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September 2008

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Abstract

In this paper, we analyze the relationship between international financial integration and macroeconomic volatility. Looking at a panel of 90 countries over the period 1960-2000, we find that domestic financial conditions matter when assessing the impact of financial integration on consumption growth volatility. More specifically, consumption growth volatility is found to increase with the degree of financial integration in countries with low level of financial development and to decrease in countries with high level of financial development. When measuring domestic financial conditions by the share of private credits to GDP, the threshold level of financial development above which financial integration yields consumption smoothing benefits is estimated to be around 60%-70% GDP.

JEL Classification: C23, E44, F30, G15, O16.

Keywords: GMM-IV, Dynamic Panel, Financial Integration, Financial Development.

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1 Introduction

International financial integration has considerably increased since the late 1980s and 1990s, and it is considered as a source of important potential benefits. First, opening to international capital markets provides additional resources to finance investment and may therefore lead to greater capital accumulation, especially in countries where the saving capacity is constrained by a low level of income. In addition, financial integration can lead to more efficient capital allocation by enhancing market discipline and by strengthening the banking system. Together, increased capital allocation and increased allocative efficiency are expected to lower the cost of investment, and hence foster higher growth. Another major source of benefits is to facilitate international risk sharing by providing more opportunities for portfolio diversification. This channel provides additional means of insurance for firms, allowing them to invest in high-risk/high-return activities and to fully exploit their comparative advantage by reducing production risk induced by more specialized activities. Finally international trade in assets should yield consumption smoothing benefits by allowing risk averse agents to better protect themselves against idiosyncratic shocks.

However, if these potential benefits are well established in theory, the empirical evidence are mixed and rather weak. While most of the empirical literature dealing with financial integration had focused on assessing the impact of capital account openness on the growth rate (Edison et al., 2002) , the attention has recently shifted to the relationship between financial openness and macroeconomic volatility. After the financial crisis of the 1980's and 1990's which followed capital account liberalization reforms, some authors have argued that financial integration could be a source of greater macroeconomic volatility, exposing vulnerable countries to sudden reversals of capital flows (Kaminsky and Reinhart, 1999). According to this line of explanation, some countries may be more likely to experience higher macroeconomic volatility, either because they lack a policy instrument to smooth cycles, or because they lack the adequate financial institutions to cope with large and sudden reversals of capital flows.

Even without considering extreme episodes of macroeconomic volatility such as financial crisis, it might also be the case that financial integration, associated with weak domestic financial institutions, exacerbate existing distortions due to credit market imperfections, thus yielding higher business cycle volatility. In the presence of informational asymmetries and/or limited enforceabil-

ity of contracts for example, capital account openness provides additional liquidity to the domestic banking system and higher leverage for borrowing firms. In this context, financial integration may amplify the financial accelerator mechanism identified by Bernanke et al. (2000).

From a welfare perspective, there are two alternative ways to see the relationship between financial integration and macroeconomic volatility. The first view is that financial integration should help countries to untie consumption streams and output streams, allowing risk averse agents to smooth consumption and leaving output volatility inconsequential for welfare. Another way is to consider that in addition to consumption volatility, output volatility is also detrimental for welfare. Along this line, Ramey and Ramey (1995) have shown that volatility has a detrimental impact on output growth even after controlling for investment.

Existing empirical evidence are mostly based on cross sectional analysis, and suggest either the absence of any significant link between financial openness and macroeconomic volatility in general, or that consumption volatility tends to increase with the degree of financial integration for low and middle income countries (Prasad et al., 2003). Regarding consumption growth volatility, this contradicts the idea that capital account openness allows international risk sharing and consumption smoothing.

This paper is an empirical attempt to determine whether domestic financial conditions matter in the relationship between international financial integration and volatility. More specifically, I use a panel of 90 countries over the period 1960-2000 to examine explicitly the role of the interaction effects between international and domestic finance in the relationship between financial integration and volatility. I look at consumption growth volatility to assess whether more financially integrated countries have experienced higher degrees of consumption smoothing, and to what extent does this depend on the level of domestic financial development. Moreover, since output growth volatility has been shown to have adverse effects on economic growth, I also examine whether or not financial openness has been associated with more volatile output growth rates.

The remainder of the paper is structured as follows: section 2 reviews the related literature, section 3 presents the data and the methodology, section 4 discusses the results and section 5 concludes.

2 Related literature

2.1 Financial integration and macroeconomic volatility

Economic theory does not give a clear-cut prediction on the expected impact of financial integration on volatility. Under standard preferences, agents are risk averse and hence trade in international assets should allow them to smooth consumption over time. If taste shocks are important however, allowing for more international trade in assets would drive consumption volatility up. For output growth volatility, the impact is also ambiguous. On one hand, opening the capital account can yield lower output volatility by promoting production base diversification. On the other hand, output volatility can rise if the consequence of financial integration is to facilitate the exploitation of comparative advantages and to yield increasing production specialization. To analyze this impact, most models are based on standard 2 countries dynamic stochastic general equilibrium setups, and their predictions depend on the nature of the assumed shocks that hit the economy (e.g. Mendoza (1994), Baxter and Baxter and Crucini (1995), and Sutherland (1996) amongst others).

Compared to the rich literature dealing with the empirical impact of financial integration on economic growth, the number of empirical studies focusing on macroeconomic volatility is much more limited.

2.1.1 Empirical evidence

Most existing empirical evidence suggest the absence of a strong relationship between financial integration and macroeconomic volatility.

Razin and Rose (1994) assess the impact of current and capital account openness on volatility of output, consumption and investment by using a cross-sectional approach. They estimate the following regression model:

$$\sigma_{j,i} = \alpha + \beta_{j,C} FC_i + \beta_{j,K} FK_i + \varepsilon_{j,i}$$

where $j = Y, C, I$ are the variables of interest (output, consumption and investment), σ is the standard deviation of the de-trended variables, and FC_i (*resp*. FK_i) is a measure of current account (*resp*.capital account) openness. The main result is the absence of any significant relationship between openness and any of the volatility series.

Easterly et al. (2004) examine the sources of output growth volatility for a broad sample of countries over two long periods, 1960-1978 and 1979-1997. Using (2 periods) panel OLS and IV methods, they find that trade openness exposes a country to greater volatility, but neither the level of private capital flows, nor the volatility of these flows, have a significant impact on output growth volatility. The level of financial development however, appears to have a significant smoothing effect on output growth, but the impact is nonlinear. Deep financial systems seem to reduce volatility, but only up to a certain threshold. This threshold for private credit is estimated to be around 100 percent of annual GDP which is relatively high.

Buch et al. (2002) focus on OECD countries using annual data from 1960 to 2000, and their analysis is based on Sutherland (1996). They propose the following model:

$$\sigma_{i,t} = \alpha_{0,i} + \alpha_{1,t} + \beta_1 \sigma_{i,t}^{controls} + \beta_2 FO_{i,t} + u_{i,t}$$

where $\sigma_{i,t}$ is the standard deviation of the cyclical component of real GDP computed over 5-years time periods, and $FO_{i,t}$ is a measure of financial openness. According to Sutherland's model, financial openness should magnify monetary shocks and dampen budgetary shocks. The main result is the absence of significant relationship between financial openness and output volatility. The results support the model's predictions that financial integration amplifies monetary shocks and dampens fiscal shocks.

Kose et al. (2003) (henceforth KPT) look at the volatility of output growth, of consumption growth and also at the relative consumption volatility (ratio of consumption volatility to output volatility), for a sample of 76 countries over the period 1960-1999. They use two indicators of financial openness: a dummy variable for capital account restrictions and private capital flows. The results confirm the smoothing impact of financial development and the positive impact of trade openness on volatility. Financial openness appears with a non significant positive sign when regressed on output and consumption volatility, but its impact is strongly significant and non linear when looking at the relative consumption volatility. These results suggest that increasing financial integration brings benefits in terms of consumption smoothing only beyond a certain level of financial openness (the estimated threshold for private capital flows is around 49% of GDP). Below that level, consumption volatility is found to increase with the degree of financial integration. It must be noted

that only some industrialized countries experience such high levels of private capital flows relative to their GDP. Since this result holds also for relative consumption volatility, the authors argue that the positive impact of financial integration on consumption volatility cannot be explained away by the fact that integrated countries have experienced economic crisis.

Previous empirical studies have tried to assess the influence of financial conditions on volatility by looking at both domestic and external finance, independently of each other. This paper seeks to investigate further these links by examining explicitly the interaction effects between international financial integration and domestic financial development in their relationship to macroeconomic volatility.

2.1.2 Financial integration, financial development and macroeconomic volatility

Aghion et al. (1999) and Aghion et al. (2000) show that economies with low level of domestic financial development should experience more volatile growth rates. However Beck et al. (2001) argue that this is not necessarily the case, and that the effect of financial development on volatility depends on whether the economy is affected by real or monetary shocks. Using a panel of 63 countries over the period 1960-1997, they find no robust relationship between financial development and output growth volatility.

There has been a recent growing interest in analyzing the interdependence between domestic and foreign financial markets. Chang and Velasco (1999) examine the influence of foreign banks and foreign investors on domestic banking systems, while Caballero and Krishnamurthy (2001) focus on the role of the domestic financial system to access international markets. In Broner and Ventura (2005), domestic and foreign risk sharing are connected because the government cannot discriminate between domestic and foreign agents. Because of this mechanism, they show that when the asset market is incomplete due to sovereign risk, financial globalization can lead to losses of risk sharing opportunities both within and between countries, and hence to loss in welfare.

Leblebicioglu (2005) analyzes formally the interaction effects between domestic credit market imperfection and financial integration. She develops a two-country two-sector real business cycle model where one of the countries faces asymmetric credit conditions in the sense that traded good (T) firms have access to international finance while non traded good (NT) firms are restricted to the

imperfect domestic capital market. The credit market imperfection in the home country comes from an assumption that entrepreneurs in the NT sector borrow directly from workers to finance their investment. In doing so they also face a borrowing constraint specified as a collateral constraint. The proportion of net worth determining the maximum amount of loans is the parameter that represents the domestic credit market imperfection. In this model, after a positive productivity shock in the NT sector, workers want to consume more but they are also poorer because of terms of trade effects. Under perfect financial integration, workers can borrow from the foreign country to sustain their consumption level. Under autarky however, the only way workers can increase their revenue is to work more for the T sector. This worsens the terms of trade and hence make the home consumption bundle more expensive which dampens the increase in consumption. Under this mechanism productivity shocks in the credit constrained NT good sector brings higher consumption volatility and higher relative consumption volatility under financial integration than under financial autarky.

In this paper, we examine empirically the interaction effects between domestic financial sector and international financial integration. We use the GMM-IV estimator proposed by Arellano and Bover (1995) and Blundell and Bond (1998) to ask (1) whether financial integration has a significant impact on macroeconomic volatility, and (2) whether this relationship depends on the level of financial development. The following section presents the data and the methodology.

3 Data and Methodology

3.1 GMM-IV panel estimation methods

The use of GMM-IV panel methods offers many advantages compared to the estimation methods previously used in the literature, most of which are cross-section based or rely on very short panels. First, it improves on cross-sectional analysis by exploiting the temporal dimension of the data, and this additional source of variability provides more degrees of freedom to estimate the parameters of interest. Second, by estimating a fixed effects model, one can control for unobserved time invariant heterogeneity in the data. Third, by using lagged variables as instruments, GMM-IV estimators deal

explicitly with the potential endogeneity of all explanatory variables[1]. Fourth, this class of estimator is consistent for large *N* and small *T*, which fits the structure of our sample.

We want to look at the impact of financial integration on medium to long term volatility, while keeping the time dimension of the dataset long enough. Therefore we choose to work with non-overlapping five-years periods from 1960 to 2000. This gives an unbalanced panel of 90 countries and 8 time periods. Since there is no reason a priori to specify a dynamic equation for macroeconomic volatility, the model is estimated both under a static and a dynamic specification. The empirical results suggest however that past volatility is relevant in explaining current volatility both for consumption growth and output growth. The following presentation of the regression framework is based on a dynamic specification.

Consider the following regression model:

$$y_{i,t} = \alpha y_{i,t-1} + \beta x_{i,t} + \eta_i + v_{i,t}$$

with η_i and v_{it} independently distributed across i, $E[\eta_i] = E[v_{i,t}] = E[\eta_i v_{i,t}] = 0$ for $i = 1, ..., N$ and $t = 2, ..., T$, and $E[v_{i,t} v_{i,s}] = 0 \; \forall t \neq s$.

With this specification and our panel structure (long N and short T), OLS and WITHIN estimators are biased, Maximum Likelihood estimators will depend heavily on the assumed distribution for initial conditions and the 2SLS estimator proposed by Anderson and Hsiao (1981) lacks asymptotic efficiency (Bond, 2002). Arellano and Bond (1991) and Arellano and Bover (1995) have proposed linear GMM-IV estimators which are consistent and asymptotically efficient under relatively weak assumptions. The *"System-GMM"* estimator developed by Arellano and Bover (1995) consists in estimating a system of equations (one for each time period) specified in level and in first difference. Adequate lagged levels of endogenous and predetermined variables, along with contemporaneous levels of strictly exogenous variables are then used as instruments for the first differenced equations, exploiting the following moment conditions:

$$E[Z_i' \Delta v_i] = 0$$

[1]The type of endogeneity that is allowed for in Arellano and Bover (1995) is one in which a variable x_{it} may be correlated with current and past values of the error term v_{it}, but not with future realizations (weak exogeneity).

where Z is the matrix of instrument and $\Delta v_i = (\Delta v_{i3}, \Delta v_{i4}, ..., \Delta v_{iT})'$. Under the additional assumption that the first differences Δx_{it} are uncorrelated with the individual fixed effects η_i, appropriate lagged values of Δx_{is} also enter the instrument matrix for the equations in level. The GMM-IV estimator then minimizes

$$J_N = \left(\frac{1}{N} \sum_{i=1}^{N} \Delta v_i^{'} Z_i \right) W_N \left(\frac{1}{N} \sum_{i=1}^{N} Z_i^{'} \Delta v_i \right)$$

with

$$W_N = \left[\frac{1}{N} \sum_{i=1}^{N} \left(Z_i^{'} \widehat{\Delta v}_i \widehat{\Delta v}_i^{'} Z_i \right) \right]$$

as a weighting matrix. $\widehat{\Delta v}_i$ are consistent estimates of the first differenced residuals obtained in a first step. If the disturbances v_{it} are homoskedastic, then this "two-step" estimator has an asymptotically equivalent "one-step" version[2].

The validity of the assumed moment conditions can be tested with Hansen's or Sargen's overidentifying restriction tests. Serial correlation tests are also needed to assess the validity of the instruments.

3.2 Estimation strategy and Data

We consider the following two equations for the dynamic specification:

$$\sigma_{ij,t} = \alpha \sigma_{ij,t-1} + \beta_1 Q_{i,t}^{'} + \beta_2 FD_{i,t} + \beta_3 FI_{i,t} + \eta_i + \varepsilon_{i,t} \tag{1}$$

$$\sigma_{ij,t} = \alpha \sigma_{ij,t-1} + \beta_1 Q_{i,t}^{'} + \beta_2 FD_{i,t} + \beta_3 FI_{i,t} + \beta_4 (FD_{i,t} * FI_{i,t}) + \eta_i + \varepsilon_{i,t} \tag{2}$$

with $i = 1, ..., N$, $t = 1, ..., 8$ and where $\sigma_{ij,t}$ denotes the standard deviation of the annual growth rate of variable $j = Y, C, C + G$ computed over 5-years windows. We consider GDP (Y), private consumption (C) and total consumption ($C+G$). All these variables are expressed in real per capita terms. $Q_{i,t}$ is a set of control variables, $FD_{i,t}$ is a measure of financial development, and $FI_{i,t}$ is a measure of financial integration. The parameters of interest are β_2, β_3, and β_4 which captures

[2]Simulations show that the asymptotic standard errors tend to be too small for the "two-step" version. Windmeijer (2000) analyzes this issue and proposes finite sample corrections for the variance.

the potential interaction effect between financial integration and financial development. With this formulation, we allow the impact of one of these two variables to depend on the level of the other. β_2 and β_3 in (1) are marginal impacts of, respectively, financial development and financial integration, *unconditional on the level of the other variables*. In contrast, β_3 in (2) represents the marginal impact of financial integration *conditional on the level of financial development being zero*, and the analog interpretation for β_2 also holds.

The data are taken from the Penn World Tables (mark 6.1) and the World Development Indicators[3]. Standard determinants of macroeconomic volatility are included in the control set Q. We control for volatility of inflation and of terms of trade, for the degree of trade openness and also for the share of agriculture in GDP to capture primary product dependence. We also include time dummies in the regressions. Table 13 shows the correlation matrix of the selected variables.

We use a measure of domestic credit to the private sector as a proxy for financial development. It is the value of credits provided by financial intermediaries to the private sector divided by GDP. This measure of financial development is standard in the finance literature[4], and it excludes credit issued to the governments, to government agencies, and to public enterprises, and also credits provided by the central bank. While this measure does not directly measure credit market imperfections, one can interpret higher levels of domestic private credit as proxying greater financial intermediary development. For financial integration, we chose not to use qualitative measures for two reasons. First, to the extent that they are *de jure* measures, they do not necessarily capture the effective exposition to capital flows. Latin America for example has relatively high measures of capital control but also high levels of capital flows, while on the other hand, Africa has relatively low capital controls without experiencing high levels of capital flows. The second reason is that qualitative measures do not vary over time as much as quantitative measures. Among the existing *de facto* measures, we use the share of private gross capital flow on GDP because it is the most widely available measure in terms of period and country coverage.

Figures 1 to 3 show some basic trends in the evolution of the main variables of interest. For the whole sample[5], financial integration and financial development rose steadily over the period 1960-

[3] Complete data description is given in table 1

[4] See Levine et al. (2000) for a discussion on this indicator compared to alternative ones, in a financial development/growth context.

[5] See the country list in table 2.

2000, with an acceleration of financial integration since the mid 1990's (fig.1). On the other hand, output growth volatility declined significantly from 1960 to 2000, with interruption periods of higher volatility, in the 1970's and the 1990's. Private consumption is more volatile than output volatility over the whole sample, but total consumption volatility is closer to output volatility, underlining the consumption smoothing role of government expenditures.

4 Results

We estimate equations (1) and (2) using the "System-GMM" estimator described above. Both the "one step" and "two step" versions of the system estimator are implemented to check whether the results are sensitive to potential heteroskedasticity. We focus first on output growth volatility and on absolute consumption growth volatility (private consumption and total consumption). When building the instrument matrix, we treat all explanatory variables as being potentially endogenous, except the time dummies, the agricultural share of GDP, and the volatility of terms of trade which we treat as strictly exogenous[6]. The estimation results are given in tables 3 to 5. All t-values are based on robust estimation for the "one-step" version, and on Windmeijer's finite sample correction for the "two-step" version. Serial correlation tests are reported in the tables to assess the validity of the chosen instruments[7], and both Hansen's and the Sargan's overidentifying restriction tests suggest that we cannot reject the null hypothesis that the moment conditions are valid.

We report standardized coefficients[8]. The estimated coefficients have the expected sign. The lagged dependent variable coefficient has a significant and positive sign with magnitude less than one. Given that we are considering 5 years periods, this suggests that output and consumption volatility are relatively persistent. Moreover, this also supports the dynamic specification adopted here. Inflation volatility impacts positively on output growth volatility, as do terms of trade volatility and the share of the agricultural sector on GDP. However, these variables do not have a significant influence on consumption growth volatility. Trade openness also appears with a positive and significant coefficient, which is in line with Rodrik (1998) argument: more open economies are more

[6]Treating terms of trade volatility as endogenous did not change the results.

[7]No second order serial correlation is detected, so lagged variables of endogenous variables starting from lag $t-2$ and backward are valid instruments.

[8]The coefficients are the estimated standard deviation change in the dependent variable for one standard deviation change in the corresponding explanatory variable.

specialized and thus experience larger income shocks, which, combined with imperfect capital markets, lead to greater macroeconomic volatility. This result is also consistent with the findings of Kose et al. (2003), and Easterly et al. (2004).

The decline in output growth volatility over the sample period is better explained by the evolution of trade openness, inflation, primary product dependence and terms of trade, rather than by the financial variables. For output growth volatility, the financial variables do not have any significant impact on volatility, regardless of whether we consider the interaction term or not. The point estimates for (2) suggest that financial integration has a positive impact on output growth volatility up to a certain level of financial development (around 70%-80% GDP), but the coefficients are far from being statistically significant. This finding is consistent with previous empirical results and with most theoretical models which predict an ambiguous impact of financial integration on output growth volatility, depending on the nature of the shocks that hit the economy. For domestic financial development, this result is in line with Beck et al. (2001).

Now we turn to consumption volatility. When the interaction between financial development and financial integration is not taken into account, estimates of (1) show that the marginal impact of financial development on volatility is negative for private and total consumption growth volatility, while the impact of financial integration is positive. These coefficients are however not significantly different from zero at the 95% confidence level. In other words, taken independently of each other, domestic and external financial conditions do not affect consumption volatility. This result contradicts the idea that allowing for more trade opportunities in international assets should allow agents to better share risk and to smooth their consumption plan. Although surprising, this finding is in line with previous empirical studies that did not find any significant relationship between the degree of financial integration and macroeconomic volatility.

However, if we look now at the estimates of (2), we see that accounting for the interaction term matters when evaluating the marginal impact of financial integration on consumption volatility. Including the interaction term in the regression equation, the coefficient of financial integration (β_3) becomes positive and strongly significant. This means that conditional on the level of financial development being zero, consumption volatility increases with the degree of financial integration. Besides, the interaction term (β_4) has a significantly negative coefficient, suggesting that as the level of financial development increases, the positive impact of financial integration on consumption

volatility looses strength. Moreover, since $|\beta_4| > |\beta_3|$, there is eventually a point at which financial development is sufficiently high (say FD^*) to allow the marginal impact of financial integration on consumption volatility to change sign. In other words, financial integration has a positive impact on consumption volatility when financial development is low, but when the domestic financial system is strong enough, i.e when $FD_{i,t} > FD^*$, then financial integration lowers consumption volatility.

Previous empirical work seeking to assess the impact of financial integration on macroeconomic volatility found either the absence of a robust link, or that financial integration impacts positively on consumption volatility. The main contribution of this paper is to show that the impact of financial integration on consumption volatility depends on the level of financial development. Consumption volatility increases with financial integration for low levels of financial development, and smoother consumption is associated with financial integration for high levels of financial development. From a policy perspective, this result suggests that reforms aiming at strengthening the domestic financial system should be a prerequisite to capital account liberalization.

Computing the threshold level FD^* of financial development from the unstandardized point estimates, it appears that the benefits of financial integration in terms of consumption smoothing occur after financial development (i.e the GDP share of credits to the private sector) has reached a level of about 55%-60% of GDP for private consumption (see table 9). This is a relatively high level of financial development as only 17% of our sample (mostly industrial countries) experience such levels of financial development. Whether we consider a static or a dynamic version of (1) and (2) yields very similar results[9]. Moreover, the results do not vary much whether we consider "one-step" or "two-step" estimation, suggesting the absence of heteroskedasticity in the disturbances. Finally, the results are robust to alternative financial development indicators[10].

Next, from these point estimates, we compute the total marginal effect of financial integration conditional on the level of financial development as:

$$\beta_{it}^{FI} = \frac{d[\sigma_{i,t}]}{d[FI_{i,t}]} = \beta_3 + \beta_4 FD_{i,t}$$

[9]These results are not reported here but are available on request.

[10]Similar results are obtained with alternative indicators based on private credit (private credit provided by the banking sector, private credit by deposit money bank), and also with other indicators such as liquid liabilities (M3) as a % of GDP, or financial depth (M2) as a % of GDP.

and its associated standard error as:

$$SE(\beta_{it}^{FI}) = \sqrt{\left[VAR\left(\beta_3\right) + FD_{i,t}^2 VAR(\beta_4) + 2FD_{i,t}COV(\beta_4, \beta_3)\right]}$$

Both the total marginal effects and their associated standard errors are functions of $FD_{i,t}$. Figures 4 and 5 show the estimated coefficients and their corresponding 95% confidence intervals for absolute and relative consumption volatility. These confidence intervals reach their minimum value close to the estimated threshold, and they get wider as one moves away from it. For both private and total consumption, the estimated coefficient is significantly positive (above the zero line) for low levels of financial development, it is close to zero for intermediate range and negative for high values of financial development. The standard errors get quite large as we move away from the estimated threshold. A possible explanation is that multicollinearity effects introduced by the interaction term inflate the variance of the estimated coefficients. The sample correlation coefficient between financial integration and the interaction term (see table 8) is indeed relatively high (0.88). Multicollinearity would however only influence the precision of the estimator, and not its consistency property. Hence, this potential effect only strengthens our finding. These results are conservative in the sense that even in the presence of potentially inflated variances due to multicollinearity effects, financial integration remains significantly associated with higher consumption volatility for low level of financial development, and with smoother consumption for sufficiently developed financial systems. Without multicollinearity effects, the confidence intervals around the estimated total marginal impact would be narrower, yielding a higher threshold level of financial development below which financial integration impacts positively on consumption volatility, and a lower threshold level of financial development above which financial integration is expected to bring consumption smoothing benefits.

We saw that financial integration affects consumption volatility but not output volatility. In order to be sure that the changes in consumption volatility are not driven by changes in output volatility we also look at the ratio of consumption growth volatility to output growth volatility. The results for relative consumption volatility are reported in tables 6 and 7[11] and they confirm what we found for the absolute level of consumption volatility. Financial integration has a strong positive impact on

[11] In contrast with output and consumption equations, serial correlation tests detect second order serial correlation. Hence, only lags starting from $t-3$ and backward provide valid instruments for the endogenous variables.

relative consumption volatility for low levels of financial development. Above a threshold level of financial development (around 65%-70% of GDP for private consumption, see table 9), the marginal impact of financial integration is to reduce consumption volatility relative to output volatility.

Overall, these results suggest that for most countries in the sample, the marginal effect of financial integration is to increase absolute and relative consumption volatility. Only a small number of countries with sufficiently developed financial systems will experience consumption smoothing benefits from financial integration. Looking at absolute private consumption volatility, figure (6a) shows a cross plot of financial integration against financial development for countries with low levels of financial development (below 35% of GDP). These are the countries for which financial integration is significantly associated with more volatile consumption. Most of the developing countries in the sample belong to this group. African countries are typically characterized by low levels of both financial development and financial integration. Among these countries with low level of financial development, we also find some Latin American countries with relatively higher levels of financial integration, and which have been subject to financial crisis in the 1980's (Mexico) and in the 1990's (Argentina). Figure (6b) instead plots the few countries with level of financial development above the estimated threshold level (59%). These are the countries for which financial integration is expected to bring consumption smoothing benefits. Most of these are rich and industrialized countries.

Now we want to have an idea of the magnitude at which consumption volatility responds to changes in the degree of financial integration. We compute the elasticity of consumption volatility with respect to changes in the degree of financial integration as:

$$\varepsilon_{it} = \frac{d[\sigma_{it}]}{d[FI_{it}]} \frac{FI_{it}}{\sigma_{it}} = (\beta_3 + \beta_4 FD_{it}) \frac{FI_{it}}{\sigma_{it}}$$

These elasticities are evaluated at the mean value of financial integration and of financial development over the period 1960-2000. Figures 7 and 8 show these elasticities for a selected group of countries. If we look at countries with low level of financial development (credit to the private sector below 35% GDP), the elasticity of absolute private consumption volatility (following a 1% change in the degree of financial integration) ranges from 0.01% (Zimbabwe) to 0.34% (Guatemala), but most values of the estimated elasticities lie between 0.01% and 0.1%. If we look now at countries with high level of development (above 59%), these elasticities range from -0.37% (Japan) to -0.01%

(Italy), with most values between -0.2% to -0.01%.

Summarizing our findings, the first result is that the decline in output volatility over the sample period is better explained by the traditional indicators rather than by the financial variables. Second, for low levels of financial development consumption volatility increases with financial openness, both in absolute and relative to output volatility. However, when the domestic financial system is sufficiently developed, financial integration yields consumption smoothing benefits. The estimated threshold level of financial development at which the marginal impact of financial integration on volatility changes sign is relatively high. Only 17% of the sample at most experience consumption smoothing benefits from financial integration, most of which are industrialized countries.

5 Conclusion

In theory, the ability to trade internationally in assets should help risk averse agents to untie their consumption stream to their income stream and thus should facilitate consumption smoothing. However, recent empirical evidence have suggested either the absence of a significant correlation, or the opposite relationship, namely that more financially integrated countries have experienced more volatile consumption, especially for emerging market economies in the late 1980's and 1990's.

The contribution of this paper is to show that the interaction between domestic and external market matters in assessing the relationship between financial integration and consumption volatility. Financial integration is associated with higher volatility in consumption growth rates if the level of domestic financial development lies below a threshold level. This result holds both for consumption in absolute terms and relative to output volatility. The threshold level of financial development, measured by the share of private credits to GDP, is estimated to be around 55%-60% for absolute consumption volatility and around 65%-70% for relative consumption volatility. Above this level, consumption smoothing benefits are expected. It appears however that only a limited number of industrial countries benefit from international financial integration as far as consumption smoothing is regarded. In terms of policy, this suggests that sound domestic financial system should be a prerequisite to capital account liberalization reforms in developing countries.

Our findings are consistent with general equilibrium models including frictions both in the domestic and in the international financial markets Leblebicioglu (2005). These results support the

idea that when the domestic financial system is weak, exposition to international capital flows might exacerbate existing distortions due to capital market imperfections, and hence amplify economic fluctuations. An other interpretation goes along the lines of Broner and Ventura (2005) in the sense that rising financial globalization can be associated with the destruction of risk sharing opportunities when asset markets are incomplete.

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Tables

Table 1 Data description and sources

Variable name and description	*Source*
Output	**Summers and Heston PWT 6.1**
Real GDP per capita (Constant price: Laspeyres)	series code: RGDPL
Private consumption	**Summers and Heston PWT 6.1**
Consumption share of RGDPL	series code: KC
Government consumption	**Summers and Heston PWT 6.1**
Government share of RGDPL	series code: KG
Inflation	**World Bank WDI**
log (1+inf) where inf is inflation, GDP deflator (annual %)	series code: NY.GDP.DEFL.KD.ZG
Terms of trade	**World Bank WDI**
Net barter ToT (1995=100)	series code: TT.PRI.MRCH.XD.WD
Agriculture	**World Bank WDI**
Agriculture, value added (% GDP)	series code: NV.AGR.TOTL.ZS
Trade openness	**World Bank WDI**
Trade (% GDP)	series code: NE.TRD.GNFS.ZS
Financial developement	**World Bank WDI**
Domestic credit to private sector (% GDP)	series code: FS.AST.PRVT.GD.ZS
Financial integration	**World Bank WDI**
Gross private capital flows (% GDP)	series code: BG.KAC.FNEI.GD.ZS

Table 2. Country List

Algeria, Argentina, Australia, Bangladesh, Barbados, Belgium, Benin, Bolivia, Botswana, Brazil, Burkina Faso, Burundi, Cameroon, Canada, Central African Republic, Chad, Chile, China, Colombia, Congo (Rep.), Costa Rica, Cote d'Ivoire, Cyprus, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Fiji, Finland, France, Gabon, Gambia, Ghana, Greece, Guatemala, Honduras, Hong Kong SAR, India, Iran, Ireland, Italy, Jamaica, Japan, Jordan, Kenya, Korea, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mexico, Morocco, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Pakistan, Panama, Paraguay, Peru, Philippines, Rwanda, Senegal, Seychelles, Sierra Leone, Singapore, South Africa, Spain, Sri Lanka, Sweden, Syrian Arab Republic, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, United Kingdom, United States, Uganda, Uruguay, Venezuela, Zambia, Zimbabwe.

Dependent: Output Growth Volatility				
Standardized Coefficients	*One Step System*		*Two Step System*	
Lagged Dependent Variable	0.170	0.171	0.177	0.176
	*(1.74)**	*(1.78)**	*(2.21)***	*(1.97)***
Inflation Volatility	0.187	0.203	0.210	0.237
	*(2.07)***	*(2.35)***	*(2.49)***	*(3.49)****
Terms of Trade Volatility	0.152	0.148	0.154	0.145
	*(2.60)****	*(2.56)***	*(2.37)***	*(2.12)***
Agriculture Share	0.170	0.168	0.146	0.125
	*(2.40)***	*(2.42)***	*(2.07)***	*(1.86)**
Trade Openness	0.125	0.121	0.116	0.121
	*(2.08)***	*(1.86)**	*(1.84)***	*(1.81)**
FD Financial Development	-0.005	-0.0006	-0.004	0.003
	(0.12)	*(0.01)*	*(0.09)*	*(0.09)*
FI Financial Integration	0.018	0.019	0.024	0.047
	(0.76)	*(0.22)*	*(0.98)*	*(0.70)*
FI*FD		-0.020		-0.054
		(0.16)		*(0.54)*
Observations	363	363	363	363
Number of id	90	90	90	90
AR(1) test (p-value)	0.041	0.043	0.069	0.075
AR(2) test (p-value)	0.348	0.348	0.400	0.410
AR(3) test (p-value)	0.381	0.395	0.426	0.454

t-stats in parentheses, Windmeijer correction in "Two Step System".

** 90%, ** 95%, and *** 99% confidence level.*

Time dummies are included but not reported.

Table 4 Dynamic specification

Dependent: Private Consumption Growth Volatility				
Standardized Coefficients	*One Step System*		*Two Step System*	
Lagged Dependent Variable	0.290	0.264	0.305	0.261
	*(3.12)***	*(2.95)***	*(3.24)***	*(2.85)***
Inflation Volatility	0.053	0.038	0.041	0.039
	(0.60)	*(0.44)*	*(0.46)*	*(0.42)*
Terms of Trade Volatility	0.099	0.085	0.099	0.081
	(1.38)	*(1.29)*	*(1.34)*	*(1.14)*
Agriculture Share	0.020	0.016	0.016	0.023
	(0.32)	*(0.27)*	*(0.25)*	*(0.40)*
Trade Openness	0.245	0.296	0.243	0.293
	*(2.15)***	*(2.59)***	*(2.16)***	*(2.20)***
FD Financial Development	-0.094	-0.033	-0.091	-0.032
	(1.51)	*(0.64)*	*(1.36)*	*(0.57)*
FI Financial Integration	0.030	0.244	0.032	0.263
	(0.62)	*(2.16)***	*(0.65)*	*(2.22)***
FI*FD		-0.353		-0.383
		*(2.46)***		*(2.65)****
Observations	361	361	361	361
Number of id	89	89	89	89
AR(1) test (p-value)	0.002	0.002	0.007	0.007
AR(2) test (p-value)	0.406	0.331	0.432	0.364
AR(3) test (p-value)	0.403	0.415	0.472	0.466

t-stats in parentheses, Windmeijer correction in "Two Step System".

** 90%, ** 95%, and *** 99% confidence level.*

Time dummies are included but not reported.

Table 5 Dynamic specification

Dependent: Total Consumption Growth Volatility				
Standardized Coefficients	*One Step System*		*Two Step System*	
Lagged Dependent Variable	0.222	0.187	0.218	0.180
	*(2.70)****	*(2.42)***	*(2.49)***	*(2.53)***
Inflation Volatility	0.265	0.256	0.269	0.267
	*(3.02)****	*(2.99)****	*(2.65)****	*(3.17)****
Terms of Trade Volatility	0.091	0.079	0.096	0.092
	(1.23)	*(1.13)*	*(1.20)*	*(1.18)*
Agriculture Share	0.112	0.114	0.105	0.118
	(1.55)	*(1.70)**	*(1.98)***	*(2.20)***
Trade Openness	0.152	0.192	0.144	0.176
	*(1.69)**	*(1.99)***	*(2.05)***	*(1.96)***
FD Financial Development	-0.083	-0.016	-0.079	-0.029
	(1.51)	*(0.30)*	*(2.27)***	*(0.62)*
FI Financial Integration	0.043	0.287	0.038	0.266
	(0.72)	*(2.27)***	*(0.62)*	*(2.11)***
FI*FD		-0.368		-0.335
		*(2.10)***		*(1.90)**
Observations	361	361	361	361
Number of id	89	89	89	89
AR(1) test (p-value)	0.000	0.000	0.002	0.002
AR(2) test (p-value)	0.190	0.306	0.268	0.376
AR(3) test (p-value)	0.608	0.831	0.642	0.823

t-stats in parentheses, Windmeijer correction in "Two Step System".

** 90%, ** 95%, and *** 99% confidence level.*

Time dummies are included but not reported.

Table 6 Dynamic specification

Dependent: Relative Consumption Volatility (private)

Standardized Coefficients	*One Step System*		*Two Step System*	
Lagged Dependent Variable	0.132	0.081	0.118	0.075
	(0.87)	*(0.76)*	*(0.73)*	*(0.64)*
Inflation Volatility	0.011	0.020	-0.021	-0.001
	(0.06)	*(0.13)*	*(0.15)*	*(0.01)*
Terms of Trade Volatility	0.023	0.000	0.010	-0.002
	(0.44)	*(0.02)*	*(0.26)*	*(0.05)*
Agricultural Share	0.073	0.075	0.069	0.067
	(0.92)	*(0.95)*	*(0.91)*	*(0.72)*
Trade Openness	0.293	0.293	0.299	0.298
	*(2.30)***	*(2.21)***	*(2.35)***	*(2.47)***
FD Financial development	0.038	0.126	0.048	0.141
	(0.42)	*(1.39)*	*(0.39)*	*(1.49)*
FI Financial integration	0.004	0.336	0.023	0.334
	(0.08)	*(2.46)***	*(0.41)*	*(2.90)****
FI*FD		-0.422		-0.413
		*(2.94)****		*(3.39)****
Observations	361	361	361	361
Number of id	89	89	89	89
AR(1) test (p-value)	0.000	0.001	0.056	0.032
AR(2) test (p-value)	0.044	0.033	0.175	0.118
AR(3) test (p-value)	0.225	0.366	0.330	0.442

t-stats in parentheses, Windmeijer correction in "Two Step System".

** 90%, ** 95%, and *** 99% confidence level.*

Time dummies are included but not reported.

Table 7 Dynamic specification

Dependent: Relative Consumption Volatility (total)

Standardized Coefficients	*One Step System*		*Two Step System*	
Lagged Dependent Variable	0.399	0.313	0.405	0.312
	*(2.41)***	*(1.89)**	*(2.70)***	*(2.18)***
Inflation Volatility	-0.006	-0.006	0.017	-0.035
	(0.06)	*(0.07)*	*(0.36)*	*(0.58)*
Terms of Trade Volatility	-0.004	-0.026	-0.019	-0.016
	(0.10)	*(0.62)*	*(0.35)*	*(0.32)*
Agricultural Share	0.149	0.173	0.126	0.147
	*(1.90)**	*(2.26)***	*(1.50)*	*(1.88)**
Trade Openness	0.312	0.306	0.311	0.304
	*(2.47)***	*(2.34)***	*(2.77)****	*(2.54)***
FD Financial Development	-0.041	0.076	-0.054	0.049
	(0.61)	*(1.28)*	*(0.82)*	*(0.71)*
FI Financial Integration	0.010	0.476	0.009	0.447
	(0.16)	*(3.09)****	*(0.14)*	*(2.58)****
FI*FD		-0.564		-0.474
		*(3.42)****		*(2.35)***
Observations	361	361	361	361
Number of id	89	89	89	89
AR(1) test (p-value)	0.000	0.001	0.003	0.003
AR(2) test (p-value)	0.019	0.036	0.023	0.028
AR(3) test (p-value)	0.339	0.657	0.369	0.588

t-stats in parentheses, Windmeijer correction in "Two Step System".

** 90%, ** 95%, and *** 99% confidence level.*

Time dummies are included but not reported.

Table 8 Correlation matrix

Whole sample	**Vol(Y)**	**Vol(C)**	**Vol(inf)**	**Vol(ToT)**	**Agric.**	**Open.**	**FD**	**FI**	**FI*FD**
Vol(Y)	1.00								
Vol(C)	0.5593	1.00							
Vol(inf)	0.3004	0.2381	1.00						
Vol(ToT)	0.3615	0.2159	0.1574	1.00					
Agric.	0.2897	0.1514	0.1279	0.3000	1.00				
Open.	0.1455	0.2355	0.0566	-0.0442	-0.1592	1.00			
FD	-0.3581	-0.2876	-0.1872	-0.3119	-0.5994	0.0410	1.00		
FI	-0.0121	0.0464	0.0335	-0.0776	-0.2242	0.3332	0.2535	1.00	
FI*FD	-0.1073	-0.0494	-0.0191	-0.1404	-0.2683	0.3609	0.4609	0.8844	1.00

Table 9

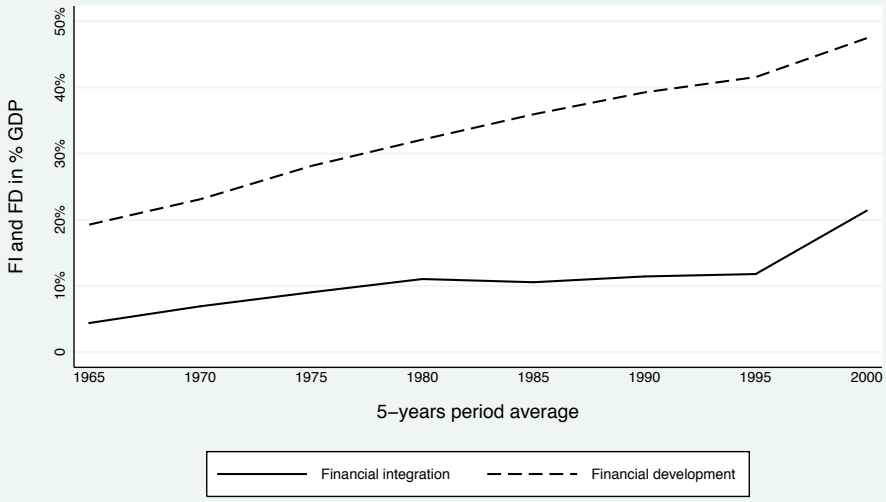
Estimated Thresholds of Financial Development (private credit in % GDP)

Point estimates of the threshold level of FD at which the marginal effect of FI on volatility changes sign.

Dependent Variable:	$Vol(C)$	$Vol(C+G)$	$\frac{Vol(C)}{Vol(Y)}$	$\frac{Vol(C+G)}{Vol(Y)}$
Dynamic specification, One-Step	58.9	66.5	67.7	71.8
Dynamic Specification, Two-step	58.4	67.8	68.9	80.2
Static specifiaction, One-Step	54.9	64.3	67	67.8
Static specification, two-Step	55.2	65.1	66.8	67.5

Figures

(Fig.1) Financial Integration and Financial Development
Evolution for the whole sample over 1960–2000



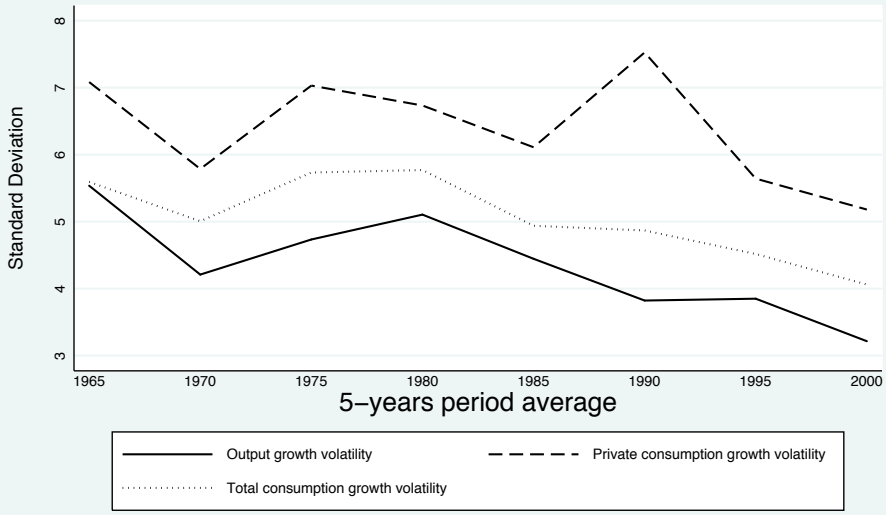
Financial integration is measured by gross private capital flows in %GDP (source: WDI).
Financial development is measured by credits to the private sector in %GDP (source: WDI).

(Fig.2) Financial Integration and Financial Development
Over 1960–2000

(Variables are plotted in log)

(Fig.3) Volatility

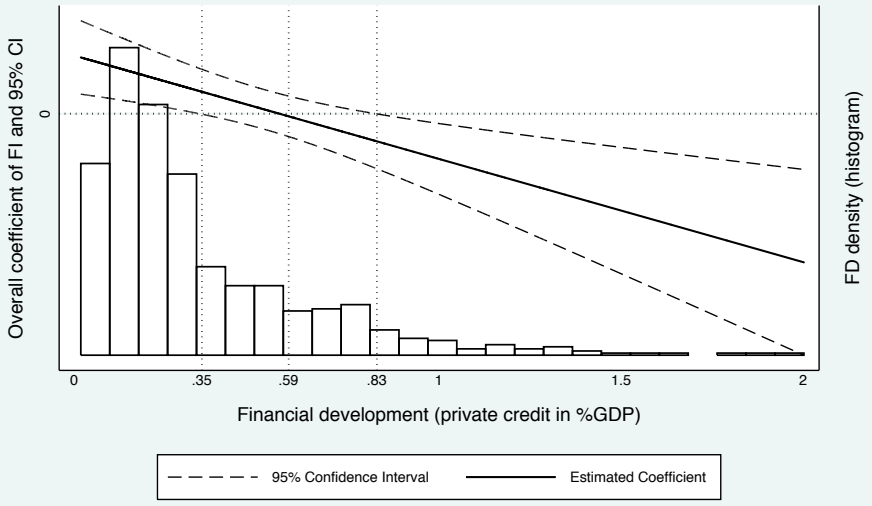
Evolution for the whole sample over 1960–2000



Volatility is the standard deviation of a given variable's annual growth rate over 5–years (non overlapping) periods.

(Fig.4a) Overall Coefficient of FI at Different Levels of FD, Dynamic Model

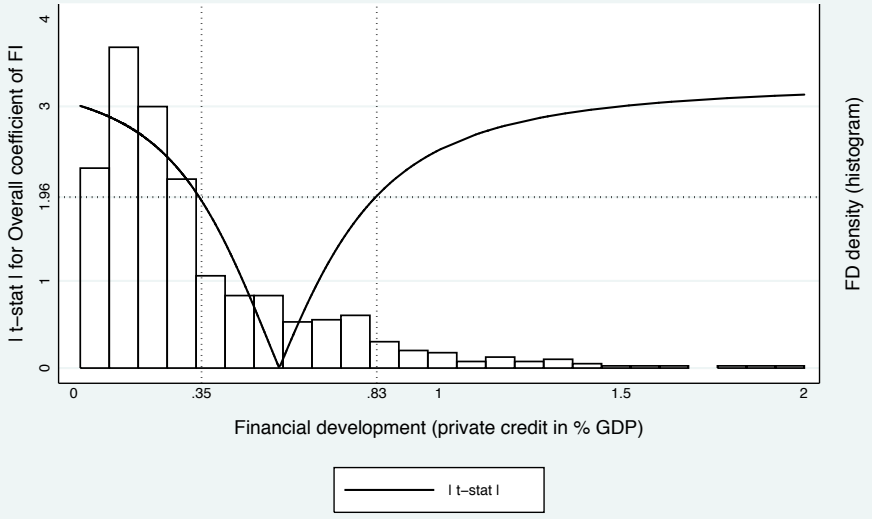
Dependent: Private consumption growth volatility



One−step estimates, overlaid with histogram of FD
Overall impact of FI is positive for levels of private credit below 35%
and it is negative above 83% GDP

(Fig.4b) | t−stat | of FI Coefficient at Different Levels of FD, Dynamic Model

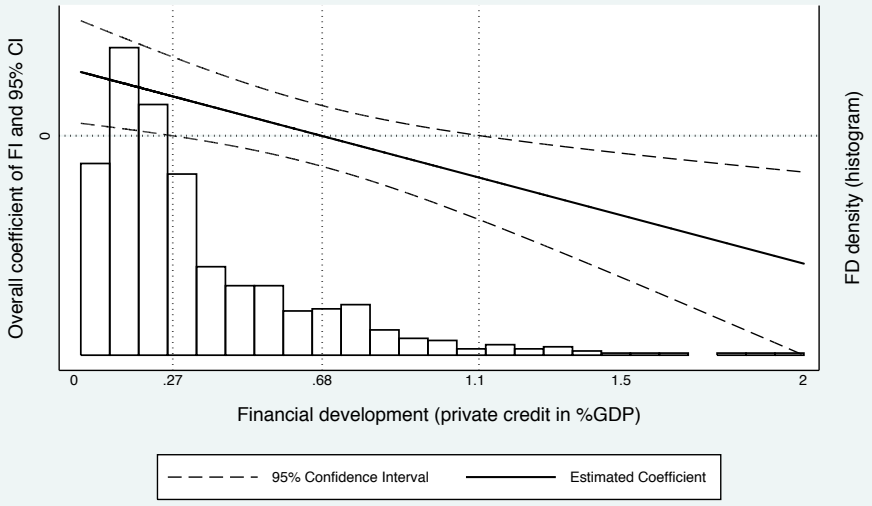
Dependent: Private consumption growth volatility



Dynamic model, One−step estimates
Overlaid with histogram of FD

(Fig.5a) Overall Coefficient of FI at Different Levels of FD, Dynamic Model

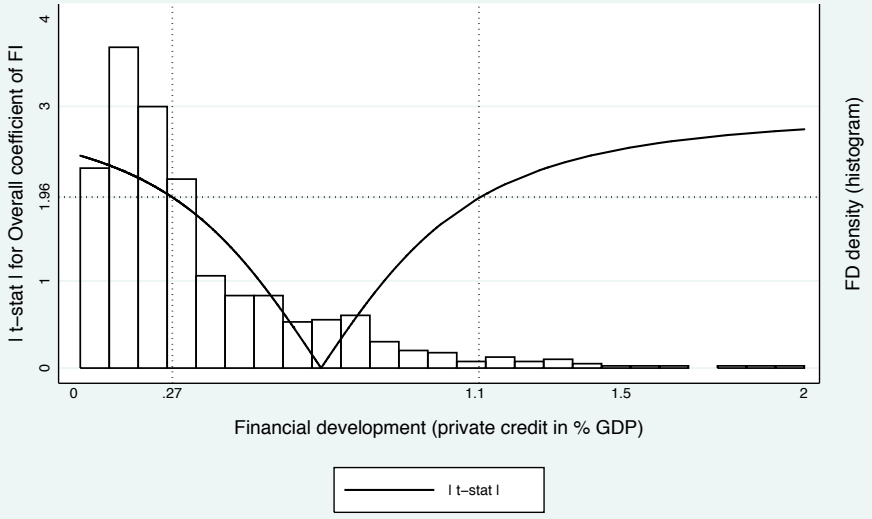
Dependent: Relative private consumption growth volatility



One−step estimates, overlaid with histogram of FD
Overall impact of FI is positive for levels of private credit below 27%
and it is negative above 110% GDP

(Fig.5b) | t−stat | of FI Coefficient at Different Levels of FD, Dynamic Model

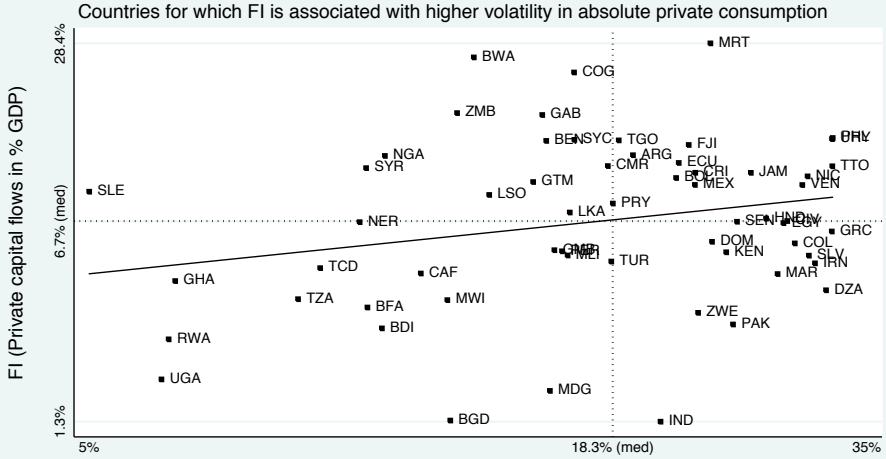
Dependent: Relative private consumption growth volatility



Dynamic model, One−step estimates
Overlaid with histogram of FD

(Fig.6a) Financial Integration and Financial Development
Low FD countries

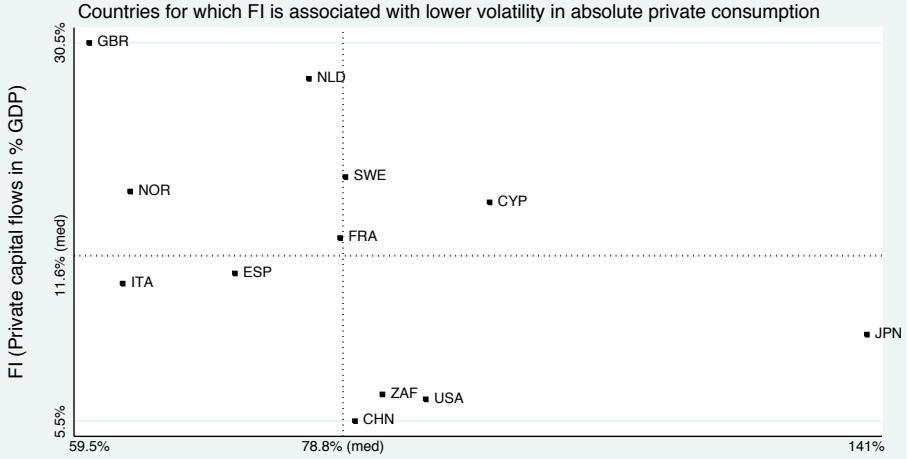
Countries for which FI is associated with higher volatility in absolute private consumption



Countries with level of FD below 35% GDP are countries for which the overall effect of FI on absolute private consumption volatility is positive.
(Variables are plotted in log)

(Fig.6b) Financial Integration and Financial Development
High FD countries

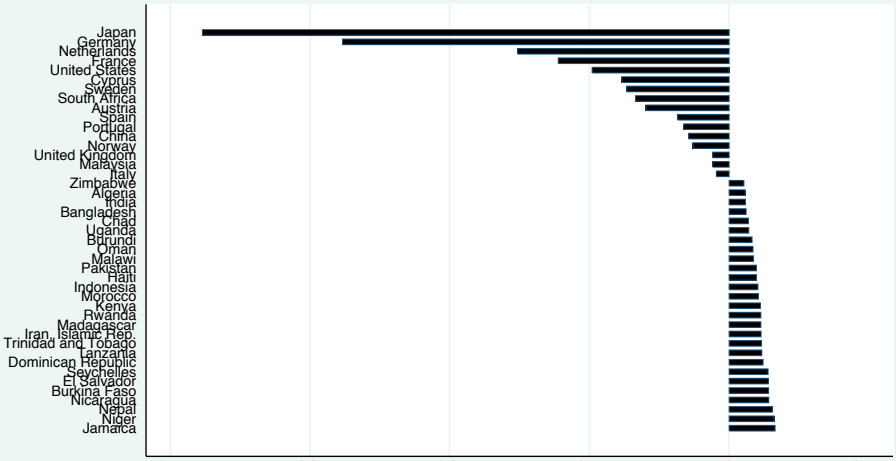
Countries for which FI is associated with lower volatility in absolute private consumption



Countries with level of FD above 59% GDP are countries for which the overall effect of FI on absolute private consumption volatility is likely to be negative.
Given their already high level of FI, Singapore and Hong Kong are not plotted

(Fig.7a) FI–Elasticity of Absolute Consumption Volatility

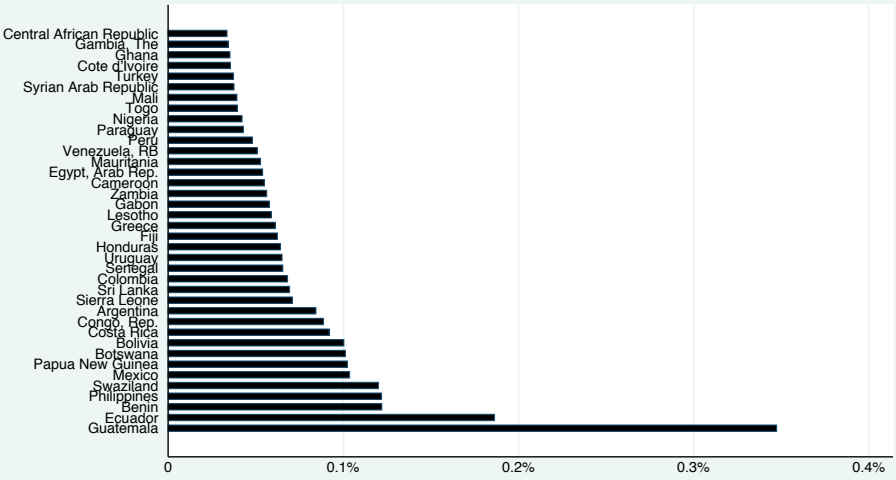
Selected group of countries from regression sample (1/2)



Two groups of countries are included:
Countries with level of FD below 35% GDP and above the point estimate of the treshold level of FD (59%).
Hong Kong and Singapore have been dropped.

(Fig.7b) FI–Elasticity of Absolute Private Consumption Volatility

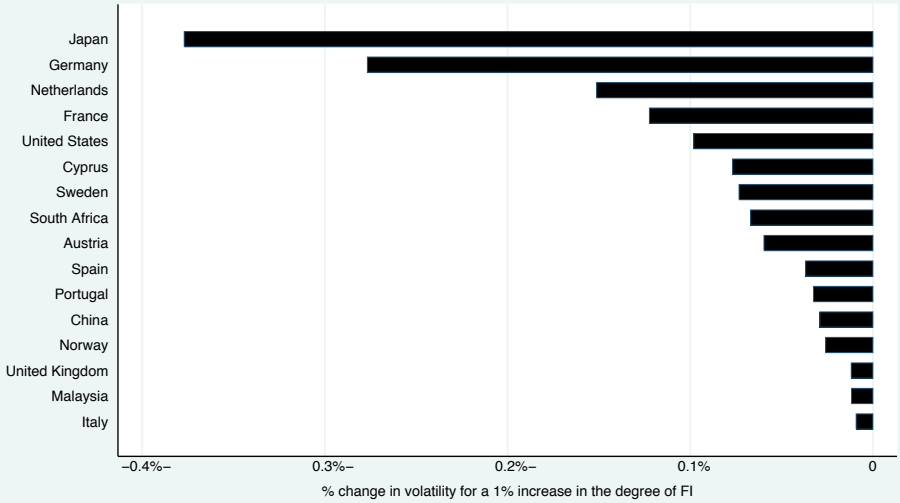
Selected group of countries from regression sample (2/2)



Two groups of countries are included:
Countries with level of FD below 35% GDP and above the point estimate of the treshold level of FD (59%).
Hong Kong and Singapore have been dropped.

(Fig.8) FI–Elasticity of Absolute Consumption Volatility

Countries for which FI lowers consumption volatility



Countries with level of FD above the point estimate of the treshold level of FD (59%).
Germany, Austria, Portugal and Malaysia are out of the regression sample
Hong Kong, and Singapore have been dropped.