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Volatile capital flows and economic growth: The role of banking supervision

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ABSTRACT

In this paper, we examine the links among banking supervision, the volatility of financial flows, and economic growth. In particular, we explore whether banking regulation mitigates the adverse effects of capital flows volatility on economic growth. Using cross-country data over four decades, we find that banking supervision promotes economic growth by dampening the negative impact of volatile capital flows. The findings hold for both aggregate capital flows and its various components, and for both its net and gross counterparts, while they are also robust for various indicators of regulatory policies. The results support the argument that bank regulatory policy rules designed to ensure financial stability are beneficial to long-run economic growth.

1. Introduction

Financial sector regulatory policies, their use, implementation and effectiveness, have been at the center of a heated debate since the onset of the global financial crisis (see Bank of England, 2009; Hanson et al., 2011; Brunnermeier et al., 2012; International Monetary Fund, 2013 for reviews). These policies aim to achieve greater financial stability and, in this way, reduce the adverse consequences of financial volatility for the real economy. The work that has been produced has identified the links between regulatory policies and financial stability by also recognizing the importance of general equilibrium effects. The analysis carried out, however, has been solely focused on the implications of banking regulation for short-term economic stability. In this paper, we depart from this time profile and set the emphasis on the long-term effects of financial regulation for financial volatility and on the way this feeds into economic growth.

The effectiveness of regulatory rules cannot be fully assessed by limiting the analysis in the short-term objective of financial and economic stability, but also take into account the broad objective of economic growth (Bank for International Settlements, 2012). This argument is consistent with the view that financial stability is not an objective in itself, but rather a necessary condition for sustainable financial deepening, with the ultimate goal of economic development (Beck, 2015). From this perspective, one can raise the following questions. How does financial volatility affect long-run growth? Can regulatory rules designed to reduce the procyclicality of financial systems be detrimental to long-run growth, due to their declining effect on risk taking, or can they promote growth by attenuating the adverse effects of financial volatility? Evidently, these matters are equally relevant for advanced and developing countries and despite the growing body of research on the effectiveness of regulatory policies, evidence on their growth implications available to date is still limited.

The objective of this study is to investigate the link between financial volatility and economic growth and whether the applied regulatory rules influence this link. We broadly define financial volatility as the volatility of capital flows due to the presence of a well-established relationship between bank regulatory policies and capital inflows, for both the flows' first and second moments. Even before the onset of the global financial crisis, United Nations

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Conference on Trade and Development, 2000 highlighted that "effective utilization of capital inflows to raise accumulation and growth will not be possible without an appropriate management of the capital account, particularly without regulation and control of short term capital flows." Since the crisis, there is increasing convergence in central banking circles that "Together, macro- and micro-prudential policies aim to ensure the stability of the financial system, aiding it in efficiently allocating resources to the real economy." (Sinha, 2011). This means that the management and regulation of capital flows is necessary because their inherent volatility can trigger a financial instability cycle for recipient economies: a surge in capital flows leads to a currency appreciation, an improved balance sheet of borrowers, easier credit conditions, an increase in non-tradable prices and overall inflation, thus generating a financial risk of a sudden stop and contributing to domestic financial instability.[1] It is for this reason that regulatory measures are important for minimizing financial-stability risks and for increasing the resilience of the financial system to aggregate shocks that arise from volatile capital flows (Organization for Economic Cooperation and Development, 2011; Qureshi et al., 2011; International Monetary Fund, 2013; IMF-FSB-BIS, 2016).[2]

But why would regulatory policies have a direct impact on capital flows? Recent evidence provided by Brunnermeier et al. (2012) suggests that most cross-border capital flows, including equity flows, are channeled through global banks. In this way, the banking sector plays an increasingly important role in channeling all types of capital flows. Due to this, the effective regulation of cross-border banking is essential for controlling capital flows, which by doing so contributes to financial stability. To this end, in recent years a number of studies have investigated the effectiveness of regulatory policies in dealing with large capital flows. Zhang and Zoli (2014) find that regulatory instruments helped curb equity flows in 13 Asian economies and 33 other economies since 2000. Bruno et al. (2015) provide evidence that regulatory policies are effective in slowing banking and bond inflows to the Asia-Pacific region. Beirne and Friedrich (2014) find that regulatory policies can be effective in reducing capital flows conditional on the structure of the domestic banking sector. Bruno and Shin (2013) show that prudential regulations introduced in Korea in 2010 to mitigate the excessive volatility of foreign capital flows, reduced the sensitivity of these flows to global factors. Results along the same line have also been documented by Aysan et al. (2015) for Turkey, Arregui et al. (2013) with regard to the Croatian experience, Kabza and Kostrzewa (2016) for Poland, and Qureshi et al. (2011) in a sample of 51 emerging market economies over the period 1995–2008.

The above evidence supports the notion that regulatory policies are effective in containing systemic risks arising from large and volatile capital flows and that, in general, form an important part of the policy toolkit to reduce the financial-stability risks associated with capital inflow surges. If one also takes into account the pivotal role of banks in financial intermediation–by pooling savings, alleviating financial constraints, improving risk sharing, reducing agency costs, providing and channeling financing for investment–banking supervision policies have far reaching effects on other sectors of the economy that depend on having access to capital. In this way, banking regulation and supervision affect the growth implications of capital flows towards all finance-depending sectors of an economy.

Prompted by the above observations, we take the literature a step further and explore the extent to which regulatory rules can mitigate the adverse effect of volatile financial flows on economic growth. To achieve this goal we utilize a diverse sample of 78 countries over the period 1973–2013 and make use of various measures and types of financial capital flows, combined with different indicators of banking regulation policies. We set an econometric specification that allows assessing the specific channel of interest: the role of financial regulation on the way financial volatility impacts upon the economic growth process. In further analysis, we offer qualifications on whether this effect is driven by country differences in income levels or geographic considerations (Cerutti et al., 2017), or being conditioned by domestic country characteristics (Blomström et al., 1992; Balasubramanyam et al., 1996; Borensztein et al., 1998; World Bank, 2001; Alfaro et al., 2004; Durham, 2004).

We find strong evidence that volatile capital flows retard economic growth, while banking regulation reduces the negative impact of financial volatility. This means that regulatory policies are effective in limiting financial system vulnerabilities and by doing so mitigate the adverse growth effects of unstable capital flows. Further findings are that these outcomes hold for both gross and net flows, are mainly restricted in the sample of middle-income countries, while countries that are relatively open, with deep financial systems and exposed to macroeconomic volatility experience lower marginal benefits, consistent with the notion of regulatory policy leakages. Overall, our results suggest that banking supervision policies can be important elements of the toolkit aimed at overall systemic risk mitigation, especially for countries exposed to large and volatile movements in financial flows. This, in turn, then justifies efforts for international cooperation and coordination in setting global regulatory rules and standards as a way of combating and minimizing financial volatility and its consequences (Brunnermeier et al., 2012; International Monetary Fund, 2013).

Our study sits at the intersection of two empirical literatures to which it makes contributions. First, we add to the existing evidence on the importance of volatile international capital flows for economic growth. Much of the empirical literature concerned with the effect of financial flows on growth has focused on levels (Borensztein et al., 1998; Edison et al., 2002; Alfaro et al., 2004; Durham, 2004; Prasad et al., 2007; Kose et al., 2008; Schularick and Steger, 2010)[3]; there has been limited research on the impact of financial volatility on growth (World Bank, 2001; Lensink and Morrissey, 2006; Ferreira and Laux, 2009). However, even though financial flows may stimulate private investment and raise growth in the long-run, financial volatility may also hamper investment—by blurring price signals and making it more costly to monitor borrowers, and thereby increasing borrowing costs. Some observers believe that the inherent volatility of capital flows, as manifested most severely in "sudden stops" (Calvo and Reinhart, 1999), "hot money" (Stiglitz, 1999) and even capital flight, leads to adverse growth effects (Milesi-Ferretti and Tille, 2011; United Nations Development Programme, 2011). Volatility may also deter investment due to irreversibility problems, a well-documented

[1] IMF (2017) summarizes five channels via which capital flows can increase systemic risk and discusses the scope for regulatory measures to help limit this risk. These are represented by (i) credit booms, (ii) asset price booms, (iii) unhedged foreign currency exposures, (iv) non-core funding of the banking system, and (v) interconnectedness.

[2] The role of prudential policies in managing capital flows has also been examined with reference to Sub-Saharan Africa (Regional Economic Outlook, 2013). The Outlook recognizes that volatile capital flows may increase financial system risks by facilitating excessive credit growth by banks, fostering asset/liability currency mismatches, and fueling asset price bubbles in real estate or in the equities market. For these reasons, it stresses the need for policymakers to better tailor prudential regulations to address systemic risks and build capacity to monitor and assess risks associated with cross-border activities as sub-Saharan African frontier markets become more integrated into the global financial system.

[3] Overall, the empirical literature yields a complex and mixed picture about the relationship between capital flows and growth. The balance of evidence does not conclusively support either a positive or negative impact of capital flows on growth, both collectively and for its different components.

issue for Sub-Saharan Africa (see Agénor, 2004).[4] Our work acts complementary to these studies, by focusing on the effect of volatile capital flows and offers a new mechanism that limits the distortionary impact of this volatility: regulatory policies.

Second, our study contributes to a broader literature that investigates the effectiveness of bank regulation and supervision. Several studies have analyzed the effects of regulation policies on various measures of financial vulnerability and stability.[5] Lim et al. (2011) document, using cross-country regressions, some policies being effective in reducing the procyclicality of credit and leverage. Crowe et al. (2011) find that policies, such as maximum loan-to-value ratios have the best chance to curb a real estate boom. Vandenbussche et al. (2015) find that capital ratio requirements and non-standard liquidity measures (marginal reserve requirements on foreign funding or linked to credit growth) helped slow down house price inflation in Central, Eastern and Southeastern Europe. Dell'Ariccia et al. (2012) find that macroprudential policies can reduce the incidence of general credit booms and decrease the probability that booms end up badly. They also show that such policies reduce the risk of a bust, while simultaneously reducing how the rest of the economy is affected by troubles in the financial system. Claessens et al. (2013) show that measures aimed at borrowers are effective in reducing the growth in bank's leverage, asset and noncore-to-core liabilities growth. All these studies focus exclusively on the role of prudential regulation in credit and housing developments and, by doing so, provide evidence that regulatory policy can contribute to reducing systemic risk and financial instability. In our setting, the distinctive characteristic of the analysis is the focus on long-run economic growth that captures the interaction between financial volatility and prudential rules.[6] Doing so, allows us to draw conclusions about the broader success of regulatory policies in reducing systemic risk by dampening the volatility of flows, thereby giving rise to a growth-promoting effect.

The remainder of the paper is organized as follows. Section 2 describes the econometric model and the data. Section 3 presents the main findings of the analysis and reports on the robustness of our results. Finally, Section 4 concludes.

2. Econometric model and data

2.1. Econometric model

The objective of our empirical analysis is to examine a specific channel through which regulatory policies may be beneficial for economic growth, namely, by reducing the negative effects of volatile capital flows. For this reason, we employ an empirical specification that allows focusing on this particular channel. This is the following growth regression model:

$$g_{i,t} = \alpha + \beta_1 F_{i,t} + \beta_2 VolF_{i,t} + \beta_3 BS_{i,t} + \gamma(BS \times VolF)_{i,t} + \delta X_{i,t} + \mu_i + u_t + \varepsilon_{i,t}, \quad (1)$$

where the $i(t)$ subscript indicates country (time period); g is the growth rate of GDP per capita; F represents international capital flows; $VolF$ is the volatility of capital flows; BS denotes an indicator of banking supervision; $(BS \times VolF)$ is the interaction term between banking supervision and the volatility of capital flows; and X is a standard set of control variables typically found in cross-country growth regressions. Furthermore, the specification includes country dummies, μ_i, to control for unobserved country-specific time-invariant variables, and time dummies, u_t, to capture common shocks affecting all countries simultaneously. Finally, $\varepsilon_{i,t}$ is the error term, a white noise process with a zero mean.

The literature produces mixed evidence regarding the level effects of (various types of) capital flows on growth, implying that the sign of coefficient β_1 cannot be determined *a priori* (see Borensztein et al., 1998; Edison et al., 2002; Durham, 2004; Alfaro et al., 2004, 2014; Prasad et al., 2007; Ferreira and Laux, 2009; Schularick and Steger, 2010). Volatile capital flows, however, have been established to have an adverse growth effect, indicating a negative coefficient for β_2, due to the procyclical nature of capital flows, themselves an outcome of imperfect integration of economies into world financial markets and of informational asymmetries (Calvo and Mendoza, 1999; World Bank, 2001; Lensink and Morrissey, 2006). Regulatory policies, similar to the level effect of capital flows, may either promote or distort growth. Each result is possible since, on the one hand, prudential rules designed to reduce the procyclicality of financial systems may enhance economic growth by reducing the vulnerabilities in banking systems and containing system-wide risks, while, on the other hand, they may be detrimental to long-run growth due to their distortive effect on risk taking. Hence, the coefficient estimate of β_3 could go in either direction. Turning to the coefficient of our interest, γ, it summarizes the effect of volatile capital flows on growth in the presence of banking regulation policies.[7] Expecting volatile flows to be detrimental to economic growth and considering the objective of regulatory rules to ensure financial stability and reduce the procyclical nature of capital flows, a $\gamma > 0$ would support the role of financial regulation in mitigating the adverse effect of capital flows volatility on economic growth.

We first estimate Eq. (1) with OLS, but acknowledging its failure to control for simultaneity and omitted variable biases, we prefer using the dynamic system-GMM technique that overcomes these weaknesses. The GMM technique is particularly advantageous because it corrects for the biases introduced by endogeneity problems (e.g., countries that use a regulatory policy may do so in response to low growth performance, captured by our dependent variable). It also addresses potential biases induced by country specific effects. Specifically, the system GMM estimator, developed by Arellano and Bover (1995) and Blundell and Bond (1998), combines the use of lagged levels of the series as instruments for the pre-determined and endogenous variables in equations in first differences, and the use of lagged differences of the dependent variable as instruments for equations in levels. The consistency of this GMM estimator depends on the validity of the assumption that the error terms do not exhibit serial correlation and on the validity of the instruments.[8]

To address these issues we use two specification tests. The first is the Hansen test of over-identifying restrictions, which tests the overall validity of the instruments by analyzing the sample ana-

[4] At the same time, volatility may increase savings (due to precautionary behavior), but such savings may not be invested domestically and rather transferred abroad, fueling capital flight.

[5] Galati and Moessner (2013) offer an excellent review of the literature, while Claessens (2014) provides an overview of macroprudential policy tools.

[6] Agénor (2016) represents one of the few theoretical contributions that tackle the growth effects of macroprudential policies within an overlapping generations growth framework. Focusing on one such instrument, the reserve requirement rate, he identifies its growth-maximizing level which arises due to a trade-off it generates between directly reducing the supply of loanable funds and lowering the banks' monitoring costs, freeing up resources that raise lending.

[7] The use of interaction terms in proxying for conditional effects in the economic growth process has become popular over the years. See, for example, Alfaro et al. (2004), Durham (2004), Demetriades and Rousseau (2015).

[8] We use the two-step GMM estimator. In the first step the error terms are assumed to be independent and homoskedastic across countries and over time. In the second step, the residuals obtained in the first step are used to construct a consistent estimate of the variance-covariance matrix, thus relaxing the assumptions of independence and homoskedasticity. The two-step estimator is thus asymptotically more efficient relative to the first-step estimator.

log of the moment conditions used in the estimation process. The second test examines the hypothesis that the error term is not serially correlated. We test whether the differenced error term is second-order serially correlated (by construction, the differenced error term is first-order serially correlated even if the original error term is not). Failure to reject the null hypotheses of both tests gives support to our model.

The GMM procedure allows a fair amount of freedom, especially in specifying the lag structure for the instruments. To avoid instrument proliferation, we adopt a parsimonious specification with only few variables controlled for endogeneity: the level and volatility of capital flows, the indicator of BS, and the interaction term. Further, using as instruments the second (or third) lag of the instrumented variables up to the n^{th} lag ($n \geq 2$) so as to satisfy the restriction that the number of instruments does not exceed the number of countries in the regressions, we avoid instrument overfitting and hence avoid bias towards OLS estimation results (Roodman, 2009).

2.2. Data

This section describes the data used in the empirical analysis, specifically the measures of financial flows, their volatility, the various indicators of BS, and a number of other control variables used in the growth regressions.

To estimate the model, our dataset employs panel data for 78 countries over the period 1973–2013.[9] The number of countries in the sample and the length of the period coverage are strictly dictated by the availability of data on banking supervision. In line with the empirical growth literature, we minimize business cycle effects by averaging the dataset over a number of years. To maximize the number of observations, we construct three-year period averages (i.e., 1973–1975, 1976–1978, 1979–1981, 1982–1984, 1985–1987, 1988–1990, 1991–1993, 1994–1996, 1997–1999, 2000–2002, 2003–2005, 2006–2008, 2009–2011, 2012–2013). The use of three-year averages represents a compromise between the need to focus on long-term relationships and the need to maximize the time-series (within-country) variation in the data, especially post-2000 when most of the BS indices are available.[10]

There are several sources of data on capital flows. At the same time, there is a large debate on the advantages and disadvantages of focusing on gross versus net capital flows. Earlier studies place greater emphasis on net capital flows, while the literature has recently emphasized the importance of gross capital flows (see Milesi-Ferretti and Tille, 2011; Broner et al., 2013) due to the fact that gross positions can better reflect the impact of various economic shocks on national balance sheets while they have also been found to be more procyclical and more volatile than net flows. In an effort to be as comprehensive as possible, we use data on both net and gross capital flows. Benchmark results are based on net flows mainly because, somewhat surprisingly, data on such flows are more widely available than those on gross flows. Further analysis, however, makes use of various measures and types of gross flows. Overall, we put together six different measures of total capital flows and fifteen measures of its subcomponents. All capital flow variables are expressed as a fraction of GDP and the standard deviation of the normalized flows is used as our measure of volatility (see World Bank, 2001; Bluedorn et al., 2013).[11]

Firstly, we collect net annual data for the three main categories of capital flows: foreign direct investment (FDI), portfolio equity investment, and debt securities.[12] The first two categories are drawn from the World Development Indicators issued by the World Bank, while the third category is obtained from the International Financial Statistics issued by the International Monetary Fund. We construct a variable of total net capital flows by adding up these three components of capital flows, while we also use each category separately in our regressions.[13] We note that the World Bank does not report data on gross capital flows, thus having to resort to other sources for this data.

Secondly, we use data by Alfaro et al. (2014) who distinguish between private and public net capital flows in 156 developing economies for the period 1980–2013. These authors employ an innovative approach to constructing cross-country net capital flows by using data from the World Bank Global Development Finance to decompose debt into official and private borrowers respectively. The dataset includes both net and gross measures of FDI, equity, and debt flows. It also disaggregates the latter flows into private and public debt flows, but only for its net counterpart. Importantly, the sum of net FDI, equity, and private debt securities give rise to total net *private* capital flows. This is our second measure of total net capital flows, but we also make use of each of the disaggregated types of flows (FDI, equity, debt) for both of their available measures, net and gross.

Thirdly, Alfaro et al. (2014) includes data on the size of the financial account, which records the net acquisition of financial assets and the net incurrence of liabilities. By defining total net capital account flows to be the negative of the current account balance, we use this as a third measure of total net capital flows (this measure has been used by Prasad et al., 2007; Mody and Murshid, 2011).

Fourthly, we utilize capital flows data once again from Alfaro et al. (2014) as they construct them from stock data found in Lane and Milesi-Ferretti, 2007. The advantage of these data is that they take into account valuation effects and in so doing, they provide a better proxy for a country's external position. The valuation effects, associated with capital gains and losses, defaults and price and exchange rate fluctuations, play an important role as an international financial adjustment mechanism. Ignoring these effects leads to less accurate measures of capital flows.[14] Thus, we adopt from Alfaro et al. (2014) both gross and net data on FDI, equity, and debt flows, while also making use of their aggregative measure of total net private capital flows.

Finally, we use data by Bluedorn et al. (2013) who construct a database of gross and net capital flows during 1970–2011 for a sample of 147 countries. They provide data on total capital flows and total capital private flows, both used as aggregate measures of flows. They also break down capital flows into several categories, of which we utilize those of FDI, equity and debt flows. The dataset

[9] The full list of countries appears in the Appendix.

[10] Due to constraints in the time series element of the BS data, a maximum of eleven observations is available for each variable per country.

[11] We also experiment with an alternative measure of volatility, the normalized flows' coefficient of variation.

[12] FDI data include greenfield investments (construction of new factories), equity capital, reinvested earnings, other capital and financial derivatives associated with various intercompany transactions between affiliated enterprises. Portfolio equity investment includes shares, stock participations, and similar documents that usually denote ownership of equity. When a foreign investor purchases a local firm's securities without a controlling stake, the investment is regarded as a portfolio investment. FDI is equity participation giving a controlling stake. Debt flows include bonds, debentures, notes, and money market or negotiable debt instruments.

[13] Although debt flows tend to be shaped by government decisions to a greater extent than flows of equity, we include them nevertheless in total capital flows as is standard practice (see World Bank, 2001; Prasad et al., 2007; Mody and Murshid, 2011; Alfaro et al., 2014).

[14] The authors relied on the cumulative flows of IFS data to construct the stock data with an adjustment for the effects of exchange rate changes (for FDI), changes in the end-of-year dollar value of the domestic stock market (for portfolio equity stocks), and an adjustment of currency composition of the debt (for portfolio debt). These are the adjustments that account for valuation effects.

also allows for the consideration of bank-specific cross-border capital flows, which we also experiment with. Given that banking regulation policies have been developed with the view of limiting instability arising primarily in the financial sector, it is quite likely they are particularly effective with regard to cross-border bank flows.

Banking regulation policies have been increasingly used in the literature to study their implementation, effectiveness and impact on macroeconomic outcomes (Hanson et al., 2011; Claessens et al., 2013; Galati and Moessner, 2013; Claessens, 2014). At the empirical level, most of the studies have focused on single or few countries, mainly due to the lack of available and comparable cross-country data (Tovar et al., 2012; Wang and Sun, 2013; Bruno et al., 2015; Darbar and Wu, 2015). Only recently, some studies have expanded the sample both in terms of countries and time coverage by relying either on their own collection of prudential data (Claessens et al., 2013; Vandenbussche et al., 2015), or on data produced by detailed surveys of bank regulation and supervision across the globe (Barth et al., 2008; Crowe et al., 2011; Kuttner and Shim, 2013; Cerutti et al., 2017; Demetriades and Rousseau 2015). These latter data are the measures of banking regulation tools we employ in this study and are drawn from three different sources.

The first source is Abiad et al. (2008) who put together an annual database of financial reforms for 91 countries over 1973–2005. Amongst their seven dimensions of financial sector policy reforms, the indicator of prudential regulation and banking sector supervision is our first measure of BS. The second source is a survey, called Global Macroprudential Policy Instruments (GMPI), carried out by the IMF's Monetary and Capital Department covering 119 countries for the period 2000–2013 with the data produced in Cerutti et al. (2017). The authors combine twelve different macroprudential instruments to develop a macroprudential index, which forms our second measure of BS. The third source is Barth et al. (2013) which builds on four surveys (1999, 2003, 2007, 2011) sponsored by the World Bank and covers 180 countries from 1999 to 2011. Although the dataset provides a wealth of indexes, we choose three measures of bank regulatory and supervisory practices, all of them reflecting aggregated indexes: i) restrictions on banking activity, ii) entry requirements in the banking sector, and iii) an index of external governance. Overall, the BS data from the above three sources represent the most detailed and up-to-date data on both micro- and macro-prudential policies employed by the largest possible set of countries. In our analysis, due to the availability of the BS data for different years, the period coverage of the regressions refers to 1973–2005 when using the data by Abiad et al. (2008) and to 2000–2013 when using data by Barth et al. (2013) and Cerutti et al. (2017).

The dependent variable of our analysis, the growth rate of output, is measured as the growth of real per capita GDP in constant local currency. As controls in the set X we include a number of variables drawn from the extant growth literature. The set includes the logarithm of beginning-of-period real GDP per capita to control for conditional convergence effects, initial secondary school enrollment rates to proxy for education, the growth rate of the population, the ratio of private investment to GDP, the ratio of trade to GDP as a measure of country openness, government consumption expenditure to GDP, inflation as a proxy of macroeconomic stability, the institutional quality of the government, and a measure of financial depth: private credit provided by deposit money banks and other financial institutions as a share of GDP.

Table A1 lists all variables with their respective definitions and sources, while Table 1 provides summary statistics for all the variables included in the benchmark regressions.

Table 1
Summary statistics.

	Mean	Std Dev	Min	Max	Obs
Growth rate of GDP per capita	2.21	3.06	−10.86	13.04	554
Total capital flows	1.73	2.33	−1.51	20.75	554
Volatility of total capital flows	0.810	1.48	0	14.36	554
FDI flows	1.75	2.33	−1.51	20.75	545
Volatility of FDI flows	0.818	1.48	0.001	14.36	542
Equity flows	0.558	3.86	−2.48	65.85	518
Volatility of equity flows	0.432	1.61	0	30.66	500
Debt flows	0.999	3.01	−10.10	46.02	445
Volatility of debt flows	0.834	1.62	0	17.63	468
Banking supervision	0.884	1.01	0	3	554
Initial GDP per capita (log)	8.38	1.60	4.77	11.08	554
Education	67.91	33.37	1.40	160.6	554
Population growth rate	1.45	1.16	−1.42	6.95	554
Investment	23.21	5.97	4.66	47.49	554
Trade	59.76	30.36	12.22	207.7	554
Government consumption	15.72	5.55	3.98	41.71	554
Inflation	24.81	156.7	−8.91	3139.9	554
Institutions	0.626	0.243	0.111	1	554
Private credit	48.14	38.75	1.51	204.5	554

Note: The dataset combines a number of sources: Abiad et al. (2008), Alfaro et al. (2014), Barth et al. (2013), Beck et al. (2009), Bluedorn et al. (2013), Cerutti et al. (2017), International Financial Statistics, Quality of Governance, World Development Indicators. The maximum number of observations is based on the benchmark regression column (5) of Table 2 below.

3. Empirical analysis

In this section, we first present the results based on OLS and system GMM estimations of Eq. (1) for total capital flows and for each of its three components: FDI, equity, and debt flows. Then, we subject these benchmark findings to a series of sensitivity tests.

3.1. Main findings

The baseline results are presented in Table 2. We keep the analysis simple, whereby columns (1)–(4) present results based on OLS regressions while columns (5)–(8) are based on system GMM. The top of each column describes the type, or category, of capital flows considered. Our main interest lies in the effect of the volatility of capital flows and its interaction with prudential regulation, measured in this table by the degree of banking supervision (Abiad et al., 2008).

Although capital flows appear to be positively associated with growth in the OLS regressions (except for debt flows), system GMM results indicate that total capital flows and FDI flows are not statistically significant whereas equity flows enhance growth and debt flows diminish growth.[15] These findings are in line with earlier studies largely supporting the ambiguous effects of total capital flows on economic growth as an outcome of the offsetting impact of its different components (see Alfaro et al., 2014). Despite differences in the level effects of capital flows on growth, system-GMM results show that more variable capital flows, of any type, reduce economic growth, consistent with World Bank (2001) and Lensink and Morrissey (2006). Stricter banking supervision practices, on the other hand, promote directly economic growth, a finding first illustrated by Demetriades and Rousseau (2015). Turning our attention to the interaction term, we find strong evidence that regulatory

[15] Kose et al. (2008) argue that the positive effect of equity flows on (TFP) growth are due to the positive spillovers of these flows in deepening and developing the domestic financial markets and by improving corporate governance among domestic firms. The negative effect of debt flows, on the other hand, can be rationalized because countries with weaker institutional frameworks and weakly-supervised financial institutions do get more debt flows. These, in turn, finance politically well-connected local firms which grow bigger and stronger, to the detriment of other firms, suppressing aggregate efficiency and overall growth.

Table 2
Benchmark findings.

Type of capital flows →	Dependent variable: Growth rate of GDP per capita (period: 1973–2005)							
	(1) OLS Total flows	(2) OLS FDI flows	(3) OLS Equity flows	(4) OLS Debt flows	(5) GMM-SYS Total flows	(6) GMM-SYS FDI flows	(7) GMM-SYS Equity flows	(8) GMM-SYS Debt flows
Capital flows	0.208***	0.205**	0.024*	−0.017	−0.008	−0.054	0.048***	−0.204***
	(0.077)	(0.081)	(0.015)	(0.055)	(0.039)	(0.043)	(0.001)	(0.006)
Volatility of capital flows	−0.379*	−0.403*	0.027	0.023	−2.10***	−1.53***	−0.301***	−0.499***
	(0.212)	(0.317)	(0.474)	(0.168)	(0.143)	(0.198)	(0.019)	(0.040)
Banking supervision	0.402***	0.401***	0.534***	0.622***	0.452***	0.490***	0.372***	0.024
	(0.146)	(0.147)	(0.147)	(0.175)	(0.097)	(0.153)	(0.018)	(0.018)
Vol. of capital flows * Banking supervision	0.105*	0.113*	0.035	0.007	0.862***	0.673***	0.147***	0.195***
	(0.065)	(0.066)	(0.157)	(0.094)	(0.041)	(0.057)	(0.006)	(0.018)
Initial GDP per capita (log)	−0.540***	−0.563***	−0.615***	−0.624***	−1.51***	−1.00 ***	−0.660***	0.984***
	(0.167)	(0.165)	(0.187)	(0.190)	(0.171)	(0.184)	(0.065)	(0.102)
Education	0.007	0.007	0.007	0.007	0.039***	0.029***	0.023***	0.042***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.009)	(0.009)	(0.001)	(0.001)
Population growth rate	−0.560***	−0.564***	−0.740***	−0.654***	−0.320***	−0.358***	−0.780***	−0.125***
	(0.174)	(0.175)	(0.180)	(0.177)	(0.119)	(0.119)	(0.027)	(0.031)
Investment	0.239***	0.239***	0.255***	0.257***	0.413***	0.411***	0.404***	0.249***
	(0.025)	(0.025)	(0.025)	(0.027)	(0.007)	(0.020)	(0.004)	(0.006)
Trade	0.002	0.002	0.004	0.011**	0.002	0.001	−0.013***	0.030***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.002)	(0.002)	(0.001)	(0.001)
Government consumption	−0.068**	−0.067**	−0.052*	−0.061**	−0.001	−0.084***	0.068***	−0.198***
	(0.027)	(0.027)	(0.028)	(0.028)	(0.013)	(0.020)	(0.004)	(0.007)
Inflation	−0.004***	−0.004***	−0.004***	−0.004***	−0.006***	−0.009***	−0.013***	−0.004***
	(0.0002)	(0.0002)	(0.0002)	(0.0009)	(0.001)	(0.001)	(0.001)	(0.001)
Institutions	1.79*	1.90**	1.51	1.64	4.89***	3.89***	−0.981***	−7.48***
	(0.950)	(0.960)	(1.02)	(1.11)	(0.600)	(0.575)	(0.147)	(0.411)
Private credit	−0.015***	−0.016***	−0.018***	−0.019***	−0.051***	−0.046***	−0.021***	−0.016***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.001)	(0.001)
Countries/Observations	78/554	78/542	79/500	71/445	78/554	78/542	77/500	71/445
R-square	0.345	0.346	0.354	0.342				
Number of instruments					73	73	73	63
Chi-square (p-value)					0.000	0.000	0.000	0.000
Hansen J-statistic (p-value)					0.828	0.826	0.751	0.566
AR(2) test (p-value)					0.457	0.193	0.191	0.968

Notes: Dependent variable is the growth rate of GDP per capita. Regressions based on Ordinary Least Squares (OLS) and GMM-system (GMM-SYS). Standard errors in parentheses based on White correction for OLS and the two-step estimator for GMM-SYS. Constant term, included in all regressions, not reported. Instrumented variables include the capital flows, volatility of capital flows, banking supervision, and the interaction term. Instrument set: starts from the second or third period lag of the instrumented variables and varies the final period lag so as to satisfy the restriction that the number of instruments does not exceed the number of countries to avoid overfitting. ***, **, *, indicates statistical significance at the 1%, 5%, 10% respectively.

practices mitigate the negative growth effect induced by more volatile capital flows. The positive coefficient of the interaction term, therefore, provides a first indication that banking supervision reduces the adverse impact of procyclical and volatile financial flows of all types on economic growth.

To assess the economic significance of this effect, we use the coefficient estimates of total capital flows volatility and its interaction term in column (5) with data on their standard deviation described in Table 1. Specifically, we multiply each coefficient with the sample standard deviation of the corresponding variable. To illustrate, increasing the volatility of total capital flows by one standard deviation decreases the growth rate of GDP per capita by 3.108 percentage points (-2.10×1.48), while increasing the interaction term by one standard deviation increases growth by 1.288 percentage points ($0.862 \times 1.48 \times 1.01$). This means that regulatory policies have the capacity to reduce the negative impact of total capital flows volatility on growth by over 40%. The same principle applies when calculating the quantitative effects for FDI (by 44%), equity (by 49%) and debt flows (by 40%).

The variables included in set *X* are supportive of the typical findings in the literature. Specifically, they indicate the presence of conditional income convergence and that a better educated population, higher levels of private investment and better institutional quality are all conducive to faster economic growth. In contrast, higher rates of population growth, inflation, and levels of government consumption are all associated with slower economic growth. We also find that greater trade openness is not statistically significant in most cases, while it is interesting to note that financial depth is found to retard growth. This latter finding appears counter-intuitive given the large number of studies in support of the importance of the financial sector in a country's growth process (Rajan and Zingales, 1998; Levine et al., 2000; Beck and Levine, 2004). More recent work, however, has shown that the effect of financial development on economic growth is either null or even negative (Arcand et al., 2012; Henderson et al., 2013; Law and Singh, 2014; Bezemer et al., 2015; Demetriades and Rousseau, 2015). It is this recent work that offers a qualification for this finding.[16]

The bottom panel of the table shows that for the analysis of columns (1)–(4), the estimated R-square suggests that regressions account for a third of variation in the data. It also reports the standard specification tests for columns (5)–(8) and shows that (i) the Hansen tests of overidentifying restrictions never reject the null, thus providing support for the validity of our exclusion restrictions, and (ii) all regressions reject the null of no second order autocorrelation.

[16] These studies show a non-monotonic effect of financial development on growth, with the threshold located around 80–100% of the size of the financial sector compared to GDP. Above this threshold, finance adversely affects economic growth, pointing out to a "vanishing effect" of financial development. Bezemer et al. (2015) have gone even further to claim that since 1990 financial development has been having a negative growth effect due to the negative role of high mortgage credit. According to them, the type of bank credit matters, with the recent shift from non-financial business toward asset markets hurting economic growth prospects.

The final point to note from our benchmark findings in Table 2 is that although the levels of capital flows may have an ambiguous effect on growth, their volatility strongly distorts growth and the size of the distortion is less severe when countries apply instruments of regulatory policy. The aim of the next section is to investigate the robustness of our findings in a more detailed manner.[17]

3.2. Sensitivity tests

This section examines the sensitivity of our baseline results by conducting the following exercises. First, we consider different measures of aggregated and disaggregated capital flows, both net and gross. Second, we carry out regressions with alternative indicators of regulatory policy available over different time horizons. Thirdly, we change our dependent variable by using PPP-corrected measures of GDP and alter the periodization of the sample from 3-year to 5-year averages. Finally, we explore the robustness and strength of our results by considering further the income and regional characteristics of our country sample and by imposing additional interaction effects proposed in prominent studies. Our basic finding survives all these tests and clearly indicates the importance of regulatory rules as a mitigating factor in the volatility of capital flows in the growth process of countries.

3.2.1. Alternative types of capital flows

The measures of disaggregated net capital flows we have used thus far (FDI, equity, debt) have been individually collected by the WDI and the IFS and their sum has been coined "total capital flows". Prasad et al. (2007) and Mody and Murshid (2011) prefer using a more general measure of total capital flows: the size of the current account balance, which measures the difference between exports of domestic capital and receipts of foreign capital. Based on this measure, adopted by Alfaro et al. (2014), we call "capital account flows" the negative of the current account balance (% GDP). We also use a more refined measure of capital account flows by deducting from total capital account flows aid receipts from the official sector, coining this "capital account aid-adjusted flows". Using further data from Alfaro et al. (2014), we use a measure of "total private capital flows" and its components of FDI, equity and *private* debt flows. Alfaro et al. (2014) also compile aggregated and disaggregated data from Lane and Milesi-Ferretti, 2007 which take into account valuations effects of capital flows. It is these different measures of capital flows that we consider in Table 3, all of them expressed once again as net flows.

The results are strongly supportive of our benchmark findings. As before, the coefficient of capital flows displays considerable variation by measure and type, making the case for examining each category separately. Only equity flows have consistently a positive growth effect, similar to private debt flows as first illustrated by Alfaro et al. (2014).[18] The volatility of capital flows, on the other hand, exhibit a consistent pattern with a clear negative growth effect regardless of the type or measure of flows considered. Similarly, the interaction term is positive and statistically significant throughout (at least at the 5% level) confirming the role of regulatory policies in reducing the distortive impact of volatile flows. The only exception to the benchmark findings is the effect of banking supervision itself, which now is not always found to promote growth; in some regressions it is insignificant and even negative. This may in part be due to the interaction term capturing an important cushioning function that financial regulation performs, namely, having a well-regulated financial sector is a means to an end and not an end in itself. With the remaining control variables having effects similar to those of the benchmark results, one can conclude that the choice of the type and measure of capital flows makes little difference to our original findings.

An obvious question at this stage is whether our hypothesis survives the use of *gross* capital flows, which are in general more volatile than their net equivalents (Broner et al., 2013). To explore this, we provide regression results based on (i) gross capital flows on FDI, equity and debt from Alfaro et al. (2014)—Table 4, and (ii) both net and gross capital flows from Bluedorn et al. (2013)—Table 5. Before turning to the findings, we indicate that preliminary statistics show that both gross and net flows are highly correlated in our sample (the spearman correlation coefficient ranges from 0.45 to 0.65), but that gross flows are greater in size and more volatile than their net counterparts, the latter by a degree of between 15%-257% depending on the type of flow. Further we note that amongst the sub-categories of flows, cross-border bank flows represent the most volatile component.[19]

Findings in both Tables 4 and 5 are consistent with those of net capital flows.[20] They confirm our main prediction that regulatory rules diminish the negative growth effect of gross volatile flows, including cross-border capital flows. They also show that such policies attenuate the growth-reducing effect of volatile *gross* flows by at least the same degree as that of *net* flows, and in most of the cases by a much greater degree than net flows. This is particularly evident in Table 5 where all even-numbered columns, showing results based on gross flows, have an interaction term greater in magnitude than the respective odd-numbered columns with net flows. This seems to imply that prudential regulation may have a greater capacity to have a more pronounced tempering effect on the more volatile type of flows, gross capital flows. In sum, the main message is that regardless of the measure of flows used (net vs. gross), their type (total, FDI, equity, debt, private, public, bank), or source of data (WDI, IFS, Alfaro et al. (2014), Bluedorn et al. (2013)), results strongly support our hypothesis.[21]

3.2.2. Alternative indicators of banking regulation

In all preceding analysis we have been using the degree of banking supervision (Abiad et al., 2008) as our measure of prudential regulation due to it being available for the longest possible period (1973–2005). More recently, however, more measures and indicators of both micro- and macro-prudential policies have been made available and used by the literature. At the cross-country level, such indicators have been compiled by Barth et al. (2013) and Cerutti et al. (2017), all available since the year 2000. An advantage of these two sources is that they include a variety of prudential rules, twelve

[17] Findings do not change when we include a lagged dependent variable as control in the regression and instrument for it. In each case, the coefficient of the lagged per capita growth rate is significantly negative indicating a slowdown of growth across time.

[18] One can note that in columns (7)-(10) all types of capital flows have positive effects on economic growth. This may offer indirect support to the argument that considering valuations effects may be important for unveiling the true level effect of capital flows.

[19] In a recent study, Spagliari and Hannan (2017) using quarterly data for 65 countries over 1970Q1-2016Q1 construct three measures of volatility for total capital flows and key components. They also find that bank flows usually tend to be more volatile than non-bank flows.

[20] Note that both tables report the coefficient estimates of the variables of interest and skip, for saving space, the rest of the controls.

[21] We have also experimented with cross-border bank flows data from the BIS locational banking statistics that correspond to exchange rate-adjusted changes in cross-border claims for each country (these are drawn from Table A3.1 in BIS locational banking statistics). Following Correa et al. (2017), we construct annual cross-border bank flows by taking the first difference of outstanding claims from year t-1 to year t of the BIS-reporting banks on banking sector counterparties in a particular country, and normalizing this by GDP in year t. We then re-run our benchmark system-GMM regression and find that our thesis carries over when using the BIS data. Results are available upon request.

Table 3
Alternative types of net capital flows.

Type of capital flows →	Dependent variable: Growth rate of GDP per capita (period: 1980–2005)											
	(1) Capital account flows	(2) Capital account aid-adjusted	(3) Total private flows (IFS)	(4) FDI flows (IFS)	(5) Equity flows (IFS)	(6) Debt flows (IFS)	(7) Total private flows (LM)	(8) FDI flows (LM)	(9) Equity flows (LM)	(10) Debt flows (LM)	(11) Private debt flows	(12) Public debt flows
Capital flows	−0.022	−0.138***	−0.012	−0.077*	0.112***	−0.090***	0.099***	0.083***	0.020***	0.017**	0.121***	−0.032
	(0.040)	(0.021)	(0.023)	(0.045)	(0.005)	(0.020)	(0.012)	(0.019)	(0.004)	(0.008)	(0.046)	(0.023)
Volatility of capital flows	−1.96***	−0.595***	−0.633***	−0.988***	−1.26***	−0.422***	−0.350***	−0.328***	−0.194***	−0.074***	−0.687***	−0.083**
	(0.148)	(0.106)	(0.084)	(0.262)	(0.026)	(0.074)	(0.020)	(0.120)	(0.008)	(0.012)	(0.100)	(0.041)
Banking supervision	−0.871***	0.106	1.30***	−0.042	0.050**	0.308*	0.858***	0.604***	0.126***	0.459***	1.26***	0.761***
	(0.240)	(0.326)	(0.401)	(0.166)	(0.025)	(0.181)	(0.168)	(0.149)	(0.048)	(0.065)	(0.325)	(0.162)
Vol. of capital flows * Banking supervision	0.855***	0.146**	0.260***	0.371***	0.337***	0.150***	0.113***	0.116**	0.112***	0.013**	0.216***	0.063**
	(0.079)	(0.071)	(0.056)	(0.088)	(0.016)	(0.034)	(0.010)	(0.046)	(0.005)	(0.005)	(0.068)	(0.026)
Initial GDP per capita (log)	0.418*	−0.069	0.090	−1.74***	−0.567***	−1.73***	0.666**	−0.791***	−1.12***	0.065	0.482	−0.503*
	(0.243)	(0.249)	(0.283)	(0.382)	(0.102)	(0.322)	(0.258)	(0.249)	(0.072)	(0.180)	(0.366)	(0.292)
Education	0.041**	0.068***	0.046***	0.065***	0.062***	0.102***	0.022	0.018***	0.075***	0.050***	0.019	0.042***
	(0.016)	(0.013)	(0.017)	(0.006)	(0.002)	(0.012)	(0.016)	(0.005)	(0.002)	(0.005)	(0.020)	(0.015)
Population growth rate	−0.391***	−0.039	0.382***	−1.08***	−0.817***	0.115	0.174	−0.554***	−0.760***	−0.351***	0.400***	−0.212
	(0.144)	(0.095)	(0.110)	(0.149)	(0.030)	(0.218)	(0.226)	(0.064)	(0.044)	(0.029)	(0.110)	(0.240)
Investment	0.094**	0.054***	0.515***	0.391***	0.313***	0.351***	0.395***	0.300***	0.379***	0.291***	0.422***	0.301***
	(0.044)	(0.013)	(0.036)	(0.015)	(0.005)	(0.035)	(0.030)	(0.023)	(0.009)	(0.015)	(0.050)	(0.018)
Trade	0.003	0.019***	−0.015*	−0.008**	0.005***	−0.008	0.001	0.025***	−0.001	0.001	0.016	0.002
	(0.006)	(0.004)	(0.008)	(0.004)	(0.001)	(0.005)	(0.006)	(0.003)	(0.001)	(0.003)	(0.010)	(0.006)
Government consumption	−0.033	−0.277***	−0.406***	−0.032	−0.062***	0.149***	−0.294***	−0.110***	−0.095***	−0.156***	−0.335***	−0.255***
	(0.036)	(0.033)	(0.061)	(0.026)	(0.006)	(0.025)	(0.032)	(0.036)	(0.010)	(0.028)	(0.061)	(0.037)
Inflation	0.0004	−0.006***	−0.008***	−0.006**	−0.005***	−0.003***	−0.003***	−0.003***	0.006***	−0.005***	−0.001	−0.002**
	(0.001)	(0.001)	(0.002)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Institutions	−6.76***	−0.526	−1.18	2.52**	−2.69***	−1.40	−3.39***	2.68***	1.39***	−1.47**	0.201	0.209
	(1.21)	(1.16)	(1.40)	(1.23)	(0.236)	(1.27)	(1.09)	(0.898)	(0.280)	(0.588)	(1.18)	(0.997)
Private credit	−0.043***	−0.061***	−0.096***	−0.020***	−0.009***	−0.036***	−0.040***	−0.025***	−0.031***	−0.038***	−0.114***	−0.038***
	(0.007)	(0.006)	(0.009)	(0.005)	(0.001)	(0.008)	(0.005)	(0.003)	(0.001)	(0.004)	(0.008)	(0.008)
Countries/Observations	78/467	78/467	57/294	78/456	76/434	78/467	57/312	78/484	78/473	78/484	57/312	57/302
Number of instruments	53	60	52	60	60	53	57	53	60	75	52	57
Chi-square (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hansen J-statistic (p-value)	0.203	0.621	0.870	0.408	0.465	0.231	0.762	0.312	0.561	0.649	0.733	0.670
AR(2) test (p-value)	0.499	0.593	0.554	0.725	0.899	0.701	0.267	0.454	0.175	0.608	0.361	0.135

Notes: As in Table 2. Regressions based on GMM-system (GMM-SYS).

Table 4
Alternative types of gross capital flows.

Type of capital flows →	Dependent variable: Growth rate of GDP per capita (period: 1980–2005)					
	(1) FDI flows (IFS)	(2) Equity flows (IFS)	(3) Debt flows (IFS)	(4) FDI flows (LM)	(5) Equity flows (LM)	(6) Debt flows (LM)
Capital flows	0.141***	0.022***	0.060***	0.044***	0.020***	0.015***
	(0.035)	(0.002)	(0.019)	(0.009)	(0.004)	(0.003)
Volatility of capital flows	−1.41***	−0.874***	−0.400***	−0.484***	−0.194***	−0.088***
	(0.293)	(0.031)	(0.092)	(0.118)	(0.008)	(0.012)
Banking supervision	0.168*	−0.135**	0.716**	1.01***	0.127***	0.401**
	(0.103)	(0.063)	(0.350)	(0.144)	(0.048)	(0.110)
Vol. of capital flows * Banking supervision	0.516***	0.324***	0.139***	0.194***	0.112***	0.040***
	(0.094)	(0.012)	(0.029)	(0.045)	(0.005)	(0.005)
Includes control variables in set *X*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*
Countries/Observations	78/464	76/437	78/467	78/484	78/473	78/484
Number of instruments	60	60	63	53	60	75
Chi-square (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
Hansen J-statistic (p-value)	0.656	0.359	0.395	0.375	0.562	0.531
AR(2) test (p-value)	0.474	0.335	0.425	0.773	0.175	0.923

Notes: As in Table 2. Regressions based on GMM-system (GMM-SYS). To save space, the table presents only the coefficient estimates of the interaction term between the volatility of capital flows and banking supervision for different types of flows. All other control variables, although not reported, are included in the regressions.

in Cerutti et al. (2017) and over fifty in Barth et al. (2013), which one can use either individually or by aggregating them to establish their significance. In what follows, we assess the robustness of our main findings by using four aggregated measures of regulatory rules taken as such from their sources, one from Cerutti et al. (2017) and three from Barth et al. (2013). Our choice is driven by the argument that aggregated rules better reflect the presence, application and practice of prudential regulation policies at the macroeconomic level, relevant for the examination of issues pertaining to economic growth. We claim that such consideration may not be fully captured by the use of individual prudential regulation indicators.[22]

The four regulatory policy variables are the i) macroprudential index, ii) restrictions on banking activity, iii) entry requirements in the banking sector, and iv) an index of external governance (see Table A1 for details on their definition and the way they are constructed by their sources). Table 6 presents the results of regressions that involve these four regulatory policies and eight different measures and types of capital flows we have used before in Tables 2 and 3. Accounting for each pair generates thirty-two coefficient estimates of the interaction terms, which are the only ones presented to save space. All other control variables, although not reported, are included in the regressions.

The vast majority of the interaction terms has the expected positive sign and is statistically significant. There are only five pairs that do not satisfy this finding, of which three are not statistically significant while two take up a negative sign. For these last two, stricter restrictions on banking activity seem to reinforce the negative effect of unstable capital flows in the case of equity and private debt. A plausible explanation for this result could be that the restrictions imposed on banks in entering specific financial activities (in securities, mutual funds, insurance, real estate, etc.) is causing them to reshuffle their portfolio and direct funds toward investments in equity and private debt flows, thereby, causing more volatility in these types of flows. But, overall, the main message is that our main findings are largely not conditional on the measure of regulatory policy.

3.2.3. *Further robustness tests*

In this section, we conduct some further robustness tests to confirm the validity of our main findings. To start with, we consider the case on the way we measure our dependent variable, the rate of GDP per capita growth. Currently measured in constant local currency, we ignore the possibility that growth differences amongst countries are influenced by the extent to which they diverge from purchasing-power-parity. This is a point that has not been conclusively answered in the empirical growth literature as there are studies that use GDP measured either as PPP-adjusted (Dollar and Kraay, 2003; Jones and Olken, 2005; Rajan and Subramanian, 2008; Czernich et al., 2011) or in constant local currency (Alfaro et al., 2004; Easterly et al., 2004; Adam and Bevan, 2005; Clemens et al., 2012). Given the ambiguity as to the "appropriate" measure of GDP, we have collected six PPP-corrected measures of GDP from two different sources, Penn World Tables and World Bank (see Table A1 for details), and re-run regressions for total capital flows after having replaced the dependent variable with the average growth rate of purchasing-power-parity GDP per capita. The high correlations between the PPP-corrected measures of GDP growth rate and that of our original measure (ranging from 0.68 to 0.98), imply that switching between them is not expected to have an impact on benchmark findings. This expectation is echoed in the results shown in Table 7, columns (1)-(6). This points to the argument that the way GDP is measured has no implications for the key message of our study, despite the significant drop in the number of observations in columns (5) and (6) that use World Bank data owing to the fact these are available only post-1990.

Next, we take into account the time-period averaging of our dataset. As explained in the Data section, we opt for three-year period averages for the simple reason that it allows capturing the long-run effects of the conditioning variables on economic growth, while, at the same time, maximizes the time-series variation in the data. This is particularly important for the post-2000 period where all of the BS data (Barth et al., 2013; Cerutti et al., 2017) used in Table 6 are available. In the literature, however, cross-country growth regressions use period averages of typically four or five years to avoid short-term business cycles effects. To align with tradition, we now consider the most commonly used time period average of five-year intervals (1973-77, 1978-82, 1983-87, 1988-92, 1993-97, 1998–2002, 2003-07, 2008-13), that delivers a maximum of eight observations per country. Columns (7)-(10) in Table 7 report results based on system-GMM estimations for aggregated and disaggregated types of flows, as in Table 2. They show that our results remain qualitatively unaffected by altering the periodization of the regression implying that increasing the period averaging does not affect our main prediction. Compared

[22] Obviously, one could also examine the importance of individual prudential policies, but given their large number, we prefer to leave this for future work.

Table 5
Alternative Types of Net and Gross Capital Flows.

Type of capital flows →	Dependent variable: Growth rate of GDP per capita (period: 1970–2011)											
	(1) Total flows	(2)	(3) Total private flows	(4)	(5) FDI flows	(6)	(7) Equity flows	(8)	(9) Debt flows	(10)	(11) Bank flows	(12)
	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross
Capital flows	0.072**	0.089***	0.113***	0.062***	−0.149**	−0.087	0.032**	0.110***	0.046***	−0.046***	0.059	0.021
	(0.034)	(0.019)	(0.039)	(0.015)	(0.075)	(0.064)	(0.012)	(0.011)	(0.006)	(0.011)	(0.064)	(0.031)
Volatility of capital flows	−0.440***	−0.565***	−0.635***	−0.990***	−0.542***	−0.909*	−0.860***	−1.71***	−0.189***	−0.371***	−0.463***	−0.787***
	(0.087)	(0.047)	(0.125)	(0.078)	(0.185)	(0.492)	(0.051)	(0.198)	(0.050)	(0.053)	(0.081)	(0.083)
Banking supervision	1.18***	0.690***	0.172	−0.864***	0.669**	0.606**	0.243***	−0.378***	1.17***	0.771***	0.302	−0.037
	(0.199)	(0.263)	(0.343)	(0.199)	(0.275)	(0.248)	(0.047)	(0.048)	(0.064)	(0.104)	(0.217)	(0.163)
Vol. of capital flows * Banking supervision	0.156***	0.207***	0.227***	0.381***	0.183**	0.343**	0.394***	0.659***	0.058***	0.068***	0.128***	0.299***
	(0.056)	(0.034)	(0.075)	(0.043)	(0.082)	(0.156)	(0.024)	(0.067)	(0.019)	(0.022)	(0.044)	(0.046)
Includes control variables in set *X*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*
Countries/Observations	77/513	77/513	77/513	77/513	77/510	77/510	77/507	77/506	77/507	77/507	77/501	77/500
Number of instruments	57	57	57	57	57	57	57	57	57	57	57	57
Chi-square (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hansen J-statistic (p-value)	0.543	0.473	0.643	0.513	0.586	0.440	0.616	0.726	0.514	0.646	0.473	0.735
AR(2) test (p-value)	0.795	0.451	0.591	0.438	0.558	0.926	0.179	0.142	0.281	0.297	0.386	0.893

Notes: As in Table 2. Regressions based on GMM-system (GMM-SYS). To save space, the table presents only the coefficient estimates of the interaction term between the volatility of capital flows and banking supervision for different types of flows. All other control variables, although not reported, are included in the regressions.

Table 6
Alternative indicators of banking supervision.

Type of capital flows → Indicator of MPR ↓	Dependent variable: Growth rate of GDP per capita (period: 2000–2013)							
	(1) Total Flows (WDI)	(2) Total private flows (IFS)	(3) FDI Flows (WDI)	(4) Equity Flows (WDI)	(5) Debt Flows (WDI)	(6) FDI flows (IFS)	(7) Equity flows (IFS)	(8) Private debt flows
Macroprudential index	0.085***	0.061**	0.064***	0.172***	0.106***	0.083***	0.137***	0.086**
	(0.015)	(0.028)	(0.015)	(0.002)	(0.004)	(0.023)	(0.008)	(0.038)
Banking activity restrictions	0.049***	0.053***	0.064***	−0.004***	0.037***	0.122***	0.003**	−0.107***
	(0.009)	(0.008)	(0.011)	(0.001)	(0.001)	(0.022)	(0.001)	(0.014)
Banking entry requirements	0.042***	0.107***	0.030***	0.061***	0.047***	0.057***	0.100***	−0.075
	(0.007)	(0.034)	(0.009)	(0.003)	(0.002)	(0.020)	(0.010)	(0.047)
External governance index	0.085**	0.145***	0.022	−0.033	0.029***	0.159***	0.046***	0.265***
	(0.038)	(0.037)	(0.035)	(0.023)	(0.011)	(0.016)	(0.014)	(0.046)
Includes control variables in set *X*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*

Notes: As in Table 2. Regressions based on GMM-system (GMM-SYS). To save space, the table presents only the coefficient estimates of the interaction term between the volatility of capital flows and banking supervision for different indicators of banking supervision. All other control variables, although not reported, are included in the regressions.

Table 7
Sensitivity tests I.

Type of capital flows →	Dependent variable: Growth rate of GDP per capita (period: 1973–2005)									
	(1) Total flows	(2) Total flows	(3) Total flows	(4) Total flows	(5) Total flows	(6) Total flows	(7) Total flows	(8) FDI flows	(9) Equity flows	(10) Debt flows
Capital flows	−0.121***	−0.105*	−0.091**	−0.008	0.063***	0.153***	0.080**	0.152***	−0.039***	−0.086***
	(0.037)	(0.054)	(0.039)	(0.048)	(0.020)	(0.030)	(0.031)	(0.031)	(0.009)	(0.017)
Volatility of capital flows	−3.14***	−2.28***	−3.00***	−2.13***	−0.971***	−1.80***	−1.10***	−0.974***	−0.507***	−0.187***
	(0.283)	(0.225)	(0.309)	(0.302)	(0.084)	(0.134)	(0.168)	(0.184)	(0.012)	(0.038)
Banking supervision	0.719***	0.079	0.799***	0.530**	0.660***	0.178	0.366*	0.341***	0.314***	0.324***
	(0.263)	(0.183)	(0.234)	(0.229)	(0.150)	(0.155)	(0.216)	(0.097)	(0.072)	(0.027)
Vol. of capital flows * Banking supervision	1.25***	0.959***	1.23***	0.903***	0.407***	0.667***	0.356***	0.302***	0.186***	0.073***
	(0.105)	(0.062)	(0.111)	(0.103)	(0.030)	(0.056)	(0.053)	(0.058)	(0.050)	(0.028)
Includes control variables in set *X*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*
Countries/Observations	78/554	78/554	78/554	78/554	76/291	76/291	76/353	76/346	76/335	69/266
Number of instruments	73	73	73	73	69	69	69	69	69	66
Chi-square (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hansen J-statistic (p-value)	0.765	0.525	0.686	0.688	0.477	0.318	0.805	0.789	0.855	0.148
AR(2) test (p-value)	0.143	0.316	0.251	0.274	0.467	0.966	0.672	0.807	0.186	0.370

Notes: As in Table 2. Regressions based on GMM-system (GMM-SYS). In columns (1)-(6), the dependent variable is based on different PPP-corrected measures, while in columns (7)-(10) data are based on 5-year period averaging. To save space, the table presents only the coefficient estimates of the interaction term between the volatility of capital flows and banking supervision for different types of flows. All other control variables, although not reported, are included in the regressions.

to Table 2, notable changes refer to the magnitude of the impact of volatility of flows and its interaction with regulatory instruments, which are now smaller although still significant at the 1% level. The only exception is that for equity flows where now the respective coefficients are somewhat greater in size.

The next task we undertake is to investigate whether there are differences in the effectiveness of regulatory policies depending on country characteristics. We run regressions where we separate by income group the volatility of total capital flows and their interaction with policies. This requires creating dummy variables by income group (high income, middle income, low income) and interact these dummies with *VolF* and ($BS \times VolF$). The first column of Table 8 presents the results and shows that, differentiating by level of income, the statistical significance of both the volatility of capital flows and the effectiveness of regulatory policies are limited to the group of middle-income countries. In none of the other country groups volatile flows retard growth, nor does financial regulation change the impact of volatile flows. This may reflect two factors, also emphasized by Cerutti et al. (2017) in the case of credit and housing markets. First, middle-income economies have relied more on regulatory policies than advanced economies. Second, advanced economies tend to have more developed financial systems which offer various alternative sources of finance and scope for avoidance, making it possibly harder for regulatory policies to be effective, a notion coined as regulatory policy leakage.

Further, we examine the marginal effects that volatile capital flows and the effectiveness of regulation policies may have on growth in specific geographic regions with a focus in the African continent. Sub-Saharan Africa (SSA), in particular, is an interesting case because it has experienced sustained economic growth since the mid-1990s but, at the same time, remains one of the most financially under-developed regions in the world (Honohan and Beck, 2007). With this in mind, it is interesting to examine the role of regulatory practices within our framework as financial deepening gradually takes pace and has the capacity to attract more (volatile) capital flows in the region. To test for this, column (2) adds to our regression equation two further interaction terms: a SSA dummy multiplied with *VolF* and with ($BS \times VolF$). The results show that volatile capital flows on average continue to disrupt economic growth, with the marginal effect experienced in SSA being greater in magnitude. Similarly, regulatory policies on average attenuates the effect of volatile flows, doing so at a greater degree in SSA. Repeating the same exercise for the sub-sample of Francophone SSA countries in column (3), we observe a similar finding. This, however, is not the case for an even smaller sub-sample of countries that participate in the West African Economic and Monetary Union (WAEMU/BCEAO). Column (4) shows that these countries although benefit from the impact of regulatory policies, they do not appear to obtain any additional marginal gains. The same appears to be the case for another monetary union, the Economic and Monetary Union (EMU) of the European Union, illustrated by the findings in column (5).

The last two columns of Table 8 test our benchmark findings against an alternative measure for the volatility of capital flows. We now use the coefficient of variation instead of the standard deviation of total capital flows in column (6) and of total *private* capital flows in column (7). This modification does not influence our findings. A further test we conduct, for which we do not provide tabular results, is to consider the importance of zero capital flows in our dataset. Although period averaging minimizes the importance of zero flows compared to a situation where the analysis uses annual data, it is possible the presence of zero flows, particularly pronounced for equity and debt flows, to affect our findings. For this reason, we re-run the benchmark system-GMM regressions of Table 2 by excluding from the sample all zero entries from each respective type of flows. Results indicate that the coefficient esti-

Table 8
Sensitivity tests II.

	Dependent variable: Growth rate of GDP per capita (period: 1973–2005 & 2000–2013)						
	(1) Income Level	(2) SSA	(3) Francophone SSA	(4) WAEMU	(5) Euro Area	(6) Coefficient of Variation	(7) Coefficient of Variation
Capital flows	0.332***	−0.027	−0.190***	−0.220***	−0.093**	0.138**	−0.138
	(0.065)	(0.33)	(0.065)	(0.065)	(0.042)	(0.056)	(0.106)
Volatility of capital flows		−0.556***	−0.529**	−0.501**	−0.849***	−0.485***	−0.244***
		(0.163)	(0.254)	(0.255)	(0.177)	(0.179)	(0.053)
Volatility of capital flows * High	−0.365						
	(0.254)						
Volatility of capital flows * Middle	−2.59***						
	(0.646)						
Volatility of capital flows * Low	−0.412						
	(2.97)						
Volatility of capital flows * Region		−2.93***	−1.37*	−0.151	0.008		
		(0.484)	(0.857)	(2.26)	(0.481)		
Banking supervision	0.620**	0.689***	1.36***	1.39***	0.387***	0.469**	0.853**
	(0.270)	(0.065)	(0.156)	(0.177)	(0.115)	(0.207)	(0.407)
Vol. of capital flows * Banking supervision		0.222***	0.285***	0.274***	0.431***	0.265***	0.097*
		(0.052)	(0.091)	(0.099)	(0.076)	(0.099)	(0.057)
Vol. of capital flows * Banking supervision * High	0.085						
	(0.077)						
Vol. of capital flows * Banking supervision * Middle	1.06***						
	(0.313)						
Vol. of capital flows * Banking supervision * Low	−3.28						
	(2.45)						
Vol. of capital flows * Banking supervision * Region		3.54***	1.40**	−0.874	−0.099		
		(0.453)	(0.685)	(6.18)	(0.174)		
Includes control variables in set *X*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*
Countries/Observations	78/554	78/554	78/554	78/554	78/554	78/553	57/294
Number of instruments	67	75	73	68	67	49	44
Chi-square (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hansen J-statistic (p-value)	0.902	0.798	0.925	0.902	0.343	0.485	0.492
AR(2) test (p-value)	0.028	0.658	0.217	0.028	0.310	0.219	0.151

Notes: As in Table 2. Regressions based on GMM-system (GMM-SYS). In columns (1)-(6), capital flows represent "Total capital flows", while in column (7) they represent "Total private capital flows_IFS". Instrumented variables include the capital flows, volatility of capital flows, banking supervision, and *all* interaction terms.

mates for all types of flows remain remarkably similar, despite the loss of a significant number of observations for equity flows (loss of 40% of observations) and debt flows (loss of 24% of observations). Another test we conduct, for which we do not provide results, is to consider the presence of extreme values amongst our data. Specifically, we exclude from the sample observations that correspond to cases of hyperinflation, i.e., inflation rates over 50%, and in a second test we exclude multiple outliers identified by the Hadi (1992) procedure. In each case the benchmark system-GMM regressions of Table 2 show that results are very robust to the omission of extreme observations. These findings are available upon request.

The final table, Table 9, investigates the degree by which some further country characteristics may influence the weakening effect of regulatory policies on the way volatile financial flows affect economic growth. A number of studies have examined the conditional effects of the *level* of capital flows on growth. Following their lead, in turn, we test the conditional effect of the ($BS \times VolF$) term by interacting this with i) financial deepening (Alfaro et al., 2004), ii) human capital (Borensztein et al., 1998), iii) institutional quality (Durham, 2004), iv) trade openness (Balasubramanyam et al., 1996), v) initial level of development (Blomström et al., 1992), and vi) macroeconomic stability (World Bank, 2001). Columns (1)-(6) provide the results, where in addition to confirming our main finding, they indicate that the effectiveness of banking supervision within our framework is smaller in economies with deeper financial systems, that are relatively open, and experience greater macroeconomic instability (proxied by inflation). As indicated before, countries with more developed financial systems, by offering alternative sources of finance, make it harder for regulatory policies to be effective, thus, documenting leakages. Regulatory policies are also less effective for relatively open economies, since such economies may see more circumvention of regulatory policies, including by borrowers substituting to nonbank sources of finance and obtaining funds through cross-border banking activities (i.e., cross-border leakages). Similarly, countries that exhibit substantial macroeconomic volatility find it harder to apply regulatory policies more effectively. This provides limited support for the view that more developed countries have greater ability to enforce regulatory policies and make them more effective.

The last four columns of Table 9 experiment with the idea that regulatory rules may have an effect on growth not only via their tempering effect on the second moments of capital flows, but also by influencing the level effect of such flows. For this reason, we extend our benchmark specification by adding an interaction term between regulatory policies and the level of capital flows, ($BS \times F$), for the different categories of flows. The results illustrate that although financial regulation continues to mitigate the negative growth effect of volatile flows, it also reduces the positive level effect of these flows. The negative coefficient of the ($BS \times F$) term, therefore, highlights a trade-off as to the effect of regulation policies on growth. On the one hand, prudential rules help to offset the adverse effects of financial volatility on growth, while, on the other, they potentially "shrink" the pool of (high return) projects that are financed, with a negative effect on growth. This is an outcome that needs to be further investigated, but it raises the point that the benefits of regulatory rules do not come without a cost for the economy. Such a claim would rationalize an "optimal" level of regulation rules that maximize macroeconomic net benefits, in line with Agénor (2016).

Table 9
Sensitivity tests III.

Type of capital flows →	Dependent variable: Growth rate of GDP per capita (period: 1973–2005)									
	(1) Total flows	(2) Total flows	(3) Total flows	(4) Total flows	(5) Total flows	(6) Total flows	(7) Total flows	(8) FDI flows	(9) Equity flows	(10) Debt flows
Capital flows	0.154*	−0.026	0.122	−0.053	−0.054	−0.050	0.698***	0.570***	1.65***	0.346***
	(0.085)	(0.045)	(0.105)	(0.051)	(0.040)	(0.074)	(0.119)	(0.047)	(0.709)	(0.102)
Volatility of capital flows	−2.47***	−0.407*	−1.22**	−0.639***	−0.682***	−0.662**	−1.25***	−0.955***	−1.99***	−0.806***
	(0.602)	(0.247)	(0.491)	(0.229)	(0.248)	(0.294)	(0.207)	(0.122)	(0.907)	(0.173)
Banking supervision	−0.431	0.495***	−0.278	0.662***	0.365***	0.712***	0.815***	0.809***	0.441	0.757***
	(0.443)	(0.141)	(0.607)	(0.174)	(0.140)	(0.163)	(0.135)	(0.043)	(0.671)	(0.330)
Vol. of capital flows * Banking supervision	1.38***	0.273*	0.863*	0.326***	0.827*	0.497***	0.498***	0.432***	0.720**	0.282***
	(0.261)	(0.169)	(0.480)	(0.100)	(0.431)	(0.131)	(0.074)	(0.042)	(0.350)	(0.072)
Vol. of capital flows * Banking supervision * Private credit	−0.005***									
	(0.002)									
Vol. of capital flows * Banking supervision * Education		−0.001								
		(0.001)								
Vol. of capital flows * Banking supervision * Institutions			−0.513							
			(0.397)							
Vol. of capital flows * Banking supervision * Trade				−0.001***						
				(0.0003)						
Vol. of capital flows * Banking supervision * Initial GDP pc					−0.054					
					(0.034)					
Vol. of capital flows * Banking supervision * Inflation						−0.106***				
						(0.015)				
Capital flows * Banking supervision							−0.306***	−0.226***	−0.620**	−0.146***
							(0.040)	(0.020)	(0.261)	(0.038)
Includes control variables in set *X*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*
Countries/Observations	78/554	78/554	78/554	78/554	78/554	78/554	78/554	78/542	79/539	71/445
Number of instruments	51	71	51	71	71	71	71	81	64	55
Chi-square (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hansen J-statistic (p-value)	0.990	0.909	0.963	0.936	0.928	0.913	0.902	0.784	1	0.973
AR(2) test (p-value)	0.309	0.337	0.312	0.565	0.380	0.948	0.426	0.339	0.355	0.940

Notes: As in Table 2. Regressions based on GMM-system (GMM-SYS). Instrumented variables include the capital flows, volatility of capital flows, banking supervision, and *all* interaction terms.

4. Conclusion

An established literature has been concerned with, and has identified, the effects of international capital flows on economic growth. The main finding is that the impact of capital flows depends on their type, with FDI and equity flows having a higher probability to promote growth compared to debt flows which typically distort growth. In parallel, there are studies that support a non-linear growth effect of capital flows, this being subject to conditions in the recipient countries, such as the degree of financial development, the stock of human capital, and the quality of institutions. These considerations, however, have limited the analysis in the first moments of capital flows while, at the same time, have ignored the potential role of regulatory policies. Less than a handful of studies have explored the importance of the volatility of capital flows, illustrating its growth-retarding effect. The adoption and application of regulatory policies, on the other hand, have only been examined with respect to their effectiveness on short-term economic stability without any reference to its long-run implications. This paper fills the gap in the literature by investigating the role of regulatory rules in the long-run growth process focusing on a particular channel: the way by which financial regulation affects the impact of financial volatility.

With regulatory policies aimed at strengthening the safeguards against financial instability, we utilize an empirical specification that tests whether prudential regulation has achieved its objective in a growth framework. This amounts to examining the effect of volatile financial flows on economic growth in the presence of regulatory rules. We find that regulatory policies mitigate the negative growth effects of unstable capital flows and, by so doing, are effective in limiting financial system vulnerabilities. This finding holds across a variety of types and measures of capital flows, with indications that the dampening effect is more pronounced for gross flows, as well as across different aggregate instruments of regulation. Further results qualify that these outcomes are mainly restricted in the sample of middle-income countries, while countries that are relatively open, with deep financial systems and exposed to macroeconomic volatility experience lower marginal gains—although they still benefit.

Our work comes with caveats. Endogeneity and omitted variables problems can bias our results. In addition, our findings are conditional on the use of aggregate regulatory instruments. As the list of individual policy instruments is long, the question of whether some levers are more effective than others and which of them should be used is equally important. Despite these limitations, we believe that the evidence this study provides is informative and can be useful to policymakers.

Finally, while our results suggest that regulatory policies can be important elements of the toolkit aimed at mitigating systemic risks, especially for countries exposed to large and volatile movements in financial flows, the adoption of such policies may also entail some costs. In particular, in as much as regulatory policies reduce the pool of high-risk financial projects, they may affect economic activity and growth and limit efficient resource allocation. Taken together, the results suggest that regulatory policies have the potential to make a significant effect on long-run growth, but more work is required.

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Appendix A. Country Sample and Data Sources

Country Sample (78)

Albania, Algeria, Argentina, Australia, Austria, Azerbaijan, Bangladesh, Belarus, Belgium, Bolivia, Bulgaria, Burkina Faso, Cameroon, Canada, China, Colombia, Costa Rica, Cote d’Ivoire, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Ethiopia, Finland, France, Germany, Ghana, Greece, Guatemala, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Kenya, Korea Republic, Latvia, Madagascar, Malaysia, Mexico, Morocco, Mozambique, Netherlands, New Zealand, Nicaragua, Nigeria, Norway, Pakistan, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Russian Federation, Senegal, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Tanzania, Thailand, Tunisia, Turkey, Uganda, Ukraine, United Kingdom, USA, Uruguay, Zimbabwe.

Table A1
Variables description and sources.

Variable	Definition	Source
Dependent		
Growth rate of GDP per capita	Annual percentage growth rate of GDP per capita based on constant local currency.	World Bank, *WDI*
Control Set		
Initial GDP per capita	Logarithm of GDP per capita in constant 2005 USD for the first year of each period average.	World Bank, *WDI*
Education	School enrollment rate, secondary (% gross), for the first year of each period average.	World Bank, WDI
Population growth rate	Population growth (annual%).	World Bank, WDI
Investment	Gross capital formation (% of GDP).	World Bank, *WDI*
Trade	Trade (% of GDP).	World Bank, *WDI*
Government consumption	General government final consumption expenditure (% of GDP).	World Bank, *WDI*
Inflation	Inflation, GDP deflator (annual%).	World Bank, *WDI*
Institutions	ICRG Indicator of Quality of Government (icrg_qog). It is the mean value of the ICRG variables of "Corruption", "Law and Order", and "Bureaucracy Quality", scaled 0–1, with higher values indicating higher quality of government. The data only go back to 1984. For earlier periods, we set the variable to be equal to its 1984 value.	QOG Institute, University of Gothenburg
Private credit	Private credit by deposit money banks and other financial institutions (% of GDP).	Beck et al. (2009), Revised version of November 2013
Capital Flows		
Total capital flows	Sum of FDI, Portfolio equity, Debt securities, net inflows (% of GDP).	World Bank, *WDI* & International Monetary Fund, *IFS*
FDI flows	Foreign direct investment, net inflows (% of GDP).	World Bank, *WDI*
Equity flows	Portfolio equity, net inflows (% of GDP).	World Bank, *WDI*
Debt flows	Debt securities, net inflows (% of GDP)	International Monetary Fund, *IFS*
Capital account flows	Net capital flows (-CA/GDP), (-1)*CA Balance (% of GDP).	Alfaro et al. (2014)
Capital account flows (aid adjusted)	Aid-adjusted Net capital flows (% of GDP). Computed as "Capital account flows" minus "Aid receipts".	Alfaro et al. (2014)
Total private capital flows_IFS	Sum of FDI, Portfolio equity, total debt from private sources flows (% of GDP), constructed from IFS and WB data.	Alfaro et al. (2014)
FDI flows_IFS	Foreign direct investment, net and gross inflows (% of GDP), constructed from IFS data.	Alfaro et al. (2014)
Equity flows_IFS	Portfolio equity, net and gross inflows (% of GDP), constructed from IFS data.	Alfaro et al. (2014)
Debt flows_IFS	Total debt net and gross flows (% of GDP). Includes portfolio debt and other investment flows, constructed from IFS data.	Alfaro et al. (2014)
Total private capital flows_LM	Sum of FDI, Portfolio equity, total debt from private sources flows (% of GDP), constructed from Lane and Milesi-Ferretti (2007) and WB data.	Alfaro et al. (2014)
FDI flows_LM	Foreign direct investment, net and gross inflows (% of GDP), constructed from Lane and Milesi-Ferretti (2007) and WB data.	Alfaro et al. (2014)
Equity flows_LM	Portfolio equity, net and gross inflows (% of GDP), constructed from Lane and Milesi-Ferretti (2007) and WB data.	Alfaro et al. (2014)
Debt flows_LM	Total debt net and gross flows (% of GDP). Includes portfolio debt and other investment flows, constructed from Lane and Milesi-Ferretti (2007).	Alfaro et al. (2014)
Private debt flows	Total debt flows from private creditors (% of GDP).	Alfaro et al. (2014)
Public debt flows	Net public debt flows (% of GDP).	Alfaro et al. (2014)
Volatility of capital flows	Standard deviation of respective category of capital flows.	Author's calculations
Total flows	Total net and gross inflows (% of GDP).	Bluedorn et al. (2013)
Total private flows	Total private net and gross inflows (% of GDP).	Bluedorn et al. (2013)
FDI flows	Foreign direct investment, net and gross inflows (% of GDP).	Bluedorn et al. (2013)
Equity flows	Portfolio equity, net and gross inflows (% of GDP).	Bluedorn et al. (2013)
Debt flows	Total debt net and gross flows (% of GDP).	Bluedorn et al. (2013)
Bank flows	Net and gross other inflows to banks (percent of GDP).	Bluedorn et al. (2013)
Indicators of banking supervision		
Banking supervision	Enhancement of banking supervision over the banking sector is coded by summing up four dimensions: 1) Has a country adopted a capital adequacy ratio based on the Basle standard? (0/1); 2) Is the banking supervisory agency independent from executives' influence? (0/1/2); 3) Does a banking supervisory agency conduct effective supervisions through on-site and off-site examinations? (0/1/2); 4) Does a country's banking supervisory agency cover all financial institutions without exception? (0/1). These are assigned a degree of reform as follows. Highly Regulated = [3], Largely Regulated = [2], Less Regulated = [1], Not Regulated = [0].	Abiad et al. (2008)

Table A1 (*Continued*)

Variable	Definition	Source
Macroprudential index	Macroprudential Index (0–12, higher values indicate greater stringency) = LTV_CAP + DTI + DP + CTC + LEV + SIFI + INTER + CONC + FC + RR_REV + CG + TAX. Each of the indicators takes the value of 1 when in place and 0 otherwise. LTV_CAP: Loan-to-Value Ratio Caps which restricts to LTV used as a strictly enforced cap on new loans, as opposed to a supervisory guideline or merely a determinant of risk weights; DTI: Debt-to-Income Ratio which constrains household indebtedness by enforcing or encouraging a limit; DP: Time-Varying/Dynamic Loan-Loss Provisioning which requires banks to hold more loan-loss provisions during upturns; CTC: General Countercyclical Capital Buffer/Requirement which requires banks to hold more capital during upturns; LEV: Leverage Ratio which limits banks from exceeding a fixed minimum leverage ratio; SIFI: Capital Surcharges on SIFIs which requires Systemically Important Financial Institutions to hold a higher capital level than other financial institutions; INTER: Limits on Interbank Exposures which limits the fraction of liabilities held by the banking sector or by individual banks; CONC: Concentration Limits which limits the fraction of assets held by a limited number of borrowers; FC: Limits on Foreign Currency Loans which reduces vulnerability to foreign-currency risks; RR_REV: Foreign Currency and/or Countercyclical Reserve Requirements which restricts to RR when i) imposes a wedge on foreign currency deposits, or ii) is adjusted countercyclically; CG: Limits on Domestic Currency Loans which limits credit growth directly; and TAX: Levy/Tax on Financial Institutions which taxes revenues of financial institutions.	Cerutti et al. (2017)
Banking activity restrictions	Overall restrictions on banking activities (3–12, higher values indicate more restrictiveness) = Sum of "The extent to which banks may engage in underwriting, brokering and dealing in securities, and all aspects of the mutual fund industry (1–4)", "The extent to which banks may engage in insurance underwriting and selling (1–4)", and "The extent to which banks may engage in real estate investment, development and management (1–4)".	Barth et al. (2013)
Banking entry requirements	Entry into banking requirements (0–8, higher values indicate greater stringency) = Whether various types of legal submissions are required to obtain a banking license.	Barth et al. (2013)
External governance index	External governance index (0–19, higher values indicate better corporate governance) = Sum of "The effectiveness of external audits of banks (0–7)", "The transparency of bank financial statements practices (0–6)"," "The type of accounting practices used (0–1)", and "The evaluations by external rating agencies and incentives for creditors of the bank to monitor bank performance (0–5)".	Barth et al. (2013)
Sensitivity Set		
Growth rate of GDP per capita	1. Annual percentage growth rate of GDP per capita based on each of the following purchasing-power-parity measures: 2. 1. Expenditure-side real GDP per capita at chained PPPs (in mil. 2011US$) 3. 2. Output-side real GDP per capita at chained PPPs (in mil. 2011US$) 4. 3. Expenditure-side real GDP per capita at current PPPs (in mil. 2011US$) 5. 4. Output-side real GDP per capita at current PPPs (in mil. 2011US$) 6. 5. GDP per capita, PPP (constant 2011 international $) 7. GDP per capita, PPP (current international $)	Penn World Tables 9.0 Penn World Tables 9.0 Penn World Tables 9.0 Penn World Tables 9.0 World Bank, *WDI* World Bank, *WDI*
High income countries	Dummy for high income countries (income groups according to 2008 GNI per capita).	World Bank, Atlas method
Medium income countries	Dummy for medium income countries (income groups according to 2008 GNI per capita).	World Bank, Atlas method
Low income countries	Dummy for low income countries (income groups according to 2008 GNI per capita).	World Bank, Atlas method
SSA	Dummy for Sub-Sahara African countries	
Francophone	Dummy for Francophone SSA countries = Benin, Burkina Faso, Burundi, Cameroon, the Central African Republic (CAR), Chad, the Comoros, the Democratic Republic of the Congo (DRC), the Republic of Congo, Côte d'Ivoire, Djibouti, Gabon, Guinea, Madagascar, Mali, Mauritania, Niger, Senegal, and Togo.	
WAEMU	Dummy for West African Economic and Monetary Union (WAEMU/BCEAO) countries, which is a group with uniform bank regulations and supervisory practices = Benin, Burkina Faso, Cote d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, Togo.	
Euro Area	Dummy for Euro Area countries, which is a group with uniform bank regulations and supervisory practices = Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Portugal, Slovak Republic, Slovenia, Spain.	
Volatility of capital flows_COV	Coefficient of variation of respective category of capital flows.	Author's calculations

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