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THE DOMESTIC IMPACTS AND SPILLOVERS OF CAPITAL CONTROLS

ABSTRACT: *The effectiveness of capital controls has still not been established, and if they are indefinite they create distortions. This study uses quarterly data on capital controls in 25 Asian and Latin American countries from 2000 to 2019. We present further evidence on the internal and multilateral impacts of capital controls using a Panel VAR model with variance decomposition and impulse-response function analysis. The results show that domestically, capital controls, became more effective after the global financial crisis, with more monetary policy autonomy and exchange rate policy stability. Contrarily, these controls do not affect international reserve accumulation, and a combination of policies, capital controls, and reserves is required to assist governments' decisions. Internationally, capital controls cause negative spillovers that require policy coordination between the countries setting controls and those consequently receiving massive inflows.*

KEY WORDS: *capital controls, monetary policy, exchange rate policy, reserves, spillovers.*

JEL CLASSIFICATION: F32; F38; F41; F42.

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1. INTRODUCTION

In response to the 2008 financial crisis a recent policy pattern has emerged in which old-model forms of authority intervention – macro prudential policies such as capital controls and other quantitative constraints on debt flows – are considered the major instruments of ordinary policy. Macro-prudential policies are an advisable way to prevent financial crises that would be costly to control through later interventions. Several emerging countries have used these controls, and the International Monetary Fund has changed its opinion regarding the liberalisation of the capital account, supporting the use of capital controls when other instruments are inaccessible or are no longer effective (Obstfeld et al., 2010; Desai et al., 2006).

To enhance macroeconomic stability and design efficient economic policies it is important to understand the behaviour of international capital flows. Effective capital controls may reduce these capital flows, alter their composition from short-term to long-term, and allow for more monetary policy autonomy and exchange rate stability (Magud et al., 2018). Previous studies have highlighted multiple issues with capital controls (Korinek, 2011; Bianchi & Mendoza, 2011; Benigno et al., 2013), including the absence of a theoretical framework to define their macroeconomics consequences, the heterogeneity between countries applying capital controls, and the success of these restrictions. Several studies have emphasized the difficulty isolating the direct impact of capital controls, which constrains the potential success of capital flows and their objectives (Fernández et al., 2015; Forbes et al., 2015; Alfaro et al., 2017). It has been difficult to develop a standard of best practices to regulate international capital flows due to economies' specific characteristics and different market responses (Qureshi et al., 2011). The efficiency of capital controls remains unclear, but they are still used in countries throughout the world. Globally, there are two aspects to the study of the effectiveness of capital controls: actions of capital control, and achieving macroeconomic objectives (autonomy of monetary policy, reduction of exchange rate pressures, etc.). The present study mainly belongs to the second category, as it examines the impact of controls on the macro-financial policies of emerging economies. Since the 2008 financial crisis these impacts have been much debated, as several economies started employing these restrictions, while others tightened them (Fernández et al., 2015).

The present study uses a Panel VAR model with variance decomposition and impulse-response function analysis, applied to a sample of 25 countries over the period 2000–2019. Table 1 in the Appendix shows the sample of countries. This study is divided into three parts. The first section analyses the impact of capital controls on monetary and exchange rate policies, the second section empirically verifies the claim that many economies accumulate increasing international reserves although the use of capital controls, and the third section examines the spillover effects of capital controls.

Firstly, in recent decades, international macroeconomics has postulated the trilemma that with free capital mobility (absence of capital controls), independent monetary policies are only feasible if exchange rates are floating. Our analysis follows the trilemma framework but replaces capital mobility with capital controls. Many previous studies of capital controls have focused on the incompatibility triangle, so capital controls have usually been related to the hope of keeping monetary policy autonomous to some degree while applying fixed exchange regimes. It would be interesting to study the effects of restrictive measures on the conduct of monetary policy and exchange rate policy. Capital controls retain monetary autonomy in a fixed exchange rate regime and work as trade manipulation in a flexible exchange rate regime. Exchange rate policies are beneficial to lower the severity of a financial crisis beyond capital controls (Benigno et al., 2016; Chamon & Garcia, 2016). Likewise, Devereux et al. (2019) show that capital controls can be considered as state-improving tools when they are optimally merged with monetary policy in the presence of policy commitment. Recently some emerging economies have tended to use a more flexible exchange rate. The fear of floating has led these countries to intervene massively on the exchange markets or to vary their director rate to prevent huge fluctuations in the exchange rate. Considering the potential support that capital controls can give to stabilising the financial system, the first hypothesis of this research is that capital controls allow more monetary autonomy and stable exchange rate policies.

Secondly, monetary authorities have hotly debated the increase in international reserves in the presence of national outputs. Further rapid reserve accumulation is assumed to have influenced the global patterns of real interest rates, capital flows, and exchange rates, specifically among emerging economies (Bénétrix et

al., 2015). As a response to the harmful policy of liberalising capital flows, many emerging economies have re-instituted capital controls to limit the negative effects of short-term capital inflows (Magud et al., 2018; Farhi & Werning, 2014). This has often been aimed at optimally managing capital flow issues. Several studies have looked for an optimal combination of the accumulation of reserves and the capital control levels that a country must apply (Jeanne, 2007; Bacchetta et al., 2013). The second hypothesis of this study is that capital controls reduce international reserve holdings.

Thirdly, although there is little evidence of capital controls having internal effects, there has been a growing international debate on the consequences of these controls. The fear is that they will have multilateral adverse effects, i.e., spillover effects. Following these controls a misallocation of resources may result from directing capital flows to countries that accept these inflows for speculation purposes, for a fight between currencies, with the ultimate objective of profiting from inequitable competitive advantages. Variation in capital inflow controls generally leads to spillovers. These originate from changes in the conduct of investors in developed countries who adjust the combination of their investments in emerging markets, or the overseas or domestic investment decisions of residents in emerging economies. Spillovers increased after the 2008 financial crisis, which may be connected to the abundant global liquidity and larger role of equity funds during this period (Miyajima & Shim, 2014). Recent studies highlight evidence of policy spillovers when explaining the role of capital controls in reducing capital inflows (Pasricha et al., 2018; Forbes et al., 2017; Lambert et al., 2011). These spillovers indicate the possible presence of a coordination issue among economies that employ capital controls as a policy instrument. This raises the third research hypothesis, that capital controls cause considerable spillovers.

The present study adds to previous empirical studies in two ways. First, the use of a recent, large dataset on capital controls allows us to identify whether capital controls are an effective monetary and exchange rate policy. Most previous studies on the effectiveness of capital controls have used infrequent data, usually annual, and are less precise. These annual data suffer from two essential shortcomings: they do not accurately reflect the intensity of their application in countries, and are often confused with other policies that are applied simultaneously. The use of quarterly data in the present study allows for a larger

time interval and a more accurate analysis of the actions taken by policymakers. Second, the current study regroups the three elements of the incompatibility triangle in one model. These elements are usually studied independently (Rey, 2015). The incompatibility triangle framework also presents the de jure and de facto changes in the opening of the capital account as related (Rebucci & Ma, 2019). This study examines whether the applied controls are effective within the incompatibility triangle and, using a Panel VAR model, whether capital markets affect the autonomy of monetary policy and changes in the exchange rate. As presented in several studies, capital controls are endogenous, which highlights the recurrent changes in these controls within countries and shows their repercussions on other macroeconomic policies. To my knowledge, no previous study uses the Panel VAR approach to study the repercussions of capital control changes on monetary and exchange policies. The study analyses the domestic and multilateral impacts of capital controls. Domestically, the main finding is that by reducing capital inflows, capital controls make it possible to stabilize the economy: they allow more monetary policy autonomy and less pressure on the exchange rate.

The empirical literature shows that many emerging economies accumulated excessive international reserves after the 2008 financial crisis (Bianchi et al., 2018; Aizenman & Jinjarak, 2019). A few studies highlight the association between capital control actions and international reserve accumulation (Jeanne, 2016; Korinek, 2018). The present study shows that despite the application of strict capital controls, emerging economies have accumulated higher reserves that support monetary and exchange rate policy decisions.

Regarding the multilateral effects, this study explains the spillover effects that capital controls imposed in one country may have on neighbouring economies. While empirical studies of this spillover effect are rare (Forbes et al., 2017; Lambert et al., 2011), the present study empirically highlights these foreign policy changes as a response to earlier capital controls applied by a country.

This paper is organized as follows. After a review of the literature on the effectiveness of capital controls in section 2, the data and methodology are presented in section 3. The results of the model regressions are presented and

discussed in sections 4 and 5 respectively. The last section presents the study's conclusions.

2. LITERATURE REVIEW

2.1 Impact of Capital Controls on Monetary and Exchange Rate Policies

Identifying how and which kind of artificial barriers should be applied to capital flows and how they influence the monetary and exchange rate policy are frequently researched issues (Edwards, 1997). However, the empirical literature on the effectiveness of capital controls on monetary and exchange policies has several methodological shortcomings. Two main points are noted. First, many capital-control indicator boundaries are constructed by following reforms presented in the International Monetary Fund's Annual Report on Exchange Arrangements and Exchange Restrictions. Second, it is difficult to separate the impacts of capital controls from those caused by other macroeconomic policies. As a result, several countries have benefited from the introduction of capital controls, but success has varied across countries.

Despite these criticisms, several studies investigate the effectiveness of capital controls on monetary and exchange rate policies under certain macroeconomic conditions (Bayoumi et al., 2015; Pasricha et al., 2018; Magud et al., 2018). Focusing on the macroeconomic framework in which capital controls are applied, Bayoumi et al. (2015) study 37 countries that introduced outflow restrictions from 1995 to 2010. Their results suggest that capital outflow restrictions reduce the pressure on monetary and exchange rate policies under certain conditions: strong macroeconomic fundamentals (growth rate, inflation, fiscal and current account balances), good institutions (World Bank Governance Effectiveness Index), and existing restrictions (intensity or comprehensiveness of capital controls). When none of these conditions are met, controls fail to support the monetary and exchange rate policies. Other studies highlight the role of institutional reform, and find that controls are more effective in developed countries due to the higher quality of institutions and regulations (Binici et al., 2010).

Some recent studies analyse the conditions for the success of capital controls, particularly the impact of capital controls on the country applying them and its

neighbouring countries. Pasricha et al. (2018) use a recent frequency dataset on capital control instruments in 16 emerging market economies from 2001 to 2012 and provide novel evidence on the domestic and multilateral impacts of these instruments. Increased financial liberalisation constrains monetary policy autonomy and decreases exchange rate instability, confirming the incompatibility trilemma. Magud et al. (2018) conduct a meta-analysis of the literature on capital controls. They standardize the results of close to 40 empirical studies, building two capital control indicators – a Capital Controls Effectiveness Index and a Weighted Capital Controls Effectiveness Index. Their results show that capital controls on inflows seem to make monetary policy more independent and alter the composition of capital flows; there is less evidence that capital controls reduce real exchange rate pressures. Kim and Yang (2012) determine that a fixed exchange rate allows capital controls to support the independence of monetary policy. This impact is clearer with wider and longer-standing capital controls.

Klein and Shambaugh (2015) consider whether partial capital controls and restricted exchange rate flexibility enable considerable monetary policy autonomy. They find that partial capital controls do not usually allow for larger monetary autonomy than liberalized capital accounts unless they are very wide, but a moderate level of exchange rate flexibility can allow monetary autonomy to some extent, particularly in emerging economies, which are more protected from external monetary shocks when they use intensive capital controls. Similarly, Liu and Spiegel (2015) show that the wide use of capital controls allows countries to maintain the desired interest rate differential between domestic and foreign markets. Furthermore, these strict controls are not linked to the currency appreciation found in some emerging economies.

Obstfeld et al. (2004) find that financial instability is often due to policies that are incompatible with the restrictions of the liberalized economy trilemma. The authors find strong support for the trilemma theory. Thus, the ability to follow consistent capital controls in fast-evolving economic conditions appears essential to identifying the impacts of capital controls on monetary and exchange rate policies. The same line of thought is found in Devereux et al. (2019), who study the advantages of capital controls and monetary policy in a small liberalized economy with financial conflicts, nominal inflexibilities, and sudden stops. They find that a perfect monetary policy requires constraints on capital inflows, but

that such restrictions can reduce the well-being of the economy. Capital controls cause a combination of current tax inflows and future grant inflows. The authors find that an optimal policy does not induce large inflows or a deviation from price stability. Furthermore, an association between rigid prices and financial restrictions that rely on equity prices allows for using a combination of monetary policy and capital controls as part of an optimal policy.

2.2 Capital Controls and International Reserves

International reserves enable countries to avoid barriers to policy options raised by the trilemma. Economies may collect foreign exchange reserves to achieve a combination of exchange rate constancy, monetary policy independence, and capital account liberalisation (Aizenman & Lee, 2008).

After the 2008 financial crisis many economies accumulated excessive international reserves that enabled them to support their monetary and exchange rate policies. The rise in international reserves is the subject of much recent discussion among financial policymakers. The high volume of international reserves in emerging economies is supposed to have affected real interest rates, current accounts, and exchange rates (Aizenman & Jinjarak, 2019). According to Chen et al. (2016), international reserves are accumulated as a guarantee, offsetting the spillover risk of financial instability. Frequently, financial imbalances have a slight impact on economies with a large stock of reserves. China, Hong Kong, Taiwan, and Singapore have all accumulated enormous reserves, and all seem to be relatively unharmed (Obstfeld et al., 2010). The accumulation of such reserves is achieved through a positive trade surplus and a large stock of foreign currency.

How emerging economies have been able to accumulate large international reserves although capital controls is interesting. China is a representative case that is known for its restrictive policy on capital movements while being very active in the capital market by accumulating a huge stock of foreign exchange reserves. Bachetta et al. (2013) suggest an optimal reserve accumulation model for China in which the Chinese central bank motivates credits to the private sector at the same time as accumulating foreign exchange reserves. Capital controls do not pose a barrier to this process. The authors find that a country can benefit from rapid growth without opening its capital account. Reserve accumulation in China

has exceeded that of an open economy. Similarly, Bussiere et al. (2013) explore the linkage between the preventive cause of international reserves and the setting of capital controls. They find that the degree of reserves is the issue: economies that have a high ratio of reserves to short-term debt are less negatively affected in a period of crisis, particularly when capital controls are applied. This indicates that contrary to common understanding, international reserves and capital controls can be complementary (Zehri & Abdelkarim, 2020).

2.3 Spillover Effects of Capital Controls

The literature generally considers the minor impacts of controls on overall capital inflows. Consequently, there is very little interest in the spillover effects of capital controls. Broad evaluation of the cross-economy spillover impacts of capital controls before and after the 2008 financial crisis have little empirical proof. The existing evidence concerns either impacts during the post-crisis years, impacts on a single country (Forbes et al., 2017; Lambert et al., 2011) or unique region (Bruno et al., 2017), or employs unclear indicators of capital controls (Kim & Kim, 2015; Schipke, 2016). The small amount of literature on the spillover effects of capital controls is usually based on theoretical models of portfolio allocation. This literature shows that when new capital controls in a country decrease the anticipated return on investment in that country, then, ceteris paribus, foreign investors decrease the portion of their investment assigned to that country and increase their assets in other countries.

In one of the main studies highlighting the spillover effects of capital controls, Forbes et al. (2015) examine variations in Brazil's tax on external investors from 2006 to 2011 to analyse any direct and multilateral impacts capital controls have on investment flows. The authors find that an increase in capital controls in Brazil has led to a reduction in foreign investment. The same result is observed for other countries likely to use controls. Contrarily, there is a flow of these investments towards other Latin American countries that do not practice capital controls. In a more recent paper, Forbes et al. (2017) extend their previous 2013 study and find that many of capital control's impacts on portfolio distribution emerge under signalling – i.e., variation in investor predictions regarding forthcoming policies – rather than from the direct expense of the controls. The authors suggest that before instituting any restrictions on capital flows, countries should think about the impacts of such restrictions on investment flows to neighbouring countries.

Lambert et al. (2011) focus on a sample of Latin American economies. They employ balance of payments data and large data on many asset types to examine the predicted spillover effects that capital controls introduced in one economy may have on neighbouring countries. The authors find that a higher tax imposed on portfolio investment in Brazil has consequences for other Latin American economies through an increase in investment inflows. However, this effect is generally short-lived and followed by rapid reductions in these inflows.

The current study examines a sample of Latin American and Asian countries. The Latin American countries applied capital controls earlier than the Asian countries. The spillover effects were identified by monitoring the direction of capital flows (inflows and outflows) between these two regions, and by following the changes in interest rate spread and exchange rate in each region.

3. DATA AND METHODOLOGY

3.1 Data

Finding an exact measure of capital controls is difficult. The pre-2008 financial crisis literature employed multiple indicators as proxies for capital restriction intensity, which usually helps to set the extent of restrictions. It was thus possible to define which is the most appropriate when evaluating the efficiency of controls. In more recent literature many improvements have been made in measuring capital controls. The most relevant novelty in those studies is gathering data on variation in institutional arrangements (Edison & Warnock, 2003; Eichengreen & Rose, 2014; Van der Laan et al., 2017). This new approach allows us to determine the type of policy action that is consistent with the time of the action. The choice of capital control indicators in the present study is close to the approach in recent capital control studies. We use the *ka*, *kai*, and *kao* indicators suggested by Fernández et al. (2016), and the *kaopen* indicator suggested by Chinn and Ito (2008). Fernández et al. (2016) presented a new dataset of capital controls, divided into 10 asset categories along with the structure of inflows and outflows. These indicators were applied to 100 economies over the period 1995–2013. The present study uses the first three indicators of the ten capital-control asset categories – *ka*, *kai*, and *kao* (controls applied to gross flows, inflows, and outflows, respectively). Chinn and Ito (2008) established an index called *kaopen,* which measures the extent of openness in capital account transactions and has

been regularly updated (most recently in 2017). The *kaopen* index is a proxy for a country's level of capital controls, using a dual variable that summarizes the operations displayed in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) database. *Kaopen* is applied to 182 economies covering the period between 1970 and 2010 and varies between –1.9 (more capital controls) and 2.5 (fewer capital controls).

The main difference between the Fernández et al. (2016) and the Chinn and Ito (2008) indicators is that the *kaopen* index is a broader measure of capital account liberalisation that includes regulations of the current account of the balance of payments and the foreign exchange market, while the dataset used by Fernández et al. (2016) is smaller, focusing particularly on capital flows, though it has further details on the intensity of controls, with distribution data on 10 asset categories. The Fernández et al. (2016) indicators allow detecting more changes over time when countries set regulations than the Chinn and Ito (2008) index.

For the other variables in the empirical analysis the present study uses the interest rate differential as a proxy for monetary policy independence (*rate* variable). A country that maintains a differential of domestic and external interest rates can act on the volume of capital inflows and consequently define a domestic interest rate freely without being constrained by the external rate. The standard deviation of the bilateral exchange rate (to the US$) is a proxy used for the fluctuation of the exchange rate (*xchge* variable). To separate the effects of capital flows, we distribute them between inflows (*infl* variable) to the Asian countries and outflows from Latin American countries (*outfl* variable). We include a set of exogenous variables to control for drivers that can influence the endogenous variables (the short-term interest rate in the United States (*fed*), the oil price (*oil*), and real gross domestic product growth in the United States (*gdp*)). For the second research hypothesis we introduce international reserves (*ir*). The impacts of capital controls used by a country can affect the inflows to other countries; the spillover effects are found by following the reverse capital flows between the Asian and Latin American countries and by monitoring the evolution of interest rate spread and exchange rate. Lastly, to highlight policy changes pre- and post-crisis we divide the analysis period into two sub-periods, before and after 2008. Table 2 in the Appendix summarizes the four capital control indicators and the variables used in this study.

Table 3: Descriptive Statistics

	Mean	Std. Dev.	Min.	Max.
kaopen	1.39	0.25	–1.90	2.50
ka	0.49	0.15	0	1
kai	0.67	0.31	0	1
kao	0.55	0.28	0	1
rate	0.23	0.14	–0.14	0.75
xchge	2.81	0.45	0.84	5.31
infl	2.64	0.52	0.12	11.26
outfl	2.87	0.43	0.27	10.33
fed	2.75	0.25	0.25	6.25
oil	55.47	10.75	22.66	165.20
gdp	2.76	0.79	–2.45	6.33
ir	12.57	2.70	2.68	22.65

***Source**: Authors' calculations*

Table 3 shows little variation in the capital control indicators, which do not exceed 0.31; this demonstrates the slowness of restrictive reforms in the sample countries. The variation in the interest rate spread is also low, 0.14 on average, which shows that countries seeking an effective monetary policy try to set their domestic interest rate as close as possible to the US interest rate. The exchange rate is much more volatile (standard deviation of 0.45); this can be explained by the conditions post-crisis – instability and uncertainty – in the international financial sphere. This high variation in the exchange rate is also associated with big changes in inflows and outflows, which have a standard deviation of 0.52 and 0.43 respectively.

Table 4 shows a negative correlation between *kaopen* and *ka*, *kai*, and *kao*. This is explained by a difference in the construction of these indicators; an increase in *kaopen* indicates fewer controls, while an increase in the *ka*, *kai,* and *kao* indicators shows more controls. This distinction will influence the interpretation of the empirical results in the following sections. There is a significant negative correlation between *rate* and *xchge* (–0.71), which shows that a higher spread in interest rates leads to large exchange rate fluctuations; hence the difficulty of optimal coordination between monetary and exchange rate policies. The correlation between *infl* and *outfl* is positive and significant (0.75). This result

shows that the Asian countries' capital inflows constitute the Latin American countries' capital outflows. The spillover effects caused by capital controls will be verified in the empirical analysis. The international reserves do not correlate with any capital control indicators. However, there are positive correlations with interest rate spread, exchange rate changes, and inflows (0.45, 0.88, and 0.76, respectively), and a negative correlation with outflows (–0.47).

Table 4: Correlations for Study Variables

Variable	1	2	3	4	5	6	7	8	9
1. kaopen	—								
2. ka	−.48**	—							
3. kai	−.05**	.81	—						
4. kao	−.08**	.77**	.04*	—					
5. rate	−.79**	.65**	.01*	.61**	—				
6. xchge	−.45**	.39**	.24**	.08**	−.71**	—			
7. infl	.68**	−.63**	−.82**	−.57*	−.02	.16**	—		
8. outfl	−.36**	.23	.75*	.68**	.32	.33	.75**	—	
9. ir	.12	.24	.31	.15	.45*	.88**	.76*	−.47*	—

***Source**: Authors' calculations*

**, and ** denote statistical significance at the 5%, and 1% level, respectively.*

3.2 Methodology

Capital control instruments may affect a set of variables while at the same time being affected by these variables, which motivates the use of a panel VAR model. This model includes a system of equations in which the dependent variables represent capital controls, capital flows, monetary policy, and exchange rate policy. The study sample comprises 25 countries (12 Latin American countries and 13 Asian countries) that implemented capital controls over the period 2009Q1 to 2019Q4. A panel VAR is the baseline model. The independent variables of this model are all considered endogenous and are explained by the set of exogenous variables previously cited. The model is written as follow:

$$Y_{i,t} = \alpha_0 + Z_1 y_{i,t-1} + \ldots + Z_n y_{i,t-n} + W_1 x_{i,t-1} + \ldots + W_m x_{i,t-m} + FE_i + £_{i,t} \quad (1)$$

This model is described by a system of equations, where Y_t is the vector of endogenous variables for country i, defined as Y_t = [*rate*, *xchge*, *ir*, *infl*, and *outfl*],

x_t is the vector of exogenous variables common to all countries, $£_{i,t}$ is the vector of residuals, and Z and W represent the coefficients for the endogenous and the exogenous variables, respectively. Factors that were omitted and may affect the dynamics of the model (e.g., administrative efficiency) are regrouped in the term FE_i, which represents the country's fixed effects (*FE*).

Firstly, we proceeded with the regression of the Panel VAR model described in Equation 1. The Panel VAR has many advantages over other empirical methods. First, when the theoretical baseline for the studied relationship is low, Panel VAR is recommended to guide the model formulation. Second, the endogeneity bias presents a serious problem for many empirical studies. Glick and Hutchison (2005), Ito et al. (2015), and Qian and Steiner (2017) all consider this problem of endogeneity and try to solve it by including lagged variables or by imposing additional restrictions on their regressions. Panel VAR can reduce the endogeneity bias by considering all variables as probably endogenous. Third, by using VAR regressions we can obtain the impulse response functions (IRF) that record any delayed effects of the considered variables, while the classical panel models are unable to display these dynamic effects. Panel VAR also considers missed variable bias by employing country fixed effects, which capture the aspects that do not change over time and may affect the independent variables. Panel VAR also has the advantage of being used with a short temporary scale that may be compensated by the gain from the cross-sectional scale.

The Panel VAR analysis examines the significance and the sign of the coefficients of the capital control indicators for three components: explaining interest rate spread (*rate*) and changes in the bilateral exchange rate (*xchge*), explaining the accumulation of international reserves (*ir*), and tracking their effects on capital inflows and outflows.

Secondly, throughout the Granger causality test we examine the causal relationships between the capital control indicators and the variable proxies for monetary policy, exchange rate policy, accumulation of reserves, and spillover effects (*infl* and *outfl*) between Latin American and Asian countries. This causality examination is followed by a variance decomposition analysis that illustrates the response of these variables to shocks applied for two capital control indices (*ka* and *kaopen*) over four time periods. This shock illustration is

supported by the IRF graphs. This method details the response of one variable to changes in another variable in the VAR while keeping all other changes equal to zero (Abrigo & Love, 2016). In our case, we draw the IRFs illustrating the responses of the variables *rate*, *xchge*, *ir*, *infl* and *outfl* to shocks on *ka* and *kaopen*.

The present study takes into account changes in countries' policies before and after the 2008 financial crisis by splitting the sample into two parts: the quarters before the crisis (2000Q1–2008Q2) and the quarters after the crisis (2009Q3–2019Q4). All the explicative variables are introduced with one lag difference and with first differences. The same regressions are run with standardized variables, but the results are not significant; variables in first differences are more stable and representative of the macroeconomic policy changes. Based on the empirical literature, this study assumes that capital controls became tighter in Latin American countries than in Asian countries after the crisis (Lin, 1988; Kohli, 2012; Bouchet et al., 2018).

4. RESULTS

This section presents the evidence from the estimation of the Panel VAR model for two periods: 2000Q1–2008Q2 and 2009Q3–2019Q4. We examine whether changes in capital controls have an effect on monetary and exchange rate policies as per the incompatibility triangle forecast. The Panel VAR also investigates the impact of capital controls on international reserves, to verify whether capital controls reduce reserve accumulation in the sample countries. The empirical analysis examines the effect of a shock to capital controls on multiple national policy variables, including differential interest rate, exchange rate volatility, capital flows, and international reserve accumulation.

The results of the PVAR analysis are displayed in Table 5. We explain these findings through the impact of capital controls on three components: monetary and exchange rate policies, international reserve accumulation, and spillover effects.

Table 5: PVAR analysis

		Before the crisis (2000Q1–2008Q2)			After the crisis (2009Q3–2019Q4)		
		Coeff.	t-stud.	P>|z|	Coeff.	t-student	P>|z|
		Effects on monetary and exchange rate policies					
rate	ka	–0.026	–1.34	0.135	–0.019	–2.17	0.016**
(Eq. 1)	kai	0.022	0.78	0.265	0.049	0.58	0.365
	kao	0.245	0.38	0.176	0.035	0.15	0.247
	kaopen	0.187	0.74	0.217	0.541	2.97	0.000***
	xchge	–0.027	–1.98	0.045**	0.027	2.31	0.025**
xchge	ka	–0.003	–2.01	0.076*	–0.019	–2.05	0.036**
(Eq. 2)	kai	0.018	0.47	0.297	0.228	0.15	0.297
	kao	0.184	1.23	0.237	0.139	1.05	0.109
	kaopen	0.022	1.98	0.085*	0.012	2.62	0.015**
	rate	–0.016	–3.64	0.000***	0.016	2.24	0.000***
		International reserve accumulation					
ir	ka	–0.036	–2.13	0.081*	–0.096	–3.24	0.001***
(Eq. 3)	kai	–0.002	–2.01	0.075*	–0.004	–2.38	0.025**
	kao	–0.012	–0.95	0.628	–0.015	–0.85	0.517
	kaopen	0.061	1.98	0.073*	0.080	2.06	0.013**
		Spillover effects					
infl	ka	–0.014	–1.23	0.131*	–0.006	–1.05	0.268
(Eq. 4)	kai	–0.031	–2.02	0.078*	–0.003	–0.45	0.313
	kao	0.016	0.75	0.317	0.009	0.85	0.209
	kaopen	0.028	1.99	0.062*	0.046	0.29	0.112
	outfl	0.001	2.01	0.082*	0.021	2.32	0.042**
outfl	ka	0.007	1.98	0.068*	0.036	2.51	0.048**
(Eq. 5)	kai	0.348	1.15	0.145	0.028	2.04	0.080*
	kao	0.026	0.85	0.199	0.009	2.26	0.064*
	kaopen	–0.123	–1.49	0.131	–0.046	–2.49	0.026**
	infl	0.034	2.14	0.062*	0.051	2.32	0.022**

***Source**: Authors' calculations*

, ** and * denote statistical significance at the 10%, 5%, and 1% level, respectively.*

First, the results show that capital control indicators were more effective after the financial crisis than in the period before the crisis: the coefficients of the capital control indicators in the second period are more significant. Second, of the four capital control indicators, *ka* and *kaopen* have stronger effects on interest rate spread and bilateral exchange rate. The coefficients of these indicators are significant but with opposite signs. We must be careful when interpreting the impacts of Fernández et al.'s (2016) indicators (*ka*, *kai*, and *kao*) and Chinn and Ito's (2008) index (*kaopen*). An increase in *kaopen* shows less capital control intensity, while an increase in the *ka*, *kai,* and *kao* indicators shows a higher intensity of controls. This explains the opposite signs of the two indicators, and both *ka* and *kaopen* indicators support a more autonomous monetary policy (high interest rate spread). The other coefficients related to inflow and outflow controls (*kai* and *kao*) are not significant. The same interpretations can be deduced for the equation using *xchge* as the dependent variable as previously with *rate* as the dependent variable. The indicators *ka* and *kaopen* have significant coefficients (–0.019 and 0.012 respectively, with a 5% significance level), showing that capital controls allow for more stability of the exchange rate policy, i.e., more liberalisation results in higher exchange rate instability. This positive impact appears only after the crisis period.

In addition to the capital control effects, the results show a positive correlation between *rate* and *xchge*. The coefficients of these two variables in the first two equations are positive and significant (0.016 and 0.027 respectively, with 5% significance level). A higher interest rate spread leads to more variation in the exchange rate; i.e., more monetary policy autonomy leads to more exchange rate instability. This demonstrates the difficulty of finding a compromise between these two policies.

Second, the results of the third equation, indicating the correlation between the capital control indicators and international reserves, show that the impact of capital controls was more significant after the 2008 financial crisis. The coefficients of *ka* and *kao* are negative and significant, and that of *kaopen* is positive and significant. All these indicators show that capital controls do not support international reserve accumulation.

Third, the spillover effects of capital controls are examined through the association between capital outflows from Latin American countries and capital inflows to Asian countries. The fifth equation explaining *outfl* as a dependent variable shows that capital controls applied by Latin American countries lead effectively to more outflows from these countries. The coefficients of *ka*, *kai*, and *kao* are positive and significant, and that of *kaopen* is negative and significant. However, not all capital control indicators are significant for explaining capital inflows to Asian countries. Spillover effects are mainly found regarding the coefficients of *outfl* and *infl* in Equations 4 and 5 respectively. For the period after the 2008 financial crisis these coefficients are positive and significant, showing that capital controls applied by the Latin American countries caused an outflow of capital and at the same time massive inflows to Asian countries.

The PVAR analysis was followed by a Granger causality test, presented in Table 6. The findings display the presence of causality between the *ka* and *kaopen* indicators and the *rate* and *xchge* variables; i.e., the capital control actions affect monetary and exchange policies. In the equation explaining the international reserve accumulation, capital controls have no significant causal relationship with *ir*. This result is similar to that found by the PVAR estimation: capital controls have reduced the accumulation of international reserves across the sample countries. The last two equations, illustrating the spillover effects, show a significant causal relationship between *infl* and *outfl*. They highlight the capital flow reversal between the two regions: outflows from the Latin American region (caused by capital controls), and inflows to the Asian region (a region with less capital control intensity).

Table 6: Granger causality test (2009Q3 – 2019Q4)

Equation	Excluded	Chi2	Prob > chi2
rate	ka	15.983	0.000
	kai	5.367	0.202
	kao	3.687	0.314
	kaopen	27.692	0.000
	xchge	57.427	0.000
xchge	ka	6.833	0.009
	kai	4.367	0.152
	kao	6.324	0.213
	kaopen	23.687	0.004
	rate	27.692	0.000
ir	ka	2.505	0.549
	kai	5.312	0.312
	Kao	7.639	0.494
	kaopen	7.615	0.348
	rate	23.622	0.004
	xchge	67.692	0.000
infl	ka	6.833	0.429
	kai	5.367	0.330
	kao	6.324	0.375
	kaopen	8.687	0.265
	outfl	47.272	0.000
outfl	ka	46.833	0.000
	kai	14.337	0.012
	kao	23.274	0.006
	kaopen	38.317	0.000
	infl	57.102	0.000

***Source**: Authors' calculations*

Table 7 summarizes the forecast-error variance decomposition. It displays the changes in the endogenous variables caused by a capital control shock. The findings show that unpredicted changes in the *kaopen* and *ka* indicators explain a big percentage of the dynamics of the differential interest rate (78.1% and 70%, respectively) and the exchange rate variation (79% and 90%, respectively) over the four quarters. In the exchange rate variation the major effect happens in the following quarter, while the effect on the interest rate spread is longer, lasting

more than one year. The reduction in monetary policy autonomy is longer-lasting than the exchange rate instability. This response time lag suggests that the exchange rate is more vulnerable to higher instability than the occurrence of intensive short-term flows generated by United States monetary policy variation. In the short term and following capital controls, monetary policy needs more time to better react to changes in the foreign interest rate. For the other two capital control indicators, *rate* and *xchge,* the impact of *kai* and *kao* shocks is small (less than 20% after four quarters).

Table 7: Variance decomposition by capital control shocks (2009Q3 – 2019Q4)

Variable	1 quarter ahead	2 quarters ahead	3 quarters ahead	4 quarters ahead
Kaopen shocks				
rate	0.002	0.141	0.258	0.380
xchge	0.381	0.231	0.142	0.036
ir	0.054	0.078	0.073	0. 061
infl	0.354	0.308	0.155	0.128
outf	0.326	0.287	0.174	0.013
Ka shocks				
rate	0.015	0.141	0.258	0.286
xchge	0.325	0.212	0.207	0.106
ir	0.031	0.014	0.025	0. 021
infl	0.389	0.231	0.131	0.089
Outfl	0.377	0.296	0.125	0.102
Kai shocks				
rate	0.012	0.026	0.078	0.064
xchge	0.016	0.041	0.057	0.075
ir	0.014	0.028	0.027	0. 015
infl	0.054	0.148	0.165	0.198
outf	0.226	0.187	0.194	0.113
Kao shocks				
rate	0.002	0.041	0.058	0.060
xchge	0.006	0.032	0.041	0.055
ir	0.014	0.018	0.027	0. 025
infl	0.314	0.218	0.205	0.118
outf	0.326	0.221	0.174	0.113

***Source**: Authors' calculations*

Concerning the impact on international reserves, *kaopen* and *ka* shocks explain only 26.6% and 19.1% respectively of the variation in international reserves for four quarters ahead. The shocks on *kai* and *kao* also have small impacts on *ir*. The spillover effects (*infl* and *outfl* equations) highlight a strong impact of all capital controls indicators on the *infl* and *outfl* variables. This impact is instantaneous, with a considerable effect from the first quarter. This finding shows that capital controls contribute intensively to spillover effects in both regions. The impact decreases over time and weakens in the fourth quarter.

The variance decomposition is followed by IRF analysis. Figure 1 in the Appendix shows the internal impact of tightening capital controls. The positive shock of the capital control indicators *kaopen* and *ka* was measured by a one-unit shock on the capital account (i.e., a rise in one weighted unit in capital account restriction). Figure 1 (in a and b for *kaopen* and *ka* shocks respectively) reveals positive impacts on *rate*, which take a relatively long time and remain for at least four quarters before disappearing. This shows that monetary policy requires more than one year to respond to shocks. Exchange rate policy has a faster response to these shocks, which occurs after only two quarters (Figure 1, c and d). Concerning the international reserve accumulation, the IRFs show no response of reserves to shocks on capital control indicators (Figure 1, e and f). These results are in line with previous results found with the Granger causality test and variance decomposition.

For the spillover effects, the IRFs highlight a reversal shock between *infl* and *outfl* (Figure 2), a shock on *outfl* (generated earlier by capital controls applied by Latin American countries), and the response of *infl* (results of the escape of capital flows to Asian countries). These IRFs illustrate the spillover effects with a fast response of outflow to inflow shock (i.e., fast reversal flows between the two regions). Regardless of the speed of the inflows' or outflows' response, these IRFs highlight the presence of spillover effects.

5. DISCUSSION

Within the framework of the impossible trinity theory, and in a setting of capital controls (i.e., without free capital movement), the present study highlights the central role of these controls in stabilizing the economy. Capital account liberalisation is considered to be a major source of financial instability, and capital

controls are an effective instrument for protecting financial systems from these undesirable flows. Policymakers employ an internal interest rate to manage capital flows to diminish the effect of capital movements on financial instability. Capital controls influence the conduct of an effective monetary policy as a response to changes in the international interest rate and enable effective monetary policy to concentrate less on the international interest rate (Orlik & Presno, 2017).

The results of this study show that capital controls supported a higher interest rate spread. Consequently, policymakers have wider margins to focus on the domestic interest rate and respond effectively to changes in the foreign interest rate. The responses of monetary policy are not instantaneous; they take at least four quarters to respond to these capital controls. This delayed impact can be explained by the fact that capital controls form part of a larger set of macroprudential methods. Some studies suggest that capital controls may be a complement to internal macroprudential rules (Jeanne & Sandri, 2020). Capital controls' actions may need to be associated with other policies to be effective.

Evidence in the literature suggests that capital controls are not needed when the optimal interest rate is equal to the foreign interest rate (Dooley & Isard, 1980; Edwards, 1997; Otani & Tiwari, 1981). Regarding the positive impacts of the *ka* and *kaopen* indicators on the interest spread, we affirm that the domestic interest rate differs from the international rate, and in this case capital controls are welfare-improving (Bianchi et al., 2018). Policymakers have good reason to control the internal interest rate by setting capital controls.

Concerning the exchange rate policy, capital controls allow for more stability by reducing the bilateral exchange rate. The effect of capital controls on the exchange rate is generally indirect, mediated by capital inflows and outflows (Glick & Hutchison, 2005; Frenkel et al., 2002). Restrictive policies on capital flows affect inflows and outflows first, and therefore the local currency value.

The impact of capital controls on exchange rate policy appears in the first quarter (contrary to the impact on monetary policy). This can be explained by the fast capital flow movements following these controls, leading to a rapid effect on the appreciation or depreciation of the local currency and exchange rate policy. Our results show a positive and significant effect of capital controls on exchange rate

fluctuations. Slowing capital flows following these controls eases the pressure on the exchange rate, leading to more stability of the exchange rate policy. Capital controls' association with exchange rate policy often involves a debate on the costs of this policy. Benigno et al. (2016) suggest that if the exchange rate policy involves considerable costs, capital controls are to be considered an essential part of a perfect policy mix. In the case of a costly exchange rate policy, this optimal policy mix would combine prudential capital controls in normal periods, with other policies limiting exchange rate instability in crisis periods. Such an optimal policy mix can generate more external debt, prevent financial instability, and lead to greater social well-being than the use of only capital controls.

Similarly, some studies highlight the association between capital controls and international reserves. Bacchetta et al. (2013) find that a competitive equilibrium of a liberalised country may not be welfare-perfect, and an association between capital controls and reserve policy can lead to more positive results in terms of social well-being. The recent literature suggests that the constraints of choice of monetary and exchange rate policies in a context of free movement of capital can be circumvented following an accumulation of international reserves. In the 2000s several emerging economies sought an optimal combination aimed at safeguarding an autonomous monetary policy, stabilizing the exchange rate, and liberalising the capital account via an accumulation of reserves. It was important to examine whether capital controls have an impact on international reserves, as such an impact can be used to analyse the changes in monetary and exchange rate policies. Unfortunately, our results did not find this impact (the coefficients of capital controls indicators on international reserves were not significant), and there was no response of the international reserves following shocks on the *ka* and *kaopen* indicators. The current findings support the claim that capital controls do not encourage the accumulation of reserves, particularly after the 2008 financial crisis, a period with an abundance of liquidity.

Although it is difficult to find an impact of capital controls on international reserves, a combination of restriction and reserves policies is necessary for a successful global public policy. Capital controls affect the current account, and in such cases, inter-temporal trade for the overall economy can only be reached through changes in the reserve holdings. Besides, only the central bank, which has a monopoly on the supply of securities to local agents, has access to foreign

assets. These restrictions enable policymakers to deal properly with monetary and exchange rate policies, as previously developed.

Capital controls also have multilateral impacts, leading to spillover effects. These multilateral impacts are important for many reasons. First, capital controls may motivate flows to recipient economies that do not apply such controls, thus aggravating local financial instability in those economies. Second, capital controls may obstruct foreign adjustment; for example, when controls on capital inflow are utilized to maintain a certain value of the currency. The cross-sectional equivalence of restrictions on capital flows is found in the fixed effects of each emerging economy, and, to a limited degree, by the declarations and changes related to the country's international investment position. The present study analysed these by determining the reversal flows between Latin American countries (outflows) and Asian countries (inflows), and this capital reversal is caused by earlier capital controls applied by Latin American countries. We found clear proof that a net tightening of inflow constraints in the Latin American countries generated significant, short-lived spillovers to Asian countries by first raising inflows in those economies, and then causing more pressure on their exchange rate. The variance decomposition and IRF graphs show this fast response of inflows and outflows and the shocks on these flows, displayed as a one-quarter response.

Our results of spillover effects on strategy in other economies are supported by theory, but this study is among the first to find empirical support for these spillover effects. As an example, Lu et al. (2017) examine the political response of one country following the intensive application of capital controls by another country. These capital controls caused a negative externality and induced a similar reaction in the country that consequently received massive inflows of capital, leading it to also practice capital controls. Nevertheless, Lu et al. (2017) do not verify this spillover effect empirically. The evidence for this spillover effect became clearer after the 2008 financial crisis: it was found that capital controls instituted by one country caused an appreciation of the currencies of other countries and a massive inflow of capital to those countries. During the following periods these effects gradually decreased, ending with the other countries introducing capital controls, followed by a drop in inflows and an increase in the short-term interest rate differential.

These spillover effects necessitate policy coordination between countries before setting capital controls. When a foreign country is influenced by the policy conducted in a neighbouring country, to secure benefits for both countries the level of policy coordination becomes a major issue. The application of capital controls may induce a capital escape from one country and at the same time large inflows to a neighbouring country (Jeanne & Sandri, 2020). This coordination policy is seen in the choice of necessary restrictive measures, and subsequently in a better choice of suitable monetary and exchange rate policies. This concurs with a brief downward effect on internal interest rates, as central banks may respond by reducing interest rates (to inhibit capital inflows). These impacts happen immediately, i.e., in the same quarter as the shock occurs (Orlik & Presno, 2017). For example, policymakers respond with stricter inflow constraints by reducing capital inflows and alleviating pressure on the exchange rate. This policy response is efficient and leads to changes in the capital inflow in the next quarter, which shows a drop that largely covers the initial impact of the rise in inflows. As capital inflows decline, the revaluation of the exchange rate peters out and local interest rates rise compared to the US, which may indicate an internal policy rate response to stop capital inflow reversals (Kim & Yang, 2012). The greater rates of return on local investments encourage locals to invest more in their country, and capital outflows fall in the next quarter after the shock in external capital controls.

Finally, we conclude from this empirical analysis that domestically, capital controls allow for a more autonomous monetary policy and a more stable exchange rate policy, while unpredictably they have no impact on international reserve accumulation. On the other hand, this analysis suggests a joint use of these different policies, particularly capital controls and reserve policy. The use of capital controls as a restrictive policy has considerable advantages in supporting other economic policies, and this finding adds to earlier studies seeking an optimal policy mix. These domestic impacts of capital controls also highlight multilateral effects through spillover effects. The results show a reversal of capital flows between Latin American and Asian countries, and coordinated policy between these countries is important for the success of capital controls.

6. CONCLUSION

This study examines the internal and external impacts of capital controls using a new, elaborated dataset and a Panel VAR approach. The limitations of the

incompatibility triangle (trilemma) formed the policy decisions in our sample countries after the 2008 financial crisis. Governments have become more focused on quickly stabilizing their exchange rates and saving the autonomy of their monetary policy by setting capital controls. Policymakers would like to shift away from the corners of this triangle and want to have more monetary autonomy and more exchange rate stability, and thus less financial openness. Our analysis confirms these goals: the impact of capital controls highlights a return to greater monetary autonomy and stable exchange rates, thus confirming the first research hypothesis. These results are consistent with evidence in the literature showing that capital account liberalisation leads to the loss of some monetary policy instruments and causes major fluctuations in the exchange rate, but capital controls may correct these effects.

This study highlights the role of international reserve accumulation as a policy that supports the macroeconomic policies of emerging economies. The results confirm that capital controls fail to affect international reserve accumulation, and no responses were found following their shocks. The second hypothesis is thus not supported. The evidence in the literature suggests using a combination of capital controls and reserve policy to support monetary and exchange rate policies. These reserves may be considered a substitute for capital outflows following capital controls.

The current findings also emphasize the spillover effects and support the third research hypothesis. These restriction policies may affect neighbouring countries through reversal capital flows. After the financial crisis these spillover effects were encouraged by abundant international liquidity and the major role of investment funds (Miyajima & Shim, 2014). The present study shows policymakers the need for more coordination between countries' policies before setting capital controls.

Several shortcomings can be identified in this analysis; in particular, the capital control indicators used. Other studies using different indicators may obtain different results. This is a common problem in most capital control studies. Similarly, the choice of the differential interest rate as an indicator of monetary policy autonomy is problematic. Although the differential in domestic and foreign interest rates is often seen as a proxy for monetary policy independence (Borio & Gambacorta, 2017), it is subject to debate. A decrease in this differential

will not effectively convert into a loss of monetary autonomy, especially in countries with high inflation that consequently affects the exchange rate. In such circumstances, a drop in the differential interest rate, perhaps originating from a tightening of United States monetary rules, can explain the internal inflation order, and consequently the differential interest rate (Rudebusch & Williams, 2016; Laséen et al., 2017).

Our study was conducted within the framework of a relatively simple empirical model; in reality, however, the connections between restrictive policies and other macroeconomic policies are complex. It is very difficult to find an optimal policy mix that combines monetary, exchange rate, international reserve, and capital control policies; this topic is left for future research. To a certain extent, our analysis can be considered an investigation of capital control impacts that considers other macroeconomics policies, yet we admit that a more developed model is essential to establish a combination of multiple macroeconomic policies. Such a model would need to define robust proxies for monetary policy autonomy, exchange rate stability, and particularly for a robustness check with more robust capital control indicators.

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APPENDIX

Table 1: Sample Countries

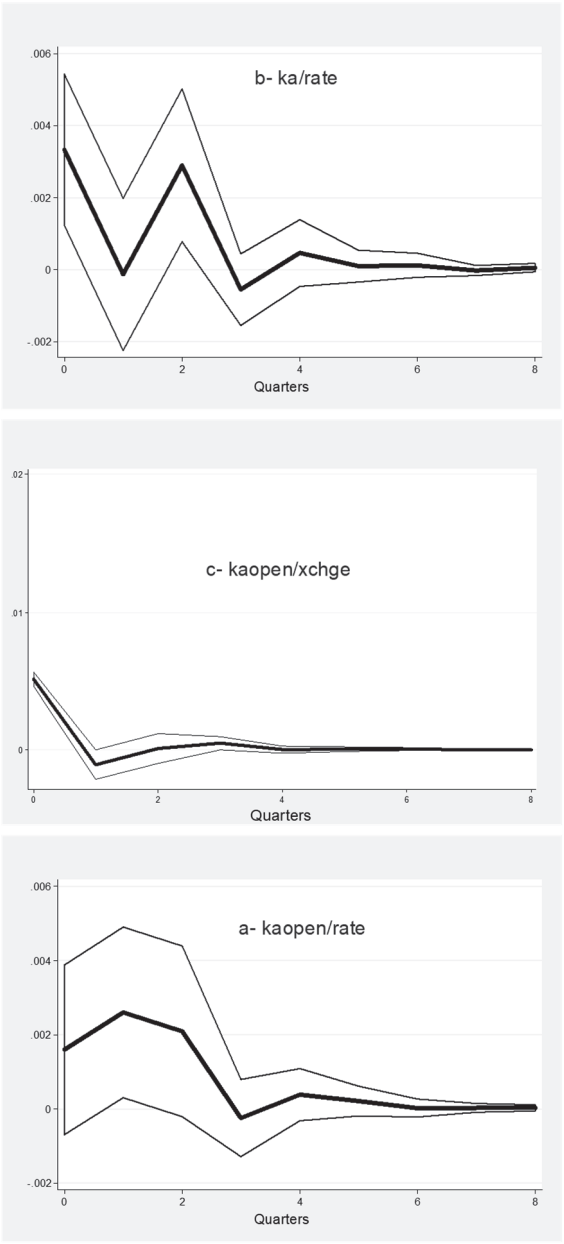
Latin American Countries	Asian Countries
Brazil	Philippines
Argentina	Thailand
Bolivia	Indonesia
Colombia	Malaysia
Costa Rica	Vietnam
Ecuador	China
Venezuela	India
Paraguay	Taiwan
Peru	Singapore
Panama	Cambodia
Mexico	Myanmar
Chile	Brunei
	Laos

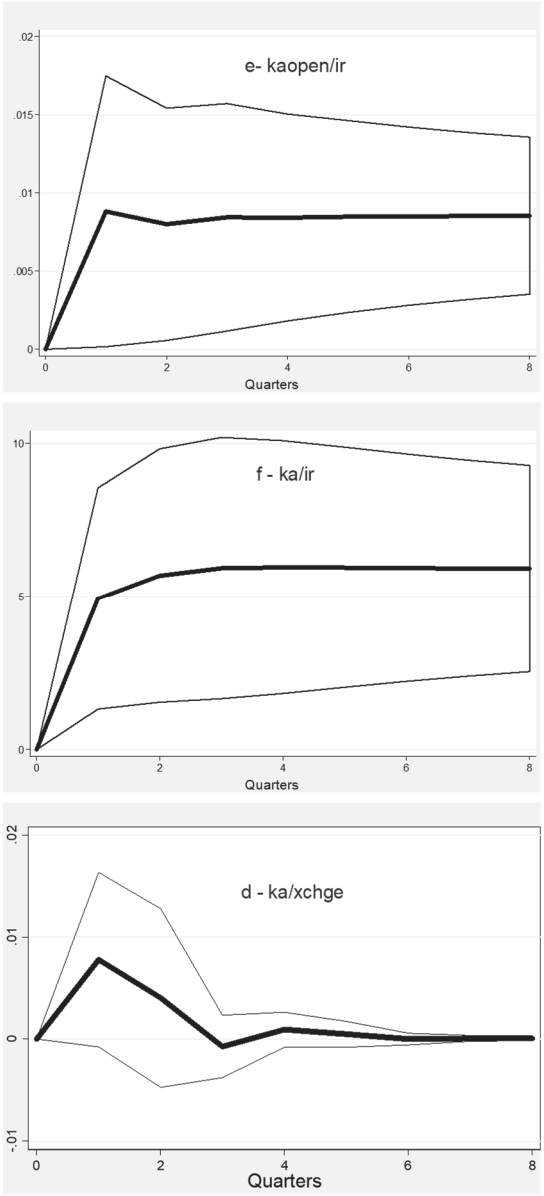
***Source**: authors' illustration*

Table 2: Description of Variables

Variable	Description	Source
ka	Overall restrictions index (all asset categories)	Fernández, Klein, Rebucci, Schindler, and Uribe (2016) "Capital Control Measures: A New Dataset"
kai	Overall inflow restrictions index (all asset categories)	
kao	Overall outflow restrictions index (all asset categories)	
kaopen	The extent of openness in capital account transactions	Chinn, M. D., and H. Ito, The Chinn-Ito Index, http://web.pdx.edu/~ito/Chinn-Ito_website.htm, last updated July 2017.
rate	Interest rate spread (to the US interest rate)	IFS, International Financial Statistics of IMF
xchge	Bilateral exchange rate (to the US $)	IFS, International Financial Statistics of IMF
ir	Reserves and related items	WDI, World Bank Data
infl	Capital inflows, Portfolio equity and FDI, net inflows (BoP, current US$)	WDI, World Bank Data
outfl	Capital outflows, Portfolio equity and FDI, net outflows (BoP, current US$)	WDI, World Bank Data

Figure 1: Domestic impact of tightening capital controls

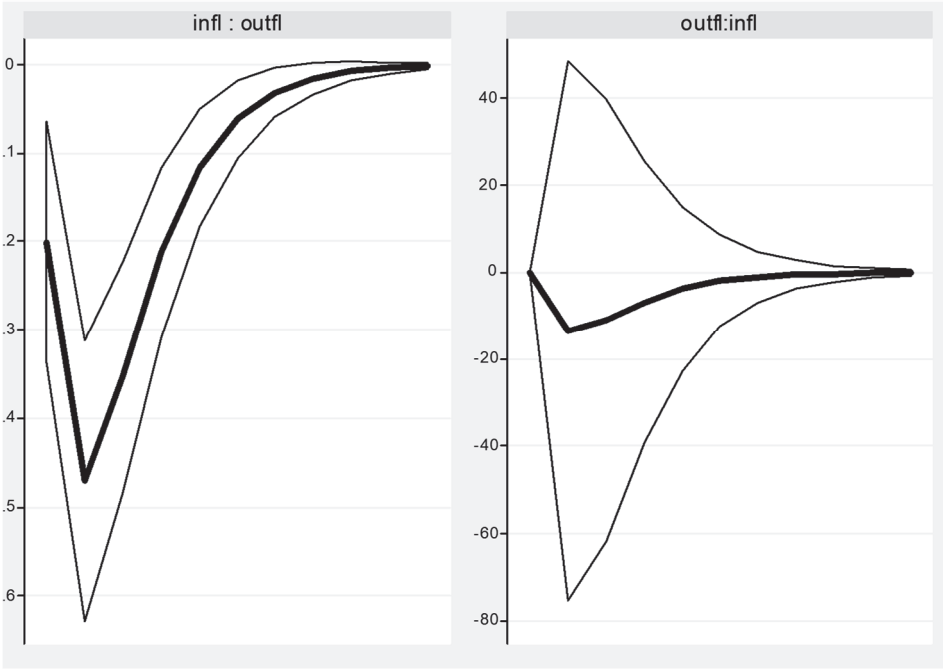




Legend: *95% Confidence Interval*
Orthogonalized IRF

Note: Impulse variable is the first variable cited (kaopen or ka); Response variable is the second variable cited (rate or xchge or ir)

Figure 2: Spillover effects - IRFs for inflow and outflow



Note: Impulse variable is the first variable cited; Response variable is the second variable cited