1.19	>1.31	>2.02	>1.97	>9.64	>10.12
C. Quadratic interaction	FO	-0.0825	-0.0724	-0.0179	-0.0121	-0.0386	-0.0795	-1.3559	-1.7303
		[0.0277]***	[0.0325]**	[0.0084]**	[0.0108]	[0.0137]***	[0.0262]***	[0.7836]*	[1.2973]
	Gross FO*threshold variable	0.1761	0.2024	0.0724	0.0779	0.0342	0.0733	0.289	0.3637
		[0.0518]***	[0.0814]**	[0.0256]***	[0.0262]***	[0.0161]**	[0.0249]***	[0.1769]	[0.3019]
	Gross FO* threshold variable squared	-0.0845	-0.115	-0.0339	-0.0421	-0.0056	-0.0147	-0.0153	-0.0191
		[0.0242]***	[0.0464]**	[0.0152]**	[0.0155]***	[0.0042]	[0.0055]***	[0.0098]	[0.0172]
	Threshold cutoffs at which overall FO coeff. zero:	0.711	0.500	0.285	0.171	1.496	1.602	8.569	-6.129
		1.372	1.260	1.848	1.681	4.633	3.368	10.368	3.827
	% observations above lower cutoff								
	Industrial countries	60%	80%	100%	100%	2%	2%	100%	100%
	Emerging economies	21%	42%	29%	29%	7%	6%	49%	100%
	Other developing countries	1%	10%	17%	21%	2%	1%	22%	100%

Notes: All specifications include the same base controls as in Table 2 and period effects, which are not reported. Standard errors in parentheses. The symbols *, **, *** indicate statistical significance at 10%, 5% and 1% levels, respectively. Also see notes to Table 3.

Data Appendix

Table A1. Country Sample

Industrial	Emerging economies (EMs)	Other developing countries (ODCs)	
Australia	Argentina	Algeria	Mauritius
Austria	Brazil	Bangladesh	Mozambique
Belgium	Chile	Benin	Nepal
Canada	China	Bolivia	Nicaragua
Denmark	Colombia	Botswana	Niger
Finland	Egypt	Cameroon	Panama
France	India	Congo, Republic of	Papua New Guinea
Germany	Indonesia	Costa Rica	Paraguay
Greece	Israel	Dominican Republic	Rwanda
Ireland	Jordan	Ecuador	Senegal
Italy	Korea, Republic of	El Salvador	Sri Lanka
Japan	Malaysia	Ghana	Sudan
Netherlands	Mexico	Guatemala	Syria
New Zealand	Pakistan	Haiti	Togo
Norway	Peru	Honduras	Trinidad &Tobago
Portugal	Philippines	Iran	Tunisia
Spain	Singapore	Jamaica	Uganda
Sweden	South Africa	Kenya	United Arab Emirates
Switzerland	Thailand	Kuwait	Uruguay
United Kingdom	Turkey	Malawi	Zambia
United States	Venezuela	Mali	Zimbabwe

Notes: The sample comprises 84 countries—21 industrial and 63 developing (of which 21 are emerging market economies, EMs, and 42 are other developing countries, ODCs).

Table A2. Variable Definitions and Sources

Variable	Sources
Growth rate of PPP per capita GDP (log difference over period divided by length)	PWT
GDP per capita PPP, 1996 constant prices	PWT
Average investment to GDP	PWT
Average schooling years in population over 25 years old	Updated Barro and Lee (2000) database. Data available at http://www.cid.harvard.edu/ciddata/ciddata.html
Average annual population growth rate (log difference over period divided by length)	WDI
Gross de facto financial openness to GDP	Stock data from Lane and Milesi-Ferretti (2006). Current price US dollar GDP data from WDI.
Stock of external liabilities to GDP	As above
Stock of external FDI and portfolio equity liabilities to GDP	As above
Stock of external debt liabilities to GDP	As above
Gross flows to GDP defined as sum of absolute inflows and absolute outflows	Flow data from IMF IFS. Current price US dollar GDP data from WDI.
Total financial inflows to GDP	As above
FDI plus portfolio equity inflows to GDP	As above
Debt inflows to GDP	As above
Domestic credit to private sector to GDP	WDI
Current price trade openness (exports plus imports) to GDP	PWT
Average institutional quality index	Simple average of six World Bank Governance Indicators (data available from 1996)
Rigidity of employment index for employing workers	World Bank / International Finance Corporate Doing Business Database (data available from 2003)
Annual CPI inflation	IFS

Notes: PWT: Penn World Tables (version 6.2); IFS: International Financial Statistics; WDI: World Development Indicators.