



MASTER PROJECT

# **An Empirical Framework: Financial Globalization and Threshold Effects**

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Barcelona Graduate School of Economics  
Master Degree in Economics and Finance  
2018-2019

31 May, 2019

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## Abstract

Is financial globalization beneficial to economies at all levels of development? Or are there certain “threshold” levels of financial, institutional and economic development a country must first attain in order to realize the growth benefits of globalization? Kose, Prasad and Taylor (2009) [14] develop a unified empirical framework to answer this question. The debate on the literature is ongoing. Yet few studies have explored these questions in a post-crisis context. In this paper, we replicate and extend their work, paying close attention to the period 2005-2014. Our analysis yields three key results. First, the financial depth threshold above which countries can benefit from financial globalization increases from 66% to 81% when we consider the extended period. Second, the proportion of countries with depth levels above this threshold declines over time. Finally, the coefficients are smaller in absolute value over the period 1975-2014. Taken together, these results imply a breakdown in the relationship between financial depth, openness and growth since the Great Recession. Financial deepening on its own can no longer ensure positive growth effects of financial integration.

# 1 Introduction

Economic theory predicts long run benefits of financial integration. In the standard neoclassical growth model, financial globalization generates growth by facilitating international risk sharing and a more efficient allocation of capital. While the theoretical prediction is clear, the growth effects of financial globalization are much disputed. Empirical studies of the relationship between financial integration and economic growth typically identify a weak relationship between openness and growth, if any.<sup>1</sup> Financial globalization can also generate indirect benefits. Kose et al [13] suggest that indirect benefits may in fact exceed the direct benefits. Financial market integration may facilitate the strengthening of the domestic financial sector, foster the development of institutions, promote better corporate and public governance or encourage the implementation of more sound macroeconomic policies.

Common in the empirical literature is the finding that advanced economies experience greater benefits of financial market integration. This empirical regularity underscores the importance of initial conditions. Countries must first attain a certain level of economic, financial and institutional development in order to reap the growth benefits of financial openness. Put simply, thresholds exist. Only those countries with levels of domestic financial sector development, institutional quality, or trade openness above a certain threshold will experience positive effects of financial globalization.

Despite consensus regarding the existence of threshold effects, knowledge of the impact of the global financial crisis on these thresholds is limited. In the 1990s and early 2000s, the trend was increasingly towards financial globalization. The crisis of 2007 however saw a reversal of this trend, resulting in a retrenchment in global financial integration [16]. Advanced economies were the worst hit, with capital flows reaching record lows. Despite a decline in the stock of external assets and liabilities in emerging markets, the trend toward financial integration re-emerged, with flows returning to their pre-crisis levels [19]. The changes that occurred in the process of global financial integration during the pre- and post-crisis period were unprecedented. An understanding of these changes is an essential first step if we are to think meaningfully about threshold effects or make predictions about likely future trends in the pattern of financial globalization.

The primary objective of this paper is to replicate and extend the analysis undertaken by Kose, Prasad and Taylor [14] in their paper ‘Thresholds in the Process of Financial Integration’. We extend the data set to test for threshold effects over the period 1975-2014. First, we will test for threshold effects in the periods 1975-2004 and 1975-2014. We will ask whether there are certain lev-

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<sup>1</sup>Rodrik [25] tests for growth benefits of financial integration for a sample of 100 countries over the period 1975-1989 and finds no evidence of a relationship. Similarly, Kraay [15] does not find that openness positively affects growth. Conversely, Quinn’s [23] analysis implies a positive effect of financial openness on growth.

els of economic, institutional and financial sector development a country must first attain in order to realize the benefits of financial globalization. We will then hone in on financial depth as a threshold, analysing changes in both its level and the proportion of countries with levels of depth above this threshold over time, paying close attention to the period 2005-2014.

Our paper constitutes a unique contribution to the empirical literature investigating the existence of threshold effects in the process of financial globalization. We are not aware of any study of this kind with a focus on the years directly preceding or following the global financial crisis. Our results identify a significant role for financial depth in mediating the growth effects of financial globalization. When we extend the data set to include 2005-2014, we observe an increase in the threshold level of financial depth required for countries to realize the growth effects of financial integration from 66% to 81%. Secondly, we document a decline in the proportion of countries with levels of depth above this threshold. Third, we identify a weaker relationship between financial openness and growth when we consider the period 1975-2014. Finally, consistent with Kose et al [21], we identify threshold effects associated with the level of institutional quality of a country.

Taken together, these findings hint at a breakdown in the relationship between financial openness and growth. An analysis of the extended period raises the question of whether financial depth alone can ensure positive growth effects of further financial integration. The recent trend toward macro-prudential policies and greater financial market regulation points to the possibility of alternative threshold variables. To fully understand the relationship between financial openness and growth and the changes that occurred in the wake of the global financial crisis, we may require a new approach that accounts for both financial depth and financial stability.

The paper proceeds as follows. Section 2 reviews the theoretical literature and the empirical studies undertaken to date. Section 3 describes the data used, in particular the differences between our data set and that used by Kose et al [14]. In Section 4, we provide an outline of our empirical strategy and the estimation issues we encounter. In Section 5 we discuss our results. We conclude our analysis with an exploration of possible avenues for further research.

## 2 Literature Review

A common finding in the empirical literature is that developed countries benefit more from financial integration than developing countries.<sup>2</sup> Countries may first need to attain a certain level of economic and institutional development in order to realize the benefits of financial globalization. There may exist a threshold level of development beyond which the effects of global financial integration are

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<sup>2</sup>See Edwards [8] and Klein and Olivei [12].

positive.

The first studies of thresholds in the process of financial globalization explore differences in the response of GDP growth to financial openness between developed and developing economies, by analysing the interaction between openness and initial income. Edwards [8] interacts a measure of openness with log GDP and provides evidence that financial openness only generates growth benefits once a country achieves a certain level of economic development. The coefficient on the interaction term is positive and significant across specifications, suggesting that higher income countries benefit more from financial integration. Conversely, the negative coefficient on openness implies that openness may instead hurt low-income economies. These findings point to an optimal sequencing of liberalization. A number of variables may mediate the response of economic growth to changes in the degree of financial openness, including the level of financial depth, institutional quality or trade openness. In other words, countries may need to strengthen the domestic financial sector, open to trade, or develop institutions before opening financial markets.

### **Financial depth**

The depth of the domestic financial sector plays an important role in mediating the effects of financial globalization on growth. Financial depth is defined as the size of a country's financial sector relative to the size of its economy. It captures increasing provision of financial services. Kose et al [14] note that countries lacking deep financial sectors may experience greater volatility as a result of capital account liberalization. Financial integration may exacerbate booms and busts and increase the likelihood of crises in poorly managed financial sectors. A vast literature explores the relationship between financial depth, financial openness and economic growth. Masten et al [18] test for threshold effects with respect to the depth of domestic financial markets. Their estimates imply significant threshold effects. They show that developing countries benefit more from financial sector development than from financial openness per se. Financial integration only generates growth benefits if countries first strengthen the domestic financial sector.

Similarly, Bailliu [2] examines a panel of 40 developing countries over the period 1975-1995 and interacts various capital flow measures with a measure of banking sector development. The coefficient on the interaction term is consistently positive, while that on capital flows is negative. Both are statistically significant. The estimates suggest that financial liberalization will only stimulate growth in countries that first develop their banking sectors. Rioja and Valev [24] create a financial development indicator that takes three possible values; low, medium and high, and classify the countries in their sample accordingly. They include a linear interaction between the indicator and financial openness and show that the effects on GDP growth depend on the region to which a country belongs. Financial openness will yield positive growth effects for countries with financial depth between 60% and 150%, but may adversely affect those with depth levels below this thresh-

old. The effect of openness on the growth rates of countries with levels of integration above 150% is insignificant, suggesting that the effect peters out once a maximum level of financial development is attained. In contrast, Kraay [15] fails to find support for the hypothesis that financial integration only stimulates growth in countries with a sufficiently strong financial sector.

### **Trade openness**

The degree of trade openness may also mediate the effects of financial integration on growth. Financial market integration tends to follow goods market integration [1]. Eichengreen [9] notes that opening financial markets before opening up to trade in goods can result in an inefficient allocation of investment as funds may flow to sectors in which the country does not have a comparative advantage. Second, trade generates revenue that countries can use to escape a recession. When countries are more open to trade, they can implement smaller exchange rate depreciations for a given adjustment in the current account. This minimises the associated balance sheet effects, thereby making adjustments less painful and allowing countries to better reap the benefits of financial integration. Arteta et al [1] test whether the relationship between financial openness and growth depends on the degree of trade openness. The authors interact financial openness with Sachs and Warner's [28] index of trade openness and conclude that the opening of financial markets will stimulate growth if a country first eliminates trade barriers.

### **Institutional quality**

Institutions also play a part in determining the impact of financial openness on GDP growth. Financial integration increases the amount of resources in the economy. Strong institutions are necessary to ensure the efficient allocation of these resources. Thus, we might expect to observe positive effects of financial integration in countries with better institutions. Klein [11] investigates whether institutional quality affects the impact of financial market liberalization on growth by interacting an institutional quality indicator with an indicator for the number of years between 1976 and 1995 that a country was considered financially open. Allowing for linear, quadratic and cubic effects, the author finds that openness significantly impacts growth for countries with levels of institutional quality above the median value. In contrast, Kraay [15] interacts several indicators of institutional quality with financial openness but fails to find evidence of threshold effects.

While the empirical literature on thresholds in the process of financial globalization is vast, the majority of studies undertaken to date evaluate the effects of financial depth, institutional quality or trade openness in isolation. Kose et al [14] develop a unified empirical framework to identify the role of these variables in mediating the effect of financial openness on economic growth. They present evidence of thresholds in the level of financial depth and institutional quality. Perhaps most importantly, the authors estimate these thresholds and the corresponding confidence intervals. Their estimates suggest that countries with levels of financial depth above 71% will experience positive

effects of financial openness, while those with depth levels below this threshold may instead experience adverse growth effects of financial globalization.

While the results vary widely depending on the sample of countries, time period and measures of financial openness chosen as well as the estimation technique employed, there is consensus on the existence of threshold effects. Countries may need to postpone liberalization of financial markets in order to first strengthen domestic institutions. There exists a gap in the literature, however. No study undertaken to date tests for threshold effects in the post-crisis period. This paper endeavours to fill this gap.

### 3 Data

As the primary objective of this research is to replicate and extend the analysis undertaken by Kose et al [14], the same data is used where possible. Data availability issues resulted in some differences. Table 7 lists our sources. The final data set consists of 80 countries and spans the period 1975-2014.<sup>3</sup>

#### Dependent variable

Our dependent variable is the growth rate of real GDP per capita over five-year period measured as the log difference divided by length. To construct this variable we use RGDPNA (Real GDP at constant 2011 national prices) contained in Penn World Table (PWT) version 9.0<sup>4</sup>. It is important to bear in mind that this measure differs significantly from the measure used by the authors, making differences between our estimates unavoidable.

#### Controls

We control for average years of schooling, the ratio of average investment to GDP, population growth and initial income per capita. These controls are typical of cross-country growth regressions. Average years of schooling in the population aged 25 and over proxies for the level of human capital in a country. The data comes from Barro and Lee's educational attainment data set and is available in five-year intervals for the entire period 1975-2014. We control for differences in the level of development across countries using log of real per capita GDP at the beginning of each period. We use investment as a share of GDP at constant national 2011 prices to measure average investment. Both variables come from the PWT. Finally, we control for population growth. Annual data is available from the World Bank's World Development Indicators database.

#### Financial openness

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<sup>3</sup>See Table 6 for a list of the countries in our sample.

<sup>4</sup>RGDPNA is recommended for growth regressions in the PWT User's Guide. In addition, the new version corrects for previous measurement errors.



We define financial globalization as an increase in cross-country capital flows. De facto financial openness is measured as the stock of external assets and liabilities as a ratio of GDP, obtained from Lane and Milesi-Ferretti's [16] External Wealth of Nations data set. While Kose et al [14] examine both stock and flow measures, we chose to consider only stock variables in our analysis. Masten et al [18] note that stock variables are likely to provide better measures of financial integration as they are typically less volatile and less likely to be subject to measurement error.

### Threshold indicators

The purpose of this analysis is to determine whether a country's initial conditions influence the impact of financial integration on growth rates. Financial globalization may only translate into economic growth if a country first develops strong institutions, strengthens the domestic financial sector or opens up to international goods trade. To test this hypothesis, we require data on three threshold indicators.

- *Financial depth*: We define financial depth as the ratio of liquid liabilities to GDP. This data is available annually from the World Bank's Global Financial Development database. While Kose et al [14] use domestic credit to the private sector as a proportion of GDP in their analysis, both measures are common in the literature.<sup>5</sup> It is important to note that empirical research yields different results depending on the measure of depth used [13].
- *Institutional quality*: World Bank Governance indicators capture institutional quality. The index takes values between -2.5 and 2.5, and covers six aspects of institutional quality: corruption, voice and accountability, political instability and violence, government effectiveness, rule of law, and regulatory quality. The indicators are not available annually. Kose et al [14] however note the persistence of these indicators over time for each country. We follow their approach and create a fixed measure of institutional quality by taking a simple average of the six indicators over the periods of interest.
- *Trade Openness*: We construct trade openness as the sum of nominal imports and exports as a share of nominal GDP. Our measure of trade openness differs from that used in the original paper. The authors obtained a pre-constructed index of trade openness from PWT 6.2. This index does not appear in more recent versions of the PWT.

We take five-year averages of each of our variables, with the exception of, initial GDP per capita, our measure of human capital and institutional quality. This gives us 8 non-overlapping periods for each of the 80 countries in our sample, and yields a sample size of 640 observations for the extended period, 1975-2014. Averaging over five-year periods allows us to eliminate fluctuations due to the business cycle[2].

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<sup>5</sup>Klein and Olivei [12], Arteta et al [1] and Edwards [8] use liquid liabilities as a proxy for depth.

## 4 Empirical Strategy

### 4.1 Model

We now introduce our cross-country econometric model. The main objective is to investigate potential thresholds in the relationship between financial openness and growth and determine whether these thresholds have changed over the two periods under analysis. We employ a parametric approach and estimate a standard linear dynamic panel data model that uses both the cross sectional and the time dimension of the data. This increases the number of observations and allows us to include country fixed effects to account for potential endogeneity of the regressors. The regression equations is as follows:

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

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

We wish to explain a country's growth over a five-year period,  $\Delta y_{it}$ , as a function of a set of controls typically included in growth models,  $x_{it}$ , such as initial income per capita levels at the start of each 5-year period, the level of investment to GDP, a proxy for human capital and population growth, as well as country and time period specific effects,  $\delta_i$  and  $\gamma_t$  respectively. We also have an interaction function  $g(\cdot)$  that accounts for financial openness ( $FO_{it}$ ) and its relationship with a threshold variable ( $THV_{it}$ ). Based on Kose et al [14], we define three interaction specifications:

1) A linear interaction that tests if the level of a particular variable affects the marginal effect of financial openness on growth.

$$g(FO_{it}, THV_{it}) = \beta_{FO}FO_{it} + \beta_{THV}THV_{it} + \beta_{FO\cdot THV}FO_{it} * THV_{it}$$

2) A quadratic interaction that tests whether, beyond a certain level, the threshold variable becomes less or more important in explaining the marginal effect of financial integration on growth.

$$g(FO_{it}, THV_{it}) = \beta_{FO}FO_{it} + \beta_{THV}THV_{it} + \beta_{FO\cdot THV}FO_{it} * THV_{it} + \beta_{THV^2}THV_{it}^2 + \beta_{FO\cdot THV^2}FO_{it} * THV_{it}^2$$

3) A High-Low interaction that allows us to see whether the relationship between financial openness and growth differs between countries with threshold levels above or below the median value.

$$g(FO_{it}, THV_{it}) = \beta_{FO}FO_{it} + \beta_{FO\cdot THV_{high}}FO_{it} * \mathbf{D}(THV_{it} > THV_{median_t}) + \beta_{THV}THV_{it}$$

where  $\mathbf{D}(TH_{it} > TH_{median_t}) = 1$  if the THV for a country is above the median value for all countries in that time period.

## 4.2 Estimation and Econometric Issues

Each of the aforementioned specifications is first estimated through robust pooled OLS with controls for country and time dummies. We then estimate the specifications using Fixed Effects (FE) with robust standard errors. FE is advantageous as it allows us to account for country specific effects,  $\delta_i$ , but this might also lead to inaccurate results since we are dealing with variables like growth and initial income which mostly vary in the cross-section dimension [7].

However, the two methods might be affected by an endogeneity bias, as we include the lagged dependent variable as a regressor. Moreover, FO might also be biased due to reverse causality and/or omitted variables. A major limitation of growth models is the lack of suitable external instruments. We might think of using Arellano and Bond's GMM approach to overcome this issue. However, due to the high persistence of GDP and the small number of time periods (eight or less), Difference-GMM may yield biased coefficients. Equally, the highly persistent nature of GDP can result in a weak instruments problem. At the time the paper of Kose et al [14] was released, most of the work on growth models used System-GMM to overcome these issues. System GMM involves the estimation of a system of equations in both first-differences and levels. Lagged values of levels and first differences are used as instruments, respectively. We conduct this two-step system GMM estimation using Windmeijer standard errors with small sample correction.

Although it is widely used, it should be noted that System GMM performs better when the number of cross-sectional observations is large (when  $N$  goes to infinity) [7]. In our study we have 80 countries which yields, at most, 640 observations for the period 1975-2014<sup>6</sup>. Even when correcting for the small sample size, standard errors can still be heavily biased. Instrument proliferation also poses a problem. To tackle this issue, we perform an Arellano and Bond test to determine how many lags to include. We then used the Hansen Test to test the joint validity of our instruments. While the inclusion of more instruments increases efficiency, an excessive number of instruments could result in biased estimates when the sample is small [27]. Therefore, this trade off needs to be addressed with caution. Furthermore, the validity of System GMM relies on the assumption of mean stationarity. In other words, it requires that the mean of the data does not depend on time  $t$ . This is a strong assumption on initial conditions that may not be true in practice. Bun and Sarafides [3] note that System GMM is generally credited with providing a solution to the problems arising from persistent panel data in a first-differenced GMM approach. However, they recognize that the additional restriction it imposes on initial conditions is unrealistic especially in the case of persistent panel data. The Hansen J test should detect any violation of this assumption but, as noted by Roodman [26], this test might be weakened by the instruments proliferation problem mentioned before.

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<sup>6</sup>We would like to thank Sergi Jiménez-Martín and Vladislav Morozov for valuable guidance and helpful comments on SGMM and its application.

To summarize, if  $N$  is relatively small and the data exhibit a high degree of persistence, System GMM estimators may also behave poorly. Therefore, it is not clear that using system GMM is preferable to pooled OLS or FE. For this reason, we estimate our regression model using the three approaches.

## 5 Results

### 5.1 Stylized facts

Before proceeding with the empirical analysis, we analyze the raw data to check for potential threshold effects. For this exercise, we group countries into industrial economies (Ind), emerging markets (EMs) and other developing countries (ODCs). We follow the authors' approach and use the MSCI Emerging Market Index to assign countries to these categories. Our classification of countries differs slightly from that of Kose et al (2009) as some countries have moved between groups since 2004. We do not make this distinction in our econometric analysis as the objective is to test for threshold effects at a national level.

We are interested in understanding whether the level of each threshold variable is associated with differences in average growth rates within each group. Table 1 presents unconditional growth rates for the two periods, 1975-2004 and 1975-2014. Within each country category, we split the countries into High and Low groups based on their order with respect of the median of the variable in question. We then report the average growth rate for the High and Low groups. Table 2 contains the conditional growth rates. The conditional growth rates indicate residuals from a cross-sectional regression of growth on our control variables, log initial GDP per capita, average investment to GDP, average years of schooling and average population growth rate.

We now discuss the main results that follow from the two tables. Firstly, growth rates are higher in EMs and industrial countries than ODCs. If we consider initial income, we see that countries in the low group experience higher GDP growth, pointing to convergence effects.

Secondly, countries with high levels of financial openness show higher unconditional growth rates. However, the opposite pattern emerges when we consider conditional growth rates. This is consistent with the ambiguous effects of financial openness on GDP growth common in the empirical literature.

Third, EMs with high (within-group above-median) levels of threshold variables show higher unconditional growth rates, a pattern that is suggestive of threshold effects. The results are less pronounced for ODCs.

Fourth, when we condition on control variables, we see that the growth rates are much smaller. This finding highlights the importance of conditioning on other variables in order to estimate the relationship between financial openness and growth. Conditional growth rates show the part of development that is attributable to dynamics other than average investment, for example cross-border financial interactions.

## 5.2 Empirical results

In this section we present our FE and System GMM results. We also conducted pooled OLS estimation. However, we do not report the results as they are similar to the FE estimates.

Firstly, it's important to note that most of the coefficients obtained when estimated through System GMM are insignificant. Nevertheless, we consider it good practice to report these estimation results as it points to the fact that there is no clear evidence of the effects of financial openness on growth, even when we account for endogeneity. Results are generally dependent on the selection and measure chosen for the variables and the time periods taken into account.[13]

Our primary aim is to estimate the threshold levels for the two periods. Given the aforementioned limitations of SGMM, we decided to do so by focusing on FE estimates which yield results that are significant and in line with the findings of Kose et. al. [14]

In Table 3 we present the FE results for our main threshold variable, financial depth. All specifications include control variables. The second column (M2) shows the results of the FE regression including financial openness as a control. In line with Kose et al. [14], we identify an insignificant relationship between financial openness on growth, for both the original and extended periods. This result is also in line with the literature, which finds ambiguous effects of financial openness on growth.

Model M3 presents the results with high/low interaction term. We created a dummy variable that takes the value 1 when a country has a level of financial depth that is above the sample median for that period. In line with the paper, we can see that for the period until 2004, the effect of financial openness on growth was significant and negative but, for those countries above the median-level of financial depth, there was an additional positive effect. In other words, the coefficients for  $FO_{it}$  and for  $FO_{it} * \mathbf{D}(THV_{it} > THV_{median_t})$  have similar magnitudes but opposite sign. Then, which is the overall effect? For a country below the median of financial depth, the effect of financial openness on growth is negative. On the other hand, for countries above the median level of financial depth, this effect is negligible since the positive coefficient nets out with the negative one. When we extend the period until 2014 the coefficients are insignificant.

In M4, we introduce a linear interaction between our threshold variable, financial depth and financial openness. The interaction coefficient is significant and positive, implying that the level of financial

depth positively affects the relationship between financial integration on growth. However, it is insignificant for the period spanning 1975-2014, implying that the effect of financial depth on the relationship between FO and growth is not clear anymore. The breakdown of this relationship is apparent if we consider that it was advanced countries with the highest levels of depth that were the most affected by the financial crisis.

In M5, we estimate the quadratic interaction specification. In this case, the coefficients are significant in each period. The coefficient for  $FO*FD$  is positive, while for  $FO*FD^2$  squared is negative. This suggests that a higher level of financial depth enhances the effects of financial openness on growth but only up to a certain level of financial depth. Additionally, the coefficients for the period until 2014 are much smaller in absolute value, again pointing to a breakdown in the relationship between financial openness and growth. This result is discussed in greater detail in the following section.

### 5.3 Financial depth threshold

We wish to determine the threshold levels beyond which a country manages to reap the benefits of financial integration. The coefficients of financial openness in the quadratic specification represent the overall effect of financial integration on growth, as a function of the threshold variable. Hence, we take the coefficient on gross financial openness, on the linear and the quadratic interaction terms from the regression in Table 3. This yields a quadratic polynomial of the form  $-0.0541 \cdot x^2 + 0.1035 \cdot x - 0.0447$ , which gives two roots, 0.6590 and 1.2541. We focus on the lower root, as our aim is to capture the point beyond which the effect of financial openness on growth becomes positive. In this respect, the lower root is more relevant for developing economies. It is closer to the average financial depth of our data (48%) than the upper root. We note that our threshold of 66% is very close to the 71% estimated by Kose et al [14].

A ratio of liquid liabilities to GDP of approximately 66% is the cutoff above which the sign of the gross FO coefficient becomes positive. It is important to note that the polynomial has an inverted-U shape: The sign of the gross FO coefficient is negative below a level of financial depth of 66%, i.e. a country with depth below this level in the period 1975-2004 experiences adverse effects of further financial integration. Above the upper threshold, the effect of FO becomes negative. We also examine the proportion of countries in each category with levels of depth above this threshold. Based on our estimates, 5% of ODCs and 25% of EMs lie above the lower threshold, while this figure is 55% for industrialized countries over the period 1975-2004.

We want to check whether there has been any change in the overall effect of financial openness on growth and the estimated financial depth threshold when we extend the period until 2014.<sup>7</sup> The estimated threshold for this period is 81% with an upper root of 1.14. Moreover, the percentage of

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<sup>7</sup>It is important to note the difficulty in making a dynamic comparison in the context of thresholds. Kose, Prasad, Taylor [14] warn of this difficulty when analyzing cross-country data.

countries with a depth level above the threshold decreased. This is perhaps unsurprising given the higher threshold level. Only one-fifth of industrial countries have a level of financial depth above 81% over the whole period. The proportion of EMs above the threshold is 15%, while only two of the forty ODCs have depth levels above the threshold.

In order to better understand why the threshold increased, we analyze and compare the shape of the quadratic function in the two periods. Figure 4 shows the thresholds as well as the quadratic functions of the overall financial openness coefficient for 1975-2004 and 1975-2014. It is important to note that the extent to which countries can benefit from financial openness by increasing their financial depth is smaller when we consider the period 1975-2014. This is evident from the difference in the area under the curve between the two periods and is a clear consequence of the smaller regression estimates in the extended period.

What might have happened between 2004 and 2014 to have caused such a decrease in the coefficients and an increase in the threshold? To understand what is driving our estimates, we break down the analysis further and consider the period 1975-2009. The coefficients on each interaction term are statistically significant at the 5% level and the estimated threshold is 59%. Hence we conclude that the increase in the threshold to 81% is driven by the period 2010-2014.

There are a number of factors that could explain a higher threshold level of financial depth over the period 1975-2014, including the unprecedented changes in the pattern of global financial integration that took place in the years immediately preceding and following the crisis. However, we think that an important takeaway from this result is that it is now more difficult for countries to obtain the growth benefits of financial openness. This is confirmed by the reduction in our regression estimates when we extend the analysis to cover the period 1975-2014. The global financial crisis provides proof that financial depth does not guarantee financial stability [14]. The group of countries that was most severely affected by the recession was the group with the highest percentage of economies lying above the financial depth threshold of 66%. This is evident in Figure 3. Industrial economies experienced the greatest decline in growth rates in the periods under analysis.

Could it be possible that financial stability now plays a greater role than financial depth in helping countries continue on their path of economic development? Growth in the post-crisis period was likely influenced by changes in monetary policy, the wider use of macro-prudential policies and the introduction of better financial regulatory tools in both industrialized and emerging economies, factors that may not previously have been important in explaining the relationship between financial openness and growth.

Loayza, Ouazad and Ranciere [17] highlight the important trade-off that further financial deepening can generate between higher growth and a higher risk of crisis. There is a disconnect between the two strands in the literature, with studies either focusing on the relationship between depth and long-run growth or that between depth and the probability of crises [17]. In this analysis, we replicate

a paper focusing only on the long run growth effects of financial depth. Increasingly, the literature underlines the need for an integrated approach that tackles the two sides of this existent trade-off. Thus, we conclude that an analysis focusing only on long run growth effects can be misleading. This is especially true for the post-crisis period given the extraordinary changes that occurred in the pattern of global financial integration.

For these reasons, we interpret the increase in the threshold and the smaller regression estimates as an indicator of the possible breakdown in the relationship between growth and financial globalization. Further research on the role of financial deepening in explaining the growth effects of financial openness ought to account for this trade-off between growth and a greater probability of crises.

## 5.4 Alternative thresholds

While financial depth is the primary focus of our analysis, we also estimate two other thresholds, institutional quality and trade openness. We estimate linear and high/low specifications for each of the alternative threshold variables. The results are presented in Table 5. Our focus on the linear and high-low interaction specifications is grounded in economic theory. As outlined in Section 2, countries may need to attain a threshold level of trade openness if they are to realize the benefits of financial integration. For instance, greater trade openness generates export revenue which countries can use to stimulate the economy in a recession. It is unlikely that there would come a point after which the effect would peter out. For this reason, we exclude the quadratic specification. The same applies to institutional quality. Strong institutions improve allocative efficiency, signalling stability and confidence to investors, thereby increasing the growth benefits of financial globalization. Again, we do not expect there to reach a level of institutional quality, after which point the effect diminishes or disappears.

### 5.4.1 Institutional quality

We identify significant threshold effects for institutional quality when we include the high/low interaction term. For the period 1975-2004, the coefficients on both the interaction term and financial openness are significant at the 1% level. We can determine the overall effect of financial integration on the growth rates of countries with levels of institutional quality above the median level by combining the coefficients on gross financial openness and that on the interaction term. Countries with institutional quality greater than the median value will experience significant positive GDP growth when they become more financially open. In contrast, the negative coefficient on financial openness suggests that further financial integration will generate adverse growth effects for countries with levels of institutional quality below the median.



When we estimate a linear interaction specification, the overall impact of financial openness on GDP growth is positive for countries with higher levels of institutional quality. The coefficient on gross financial openness however is insignificant. The negative coefficient however again suggests that countries with lower levels of institutional development will experience adverse effects of further financial integration. Our results for the linear and high/low specifications are consistent with those estimated by Kose et al [14] in terms of sign, magnitude and significance.

When we extend the data set to cover the period 1975-2014, the relationship between openness and growth appears to break down. The high/low interaction remains significant at the 5% level. The interaction term implies slightly positive overall growth effects for countries with levels of institutional quality above the median value. There is a slightly positive effect of increased financial integration on GDP growth for countries with institutional quality above the median value. The negative coefficient on gross financial openness is negative as expected. However, it is no longer significant.

We observe the same pattern when we include a linear interaction term. The estimates, despite having the same signs, are much smaller in magnitude and are no longer statistically significant. The breakdown in the relationship between openness and growth observed when we extend the data to include the period 2005-2014 is perhaps unsurprising. The result implies that financial openness was not a significant determinant of GDP growth during this period. There were likely a number of factors that exerted significant influence on growth rates at this time, such as a country's monetary, or macro-prudential policy stance. Their importance in explaining a country's GDP growth rate likely overtook the role of financial integration during this period.

## 5.4.2 Trade openness

Only the linear interaction specification is significant for the period 1975-2004. The positive interaction coefficient points to a positive effect of trade openness in mediating the effects of financial integration on growth. Conversely, those with a low level of trade openness may instead experience negative effects. The coefficients are significant at the 10% level. Our estimates are very close in magnitude to those of Kose et al [14], despite differing in terms of statistical significance. It is important to note that our measure of trade openness differs from that used by the authors due to differences across versions of the PWT.

For the period 1975-2014, the pattern is similar to that observed for institutional quality. Again, the coefficient on the linear interaction term is positive while that on gross financial openness is negative. The estimates however are not statistically significant for the extended period. The coefficients are much smaller in each case, again implying a weaker relationship between openness and growth during the extended period.

Our estimates for the alternative thresholds are broadly consistent with those of Kose et al [14].

The estimates point to the importance of institutional quality in mediating the effect of financial openness on growth. The results for trade openness are less clear cut. Most noteworthy is perhaps the breakdown in the relationship between openness and growth that is evident when we extend the data set to include the post-crisis period. Other factors may have played a more important role in explaining GDP growth at this time. The insignificance of our estimates makes inference challenging. For this reason, we do not calculate threshold levels for the alternative threshold variables.

## 6 Conclusion

We test for threshold effects in the process of financial globalization over two periods, 1975-2004 and 1975-2014. This paper is unique in its inclusion of the years immediately before and following the Great Recession. Following a surge in international financial integration between 2005 and 2007, financial openness plummeted with the onset of the crisis in 2007. This effect was most pronounced in advanced economies. As economic growth rates declined, countries turned their backs on financial globalization. Financial flows have since rebounded, albeit not to their pre-crisis levels [19]. The effect of this volatility on the relationship between financial openness and economic growth however is not well understood.

Our primary objective was to replicate and extend the analysis of Kose et al [14]. We examine two periods 1975-2004 and 1975-2014 and test for threshold effects in three variables, financial depth, institutional quality and trade openness. We analyze changes in the financial depth threshold over time as well as changes in the proportion of countries with depth levels above this threshold over time.

We present three key findings. We first document an increase in the threshold level of financial depth from 66% to 81% when we extend the period to 2014. It follows that the proportion of countries with levels of depth above this threshold decreases over time. Our estimate of 66% for the period 1975-2004 is remarkably close to that of Kose et al [14]. Secondly, the coefficient estimates are smaller and less significant which points to a breakdown in the relationship between financial openness and growth in the post-crisis period. Finally, we identify significant threshold effects of institutional quality.

Together these results point to a weaker relationship between financial openness and growth in the post-crisis period. Our estimates suggest that once a country reaches the threshold level of financial depth, further improvements in depth stop being important quite rapidly. It is now more difficult for countries to attain the benefits of financial integration, not just because the threshold of financial depth is higher but because financial depth alone may no longer be sufficient to ensure growth. The trade-off that further financial deepening can generate between higher growth and a higher risk of crisis needs to be addressed. The Great Recession was a reminder that financial depth and financial

stability need not go hand in hand. The risks of financial deepening are more evident than before. Focusing only on the long run growth view overlooks this trade-off. In order to conduct policy relevant research, a new approach that realistically accounts for both the growth and crisis effects of financial deepening is required.

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# Appendix

**Table 1:** Long term unconditional growth rate(in % per annum)

		Unconditional growth (% per annum)					
		1975-2004			1975-2014		
		EM	ODCs	Ind	EM	ODCs	Ind
Overall (GDP)		2.361	0.78	1.631	2.238	1.054	1.265
By initial GDP per capita	High	2.504	1.07	1.496	2.284	1.298	1.226
	Low	2.219	0.242	1.767	2.193	0.602	1.303
	Diff. in means	0.285	0.828	-0.272	0.091	0.697	-0.077
By de facto gross financial openness	High	2.66	0.9	1.62	2.213	1.163	1.263
	Low	2.062	0.692	1.642	2.264	0.982	1.266
	Diff. in means	0.598	0.208	-0.022	-0.051	0.181	-0.004
By financial depth	High	2.652	1.125	1.53	2.67	1.321	1.19
	Low	2.07	0.36	1.733	1.806	0.693	1.339
	Diff. in means	0.582	0.766	-0.203	0.865	0.628	-0.15
By institutional quality index	High	3.13	1.276	1.447	2.582	1.466	1.16
	Low	1.592	0.285	1.816	1.894	0.643	1.369
	Diff. in means	1.538	0.991	-0.369	0.688	0.824	-0.209
By trade openness	High	3.083	1.246	1.609	2.664	1.352	1.283
	Low	1.639	0.266	1.653	1.813	0.691	1.246
	Diff. in means	1.444	0.981	-0.045	0.851	0.661	0.038

**Note:** Numbers are average annual growth rates within groups High and Low. High/low sub-samples are defined relative to medians within groupings.

**Table 2:** Long term conditional growth rate(in % per annum)

		Conditional growth (% per annum)					
		1975-2004			1975-2014		
		EM	ODCs	Ind	EM	ODCs	Ind
Overall (GDP)		0.341	-0.468	0.595	0.463	-0.356	0.249
By initial GDP per capita	High	0.249	-0.461	0.261	0.538	-0.157	-0.018
	Low	0.432	-0.481	0.929	0.388	-0.725	0.514
	Diff. in means	-0.183	0.02	-0.668	0.151	0.569	-0.531
By de facto gross financial openness	High	0.169	-0.593	0.831	0.431	-0.33	0.384
	Low	0.512	-0.375	0.359	0.495	-0.373	0.113
	Diff. in means	-0.344	-0.219	0.473	-0.064	0.044	0.272
By financial depth	High	0.079	-0.266	0.583	0.284	-0.111	0.298
	Low	0.603	-0.714	0.606	0.642	-0.688	0.199
	Diff. in means	-0.525	0.448	-0.023	-0.359	0.577	0.099
By institutional quality index	High	0.926	0.001	0.064	0.856	0.123	-0.108
	Low	-0.245	-0.935	1.126	0.071	-0.834	0.604
	Diff. in means	1.171	0.936	-1.062	0.786	0.957	-0.712
By trade openness	High	0.337	-0.271	0.535	0.532	-0.193	0.334
	Low	0.344	-0.685	0.655	0.395	-0.555	0.163
	Diff. in means	-0.007	0.415	-0.12	0.138	0.363	0.172

Conditional growth rates obtained from 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 3:** FE - Interaction of Financial Depth and Gross Financial Openness to GDP

	M1 Base		M2 With FO		M3 High-Low Interaction		M4 Linear Interaction		M5 Quadratic Interaction	
	2004	2014	2004	2014	2004	2014	2004	2014	2004	2014
Log initial income	-0.533*** (0.15)	-0.421** (0.15)	-0.534*** (0.15)	-0.423*** (0.15)	-0.565*** (0.15)	-0.442*** (0.16)	-0.5608*** (0.148)	-0.4417*** (0.16)	-0.563*** (0.15)	-0.444** (0.16)
Av investment to GDP	0.99*** (0.21)	0.971*** (0.2)	1.002*** (0.21)	0.98*** (0.2)	0.95*** (0.19)	0.96*** (0.205)	0.98*** (0.2)	0.97*** (0.2)	1.004*** (0.2)	0.97*** (0.212)
Years schooling	0.046* (0.027)	0.04 (0.025)	0.046* (0.027)	0.04 (0.025)	0.046* (0.026)	0.04 (0.025)	0.046* (0.02)	0.039 (0.25)	0.042 (0.0296)	0.034* (0.02)
Pop growth	15.33 (10.95)	7.18 (7.62)	15.26 (11.02)	7.08 (7.55)	15.27 (9.98)	7.13 (7.13)	15.3 (9.8)	7.16 (7.11)	15.01 (9.7)	7.2 (6.96)
Financial Openness (FO)			0.0014 (0.006)	0.001 (0.0016)	-0.0187* (0.01)	-0.004 (0.009)	-0.025* (0.014)	-0.002 (0.007)	-0.0447*** (0.019)	-0.035** (0.016)
Financial Depth (FD)					0.188 (0.11)	0.116 (0.105)	0.159 (0.11)	0.1154 (0.106)	-0.04 (0.14)	-0.0848 (0.13)
FO*high FD					0.01787* (0.011)	0.004 (0.009)				
FO*FD							0.028* (0.016)	0.0017 (0.007)	0.1036** (0.047)	0.073** (0.035)
FD squared									0.136 (0.096)	0.124 (0.119)
FO*FD squared									-0.054* (0.04)	-0.0376** (0.018)
Constant	4.208*** (1.16)	3.329*** (1.17)	4.216*** (1.16)	3.348** (1.19)	4.446*** (1.16)	3.48** (1.19)	4.41*** (1.14)	3.47** (1.20)	4.504*** (1.16)	3.55*** (1.22)
Observations	480	640	480	640	480	640	480	640	480	640
R-squared	0.588	0.447	0.588	0.447	0.6052	0.4543	0.6068	0.4542	0.6098	0.4619

Regressions above are Fixed Effects estimation results with robust standard errors, all specifications include base controls and period effects, which are not reported. Dependent variable is real per capita GDP Growth Rate over 5 year period. Standard errors in parenthesis. Symbols \*, \*\*, \*\*\* indicate significance at 10%, 5% and 1% respectively.

**Table 4:** SysGMM - Interaction of Financial Depth and Gross Financial Openness to GDP

	M1 Base		M2 With FO		M3 High-Low Interaction		M4 Linear Interaction		M5 Quadratic Interaction	
	2004	2014	2004	2014	2004	2014	2004	2014	2004	2014
Log initial income	-0.043 (0.0436)	0.024 (0.046)	-0.058 (0.042)	-0.0005 (0.046)	-0.0178 (0.052)	-0.0035 (0.05)	-0.044 (0.03)	0.004 (0.004)	-0.02 (0.03)	-0.0032 (0.036)
Av investment to GDP	0.556** (0.25)	0.49** (0.23)	0.588** (0.245)	0.569** (0.25)	0.478 (0.306)	0.412* (0.233)	0.68** (0.26)	0.698*** (0.216)	0.516* (0.29)	0.59** (0.234)
Years schooling	0.025 (0.024)	-0.038 (0.03)	0.034 (0.022)	-0.0206 (0.032)	0.019 (0.026)	-0.03 (0.025)	0.035* (0.02)	-0.0081 (0.016)	0.033 (0.025)	-0.014 (0.017)
Pop growth	-3.409 (2.82)	-8.42*** (2.36)	-2.155 (1.82)	-6.84** (3.22)	-3.54 (2.67)	-7.74*** (1.58)	-1.69 (2.00)	-4.22*** (1.18)	-11.75 (10.45)	-5.26*** (1.145)
Financial Openness (FO)			-0.0039 (0.009)	-0.001 (0.001)	-0.015 (0.018)	-0.0313* (0.018)	-0.0059 (0.012)	-0.0097 (0.007)	0.005 (0.016)	0.014 (0.014)
Financial Depth (FD)					-0.083 (0.136)	0.075 (0.158)	-0.0706 (0.085)	-0.057 (0.053)	-0.0118 (0.18)	0.127 (0.13)
FO*high FD					0.013 (0.014)	0.0275 (0.018)				
FO*FD							0.0032 (0.012)	0.009 (0.0065)	-0.057 (0.062)	-0.038 (0.027)
FD squared									-0.0397 (0.098)	-0.08 (0.06)
FO*FD squared									0.038 (0.041)	0.0209 (0.013)
Constant	0 (.)	0.255 (0.17)	0 (.)	0.289 (0.19)	0.136 (0.26)	0.438* (0.226)	0 (.)	0.0845 (0.34)	0.0059 (0.17)	0.1913 (0.316)
Observations	480	640	480	640	480	640	480	640	480	640
AR2 test p-value	0.66	0.622	0.413	0.809	0.66	0.685	0.358	0.694	0.456	0.889
Hansen p-value	0.76	0.792	0.847	0.779	0.843	0.9	0.759	0.357	0.627	0.317

Regressions above are System GMM estimation results, two step using Windmeijer standard errors with small sample correction. Variables treated as endogenous instrumented using 2nd and 3rd lag. All specifications include base controls and period effects, which are not reported. Dependent variable is real per capita GDP Growth Rate over 5 year period. Standard errors in parenthesis. Symbols \*, \*\*, \*\*\* indicate significance at 10%, 5% and 1% respectively.

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

		Institutional Quality		Trade Openness	
		2004	2014	2004	2014
High/Low Interaction	Gross FO	-0.0447** (0.017)	-0.0117 (0.0137)	-0.0183* (0.01)	-0.0079 (0.005)
	Gross FO*High Threshold	0.0503** (0.02)	0.0128 (0.014)	0.0169 (0.01)	0.0087 (0.006)
Linear Interaction	Gross FO	-0.0241** (0.01)	-0.0020 (0.004)	-0.0145* (0.01)	-0.0020 (0.002)
	Gross FO*Threshold Var	0.0229** (0.01)	0.0032 (0.004)	0.0056* (0.0032)	0.0019 (0.001)

Regressions above are Fixed Effects estimation results with robust standard errors, all specifications include base controls and period effects, which are not reported. Dependent variable is real per capita GDP Growth Rate over 5 year period. Standard errors in parenthesis. Symbols \*, \*\*, \*\*\* indicate significance at 10%, 5% and 1% respectively.



**Table 6:** List of countries categorized as by MSCI Emerging Market Index

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

The sample consists of 80 countries—21 industrial, 20 emerging economies and 39 other developing countries, ODCs.

**Table 7:** Variable definitions and sources

<b>Variable</b>	<b>Sources</b>
Growth rate of real GDP per capita at constant 2011 national prices	Penn World Table
Average investment to GDP	Penn World Table
Average schooling years in population over 25 years old	Updated Barro and Lee database and UNDP
Average annual population growth rate (log difference divided by length)	World Bank
Gross de facto openness to GDP : stock of external assets and liabilities as a ratio of GDP	Lane and Milesi-Ferreti 2017 database
Financial Depth: Ratio of liquid liabilities to GDP	World Bank
Average institutional quality index	World Bank
Trade openness: Sum of nominal imports and exports as a share of nominal GDP	Penn World Table

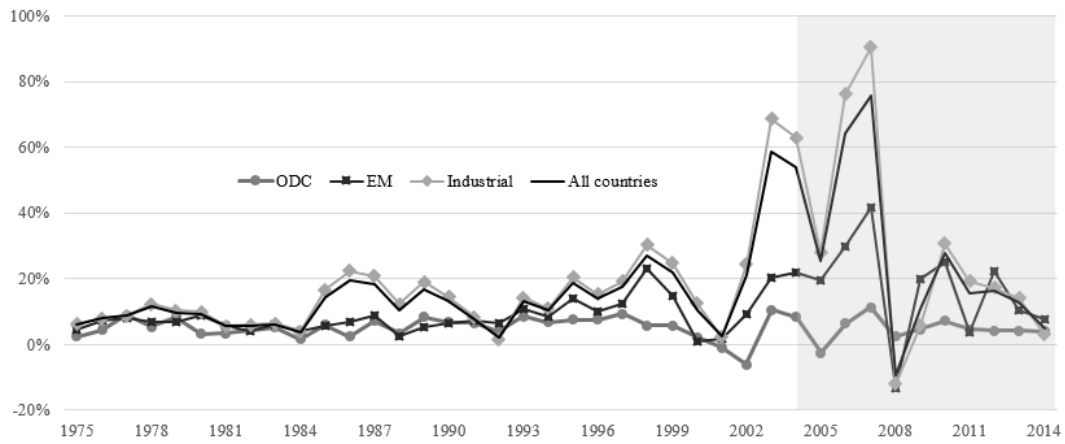


Figure 1: Financial Openness

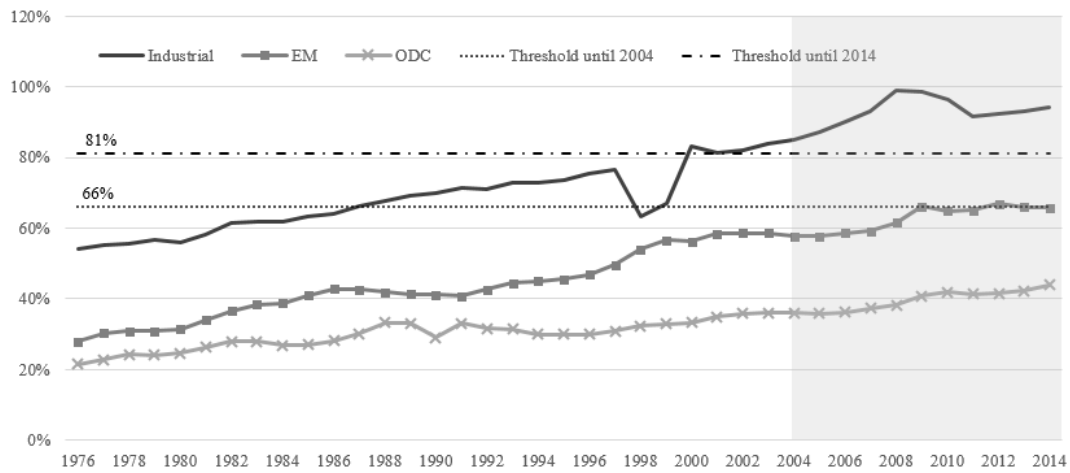


Figure 2: Average Financial Depth

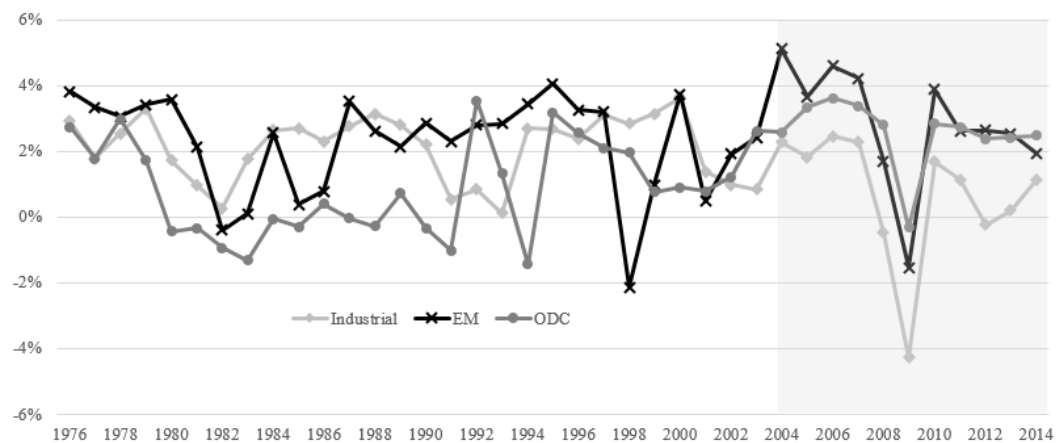
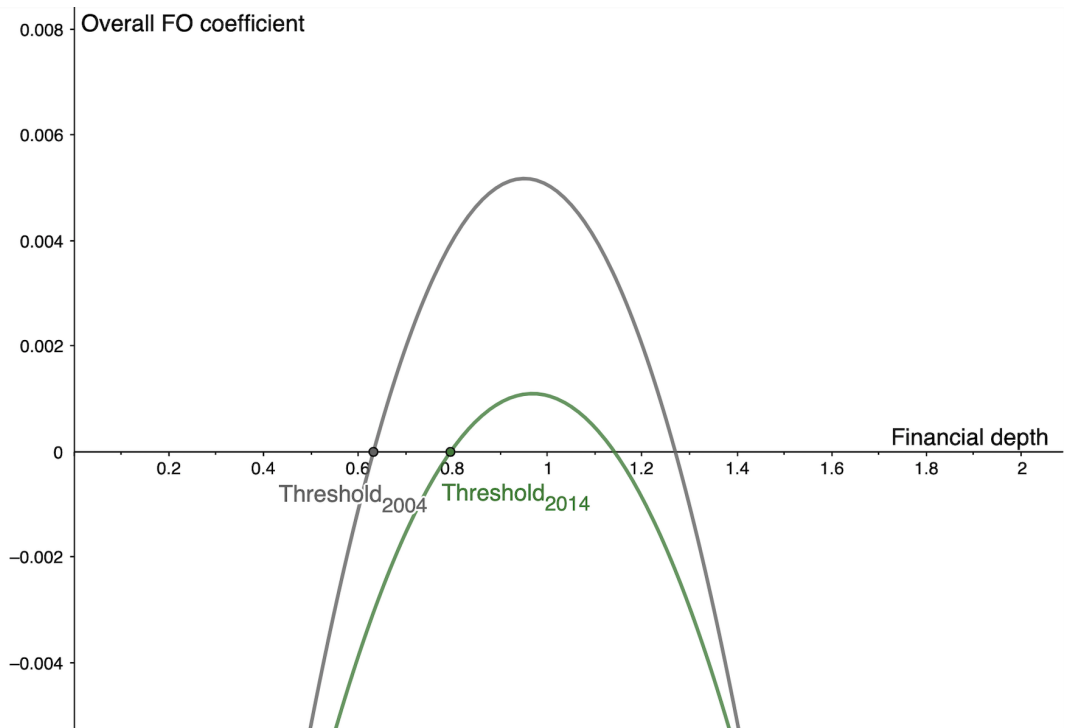


Figure 3: Log GDP per capita growth rates



**Figure 4:** Overall Financial Openness Coefficient and Financial Depth in 1975-2014 vs 1975-2004