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Effects of Capital Control Actions on Cross-Border Trade

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Abstract

The evidence that capital controls adversely affect cross-border trade is debatable. This study proves that capital controls may support international trade by mitigating the negative effect of macroeconomic volatility. We use quarterly data from a sample of 25 emerging countries over the period 2011-2019. Using long- and short-standing capital controls dynamic panel models, and diversifying robust estimations techniques, our results show that capital controls alleviate the adverse effect of the exchange rate, interest rate differential, and inflation volatilities. The long-lasting capital controls «walls» are more effective than short-lasting capital control «gates». Besides, the effects of these controls are asymmetric regarding the financial development level and category of flows for which are applied, inflows or outflows. The study highlights the beneficial role of the macroprudential policy in supporting capital control actions. The results of this study have two main policy implications, the effectiveness of 'walls' controls and the importance of macroeconomic policy coordination.

Keywords: capital controls; flows; volatility; trade.

JEL classification: F14; F38; F68.

1. INTRODUCTION

The international exchange of goods and services becomes easier with more capital account liberalization and engenders transnational financial flows. However, capital flows restrictions have been frequently employed to secure countries from grave financial panics, and consequently disrupt capital flow movements. As a main tool of the restrictive policy, capital controls have important implications for international trade (Lai, Wang, & Xu, 2021). Few studies have dealt with the relationship between capital controls and international trade (Giovannini & Park, 1989; Tamirisa, 1999; Wei & Zhang, 2007), and different results were obtained. Besides, only the direct effect of capital controls on international trade was analyzed, and previous studies have found an adverse effect. This study contributes to the empirical literature by examining the indirect effect through some macroeconomic channels. Our findings are different and suggest that capital controls are likely to support international trade.

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Our investigation identified three distinct channels that could potentially mitigate or aggravate the effects of capital control actions on international trade. First, the exchange rate is a key variable in international trade and affects both imports and exports (Annelies, Mark, Roel, & Sigrid, 2020). Certainly, any change in the value of currencies will stimulate or constrain commercial and financial transactions of goods and services by affecting relative prices (Cravino, Lan, & Levchenko, 2020). To reach exchange rate targets and avoid systemic risk, policymakers use capital controls (Magud, Reinhart, & Rogoff, 2011). These controls are also employed to prevent or limit the overheating of the economy and an increased appreciation of the exchange rate caused by massive capital inflows (Pandey, Pasricha, Patnaik, & Shah, 2021). Second, the exchange rate policy is closely related to the monetary policy, which uses the interest rate as its essential instrument. Indeed, the differential of domestic and foreign interest rates is often used in international economics literature as the main determinant of international capital flows (Gong, Wang, & Zou, 2017). Capital controls may affect the monetary policy. According to S. Edwards (1999), following the implementation of capital controls, interest rate differentials are reduced and tend to disappear gradually, more so than following capital account liberalization events. Furthermore, the interest rate differentials affect the cost of capital borrowed from abroad, which raises the cost of international transactions (Soto, 1997). Third, both the exchange rate and monetary policies have often been used together to deal with unwanted inflation (F. Bianchi, Melosi, & Rottner, 2019). General inflation has a close relationship within the exchange rates, through which it can affect international trade. Trade policy and cross-border trade are difficult to understand even with low inflation rates; economic principles become more complex with high and chronic inflation. Indeed, high inflation reflects increased changes in the level and allocation of real income domestically and internationally.

Drawing on the above literature, capital controls may operate through exchange rate, interest rate differential, and inflation rate to affect international trade and contribute to imports and exports. This study hypothesizes that these channels are relevant conduits for capital controls to affect international trade[1]. This indirect impact of capital controls has never been tested empirically. This lack of empirical assessment is surprising, given the important implications these transmission channels have for designing a suitable macroeconomic policy supporting international trade. It has been argued that capital controls stringency has a direct detrimental effect on international trade (Lai et al., 2021). A consequence and relevant area of inquiry is whether, in addition to their direct effect, these restrictions on capital flows also indirectly affect international trade. This study predicts that the indirect impact of capital controls may be different based on whether the exchange rate, interest rate differential, and inflation volatilities are mitigated.

A key focus of our analysis is the interaction between capital controls (i.e., the “walls” and the “gates”) and the channel variables: Do such controls reduce the extent to which the channels stimulate or dampen international trade? The present study contributes to the literature in multiple ways. First, the existing literature on the impact of capital controls on international trade is scant and deals particularly with the direct effect. Our study differs in that we focus on both direct and indirect effects of capital controls, to evaluate how capital control policies mitigate or aggravate the impact of transmission channels on international trade. Second, we extend the existing literature by employing a broader scope data on capital controls, international trade, and related channels that affect international trade. Our data reflect capital control stringency across 25 countries from 2011 to 2019. Unlike the majority of previous studies that consider broad-based measures of capital controls and apply indicators

of inflow and outflow restrictions on all types of flows, we adopt a new kind of capital controls index. The relevant Financial Accounts Restrictiveness Index is compiled by the IMF's Monetary and Capital Markets Department, relying on source data of the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). The widely used indicators, including the Fernández, Klein, Rebucci, Schindler, and Uribe (2016) and Chinn and Ito (2008) indexes, are used for robustness check. Third, the literature has focused mainly on the effects of capital control on exporting countries (Pasricha, 2021). However, the international trade value is measured for both exports and imports of goods and services. In this study, the bilateral trade flows are considered; we analyze these effects for both exporting and importing countries. Fourth, our paper extends the analysis to some capital control related issues. For instance, during periods of large inflows, policymakers tighten restrictions on capital inflows and reduce them for outflows, and vice versa during tightening periods. The cyclical behavior of capital controls highlights multiple impacts on international trade according to the type of controls applied, and affects exporters and importers asymmetrically. Furthermore, macroprudential policies aiming for stability of the financial system can be introduced concurrently with capital controls, and the effects of the two policy tools may therefore be conflated (Bergant, Grigoli, Hansen, & Sandri, 2020; Lai et al., 2021). We provide evidence of a useful combination between capital controls and macroprudential policies. Finally, we compare the effect of capital controls in countries with developed and less developed financial systems, in accordance with previous findings that show that developed financial systems support capital control actions, which reduce macroeconomic volatility and benefit international trade in those countries (K. J. Forbes, 2007).

The empirical analysis uses a dynamic panel framework to investigate the impact of capital controls on international trade. This study analyzes the behavior of capital controls in economies that vigorously alter these constraints over time. Our empirical approach entails two estimation phases, as in K. J. Forbes, Fratzscher, and Straub (2015) and Glick, Guo, and Hutchison (2006). Based on a quarterly dataset of 25 countries covering the period 2011–2019, we regressed two models according to the length of time capital controls were in place[2].

The empirical results show a significant negative impact of capital controls on international trade. This finding is consistent with the empirical literature suggesting a direct detrimental effect on international trade. Strangely, the direct effect of capital controls on international trade is different from the indirect effect inferred through interaction terms. The results provide strong evidence that long-lasting capital controls mitigate the adverse effects of exchange rate and interest rate differential volatilities on international trade. This result is interesting, as while the direct effect of capital controls harms international trade, we provide evidence that such controls can also benefit international trade by mitigating the adverse effects of the three channels. Furthermore, we found that capital controls affect exporting and importing countries asymmetrically. The findings support an intensification of capital control actions for more developed financial systems. Finally, the results show that the macroprudential policy lessens the extent to which fluctuations of the channels affect international trade. We ensured the results of this study are robust through further conventional indexes of capital controls — those of Fernández et al. (2016) and Chinn and Ito (2008).

This paper is structured as follows. Section 2 presents the literature review. Section 3 outlines the empirical framework and data used. Section 4 reports our main findings and the interpretation of the results. Section 5 extends the analysis to capital controls related issues, along with robustness checks. The final section provides the conclusion.

2. LITERATURE REVIEW

During the early 1990s, there was a growing belief that relaxing restraints on the movement of capital would yield benefits similar to liberalized trade. It was strongly believed that free movement of capital can have several important benefits for the domestic economy. It led to overall improved international allocative efficiency. However, a spate of financial crises in the 1990s forced policymakers to rethink the strategy of unbridled capital flows. The countries that were worst affected by these crises were the ones that had opened up capital inflows. As a result, several economists have pointed out that unrestrained capital flows can act as a serious impediment to global financial stability and have called for the imposition of capital controls, such as the Tobin Tax, on trade in international assets. Capital controls remain a widely discussed issue in macroeconomic policies. Yet, the abundant studies on the effectiveness of capital controls and their impacts on international trade are less debated. Capital controls may act through multiple channels to affect international trade.

One main potential channel is the exchange rate. The theoretical literature has developed multiple evidence of a close causal relationship between changes in exchange rates and international trade. The evidence shows that higher volatility of the exchange rate leads to an increase in revenue uncertainty, which adversely impacts bilateral trade. Risk aversion and irrecoverable investment in productive capital seem to be the motivators of this increased uncertainty (Cushman, 1983; Hooper & Kohlhagen, 1978). Due to investors' risk aversion, a negative correlation between exchange rate volatility and international trade can be assumed (Asteriou, Masatci, & Pılbeam, 2016). In contrast, McKenzie (1999), among others, showed a positive impact of exchange rate fluctuations on international trade. Nonetheless, there is no consensus regarding this relationship. The consequences of exchange rate volatility for international trade remain undetermined, and the corresponding literature is mostly inconclusive. The global evidence characterizes the results of this relationship as heterogeneous, since findings are dependent on the sample studied, empirical specifications, the proxies for exchange rate and international trade used, and the period of analysis (Steinbach, 2021).

A second potential channel of impact is through the interest rate differential. A large number of empirical studies examining the surge in capital inflows to emerging economies found that the interest rate differential is the basic determinant of these flows (Chakraborty, 2006; De Gregorio, Edwards, & Valdés, 2000; Frankel & Okongwu, 1996). Both capital inflows and outflows are seen as an obvious result of trade globalization[3] (Davis & Van Wincoop, 2018). The interest rate differential may be considered as a key variable for the development of international trade through its role in the surge of capital flows. This role is also implied by the sticky price assumption of exchange rate determination, as capital inflows are attracted by the highest interest rate under a floating exchange rate regime (Meese, 1984; Obstfeld & Rogoff, 1995). Capital control actions may impact international trade via the interest rate differential (Grilli & Milesi-Ferretti, 1995). K. J. Forbes (2007) showed that capital flow restrictions increase its cost (i.e., a rise in interest rate as a proxy for capital cost) and reduce international commercial transactions. The countries with the least access to international financial markets and which do not benefit from preferential rates would be most affected by these controls.

Inflation volatility may affect international trade and is proposed as our third channel. Stockman (1985) suggests that adverse impact on the direction of trade is caused by slight changes in the inflation rate, and this impact becomes stronger with large shifts in the inflation rate. Capital controls exacerbate the adverse effect of inflation volatility, as they increase the

cost of trade by creating additional frictions (Lai et al., 2021). Bilateral commercial transactions take a long time to conclude; the extent of these transactions will undoubtedly increase the costs of capital in surrounding exports and imports. The availability of this capital is still questioned with capital control policies. Likewise, additional costs may be incurred by governments applying administrative charges surrounding the delivery of goods and services, thus increasing the cost of international trade (Chor & Manova, 2012). These frictions will increase international trade costs. Grilli and Milesi-Ferretti (1995) showed that capital controls act on the interest rate elasticity of money demand and consequently increase the optimal inflation rate; this effect on the inflation is unrelated to the exchange rate regime pursued – floating or fixed. The authors found that capital controls were correlated with minor real interest rates and increased inflation. Similarly, Romer (1993) suggested that liberalization leads to lower inflation rates. Similarly, Gruben and McLeod (2002) showed that inflation tends to decline in more liberalized economies. Rodrik (1998) overlooked the evidence provided by the abovementioned studies. He suggested that governments' attempts to restrain inflation are weakened by large inflows, and there is no evidence that inflation is reduced with more capital account liberalization. McKinnon and Mathieson (1981) considered the role of financial development, and endorse the use of capital controls in less financially developed countries in order to control inflation.

An extensive empirical literature has focused on the difficulty of identifying capital controls effects. On the one hand, these controls do not vary much over time, reducing the power of standard fixed-effects regressions. On the other hand, their level could be correlated with several country-specific factors, exposing a random-effects regression to potential omitted variables. Cerdeiro and Komaromi (2019) argue in favor of identifying the effects of capital controls through interaction effects by showing in a simple model that capital controls affect the unconditional mean of flows and the sensitivity of capital to numerous pull and push determinants. This point is usually not exploited in regression models that neglect to consider interactions and assume a cumulative linear impact of capital controls on the degree of capital movements. Following Cerdeiro and Komaromi (2019), we controlled for time-invariant omitted variables at the country level as tightly as possible. In addition, and to identify the effects of policies, we included interaction terms to analyze how capital controls interact with macroeconomic fundamentals (channel variables) in affecting international trade.

Finally, our paper relates to a growing body of literature that investigates capital control related issues. For instance, studies searching for optimal capital controls show that controls must be procyclical for inflows and countercyclical for outflows (Benigno, Converse, & Fornaro, 2015; J. Bianchi, 2011). Consequently, to ensure more macroeconomic stability, these controls should discourage capital inflows during expansions and encourage them during contractions (Erten, Korinek, & Ocampo, 2021; Fernández et al., 2016). The cyclical and countercyclical behavior of capital controls should produce asymmetric impacts on exporting and importing countries. A second related topic is the role of financial development in supporting capital control actions (Binici, Hutchison, & Schindler, 2010; Bush, 2019; Lane & Milesi-Ferretti, 2008). For instance, Bush (2019) provides evidence that the impact of capital controls is influenced by the level of financial development. He found that a high level of financial development supports the impact of the restrictive policy; therefore, policymakers need to choose between more financial liberalization or restricted capital account and act through targeted controls. Other studies looked at capital account liberalization instead of capital controls (Chinn & Ito, 2008; Eichengreen, Gullapalli, & Panizza, 2011). These studies

have highlighted the role of a more developed financial system in the success of the financial liberalization process. Another relevant matter concerns the joint use of macroprudential policies and capital controls. With data available for more than a decade since the 2008 global financial crisis, a number of recent studies examined the efficiency of restrictive policies in retrospect through a panel data analysis (Frost, Ito, & van Stralen, 2020; Nier, Olafsson, Rollinson, & Gelos, 2020; Zehri, 2022). Many countries, particularly emerging economies, have used capital controls as an effective tool against the surge of capital flows. Those countries have also employed macroprudential policies to target major disequilibrium affecting the global macroeconomic and financial spheres. For instance, Qureshi, Ostry, Ghosh, and Chamon (2011) examined a joint effect of macroprudential policies and capital controls to counter massive inflows and ensure more stability of the financial system. The authors found some overlap between macroprudential policies and capital controls.

3. EMPIRICAL FRAMEWORK AND DATA

3.1 Data and Variables

We constructed a quarterly dataset for 25 countries[4]. The sample is composed mostly of emerging economies[5]. These countries were chosen for two main reasons: first, they have floating exchange rate regimes that allow considering the exchange rate volatility; second, they have taken frequent capital control actions (e.g., Chile, Brazil, and Russia) that actively change over time, and such changes enable to highlight the cyclical behavior of capital controls. We take into account the differences in the level of financial development and the adoption of macroprudential policies in these countries; such partition will be useful in the empirical analysis. The period of the analysis is considered significant for this study, as it follows the 2008 financial crisis which led to a rapid return to capital controls. Likewise, this period exhibits considerable fluctuations in international trade values (Lai et al., 2021).

Table no. 1 – Country Sample

High (9)	Upper-Middle (9)	Lower-Middle & Low (7)
Chile (0.545)	Paraguay (0.171)	Algeria (0.128)
Croatia (0.406)	Turkey (0.537)	India (0.392)
Iceland (0.629)	Thailand (0.645)	Philippines (0.365)
Japan (0.827)	Russia (0.592)	Indonesia (0.322)
Cyprus (0.556)	South Africa (0.618)	Ukraine (0.275)
Poland (0.476)	Colombia (0.449)	Morocco (0.390)
Singapore (0.731)	Mexico (0.396)	Egypt (0.280)
Uruguay (0.240)	Peru (0.410)	
South Korea (0.854)	Brazil (0.652)	

Note: The repartition of countries is made according to the World Bank income classification. The values of Svirydzenka (2016) financial development index are reported in parentheses. The country is considered high-financially developed if the index exceeds 0.5.

Source: author's illustration

3.1.1 Capital controls and international trade

The literature on capital controls recognizes multiple limits to finding accurate measures for the stringency of these controls. Previous works have employed de facto, de jure, and mixed indexes (Chinn & Ito, 2008; Fernández et al., 2016; Quinn, Schindler, & Toyoda, 2011). Unlike the majority of previous studies that considered broad-based measures of capital controls and applied indicators of inflow and outflow restrictions on all types of flows, we used an index of controls — denoted CC — developed in 2011 by the Fund's Monetary and Capital Markets Department of the IMF. The relevant Financial Accounts Restrictiveness Index is based on source data from the IMF's AREAER. The Financial Account Restrictiveness Index is a broad index obtained by averaging binary (i.e., "open" or "closed") indexes of barriers in 62 groups of capital account transactions in the AREAER[6] (Nier et al., 2020). The dependent variable of our empirical models (denoted trade) is the value of international trade calculated by the total of exports and imports of goods and services (Amiti & Wakelin, 2003). Table no. 2 reports description of all variables used in the empirical analysis.

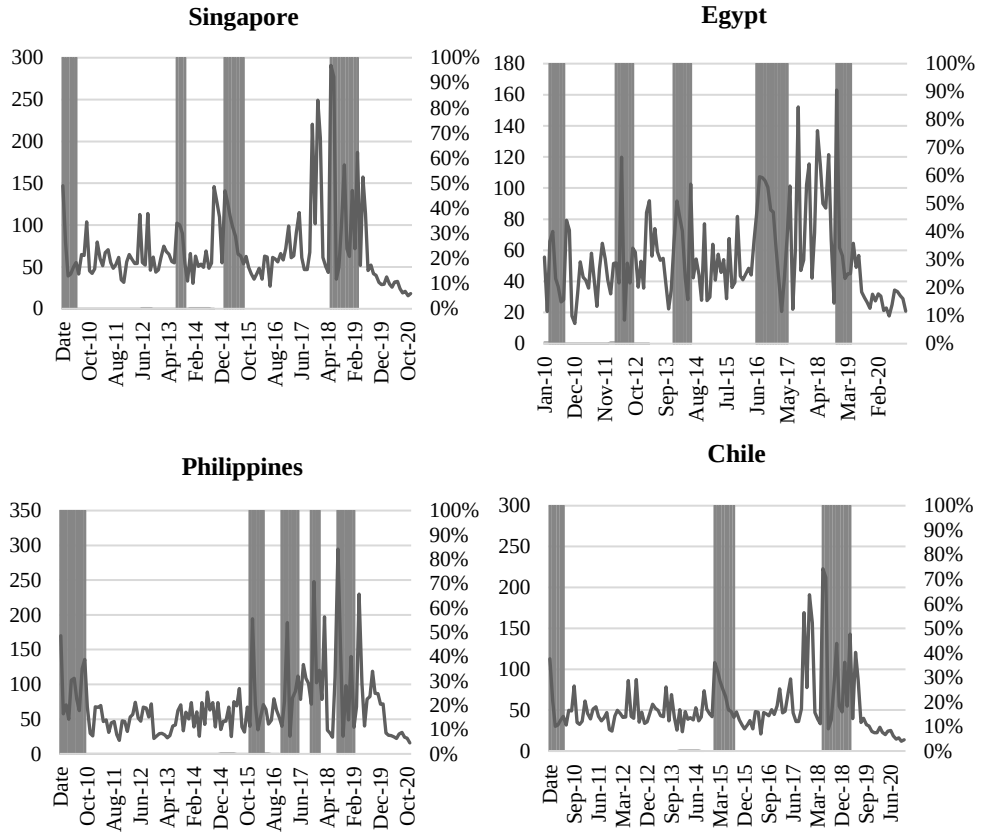
Table no. 2 – Description of Variables

Variable	Symbol	Description	Sources
		Dependent variable	
Trade value	Trade	(Log) Total exports and imports of goods and services	The UN Comtrade Database
		Capital control index	
Capital controls index	CC	Financial account restriction index, range 0-1 (higher values indicate a more restrictive system).	IMF AREAER
		Indexes of robustness	
An alternative measure of capital controls	ka	Overall restrictions index (all asset categories)	Fernández et al. (2016)
An alternative measure of capital controls	kaopen	Based on the binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER).	Chinn and Ito (2008)
		Channels variables	
Exchange rate volatility	XC	Real effective exchange rate	IMF IFS
Interest rate differential	RATE	Differences between domestic interest rate and the real U.S. 10-year Treasuries rate	IMF IFS
Inflation volatility	INF	Variation of the CPI	IMF IFS
		Control and Instrumental Variables	
Gross Domestic Product	GDP	Rate of growth in nominal Gross Domestic Product	IMF IFS
Forecast of future GDP growth	FGDP	Year-over-year quarterly log change of forecasted real GDP growth. It is a weighted average of current year's and next year's forecasted growth rates.	Consensus Forecast, IMF WEO
Tariff rate	TAR	A simple average of tariff rates across all manufactured products	WDI
Change in the current account deficit	CA	Positive values entail a greater deficit while negative values a move towards surplus (% GDP)	WDI
Terms of trade	TERMS	The ratio of export prices to import prices	WDI

Foreign Direct Investment	FDI	Foreign direct investment (% GDP)	IMF IFS
International Reserves	IR	Reserves and related items (% total external liabilities)	WDI
		Related-issues variables	
Macroprudential policy	MP	The MP index takes the value of 1 in every quarter macroprudential policies increase, -1 when they decrease and 0 when they do not change.	Ahnert, Forbes, Friedrich, and Reinhardt (2021)
Financial development	FD	The index has a range of 0 to 1, with 1 accorded to a more developed financial system	Svirydzenka (2016)

Source: author's illustration

Figure no. 1 represents an association between capital control periods and the international trade value (% GDP). The figure corresponds to eight countries in our sample that have significant capital controls experience: Singapore, Egypt, Philippines, Iceland, Brazil, Chile, Thailand, and Turkey. Pandey et al. (2021) and Binici and Das (2021) have identified these countries among the most controlled countries.



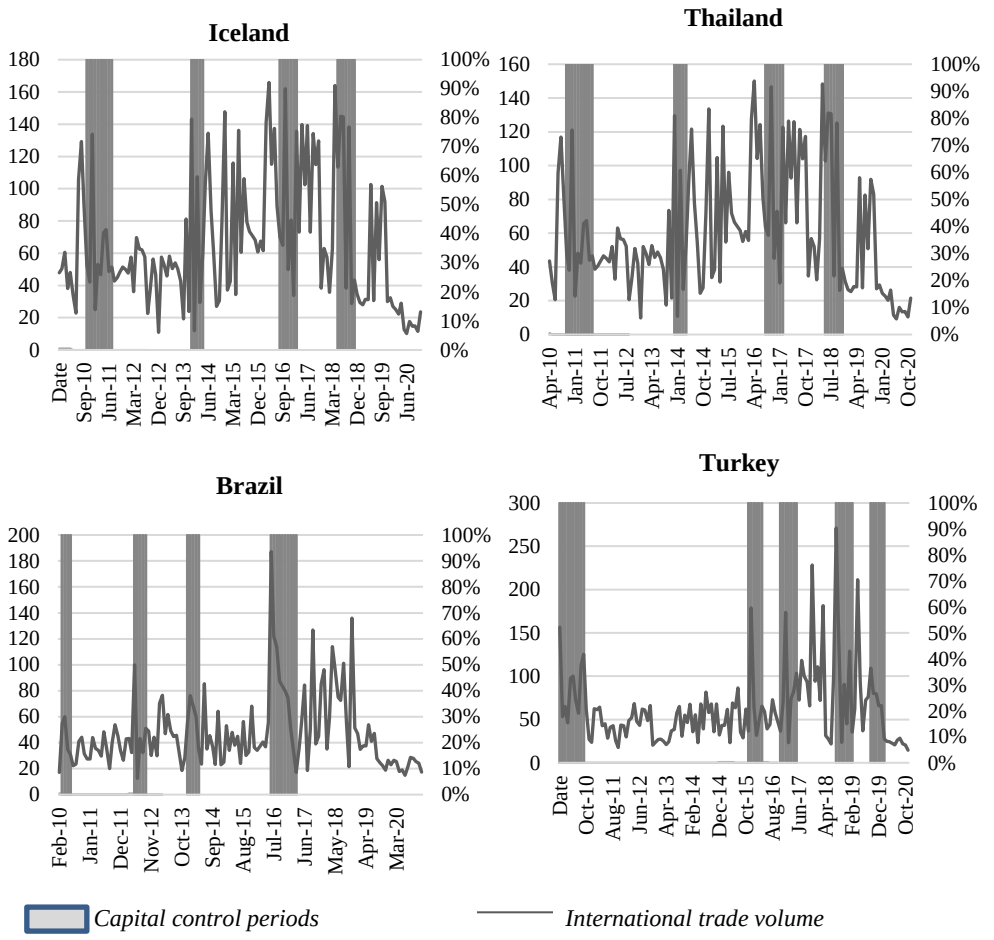


Figure no. 1 – Capital Control Periods and International Trade

The periods marked in gray correspond to capital control events. These periods are identified by monitoring restrictions to international trade applied by each country, relying on the information in the IMF's AREAER. For the eight countries, we note a reduction in international trade volume during capital control periods. The results in Figure no. 1 are in line with the literature showing that capital control actions harm international trade (Giovannini & Park, 1989; Tamirisa, 1999; Wei & Zhang, 2007).

3.1.2 Channels of capital controls

We draw on the previous studies by using three interaction terms between the capital control index and the volatility of some channel variables affecting international trade. Our first channel is the exchange rate volatility (XC); we used the real exchange rate standard deviation which captures the effective relative price of goods and services. We controlled for

the interest rates differential (RATE) — our second channel — computed as the difference between domestic and international interest rates (Bacchetta et al., 2021)[7]. We also controlled for inflation volatility (INF) — our third channel — calculated as the standard deviation of the Consumer Price Index.

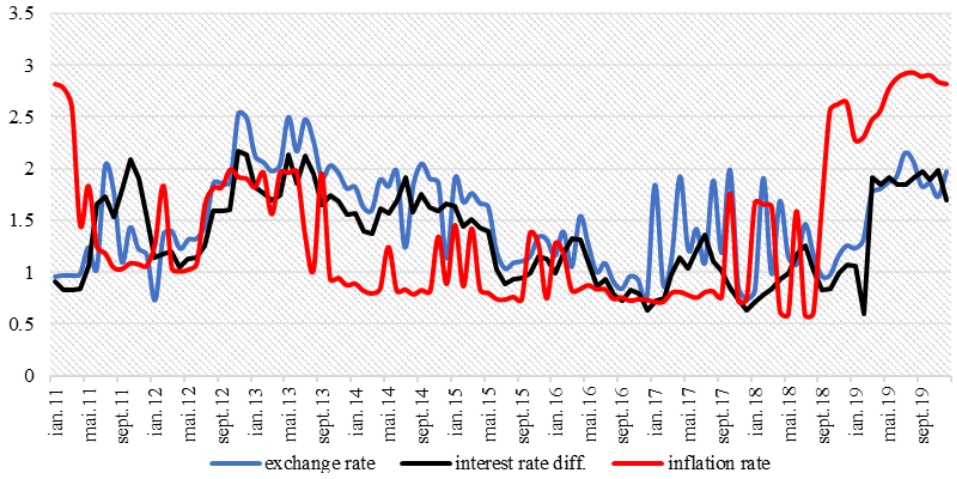


Figure no. 2 – Channel Variables Volatilities

Figure no. 2 displays the fluctuations of the channel variables during the analysis period[8]. It shows some correlation between exchange rate and interest rate differential volatilities. In certain time periods, the exchange rate and interest rate differentials show a similar pattern, while in others, the movements are in opposite directions. For instance, a distinct pattern can be seen at the end of the period which corresponds to the COVID-19 shock which affected the entire world. Those multiple associations confirm the diversity of correlations found by theoretical and empirical studies on the exchange rate volatility and interest rate differential linkage. Multiple studies highlight the difficulty of coordinating between the two policies (i.e., policy mix, exchange rate, and monetary policy) to deal with concerning macroeconomic issues. Regarding the inflation rate volatility, Figure no. 2 shows an increase during the start and end periods. This may be attributed to two international shocks affecting the entire world – the start period following the 2008 global financial crisis, and the end period coinciding with the COVID-19 pandemic.

3.1.3 Control variables and instruments

Our empirical models include important control variables that are expected to have deep impacts on international trade. The first control variable is the real GDP, which is a proxy for the country's economic power. We included the consensus forecast of future GDP growth (FGDP) as a control variable, since this serves to mitigate a potential simultaneity problem when "good news" about the economy leads to appreciation of the exchange rate and at the same time affects trade. Wei and Zhang (2007) showed that capital control stringency causes a considerable

drop in bilateral trade transactions, similar to a rise in tariffs of about 11% to 14%. We controlled for trade barriers effects by including a simple average of tariff rates (TAR).

Since capital controls are potentially endogenous to other economic policies, we used instrumental variables estimation to isolate exogenous changes in capital controls and their implications for international trade. Relying on the empirical literature, and as suggested by S. Edwards (2007), the following instruments were used: the current account deficit (CA), the percentage change in the terms of trade (TERMS), foreign direct investment relative to the GDP (FDI), and international reserves (IR).

Table no. 3 reports descriptive statistics of the model's variables. The main finding is that capital restrictions change little over the period of analysis; the capital controls index CC shows slight changes over time, with a standard deviation of 0.16. High volatilities are the main characteristic of the analysis period. Besides, the dominant aspect that stands out is the large variations of the channel variables and international trade. For the sample countries, on average, the standard deviation of the channel variables is roughly 31.45. The high volatility of the channels displayed in Figure no. 2 is confirmed by the results of Table no. 3.

Table no. 3 – Summary of Statistics

Variable	Mean	St. Dev.	Min	p25	p50	p75	Max
Trade ($, millions, E+10)	5.45	1.15	0.13	2.03	3.48	6.22	12.03
CC	0.18	0.16	0	0.08	0.16	0.25	1
Ka	0.36	0.39	0	0.15	0.38	0.73	1
Kaopen	0.79	0.23	−1.90	-1.24	0.75	1.34	2.37
XC	-0.51	37.19	-21.54	-5.24	-1.27	4.47	23.15
RATE	-0.24	15.83	-0.41	-0.16	1.07	1.84	3.48
INF	6.23	41.35	2.45	1.12	3.01	4.65	70.70
GDP	1.13	0.41	-1.15	1.05	1.87	2.14	6.74
FGDP	3.14	2.05	-3.55	1.56	3.58	7.56	8.57
TAR	7.07	6.60	0.00	2.23	4.76	10.42	86.48
CA	5.08	3.75	-7.14	-1.57	3.48	5.27	11.32
TERMS	4.86	2.08	1.04	1.17	3.14	6.59	9.37
FDI	5.66	17.64	-46.21	12.45	33.08	69.12	53.16
IR	21.38	12.54	5.31	10.54	14.87	23.57	85.67
MP	0.14	0.36	-1	-0.66	0	0.66	1
FD	0.41	0.08	0	0.31	0.46	0.78	1

Note: This table presents the summary statistics for all variables used in all specifications.

Source: authors' calculations

3.2 Baseline Setup and Methodology

To formally study the links between capital controls and trade, the estimation equation underlying the baseline estimates was adopted from previous studies (e.g. Lai et al., 2021; Manova, 2013). As in M. W. Klein (2012) and Bacchetta et al. (2021), we distinguished between "wall" and "gate" controls.

The empirical analysis used a dynamic panel framework to investigate the effects of capital controls on international trade through the channel variables. Our baseline setup, in which we expand on some capital controls related issues, relates the dependent variable (trade) to exchange rate volatility (XC), interest rate differential (RATE), inflation volatility (INF),

capital control actions (CC), and their interactions. We denote TC the vector of transmission channel variables; TC : {XC; RATE; INF}. Our regressions are based on the two equations for long-lasting controls and episodic controls outlined below:

- Long-lasting controls, the "walls" effect of capital controls (levels, CC)

$$\log(\text{trade}_{i,t}) = £_{i,j}\log(\text{trade}_{i,t-1}) + \alpha_{i,j}CC_{i,t-1} + \beta_{i,j}TC_{i,t-1} + \theta_{i,j}CC_{i,t-1} \times TC_{i,t-1} + \partial_i Z_{i,t-1} + \delta_{i,t} + \varepsilon_{i,t} \quad (1)$$

- Short-standing controls, the "gates" effect of capital controls (1-quarter change, ΔCC)

$$\log(\text{trade}_{i,t}) = £_i\log(\text{trade}_{i,t-1}) + \alpha_i\Delta CC_{i,t-1} + \beta_i TC_{i,t-1} + \theta_i\Delta CC_{i,t-1} \times TC_{i,t-1} + \partial_i Z_{i,t-1} + \delta_{i,t} + \varepsilon_{i,t} \quad (1)$$

where log ($\text{trade}_{i;t}$) is the dependent variable measured by the total of imports and exports of goods and services in country i at time t. CC is the level of capital control index. Z denotes the vector of control variables and instruments previously described.

If capital control actions are effective in mitigating an adverse impact of our channels on international trade, we expect a rise in θ_i. The parameters α and θ reflect the direct and indirect effects of capital controls, respectively.

We performed the estimation of Equations (1) and (2) with various estimation techniques commonly recommended for dynamic panel models and which provide robust estimators. For our study, these estimators fit better with a moderate number of countries and a short time period. We used two estimators of the Generalized Method of Moments (GMM) — the difference and the system GMM. Some studies have concluded that system GMM is more efficient than difference GMM (Blundell & Bond, 1998); the preference for the system GMM estimators is motivated by their robustness despite the heteroskedasticity aberrations in a linear regression specification containing a narrow time series[9]. Alternatively, dynamic panel data analysis can use two commonly used estimators — the fixed effects and random effects maximum likelihood estimators (MLE) (Hsiao, Pesaran, & Tahmiscioglu, 2002). The two types of estimation – GMM and MLE – have different advantages, particularly related to the weakly endogenous explanatory variables.

A common challenge faced by the research on the impacts of capital controls is the problem of endogeneity – more specifically that of potential reverse causality (Alam et al., 2019; Galati & Moessner, 2018). Capital control actions do not occur in a vacuum; they may be taken in response to macroeconomic and financial developments, which may be the same variables used to assess their effects. We mitigated the risk of biased estimates due to endogeneity in four ways (the first two being commonly applied in the literature — e.g., Cerutti, Claessens, & Laeven, 2017; Claessens, Ghosh, & Mihet, 2013)

1. In our baseline setup, we lagged the capital controls index and control variables by one-quarter and include the lagged dependent variable [10];
2. Among our estimators, we used the Arellano-Bond GMM methodology, which is suitable for independent variables that are not strictly exogenous;
3. We focused on the interaction term of $CC_{i,-1} \times TR_{i,t-1}$. This should suffer less from an endogeneity bias, based on the assumption that changes in the transmission channels are not commonly taken into consideration when designing a capital control policy. The change

in the transmission channel then functions as an exogenous shifter of the effect of prior capital control action, reducing the potential endogeneity problem;

4. We included the control and instrumental variables described earlier.

We take our examination of potential simultaneity one step further by accounting more fully for economic fundamentals that may be driving both capital controls and international trade simultaneously.

4. RESULTS AND INTERPRETATION

Estimation results of the baseline regression for the "walls" and "gates" effects of capital controls (i.e., Equations (1) and (2)) are presented in Table no. 4[11]. Panels (1) and (2) report the estimates using GMM estimators – difference and system, respectively. Panels (3) and (4) report the findings using MLE estimators – fixed and random effects, respectively. Similarly, we regressed panels (5) to (8) for Equation (2)[12].

The different estimation methods – GMM and MLE – match the signs and levels of the coefficients. There is higher statistical significance with the MLE estimators. The validity of the instruments is accepted for the GMM regressions, following the Hansen test for over-identifying restrictions. The p-values for first- and second-order autocorrelated disturbances are displayed for AR(1) and AR(2). The results show the absence of autocorrelation for the second-order, however there is a significant first-order autocorrelation. The fixed effects MLE are preferred to random effects according to the Hausman test. The Wald test statistics are highly significant for all estimation methods, showing that the variables composing the models lead to statistically significant improvement in their fit. In sum, our diagnostic tests corroborate the correct model specifications.

The findings show very similar coefficients generated by the different estimation techniques. Globally, our results clearly show significant adverse effects of capital controls on international trade. This result is consistent with the empirical literature showing a direct detrimental effect of capital controls on international trade (Giovannini & Park, 1989; Tamirisa, 1999; Wei & Zhang, 2007). For the channels without interaction with the capital controls index, the estimated exchange rate volatility is in the range of -0.091 to -0.132, showing an adverse effect on international trade. Similarly, a harmful impact is displayed by the estimates of interest rate differential which range from -0.095 to -0.136. These results are expected given the specific relationship between monetary and exchange rate policies in developing economies due to persistent boom-and-bust of capital flows (Guzman, Ocampo, & Stiglitz, 2018). Globally, macroeconomic instability and excess volatility are often a source of weak economic performance and fragility (Kose, Prasad, & Terrones, 2003). The impact of inflation fluctuations is stronger; its coefficient is about -0.192 to -0.236, indicating that around the fifth to the fourth decrease in international commerce is caused by inflation volatility. Usually, inflation volatility reflects a climate of uncertainty which discourages international trade transactions.

Considering the indirect impact, the exchange rate interaction term has a significant coefficient of -0.095, which has interesting economic significance implying that 9.5% of international trade changes are transmitted through exchange rate changes (with the different estimation methods). When capital controls are permanent (comparison between coefficients of "walls" and "gates"), the exchange rate becomes less volatile, and reduces the adverse effect on trade.

Table no. 4 – Baseline Model

	"Walls" Effect				"Gates" Effect			
	GMM		MLE		GMM		MLE	
	Difference	System	FE	RE	Difference	System	FE	RE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CC	-0.117**	-0.129***	-0.121*	-0.115*	-0.097*	-0.099**	-0.101*	-0.108
	(0.047)	(0.039)	(0.061)	(0.058)	(0.050)	(0.043)	(0.051)	(0.119)
XC	-0.101*	-0.132**	-0.131*	-0.094	-0.091*	-0.131**	-0.125	-0.124
	(0.053)	(0.055)	(0.066)	(0.102)	(0.046)	(0.041)	(0.089)	(0.102)
RATE	-0.127**	-0.136**	-0.112*	-0.095	-0.117**	-0.106**	-0.125	-0.115
	(- 0.054)	(- 0.057)	(0.056)	(0.113)	(0.049)	(0.044)	(0.302)	(0.413)
INF	-0.204*	-0.216*	-0.228*	-0.192	-0.224**	-0.236*	-0.238*	-0.232
	(0.103)	(0.109)	(0.115)	(0.203)	(0.091)	(0.119)	(0.121)	(0.203)
CCxXC	-0.082*	-0.095***	-0.092**	-0.081*	-0.105*	-0.108**	-0.112*	-0.109*
	(0.040)	(0.027)	(0.037)	(0.042)	(0.053)	(0.043)	(0.057)	(0.055)
CCxRATE	-0.094*	-0.081***	-0.097**	-0.072*	-0.104*	-0.101*	-0.113**	- 0.109*
	(0.047)	(0.024)	(0.033)	(0.036)	(0.052)	(0.051)	(0.047)	(0.055)
CCxINF	-0.304*	-0.306**	-0.312	-0.285	-0.253*	-0.246*	-0.241	-0.245*
	(0.154)	(0.129)	(0.212)	(0.223)	(0.128)	(0.124)	(0.212)	(0.124)
Wald/LL	-162.37	-124.17	-91.57	-112.58	-127.54	-147.68	-158.02	-105.97
(P-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Hansen test	(0.72)	(0.09)			(0.86)	(0.17)		
AR(1)	(0.00)	(0.00)			(0.00)	(0.00)		
AR(2)	(0.75)	(0.83)			(0.91)	(0.86)		
No. Obs.	895	1080	895	1080	895	1080	895	1080
# of Economies	25	25	25	25	25	25	25	25

Note: The dependent variable is the logarithm of the international trade value. Significant at *10%, **5%, ***1%. Robust standard errors are in parentheses. Panels (1), (2), (5) and (6) reports GMM estimates ; Panels (3), (4), (7) and (8) reports MLE estimates.

For GMM estimates. The Hausman test of random vs. fixed effects MLE is 31.7 (P<0.001) and 65.3 (P<0.001) for the 'walls' and 'gates' models respectively. The row for the Hansen test reports the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first and second-order autocorrelated disturbances in the first differences equations.

CC: Capital controls index; XC: Exchange rate volatility; RATE: Interest rate differential; INF: Inflation volatility

Source: authors' calculations

The interest rate differential interaction term shifts in accordance with the results found for the exchange rate. Compared to the direct effect, there is a significant decrease in the interaction term coefficient of the interest rate differential (for the "walls" effect). For example, in column (1) the coefficient decreases from -0.127 to -0.094. Furthermore, the results show that permanent capital controls are more effective in mitigating the adverse effect of interest rate differential compared to episodic controls. Indeed, the coefficients of the interaction term increase from "gates" to "walls".

The exception in these results is the inflation rate volatility; capital controls seem to worsen the unwanted effect of inflation. The comparison between the coefficients of INF and CCxINF shows that the adverse effect of inflation on international trade was aggravated following the application of capital controls. This result is different from that found with the exchange rate and the interest rate differentials, for which capital controls mitigate the adverse effects of their volatility. This result of the inflation effect is not surprising; as detailed in the literature review, there is no clear consensus regarding the relationship between capital controls and inflation. Our results are similar to those of the studies suggesting that capital controls are correlated with higher inflation (Grilli & Milesi-Ferretti, 1995; Romer, 1993).

Overall, the results provide strong evidence that more capital control stringency mitigates the adverse effects of exchange rate and interest rate differential volatilities on international trade. This result is interesting, since while the coefficients displaying the direct impact of capital controls on international trade are negative, we found that these controls can in fact benefit trade by limiting the adverse effects of these channels. Thus, our study reveals that the direct effect of capital controls on international trade is – unexpectedly – different from the indirect effect inferred through interaction terms. The result of inflation volatility is more debatable, since capital controls amplify the detrimental effects of inflation volatility on trade. Comparing "walls" with "gates" estimates, we found that the coefficients are stronger for "walls", showing that long-lasting capital controls have a stronger impact on international trade. Targeted controls should be effectively implemented in a precautionary manner, ahead of the occurrence of a surge of trade flows. This suggests that long-lasting targeted controls indeed reduce the volatility of our channels and thereby support international trade.

The different results for the exchange rate and interest rate differential, on the one hand, and inflation, on the other hand, raise the necessity of coordination between the various economic policies affecting these variables. Exchange rate and monetary policies have often been used as a policy mix to target inflation. Capital controls as a restrictive policy may be added to the policy mix to support international trade. A careful mix of these various policies is necessary to achieve optimal results (Bhattarai, Mallick, & Yang, 2021).

5. CAPITAL CONTROLS RELATED ISSUES AND ROBUSTNESS CHECK

Here we extend the analysis for further consideration and examine issues related to the use of capital controls. First, previous studies have been particularly interested in the countercyclical behavior of capital controls and distinct controls on inflows and outflows. Second, a debate has been raised about the role of financial development in supporting capital control actions. Third, macroprudential policies – as closely related restrictive policies – may be implemented concurrently or separately from capital controls.

Table no. 5 reports the estimates of capital controls related issues. For Equation (1), panels (1) and (2) report the findings on the cyclical behavior of capital controls, and distinguish between capital control actions on exporters (controls on inflows) and on importers (controls on outflows), respectively. Panels (3) and (4) consider the role of financial development, and display the results for financially developed and less developed countries, respectively. Finally, Panel (5) reports the findings following the introduction of macroprudential policies. Similarly, we regressed panels (6) to (10) for Equation (2).

5.1 Countercyclical Capital Control Policy

There are specific circumstances when countercyclical capital controls are desirable. Policymakers are advised to impose stringent controls on inflows during expansions and ease controls on outflows during contractions, and vice versa. Thus, there should be negative correlations between capital controls and the two types of flows during expansions and contractions. The cyclical behavior of capital controls highlights multiple impacts on international trade according to the type of controls applied (controls on inflows or outflows). For the purpose of the present examination, we hypothesized that (1) exports are related to capital controls on inflows, and (2) imports are associated with capital controls on outflows

(Lai et al., 2021). The results of this exercise are reported in Table no. 5. Panels (1) and (6) present the estimates for controls on inflows (exporting countries), and panels (2) and (7) present the controls on outflows (importing countries).

Table no. 5 – Capital control related-issues – System GMM estimates

	"Walls" Effect					"Gates" Effect				
	Cyclical behavior of capital controls		Financial development		Macro-Prudential policies	Cyclical behavior of capital controls		Financial development		Macro-Prudential policies
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CC	-0.078***	-0.102*	-0.081**	-0.095*	- 0.086**	-0.101**	-0.113*	-0.104*	-0.129*	- 0.091*
	(0.021)	(0.051)	(0.039)	(0.046)	(0.041)	(0.048)	(0.057)	(0.052)	(0.065)	(0.046)
XC	-0.127**	-0.135*	-0.121*	-0. 144*	- 0.114*	-0.137**	-0.138	-0.130*	-0. 147	- 0.115*
	(0.051)	(0.068)	(0.061)	(0.073)	(0.057)	(0.055)	(0.123)	(0.065)	(0.132)	(0.058)
RATE	- 0.116**	-0.129	-0.112*	-0.145	- 0.101*	- 0.124**	-0.132	-0.128*	-0.151	- 0.114
	(0.046)	(0.104)	(0.056)	(0.113)	(0.052)	(0.051)	(0.204)	(0.064)	(0.113)	(0.103)
INF	-0.166*	-0.174**	-0.128**	-0.152	-0.130*	-0.156*	-0.168**	-0.134**	-0.148	-0.128
	(0.084)	(0.073)	(0.054)	(0.103)	(0.065)	(0.079)	(0.071)	(0.052)	(0.113)	(0.207)
CCxXC	-0.091**	-0.107*	-0.062**	-0.089*	-0.041**	-0.104**	-0.117*	-0.092*	-0.109*	-0.072*
	(0.43)	(0.054)	(0.030)	(0.045)	(0.019)	(0.041)	(0.059)	(0.046)	(0.055)	(0.036)
CCxRATE	-0.094*	-0.112*	-0.094**	-0.110*	-0.047**	-0.101*	-0.125*	-0.125**	-0.134*	-0.093*
	(0.047)	(0.056)	(0.038)	(0.055)	(0.019)	(0.051)	(0.063)	(0.051)	(0.068)	(0.047)
CCxINF	-0.207*	-0.245	-0.142*	-0.175	-0.116**	- 0.186*	-0.193	-0.142*	-0.155	-0.105*
	(0.105)	(0.214)	(0.072)	(0.223)	(0.046)	(0.093)	(0.114)	(0.072)	(0.123)	(0.053)
Wald/LL	-161.27	-127.07	-91.44	-105.31	-119.64	-129.58	-156.34	-108.95	-111.52	-116.47
(P-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Hansen test	(0.00)	(0.12)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
AR(1)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
AR(2)	(0.75)	(0.83)	(0.55)	(0.64)	(0.61)	(0.58)	(0.63)	(0.71)	(0.74)	(0.81)
No. Obs.	1080	1080	475	605	1080	1080	1080	475	605	1080
# of Economies	25	25	11	14	25	25	25	11	14	25

Note: The dependent variable is the logarithm of the international trade value. Significant at *10%, **5%, ***1%. Panels (1) to (5) report the « Walls » effect estimations and panels (6) to (10) report the « Gates » effect estimations. Panels (1) and (2) for inflows and outflows controls, respectively; Panels (3) and (4) for financially developed and less developed systems, respectively. We follow the same presentation for panels (6) and (7); and (8) and (9) concerning the « Gates » effect.

Robust standard errors are in parentheses. The row for the Hansen test reports the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first and second-order autocorrelated disturbances in the first differences equations. For the columns of financial development, the number of countries is determined according to Svirydzenka (2016) index reported in Table 1.

CC: Capital controls index; XC: Exchange rate volatility; RATE: Interest rate differential; INF: Inflation volatility

Source: authors' calculations

Overall, the results suggest that exporting countries are the least affected by the adverse effect of capital controls. In "walls" regressions, the capital controls index has statistically significant coefficients of around -0.078 and -0.102 for exporting and importing countries, respectively. This result shows that the adverse effect of capital controls on international trade is stronger for importing countries. Similarly, the adverse effects of the channels are diminished with the interaction terms. This improvement in the impact on trade is more sizeable in the exporting countries compared to the importing countries. The coefficients of these channels are -0.091, -0.094, and -0.207 for exporting countries, and lower for importing countries (-0.107, -0.112, and -0.245), showing a stronger adverse impact on international trade in importing countries.

Exporting countries have the privilege of accessing foreign exchange earnings and can hedge against the effects of capital controls more effectively than importing countries. Likewise, capital controls increase currency depreciation events and grow foreign exchange reserves of exporting countries (Alfaro, Cunat, Fadinger, & Liu, 2018). After the 2008 financial crisis, emerging economies have accumulated huge reserves of foreign exchange (Pina, 2015). Capital controls can isolate these countries from international capital markets and thus deprive them of owning foreign currencies. International reserve holdings have allowed several emerging markets to mitigate the adverse impact of capital controls on international trade. This increased accumulation of international reserves enables the country to obtain extra liquidity and constitutes a solution to such a situation (Aizenman & Lee, 2007; Obstfeld, Shambaugh, & Taylor, 2008).

5.2 Level of Financial Development

The effect of capital controls is not isolated from the macroeconomic and domestic financial circumstances. A close link exists between the development of the financial system and the quality of financial institutions (Eichengreen & Rose, 2014). Bush (2019) found that capital control actions are amplified in a more developed financial system, through enforcing targeted controls to alter international trade. A number of papers examine the linkage between financial development and trade. Globally, there is a positive effect of financial development on trade (Beck, 2002; Eichengreen et al., 2011; K. J. Forbes, 2007; Manova, 2013; Rajan & Zingales, 1998). We investigated whether the impact of capital controls is different based on the level of financial development. We divided our sample into financially developed and financially repressed economies. The data on financial development were borrowed from Svirydzenka (2016), who established a classification of 180 economies according to their level of financial development (noted FD). In Table no. 5, panels (3), (8), (4), and (9) report the findings for financially developed and less developed economies, respectively.

The findings support an intensification of capital control actions in more developed financial systems. Considering the direct impact, the capital controls index coefficients are lower (with a negative sign) in the financially developed countries, which shows a mitigation of the adverse effects of capital controls on international trade. This mitigation effect is even stronger for long-lasting controls ("walls") compared to episodic controls ("gates"). Regarding the indirect effects through the channel variables, the results of the interaction terms show that financial development also helps to sustain the impact of capital controls. Indeed, the coefficients of these interaction terms are negative and statistically significant, and are higher in financially developed countries than in less developed ones. Financial development facilitates the effectiveness of capital control actions in reducing the volatility of channel variables, thereby improving international trade.

5.3 Macro-Prudential Policies

We examined whether macroprudential measures applied to protect the financial system can support or hinder capital control actions. When macroprudential policies and capital controls are introduced concurrently, the effects of the two policies may be conflated. Panels (5) and (10) display the results when macroprudential policies are applied jointly with capital controls. [13] The data source for macroprudential policy actions is the IMF's iMaPP database

(Alam et al., 2019)[14], which is the most comprehensive database of macroprudential policies to date (noted MP).

Previous studies have shown that macroprudential and capital control policies, introduced countercyclically to capital inflows, support the stability of the financial system and maintain macroeconomic equilibrium (Eichengreen & Rose, 2014; K.J. Forbes, Fratzscher, & Straub, 2013). Both policies should "put sand in the wheels" of bilateral financial transactions, and are more active in times of inflows surges and relaxed during recessions (L. R. Klein, Mariano, & Özmucur, 2006).

Our results show that a macroprudential policy lessens the extent to which the volatility of the channel variables affects international trade. Comparing the coefficients of the interaction terms in Table no. 4 and Table no. 5, for the "walls" regressions we found that exchange rate, interest rate differential, and inflation coefficients increase from -0.095, -0.081, and -0.306 to -0.041, -0.047, and -0.146, respectively. These findings show that controlling for the macroprudential policies does not reduce the impact of capital controls; contrarily, this impact is strengthened. For a given appreciation of the real exchange rate, the subsequent adverse effect of the exchange rate channel is weaker when macroprudential policies had been tightened in the previous quarter. The results also show an increase in the coefficients of interest rate differential and inflation volatility, indicating that the adverse effect on international trade was mitigated following the introduction of macroprudential policies. Comparing the findings of "walls" and "gates" in Table no. 5, macroprudential policies fit better with long-lasting capital controls and tend to reinforce the preceding impact exerted by capital controls of reducing the volatilities. Also here, policy coordination between macroprudential regulations and capital controls is necessary. An optimal adjustment of both policies is required in order to control the risks threatening the stability of the financial system and to reduce the volatility of the transmission channels to support international trade.

5.4 Robustness Check

We considered two alternative capital control indexes in our robustness test: the Fernández et al. (2016) and the Chinn and Ito (2008) indexes[15] For the purpose of the present investigation, both indexes are well-suited for cross-country comparisons of the level of openness, and have the advantage of differentiating between controls on inflows and on outflows and between "walls" and "gates" controls.

The dataset of Fernández et al. (2016) reports the restrictions applied by 99 economies from 1995 to 2015. Each index takes the value 1 if a restriction exists, and the value 0 otherwise. This binary index is based on a narrative reading of IMF's AREAER. Fernández et al. (2016) analyzed the restrictions on 10 asset categories. The present study used the overall index, noted 'ka'. Furthermore, we used the 'kaopen' index from Chinn and Ito (2008). This index is widely used as a de jure proxy of financial liberalization. Its construction is also based on a narrative description of the restrictions provided by the IMF's AREAER. It proxies the extent of liberalization measures for various international transactions likely to be subject to capital controls. 'kaopen' ranges from -1.80 to 2.54, was applied to 181 countries, and covers the period 1970-2019. Higher values correspond with more openness of cross-border trade transactions. Like the Fernández et al. (2016) index, 'kaopen' has the merit of measuring the stringency of capital controls on inflows and on outflows.

Table no. 6 – Robustness check - The "Walls" effect of capital controls

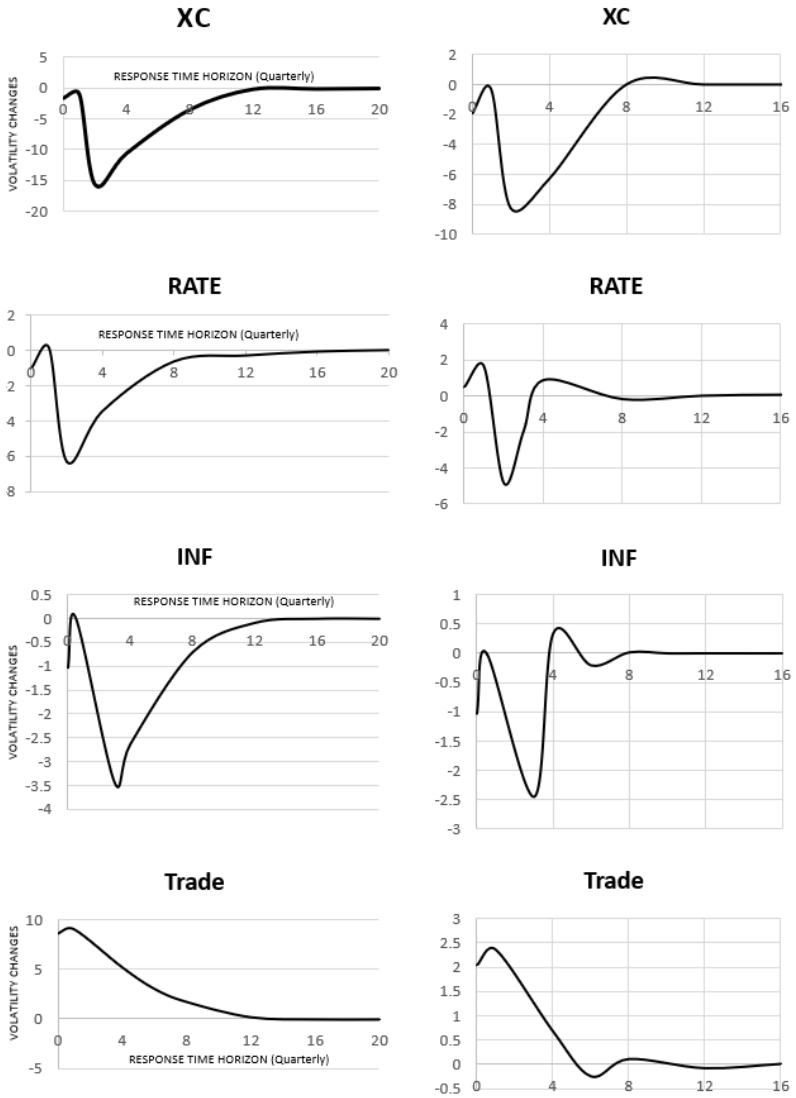
	Fernández et al. (2016)					Chinn and Ito (2008)					
	Baseline	**Cyclical behavior of capital controls**		**Financial development**	**Macro-Prudential policies**	**Baseline**	**Cyclical behavior of capital controls**		**Financial development**	**Macro-Prudential policies**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
CC	-0.125***	-0.097***	-0.105*	-0.076**	-0.085*	-0.081**	-0.119***	-0.102**	-0.110*	-0.106*	-0.131*	-0.094**
	(0.035)	(0.027)	(0.008)	(0.038)	(0.043)	(0.039)	(0.101)	(0.049)	(0.055)	(0.053)	(0.066)	(0.041)
XC	-0.134**	-0.128**	-0.134*	-0.118*	-0.142	-0.113*	-0.130**	-0.135**	-0.140	-0.128*	-0.145	-0.113*
	(0.059)	(0.057)	(0.068)	(0.059)	(0.172)	(0.057)	(0.057)	(0.059)	(0.123)	(0.064)	(0.102)	(0.056)
RATE	-0.130**	- 0.114**	-0.131	-0.109*	-0.143	-0.098*	-0.135**	-0.123**	-0.133	-0.129*	-0.149	- 0.115*
	(- 0.057)	(0.051)	(0.104)	(0.052)	(0.213)	(0.049)	(0.059)	(0.054)	(0.104)	(0.065)	(0.113)	(0.058)
INF	-0.215*	-0.164*	-0.172**	-0.126**	-0.151	-0.129*	-0.215*	-0.158*	-0.165**	-0.131**	-0.150	-0.129*
	(0.105)	(0.082)	(0.069)	(0.051)	(0.103)	(0.065)	(0.105)	(0.081)	(0.066)	(0.053)	(0.113)	(0.065)
CCxXC	-0.093**	-0.090**	-0.088*	-0.064*	-0.087**	-0.043**	-0.093**	-0.102**	-0.119*	-0.094*	-0.110**	-0.070**
	(0.037)	(0.036)	(0.044)	(0.032)	(0.035)	(0.017)	(0.037)	(0.042)	(0.061)	(0.047)	(0.044)	(0.028)
CCxRATE	-0.079*	-0.089*	-0.096*	-0.092**	-0.108*	-0.089*	-0.083*	-0.097*	-0.123*	-0.128**	-0.130*	-0.096*
	(0.041)	(0.045)	(0.048)	(0.035)	(0.054)	(0.045)	(0.042)	(0.050)	(0.062)	(0.049)	(0.065)	(0.048)
CCxINF	-0.305**	-0.205*	-0.187	-0.143	-0.169	-0.147*	- 0.311*	-0.181*	-0.192	-0.140	-0.152	-0.170*
	(0.119)	(0.104)	(0.114)	(0.158)	(0.123)	(0.074)	(0.157)	(0.091)	(0.214)	(0.112)	(0.153)	(0.086)
Wald/LL	-161.27	-127.07	-81.44	-125.31	-119.64	-129.58	-156.34	-108.95	-141.52	-161.47	-123.27	-127.07
(P-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Hansen test	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
AR(1)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
AR(2)	(0.75)	(0.83)	(0.55)	(0.64)	(0.61)	(0.58)	(0.63)	(0.71)	(0.74)	(0.81)	(0.75)	(0.83)
No. Obs.	1080	1080	1080	475	605	1080	1080	1080	302	475	605	1080
# of Economies	25	25	25	11	14	25	25	25	25	11	14	25

Note: The dependent variable is the logarithm of the international trade value. Significant at *10%, **5%, ***1%. Panels (2) and (3) for inflows and outflows controls, respectively; Panels (4) and (5) for financially developed and less developed systems, respectively. We follow the same presentation for panels (8) and (9) ; and (10) and (11) concerning the Chinn and Ito (2008) index estimations.

Robust standard errors are in parentheses. The row for the Hansen test reports the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first and second-order autocorrelated disturbances in the first differences equations. For the columns of financial development, the number of countries is determined according to the index of Svirydzenka (2016) reported in Table no. 1.

CC: Capital controls index; XC: Exchange rate volatility; RATE: Interest rate differential; INF: Inflation volatility.

Source: authors' calculations.



Note : The black line reports the orthogonalized IRF with 95% confident interval to one standard deviation capital controls shock.

Figure no. 3 – Impulse responses to a capital controls shock

Table no. 6 reports the findings of the robustness test. Globally, our results were not altered following the use of alternative capital control indexes. In particular, the interaction term coefficients remain statistically significant and have the same signs as in Table no. 5. The estimates in Table no. 6 are in line with our previous findings and indicate that capital controls mitigate the adverse effect on international trade through their impact on the channel variables.

As a further robustness check, we applied our panel data to a VAR model to obtain the impulse response function and confidence intervals. Two lags of each variable were included

in the model. Figure no. 3 shows the responses of the exchange rate, interest rate differential, inflation rate, and international trade volatilities to a change of one standard deviation of the capital controls indexes.

The first column in Figure no. 3 plots the impulse response of the volatilities corresponding to a random shock of long-lasting capital controls. This column shows a negative impact of the shock on all three macroeconomic volatilities. These plots mirror the role of capital controls in mitigating the adverse effects of the channel variables' volatilities. Besides, there is a positive impact on international trade showing a supporting role of capital controls. The second column in Figure no. 3 plots the impulse response of episodic capital controls shock. We observe a close trend like in first column; however, the magnitude of the impact is lower, and the effect of the shock dies out relatively quickly (after 8 quarters). The impulse response analysis confirms the empirical results discussed previously and particularly highlights that "walls" controls are more effective in reducing volatilities and supporting international trade.

6. CONCLUSION

This paper presents an empirical investigation of the channels through which capital controls impact international trade. The findings of this study cast doubt on the prevailing view on the adverse effect of capital controls on international trade. We found that capital controls are useful and mitigate the harmful effects of the volatility of the exchange rate and interest rate differentials. The moderation of these volatilities supports international trade. Conversely, capital controls aggravate the unwanted effect of inflation volatility on international trade.

The results of this study raise some policy implications. First, targeted long-lasting "walls" capital controls can have a sizeable impact of reducing the adverse effects of the volatility of the channel variables. Policymakers need to choose the right time to introduce capital controls. When these controls are applied early, they are more effective and respond better to macroeconomic imbalances. Second, The complexity of the players in international trade calls for the use of monetary and exchange rate policies in tandem with capital controls. The combination of these policies turns out to be quite delicate. This combination requires close coordination domestically and internationally, which can eventually redress the unwanted effect found for inflation volatility.

The decisions to control inflows or outflows are concerning, since the analysis carried out on the countercyclical behavior of capital controls revealed that exporting countries are the least affected by the adverse impact of these controls. This study highlights the useful role of macroprudential policies, which support capital control actions in reducing macroeconomic fluctuations. The role of financial development is also emphasized; more developed financial systems support capital control actions in mitigating the volatilities of the channel variables, thus promoting international trade transactions.

Our results are compatible with the current literature. The impact of capital controls varies according to different considerations; particularly, the level of financial development, targeting inflows vs. outflows, and the concurrent use of macroprudential policies. Our findings remain robust across specifications, specifically the use of alternative capital control indexes.

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ANNEX

Unit root tests

Variables	Test in	ADF		PP	
		t-statistic		t-statistic	
		Intercept	Intercept & trend	Intercept	Intercept & trend
CC	Level	-3.568***	-3.789***	-2.487***	-2.715***
	First Difference	-10.254**	-11.145***	-9.358***	-9.357***
XC	Level	-1.214	-1.587	-1.051	-1.231
	First Difference	-10.112**	-10.454**	-10.202**	-10.313**
RATE	Level	-1.311	-1.659	-1.587	-2.101
	First Difference	-10.254**	-10.254**	-9.867**	-9.874**
INF	Level	-2.411	-2.875	-2.213	-2.051
	First Difference	-12.451**	-12.876**	-11.021**	-11.951**
GDP	Level	-2.145	-2.212	-1.501	-1.875
	First Difference	-11.267**	-11.542**	-11.012**	-10.954**
FGDP	Level	-2.314	-2.587	-2.101	-2.231
	First Difference	-11.012**	-11.354**	-11.002**	-11.113**
TAR	Level	-1.548	-1.598	-1.245	-1.387
	First Difference	-10.257**	-11.201**	-10.541**	-10.311**
CA	Level	-2.548	-2.671	-2.015	-2.147
	First Difference	-12.548**	-12.687**	-11.650**	-11.821**
TERMS	Level	-1.201	-1.311	-1.457	-1.687
	First Difference	-11.144***	-11.687***	-10.547***	-10.985***
FDI	Level	-2.354	-2.871	-2.132	-2.341
	First Difference	-10.245**	-10.356**	-10.512**	-10.631***
IR	Level	-1.217	-1.542	-1.034	-1.548
	First Difference	-12.218**	-12.856**	-11.954**	-12.034**
MP	Level	-2.047	-2.157	-2.011	-2.325
	First Difference	-13.102**	-13.657***	-12.541**	-12.810**

Note: ***, ** and * are respectively the 1%, 5% and 10% significance level. * ADF stands for Adjusted Dickey-Fuller test, PP – Phillips-Perron test.

CC : Capital controls index ; XC : Exchange rate volatility ; RATE : Interest rate differential ; INF : Inflation volatility ; GDP : Gross Domestic Product ; FGDP : Forecast of future GDP growth ; TAR : Tariff rate ; CA : Change in the current account deficit ; TERMS : Terms of trade ; FDI : Foreign Direct Investment ; IR : International Reserves ; MP : Macroprudential policy.

Source: Authors' calculation

Notes

[1] Throughout the remainder of the paper, we refer to exchange rate, interest rate differential, and inflation rate as the channels of capital controls. We refer to indirect effect when the impact of capital controls operates through these channels (i.e., within interaction terms).

[2] We use the distinction between "walls" and "gates" effects of capital controls defined in M. W. Klein (2012) and later employed by Bacchetta, Davenport, and van Wincoop (2021).

[3] Davis and Van Wincoop (2018) compared between financial globalization and trade globalization. They found that neither financial nor trade globalization affected the volatility of gross capital flows. However, trade integration increased the volatility of net flows, while financial integration decreased the volatility of net flows.

[4] To provide a robust analysis, we apply the Fisher ADF and Fisher PP panel unit root tests. The Table in Annex reports the results of these tests and shows the variables' stationarity of the level and first differences.

[5] The sample is restricted to 25 countries due to data limitation, and Table no. 1 reports the country sample.
[6] The index is useful for our empirical examination since it differentiates between controls on inflows and on outflows.
[7] The international interest rate is measured by real U.S. 10-year treasuries rate. Movements in this interest rate are the global benchmark for markets and dominate the world's real interest rate.
[8] The data is aggregated for all sample countries.
[9] This motivated our choice to regress our models with the system GMM for the analysis of capital controls related issues and robustness check of Table no. 5 and Table no. 6, respectively.
[10] One quarter lag was chosen according to the AIC information criteria and sequential testing for the significance of coefficients on lag.
[11] The results focus more on capital controls index coefficients, channels, and interaction terms. Control variables, instruments, and the lagged dependent variable are inserted in all panel regressions, but not reported in the estimates results to avoid content overload.
[12] Columns (1) to (4) present the estimates from Equation (1) – long-lasting controls, and columns (5) to (8) report the estimates of Equation (2) – episodic controls.
[13] We obtained from Ahnert et al. (2021) indexes of macroprudential FX regulations (MP) — i.e., prudential regulations targeting the financial sector – from Ahnert et al. (2018).
[14] The database covers 17 instruments for a total of 138 counties over the period 1999–2016 at a monthly frequency.
[15] See Batini and Durand (2020) for a survey on capital control indexes.

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