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Do capital controls help to manage capital flows in developing countries? Evidence from linear and nonlinear panel estimations*

Büşra Kuzucu[a], Zühal Kurul[b]**

[a] *Senior Expert, The Scientific and Technological Research Council of Türkiye (TÜBİTAK), Çankaya, Ankara, 06100, Türkiye. E-mail: kuzucu.busra@ogr.hbv.edu.tr. ORCID: https://orcid.org/0000-0003-2473-3818*

[b] *Ph.D., Assoc. Prof., Hacettepe University, Faculty of Economics and Administrative Sciences, Department of Economics, Beytepe, Ankara, 06800, Türkiye. E-mail: zkurul@hacettepe.edu.tr. ORCID: https://orcid.org/0000-0001-9677-8260*

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ABSTRACT

With the recognition of risks arising from the increasing volume and volatility of capital flows, particularly after the global financial crisis, many developing countries have started to impose capital controls to cope with macro-financial instability. To improve our understanding of the role of capital controls in managing capital flows, this study investigates whether restrictions on inflows and outflows have an impact on gross flows. Further, this paper questions whether the financial development level of countries has a role in the effectiveness of capital control policies. Utilizing a dataset encompassing 44 developing countries from 1998 to 2017 and employing linear and nonlinear panel data techniques, the findings indicate that tighter outflow controls lead to a decrease in gross outflows. In contrast, the gross inflows and the volatility of each flow do not significantly respond to the increases in restrictions. The results of further investigation based on nonlinear estimations reveal that when countries go beyond a certain threshold level of financial development, tighter capital controls lead to a reduction in the size of gross inflows.

Sermaye kontrolleri gelişmekte olan ülkelerde sermaye akımlarını yönetmeye yardımcı olur mu? Doğrusal ve doğrusal olmayan panel tahminlerinden elde edilen kanıtlar

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ÖZ

Özellikle Küresel Finansal Krizin ardından, sermaye akımlarının büyüklüğü ve oynaklığında artışa neden olan risklerin farkına varılmasıyla birlikte, pek çok gelişmekte olan ülke sermaye kontrollerini daha yoğun kullanmaya başlamıştır. Bu makale, sermaye kontrollerinin sermaye akımlarını yönetmekteki rolünü daha iyi anlamak için brüt

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** Corresponding author

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sermaye girişlerini ve çıkışlarına uygulanan kısıtlamalarının bu akımlar üzerindeki etkisi olup olmadığını incelemektedir. Ayrıca bu çalışma ülkelerin finansal gelişmişlik düzeyinin sermaye kontrollerinin etkililiğinde bir rol üstlenip üstlenmediğini sorgulamaktadır. 1998 ve 2017 yılları arasında kırk dört gelişmekte olan ülkeyi içeren, doğrusal ve doğrusal olmayan panel veri tekniklerini kullanan bir veri seti kullanılarak elde edilen sonuçlara göre, daha sıkı sermaye kontrolleri brüt sermaye çıkışlarını azaltmada etkili olmaktadır. Bunun yanı sıra, brüt sermaye girişleri ve oynaklık kısıtlamalardaki artışa anlamlı bir tepki vermemektedir. Ancak, ülkeler belirli bir finansal gelişme seviyesinin üzerine çıktıklarında, daha sıkı sermaye kontrollerinin brüt girişlerin büyüklüğü üzerinde bir azalmaya yol açtığı görülmektedir.

1. Introduction

Since the late 1980s, developing countries have experienced an increased integration into the global economy by attracting substantial capital flows. This rise in global integration reflects the increased capital mobility through financial liberalization reforms that were successively put into practice in developing countries. Once a country gets rid of financial repression, its domestic savings augments, the cost of capital reduces with the increase in risk sharing, technology diffuses via direct investments and the financial sector gets stronger (Mendoza, Quadrini, and Rios-Rull, 2009). During the 1990s, these arguments have become more pronounced, and the world economy has witnessed a remarkable increase in foreign capital flowing to developing countries. As reported by Collier, and Dollar (2002), the foreign capital stock almost doubled compared to the mid-1970s and reached 22% of developing countries' total income in 1998. Although the 1997-1998 Asian Crisis instantly deteriorated the upward trend in the flow of capital to developing countries, global financial integration stepped up a new era in the 2000s with an acceleration.

As OECD (2011) reported, in 2007, the share of total external assets and liabilities in world GDP achieved a record high of 350%, marking a significant increase from 150% in 1996. In this new era, besides the remarkable capital inflow surges to developing countries, they frequently have come upon sudden stops, capital reversals, and flights. Therefore, scholars began to question whether higher financial integration is sufficient to benefit from foreign capital while the risks of large and volatile inflows threaten the developing countries' macro-financial stability. Particularly, after the successive financial and currency crises in developing areas and increasing distress in the global economy the enthusiastic view on greater financial liberalization started to fade away. The costs of large and volatile flows became more apparent in the global financial crisis (GFC). It caused high turbulence in financial markets, a considerable collapse in trade flows, and ultimately, a severe recession that halted the growing momentum of capital inflows. Even though a few developing countries handled this turbulence better than developed countries, many of them rapidly fell into this weak global environment and experienced strong capital flow reversals, increased financial instability, and high exposure to foreign shocks. Following the GFC, scholars and policymakers started to research a new macroeconomic toolkit that could mitigate the risks of substantial and unpredictable capital flows. In pursuit of new policies, even the International Money Fund (IMF) began advocating the adoption of capital flow management measures (CFMs) in certain circumstances. The renewed interest of the IMF to limit capital flows is documented in the New Institutional View. As noted in Arora, Habermeier, Ostry and Weeks-Brown (2013)[1], this view encourages the use of CFMs but limits them to being temporary, and in line with market conditions.

The trend of capital flows and shifts in policies in the last three decades explained above enable us to categorize the global policy environment into two distinct periods. The first is the pre-crisis

[1] This policy note is first published by the IMF in 2012, and then Arora et al. (2013) presented the extended version.

environment evolved towards complete liberalization of capital accounts (pre-2008 policy environment), and the second is the post-crisis environment based on the promotion of CFMs. In the first, the goal is capital account liberalization. Implying that higher openness and deregulated financial markets are likely to be efficient and stable. Thus, only exogenous sources could threaten the stability of financial markets. To cope with exogenously driven disruptions, CFMs can only be supported if they are temporary, and policymakers should not substitute these measures for self-adjustment mechanisms. However, the latter underlines that large and volatile capital flows can cause financial instability. In cases of premature and not properly completed capital account liberalization processes, counties may apply inflow and/or outflow measures (Arora et al., 2013). Although this policy environment reflects a tendency to withdraw self-adjusting mechanisms to stabilize the macro-financial climate, the IMF emphasizes that these restrictive measures should only be used as a final device after all the typical tools of macroeconomic adjustment are exercised. Thus, the CFMs are likely to be the second-best policy. If the market is unable to adjust interest rates and exchange rates through conventional monetary policy, employing CFMs may be appropriate. In this new policy environment, academic research started to focus on which of the measures are effective in avoiding the risks of unstable and large capital flows. Kose, Prasad, Rogoff, and Wei (2009), Magud, Reinhart and Rogoff (2011), Ostry (2012), Forbes, Fratzscher and Straub (2015), Abraham and Schmukler (2018), and Perri and Quadrini (2018) have put much emphasis on capital controls as a well-known measure. They argue that capital controls may help reduce risks such as appreciation of the domestic currency, large inflows, loss of monetary autonomy, and financial fragility caused by external turbulences.

The above-mentioned debates have led to a rise in the number of theoretical and empirical studies questioning the effectiveness of capital controls in recent years. The theoretical studies have grown in three dimensions. The first is based on modeling capital controls as a tool to reduce financial frictions and mitigate externalities arising from the over-borrowing incentive of economic agents (Bianchi and Mendoza, 2010; Jeanne and Korinek, 2010; Devereux, Young and, Yu, 2019). The main argument of these studies is that if the economy faces with fall in demand and prices and negative balance sheet effects, it tends to borrow excessively in the short term and exacerbate the existing financial vulnerabilities. Thus, capital controls may serve as an effective policy option to cope with such externalities. Rey (2015) supports this view by documenting that macroprudential policies and capital controls are complementary to macroeconomic policies when financial fragility increases. The second dimension is about the role of capital control in changing the terms of trade (Costinot, Lorenzoni, and Werning, 2014; Farhi and Werning, 2014). In this dimension, the proposed tool to limit capital flows is taxing capital inflows. With a tax on capital, a reduction in the international price of a product after a productivity shock can be compensated and the control policy can delay the shift of investment to the more productive country. Lastly, Kitano and Takaku (2017) concentrate on the implications of using capital controls as instruments to alleviate financial frictions in the financial sector. They presume that the efficacy of capital controls in improving welfare grows with the decrease in financial friction. In support, Devereux et al. (2019) confirm that capital controls increase the impact of monetary policy when financial frictions decline.

Besides the increased number of theoretical studies, the empirical literature has also gained momentum in recent years. The empirical studies can be separated into two categories. At the outset, case studies focus on individual developing countries' capital control policies such as India, Malaysia, Thailand, and Chile. All these countries restrict capital flows during the mid-1990s and the early 2000s. However, among these countries, the implementation of restrictions differs in timing and coverage and hence in effectiveness. It seems that there is a lack of consensus regarding the effectiveness of capital controls in this set of studies (Edwards, 2009, Magud, Reinhart, and Rogoff, 2018). The second category examines the effects of CFMs on various macroeconomic factors, including the volume of capital flows, exchange rates, and interest rate differentials. The empirical evidence in cross-country analysis seems ambiguous, but the findings seem to be salient. In the period from 2009 to 2011, Forbes (2015) found that the influence of capital controls remains limited on net capital inflows for 60 developed and developing nations. The results of Blundell-Wignall and Roulet (2015) and Zhang and Zoli (2014) affirm the limited impact of CFMs. Specifically, Zhang and Zoli (2014) document that the restrictive policies are not influential in reducing the overall credit growth for 46 developing countries,

while they become effective in moderating housing price booms and reducing the volume of equity flows in a group of countries excluding the Asia region. By using 17 developing counties between 2001 and 2011, Pasricha, Falagiarda, Bijsterbosch, and Aizenman (2018) show that the impact of capital controls on the net inflows is still limited but this effect diminishes over time. Additionally, their research finds that capital controls are effective almost on gross outflows. Fernández, Rebucci, and Uribe (2015) examine 78 countries between 1995 and 2011 and show that capital controls are acyclical. Bruno, Shim, and Shin (2015), De Crescenzio, Golin, and Molteni (2017), and Beirne and Friedrich (2017) contribute to this discussion by investigating bank inflows and showing that capital controls can be influential in shaping the composition of capital flows. Nispi Landi and Schiavone (2021) investigate the effectiveness of capital controls and reveal that they are effective in reducing the volume and volatility of capital flows by using a large set of developed and developing countries from 1997 to 2017. Nispi Landi and Schiavone (2021) report that capital controls yield more effective results than controls in developed countries, and thus these policies can be appropriate for ensuring financial stability in developing countries.

Other recent articles contributing to the literature are Suh (2022), Zehri, Ammar, and Youssef (2023), Jain and Dubey (2024), Liao, Meng, Ren, and Zhang (2024). Suh (2022) analyzes the relationship between capital controls and capital flows with quantile regression methodology and concludes that restrictive policies can be implemented by considering the volume of capital flows, that is capital control policies yield more effective results in a country with large capital flows. Zehri, Ammar, and Youssef (2023) examine the effectiveness of control policies in ensuring financial stability in both developed and developing countries using a dynamic panel logit model. They find that capital controls are likely to reduce the risk of banking crises and ensure financial system stability, while they lead to lower economic growth. Jain and Dubey (2024) investigate the impact of capital controls in insulating emerging market economies from financial shocks. Their findings indicate that capital controls can reduce the impacts of global and financial shocks. They also suggest that countries benefit from capital controls when they target specific asset inflows. Finally, Liao, Meng, Ren, and Zhang (2024) examine capital controls from three perspectives, namely capital types, inflow intensity, and channel diversity. Their empirical results show that capital controls are more effective in countries with a lower degree of capital account openness and when short-term capital inflows dominate during a period of intense inflows.

This paper emphasizes the role of capital controls in regulating capital flows. Covering the sample of 44 developing countries[2] for 1998-2017, this study employs linear and nonlinear panel estimation techniques to determine the impacts of capital controls on the magnitude and volatility of gross flows. Our empirical investigation employs a dual-phase methodology to assess the efficacy of capital controls. Initially, through the utilization of linear models, the study endeavors to examine the marginal impacts of capital controls on gross flows. Secondly, this article put forward the conditional role of financial development on the efficacy of capital controls. Kose et al. (2009), Ostry (2012), and Bush (2019) inspired us to quantitatively assess the influence of financial development on the association between capital controls and capital flows. The idea behind these studies is the possible efficiency gains from a sound financial system that can increase the policy implementation capabilities of countries and facilitate the functioning of markets in the presence of capital controls. Kose et al. (2009) and Ostry (2012) claim that a stronger financial system may catalyze the impacts of capital account policies. Even, Kose et al. (2009) draw attention to the possibility of certain thresholds for financial development that change the effectiveness of financial openness policies for countries that are prone to risks of financial crisis. While Kose et al. (2009) and Ostry (2012) do not offer empirical outcomes, Bush (2019) empirically investigates the association between financial development and the effectiveness of capital account policies. Bush (2019) clarifies the influence of financial development by introducing an interaction term that entails the multiplication of the CFMs by the degree of financial

[2] This study includes the following countries: Bangladesh, Bolivia, Brazil, Bulgaria, Chile, China, P.R.: Mainland, Colombia, Czech Republic, Ecuador, Egypt, Arab Republic of, El Salvador, Guatemala, Hungary, Iceland, India, Indonesia, Jamaica, Kazakhstan, Republic of, Kenya, Korea, Republic Of, Kuwait, Kyrgyz Republic, Latvia, Malaysia, Mexico, Moldova, Republic of, Morocco, Nigeria, Pakistan, Paraguay, Peru, Poland, Republic of, Romania, Russian Federation, Saudi Arabia, Slovenia, Republic of, South Africa, Sri Lanka, Thailand, Togo, Tunisia, Turkey, Uganda, Ukraine.

development. Bush's (2019) way of exploring the role of financial development may not be implicative for possible thresholds suggested by Kose et al. (2009) and it may be insufficient to provide evidence for a threshold of financial development that is determined endogenously. This study proceeds to its further analysis with the inspiration of these studies and then, makes its way of determining certain thresholds for financial development that may alter the effectiveness of capital controls. Unlike Bush (2019), our methodology follows Hansen's (1999) panel threshold estimation and involves a nonlinear procedure in capturing endogenously produced financial development thresholds.

The findings of this study indicate that countries that restrict outflows can reduce the level of outflows while inflow restrictions do not alter the level of inflows. However, it is possible to reduce inflows when the financial development level of a country surpasses a certain threshold. Also, the results on volatility show that gross flows are unresponsive to changes in capital controls.

The contribution of our research is twofold. Firstly, it advances the existing literature by paying deeper attention to the dimensions of both the magnitude and volatility of capital flows. Secondly, this article has an additional perspective allowing the conditions that can alter the association between capital controls and flows. Particularly, the condition questioned in this study is the financial development level of countries. Our empirical evidence supports those higher levels of financial development leadto a reduction in the level of inflows when inflow restrictions are put into practice. Thus, the second contributing dimension of this study is providing empirical evidence on the mediating effect of financial development on the effectiveness of inflow controls. As far as we know, this study represents a pioneering work, demonstrating the conditional impact of financial development on the management of capital flows through the application of a panel threshold model.

The structure of the article is as follows. The next section summarizes the methodology and provides an overview of the data. The third section assigns the patterns of gross flows and capital controls during pre- and post-crisis periods. The fourth section articulates the empirical findings, and the concluding section presents the concluding remarks.

2. Methodology and data

2.1. Methodology

This study employs panel data estimation methods to examine the impact of capital controls (CACs)[3] on altering both the magnitude and volatility of gross capital flows. First, we build a linear model and estimate it by the Fixed Effects (FE) regressions. Secondly, to ascertain whether the impact of CACs depends on the degree of financial development, a nonlinear model is constructed and estimated by using Hansen's (1999) panel threshold regression techniques.

In the empirical part, our focus is on two key variables: the volume and the volatility of capital flows. To enhance our comprehension of the reactions of these variables to variations in capital flows, we proceed to estimate the following models:

$$CI_{it}^{c} = \alpha + \beta_1 CAI_{it-1} + \beta_2 P_{it-1} + \omega_t + \delta_i + \varepsilon_{it} \quad (1)$$

$$CO_{it}^{c} = \alpha + \beta_1 CAO_{it-1} + \beta_2 P_{it-1} + \omega_t + \delta_i + \varepsilon_{it} \quad (2)$$

where $i$represent countries and $t$is time.

In the above equations, CI_{it}^{c} and CO_{it}^{c} represents the gross inflows and outflows respectively. The superscript 'c' denotes the specific category of capital flow (Portfolio investment, FDI, and other investment flows). CAI_{it-1} And CAO_{it-1} are the capital controls imposed on gross inflows and outflows, respectively. P_{it-1}on the vector comprising control variables. The control variables are push and pull factors, expected to determine the behavior of capital flows. We include global liquidity and global risk as push factors. These variables reflect changes in the global environment concerning the risk profile of worldwide financial markets, risk sensibility, and prevailing global liquidity conditions. The set of pull factors consists of conventional domestic factors (trade openness, real GDP growth, inflation rate, and financial development). In each equation, time and country fixed effects are denoted by ω_t and δ_i, and

[3] From now on, we use CACs to express capital controls.

the error term is represented by ε_{it}. To alleviate the potential endogeneity problem, we use the first lags of all explanatory variables, as proposed by Nispi Landi and Schiavone (2021). To alleviate autocorrelation and heteroscedasticity, the standard errors are converted to the Driscoll and Kraay (1998) ones during the estimation process.

To analyze the impact of CACs on the volatility of capital flows, the following models are constructed:

$$VCI_{it}^{c} = \alpha + \beta_1 CAI_{it-1} + \beta_2 P_{it-1} + \omega_t + \delta_i + \varepsilon_{it} \quad (3)$$

$$VCO_{it}^{c} = \alpha + \beta_1 CAO_{it-1} + \beta_2 P_{it-1} + \omega_t + \delta_i + \varepsilon_{it} \quad (4)$$

where $i = 1, \dots, N$ and $t = 1, \dots, T$.

The above equations, VCI_{it}^{c} and $VCO_{it}^{c}$are the measures of the volatility in gross inflows and outflows, respectively. All explanatory variables stay the same with the equations (1) and (2). To calculate the volatility, we follow Broto, Díaz-Cassou, and Erce (2011) and Li and Rajan (2015) and apply two distinct methodologies. The first method is based on the rolling windows approach and can be shown as follows:

$$\tau_{it} = \left(\frac{1}{n}\sum_{k=t-(n-1)}^{t}(capitalflow_{ik} - \mu)^2\right)^{1/2} \quad (5)$$

$$\mu = \frac{1}{n}\sum_{k=t-(n-1)}^{t} capitalflow_{ik} \quad (6)$$

This calculation method is common in the academic literature owing to its simplicity and suitability (Neumann, Penl, and Tanku, 2009; IMF, 2007). It computes volatility by employing the standard deviation of capital flows within a rolling window of annual data.

The second method is based on computing the variance of capital flows by ARIMA estimation. This approach makes use of the absolute values of residuals derived from a fitting ARIMA model. In our empirical analysis, ARIMA (1 1 0) better fits the data and thus, we proceed by predicting the residuals of this model.

We broaden the empirical analysis by establishing a nonlinear model, enabling us to examine the influence of financial development on the efficacy of CACs. The estimation of this nonlinear model relies on Hansen's (1999) panel threshold regression. Our choice is based on two criteria. First, if the link between two variables varies across individual units, the traditional FE estimation which only allows for the heterogeneity in intercepts becomes ineffective. As the model requires estimating different slope coefficients, we need to proceed with approaches that consider varying slopes. Among them, Hansen's (1999) approach seems to be appropriate due to its simple specification in showing the changing character of the relationship in panel data. Hansen (1999) simply divides the overall sample into one or more subsamples by allowing for one or more thresholds. The presence of thresholds implies that the relationship becomes non-linear, and the new samples determined by these thresholds represent different regimes. For instance, in the presence of one significant threshold, the whole sample can be separated into two regimes upper and lower regimes and thus, the slopes under these regimes may vary. Second, Hansen's (1999) approach helps to reach policy implications. If the threshold variable that potentially alters the relationship is the policy or state variable that characterizes the economic environment or policy regimes, Hansen's (1999) approach becomes very practical in implying policies.

The threshold variable in our model is financial development, which represents the degree of access to financial instruments available to individuals. Therefore, it sounds well to employ a panel threshold regression to identify the heterogeneity across slopes in different regimes such as lower and upper financial development regimes. The signs and significance levels of slope coefficients can change under these regimes. If this is the case, policy formulation on the effective utilization of restrictions in CI and CO is required to be revised according to the outcomes of the model. More importantly, Hansen's (1999) panel threshold model can determine the threshold level endogenously. For empirical safety, the endogenous thresholds avoid imposing exogenous or a priori levels of thresholds. Thus, the employment of Hansen's (1999) model holds promise for advancing our comprehension of the nuanced relationship between CACs and capital flows, contingent upon the level of financial development.

We conduct estimations to assess the impact of CACs on the magnitude of capital flows, incorporating a threshold, through the following models:

$$CI_{it}^{c} = \beta_0 + \beta_1 CAI_{t-1}(fin\_dev_{it-1} \leq \gamma) + \beta_2 CAI_{t-1}(fin\_dev_{it-1} > \gamma) + \beta_3 P_{it-1} + \varepsilon_{it} \quad (7)$$

$$CO = \beta_0 + \beta_1 CAO_{t-1}(fin\_dev_{it-1} \leq \gamma) + \beta_2 CAO_{t-1}(fin\_dev_{it-1} > \gamma) + \beta_3 P_{it-1} + \varepsilon_{it} \quad (8)$$

Similarly, the threshold models for the volatility of capital flows in the presence of a threshold are as follows:

$$VCI_{it}^{c} = \beta_0 + \beta_1 CAI_{t-1}(fin\_dev_{it-1} \leq \gamma) + \beta_2 CAI_{t-1}(fin\_dev_{it-1} > \gamma) + \beta_3 P_{it-1} + \varepsilon_{it} \quad (9)$$

$$VCO_{it}^{c} = \beta_0 + \beta_1 CAO_{t-1}(fin\_dev_{it-1} \leq \gamma) + \beta_2 CAO_{t-1}(fin\_dev_{it-1} > \gamma) + \beta_3 P_{it-1} + \varepsilon_{it} \quad (10)$$

equations (7) to (10), fin_dev_{it-1} represents the threshold variable. CAI_{t-1} and CAO_{t-1} are regime-dependent variables. The vector P_{it-1} shows the control variables involving push and pull factors. γ is the threshold level that is endogenously estimated and ε_{it} is the error term. In all equations above, β_1 serves as the coefficient of the CACs under the lower regime (low-financial development regime). β_2 Refers to the coefficient of the CACs under the upper regime (high-financial development regime).

Within the scope of the panel threshold model, the first step requires estimating the endogenous threshold. To accomplish this, Hansen (1999) proposed taking individual-specific means from the observed data. Subsequently, all variables are arranged in ascending order based on the assigned threshold values. In the end, the sum of the squares residuals is found by trimming the η % of the de-averaged data. Once the threshold value appears, it is suitable to proceed with the estimation of the coefficients of regime-dependent and regime-independent variables by using panel fixed effects regressions.

2.2. Data

In this part, the data on gross capital inflows (CI) and gross capital outflows (CO) is obtained from the IMF Balance of Payments Statistics (BPM6), denominated in US dollars. The data is converted into percentage shares of the GDP. The data for CACs is taken from the dataset provided by Fernández, Klein, Rebucci, Schindler, and Uribe (2016) The control variables are some of the well-known determinants of capital flows (Li and Rajan, 2015; Koepke, 2019; Cerutti, Claessens, and Puy, 2019). the push factors are global risk and global liquidity, whereas the pull factors are trade openness, real GDP growth, inflation rate, and the financial development index. Global liquidity is determined by calculating the weighted average of broad money growth of Japan, Canada, the Euro area, and the United States. The global risk is represented by the implied volatility observed in the S&P 500 index options, commonly denoted as VIX. The real GDP growth demonstrates the growth in economic activity. Trade openness is defined as the ratio of the sum of exports and imports to the GDP. The inflation rate is measured as the percentage change in the consumer price index implying macroeconomic stability. Financial development is quantified through an index that gauges the accessibility, efficiency, and depth of the financial sector. The Financial Development Index is extracted from the IMF database. The remaining pull factors are taken from the World Bank World Development Indicators.

In the empirical analysis, the selection of data for CACs is an important step. We have several reasons to utilize the dataset compiled by Fernandez et al. (2016). First, in this dataset, authors separate the CACs as inflow restrictions and outflow restrictions by considering the policy targets. This allows us to work with relatively disaggregated measures of CACs. Second, this dataset is on an annual basis which better fits our empirical model. Third, it unbundles capital account restrictions as portfolio investment inflows/outflows, FDI inflows/outflows and other investment inflows/outflows. In sum, the dataset of Fernandez et al. (2016) presents us with granular, disaggregated, and practical information about CACs.

3. Patterns of gross capital flows between 1998-2017

In this part of the study, we overview the patterns of gross flows between 1998-2017.

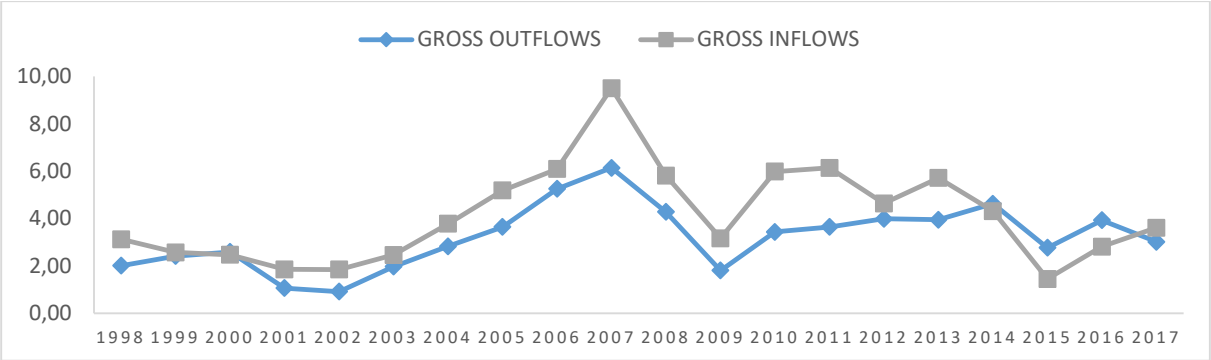

Figure 1. Patterns of capital flows. (Source: International Monetary Fund, International Financial Statistics, 2021).

Figure 1 illustrates the patterns of CI and CO between 1998 and 2017 (% of GDP). As depicted in Figure 1, there is an ascending trend in gross flows during the early 2000s. In 2007, they reached their historical peaks. However, the Global Financial Crisis in 2008 caused a substantial reduction and altered the increasing trend in gross flows. This makes an important difference between pre-crisis and post-crisis episodes. In the former, gross flows in developing countries are in an ongoing surge while in the latter they are relatively unstable. After the crisis, gross flows declined to levels of the late 1990s and fluctuated at relatively lower levels than in the pre-crisis period. This may be either due to the global business cycle or the increasing hesitation of investors to invest in developing countries. During the post-crisis era, a remarkable policy landscape emerged, marked by the notable deployment of CACs. In this period, developing nations initiate a trend of intensifying restrictions on capital flows, despite a simultaneous increase in global liquidity resulting from quantitative easing measures in advanced economies. This novel policy orientation, encompassing diverse forms of CACs and macroprudential policies, holds the potential to result in declines in gross flows. This observed pattern underscores the inclination of developing countries to mitigate the risks associated with financial instability.

Figure 1 provides insights into the symmetry or asymmetry between CI and CO. The conventional perspective posits a symmetry between these two variables, suggesting a likelihood of co-movement. Nevertheless, scholars such as Milesi-Ferreti and Tille (2011), Broner, Didier, Erce, and Schmukler (2013), and Avdjiev, Gambacorta, Goldberg, and Schiaffi (2017) contend that this anticipated co-movement diminishes in the post-crisis period. As illustrated in Figure 1, CI and CO exhibit parallel movements during the pre-crisis era, aligning with the conventional viewpoint. However, they follow an asymmetric path in the aftermath of the crisis period. These denote that the behavior of domestic and foreign investors against shocks is different after the crisis. This asymmetry may result from risk aversion behavior as argued by Broner et al. (2013). Particularly during periods of financial instability, foreign investors may exhibit hesitancy toward investment in developing countries, whereas domestic investors might be inclined towards investing in alternative destinations.

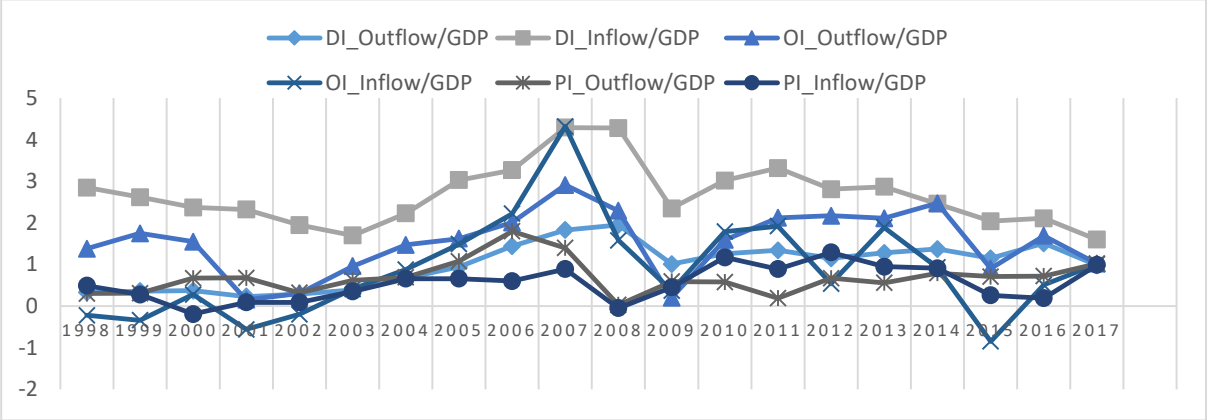

Figure 2. The trends of different types of gross inflows and outflows. (Source: International Monetary Fund, International Financial Statistics, 2021).

Figure 2 pictures the trajectories of various categories of CI and CO. As depicted, FDI inflows/outflows demonstrate an upward trend in the period spanning 2000-2007, culminating in their peak in 2007. After a shock in 2008, there was a notable contraction in international transaction volumes. In the post-crisis period, the volume of gross FDI flows fails to attain its pre-crisis levels. Following a modest recovery between 2009-2011, a downward trend in gross FDI flows becomes evident.

Although portfolio inflows have an increasing trend, they remain relatively volatile. We observe a decline in the second half of the 1990s due to the 1997-1998 Asian Crisis. Portfolio flows gathered momentum in the initial half of the 2000s and reached its peak in 2006. Nevertheless, after the substantial downturn in 2008, gross portfolio flows failed to attain their pre-crisis levels in the post-crisis era. Notably, Figure 2 highlights that gross portfolio flows manifest more abrupt fluctuations compared to other investment categories.

Other investment flows primarily encompass banking transactions. These flows exhibit an ascending trajectory from 2000 to 2007, reaching their peak in 2007. However, their decline following the crisis is more pronounced compared to FDI and portfolio investment. In the post-crisis period, the level of other investment flows remains half of the pre-crisis level and continues to follow an unstable pattern.

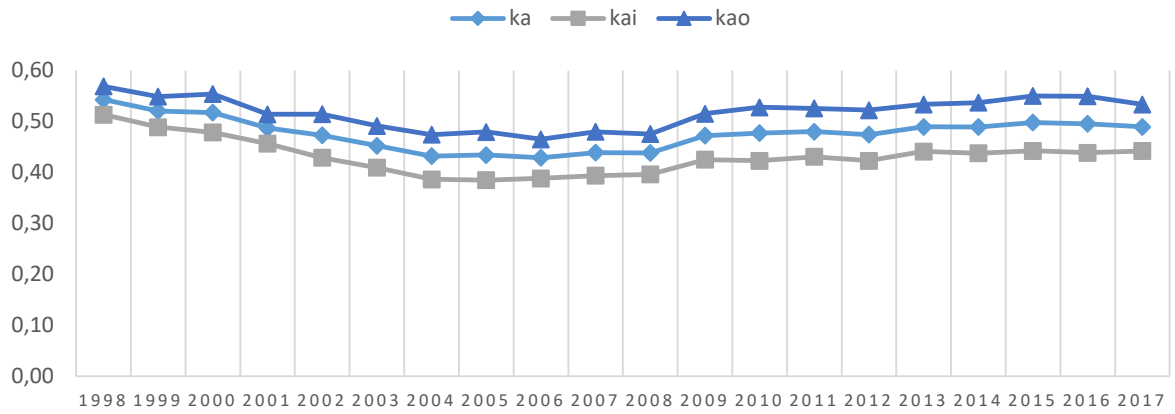

Figure 3. Trend of capital controls. (Source: Fernandez et al. (2016), 2021).

Figure 3 shows the average annual changes in CACs for 44 developing countries in our sample. The indices range from 0 to 1, with higher values indicating more stringent policies. ka, kai, and kao are indicative of the levels of total controls, controls on inflows, and controls on outflows, respectively.

As illustrated in Figure 3, the trend in the implementation of CACs has two distinct periods: a decrease in capital flow restrictions between 1998 and 2007 and an increase in capital flow restrictions between 2008 and onwards. The former reflects the traditional policy stance advocating the increasing financial liberalization and the latter indicates the new policy stance supporting the capital flows management policies in financially unstable episodes.

In Figure 3, it is seen that kao is always higher than kai. That is, developing countries tend to restrict domestic residents from investing in foreign destinations. This may be due to the fear of capital flight. In sum, developing nations have changed their view on CACs according to the new financial environment after the crisis, however, they are still prone to restrict inflows less than the outflows.

4. Empirical results

This section presents the empirical findings in two parts. Firstly, we show the results of the estimation of Equation (1-4). Secondly, we deliberate on the results of the panel threshold model, revealing the nonlinear influence of financial development on the relationship between CACs and CI and CO.

4.1. The relationship between capital controls and the volume and volatility of gross capital inflows and outflows

In this section, we employ models represented by Equations (1-2 and 3-4) to examine the relationship between CACs and the magnitude and volatility of gross flows. The findings are shown in Table 1. As seen, the first three columns are about gross inflows in terms of levels and volatility measures, respectively. The remaining is about gross outflows, in a similar vein. Columns (b) and (e) are for the volatility measured with the rolling windows method and columns (c) and (f) are for volatility measured from ARIMA (1 1 0) model.

Table 1

Estimation results: volume and volatility

VARIABLES	*(a)* *CI*	*(b)* *VOL(CI)$_1$*	*(c)* *VOL(CI)$_2$*	*(d)* *CO*	*(e)* *VOL(CO)$_1$*	*(f)* *VOL(CO)$_2$*
KAI/KAO	-8.613	-7.026	-3.388	-14.002**	5.372	3.529
	(10.922)	(6.245)	(3.850)	(5.843)	(7.509)	(2.978)
GR(VIX)	-0.209	0.096***	0.016*	0.035	0.052	-0.031
	(0.131)	(0.048)	(0.010)	(0.093)	(0.067)	(0.043)
GL	1.004**	0.377***	0.124***	0.872**	0.407***	0.003
	(0.455)	(0.063)	(0.046)	(0.360)	(0.085)	(0.063)
GROWTH	0.703**	-0.087	-0.175	0.521**	-0.125	0.006
	(0.295)	(0.079)	(0.117)	(0.218)	(0.175)	(0.059)
TRADE	-0.058	0.004	0.018*	-0.042	0.058	0.044***
	(0.055)	(0.024)	(0.009)	(0.380)	(0.038)	(0.012)
FD	30.040	12.173***	1.172	38.619**	4.266	-2.836
	(25.132)	(3.220)	(2.464)	(16.176)	(6.927)	(3.580)
INFL	0.014	0.064	0.045	0.098*	0.090	0.023
	(0.067)	(0.050)	(0.040)	(0.052)	(0.079)	(0.024)
CRISIS_2008	-6.977*	1.166	2.028***	-8.105**	3.017***	1.989***
	(4.067)	(0.874)	(0.391)	(3.176)	(1.014)	(0.540)
CONST	228.409	-2.351	0.429	-452.679	-7.752**	-2.327**
	(828.139)	(3.368)	(2.095)	(570.020)	(3.422)	(1.275)
# CNTR	44	44	44	44	44	44
# OBS	836	792	792	836	792	792
R2	0.059	0.045	0.056	0.088	0.017	0.031

Notes: *, **, and *** denote the significance levels of 10%, 5%, and 1%, respectively. The standard errors are presented within parentheses.

According to column (a), inflow restrictions do not affect the volume of gross inflows. But in column (d), higher outflow restrictions reduce the volume of gross outflows. This result indicates that CACs are effective only on the decisions of domestic residents to invest in foreign countries. Domestic residents tend to respond to the capital control policy, while foreign residents are insensitive to the changes. Our finding on the volume of gross inflows seems to be consistent with the results of Pasricha

et al. (2018), even Pasricha et al. (2018) consider the net inflows rather than gross inflows. Our finding on the volume of gross outflows is in a similar vein to the results of Nispi-Landi and Schiavone (2021).

Considering the coefficient estimates of push and pull variables, it is seen that an increase in global liquidity (GL) gives rise to CI and CO. However, the influence of global liquidity on CI surpasses its impact on CO. The size of gross flows remains unaffected by global risk (GR) suggesting that alterations in the risk level of financial markets influence the investment choices of both domestic and foreign residents. Among pull factors, the significant driver of CI is GDP growth. As the size of the market increases, the magnitude of the inflows rises. Likewise, there is a substantial positive correlation between GDP growth and CO. The influence of financial development on CI and CO exhibits disparities. An increase in financial development leads to an increased magnitude of CO, while it has no significant effect on CI. Additionally, inflation has a positive impact only on the magnitude of CO. The coefficient of the dummy variable, representing the impact of the 2008 crisis, is negative, indicating a breakdown in flows and crisis-driven increase in volatility.

As seen in the results for volatility (columns (b) and (c) for CI and columns (e) and (f) for CO) the volatility of gross flows remains unaffected by the implementation of CACs. Performing different measurement methods for volatility does not alter the results. These findings suggest that the volatility in the decisions of both domestic and foreign residents is insensitive to the changes in CACs.

When control variables are considered for the volatility, the evidence seems to be mixed. Observations indicate that the volatility of CI is positively influenced by global liquidity. However, its impact on CO is imprecise, only in column (e), it is positively significant. The global risk also has a positive effect on CI, but it is insignificant for the CO. These findings reveal that foreign investors tend to respond to global conditions more than domestic investors. Table 1 also shows that none of the pull factors precisely influence the volatility of gross flows.

All these results display the varying impacts of CACs. Even if large and unstable capital flows threaten the developing countries' macro-financial stability, implementing a more restrictive capital account policy may not simultaneously reduce the size and volatility of capital movements. Based on our empirical findings, it becomes evident that implementing stricter CACs may not necessarily ensure a reduction in both the magnitude and volatility of financial flows.

To make clear which categories of gross flows are more responding to the changes in CACs, we unbundle gross flows into FDI, portfolio, and other investments. We report the estimation results in Table 2.

Table 2

Estimation results: volume of different categories

VARIABLES	*(a) CI(FDI)*	*(b) CI(PORT)*	*(c) CI(OTHER)*	*(d) CO(FDI)*	*(e) CO(PORT)*	*(f) CO(OTHER)*
KAI/KAO	0.545	-4.592	-1.146	-2.999**	-1.532*	-3.410*
(FDI, PORT, OTHER)	(0.679)	(6.517)	(1.217)	(1.094)	(0.824)	(1.754)
GR(VIX)	-0.044	-0.055	- 0.106	-0.045	-0.005	0.099
	(0.043)	(0.072)	(0 077)	(0.030)	(0.029)	(0.067)
GL	0.318	0.119	0.588	0.131	0.202**	0.614***
	(0.244)	(0.155)	(0.353)	(0.165)	(0.081)	(0.198)

GROWTH	0.128*	0.177	0.408**	0.113*	0.083**	0.305**
	(0.064)	(0.137)	(0.192)	(0.065)	(0.037)	(0.142)
TRADE	-0.001	-0.027	-0.033	-0.010	0.005	-0.030
	(0.011)	(0.031)	(0.029)	(0.014)	(0.011)	(0.021)
FD	7.563	8.411	14.996	11.863*	7.039*	20.127**
	(7.084)	(8.471)	(16.114)	(5.876)	(3.595)	(8.974)
INFL	0.010	-0.047*	0.042	0.041**	0.012	0.029
	(0.017)	(0.023)	(0.041)	(0.018)	(0.012)	(0.022)
CRISIS_2008	-0.586	-2.542*	-3.851	-0.810	-2.511***	-5.037***
	(1.478)	(1.432)	(3.029)	(1.225)	(0.857)	(1.650)
CONST	-0.512	2.454	-1.750	-1.015	-1.443	-6.519**
	(3.496)	(2.324)	(6.900)	(2.613)	(1.943)	(2.972)
# CNTR	44	44	44	44	44	44
# OBS	836	836	836	836	836	836
R^2	0.063	0.026	0.049	0.053	0.047	0.080

Notes: *, **, and *** denote the significance levels of 10%, 5%, and 1%, respectively. The standard errors are presented within parentheses.

In Table 2, columns (a)-(c) report the results for gross inflows of FDI, portfolio investment, and other investment respectively, and columns (d)-(f) present the results of gross outflows of FDI, portfolio investment, and other investments. The results confirm previous findings for aggregate flows by indicating that all subcategories of gross inflows do not respond to the changes in CACs while all subcategories of CO are negatively affected by CACs. As seen in Table 2, outflow restrictions affect other investment outflows more than FDI and portfolio outflows. Increasing the restrictions on other investment flows leads to a decline in banks' and corporates' debt and equity flows. This evidence indicates that implementing tighter capital flow policies can melt down the buildup of private outflows led by the banking sector in developing countries.

When the effects of control variables are considered, global risk, as a push factor, has no impact on the volume of each type of gross capital movement. Nevertheless, there is a noteworthy positive impact of global liquidity on gross portfolio investment outflows. Real GDP growth remains an important driver of all categories of gross flows except the gross portfolio investment inflows. This finding can be stemmed from the idea advocating the pro-cyclicality of capital flows. In other words, there may be a tendency for gross portfolio inflows to increase in higher growth periods and vice versa. Financial development has no significant effect on inflows of FDI, portfolio investment, and other investment, while it positively affects all types of CO. Unlike aggregate inflows, inflation appears to significantly influence gross portfolio inflows, indicating that an increase in inflation brings about a decrease in the size of gross portfolio inflows. Since portfolio inflows are more sensitive to the expected yields, increases in inflation may become distortionary in investment decisions. In contrast, inflation exerts a meaningful and positive influence on gross foreign direct investment outflows. This implies that a domestic environment characterized by inflation might enhance the willingness of domestic residents to engage in acquiring foreign assets through direct foreign investment. In summary, the

outcomes related to control variables appear to align with the findings of previous literature on the determinants of capital flows.

4.2. The threshold effects of financial development on capital control policies

In this segment of the empirical analysis, we explore the potential influence of the financial development level on the efficacy of CACs through the estimation of Equations (7) and (8). We utilize Hansen's (1999) panel threshold regression method and present the findings in Table 3.

Table 3

Estimation results of panel threshold regression

VARIABLES	*(a)* *CI*	*(b)* *CO*	*(c)* *VOL(CI)$_1$*	*(d)* *VOL(CI)$_2$*	*(e)* *VOL(CO)$_1$*	*(f)* *VOL(CO)$_2$*
THRESHOLD VALUE	0.520**	0.470	0.390	0.430	0.520	0.520
KAI/KAO_LOWER	-2.082	-10.270***	-2.831	-2.260	2.779	2.729**
	(5.285)	(3.050)	(2.699)	(1.412)	(3.402)	(1.382)
KAI/KAO_UPPER	-26.492***	-20.211***	-10.102***	-5.079***	13.864	6.419***
	(6.441)	(3.358)	(2.599)	(1.539)	(4.154)	(1.688)
GR(VIX)	-0.193	0.045	0.100**	0.019	0.069	-0.020
	(0.015)	(0. 098)	(0.052)	(0.030)	(0.087)	(0.035)
GL	1.025***	0. 864***	0.391***	0.143**	0.399**	-0.008
	(0.399)	(0. 262)	(0.125)	(0.072)	(0.208)	(0.084)
GROWTH	0. 731***	0. 532***	-0.086	-0.175***	-0.138	0.015
	(0.210)	(0. 138)	(0.100)	(0.057)	(0.166)	(0.067)
TRADE	-0.064	-0.035	0.014	0.021*	0.066*	0.045***
	(0.053)	(0. 034)	(0.023)	(0.013)	(0.038)	(0.015)
FD	57.287***	52.062***	17.005***	4.467	-6.557	-2.234
	(15.594)	(10.114)	(6.428)	(3.791)	(10.753)	(4.370)
INFL	0.024	0.081	0.014	0.024	0.051	0.022
	(0. 090)	(0. 059)	(0.042)	(0.024)	(0.070)	(0.028)
CRISIS_2008	-7.558**	-8.208***	1.097	2.023***	2.665	1.699**
	(3.530)	(2.304)	(1.147)	(0.659)	(1.896)	(0.770)
CONST	-7.819	-10.107	-5.080	-1.043	-4.530	-2.735
	(9.254)	(6.131)	(3.335)	(1.921)	(5.451)	(2.215)
# CNTR	44	44	44	44	44	44
# OBS	836	836	792	792	792	792
R^2	0.083	0.103	0.051	0.041	0.042	0.040

Notes: *, **, and *** denote the significance levels of 10%, 5%, and 1%, respectively. The standard errors are presented within parentheses.

The initial two columns in Table 3 present the findings for the levels of CI and CO. The remaining columns denote the implications for the volatility of gross flows. As indicated in column (a), the financial development threshold is statistically significant at the 0.52 level for CI. This implies the estimated threshold allows two different regimes in the correlation between "KAI" and "CI" as lower financial development regime and upper financial development regime. It can be interpreted as the existence of a nonlinear relationship for CI. After considering the threshold estimate, we proceed to compare the coefficients of CACs influencing the volume of CI. We observe that the significance and magnitude of the coefficients vary. This indicates that the relationship between CACs and the volume of CI is insignificant in less financially developed countries (lower regime). Conversely, there is a negative association between CACs and CI in more financially developed countries (upper regime). Considering the outcomes of the linear model presented in Section 3.1, the inadequacy of CACs in diminishing the magnitude of gross flows can be elucidated by the mediating influence of financial development. Countries with deeper and more efficient financial sectors are likely to succeed in coping with large capital inflows. The results obtained from the threshold model suggest that countries surpassing a specific threshold of financial development have the potential to employ restrictions, resulting in a decrease in the CI.

In Column (b), the threshold estimate (0.470) is insignificant confirming the presence of a linear relationship between CACs and the volume of CO. In these circumstances, countries can reduce the size of CO by implementing restrictive capital account measures regardless of their level of financial development. According to columns (c) to (f), the estimated thresholds for financial development are insignificant indicating the lack of a threshold effect or a non-linearity. Thus, we can keep the results in linear regressions.

5. Conclusion

Considering current discussions on the use of capital control measures, this study investigates the link between capital controls and gross flows relying on data from 44 developing countries, between 1998 and 2017. In this study, capital flows are measured in gross terms, and accordingly, the CACs are used as inflow and outflow restrictions. Linear and nonlinear models are performed to magnify the effectiveness of capital controls.

The results indicate that capital controls do not play a crucial role in reducing the volume of gross inflows. However, they have a negative significant impact on gross outflows suggesting that increasing levels of outflow restrictions give rise to a decrease in the magnitude of outflows. When gross flows are unbundled, the capital restrictions on outflows affect other investment flows more than FDI outflows and portfolio investment outflows. These results highlight that only the restrictions on outflows can be effective in decreasing the magnitude of domestic residents' asset purchases abroad. Restrictive measures on outflows can play an active role in limiting large capital outflows. However, policies targeting to restrict foreign investors' domestic asset purchases might not be as influential as policymakers expected. In an investigation of the volatility of gross flows, the results show that capital control measures have no significant impact on the volatility of gross flows.

Given the outcomes of the linear estimations, this study further investigates the potential mediating role of financial development in influencing the effectiveness of capital controls. The estimation of a panel threshold regression reveals that there exists a significant financial development threshold for gross inflows. This suggests below a certain level of financial development, capital flow restrictions have no significant effect on gross inflows while the effect of these constraints turns out to be substantially positive once the threshold level is surpassed. This result complements the previous findings by drawing attention to the effectiveness of capital flow restrictions under specific conditions. Contrarily, there is no significant financial development threshold for gross outflows. When the volatility of flows is considered, the effect of capital restrictions is not dependent on the degree of financial development. The panel threshold estimations confirm that neither volatility in inflows nor outflows respond to capital controls and thus, the financial development level cannot be seen as a mediating factor to reduce the volatility in gross flows.

This paper put forward that the capital control policy can be successful in coping with large capital outflows, but it is not effective in overcoming volatility of both inflows and outflows. By

manifesting the different reactions of foreign and domestic investors in the purchase of assets, the study has two important policy implications. First, policymakers should not use a single restrictive capital flow policy. Since the results suggest that only gross outflows –at most other investment outflows- respond to the capital restrictions, at the forefront, the policy formulation might give priority to the most reactive type of capital flow. Even if being more restrictive in outflows ends up limiting the size of gross outflows, policymakers should be aware that the volatility of outflows does not respond to the increasing levels of restrictions. Thus, a uniform policy design targeting the reduction in size and volatility at the same time might be ineffective. Second, policymakers should regard financial development as a mediating factor that can be used to make capital controls more effective for gross inflows. Therefore, a deeper, more secure, and more accessible financial environment may strengthen the policymakers' stance in managing capital flows.

Author statement

Research and publication ethics statement

This study has been prepared in accordance with the ethical principles of scientific research and publication.

Approval of ethics board

Ethics committee approval is not required for this study.

Author contribution

All authors have contributed the study equally.

Conflict of interest

There is no conflict of interest arising from the study for the authors or third parties.

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