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# The Impact of International Financial Integration on Economic Growth: New Evidence on Threshold Effects<sup>1</sup>

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# The impact of International Financial Integration on Economic Growth: New Evidence on Threshold Effects

## Abstract

Recent research highlights that countries differ with respect to their experience with capital flows and do not systematically gain from capital account liberalization. This paper contributes to the empirical literature that investigates the circumstances under which international financial integration (IFI) is growth-enhancing. Relying on non-linear dynamic panel techniques, we find that countries that are able to reap the benefits of IFI satisfy certain threshold conditions regarding the level of economic, institutional and financial development, and government spending. Our results also reveal a differentiated behaviour of FDI and portfolio equity liabilities compared to other types of capital flows, with threshold conditions being systematically less restricting for the former and growth effects significantly larger.

**Key words:** International financial integration, Economic growth, Panel threshold regression model, Dynamic threshold panel.

**JEL Classification:** F3, F4, O4

# 1 Introduction

Intensification of the financial globalization (FG) process has unceasingly drawn the attention of economists and policymakers on the actual macroeconomic implications of unfettered capital flows. After three decades of witnessing rapid increase in cross-border capital flows,<sup>1</sup> the real benefits of FG in terms of economic growth remain highly controversial (Obstfeld, 2009).

Whereas standard theories predict that the gains from liberalizing the capital account are substantial and straightforward,<sup>2</sup> this view has been challenged over the years by recurring financial crises. The extensive empirical literature on the link between IFI and growth also fails to provide systematic and robust evidence of a positive causal relationship,<sup>3</sup> suggesting that, overall, financial liberalization leads to uncertain outcomes. The inherent instability of capital movements and their acute interaction with economic policies and macroeconomic conditions explain in large part the costs-benefits trade-off associated with liberalizing financial transactions (Fisher et al. 1998; Stiglitz, 2000). Foreign – and domestic – investors are indeed prone to react to a number of structural factors and macroeconomic news affecting the return and risk of financial investments.

Departing from the standard neoclassical framework, some theories suggest the existence of pre-requisites conditioning the gains from IFI and the need to sequence reforms when devising growth strategies for developing economies (Edwards, 1984; McKinnon, 1991). Theories based on second-best arguments predict, for instance, that eliminating the distorting effects of capital controls may actually amplify the negative effects of other pre-existing distortions – such as weak domestic institutions, trade barriers, market failures in the financial sector –, and result in aggravated resource allocation problems and welfare loss (see Eichengreen, 2001). In recent theoretical models, the introduction of financial frictions in open-economy models explains how financial openness can lead to a variety of

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<sup>1</sup> Following the rapid relaxation in capital controls that occurred in industrial countries in the 1980s and in developing countries since the early 1990s, international capital transactions rose from about 5% of world GDP to over 20% in 2007.

<sup>2</sup> They occur through three main channels: improved global allocative efficiency as financial resources are allowed to flow to their most productive uses (Barro et al., 1995), enhanced international risk-sharing and risk-diversification (Obstfeld, 1994), promotion of domestic financial development (Levine, 2001).

<sup>3</sup> Prasad et al. (2003), Rogoff et al. (2004), Kose et al. (2006) and Kose et al. (2009) provide detailed reviews.

outcomes, ranging from equilibrium with large capital inflows and higher investment and growth, to ones with capital outflows from poor to rich countries or volatile capital flows and unstable domestic financial markets (Aghion et al. 2004; Gertler and Rogoff, 2004; Matsuyama, 2004 and 2008; Aoki et al. 2006).

At the empirical level, the revival of the threshold research agenda has aimed at rationalizing the potential benefits of IFI with a focus placed on assessing the importance of achieving institutional and financial development, trade liberalization and macroeconomic stabilization before opening the capital account; but so far, empirical evidence has yielded conflicting conclusions.<sup>4</sup> One of the main limitations in most of past studies is their reliance on linear specification where an IFI indicator is simply interacted with a conditioning variable. These studies can therefore only provide an indirect estimation of the threshold condition – i.e. the level of the conditioning variable above which the marginal effect of IFI on growth becomes positive – whereas indication on its statistical significance and the confidence interval around it would also be of policy relevance. To our best knowledge, Kose et al. (2011) is the only study to look into this point. After estimating the IFI-growth relationship with a quadratic interaction specification, they derive the confidence intervals of the overall financial openness coefficients (including interaction terms) at different levels of the threshold variables.

This paper re-examines the IFI-growth nexus by focusing on the presence of contingency effects in the relationship. The major difference from previous FG literature lies in the use of non-linear panel estimation techniques to assess a set of well documented precondition factors. Specifically, we rely on the panel threshold regression framework, developed by Hansen (1999), and use an extension of Caner and Hansen (2004) methodology to allow for endogeneity of regressors. This empirical strategy allows us to investigate the threshold effects of the IFI-growth link in a more adequate and flexible way than previous studies. First, the panel threshold regression (PTR) methodology provides endogenous identification of threshold levels, which could bring new insights into the issue compared to *ad hoc* methods of sample-splitting or linear interaction specification. The dynamic panel threshold estimator

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<sup>4</sup> Kose et al. (2009) survey the theoretical arguments underpinning the existence of threshold effects and the related growing empirical literature.

adopted in this paper provides robust results through instrumenting the endogenous regressors. Second, it allows determining whether the threshold effect is statistically significant and the non-linear specification validated. The alternative variables selected as threshold are country characteristics deemed to be pre-requisites allowing IFI to be growth-enhancing.

We find evidence that countries benefiting from IFI satisfy certain threshold conditions in the level of income, the quality of institutions, the level of financial development and government expenditure. Our results also reveal a differentiated behaviour of FDI and portfolio equity liabilities compared to other types of capital flows, with the threshold conditions being systematically less restricting for the former and the growth effects significantly larger.

The paper proceeds as follows. In the next section, we review some of the existing literature on the factors preconditioning IFI. In section 3, the empirical methodology, consisting in a dynamic panel threshold regression (PTR) model, is presented. Section 4 describes the data and detail (i) how we measure IFI, and (ii) the choice of threshold variables. Results are shown and discussed in section 5. In section 6, we present some robustness analyses, where we introduce as well a composite indicator of development as an alternative threshold variable, before concluding in section 7.

## 2 Review of the threshold literature

One of the statistical regularities found in the literature is that studies tend to report very small or slightly negative correlations between IFI – measured by various indicators – and real per capital growth when samples include developing countries (Kose et al., 2006; Rodrik and Subramanian, 2009).<sup>5</sup> The contrasted past experience of developing and developed economies suggest that certain countries' characteristics might precondition the impact of capital flows, either leading to higher growth or increasing the vulnerability to crises. In particular, some authors have argued that financial

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<sup>5</sup> For instance Alesina et al. (1993) find evidence of a small positive association between capital account liberalization and growth with a sample of 20 high-income countries, while Grilli and Milesi-Ferretti (1995) find a negative link in a sample dominated by developing countries. Considering a broad dataset of more than 60 countries, Edwards (2001) finds opposite and significant effects of capital account liberalization on growth in high and low-income countries, although the significance of his results are sensitive to the choice of indicator for capital account openness.

development and the quality of institutions – especially those establishing the security of private property, the enforceability of contracts and an effective legal system – enhance the absorptive capacity of host countries, given their central role in shaping incentives and ensuring efficiency in the allocation of resources (Acemoglu et al., 2003; Mishkin, 2008; Ju and Wei, 2010; Blackburn et Forgues-Puccio, 2010).

Empirical studies report diverging results. Arteta et al. (2001) interact Quinn (1997)'s *de jure* index of financial openness with financial depth (proxied by the ratio of liquid liabilities to GDP) and institutional strength (the *International Country Risk Guide*' index of law and order) and show some evidence that the effects of capital account liberalization vary with the effectiveness of law and order, but not with a country's stage of financial development. Edison et al. (2002) reach similar conclusions using various *de facto* measures of IFI and additional proxies for financial development and institutions. A recent study by Bekaert et al. (2011) shows that both financial and institutional development explains the heterogeneity in the capital stock and total productivity growth effects following capital account liberalization. Kose et al. (2011) stress the key role of domestic financial development in improving the cost-benefits trade-off from capital flows. Using a non-linear – quadratic – interaction specification, the authors derive the financial development threshold as the level at which the marginal growth-effect of financial openness turns positive and report a credit-to-GDP ratio above 73% in the fixed-effect estimation and 50% in the GMM estimation.<sup>6</sup>

The literature on threshold effects and reform sequencing has also underscored the distorting effects of trade barriers and macroeconomic imbalances. Financial integration without trade openness could lead to a misallocation of resources when foreign capital flows into non-competitive domestic industries (Brecher and Alejandro, 1977). It can also raise the vulnerability to sudden stops and financial crises in face of current account adjustments (Martin and Rey, 2006; Calvo and Frankel, 2008). Regarding macroeconomic imbalances – in particular conditions inconsistent with a country's

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<sup>6</sup> The sign of marginal effect reverses for credit-to-GDP ratio above 137% in the fixed-effect estimation and 126% in the GMM estimation.

administered exchange rate –, their interactions with capital flows can pose critical challenges for developing countries, which have limited policy tools to counteract capital flight.

Few empirical studies look into the role of trade openness and macroeconomic policies in conditioning the growth effects of IFI. Calvo et al. (2004) and Calvo and Frankel (2008) show that trade openness attenuates the vulnerability to financial crises. Arteta et al. (2001) do not find that the growth-impact of financial openness is contingent on trade openness, measured by Sachs and Warner (1995)'s openness dummy. Kose et al. (2011) use the sum of exports and imports of goods and services divided by GDP and find very high threshold levels from 149.6% to 160.2%. Turning to macroeconomic policies, Edison et al (2002) report some evidence that IFI interacts with inflation, but not with government deficit. Mody and Murshid (2005) find that better policies – including better economic management – play a role in catalyzing the positive impact of financial openness on investment growth.

In view of the inconclusive results provided by past studies, the aim of this paper is to revisit the threshold effects in the IFI-growth relationship. We apply recent panel threshold regressions methodology and re-assess whether the effects of capital flows are contingent on the level of economic, financial and institutional development, the degree of trade openness, and sound macroeconomic policies.

### **3 Panel threshold regressions**

This study is based on the assumption that IFI will impact growth in a nonlinear way. First introduced by Hansen (1999)'s, the main appeal of the panel threshold regression (PTR) model is to provide endogenous estimation of the threshold parameter. However, in its initial set-up, the model only applies to non-dynamic panel and requires that all regressors are exogenous. In growth regressions, the conditional convergence term (i.e. the lagged income) would bias the fixed-effect estimator used in the PTR, especially in short-time panel. Kremer et al. (2013) proposed a dynamic extension of Hansen (1999)' panel threshold model that allows for endogenous regressors. They adapt Caner and Hansen



(2004)'s instrumental variable estimation of cross-sectional threshold model to a panel setting, which they integrate into Hansen (1999)'s threshold identification procedure.

Considering one potential threshold, the panel threshold model takes the form:

$$y_{it} = \mu_i + \beta_1' z_{it} I(q_{it} \leq \gamma) + \beta_2' z_{it} I(q_{it} > \gamma) + e_{it} \quad (1)$$

where the subscript  $i$  indexes the individual and the subscript  $t$  indexes the time period. The dependent variable  $y_{it}$  is regressed on an individual-specific fixed effect  $\mu_i$ , and a vector of  $m$  controls  $z_{it}$ , which slope coefficients switch between regimes depending on the value of an observable variable  $q_{it}$ . The indicator function,  $I(\cdot)$  equals 0 when  $q_{it}$  is below the threshold parameter  $\gamma$  and 1 in the other case. The error term  $e_{it}$  is assumed *i.i.d.* of mean 0 and variance  $\sigma^2$ . Following Caner and Hansen (2004),  $z_{it}$  is partitioned into a subset  $z_{1it}$  of exogenous variables uncorrelated with  $e_{it}$  and a subset of endogenous variables  $z_{2it}$  correlated with  $e_{it}$ . In addition, the model requires a set of  $k \geq m$  instrumental variables  $x_{it}$  including  $z_{1it}$ .

The first step consists in removing the individual specific effects. While in Hansen (1999)'s non-dynamic setting, the individual effects can be eliminated by mean differencing, in the dynamic panel, this standard within transformation leads to inconsistent estimates as the lagged dependent variable will always be correlated with the mean of the individual errors and thus all the transformed individual errors. Kremer et al. (2013) suggest using forward orthogonal deviation as in Arellano and Bover (1995). The method subtracts the average of all available future observations from the current value of a variable. As the transformed errors remain uncorrelated, the estimation procedure derived by Caner and Hansen (2004) can be applied to the dynamic panel equation (1).

As in Caner and Hansen (2004), an intermediary step is required before proceeding to the sequential identification of the threshold parameter. It implies performing a reduced form regression of the endogenous variables,  $z_{2it}$ , on the set of instruments,  $x_{it}$ . Then, replacing  $z_{2it}$  with their predicted values  $\hat{z}_{2it}$ , equation (1) is successively estimated via least squares for a strict subset of the

support of the threshold variable  $q$ .<sup>7</sup> The least square estimate of the threshold parameter,  $\hat{\gamma}$ , is then selected as to minimize the sum of squared residuals obtained in the previous steps. Once  $\hat{\gamma}$  is identified, the slope coefficient estimates,  $\hat{\beta}_1(\hat{\gamma})$  and  $\hat{\beta}_2(\hat{\gamma})$ , can be obtained with GMM for the previously used instruments.<sup>8</sup>

In accordance with Hansen (1999) and Caner and Hansen (2004), the critical values for determining the 95% confidence interval of the threshold values are given by

$$\Gamma = \{\gamma : LR(\gamma) \leq C(\alpha)\},$$

where  $C(\alpha)$  is the 95% percentile of the asymptotic distribution of the likelihood ratio  $LR(\gamma)$ .

The final issue to be addressed is the statistical significance of the estimated threshold parameter. Since  $\gamma$  is not identified under the null hypothesis of no threshold, Hansen (1999) suggests a non-standard inference strategy based on bootstrap simulations of the asymptotic distribution of the likelihood ratio test.<sup>9</sup> The null of no threshold effect is rejected if the desired critical value (e.g. 5%) is bigger than the p-value which is obtained by calculate the percentage of bootstrap samples for which the bootstrap F-stat. exceeds the actual one.

The methodology can be generalized to account for multiple thresholds. In our analysis, we start by considering the following double-threshold regression model with three potential regimes:

$$\begin{aligned} GROWTH_{it} = & \mu_i + X'_{it}\theta + \beta_1 IFI_{i,t} I(q_{it} \leq \gamma_1) + \beta_2 IFI_{i,t} I(\gamma_1 < q_{it} \leq \gamma_2) \\ & + \beta_3 IFI_{i,t} I(\gamma_2 < q_{it}) + e_{it} \end{aligned} \quad (2)$$

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<sup>7</sup> In practice, the search over values of  $\gamma$  is limited to specific quantiles. It is also recommended to eliminate a minimum percentage of extreme values to ensure that the results are not driven by potential outliers.

<sup>8</sup> For non dynamic panel, the slope coefficients are estimated by OLS in each regime separated by  $\hat{\gamma}$ . In other words, the PTR model is a piece-wise linear one. The identification of  $\hat{\beta}_1(\hat{\gamma})$  and  $\hat{\beta}_2(\hat{\gamma})$  requires that the variable  $z_{it}$  is not time-invariant (see p.347, Hansen 1999). If the threshold variable were time-invariant, e.g. a dummy variable, it would be unnecessary to employ a threshold regression because the change point would be known and would not allow an individual or a country to switch from one regime to another over time. This assumption of time-variant threshold variable has the advantage of offering a dynamic and evolving perspective in a panel data setting.

<sup>9</sup> The properties and validity of this bootstrap procedure are also discussed in Hansen (1996) and Hansen (2000).

In equation (2), only the slope coefficient on  $IFI_{i,t}$  switches between regimes depending on the value of an observable threshold variable  $q_{it}$ ,<sup>10</sup> while the slope coefficients on the other controls,  $X_{it}$ , are constrained to remain invariant.<sup>11</sup> In this way, we isolate the variable of interest and concentrate the analysis on the contingency effects in the IFI-growth relationship. The growth-enhancing - or debasing - effects of IFI will vary with the threshold condition.

## 4 Data

Our empirical study is based on a standard growth regression model, as traditionally implemented in the literature (e.g., Barro and Sala-I-Martin, 2003). Given data availability, we build an annual panel dataset consisting of 80 countries – 23 developed and 57 emerging and developing economies –, observed over the 1984-2007 period.<sup>12</sup> The dependent variable is the annual growth rate of real GDP per capita in constant 2000 prices obtained from Penn World Table.<sup>13</sup> Control variables are selected in accordance with robustness results highlighted in influential past studies (e.g., Levine and Renelt, 1992; Sala-I-Martin, 1997; Sala-I-Martin et al., 2004). For each country, they include the *initial income* – measured as the logarithm of real per capita GDP from the previous period –, a proxy for the

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<sup>10</sup> Existing estimators assume exogenous threshold variable, and when this hypothesis is violated, the results obtained with endogenous ones should be interpreted with cautions. Because no estimator has been developed yet for endogenous threshold variable, we are limited to use lagged values (of one period) of threshold variable to reduce the sample-splitting bias.

<sup>11</sup> Restricting the coefficients of some variables to be constant has no effect on the asymptotic distribution theory for threshold parameters and regression slopes (p. 357, Hansen, 1999).

<sup>12</sup> As we focus on long term growth, we use a timespan of twenty-four years to characterize the long period, taking into account the data availability of some variables. Empirical studies dealing with growth regressions traditionally average observations over fixed-length intervals (typically, 3 or 5-years intervals) to eliminate business-cycle fluctuations. However, while averaging clearly induces a loss of information, further investigation is needed on the extent to which averaging data over short time periods effectively reduces cyclical effects (see, e.g., Temple, 1999). In order to save useful information to implement a more flexible model that allows for some parameter heterogeneity, we estimate the PTR with annual data.

<sup>13</sup> See Appendix Table A.2 for variables description and data sources.

*initial stock of human capital* – measured by the logarithm of the average years of secondary schooling from the last period available<sup>14</sup> –, the *investment rate*, and the *growth rate of population*.

Starting with this baseline specification, we adopt a sequential strategy and run successive regressions, testing both different IFI indicators and alternative threshold variables (one equation is estimated for each pair of IFI indicator and threshold).

## 4.1 IFI indicators

Arguably, the theoretical growth-benefits of financial openness will hinge on the amount of capital flows experienced by a country. We consider four *de facto* measures of IFI, which we use alternatively as the single regime-dependent variable in our panel threshold specification.<sup>15</sup> The data used originates from the IMF’s International Financial Statistics (IFS) database. First, at the most aggregate level, we compute *total flows of capital* as the sum of absolute inflows (external liabilities) and outflows (external assets) of foreign direct investment, portfolio, derivatives and other investment flows, divided by nominal GDP.<sup>16</sup> This indicator is commonly used in the literature to assess a country’s actual exposure to international financial markets. Second, we examine the inward component of capital flows (*inflows of capital*) as a share of GDP. We expect that for most of the countries in our panel, which are developing economies, the positive impact of financial integration will depend primarily on the amount of external financing received. Finally, to further account for a potential

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<sup>14</sup> Barro and Lee (2010)’ data on “Education Attainment for Population Aged 15 and Over” are available on a 5-year basis.

<sup>15</sup> By contrast, *de jure* indicators place an emphasis on government policies and identify the presence of regulatory measures restricting capital account transactions. Some authors have argued that *de jure* indicators are poorly correlated to the amount of external financing received in developing countries (e.g., Prasad et al., 2003; Edison et al., 2004; Edwards, 2007) due to the usual limited capacity of governments to enforce capital controls effectively. Moreover, their high persistency makes them unsuitable for the panel threshold approach which requires, for the identification of the threshold, that regime-dependant variables are not time-invariant (Hansen, 1999).

<sup>16</sup> Since we use annual data, flows measures of capital were preferable to stock measures which display non-stationnarity. Moreover, flow measures may better reflect episodes of financial liberalization and capture shorter frequency movements in IFI, especially given the annual frequency used. In Table A.3 of the Appendix, we show the results of panel unit root tests for four stock measures of IFI drawn from Lane and Milesi-Ferretti (2007)’ database: the sum of total stocks of external assets and liabilities (as a share of GDP), total stocks of liabilities, FDI plus portfolio equity liabilities and debt liabilities.

composition effect, we break down the *inflows of capital* and isolate its two main components: *FDI and portfolio equity liabilities* and *debt liabilities*, which we both divide by GDP.

## 4.2 Threshold variables

This paper examines the existence of contingency effects in the IFI-growth relationship and assesses whether it is potentially intermediated by third factors. These factors are country characteristics that, as suggested by some economic theories and emerging evidence (reviewed in Section 2), work as pre-requisites for IFI to be growth-promoting. In particular, we examine the level of income, the degree of trade openness, the quality of the institutional setting, the level of financial development and the soundness of macroeconomic policies. Data for threshold variables are primarily obtained from the Penn World Table and World Development Indicators database.

Beginning with structural characteristics, each country's *level of income* is measured by its real per capita GDP from the previous period. The degree of *trade openness* is the conventional measure of the sum of exports and imports of goods and services divided by GDP. In the empirical literature, one common practice for deriving an indicator of *financial development* is to focus on *financial depth* and compute the size of the formal intermediary sector relative to the size of the economy. Our proxy for financial depth equals the ratio of private credit (claims on the non-financial private sector) to GDP (Gregorio and Guidotti, 1995).<sup>17</sup> To provide a proxy for the quality of *institutions*, we use data from the International Country Risk Guide (ICRG) database. The political risk rating monitored in the ICRG covers fundamental aspects of institutional quality such as law and order, corruption, the quality of the bureaucracy, government stability, democratic accountability, investment conditions and socio-economic context. We construct a composite index (a simple annual sum) of five political risk components: corruption, democratic accountability, investment conditions,

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<sup>17</sup> We are aware that this is a narrow measure which only partially reflects the level of financial development in an economy as it does not account for financial services provided outside the banking system, i.e. on financial markets. There are two reasons for focusing on the banking sector to investigate the role of financial development (Azman-Saini et al., 2010): first, bank credits are the only feasible sources of financing for the majority of developing countries in our sample; second, the number of available observations for equity market indicators are insufficient to conduct panel threshold regression.

law and order, and socio-economic context. This index ranges from 0 to 42, with higher values indicating better institutional quality. These data are available on an annual basis starting from 1984, which corresponds to the start of our period of study.

Turning to macroeconomic policy factors, we introduce as threshold variables the ratio of *government expenditure* to GDP (proxy for fiscal policy)<sup>18</sup> and the *inflation rate* calculated as the logarithmic first difference of the consumer price index (proxy for monetary policy).

### 4.3 Preliminary tests

To run the dynamic (or static) panel threshold regression, all the variables included in the model should be stationary. We perform two main panel unit root tests to ensure that our variables have suitable properties: the test of Im, Pesaran and Shin (2003) and Maddala and Wu (1999), which assume heterogeneity and cross-sectional independence. Results are presented in Table A.3 in the Appendix for a model with fixed individual effects. They show that all variables are stationary including the four flow-based IFI measures retained in the analysis.<sup>19</sup> The summary statistics are given in Table A.4.

## 5 Results

The benchmark specification (Equation 2) is estimated for each selected threshold variable and flow-based measure of IFI. Table 1 and Table 2 show the results using Hansen (1999)'s traditional panel threshold estimator while Table 3 to Table 9 report the results of dynamic panel threshold estimations.

For each selected threshold variable (Table 1 to Table 9), we report in columns the estimation results associated with the different measures of IFI. The upper panels in Table 3 to Table 9 show the

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<sup>18</sup> We also used budget deficits statistics divided by GDP, extracted from the International Financial Statistics (IFS), line 80. However, there is a structural break in the data in 2000, due to major changes in the compilation methodology, introduced by the IMF. In order to preserve the homogeneity of the series, we had to reduce to sample period to 1984-2000 and drop 18 countries. The results, not reported here, add little information over the ones with the government spending indicator. They are available upon request.

<sup>19</sup> We also tested four stock-based IFI measures commonly used in the literature and found them all to be are I(1).

coefficients and test statistics for the growth determinants, and the inferior panels display the threshold estimates along with their confidence intervals.<sup>20,21</sup>

First, estimating with traditional PTR (see Table 1 and Table 2), we find at most a single threshold in the conditioning variables - i.e. the null hypothesis of non-linearity (one threshold) cannot be rejected at 5% significance level. The results also highlight the existence of a composition effect in capital flows: the threshold estimates vary significantly across the four measures of IFI, irrespective of the conditioning variable considered. When using the dynamic estimator, the noticeable improvement of estimations is the stability of the threshold values, unconditional on the different types of capital flows. The only exception is the measures of FDI and portfolio equity flows which confirm the composition effect with a different threshold value (see Table 6-9). Another advantage of dynamic estimator is showed with more statistically significant coefficients of IFIs in the high regimes: with 5 of 6 threshold variables, we find each time at least 3 IFI measures growth-promoting in one regime.

Second, the coefficients of IFI obtained with the traditional and dynamic panel threshold estimators are similar and comparable in both regimes. As showed in similar previous studies (e.g., Edwards, 2001; Edison et al., 2002; Kose et al., 2011), the estimated coefficients on IFI tend to be smaller (in absolute terms) than the ones on core growth determinants. Mounting evidences show that IFI increases economic growth mainly through a direct positive effect on total factor productivity (TFP), while its overall impact on capital accumulation is negligible (Bonfiglioli, 2008). Both estimators report a composition effect for IFI measured by FDI and portfolio equity flows. Their larger growth-enhancing effects than other types of foreign capital confirm, indirectly, that they bring higher efficiency gains, through transfers of technology and knowledge (Borensztein et al., 1998).<sup>22</sup>

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<sup>20</sup> The coefficients and significance levels of growth determinants for traditional panel threshold model are not reported because of the limited space, but available upon request.

<sup>21</sup> Caner and Hansen (2004) provide evidence that the distribution theory in Hansen (2000) can be applied to the case of 2SLS estimation. However, a full distribution theory for dynamic panels has not yet been provided. Based on this reason, the heteroscedasticity – adjusted bootstrapped p-values are reported only for traditional panel threshold estimation of Hansen (1999) in Table1 and Table 2.

<sup>22</sup> Due to the non availability of data on portfolio equity liabilities for many developing countries in our sample, we do not measure IFI with FDI and Portfolio equity liabilities separately.

## ***5.1 Income level as a threshold***

In Table 3, using dynamic panel threshold estimator, the threshold values obtained endogenously with a narrow confidence interval are 9.27 (i.e. about 10615 US dollars). The regime-dependent coefficients imply asymmetric responses of output growth to IFI. In the low regime, where the initial income level is below the estimated threshold value, IFI has a negative but insignificant effect on growth; in the high regime, its effect becomes significantly positive. The results obtained with FDI and portfolio equity liabilities are markedly different. While the estimated threshold of income level is the same as with other measures, the slope coefficients on IFI, measured by FDI plus portfolio equity liabilities, are always positive but not significant. We thus interpret our results as emphasizing the necessity to account for the composition of external flows in assessing the IFI-growth relationship. They suggest that, from the viewpoint of the receiving economy, external liabilities are all the more beneficial if they are composed of FDI and portfolio equities.

Insert Table 3 here

## ***5.2 Trade openness as a threshold***

In Table 4, the results show the existence of two differentiated regimes for all measures of IFI. The threshold estimates indicate a trade openness ratio of 34 to 35% of GDP. Below this threshold value, IFI has a negative impact on growth, although it is not significant. Once the trade openness ratio attains the estimated threshold, the coefficient on IFI becomes positive and but only significant for FDI and portfolio equity measures. Again, this measure of IFI shows stronger effect in both regimes and a significant one in the high regime. Trade openness may be more suitable for conditioning the growth effect of FDI and Portfolio equity liabilities. In other words, in a more open country in international trade, a more prudential way to have a growth enhancing effect of IFI is to promote FDI and Portfolio equity type inflows.

Insert Table 4 here

## ***5.3 Institutional quality as a threshold***

Evidence from Table 5 strongly points to a sample-split based on the quality of institutions.

Interestingly, the institutional quality threshold interacts homogeneously with the measures of total



flows, total liabilities and debt liabilities. For these three IFI indicators, the results show a positive and significant effect of IFI conditioned by a threshold value of 25.9 in the institutional quality index (ranging from 0 to 42). Consistent with some theories and past empirical evidence (Bussière and Fratzscher, 2008; Bekaert et al., 2011), this seems to confirm that good institutions are fundamental to provide the right incentives so that external financial resources can generate social value and be earmarked to high-profitability projects. Again, worth noticing is the differentiated behavior of FDI and portfolio equity liabilities compared to the others IFI indicators. Indeed, FDI and portfolio inward investments bring higher growth-benefits to more institutionally challenged countries, and overall, their positive effects are larger than for the other types of capital flows. These findings are not contradictory with the view that institutional quality can potentially increase the volume of FDI a country attracts, and reduce their volatility (Buchanan et al., 2012). Rather they support the idea that over the long-run FDI & portfolio investments lead to higher growth acceleration in the receiving economy. A lower level of threshold value for FDI and Portfolio equity liabilities means that during the institutional development of a country, there is a less strict requirement of institutional quality to spur growth through the channel of FDI and Portfolio equity inflows.<sup>23</sup>

Insert Table 5 here

#### ***5.4 Financial development as a threshold***

We test the relevance of financial development as a threshold in the IFI-growth relationship and report a threshold value equal to 74.7% (see Table 6) except for FDI and portfolio equity (18.5%). We find positive coefficients of IFI measures using private credit except a negative but non-significant coefficient of FDI and portfolio equity liabilities for the low regime. Our results suggest that, while IFI is positively related to growth, an increase in IFI leads to higher and significant additional output growth in more financially developed economies relative to financially under-developed ones. Consistent with to some theories and past empirical studies, we do find evidence that a well-functioning financial system is crucial in the IFI-growth nexus. We also find a lower level of threshold

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<sup>23</sup> Hower, we are cautious about this interpretation because of a larger the confidence interval of threshold value estimated for FDI and portfolio equity liabilities.

value for FDI and Portfolio equity liabilities. Because of large confidence interval of threshold estimate, we interpret cautiously that FDI and portfolio equity liabilities could bolster growth even in a country with a relatively lower financial development.

Insert Table 6 here

### ***5.5 Macroeconomic policies as a threshold***

Finally, using inflation and government spending as proxies of macroeconomic policies, we find some evidence that sound macroeconomic policies also play a role in conditioning the direct benefits of IFI. In Table 7 three out of four regressions, IFI in low regime of government spending has a positive growth effect, i.e., IFI is conducive to growth in countries having low government spending than 14% of GDP. When using Inflation as threshold variable, the results suggest that, in three out of four cases, IFI has a positive and significant growth effect in high inflation regime and a negative non-significant effect in low inflation regime (see Table 8). Seemingly counter-intuitive, with an estimated inflation threshold level at 1%, these results offer some evidence to the view that IFI may be damaging to the growth in countries with prolonged periods of low inflation.<sup>24</sup> We find the composition effect for FDI and Portfolio equity liabilities: different estimated threshold values for both macroeconomic policies; positive and larger growth effect, even not always significant.

Insert Table 7, 8 here

## **6 Robustness**

In this section we have conducted some robustness checks for the benchmark specifications of equation (2). They include the inclusion of further control variables, further endogeneity tests of regime-independent and regime dependent regressors, and an analysis using a composite indicator of the six threshold variables aforementioned. The results of benchmark specification remain consistent for most of the robustness tests.

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<sup>24</sup> Low rates of inflation make it harder for governments, businesses and households to pay down their debts financed by foreign capital flows and could weaken profits and threaten consumption.

## 6.1 Inclusion of further control variables

To check further potential endogeneity problem stemming from the omission of key variables we consecutively include further control variables: Openness, Institutions, Inflation, Government spending and Private credit.<sup>25</sup> The underlying motivation to include a threshold variable as a further regressor is that the variable used as threshold may, in fact, also have a direct effect on growth - besides the threshold effect -, and not controlling explicitly for it may affect the interpretation of results.<sup>26</sup> For illustration purpose, we report in Table 9 the results only when initial income is considered as threshold variable.<sup>27</sup> We find the same threshold value 9.27 for initial income. The results suggest a stable threshold value and a narrow confidence interval of estimation for most of the regressions. There are few changes in the coefficients, no matter which additional control variable is included: the results show the positive and significant coefficient of IFI in the high regime for sixteen out of twenty regressions. The composition effect of FDI and Portfolio equity liabilities has not been affected by the inclusion of additional control variables, some of which, though, have a significant effect on growth.

## 6.2 Check for further endogeneity

As described in the section of methodology, our dynamic estimator allows to address the problem of endogenous regressor (i.e. the initial income) via 2SLS and GMM estimations. Moreover, for the possible endogeneity problem related to the threshold variable itself, we use its lagged values (of one period) to reduce the sample-splitting bias. In this subsection, we address further endogeneity issue of

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<sup>25</sup> Islam (1995) argued that the specification of individual country effects came as a potential solution for the omitted variables problem in the framework of single cross-country and pooled regressions. The new estimator adopted here eliminates the specified fixed-effects with the forward orthogonal deviations transformation, avoiding the serial correlation of the transformed error terms, and it ensures the application to the dynamic panel setting the cross-sectional estimator suggested by Caner and Hansen (2004) which allows for endogeneity of regressors by using generalized methods of moments (GMM) estimators. The new empirical strategy can control the effect of further omitted variables on growth.

<sup>26</sup> Omay and Öznur Kan (2010) show that threshold values tend to decrease significantly as new explanatory variables are introduced.

<sup>27</sup> The results of this robustness test using other threshold variables are similar and suggest the same conclusion. They are available upon request.

other regressors (other than initial income) by distinguishing regime-independent variables from regime-dependent ones.

### 6.2.1 Endogeneity of other control variables

When including further regime-independent control variables as implemented in subsection 6.1, we assume these variables are exogenous. As the possibility of endogeneity may not be completely excluded for some of these threshold variables, we also run regressions in which we include the threshold variable itself as an additional explanatory variable (see, e.g., Edison et al., 2002) and we use its lagged values as instrument in the 2SLS estimation to take into account the endogeneity issue. At first, the initial income and the chosen threshold variable (as regime-independent regressor) series are regressed on higher lags of both variables plus all the exogenous regressors. The predicted values for both initial income and the threshold variable (the second endogenous regressor) are then used in the structural equation to estimate the threshold. With the threshold value estimated with 2SLS estimator, the coefficients of regressors (endogenous and exogenous) and their confidence interval are afterwards refined with the GMM estimator.

The results reported in Table 10 suggest the following: first, all these employed endogenous threshold variables have significant effect on growth except inflation. Second, for threshold variables (openness, institutions, macroeconomic policies), employed endogenous variable has little impact on the size of the threshold value and the coefficients of IFI.<sup>28</sup> On the contrary, in the case of private credit included as endogenous variable, threshold increases for FDI and portfolio equity liabilities (from 0.18 to 0.96) while reduces for other measures (from 0.74 to 0.43). Furthermore, coefficients of IFI in low regime have become higher than those in low regime, even though neither is significant. One possible explanation for all these changes is the endogeneity issue of private credit. Third, the composition effect of FDI and portfolio equity liabilities is confirmed again (larger and significant effect at least in one of the two regimes), but the coefficients are not significant for the case of openness and private credit.

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<sup>28</sup> The only exception is observed for debt liabilities when government spending is considered endogenous: positive but non-significant coefficients in both regimes.

## 6.2.2 Endogeneity of capital flows

Another endogeneity issue might arise from IFI itself, the regime-dependent variable. Because one major shortcoming is that *de facto* measures may be affected by the same range of factors influencing economic growth - such as macroeconomic policies or political circumstances -, while growth outcomes may, in turn, drive capital flows (Eichengreen, 2001). Therefore, it is a reasonable hypothesis to consider economic growth may have a positive impact on the level and on the process of international financial integration, and we will have to account explicitly for this potential endogeneity bias in assessing the growth-IFI relationship. First, we have tested bidirectional causality between these two variables by implementing the recent panel Granger causality test developed by Dumitrescu and Hurlin (2012) (see table A.5). As the test suggests some reverse causality between GDP growth rates and IFI measures,<sup>29</sup> we then control for the endogeneity of IFI to check the robustness of our benchmark results (If it is not the case, we could suspect further endogeneity problems stemming from IFI). Therefore, we continue to estimate the dynamic panel threshold model by including endogenous IFI.<sup>30</sup> The estimation procedure is similar as for further endogenous regime-independent variables, but we have to limit our estimation to the less efficient (albeit still consistent) 2SLS estimation because it is impossible to split the instrumented IFI series within the construction of the GMM estimator (Baum et al. 2013).

Because of the limit of space, as for illustration, we only report in Table 11 the results when total flows are considered endogenous variable. Some observations are worth mentioning: similar size of threshold is found for initial income, institution, government spending and private credit. The coefficients of IFI have expected sign and are comparable to our benchmark results. Because of bigger standard errors (less efficiency) of 2SLS estimator, most of the coefficients of IFI are not significant. For Openness and Inflation, the threshold values and the growth-effect of IFI are less robust to the inclusion of endogenous IFI.

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<sup>29</sup> The panel causality test confirms as well the causality from IFI to growth.

<sup>30</sup> To studying the bidirectional relationship between IFI and economic growth, which is not the focus of the paper, a referee has suggested a Panel threshold vector regression model. This is an interesting suggestion and would be a constructive subject for future research.

Insert Table 9, 10, 11 here

### 6.3 Is one threshold variable sufficient?

Even it is not straightforward to review all these threshold variables separately for policy implication, based on the above tests of robustness, we give more creditworthiness to threshold variables with which the IFI-growth relationship are showed robust: i.e. initial income, institutional quality, private credit and government spending.

Alternatively, we propose a practical way in this subsection to employ the dynamic panel threshold estimator for analyzing the threshold effect of IFI. As each of these threshold variables is also correlated with each other and changes dynamically over time across countries, their correlation and co-movement could be captured by an unobservable common factor. As implemented in the literature (see, e.g. Chinn and Ito, 2006, 2008), we use the principal component approach to extract the first principal component of these six threshold variables.<sup>31</sup> This first principal component could be interpreted as an approximate composite indicator which measures the economic, institutional and financial development of a country over time. Then we employ this new composite indicator as threshold variable to estimate the growth effect of endogenous IFI. A threshold value of 2 (with this composite indicator ranging from -4.4 to 6.0) is reported in Table 12 and remains stable for the other IFI measures. The results confirm the threshold effect of IFI and suggest again a composition effect of FDI and Portfolio equity liabilities even though the coefficients of IFI in both regimes are not significant.<sup>32</sup>

Insert Table 12 here

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<sup>31</sup> Being conscious of the possibility of endogeneity of these six threshold variable, we use their lagged values of one period to extract the first principal component for 80 countries.

<sup>32</sup> As mentioned above, when the endogeneity of IFI is treated by instrumental regression, the less efficient but still consistent 2SLS estimator is applied and the standard errors are bigger.

## 7 Conclusion

Relying on non-linear and dynamic panel techniques, we estimate the relationship between IFI and economic growth and provide new evidence that financial integration could facilitate economic growth in countries satisfying certain threshold conditions, regarding institutional quality, private credit and government spending. Moreover, we were able to determine these threshold levels endogenously by taking advantage of the PTR modeling approach and test the validity of the non-linear structure of the IFI-growth relationship. Previous studies do not permit to establish such conclusions. In sum, the PTR methodology offers a strategy to deal with the cross-country heterogeneity regarding their experience with capital flows and allows to isolate the particular conditions under which IFI is statistically related to economic growth. However, one limit we see in the PTR approach is that it does not permit to investigate how one threshold condition can substitute to another. So far, we do not have knowledge of studies examining this question.

Our findings provide some evidence that improving the quality of the institutional setting and domestic financial development, and maintaining moderate government spending are important to support the potential gains from IFI. The results for trade openness and inflation are less supportive of the presence of threshold effects. Our findings also point to the existence of a composition effect in capital flows: (i) threshold values vary across different measures of IFI; (ii) debt inflows induce a smaller response of output growth compared to FDI inflows in the higher regime. Threshold constraints are also found to be systematically less constraining for the latter. Although this analysis has no claim to identifying rigorously a sequence of reforms, the findings suggest that the gains from FDI and equity investments can occur earlier in the reforming process to advance institutional and financial development.

## **A Data appendix**

Insert Table A.1 here

Insert Table A.2 here

Insert Table A.3 here

Insert Table A.4 here

Insert Table A.5 here

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