Macroprudential Foreign Exchange Interventions

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Abstract

Emerging market economies deploy various tools to shield themselves from the ebbs and flows of cross-border capital flows. One of the most intensively used instruments is Foreign Exchange Interventions (FXI). This paper empirically studies a panel of emerging markets to explore whether FXI reduces the probability and severity of a sudden stop, and if so, what channels are at work. We show that (i) FX reserve accumulation during episodes of capital inflow surges reduces the probability and severity of a sudden stop - revealing the ex-ante role of FXI and (ii) decumulation of FX reserves during a sudden stop dampens the severity of a recession and supports the recovery of output - illustrating the ex-post role. The macroeconomic effect of FXI thus includes a macroprudential element and extends well beyond the exchange rate. The results suggest that FX interventions can "get in all the cracks" of the economy and central banks can complement macroprudential measures with FXI when the effectiveness of the former is constrained or subject to regulatory leakage.

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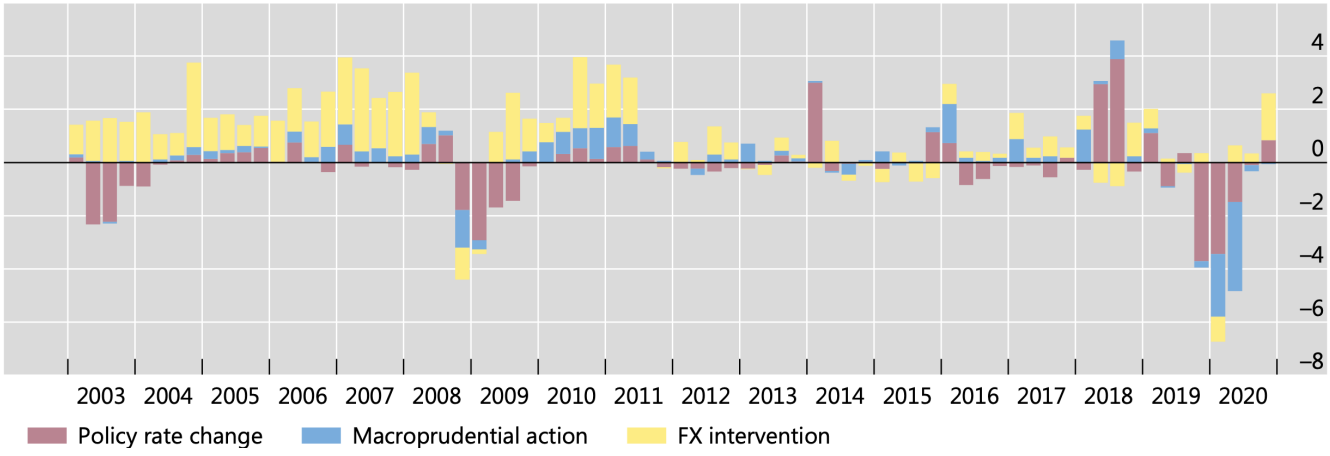
1 - Introduction

Emerging market economies are often subject to the ebbs and flows of cross-border capital flows. Abrupt changes in capital flows can lead to episodes of sudden stops and capital flights, inducing significant macroeconomic and macro-financial adjustment. Moreover, the existence of international financial as well as domestic frictions can amplify these external shocks, causing a deep recession and a depreciation of the national currency.

To mitigate the impact of volatile capital flows, policymakers deploy various tools, such as monetary policy, macroprudential policy, capital flow management measures (CFMs), fiscal policy and notably, foreign exchange interventions (FXI). The latter represents one of the most intensively used instruments by emerging and developing economies. In fact, while the majority of central banks in emerging and developing countries follow inflation-targeting, foreign exchange interventions are still used extensively in tranquil as well as in turbulent times, as illustrated in Figure 1.

Figure 1: Policy Response Intensity in Historical Perspective



Source: Borio, Shim, and Shin (2022)
Note: Policy response intensity for monetary policy, macroprudential policy and FX interventions in 17 emerging and developing economies in historical perspective.

In this paper, I analyse the macroprudential role of foreign exchange interventions by exploring whether FXI helps reduce the *probability* and *severity* of the most adverse capital flow episodes - sudden stops - and if so, what *channels are at work*. To address these questions, I employ a panel study and a panel econometric approach covering 34 emerging economies for the period of 2000 to 2020. The paper empirically tests the theoretical studies exploring the role of FX interventions in the presence of international financial frictions and occasionally binding credit constraints. I contribute to the existing literature by bridging the gap between theoretical and empirical studies, and providing empirical explanation for why emerging markets actively use FX interventions.

The recent theoretical literature has widely discussed how FXI can be used to lean against the Global Financial Cycle and dampen the contraction of the economy. Notable contributions in this regard include works by Fanelli and Straub (2021), Cavallino (2019), Basu et al. (2020), Arce, Bengui, and Bianchi (2019), Davis, Devereux, and Yu (2022) and Itskhoki and Mukhin (2022), among others. The new initiatives of the International Monetary Fund's (IMF) Integrated Policy Framework (IPF) and the Bank for International Settlement's (BIS) Macro-Financial

Stability Framework (MFSF) further spurred an interest in using FXI for ensuring broader macroeconomic and macro-financial stability, rather than solely focusing on exchange rate stability.

However, there has been limited empirical understanding of how FXI mitigates the impact of external shocks. Traditionally, FX interventions were used for enhancing export competitiveness and stabilizing import prices. Consistent with this, the empirical literature studying the effectiveness of foreign exchange (FX) interventions has primarily focused on whether they can influence the level or volatility of the exchange rate (for a comprehensive review, refer to Chamon et al. (2019) and Menkhoff (2013)). But, in recent years, financial stability has become one of the main objectives of FXI (Cavallino and Patel (2019)). Given that the financial stability goal has become so preponderant, I take a broader perspective and study the impact of FXI on macro-financial stability. To draw a parallel, "traffic lights are not intended to only stop the cars, they are designed to reduce the number and probability of car crashes." Similarly, FXI can shield the economy from broader macroeconomic and macro-financial fluctuations. In other words, in an inflation-targeting country, comprehending the role of FX interventions requires looking beyond the exchange rate.

To fill this gap and empirically explore the macroprudential aspect of FX interventions, I begin by examining the *ex-ante role* of FXI, that is, its role before a sudden stop occurs. Specifically, starting by estimating the probability-evaluating binary model, I assess whether FX interventions during a surge reduce the *probability* of a sudden stop. I show that the accumulation of FX reserves in a surge significantly dampens the probability of a sudden stop, in fact, more successfully than macroprudential measures. Next, I turn to the *severity* of a sudden stop and employ Local Projections (LPs) to analyse whether FXI in a surge mitigates the macroeconomic contraction of output. I show that the accumulation of FX reserves during the capital inflow boom phase is indeed capable of alleviating the severity of the recession triggered by a sudden stop and supports economic recovery. These findings are observable in the pegger economies, but notably, they are even more pronounced in countries with floating exchange rates. In particular, based on the median historical values of FX reserve purchases during surges, the severity of a sudden stop is dampened by 0.6% in floaters and 0.1% in pegger economies.

In addition to illustrating the *ex-ante role* of FXI, I also investigate two channels through which FXI can affect the broader macroeconomy: (i) the ex-post channel - by which FX reserves' decumulation during a sudden stop dampens depreciation of the national currency, limiting damage to the balance sheets of domestic agents and foreign lenders;[1] (ii) the effect of FXI on credit - through which FX reserves' accumulation during a surge, by dampening the overappreciation of the national currency, reduces excessive credit and asset price growth, and hence, avoids the economic bust. I find little empirical support for the second channel. On the contrary, the ex-post channel is the primary reason why FX interventions provide a cushion to the floating exchange rate economies. Based on the median historical value of FX reserves' deployment during a sudden stop, GDP growth is 0.18% higher in the floater countries. In other words, the aforementioned *ex-ante role* of FXI is observable because it enables the use of FX reserves during a sudden stop, not because FX interventions during a surge reduce credit misalignment. These findings are in line with existing theoretical studies that consider international financial frictions, illustrating the effectiveness of FX interventions during periods of large uncovered interest rate parity (UIP) deviations.[2]

[1] Particularly, damage to the balance sheets of domestic agents in economies facing the "original sin" problem or to the balance sheets of foreign lenders in the case of "original sin redux."

[2] See Section 2.1 for a more elaborate discussion of the literature.

Importantly, the above-mentioned results remain consistent when considering different policy measures, such as monetary policy stance, capital openness, FX reserves, public debt and macroprudential policy measures.

Therefore, since FXI mimics the goals and principles of macroprudential policy, I conclude that there is a macroprudential role for foreign exchange interventions. The findings of the paper have important normative and policy implications. They suggest that central banks of emerging economies can rely on FX interventions when facing changing conditions of external factors and cross-border capital flow dynamics. In particular, monetary authorities can act preemptively and countercyclically, that is, (i) accumulate FX reserves during the boom times of the capital inflow cycle, which will reduce the probability and severity of a sudden stop and (ii) decumulate FX reserves in periods of stress, thereby relaxing tight financial conditions and supporting the real side of the economy.

Given that FXI resembles the intentions and objectives of macroprudential policy and it can "get in all the cracks" of the economy by affecting the exchange rate, FX intervention policy can be used to complement macroprudential measures. Such a strategy can help prevent severe macroeconomic and macro-financial contractions in circumstances when (a) macroprudential policy remains constrained, (b) macroprudential policy decisions take a significant time to influence the economy, or (c) a considerable part of agents operates outside the regulatory perimeter of macroprudential policy, as observed in recent years (See Financial Stability Board (2022)).

The paper is structured as follows. Section 2 reviews the existing literature, summarizing both theoretical and empirical studies on FX interventions. Section 3 describes the data and the chosen econometric approach, presenting the results and robustness checks of the baseline analysis. Section 4 discusses the implications for policy-making and the lessons for central banks in emerging economies. Section 5 concludes.

2 - Literature Review

In this section, I provide a literature review of the existing studies. I start by reviewing the theoretical studies showing how foreign exchange interventions can be used as a stabilising tool. I then discuss the empirical angle, examining whether FX interventions are able to influence the exchange rate, which is one of the main channels through which FXI can affect the financial conditions and the stance of the real economy. Afterwards, I turn to reviewing the impact of FXI on the broader macro-financial outcomes. Lastly, I cover the literature documenting how and when emerging economies intervene in the FX market.

2.1 - Theoretical Studies

On the theoretical side, recently there has been a surge of interest in understanding the role of FXI as a tool to mitigate the impact of a shock as well as its amplification. The interest has been partially spiked by the policy institutions. Namely, by the International Monetary Fund's initiative of Integrated Policy Framework (IPF) (International Monetary Fund (2020)) and Macro-Financial Stability Framework (MFSF) of the Bank for International Settlements (Bank for International Settlements (2019)), which consider the joint use of monetary policy, macroprudential policy tools, foreign exchange interventions, capital flow management measures and fiscal policy for tackling with macroeconomic and macro-financial instability.

In line with the IPF and MFSF, several papers have shown when and how powerful FXI can be. Adrian et al. (2020) develop a New Keynesian model with nonlinear balance sheet channels and demonstrate that FXI and CFMs are capable of improving policy trade-offs, especially in the environment with less well-anchored inflation expectations and substantial foreign currency mismatches. These tools mitigate the rise in borrowing spreads, limiting the contraction in output and allowing monetary policy to be more accommodative by alleviating inflationary pressures. Basu et al. (2020) analyse the small open economy model with occasionally-binding borrowing constraint. It is shown that under the shallow FX markets and arising deviation from the UIP condition, FX intervention becomes effective through the portfolio balance channel, as it is able to absorb the capital flows' volatility and reduce the exposure of financial intermediaries to domestic currency debt.

Hofmann, Patel, and Wu (2022) use a two-country DSGE with the funding constraint financial intermediaries to provide a model-based evaluation of the original sin redux hypothesis, proposed by Carstens and Shin (2019). The paper shows that even if the emerging market borrows in the local currency, the economy still suffers from the macro-financial amplification due to the intermediary balance sheet constraints. Remarkably, FXI can dampen the adverse consequences of foreign financial shocks by mitigating the negative impact of external shocks via a "debt limit channel."

Cavallino (2019) builds a small open economy model with imperfect international financial markets following Gabaix and Maggiori (2015) to characterize the optimal use of sterilized FXI in response to exchange rate fluctuations which are driven by capital flows. It is shown that the optimal FXI improves the inflation-output trade-off by leaning against the wind and stabilizeing the path of the exchange rate. In a similar vein, Fanelli and Straub (2021) explore the economy with the partial segmentation of home and foreign bond markets, through which the central bank affects the exchange rate and the spread between the foreign and home bonds, addressing the pecuniary externality and making FXI desirable. The optimal intervention policy is shown to be leaning against the wind of global capital flows.

Arce, Bengui, and Bianchi (2019) explore a small open economy model with the imperfect financial market and inefficient private borrowing in the spirit of Bianchi (2011). They propose a theory of foreign reserve accumulation based on a macroprudential motive and show that the reserves provide a liquidity buffer to mitigate the contraction of consumption in a crisis. It is demonstrated that foreign reserve accumulation entails benefits similar to capital controls. Jeanne (2016) also illustrates that because of the pecuniary externality arising from global banking frictions, the emerging market economy can mitigate the friction by accumulating reserves in good times and using them to stabilize the price of its liabilities in bad times.

Davis et al. (2021) explore a small open economy DSGE model. It appears that the effectiveness of sterilized FXI depends on friction, which influence how easily private agents can trade foreign bonds. When private agents freely trade foreign bonds, sterilized intervention has no effect. However, when frictions prevent the free trade in foreign bonds, optimal sterilized FXI has the equivalent benefits to an optimal tax on foreign capital. A related conclusion is reached by Chang (2018).

In a close study, Davis, Devereux, and Yu (2022) study a small open economy subject to a sudden stop and introduce intermediary frictions in capital markets. It is demonstrated that the central bank can prevent sudden stops by pursuing optimal - "lean against the wind" - policy, that is (a) buying foreign reserves ex-ante when

private borrowing is high to accumulate the reserves and (b) selling them when private agents are deleveraging. Markedly, the authors show that optimal reserve management policy reduces the frequency and severity of sudden stops, however, it is not able to completely eliminate them.

2.2 - Empirical Evidence of FXI on Exchange Rate

Despite the ample theoretical studies showing how FX interventions can be used for supporting macro-financial stability, the empirical studies testing the theoretical channels have been much limited. Most empirical studies about FX interventions focused on whether they influence the level and volatility of the exchange rate. Indeed, the intermediate channel through which FXI can be affecting the broader macroeconomic and macro-financial variables is by influencing the exchange rate. In this subsection, I provide a brief summary of the large existing literature about how FXI can affect the level and volatility of the exchange rate.

The vast literature has concentrated on Latin America. Barroso (2014) explores the case of Brazil and studies 2007-2011 period. Using the GARCH and instrumental variable (IV) techniques, the paper shows that 1 billion US dollar (USD) intervention appreciates the Brazilian real with respect to the USD by 0.51% to 1.18%. For the same country, for 2013-2015, Chamon, Garcia, and Souza (2017) find that an announcement of 50 billion USD leads to a 10% appreciation over several weeks. In contrast, Marins, Araujo, and Vicnete (2016) employ event study analysis, but do not find any effect. Moving to the experience of other countries, Tapia and Tokman (2004) analyse the daily data for 1998-2003 in Chile and find the varying degree of effectiveness for different years. Pincheira (2013) also confirms the time-varying effectiveness of FXI.

Echavarría, Velandia, and Villamizar (2014) study the Colombian case and show that the preannounced intervention depreciates the exchange rate by 0.55 percent. On the other hand, Rincón and Toro (2010) find that FXI has no effect on the level of the exchange rate.

There have been studies analysing FX interventions in Mexico as well. Tobal and Yslas (2016) using the structural vector-autoregression (SVAR) show that the net purchase of the US dollars depreciates the peso. Domaç and Mendoza (2004) illustrate that the net sale of 100 million USD appreciates the Mexican peso by 0.08%, while the purchase has no effect.

As can be observed, the effect of FX interventions on the exchange rate varies. A more thorough overview of this literature is provided by Chamon et al. (2019) and Menkhoff (2013), who also demonstrate that the results differ widely, with some studies finding little or no effect and others - a sizable impact. This adds even larger importance to the study, which directly assesses whether FXI is affecting the real side of the economy and supports it from external shocks.

2.3 - Empirical Evidence of Macroprudential Effect of FXI

Several empirical studies touched upon how FXI can affect broader macroeconomic and macro-financial variables. This paper is related and adds a contribution to this stand of the literature.

Hofmann, Shin, and Villamizar-Villegas (2021) empirically assess how FX intervention affects new loans to firms. The analysis shows that sterilized FX purchases significantly dampen domestic bank lending to corporates,

suggesting that sterilized FX purchases have a tightening effect on domestic credit conditions. It is also shown that FXI dampens the credit supply of vulnerable banks during capital flow surges and more strongly supports these banks when the flows reverse.

Scheubel, Stracca, and Tille (2019) investigate whether the emerging economies can rely on FX reserves and IMF's help to absorb large capital flow movements in periods of globally driven sudden stops and currency crises. Using the data of 32 countries for the 1990-2014 period, the authors find that the possibility of relying on IMF support helps countries to absorb the immediate effects of sudden stops and currency crises. By contrast, the availability of FX reserves does not provide a cushion.

Bussière et al. (2015) concentrates on the level of reserves (i.e., on stock), rather than on FXI (i.e., on flows) and find that the countries with higher reserves-to-short debt ratio experienced a smaller decline in output during the period of Global Financial Crisis of 2007-2009 (GFC), demonstrating that international reserves fulfill their protective purpose. In a similar line, Dominguez, Hashimoto, and Ito (2012) show that the pre-GFC international reserve accumulations, as well as the reserve policy decisions made during the crisis, explain cross-country differences in post-crisis economic performance. Namely, the study shows that larger reserve holdings prior to the crisis were associated with higher post-crisis GDP growth, supporting the view that reserve accumulation policies influenced the economic and financial performance of countries during and after the global crisis.

2.4 - Deployment of Foreign Exchange Reserves

How and why do the central banks use international reserves? In this subsection, I review the literature and surveys trying to answer this question.

Aizenman and Sun (2012) explore the adjustment of 21 emerging economies during the window of GFC to explain the "fear of losing reserves". It is found that initially half of economies deployed international reserves. However, in the second stage, authorities relied more on currency depreciation than on reserve depletion due to uncertainty about the crisis's duration. A similar conclusion is reached by Aizenman and Hutchison (2012).

In contrast, Dominguez (2012) outline that taking into account interest income and valuation changes on existing assets is critical to assess the actual purchases and sales of reserves. Accounting for this aspect, the data indicates that the depletion of reserves during the GFC was indeed higher in countries where pre-crisis excess reserve levels were more evident.

Cavallino and Patel (2019) provide a survey of 21 emerging economies and summarise the goals, channels, effectiveness, different methods and tactics used by central banks. According to the survey, the main reasons and goals for FX interventions include reducing FX speculation, shifts in risk aversion, global liquidity or global financial conditions. Monetary authorities also intervene in the FX market to maintain price stability, achieve the desired level of international reserves and deepen the hedging markets. However, output fluctuations explanation lurks behind.

3 - Econometric Approach and Results

This section illustrates the econometric approach and presents the results of the regressions to study whether and how FXI shields the economy from sudden stops and their severity. The section starts with describing the data used. Next, I analyse the ex-ante role of FX interventions, that is the ability of foreign exchange interventions to reduce the probability of a sudden stop and the implications of FX reserves' accumulation for the severity of the economic downturn during the sudden stop. I conclude by examining two different channels through which FXI can be effective. Each subsection is accompanied by the respective robustness analysis.

3.1 - Data

For the econometric analysis, I rely on Adler et al. (2021), as the most comprehensive data source for FX interventions. It includes FXI data for 162 countries for the 2000-2020 period at the monthly and quarterly frequency.

The definition and data for identifying sudden stops is from Forbes and Warnock (2021). A sudden stop episode is defined as a period when gross capital inflows by foreigners fall one standard deviation below its mean, provided it reaches two standard deviations below at some point. The episode ends when gross capital inflows are no longer at least one standard deviation below its mean. The data for surges is also from Forbes and Warnock (2021). Symmetrically to the sudden stop, a surge is defined as an episode when gross capital inflows by foreigners increase one standard deviation above its mean, provided it reaches two standard deviations above at some point. The episode ends when gross capital inflows are no longer at least one standard deviation above its mean. Forbes and Warnock (2021) provide the data for 59 countries from 1978 to 2020.[3] Concentrating only on emerging and developing economies and only on the period for which the FXI data is available leads to the sample of 34 countries for the period of 2000Q1-2020Q3.[4] The sample covers 342 sudden stop and 356 surge episodes.

These episodes as well as the descriptive statistics for FXI data for each country are summarised in Table A1. As can be observed, there is a significant heterogeneity in how countries are deploying FX interventions. Some countries such as Colombia, Mexico, South Africa or Brazil rarely intervene in the FXI market, according to their median FX values, while others, such as Peru, Taiwan, Thailand or China - are more active. Consistent with expectations, pegger economies intervene more aggressively than floaters.

The definition of a floater (pegger) country follows Ilzetzki, Reinhart, and Rogoff (2019). Namely, a country-quarter is a floater (pegger) if the exchange rate regime of a country in a given quarter is larger than (less or equal to) 2 in the exchange rate arrangement classification of Ilzetzki, Reinhart, and Rogoff (2019). The estimations exclude countries without the national legal tender.

Other data sources and the variables used in the upcoming regressions are as follows. They are also summarised in Table A2. The source for the Chicago Board Options Exchange's volatility index (VIX) is the Federal Reserve Bank of St.Louis; the annual global growth is from IMF's International Financial Statistics (IFS); global liquidity is defined as the sum of broad money in the United States, Eurozone, United Kingdom and Japan. The sources

[3] Starting date varies by country.

[4] These countries are: Turkey, South Africa, Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Guatemala, Mexico, Panama, Peru, Venezuela, Bangladesh, Sri Lanka, Taiwan, India, Indonesia, Republic of Korea, Malaysia, Philippines, Thailand, Russian Federation, China, Czech Republic, Slovak Republic, Estonia, Latvia, Lithuania, Hungary, Croatia, Slovenia, Poland and Romania.

for broad money are the respective central banks.[5] Global interest rate is the average of monetary policy rates of the Federal Reserve, People's Bank of China, European Central Bank and Bank of England. These central banks are chosen based on their importance in driving the global financial and trade cycles following Miranda-Agrippino and Rey (2022). To account for the unconventional monetary policy measures during the zero/effective lower binding periods, the official interest rates from the central banks were complemented by the shadow rates from Wu and Xia (2016) and Wu and Xia (2017) during the periods of a liquidity trap. Commodity prices are the country-specific commodity price indices from Gruss and Kebhaj (2019). The stance of macroprudential policy comes from the database of Alam et al. (2019), which provides information about how the stance of different macroprudential instruments was changed from quarter to quarter. Data for foreign exchange reserves, exchange rate, GDP gap and GDP per capita is obtained from the IMF's IFS; Public debt data is from the IMF's World Economic Outlook database; Institutional quality is from the World Governance Indicators of the World Bank; Capital account openness data is taken from Chinn and Ito (2006); Credit-to-GDP gap and house price growth are from the Bank for International Settlements.

3.2 - Ex-Ante Role of FXI - Probability of a Sudden Stop

3.2.1 - Probability - Model Specification and Baseline Results

Do the FX interventions during the boom phase of the capital inflows' cycle reduce the probability of a sudden stop? To explore this question empirically, I estimate the following regression using the complementary logarithmic (cloglog) framework:

$$Prob(s_{i,t}=1) = F\Big(\Phi^{S*FXI}\ Surge_{i,t-n}\ *\ FXI_{i,t-n}\ +\ \Phi^{S} Surge_{i,t-n}\ +\ \Phi^{FXI} FXI_{i,t-n}\ + \Phi^{Global}\ C^{G}_{t-1}\ +\ \Phi^{Contagion}\ C^{C}_{i,t-1} + \Phi^{Domestic}\ C^{D}_{i,t-1}\Big) \tag{1}$$

where s_{it} is a dummy variable, taking the value of 1 when a country i experiences a sudden stop in a period t and 0 otherwise. The variable $Surge_{i,t-n}$ is also a dummy variable taking the value of 1 when a country i experiences a surge in any of the previous n periods and 0 otherwise. In the baseline specification $n = 12$.[6] $FXI_{i,t-n} \equiv \sum_{n=1}^{12} FXI_{i,t-n}$ - i.e., it is the accumulated value of FXI as a percentage of GDP in the previous 12 quarters and its positive value implies increasing FX reserves.

The variable $Surge_{i,t-n}\ *\ FXI_{i,t-n}$ is the interaction variable between surges and FXI. The variables $C^G, C^C$and C^D are vectors containing the control variables, in choosing of which I closely follow Forbes and Warnock (2021). Specifically, the C^G vector consists of global control variables, such as the growth of VIX, global growth, global liquidity growth, global interest rate and commodity prices. C^C contains the contagion dummy variable, defined as an episode if one of the countries in the region of country i experiences a sudden stop in the same period. The region is defined according to the World Economic Outlook report of the IMF.[7] C^D contains a

[5] The definition of broad money for the United States, Eurozone and Japan is M2 monetary aggregate, and for the United Kingdom M4. The definition follows Forbes and Warnock (2021).

[6] See Section 3.2.2 for the alternative values of n.

[7] See International Monetary Fund (2022).

domestic control variable, particularly, the annual national GDP growth rate.

Similar to Forbes and Warnock (2021), to avoid the endogeneity, the covariates are lagged by one quarter. Also, given that the sudden stop episodes do not occur frequently, namely, only 11.6% episodes in the entire sample are classified as sudden stops, the standard probability assessing binary choice models, such as Probit or Logit, are not suitable. The appropriate approach is the complementary logarithmic (cloglog) framework, which assumes that $F(\cdot)$ is asymmetric and is the cumulative distribution function (cdf) of the extreme value distribution. Mathematically:

$$F(x) = 1 - \exp[-\exp(x)] \tag{2}$$

I cluster the standard errors by country. In addition, I use a seemingly unrelated estimation technique that allows for cross-episode correlation in the error terms. The idea is to capture the fact that the covariance matrix across episodes is not zero, without assuming a structural model specifying a relationship between episodes.

Table 1 shows the baseline regression results for floater economies, followed by the results for the pegger economies and then for all countries. For each country category, first the regression without the interaction term is estimated, followed by the regression specification with the interaction term between a surge and FXI.

Starting with the variable surge, it can be observed that an episode of a surge highly statistically significantly increases the probability of a sudden stop in all specifications.[8] This finding is consistent with the empirical observation of Reinhart and Rogoff (2009) that surges in capital inflows lead to large capital outflows and sudden stops.

Moving to the effect of foreign exchange interventions, the unconditional interventions (FXI in Table 1) do not have any impact on the probability of a sudden stop. However, foreign exchange interventions during the episodes of surges highly significantly reduce the probability of a sudden stop happening. This result represents the *first important conclusion of the paper, it shows that there is the ex-ante role for foreign exchange interventions, as FX reserve's accumulation during the phase of strong capital inflows significantly reduces the probability of a sudden stop.*

Other control variables provide economically intuitive and relevant signs. Specifically, an increase in global uncertainty, captured by the growth of VIX, significantly increases the probability of a sudden stop. This result is not surprising given that amid an increase in global volatility, due to risk aversion and search for safety, foreign investors run to safe havens and withdraw from emerging markets, which are deemed riskier.

An increase in global liquidity reduces the probability of a sudden stop happening. This result can be explained by the fact that ample liquidity provides the convertibility insurance to the foreign investors. In other words, in case of a shock, with the abundant global liquidity, it is easier to withdraw from the country, which improves investors' confidence. Also, an increase in global liquidity can lead to a decline in the global interest rates, hence, reducing the profitability of global safe assets and making foreign investors more inclined to stay in the emerging economy. Indeed, the latter channel is empirically proved by looking at the global rate variable. An increase in the monetary policy rate of the major central banks significantly aggravates the probability of a sudden stop. Once again, this is explained by a higher interest income on safe assets.

[8] Note that under the cloglog framework, given its non-linear function, only the sign and significance of the estimated coefficients can be interpreted, not their size.

Moving to the national variable, national GDP growth significantly dampens the probability of a sudden stop, although only for the floaters. A higher national GDP growth can be an indicator of strong fundamentals, which makes foreign investors more confident to stay in the emerging country.

The above-mentioned findings in Table 1 largely hold for floaters as well as for peggers and respectively, for all countries in the sample. The difference between the groups emerges in the importance of global growth and contagion. The global growth variable significantly dampens the probability of a sudden stop in all countries, due to its effect on the pegger economies, however, it does not have any significant influence on floaters. Also, contagion has a statistically meaningful effect only for the pegger countries, but not for floaters. Other variables, such as commodity prices, remain statistically insignificant and do not help explaining the occurrence of a sudden stop episode in emerging economies.

To summarise and conclude this subsection, the question of whether the FX interventions during the boom phase of the capital inflow cycle reduce the probability of a sudden stop can be answered positively. Therefore, there is the ex-ante macroprudential role for FXI.

3.2.2 - Probability - Robustness

In this subsection, I provide the robustness checks for the results about the ex-ante role of FXI, shown in the previous subsection.

An important factor determining the resilience of the economy is the stance of macroprudential policy. Thus, in Table 2 I show the results of the regression where I control for macroprudential policy and its interaction with surges. Since the measure of macroprudential policy in the Alam et al. (2019) database is a flow variable, similarly to FXI in the baseline regression, I accumulate the change of macroprudential policy stance over the previous 12 periods. The baseline analysis remains robust. Intervening in the foreign exchange market during the episodes of a surge highly significantly reduces the probability of a sudden stop, while intervention without surges does not achieve the same desired result. The control variables also maintain their signs and significance. Regarding macroprudential policy, interestingly, whether a country intervenes in the periods of surges ($Surge * Macroprudential\ Policy$) or in the episodes of tranquil times ($Macroprudential\ Policy$), it does not have any effect for any group of countries. The comparison of the effectiveness of FXI with macroprudential policy indicates to a strong and important message - FX interventions are a more powerful tool for dealing with the probability of a sudden stop, than macroprudential policy measures. This can reflect the following possible reason. Macroprudential instruments are applied only to the deposit-taking commercial banks, which represent only a subset of financial agents. Over the last years, because of the regulatory burden of macroprudential measures, there has been an increased tendency to escape the additional regulations. In fact, according to Financial Stability Board (2022), the emergence of non-bank financial intermediaries (NBFIs) has been accelerated globally after the Global Financial Crisis of 2007-2009. Thus, macroprudential policy is not capable of mitigating risks in those institutions. However, with FX interventions, by affecting the exchange rate, it is possible to have an influence on the financial conditions of all agents in the economy. In other words, with foreign exchange interventions, it is possible to *"get in all the cracks"* of the economy. The latter feature makes FXI more powerful and effective compared to macroprudential policy and indicates that macroprudential policy can be complemented with FX interventions when the effectiveness of the former becomes

Table 1 - Probability of a Sudden Stop

	Floater Countries	Floater Countries	Pegger Countries	Pegger Countries	All Countries	All Countries
Surge * FXI (lagged)		-0.282***		-0.187***		-0.239***
		(0.098)		(0.065)		(0.058)
Surge (lagged)	0.541*	0.863***	1.311***	1.507***	0.860***	1.146***
	(0.301)	(0.237)	(0.440)	(0.450)	(0.245)	(0.240)
FXI (lagged)	0.000	0.014	-0.010	-0.001	-0.006	0.006
	(0.014)	(0.013)	(0.030)	(0.032)	(0.017)	(0.018)
VIX Growth (lagged)	0.013***	0.012***	0.013***	0.013***	0.013***	0.013***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
Global Growth (lagged)	-0.078	-0.054	-0.169**	-0.160**	-0.118**	-0.103**
	(0.071)	(0.069)	(0.075)	(0.068)	(0.046)	(0.044)
Global Liquidity Growth (lagged)	-0.071***	-0.070***	-0.068**	-0.058*	-0.067***	-0.063***
	(0.027)	(0.025)	(0.029)	(0.030)	(0.018)	(0.018)
Global Rate (lagged)	0.264***	0.290***	0.128	0.167*	0.196***	0.228***
	(0.072)	(0.066)	(0.104)	(0.097)	(0.050)	(0.049)
Commodity Terms of Trade Growth (lagged)	0.001	0.001	-0.004	-0.000	-0.001	-0.001
	(0.011)	(0.011)	(0.018)	(0.017)	(0.008)	(0.008)
Contagion (lagged)	0.240	0.279	1.020***	0.934**	0.549	0.535
	(0.499)	(0.496)	(0.372)	(0.388)	(0.342)	(0.349)
National GDP Growth (lagged)	-0.106**	-0.101**	-0.024	-0.023	-0.052**	-0.051**
	(0.048)	(0.047)	(0.027)	(0.025)	(0.021)	(0.021)
Number of Observations	819	819	674	674	1,493	1,493

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the probability of a sudden stop estimated by (1) for floater, pegger and all countries.

Clustered standard errors reported in parenthesis.

constrained.

A positive FXI leads to an automatic increase in the level of reserves. The latter itself is an indicator of whether a country can use the reserves in times of a sudden stop and withstand a negative external shock. To understand whether it is the level of reserves that matters or foreign exchange interventions, I include the reserves-to-GDP ratio and the interaction between surges and reserves-to-GDP as additional control variables. The results are illustrated in Table B1. As can be observed, the inclusion of reserves does not alter the results of the baseline regression. Namely, unconditional FXI does not lead to a significant change in the probability of a sudden stop. However, FXI during surges highly significantly reduces the possibility of a sudden stop, whether in floater or pegger countries. Other control variables also remain robust. The probability of a sudden stop increases as a result of a surge, after an increase in uncertainty and an increase in global rate, while decreasing with an increase in global liquidity and national GDP growth. As to the reserves, the level of reserves-to-GDP, surprisingly, leads to an increased probability of a sudden stop for all countries. This positive relation can be explained by the potential moral hazard problem, which reserves create. In particular, extra reserves can lead to the overconfidence of foreign investors in the country's ability to respond and withstand the shock, making the economy more vulnerable. However, reserves-to-GDP is insignificant for the floaters. Interestingly, the interaction of surge with reserves-to-GDP shows that if a country has higher reserves in the periods of a surge, then for floater countries the probability of a stop is highly statistically significantly reduced. Although, the same variable is positive and significant for peggers and insignificant for all countries.

I also control for the capital account openness. The results shown in Table B2 indicate that the conclusion for the floater countries from baseline regression is unchanged, however, not for the peggers, for whom, now FXI is not effective. In line with economic intuition, the table also shows that decreasing capital account openness dampens the probability of a sudden stop. Controlling for monetary policy stance to abstract from the non-sterilised FXI, as illustrated in Table B3, leads to the same result as the baseline analysis. It also shows that increasing the monetary policy rate during a surge declines the probability of a sudden stop in all groups of countries. Robustness checks for public debt and exchange rate movement, shown in Tables B4 and B5 of the Online Appendix, respectively, confirm the results of the previous subsection.

Lastly, in the baseline regression, FXI denoted accumulated FX interventions over the previous 12 quarters. On Tables B6 and B7 in the Online Appendix I show the results when FX interventions are accumulated for the previous 8 and 4 quarters, respectively. As can be observed, still, conducted FXI during the period of a surge is able to statistically significantly reduce the probability of a sudden stop.

To conclude this subsection, the finding of the baseline regression that FX interventions during the boom phase of the capital inflow cycle reduce the probability of sudden stop holds and is robust.

3.3 - Ex-Ante Role of FXI - Severity of a Sudden Stop

3.3.1 - Severity - Model Specification and Results

Do the FX interventions during the boom phase of the capital inflows' cycle reduce the severity of a sudden stop? In this section, I turn to analysing the impact of FXI on the severity of a sudden stop. For this, first, I analyse how

Table 2 - Probability of a Sudden Stop

	Floater Countries	Pegger Countries	All Countries
Surge * FXI (lagged)	-0.290***	-0.187***	-0.240***
	(0.089)	(0.066)	(0.059)
Surge (lagged)	0.853***	1.557***	1.160***
	(0.234)	(0.461)	(0.242)
FXI (lagged)	0.014	0.002	0.007
	(0.013)	(0.030)	(0.018)
VIX Growth (lagged)	0.012***	0.014***	0.014***
	(0.002)	(0.003)	(0.002)
Global Growth (lagged)	-0.056	-0.182**	-0.109**
	(0.071)	(0.083)	(0.049)
Global Liquidity Growth (lagged)	-0.070***	-0.052	-0.060***
	(0.025)	(0.032)	(0.018)
Global Rate (lagged)	0.292***	0.165*	0.229***
	(0.068)	(0.099)	(0.053)
Commodity Terms of Trade Growth (lagged)	0.000	-0.003	-0.002
	(0.011)	(0.017)	(0.009)
Contagion (lagged)	0.301	0.875**	0.510
	(0.497)	(0.398)	(0.351)
National GDP Growth (lagged)	-0.100**	-0.027	-0.052**
	(0.046)	(0.027)	(0.021)
Macroprudential Policy (lagged)	-0.019	0.088	0.024
	(0.079)	(0.091)	(0.060)
Surge * Macroprudential Policy (lagged)	0.312	-0.204	0.007
	(0.241)	(0.232)	(0.192)
Number of Observations	819	649	1,468

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

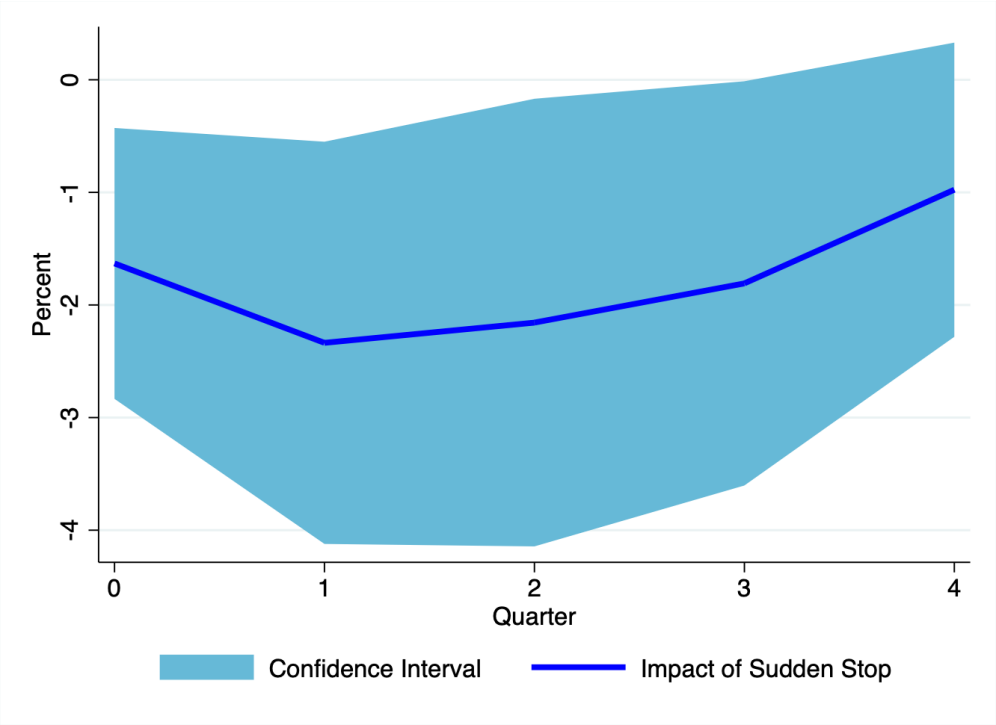
Note: Table shows the probability of a sudden stop estimated by (1) for floater, pegger and all countries when controlling for macroprudential policy measures. Clustered standard errors reported in parenthesis.

deep is the decline of the economic activity caused by the sudden stop episode. As to the econometric approach, I estimate the following regression by the local projections method from Jordà (2005) using the fixed effects:

$$Y_{i,t+h} = \alpha_{i,h} + \lambda_{t,h} + \beta_h Stop_{i,t} + \theta_h X_{i,t} + \epsilon_{i,t+h} \qquad \text{with} \qquad h = 0, 1, 2, ..., m \qquad \text{and} \qquad m = 4 \tag{3}$$

where $Y_{i,t+h}$ is the annual national GDP growth rate of country i at time $t+h$, α_i is the country-specific effects, λ_t quarter-specific effects, $Stop_{i,t}$ is the dummy variable defining the episode of a sudden stop and similarly to the probability analysis in the previous subsections comes from Forbes and Warnock (2021), $X_{i,t}$ is the vector of control variables in selecting of which I follow Obstfeld, Ostry, and Qureshi (2019) and Bergant et al. (2020). It includes lagged GDP growth rate, lagged GDP gap as a percentage of potential GDP, log of GDP per capita, institutional quality and commodity prices. $\epsilon_{i,t+h}$ denotes the error term of the regression.

Figure 2: Response of GDP Growth to Sudden Stop for All Countries



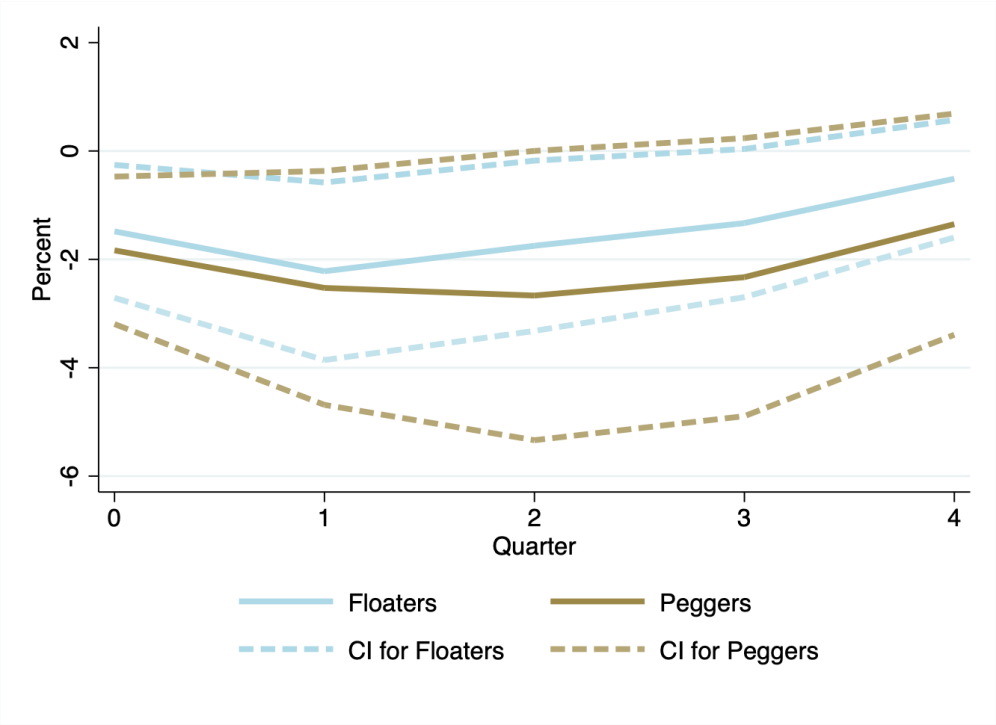
Note: Response of GDP growth to sudden stop for all countries with 90% confidence interval, estimated by (3).

To control for the cross-sectional independence, heteroscedasticity and autocorrelation in the error term of the regression, for the statistical inference, I apply the Driscoll and Kraay (1998) correction to the standard errors. As can be noticed, with $m = 4$ the regression above will assess what is the effect of a sudden stop on the economic activity in the next 4 quarters after that a stop occurs.

Tables C1, C2 and C3 show the results of the regression for all countries, floaters, and peggers, respectively. Given the interest in a variable $Stop_{i,t}$, I also plot its estimated coefficients with 90% confidence interval in Figure 2 for all countries and in Figure 3 for floaters and peggers.

Starting with all countries, it can be observed that after a country is hit by a sudden stop, the economy suffers a statistically significant 1.6% immediate decline of economic activity in the period of a shock. Afterwards, output

Figure 3: Response of GDP Growth to Sudden Stop for Floater and Pegger Countries



Note: Response of GDP growth to sudden stop for floater and pegger countries with 90% confidence interval, estimated by (3).

continues falling in the upcoming 3 quarters by around 2.1%. A similar response is noticeable for the floater and pegger countries - after a sudden stop, GDP growth declines statistically significantly. However, there are important differences between these two groups of countries. In particular, during the duration of the significant decline of output, the average magnitude of a contraction in GDP in pegger countries is 2.14%, while in the floaters 0.68 p.p. less, 1.46%. This is explained by the flexibility of the exchange rate of the floater countries, allowing the economy to adjust faster and suffer less after a shock.

As for the controls, the lagged GDP growth remains highly statistically significant, with a positive sign across the three groups. The positive sign is explained by the inertial process of GDP. Another robust and statistically significant variable is the lagged GDP gap. Its minus sign is a result of the mean-reversion process of a GDP gap. In other words, by the property that in the medium-run the value of the output gap reverts to zero. Other control variables remain largely insignificant across the groups of countries. The only exception is the commodity prices, which is an important determinant of GDP growth for floaters countries in $t+1$, $t+2$ and $t+3$ periods. The significance is caused by the heavy reliance of emerging economies on commodities (see Fernández, Schmitt-Grohé, and Uribe (2017)).

3.3.2 - Severity with FXI - Model Specification and Baseline Results

Next, I turn to analysing whether FX interventions during the boom phase of the capital flows cycle reduce the depth of the economic downturn. For this, I extend regression (3) by following:

$$
\begin{aligned}
Y_{i,t+h} = \alpha_{i,h} + \lambda_{t,h} + \gamma_h\Big(Stop_{i,t} \ * \ Surge_{i,t-n} \ * \ FXI_{i,t-n}\Big) + \beta_h^{Stop} Stop_{i,t} + \beta_h^{Surge} Surge_{i,t-n} + \\
\beta_h^{FXI} FXI_{i,t-n} + \kappa_h^{Stop*Surge}\Big(Stop_{i,t} \ * \ Surge_{i,t-n}\Big) + \kappa_h^{Stop*FXI}\Big(Stop_{i,t} \ * \ FXI_{i,t-n}\Big) + \\
\kappa_h^{Surge*FXI}\Big(Surge_{i,t-n} \ * \ FXI_{i,t-n}\Big) + \theta_h X_{i,t} + \epsilon_{i,t+h} \\
\text{with} \qquad h = 0, 1, 2, ..., m, \qquad m = 4 \qquad \text{and} \qquad n = 12
\end{aligned} \tag{4}
$$

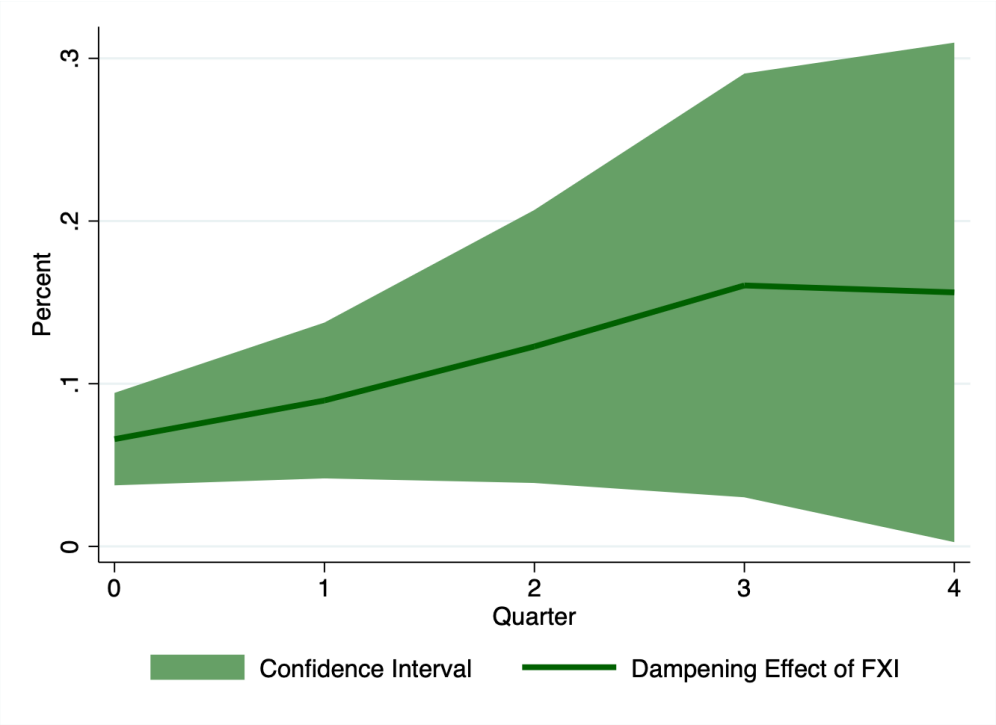
where $Stop_{i,t} * Surge_{i,t-n} \equiv Stop_{i,t} * \sum_{n=1}^{12} Surge_{i,t-n}$ - is a dummy variable indicating whether a stop in time t is preceded by a surge in any of the previous 12 quarters; $Stop_{i,t} * FXI_{i,t-n} \equiv Stop_{i,t} * \sum_{n=1}^{12} FXI_{i,t-n}$ - that is, the interaction of a sudden stop episode in a period t with the accumulated value of FXI of the previous 12 quarters; $Surge_{i,t-n} \ * \ FXI_{i,t-n} \equiv \sum_{n=1}^{12} Surge_{i,t-n} \ * \ FXI_{i,t-n}$ - in other words, it is defined as the interaction of the surge episodes with the value of accumulated FXI in the previous 12 quarters; $Stop_{i,t} * Surge_{i,t-n} * FXI_{i,t-n} \equiv Stop_{i,t} \ * \ \Big(\sum_{n=1}^{12} Surge_{i,t-n} \ * \ FXI_{i,t-n}\Big)$ - i.e., is the interaction of sudden stop in period t with the value of accumulated FXI in the previous 12 quarters if in any of those 12 periods there is a surge in the economy. The latter variable is our main variable of interest, the coefficients of which will indicate whether FX reserve accumulation during the surge phase helps dampen the severity of a recession in a bust. The controls in the vector $X_{i,t}$ are the same as in regression (3).

The regression results are shown in Table 3, 4 and 5 for all countries, floaters and pegger countries, respectively. Concentrating firstly in Table 3, there are several important observations. First of all, the regression output shows that a sudden stop is particularly costly if preceded by a surge. The coefficients on the sudden stop variable, despite being negative, remain statistically insignificant. However, the estimated coefficients of the interaction of a stop with the previous surges ($Stop \ * \ Surge$) are negative and statistically significant. They show that if the stop is preceded by a surge in any of the previous 12 quarters, then a sudden stop reduces economic activity in the next 4 quarters on average by 1.4%. Decomposing the countries by the floater and pegger economies in Table 4 and Table 5, it is noticeable that this effect is driven by the pegger countries only, as the estimated coefficients of $Stop * Surge$ are statistically insignificant for the floaters while for the peggers - significant. For floaters, it is still a sudden stop, which provides a threat to the economy, than a sudden stop preceded by a surge.[9] The coefficients on surges remain statistically insignificant, suggesting that the previous episodes of surges do not have any impact on GDP growth in the upcoming quarters.

Importantly, the coefficients on the interaction between stop, surge and FXI ($Stop \ * \ Surge \ * \ FXI$) are positive and statistically significant, indicating that the FX interventions during the surge phase help to mitigate the severity of a sudden stop. The numerical value representing the support provided by FXI, which is equivalent to 1 percentage point (p.p) of GDP for all countries is 0.12%. Given the importance of the above-mentioned

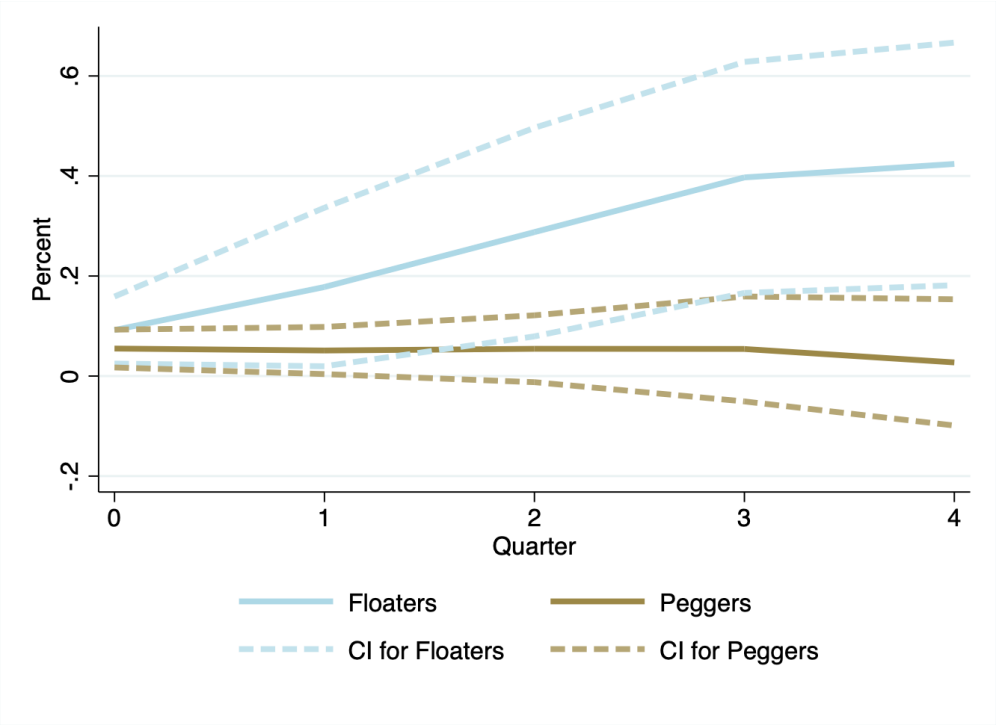
[9]This result is explicitly shown in Tables C10 and C11 in the Online Appendix for the floater and pegger countries, respectively, where I estimate (4) without FXI.

Figure 4: Dampening Effect of the Surge Phase FXI on the Severity of Sudden Stop for All Countries



Note: Dampening effect of the surge phase FXI on the severity of a sudden stop for all countries with 90% confidence interval, estimated by (4).

Figure 5: Dampening Effect of the Surge Phase FXI on the Severity of Sudden Stop for Floater and Pegger Countries



Note: Dampening effect of the surge phase FXI on the severity of a sudden stop for floater and pegger countries with 90% confidence interval, estimated by (4).

variable, its coefficients with the 90% confidence interval are provided in Figure 4. Therefore, considering the median historical accumulated FXI during surges which is 1.95 p.p. of GDP for all countries, ex-ante FX purchases reduce the severity of a sudden stop by 0.23%.

Similarly to the probability analysis in the previous section, unconditional foreign exchange interventions (FXI) do not have any influence on GDP growth. The same holds largely for FXI interacted with surges ($Surge * FXI$). The control variables demonstrate the same results as in the baseline specification without FXI in Table C1.

Moving to the floater and pegger countries and to Table 4 and Table 5, respectively, the result that FXI helps mitigate the depth of a sudden stop if the interventions happen during the period of a surge remains valid. In fact, as shown in Figure 5, for the floaters FXI helps to increase the growth of GDP by 0.28%, which is 5.3 times more than for the peggers, indicating that as a result of FXI, floaters are able to protect the economy more than non-floaters. Given that median accumulated FXI during surges in floater economies is 2.14 p.p. and 1.84 p.p. for peggers, the median estimated dampening effect of FXI is 0.6% and 0.1% for floaters and peggers, respectively. However, notice that for the pegger economies, accumulation of FX reserves before the sudden stop episode ($Stop * FXI$) also supports GDP growth by 0.18%, while this effect is not observable for the floater countries. The rest of the results is similar to the discussion of Tables C1, C2 and C3.

The analysis of this subsection provides *a second important finding of the paper, as it suggests that even those countries who let their exchange rate float, can accumulate FX reserves through foreign exchange interventions during the capital inflow boom episodes in order to shield their economies from severe external shocks. Hence, validating the ex-ante role of FXI.* Moreover, they can benefit more from such FXI, than non-floater counterparts.

3.3.3 - Severity with FXI - Robustness

To confirm the finding that positive FX interventions during the surge phase reduce the severity of a sudden stop, here I provide additional robustness checks. For the reasons outlined in section 3.2.2, I control for macroprudential policy, FX reserves, capital account openness, monetary policy rate, public debt, exchange rate movement, and vary the number of quarters for which FX interventions are accumulated.

The regression results when controlling for macroprudential policy are illustrated in Table C4 for all countries.[10] First and foremost, $Stop * Surge * FXI$ shows that interventions during the surge lead to an improvement of economic activity after the sudden stop, while unconditional interventions do not have any significant effect. The significance and signs of control variables remain similar to the baseline specification. Unlike the probability analysis, where macroprudential policy was not effective, here it has the desired effect, as tightening of macroprudential tools reduces the severity of a sudden stop. This finding is in line with Bergant et al. (2020), where it is shown that tighter macroprudential regulation can considerably dampen the impact of global financial shocks in emerging markets. This robustness analysis also indicates that both, FX interventions and macroprudential instruments, can be used to mitigate the impact of severe external shocks, such as sudden stops.

Next, I control for reserves-to-GDP ratio and show the results in Table C5 for all countries. Once again, the result that accumulating FXI during the period of a surge reduces the severity of sudden stop holds, as

[10] Online Appendix also shows the decomposition of each considered robustness check for the floater and pegger countries, illustrating that the results from the baseline analysis remain consistent..

Table 3 - Severity of a Sudden Stop with FXI - All Countries

	Y_{t+0}	Y_{t+1}	Y_{t+2}	Y_{t+3}	Y_{t+4}
Sudden Stop	-1.051	-1.464	-1.094	-0.994	-0.555
	(0.652)	(0.887)	(0.978)	(1.067)	(0.964)
Stop * Surge * FXI	0.066***	0.090***	0.123***	0.160**	0.156**
	(0.014)	(0.023)	(0.041)	(0.063)	(0.075)
Surge (lagged)	0.071	0.099	-0.132	-0.476	-0.909
	(0.224)	(0.278)	(0.284)	(0.409)	(0.623)
Surge * FXI (lagged)	0.143	0.093	0.178*	0.166	0.092
	(0.099)	(0.085)	(0.100)	(0.178)	(0.174)
Stop * FXI	0.077**	0.140***	0.177**	0.248***	0.189
	(0.033)	(0.044)	(0.072)	(0.085)	(0.155)
Stop * Surge	-0.946*	-1.531**	-1.770**	-1.358*	-0.793
	(0.476)	(0.641)	(0.748)	(0.775)	(0.839)
FXI (lagged)	0.010	0.013	-0.003	-0.004	-0.015
	(0.010)	(0.017)	(0.028)	(0.037)	(0.043)
GDP Growth (lagged)	0.714***	0.521***	0.383***	0.178**	0.101
	(0.081)	(0.085)	(0.088)	(0.068)	(0.059)
GDP Gap (lagged)	-0.062**	-0.154**	-0.171***	-0.190***	-0.154***
	(0.025)	(0.061)	(0.050)	(0.045)	(0.040)
log of GDP Per Capita (lagged)	1.515	1.522	0.525	-0.258	-1.835
	(2.105)	(2.791)	(3.229)	(3.774)	(4.281)
Institutional Quality	-0.603	-0.714	-0.578	-0.496	-0.644
	(0.915)	(1.172)	(1.287)	(1.275)	(1.325)
Linear Trend	-0.037	-0.057	-0.068	-0.072	-0.070
	(0.031)	(0.041)	(0.045)	(0.047)	(0.052)
Commodity Prices	-0.013	-0.001	0.009	0.016	0.018
	(0.013)	(0.010)	(0.011)	(0.013)	(0.016)
F Statistics	70.1	28.1	18.1	14.9	8.6
Number of Observations	1,429	1,429	1,410	1,389	1,368

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the severity of a sudden stop with FXI accumulation, estimated by (4) for all countries.

Driscoll and Kraay (1998) standard errors reported in parenthesis.

Table 4 - Severity of a Sudden Stop with FXI - Floater Countries

	Y_{t+0}	Y_{t+1}	Y_{t+2}	Y_{t+3}	Y_{t+4}
Sudden Stop	-1.229	-1.736*	-1.295	-1.339	-0.876
	(0.705)	(0.909)	(0.969)	(1.107)	(1.078)
Stop * Surge * FXI	0.092**	0.178*	0.288**	0.397***	0.424***
	(0.038)	(0.090)	(0.119)	(0.132)	(0.138)
Surge (lagged)	0.270	0.259	-0.149	-0.028	-0.497
	(0.259)	(0.382)	(0.423)	(0.386)	(0.575)
Surge * FXI (lagged)	-0.057	0.099	0.314	0.094	0.507
	(0.135)	(0.222)	(0.308)	(0.356)	(0.450)
Stop * FXI	0.205	0.148	0.230	0.488	0.049
	(0.278)	(0.269)	(0.346)	(0.342)	(0.393)
Stop * Surge	-0.400	-0.836	-0.886	-0.041	0.535
	(0.524)	(0.688)	(0.878)	(1.073)	(1.341)
FXI (lagged)	-0.003	-0.010	-0.037	-0.046	-0.071
	(0.029)	(0.046)	(0.054)	(0.053)	(0.061)
GDP Growth (lagged)	0.666***	0.459***	0.336***	0.133*	0.088
	(0.092)	(0.088)	(0.098)	(0.074)	(0.071)
GDP Gap (lagged)	-0.085*	-0.188*	-0.214***	-0.247***	-0.214***
	(0.042)	(0.089)	(0.070)	(0.059)	(0.058)
log of GDP Per Capita (lagged)	2.713	3.343	4.096	4.388	5.110
	(3.073)	(3.431)	(3.658)	(3.786)	(4.026)
Institutional Quality	0.587	1.362	1.837	2.193	1.472
	(1.053)	(1.581)	(2.088)	(2.124)	(2.105)
Linear Trend	-0.045	-0.068	-0.088*	-0.098**	-0.111**
	(0.036)	(0.042)	(0.045)	(0.045)	(0.048)
Commodity Prices	-0.002	0.015*	0.028**	0.036**	0.034*
	(0.009)	(0.008)	(0.012)	(0.015)	(0.016)
F Statistics	29.1	10.9	9.8	6.3	8.3
Number of Observations	820	820	809	797	785

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the severity of a sudden stop with FXI accumulation, estimated by (4) for floater countries.

Driscoll and Kraay (1998) standard errors reported in parenthesis.

Table 5 - Severity of a Sudden Stop with FXI - Pegger Countries

	Y_{t+0}	Y_{t+1}	Y_{t+2}	Y_{t+3}	Y_{t+4}
Sudden Stop	-0.941	-1.282	-1.059	-0.571	0.119
	(0.651)	(0.964)	(1.237)	(1.253)	(1.079)
Stop * Surge * FXI	0.055**	0.051*	0.055	0.054	0.027
	(0.022)	(0.027)	(0.038)	(0.060)	(0.072)
Surge (lagged)	0.139	0.283	0.371	-0.265	-0.765
	(0.218)	(0.331)	(0.504)	(0.565)	(0.736)
Surge * FXI (lagged)	0.204	0.123	0.186*	0.205	0.010
	(0.140)	(0.091)	(0.103)	(0.182)	(0.144)
Stop * FXI	0.091**	0.170**	0.195**	0.246**	0.225
	(0.033)	(0.063)	(0.073)	(0.102)	(0.163)
Stop * Surge	-1.293**	-1.963**	-2.241*	-2.466*	-2.034
	(0.595)	(0.821)	(1.216)	(1.405)	(1.442)
FXI (lagged)	-0.004	-0.006	-0.021	-0.030	-0.045
	(0.013)	(0.019)	(0.025)	(0.034)	(0.043)
GDP Growth (lagged)	0.738***	0.547***	0.377***	0.173**	0.075
	(0.071)	(0.084)	(0.091)	(0.079)	(0.075)
GDP Gap (lagged)	-0.007	-0.074	-0.060	-0.041	0.008
	(0.029)	(0.052)	(0.054)	(0.073)	(0.080)
log of GDP Per Capita (lagged)	-2.005	-3.571	-7.438	-10.614	-14.341
	(2.692)	(4.448)	(6.213)	(8.323)	(9.618)
Institutional Quality	2.027	2.837	4.515	5.474	6.237
	(1.594)	(2.290)	(3.103)	(3.622)	(4.005)
Linear Trend	-0.025	-0.040	-0.042	-0.032	-0.016
	(0.034)	(0.054)	(0.063)	(0.073)	(0.079)
Commodity Terms of Trade	-0.037	-0.033	-0.030	-0.021	-0.008
	(0.026)	(0.022)	(0.022)	(0.023)	(0.025)
F Statistics	27.1	11.8	8.7	6.9	8.8
Number of Observations	609	609	601	592	583

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the severity of a sudden stop with FXI accumulation, estimated by (4) for pegger countries.

Driscoll and Kraay (1998) standard errors reported in parenthesis.

$Stop * Surge * FXI$ remains positive and highly statistically significant across. Accumulation of FXI, which is not accompanied by a surge does not result in any significant change in GDP. Similarly to the baseline specification, a sudden stop leads to a significant reduction in economic activity, while a surge does not have an effect. Other control variables are also in line with the baseline analysis. Regarding the effect of reserves, it can be seen that a higher level of reserves before the sudden stop leads to a statistically significant increase of output after a stop takes place ($Stop * Reserves-to-GDP$). However, the magnitude remains marginal and is close to zero. Interestingly, a higher level of reserves during the surges ($Surge * Stop * Reserve-to-GDP$) does not have a significant impact on output after a stop. The latter result provides an important difference between the level of reserves and FX interventions. Namely, for FXI to be effective, it has to respond to the cyclical dynamics, while reserves ensure the resilience of the economy more structurally. Therefore, both high reserves and FX interventions are required to shield the economy from the severity of a sudden stop.

Table C6 shows the estimation results when controlling for capital account openness and Table C7 when controlling for monetary policy rate. As can be observed, adding capital account openness and monetary policy rate do not change the conclusions of the baseline regressions, as the accumulation of FX reserves during the periods of surges helps to dampen the contraction of the real economy after a sudden stop occurs. Controlling for the exchange rate movement also does not change the main results, as shown in Table C20 to C22 in the Online Appendix.

Similarly to the probability analysis of a sudden stop in the previous section, I also assess the specifications where FX interventions are accumulated for the previous 8 and 4 quarters. The results for the previous 8 quarters' accumulation for all countries are illustrated in Table C8. As shown in the table, $Stop * Surge * FXI$ remains consistently positive and statistically significant, preserving the baseline findings. But, when accumulating FX interventions only for 4 quarters, Table C25 to C27 of the Online Appendix illustrate that significance disappears for each group of countries. However, it should be noted that under the latter specification, the number of episodes of sudden stops, which are preceded by a surge declines significantly, hence, resulting to a possible estimation inefficiency and inconsistency for $Stop * Surge * FXI$.

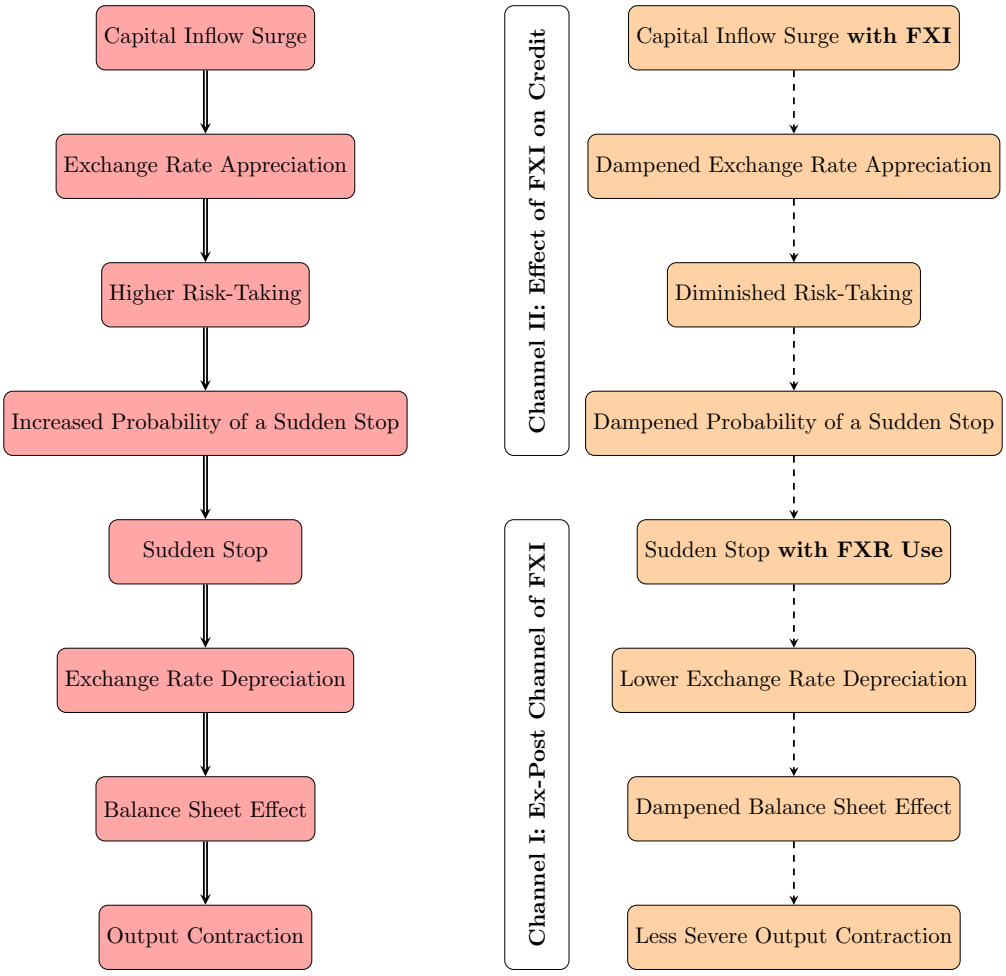
To summarise, the conclusion of the previous subsection that intervening in the FX market during the periods of a surge by accumulating FX reserves reduces the severity of a sudden stop and supports the economic recovery, remains valid across different robustness checks and regression specifications.

3.4 - FXI Channels

The previous sections have shown that FX interventions are capable of reducing the probability of a sudden stop, as well as its severity and depth. In this section, I study what are the channels through which FXI achieves these results and affect the economy. Figure 6 shows the graphical illustration of the Boom-Bust Cycle without FXI in panel a) and the proposed channels of FXI in panel b). I explore two channels: (i) *the ex-post channel* - by which a country can sell more reserves in the period of a sudden stop, which it has accumulated in the boom phase, thus, helping relax the tight financial conditions of the economic agents by avoiding excessive depreciation of the national currency and providing support to the real side of the economy; (ii) *effect of FXI on credit* - through which FX intervention is preventing capital inflows from excessive credit growth and from inflating asset price bubbles by

limiting the overvaluation of the national currency during a surge. I will study, first, the ex-post aspect and then, the credit channel.

Figure 6: Boom-Bust Cycle and FXI Channels



(a) Boom-Bust Cycle without FXI

(b) Boom-Bust Cycle with FXI

Note: The tested channels. FXR Use denotes the use of FX reserves, i.e., their deccumulation.

3.4.1 - Ex-Post Channel of FXI - Model Specification and Baseline Results

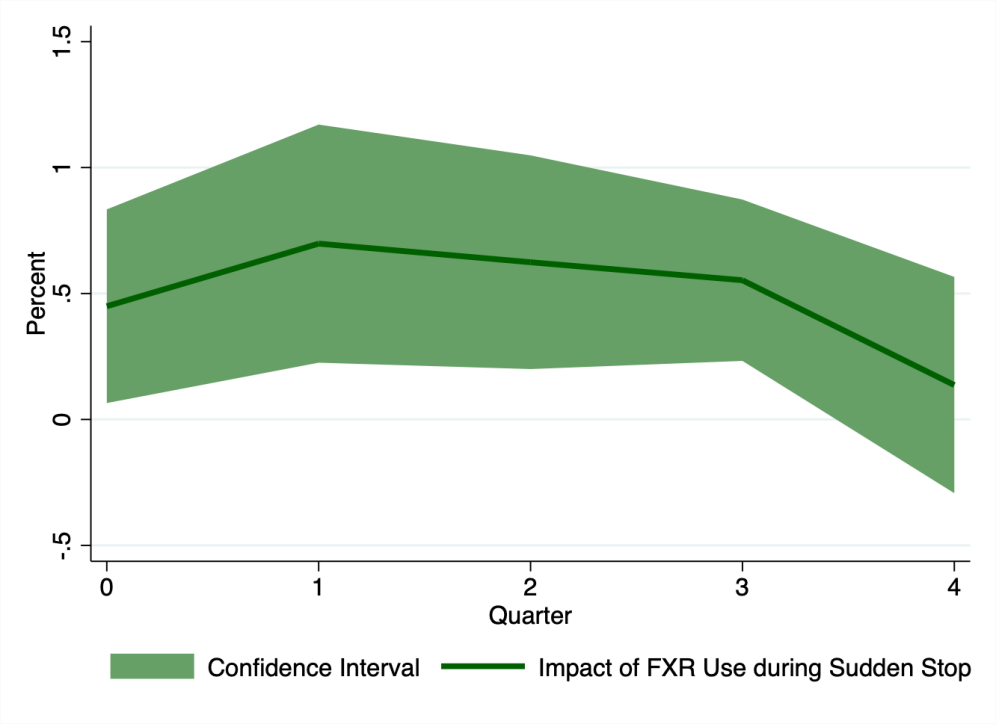
To study the ex-post channel, I use the following regression estimated using the fixed effects in the framework of the local projections method:

$$Y_{i,t+h} = \alpha_{i,h} + \lambda_{t,h} + \beta_h^{Stop} Stop_{i,t-1} + \beta_h^{FXI} FXR\ \ Use_{i,t-1} + \gamma_h (Stop_{i,t-1}\ *\ FXR\ \ Use_{i,t-1}) + \theta_h X_{i,t} + \epsilon_{i,t+h}$$
$$\text{with} \qquad h = 0, 1, 2, ..., m \qquad \text{and} \qquad m = 4 \tag{5}$$

where the notation of variables, as well as their sources is the same as in section 3.3 with one exception. $FXR\ \ Use$ denotes FX reserves' use or decumulation of FX reserves. A possible endogeneity concern could be

that FX interventions may respond to GDP growth, which will lead to reverse causality. However, as observed by Cavallino and Patel (2019), the reasons behind central banks' FX interventions do not include the dynamics of the real economy and thus, endogeneity should not arise. However, for reassurance, the variables are lagged by one quarter.

Figure 7: Ex-Post Channel - Response of GDP Growth to Sudden Stop with FX Reserves' Use for All Countries



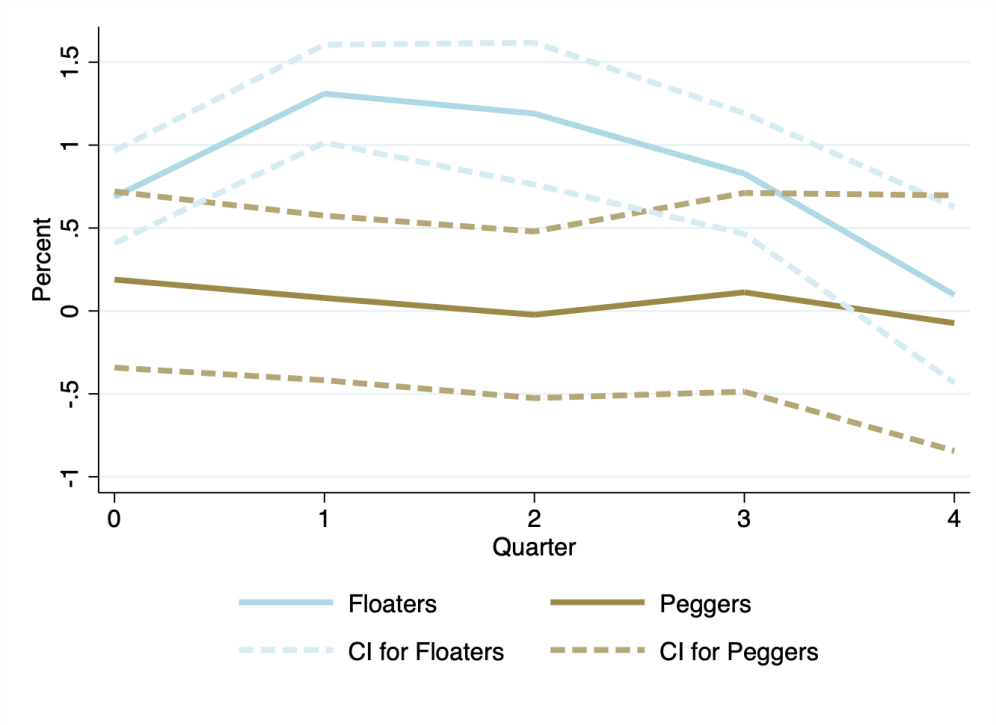
Note: Ex-Post Channel - The response of GDP growth to sudden stop with FX Reserves' deccumulation for all countries with 90% confidence interval, estimated by (5)

Therefore, the coefficients γ_h will show whether FX interventions during the sudden stop are capable of supporting the recovery of the economy. The results for all countries are illustrated in Table D1 and for floaters and peggers in Table D2 and D3, respectively.

The results show that the coefficients of *Stop* are similar to Table 3, 4 and 5. After that a country experiences a sudden stop, the economy suffers from a statistically significant negative drop. The floaters' ability to adjust is also visible, as they experience around 1.11% reduction in GDP growth, while pegger countries by 1.43%.

Given that the coefficients on the interaction between a sudden stop and FX reserves' use indicate whether negative FX interventions during a sudden stop are able to reduce the economic downturn caused by a sudden stop and support recovery, they are plotted in Figure 7 for all and in Figure 8 for floater and pegger countries. Notably, for all and floater countries, they show positive and highly statistically significant signs from $t+0$ to $t+3$ periods after a sudden stop. Although, peggers do not benefit from the deaccumulation of FX reserves. This finding provides *the third important conclusion of the paper - it suggests that floating countries who are using their reserves in the period of a sudden stop are able to support recovery in economic activity after a severe external shock.* This conclusion is in contrast with the finding of Scheubel, Stracca, and Tille (2019), where it is shown

Figure 8: Ex-Post Channel - Response of GDP Growth to Sudden Stop with FX Reserves' Use for Floater and Pegger Countries



Note: The response of GDP growth to sudden stop with FX Reserves' deccumulation for floater and pegger countries with 90% confidence interval, estimated by (5)

that using FX reserves does not help the economy when facing globally driven sudden stops. In addition, the provided support is substantial in quantitative terms - selling FX reserves' equivalent to 1 percentage point of GDP increases the GDP growth by 0.58% in all countries and by 1% in the floater economies. Considering that the median value of $Stop * FXR\ \ Use$ for all countries is 0.19 p.p. and 0.18 p.p. for floaters,[11] the result implies that as a result of FX reserves' use during a sudden stop, on average decline in GDP growth is mitigated by 0.11% in all countries and by 0.18% in floaters. This fact that floaters can benefit 1.72 times more from FXI than all countries is consistent with Section 3.3.2, where it was shown that the floater countries gain 2.3 times more from FX reserves accumulation, than all countries in the sample. In fact, as shown in Figure 8, the pegger countries do not benefit from the FX reserves' deployment during a sudden stop at all. Notice, similar to the previous sections when I analysed the impact of ex-ante accumulation of FX reserves, for the ex-post exploration, unconditional interventions ($FXR\ \ Use$) do not have any significant impact on GDP growth. Other control variables are also in line with the regression results in Section 3.3.2.

3.4.2 - Ex-Post Channel of FXI - Robustness

In this subsection, I provide the robustness check of the finding that intervening in the FX market in the period of a sudden stop supports the economic activity afterwards.

[11] For peggers the median FX reserves' deployment is 0.2 p.p.

Table 6 illustrates the results when controlling for macroprudential policy measures.[12] The main finding of the previous subsection remains valid, as selling FX reserves during a stop helps support economic activity in floater countries, but not for peggers. The control variables also remain robust. Interestingly, releasing macroprudential buffers does not have any significant effect. Additionally, the sign on the variable $Stop * Macroprudential\ Policy$ is unstable, as it switches between positive and negative signs across the different h horizons. This result, once again underlines the ability of FXI to "get in all the cracks" of the economy, mentioned in Section 3.2.2 and confirms with regard to the ex-post channel of FXI as well that macroprudential policy can be complemented with FX interventions when the effectiveness of the former becomes constrained.

Table D4' shows the result of the regression when including reserves-to-GDP as a control. As in the baseline specification, $Stop * FXR\ Use$ remains consistently positive and statistically significant, demonstrating that using FXI during the sudden stop helps the economy to recover faster, while unconditional interventions do not have any meaningful effect. The control variables also maintain the initial signs and significance. $Stop * Reserves-to-GDP$ shows that having larger reserves also helps supporting recovery, however, quantitatively only marginally.

I also control for capital account openness, monetary policy rate, public debt growth and exchange rate movement. Still, as illustrated in Part D of the Online Appendix, the baseline results hold.

Thus, the conclusion of the previous subsection that selling FX reserves during the sudden stop helps the economy to recover faster remains valid and robust.

3.4.3 - Effect of FXI on Credit - Model Specification and Baseline Results

One of the reasons why macroprudential policy was widely adopted across countries was its ability to address excessive credit expansion and asset price growth. Indeed, Kuttner and Shim (2016) find that macroprudential tools are capable of reducing credit and house price growth. In this subsection, I analyse whether FX interventions during the surge phase of capital inflows can dampen exuberant credit growth and asset price increase. For this, I estimate the following local projection regression with fixed-effects:

$$Credit\ Gap_{i,t+h} = \alpha_{i,h} + \lambda_{t,h} + \beta_h^{Surge} Surge_{i,t-n} + \beta_h^{FXI} FXI_{i,t-n} + \gamma_h (Surge_{i,t-n} * FXI_{i,t-n}) + \theta_h X_{i,t} + \epsilon_{i,t+h}$$
$$\text{with} \qquad h = 0, 1, 2, ..., m, \qquad m = 4, \qquad \text{and} \qquad n = 12 \tag{6}$$

where $Credit\ Gap$ is the credit-to-GDP gap and measures excessive credit in the economy; $Surge$ and FXI are defined as in 3.2.1. The vector X contains the control variables, which include macroprudential policy, lagged GDP growth, lagged GDP gap, change in monetary policy rate, growth of VIX and lagged credit-to-GDP gap.

The results for all, floater and pegger countries are shown in Table 7, E1 and E2, respectively. Concentrating on all countries, $Surge$ has an intuitive sign and statistically significant coefficients in all periods. They indicate that a surge in capital inflows leads to an increase in the credit-to-GDP gap. Similarly to all countries and unlike peggers, floater economies in $t + 0$ period show a positive and statistically significant sign for $Surge$.

The main variable of interest is $Surge * FXI$, which should indicate whether FX interventions during surge episodes are capable of dampening the magnitude of a credit-to-GDP gap. As can be observed, the coefficients on

[12] See Tables D5 and D6 in the Online Appendix for the decomposition of the sample into floater and pegger countries.

Table 6 - Ex-Post Severity of a Sudden Stop with FX Reserves Use - All Countries

	Y_{t+0}	Y_{t+1}	Y_{t+2}	Y_{t+3}	Y_{t+4}
Stop (lagged)	-1.287**	-1.351	-0.746	-0.457	0.225
	(0.608)	(0.797)	(0.804)	(0.681)	(0.451)
Stop * FXR Use (lagged)	0.429**	0.663***	0.593***	0.543***	0.165
	(0.178)	(0.224)	(0.206)	(0.144)	(0.205)
FXR Use (lagged)	0.064	0.010	0.128*	0.070	0.072
	(0.077)	(0.075)	(0.063)	(0.061)	(0.044)
GDP Growth (lagged)	0.693***	0.529***	0.416***	0.217***	0.152**
	(0.091)	(0.087)	(0.073)	(0.060)	(0.061)
GDP Gap (lagged)	-0.053**	-0.138**	-0.161***	-0.177***	-0.144***
	(0.021)	(0.058)	(0.052)	(0.043)	(0.036)
log of GDP Per Capita (lagged)	0.915	0.853	0.716	-0.102	-1.740
	(2.008)	(3.011)	(3.751)	(4.263)	(4.528)
Institutional Quality	-0.723	-0.700	-0.804	-0.891	-0.846
	(1.002)	(1.202)	(1.442)	(1.606)	(1.635)
Linear Trend	-0.035	-0.051	-0.063	-0.066	-0.056
	(0.029)	(0.040)	(0.047)	(0.051)	(0.052)
Commodity Terms of Trade	-0.005	0.004	0.008	0.010	0.008
	(0.011)	(0.010)	(0.012)	(0.013)	(0.015)
Stop * Macroprudential Policy (lagged)	0.151	0.336	0.191	-0.036	-0.201
	(0.233)	(0.241)	(0.253)	(0.248)	(0.208)
Macroprudential Policy (lagged)	0.197	0.095	0.209	0.137	-0.164
	(0.200)	(0.142)	(0.154)	(0.123)	(0.216)
F Statistics	65.6	16.8	6.1	6.1	4.8
Number of Observations	1,535	1,517	1,497	1,477	1,457

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the ex-post severity of a sudden stop with FXI deccumulation, estimated by (5) for all countries when controlling for macroprudential policy measures. Driscoll and Kraay (1998) standard errors reported in parenthesis.

$Surge * FXI$ are, by and large, negative across the three tables. However, at none of the h horizons are they statistically significant. FXI also suggests that unconditional interventions have no effect, as its coefficients remain mainly statistically insignificant.[13]

Other covariates show economically intuitive signs. An increase in monetary policy rate statistically significantly reduces credit growth for floaters. Notice that comparing insignificant FX interventions with a significant monetary policy rate suggests that FXI does not act as a substitute for monetary policy. An increase in global uncertainty, captured by the VIX growth, reduces excessive credit for both, floaters and peggers and GDP growth mostly has a positive impact. Interestingly, while the GDP gap positively influences the credit-to-GDP gap for all countries, for floaters and peggers it has a negative influence. In line with the literature, unconditional and/or conditional on surge macroprudential policy reduces the magnitude of the excessive credit.

To summarise, as the coefficients of $Surge * FXI$ are not negative and significant, one can say that *FX interventions during surges are not able to dampen excessive credit - this is the fourth important finding of the paper.* Therefore, there is limited evidence about the effect of FXI on credit. However, this contrasts with the findings from the micro-data analysis of Hofmann, Shin, and Villamizar-Villegas (2021), where is shown that sterilized FX purchases have a systematic tightening effect on domestic credit conditions.

3.4.4 - Effect of FXI on Credit - Robustness

To check the robustness of the previous subsection, below I provide additional controls to the regression specification (6). First, I add the reserves-to-GDP ratio and its interaction with a surge. The results of this regression are shown in Table E6 to E8 of the Online Appendix for all, floater and pegger countries, respectively. The baseline finding that there is little effect of FXI on credit remains intact, as the coefficients indicate that FX reserves' accumulation during surges is not able to reduce excessive credit in the economy. Other controls have the same sign and significance, as in the subsection above. Regarding the effect of high level of reserves, for the floater and pegger economies, it does not have any impact, whether unconditional or conditional on a surge. Given the latter result, surprisingly, for all countries, reserves-to-GDP, as well as its interaction with a surge show a negative and statistically significant sign, indicating that a higher level of reserves-to-GDP reduces the credit-to-GDP gap. Nevertheless, the impact is marginal and close to zero.

I also explore the dynamics of asset prices. I concentrate on housing prices given that the domestic financial and stock markets remain largely underdeveloped in emerging economies. For this, I rely on the set-up of (6) where everything except the dependent variable remains unchanged and estimate (7) with the local projections method with fixed-effects:

$$House\ Price\ Growth_{i,t+h} = \alpha_{i,h} + \lambda_{t,h} + \beta_h^{Surge} Surge_{i,t-n} + \beta_h^{FXI} FXI_{i,t-n} + \gamma_h (Surge_{i,t-n} * FXI_{i,t-n}) + \theta_h X_{i,t} + \epsilon_{i,t+h} \quad \text{with} \quad h = 0, 1, 2, ..., m, \quad m = 4, \quad \text{and} \quad n = 12 \tag{7}$$

The results are shown in Table E3 to E5. As can be observed, the coefficients on $Surge * FXI$ are consistently negative across the three tables. However, they remain statistically insignificant. In addition, concentrating on all

[13] Except for $t + 0$ and $t + 1$ periods for all countries.

Table 7 - Response of a Credit-to-GDP Gap - All Countries

	Gap_{t+0}	Gap_{t+1}	Gap_{t+2}	Gap_{t+3}	Gap_{t+4}
Surge (lagged)	1.496*	1.859**	1.892**	1.761**	1.898**
	(0.836)	(0.845)	(0.783)	(0.714)	(0.804)
Surge * FXI (lagged)	0.377	0.144	-0.045	-0.075	-0.349
	(0.296)	(0.319)	(0.372)	(0.326)	(0.373)
FXI (lagged)	0.076**	0.073*	0.058	0.044	0.030
	(0.033)	(0.039)	(0.042)	(0.042)	(0.041)
GDP Growth (lagged)	-0.226**	-0.133	0.051	0.175**	0.246***
	(0.092)	(0.092)	(0.086)	(0.066)	(0.063)
GDP Gap (lagged)	0.108*	0.106	0.126**	0.120**	0.080
	(0.057)	(0.061)	(0.053)	(0.048)	(0.054)
VIX Growth (lagged)	-3.515	-2.816	-2.094	-1.922	-1.443
	(3.716)	(4.108)	(4.293)	(4.199)	(4.283)
Monetary Policy Rate (lagged)	-0.046	-0.026	0.014	0.049	0.076**
	(0.052)	(0.049)	(0.044)	(0.038)	(0.034)
Surge * Macroprudential Policy (lagged)	-0.159*	-0.098	-0.007	0.005	0.117
	(0.090)	(0.093)	(0.119)	(0.107)	(0.123)
Macroprudential Policy (lagged)	-0.293	-0.353	-0.403*	-0.215	-0.133
	(0.239)	(0.246)	(0.210)	(0.141)	(0.159)
Credit-to-GDP Gap (lagged)	0.046*	-0.010	-0.064**	-0.113***	-0.142***
	(0.025)	(0.026)	(0.030)	(0.033)	(0.036)
F Statistics	7.7	4.3	4.4	7.7	12.0
Number of Observations	985	977	966	954	938

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the response of credit-to-GDP gap to a surge with FXI accumulation, estimated by (6) for all countries. Driscoll and Kraay (1998) standard errors reported in parenthesis.

countries, *Surge* has a counterintuitive sign and statistically significant coefficients in $t+0$ and $t+1$ periods. They indicate that a surge in capital inflows leads to a decline in house prices, which is in contrast with the economic literature. The coefficients for $t+2$, $t+3$ and $t+4$ are statistically insignificant, although the signs in $t+3$ and $t+4$ have a positive sign. The same irregularities are observable for peggers. Also, similar to all countries, the floater economies in $t+0$ and $t+1$ horizons show a negative sign for *Surge*. The only positive and statistically significant coefficient is in $t+3$ period, however, this is not sufficient to conclude that surges lead to an increase in house prices. FXI indicates that the unconditional accumulation of reserves has no effect, as its coefficients remain mostly statistically insignificant.[14] Thence, there is no indication that FX intervention during the surge phase can help to dampen the asset price growth.

The same conclusion is reached when controlling for macroprudential policy, as illustrated in Table E9 to E11 of the Online Appendix or for the reserves-to-GDP ratio as shown in Table E12 to E14.

4 - Implications for Policy

What are the lessons for conducting FX intervention policy in emerging markets? In this section, I discuss the normative and policy implications of the findings discussed in the paper.

Monetary policy in the emerging markets has graduated from the fixed exchange rates and currently, is largely based on the inflation targeting regime. Nevertheless, the central banks still very actively use foreign exchange interventions. The purpose of FXI includes ensuring the desired level of FX reserves, reducing FX speculation, deepening FX markets and/or maintaining price stability.

However, this paper demonstrated that the role of FXI can be far more powerful and important. Namely, ex-ante accumulation of FX reserves during the phase of capital inflow surges reduces the probability as well as severity of a sudden stop. Additionally, ex-ante accumulation makes ex-post decumulation of FX reserves in the episode of a sudden stop feasible and via this channel possible to support the economic recovery. In other words, there is a macroprudential role for foreign exchange interventions.

This finding provides *a first important lesson for the central banks, as it implies that monetary policymakers in emerging economies can act preemptively and countercyclically in the FX market.* That is, the central banks can (i) intervene to accumulate FX reserve buffers during the boom times of the capital inflow cycle and (ii) decumulate them in periods of stress to relax the tight financial conditions of the economic agents and provide cushion to the real side of the economy after the sudden stop occurs. By pursuing such a policy, a central bank can tackle the ebbs and flows of cross-border capital flows and volatile external factors, and ensure a reduction in both, probability and severity of a sudden stop. Notably, these are the aims of the macroprudential tools and capital flow management measures as well. Thus, it is possible to achieve the objectives of macroprudential policy and CFMs by relying on FX interventions.

This conclusion leads to *the second important lesson for conducting policy - when macroprudential and CFM tools are constrained or less effective, the central banks can rely on the advantageous ability of FXI to "get in all the*

[14] In $t+3$ for all countries, the coefficient is significant, but its sign is counterintuitive. However, the significance only in $t+3$ is not strong enough to make any firm conclusion.

cracks" of the economy and complement macroprudential and CFM tools with FX interventions. There are several reasons, which can make these two policies constrained. Table 8 from Borio and Disyatat (2021) refers to some of these reasons.

Policy response usually entails certain operational costs and lags, such as the transmission lags, that is the time required for the policy tool to affect its desired macroeconomic or macro-financial variable; the implementation lag - the time required to prepare and execute a decision; and reputation cost - concerns that the reversal of policy decisions can be understood as a mistake and damage credibility. The transmission lags for macroprudential policy, as well as for CFMs are significantly larger than for FX interventions. The same reasoning applies to the implementation lags and reputation costs. Therefore, FXI is much more flexible, than macroprudential tools or CFMs and can be deployed much faster with smaller costs. Given this result, it is not surprising that the central banks more intensively rely on FXI and adapt the frequency of its adjustment at a quicker pace, than that of macroprudential instruments and CFMs.

Table 8 - Characteristics of Policy Tools

	Monetary Policy	FX Intervention	Macroprudential Policy	CFMs
Transmission Lag	Medium	Negligible	Long	Medium
Implementation Lag	Negligible	Negligible	Large	Medium
Reputation Cost	Moderate	Low	High	High
Frequency of Adjustment	Frequent	Very Frequent	Infrequent	Infrequent

Source: Borio and Disyatat (2021)

Furthermore, macroprudential regulation applies only to a part of the agents and not to the whole economy, thus, leading to the potential leakage outside of the regulatory perimeter. Indeed, as documented by Financial Stability Board (2022), as a result of the imposed macroprudential tools on the commercial banks, financial stability risks are shifting to the non-bank financial intermediaries, exposing the economy to the same type of risks, as the conventional commercial banks pose. The same argument applies to CFMs, which are usually difficult to implement and significantly exposed to avoidance (Eichengreen (2008)). Therefore, in the case of regulatory arbitrage, by taking advantage of the FXI's ability to "get in all the cracks" of the economy, the latter tool can be complemented to macroprudential instruments or capital flow management measures in order to ensure the resilience of the economy.

5 - Conclusion

It is a well-established and accepted conclusion that emerging market economies are vulnerable to the shifting dynamics of the global financial markets, resulting in significant adjustment of the main domestic macroeconomic and macro-financial variables. To shield the economy from undesired volatility, policymakers rely on different policy instruments, including monetary and fiscal policies, macroprudential tools, capital flow management measures and

notably, foreign exchange interventions. In fact, FX interventions have been the most frequently employed tool in emerging and developing economies.

In this paper, I empirically analysed 34 emerging economies for the period of 2000 to 2020 and explored the macroprudential role of FX interventions by investigating whether FXI supports the economy when facing severe external conditions, such as episodes of a sudden stop. Namely, I studied whether FXI helps to reduce the probability of a sudden stop in the economy, dampens its severity on the domestic economic activity, and examined the mechanisms through which FXI could be influencing the broad macroeconomic conditions.

I demonstrated that (i) FX reserve accumulation during the surge phase of capital inflow cycle reduces the probability of a sudden stop. Importantly, such FXI policy is more successful in decreasing the probability of a sudden stop, than macroprudential tools, revealing the advantageous ability of FXI to "get in all the cracks" of the economy. (ii) I also showed that FX reserve accumulation during the boom episodes of the capital inflow cycle dampens the severity of the macroeconomic contraction when facing a sudden stop. Thus, illustrating the *ex-ante role* of foreign exchange interventions.

In addition, I explored two possible channels, which can be at work: (a) ex-post channel - through which a country can sell more reserves in the stress, thereby helping relax the tight financial conditions of the economic agents by preventing the excessive depreciation of the national currency and providing support to the real side of the economy. I found that, indeed, this is the main channel through which FXI has an effect on the macroeconomy, demonstrating its *ex-post role*; while evidence regarding (b) the effect of FXI on credit, which involves preventing capital inflows from fueling excessive credit growth and inflating asset price bubbles by avoiding over-appreciation or overvaluation of the national currency, remains limited. In other words, the ex-ante role of FXI is observable because it enables the use of FX reserves during a sudden stop, not because FX interventions during a surge reduce credit misalignment.

These findings are consistent with the recent theoretical studies that explore international financial frictions, analysing how FXI can be used for macro-stabilising purposes and showing the effectiveness of FX interventions in periods of large uncovered interest rate parity (UIP) deviations. Notably, the findings carry important normative and policy suggestions, as they indicate that the role of FX interventions extends beyond merely affecting the exchange rate. The results suggest that the central banks of emerging market economies can rely on FX interventions to reduce the probability and severity of a sudden stop. To achieve this, they should (i) accumulate reserves during periods of capital inflow booms and (ii) decumulate them in periods of a sudden stop, dampening the negative impact of a shock.

Hence, FXI policy can be deployed to mimic the objectives of macroprudential instruments. Moreover, the tools of the latter policy entail long transmission lags, implementation delays, high reputation costs and are susceptible to avoidance. In contrast, FX interventions have the capability to "get in all the cracks" of the economy and can be deployed at a faster pace. Therefore, it is desirable to complement macroprudential measures with FXI in situations where the effectiveness of macroprudential instruments is constrained or when a considerable part of the agents is outside of the regulatory perimeter of macroprudential policy.

Nonetheless, while the study suggests that emerging market economies can use FX interventions to reduce the probability and severity of a sudden stop, it is imperative to delve deeper into their associated costs and study under

what circumstances FXI can be deployed and complemented with other tools successfully. It has to be rigorously analysed how FXI interacts with other policy tools when facing various shocks, frictions and different structures of the economy. In this regard, Basu et al. (2020) provide a promising direction for further research.

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Appendix

Appendix A

Table A1 - Descriptive Statistics

Country	Sudden Stop	Surges	FXI Mean	FXI Median	FXI St.Dev.	FXI Max.	FXI Min.
Turkey	12	3	-0.11	0.02	0.91	1.65	-2.7
South Africa	13	10	0.12	0.05	0.39	1.42	-1.26
Argentina	20	10	0.41	0.25	0.41	2.6	-1.58
Bolivia	9	8	0.01	-0.36	2.16	7.80	-4.33
Brazil	10	6	0.22	0.04	0.71	3.58	-1.16
Chile	11	15	0.04	-0.03	0.77	2.80	-1.86
Colombia	6	11	0.21	0	0.41	2.60	0
Costa Rica	11	5	0.21	0.08	1.02	3.74	-2.79
Guatemala	8	4	0.32	0.14	0.74	2.80	-0.93
Mexico	12	6	-0.09	0	0.24	0.16	-1.45
Panama	5	5	0.22	0.03	1.59	5.82	-2.49
Peru	10	10	0.38	0.25	1.63	7.72	-3.36
Venezuela	5	7	-0.02	-0.06	1.83	3.85	-6.58
Bangladesh	13	20	0.32	0.21	0.49	2.31	-0.51
Sri Lanka	12	7	0.17	0.16	1.31	7.35	-4.06
Taiwan	14	12	0.64	0.48	1.58	5.95	-3.31
India	11	14	0.44	0.33	0.73	2.72	-1.73
Indonesia	12	8	0.18	0.06	0.85	3.48	-1.46
Republic of Korea	10	7	0.13	0.23	1.01	2.04	-5.00
Malaysia	8	11	0.32	0.05	2.67	7.89	-8.91
Philippines	7	10	0.41	0.30	1.07	5.46	-1.79
Thailand	10	12	0.81	0.63	1.38	7.78	-1.71
Russian Federation	10	10	0.87	0.78	1.90	6.36	-9.10
China	13	11	1.06	0.87	1.51	5.31	-1.76
Czech Republic	15	14	0.49	0	2.63	22.5	-0.37
Slovak Republic	3	8	0.77	0.16	2.95	14.24	-2.15
Estonia	10	14	0.19	0.42	1.42	2.56	-3.49
Latvia	11	15	0.44	0.49	2.00	6.61	-6.67
Lithuania	10	12	0.36	0.35	1.43	4.28	-3.49
Hungary	10	20	0.25	0.17	2.13	7.72	-5.41
Croatia	11	11	0.17	0	0.84	2.50	-4.20
Slovenia	5	11	0.16	-0.08	1.33	3.17	-2.65
Poland	8	11	0.24	0.19	1.19	3.02	-3.71
Romania	7	18	0.29	0.29	1.97	5.80	-6.06
Floater Countries	171	164	0.2	0.03	1.29	7.89	-9.10
Pegger Countries	171	192	0.41	0.21	1.66	22.54	-6.58
All Countries	342	356	0.31	0.10	1.49	22.54	-9.10

Note: Table shows the main descriptive statistics for sudden stop and surge episodes and foreign exchange interventions. FXI denotes the value of FX interventions as a percentage of GDP and its positive (negative) value implies increasing (decreasing) FX reserves.

Table A2 - Data Sources

Variable	Data Source
Foreign Exchange Interventions	Adler et al. (2021)
Sudden Stop Episodes	Forbes and Warnock (2021)
Surge Episodes	Forbes and Warnock (2021)
Chicago Board Options Exchange's Volatility Index (VIX)	Federal Reserve Bank of St.Louis
GDP Growth	IMF's IFS
Broad Money	National Central Banks
Monetary Policy Rate	IMF's IFS, BIS, Wu and Xia (2016), Wu and Xia (2017)
Commodity Prices	Gruss and Kebhaj (2019)
Foreign Exchange Reserves	IMF's IFS
Exchange Rate	IMF's IFS
Macroprudential Policy Measures	Alam et al. (2019)
GDP Gap	IMF's IFS
GDP Per Capita	IMF's IFS
Institutional Quality	World Bank
Credit-to-GDP Gap	BIS
House Prices	BIS
Exchange Rate Regimes	Ilzetzki, Reinhart, and Rogoff (2019)
Capital Account Openness	Chinn and Ito (2006)
Gross Public Debt	IMF's WEO

Note: Table shows the data sources of the variables used in the empirical analysis.

Appendix B

Table B1 - Probability of a Sudden Stop

	Floater Countries	Pegger Countries	All Countries
Surge * FXI (lagged)	-0.239**	-0.445***	-0.285***
	(0.098)	(0.165)	(0.077)
Surge (lagged)	0.836***	1.988***	1.176***
	(0.292)	(0.754)	(0.254)
FXI (lagged)	0.008	-0.053	-0.004
	(0.026)	(0.050)	(0.024)
VIX Growth (lagged)	0.011***	0.014**	0.012***
	(0.003)	(0.006)	(0.002)
Global Growth (lagged)	0.051	-0.225*	-0.075
	(0.142)	(0.115)	(0.080)
Global Liquidity Growth (lagged)	-0.093***	-0.038	-0.062***
	(0.021)	(0.025)	(0.018)
Global Rate (lagged)	0.340***	0.306***	0.280***
	(0.073)	(0.106)	(0.054)
Commodity Terms of Trade Growth (lagged)	-0.026	0.011	-0.014
	(0.023)	(0.022)	(0.014)
Contagion (lagged)	0.439	0.480	0.504
	(0.558)	(0.573)	(0.439)
National GDP Growth (lagged)	-0.135***	-0.039	-0.076***
	(0.043)	(0.029)	(0.024)
Reserve-to-GDP (lagged)	0.000	0.000	0.000***
	(0.000)	(0.000)	(0.000)
Surge * Reserve-to-GDP (lagged)	-0.000*	0.000***	0.000
	(0.000)	(0.000)	(0.000)
Number of Observations	655	398	1,053

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the probability of a sudden stop estimated by (1) for floater, pegger and all countries when controlling for reserves-to-GDP ratio. Clustered standard errors reported in parenthesis.

Table B2 - Probability of a Sudden Stop

	Floater Countries	Pegger Countries	All Countries
Surge * FXI (lagged)	-0.231**	-0.135	-0.191***
	(0.114)	(0.094)	(0.073)
Surge (lagged)	0.854***	1.698***	1.241***
	(0.260)	(0.357)	(0.234)
FXI (lagged)	0.016	-0.002	0.005
	(0.014)	(0.034)	(0.020)
VIX Growth (lagged)	0.012***	0.013***	0.013***
	(0.003)	(0.003)	(0.002)
Global Growth (lagged)	-0.021	-0.113	-0.081
	(0.090)	(0.080)	(0.056)
Global Liquidity Growth (lagged)	-0.086***	-0.056**	-0.067***
	(0.021)	(0.028)	(0.016)
Global Rate (lagged)	0.322***	0.141	0.234***
	(0.069)	(0.091)	(0.050)
Commodity Terms of Trade Growth (lagged)	0.002	-0.001	0.000
	(0.012)	(0.017)	(0.009)
Contagion (lagged)	0.264	0.977**	0.535
	(0.482)	(0.387)	(0.338)
National GDP Growth (lagged)	-0.087**	-0.029	-0.046**
	(0.043)	(0.024)	(0.022)
Surge * Capital Account Openness (lagged)	-0.783*	-0.989	-0.784*
	(0.417)	(1.026)	(0.472)
Capital Account Openness (lagged)	-0.014	-0.130	-0.094
	(0.251)	(0.363)	(0.228)
Number of Observations	820	680	1,500

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the probability of a sudden stop estimated by (1) for floater, pegger and all countries when controlling for capital flow measures. Clustered standard errors reported in parenthesis.

Table B3 - Probability of a Sudden Stop

	Floater Countries	Pegger Countries	All Countries
Surge * FXI (lagged)	-0.224**	-0.012	-0.175**
	(0.101)	(0.065)	(0.068)
Surge (lagged)	0.707**	1.807***	1.177***
	(0.283)	(0.538)	(0.278)
FXI (lagged)	0.027	-0.006	0.010
	(0.018)	(0.028)	(0.019)
VIX Growth (lagged)	0.012***	0.011***	0.012***
	(0.003)	(0.003)	(0.002)
Global Growth (lagged)	-0.065	-0.143*	-0.122*
	(0.086)	(0.074)	(0.062)
Global Liquidity Growth (lagged)	-0.093***	-0.040	-0.067***
	(0.023)	(0.033)	(0.018)
Global Rate (lagged)	0.313***	0.078	0.202***
	(0.076)	(0.111)	(0.059)
Commodity Terms of Trade Growth (lagged)	0.004	-0.006	-0.001
	(0.012)	(0.017)	(0.009)
Contagion (lagged)	0.363	0.913**	0.529
	(0.483)	(0.411)	(0.342)
National GDP Growth (lagged)	-0.063	0.008	-0.020
	(0.041)	(0.026)	(0.030)
Surge * Monetary Policy Rate (lagged)	-0.035**	-0.328***	-0.070**
	(0.017)	(0.076)	(0.031)
Monetary Policy Rate (lagged)	0.044***	0.029	0.036***
	(0.013)	(0.029)	(0.012)
Number of Observations	802	491	1,293

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the probability of a sudden stop estimated by (1) for floater, pegger and all countries when controlling for monetary policy stance. Clustered standard errors reported in parenthesis.

Appendix C

Table C1 - Severity of a Sudden Stop - All Countries

	Y_{t+0}	Y_{t+1}	Y_{t+2}	Y_{t+3}	Y_{t+4}
Sudden Stop	-1.631**	-2.336**	-2.156*	-1.808*	-0.976
	(0.704)	(1.046)	(1.164)	(1.051)	(0.765)
GDP Growth (lagged)	0.724***	0.537***	0.397***	0.187***	0.105
	(0.077)	(0.079)	(0.081)	(0.064)	(0.066)
GDP Gap (lagged)	-0.053**	-0.140**	-0.159***	-0.173***	-0.131***
	(0.021)	(0.060)	(0.053)	(0.044)	(0.035)
log of GDP Per Capita (lagged)	0.930	0.973	0.450	-0.321	-1.711
	(1.872)	(2.707)	(3.232)	(3.692)	(4.152)
Institutional Quality	-0.428	-0.512	-0.393	-0.261	-0.334
	(0.889)	(1.234)	(1.440)	(1.619)	(1.776)
Linear Trend	-0.031	-0.047	-0.056	-0.058	-0.054
	(0.027)	(0.038)	(0.044)	(0.048)	(0.053)
Commodity Prices	-0.009	0.002	0.008	0.014	0.016
	(0.014)	(0.011)	(0.012)	(0.014)	(0.017)
F Statistics	54.1	24.8	7.7	5.4	5.7
Number of Observations	1,732	1,731	1,706	1,680	1,654

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the severity of a sudden stop estimated by (3) for all countries.

Driscoll and Kraay (1998) standard errors reported in parenthesis.

Table C2 - Severity of a Sudden Stop - Floater Countries

	Y_{t+0}	Y_{t+1}	Y_{t+2}	Y_{t+3}	Y_{t+4}
Sudden Stop	-1.484*	-2.220**	-1.749*	-1.330	-0.512
	(0.700)	(0.935)	(0.896)	(0.780)	(0.619)
GDP Growth (lagged)	0.673***	0.465***	0.346***	0.154*	0.119
	(0.084)	(0.080)	(0.089)	(0.075)	(0.080)
GDP Gap (lagged)	-0.081*	-0.186**	-0.222***	-0.261***	-0.226***
	(0.038)	(0.084)	(0.066)	(0.057)	(0.057)
log of GDP Per Capita (lagged)	2.023	2.931	3.893	4.732	5.095
	(2.856)	(3.307)	(3.468)	(3.570)	(3.777)
Institutional Quality	0.252	0.790	0.842	0.738	0.044
	(1.050)	(1.445)	(1.808)	(1.886)	(1.934)
Linear Trend	-0.043	-0.066	-0.084*	-0.097**	-0.105**
	(0.033)	(0.039)	(0.041)	(0.042)	(0.045)
Commodity Prices	0.004	0.017**	0.023*	0.025*	0.020
	(0.008)	(0.008)	(0.011)	(0.013)	(0.013)
F Statistics	30.1	14.2	6.3	5.2	5.1
Number of Observations	866	866	855	843	831

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the severity of a sudden stop estimated by (3) for floater countries.

Driscoll and Kraay (1998) standard errors reported in parenthesis.

Table C3 - Severity of a Sudden Stop - Pegger Countries

	Y_{t+0}	Y_{t+1}	Y_{t+2}	Y_{t+3}	Y_{t+4}
Sudden Stop	-1.833**	-2.527*	-2.668	-2.329	-1.351
	(0.779)	(1.236)	(1.529)	(1.469)	(1.169)
GDP Growth (lagged)	0.744***	0.568***	0.407***	0.186**	0.075
	(0.074)	(0.082)	(0.088)	(0.072)	(0.079)
GDP Gap (lagged)	-0.019	-0.086*	-0.087*	-0.074	-0.020
	(0.022)	(0.047)	(0.047)	(0.049)	(0.052)
log of GDP Per Capita (lagged)	-1.033	-2.103	-3.916	-6.526	-9.439
	(1.987)	(3.178)	(4.400)	(5.787)	(6.796)
Institutional Quality	1.241	1.152	1.413	1.875	1.999
	(1.175)	(1.726)	(2.192)	(2.703)	(2.983)
Linear Trend	-0.019	-0.027	-0.030	-0.018	-0.001
	(0.025)	(0.040)	(0.051)	(0.061)	(0.068)
Commodity Prices	-0.035	-0.028	-0.020	-0.007	0.009
	(0.025)	(0.021)	(0.020)	(0.023)	(0.026)
F Statistics	38.1	20.8	9.3	6.5	11.3
Number of Observations	866	865	851	837	823

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the severity of a sudden stop estimated by (3) for pegger countries.

Driscoll and Kraay (1998) standard errors reported in parenthesis.

Table C4 - Severity of a Sudden Stop with FXI - All Countries

	Y_{t+0}	Y_{t+1}	Y_{t+2}	Y_{t+3}	Y_{t+4}
Sudden Stop	-1.600**	-2.031*	-1.644	-1.498	-0.749
	(0.740)	(1.007)	(1.140)	(1.206)	(1.048)
Stop * Surge * FXI	0.086***	0.099*	0.119	0.139	0.102
	(0.028)	(0.050)	(0.071)	(0.089)	(0.099)
Surge (lagged)	0.119	0.080	-0.172	-0.523	-0.911
	(0.228)	(0.280)	(0.292)	(0.385)	(0.573)
Surge * FXI (lagged)	0.146	0.090	0.161	0.154	0.102
	(0.093)	(0.083)	(0.103)	(0.194)	(0.188)
Stop * FXI	0.085**	0.144***	0.179**	0.246***	0.176
	(0.032)	(0.044)	(0.066)	(0.080)	(0.156)
Stop * Surge	-0.934**	-1.522**	-1.819**	-1.388*	-0.836
	(0.403)	(0.559)	(0.678)	(0.746)	(0.854)
FXI (lagged)	0.011	0.013	-0.002	-0.004	-0.014
	(0.010)	(0.017)	(0.027)	(0.036)	(0.043)
GDP Growth (lagged)	0.690***	0.505***	0.363***	0.164**	0.102*
	(0.087)	(0.085)	(0.086)	(0.068)	(0.059)
GDP Gap (lagged)	-0.066**	-0.159**	-0.179***	-0.198***	-0.159***
	(0.024)	(0.059)	(0.051)	(0.046)	(0.040)
log of GDP Per Capita (lagged)	2.492	2.511	1.781	0.842	-1.511
	(2.105)	(2.525)	(3.054)	(3.783)	(4.363)
Institutional Quality	-0.803	-0.919	-0.865	-0.725	-0.644
	(0.979)	(1.191)	(1.347)	(1.368)	(1.379)
Linear Trend	-0.047	-0.065	-0.079*	-0.082	-0.071
	(0.032)	(0.040)	(0.045)	(0.048)	(0.050)
Commodity Terms of Trade	-0.010	0.001	0.011	0.017	0.019
	(0.012)	(0.010)	(0.011)	(0.014)	(0.016)
Macroprudential Policy (lagged)	0.277	0.157	0.231	0.100	-0.208
	(0.226)	(0.138)	(0.145)	(0.113)	(0.203)
Surge * Macroprudential Policy (lagged)	-0.279	-0.033	0.052	0.107	0.090
	(0.207)	(0.132)	(0.204)	(0.237)	(0.310)
Stop * Macroprudential Policy	0.140**	0.146*	0.161*	0.142**	0.061
	(0.056)	(0.084)	(0.081)	(0.068)	(0.062)
Stop * Surge * Macroprudential Policy	-0.078	-0.029	0.025	0.100	0.235
	(0.111)	(0.158)	(0.195)	(0.201)	(0.217)
F Statistics	66.2	24.1	16.9	17.2	16.5
Number of Observations	1,403	1,403	1,385	1,365	1,345

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the severity of a sudden stop with FXI accumulation, estimated by (4) for all countries when controlling for macroprudential policy measures. Driscoll and Kraay (1998) standard errors reported in parenthesis.

Table C5 - Severity of a Sudden Stop with FXI - All Countries

	Y_{t+0}	Y_{t+1}	Y_{t+2}	Y_{t+3}	Y_{t+4}
Sudden Stop	-1.745**	-2.566**	-2.654*	-2.181	-0.913
	(0.634)	(0.985)	(1.344)	(1.287)	(1.072)
Stop * Surge * FXI	0.070***	0.099**	0.130**	0.162*	0.148
	(0.017)	(0.035)	(0.055)	(0.081)	(0.092)
Surge (lagged)	0.064	-0.017	-0.071	-0.542	-1.170
	(0.184)	(0.278)	(0.355)	(0.497)	(0.761)
Surge * FXI (lagged)	0.090	0.115	0.221	0.335	0.259
	(0.062)	(0.103)	(0.140)	(0.221)	(0.245)
Stop * FXI	0.115*	0.192**	0.219**	0.404***	0.395
	(0.060)	(0.071)	(0.100)	(0.134)	(0.240)
Stop * Surge	-0.656*	-1.154**	-1.406**	-1.418**	-1.280*
	(0.367)	(0.448)	(0.599)	(0.574)	(0.623)
FXI (lagged)	-0.016	-0.032	-0.047	-0.052	-0.074
	(0.016)	(0.029)	(0.045)	(0.059)	(0.069)
GDP Growth (lagged)	0.798***	0.600***	0.394***	0.200**	0.132*
	(0.057)	(0.091)	(0.095)	(0.077)	(0.066)
GDP Gap (lagged)	-0.051*	-0.098**	-0.111**	-0.128**	-0.095*
	(0.026)	(0.039)	(0.044)	(0.048)	(0.049)
log of GDP Per Capita (lagged)	0.223	-0.175	-2.409	-5.079	-8.187
	(1.789)	(3.051)	(3.979)	(4.955)	(5.950)
Institutional Quality	-0.244	-0.362	-0.140	0.304	0.260
	(0.927)	(1.656)	(2.183)	(2.527)	(2.701)
Linear Trend	-0.011	-0.022	-0.024	-0.022	-0.016
	(0.014)	(0.023)	(0.028)	(0.031)	(0.035)
Commodity Terms of Trade	0.003	0.014	0.023	0.030	0.034
	(0.005)	(0.009)	(0.015)	(0.020)	(0.024)
Reserves-to-GDP (lagged)	0.000	0.000	0.000	0.000*	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Surge * Reserves-to-GDP (lagged)	0.000	0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Stop * Reserves-to-GDP	0.000**	0.000***	0.000**	0.000**	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Stop * Surge * Reserves-to-GDP	-0.000	-0.000	-0.000	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
F Statistics	117.9	53.8	31.9	19.0	15.5
Number of Observations	916	916	916	916	916

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the severity of a sudden stop with FXI accumulation, estimated by (4) for floater countries when controlling for reserves-to-GDP ratio. Driscoll and Kraay (1998) standard errors reported in parenthesis.

Table C6 - Severity of a Sudden Stop with FXI - All Countries

	Y_{t+0}	Y_{t+1}	Y_{t+2}	Y_{t+3}	Y_{t+4}
Sudden Stop	-1.261	-1.689	-0.688	-0.987	-0.498
	(1.063)	(1.466)	(1.674)	(2.144)	(2.268)
Stop * Surge * FXI	0.063***	0.085***	0.119**	0.157**	0.154*
	(0.013)	(0.026)	(0.043)	(0.067)	(0.077)
Surge (lagged)	0.080	0.108	-0.608	-1.195**	-1.229**
	(0.337)	(0.443)	(0.463)	(0.560)	(0.549)
Surge * FXI (lagged)	0.145	0.096	0.186*	0.172	0.097
	(0.100)	(0.086)	(0.108)	(0.192)	(0.181)
Stop * FXI	0.082**	0.148***	0.194**	0.270***	0.204
	(0.034)	(0.048)	(0.071)	(0.089)	(0.154)
Stop * Surge	1.106	1.380	1.451	2.689	2.496
	(1.020)	(1.359)	(1.818)	(2.377)	(2.652)
FXI (lagged)	0.009	0.010	-0.009	-0.010	-0.020
	(0.013)	(0.021)	(0.031)	(0.039)	(0.044)
GDP Growth (lagged)	0.704***	0.507***	0.361***	0.152*	0.082
	(0.079)	(0.082)	(0.090)	(0.076)	(0.068)
GDP Gap (lagged)	-0.061**	-0.152**	-0.169***	-0.189***	-0.153***
	(0.024)	(0.059)	(0.049)	(0.043)	(0.039)
log of GDP Per Capita (lagged)	1.782	1.920	1.102	0.405	-1.231
	(1.928)	(2.496)	(2.895)	(3.442)	(3.986)
Institutional Quality	-0.799	-0.991	-0.930	-0.854	-0.933
	(0.936)	(1.179)	(1.275)	(1.260)	(1.317)
Linear Trend	-0.039	-0.059	-0.072	-0.076	-0.074
	(0.031)	(0.041)	(0.045)	(0.048)	(0.052)
Commodity Terms of Trade	-0.012	0.000	0.009	0.017	0.019
	(0.013)	(0.010)	(0.011)	(0.013)	(0.016)
Capital Account Openness (lagged)	-0.526	-0.697	-0.651	-0.543	-0.338
	(0.750)	(1.110)	(1.260)	(1.258)	(1.101)
Surge * Capital Account Openness (lagged)	0.052	0.063	-0.695	-1.087	-0.496
	(0.558)	(0.802)	(0.812)	(0.841)	(1.043)
Stop * Surge * Capital Account Openness	0.286*	0.402*	0.415	0.539	0.435
	(0.154)	(0.219)	(0.296)	(0.358)	(0.376)
Stop * Capital Account Openness	-0.034	-0.036	0.079	0.011	0.016
	(0.106)	(0.148)	(0.160)	(0.214)	(0.244)
F Statistics	77.1	39.3	24.3	13.1	12.6
Number of Observations	1,429	1,429	1,410	1,389	1,368

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the severity of a sudden stop with FXI accumulation, estimated by (4) for all countries when controlling for capital flow measures. Driscoll and Kraay (1998) standard errors reported in parenthesis.

Table C7 - Severity of a Sudden Stop with FXI - All Countries

	Y_{t+0}	Y_{t+1}	Y_{t+2}	Y_{t+3}	Y_{t+4}
Sudden Stop	-1.116	-1.626*	-1.260	-1.160	-0.679
	(0.681)	(0.942)	(1.032)	(1.115)	(0.995)
Stop * Surge * FXI	0.052**	0.065**	0.092**	0.104**	0.097*
	(0.022)	(0.028)	(0.033)	(0.044)	(0.050)
Surge (lagged)	0.082	0.065	-0.098	-0.185	-0.562
	(0.248)	(0.311)	(0.298)	(0.357)	(0.530)
Surge * FXI (lagged)	0.100	0.082	0.048	-0.062	-0.070
	(0.102)	(0.076)	(0.089)	(0.128)	(0.144)
Stop * FXI	0.081***	0.096**	0.148**	0.133	0.025
	(0.027)	(0.044)	(0.059)	(0.086)	(0.133)
Stop * Surge	-0.192	-0.416	-0.365	0.112	0.498
	(0.448)	(0.635)	(0.712)	(0.894)	(0.985)
FXI (lagged)	0.017	0.026	0.025	0.035	0.030
	(0.010)	(0.017)	(0.026)	(0.031)	(0.036)
GDP Growth (lagged)	0.669***	0.441***	0.276***	0.045	-0.007
	(0.084)	(0.073)	(0.082)	(0.080)	(0.081)
GDP Gap (lagged)	-0.061**	-0.154**	-0.177***	-0.190***	-0.153***
	(0.024)	(0.061)	(0.047)	(0.039)	(0.035)
log of GDP Per Capita (lagged)	2.343	2.605	2.594	3.153	2.176
	(2.091)	(2.050)	(2.089)	(2.139)	(2.237)
Institutional Quality	-0.710	-0.888	-0.968	-1.228	-1.655
	(0.885)	(1.008)	(1.060)	(1.057)	(1.101)
Linear Trend	-0.045	-0.068*	-0.081*	-0.092**	-0.089*
	(0.033)	(0.038)	(0.040)	(0.042)	(0.045)
Commodity Terms of Trade	-0.011	0.002	0.009	0.014	0.013
	(0.014)	(0.010)	(0.010)	(0.010)	(0.012)
Monetary Policy Rate Change (lagged)	-0.006	-0.033	0.020	0.019	-0.029
	(0.016)	(0.047)	(0.027)	(0.021)	(0.029)
Surge * Monetary Policy Rate Change (lagged)	0.038	0.012	0.004	0.031	0.136
	(0.050)	(0.084)	(0.056)	(0.064)	(0.079)
Stop * Surge * Monetary Policy Rate Change	0.170	0.047	0.308	0.082	-0.014
	(0.149)	(0.221)	(0.253)	(0.205)	(0.203)
Stop * Monetary Policy Rate Change	-0.097	0.116	-0.194	-0.236	-0.026
	(0.144)	(0.205)	(0.225)	(0.194)	(0.204)
F Statistics	74.7	53.6	33.2	11.2	9.4
Number of Observations	1,169	1,169	1,152	1,133	1,114

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the severity of a sudden stop with FXI accumulation, estimated by (4) for all countries when controlling for monetary policy rate. Driscoll and Kraay (1998) standard errors reported in parenthesis.

Table C8 - Severity of a Sudden Stop with FXI - All Countries

	Y_{t+0}	Y_{t+1}	Y_{t+2}	Y_{t+3}	Y_{t+4}
Sudden Stop	-1.170*	-1.409*	-0.957	-0.772	-0.166
	(0.578)	(0.723)	(0.706)	(0.761)	(0.688)
Stop * Surge * FXI	0.068	0.211*	0.299*	0.294*	0.252
	(0.066)	(0.113)	(0.155)	(0.166)	(0.170)
Surge (lagged)	0.062	0.084	-0.110	-0.403	-0.835
	(0.205)	(0.235)	(0.251)	(0.422)	(0.639)
Surge * FXI (lagged)	0.123	0.054	0.127	0.114	0.056
	(0.097)	(0.089)	(0.111)	(0.187)	(0.179)
Stop * FXI	-0.029	-0.138	-0.217*	-0.176	-0.129
	(0.054)	(0.095)	(0.120)	(0.129)	(0.123)
Stop * Surge	-1.037*	-2.050**	-2.385**	-2.289**	-1.974*
	(0.575)	(0.882)	(1.127)	(1.090)	(1.061)
FXI (lagged)	0.026*	0.044*	0.036	0.042	0.018
	(0.014)	(0.024)	(0.033)	(0.042)	(0.044)
GDP Growth (lagged)	0.709***	0.518***	0.389***	0.183**	0.117*
	(0.076)	(0.080)	(0.081)	(0.066)	(0.065)
GDP Gap (lagged)	-0.059**	-0.149**	-0.169***	-0.183***	-0.144***
	(0.023)	(0.058)	(0.050)	(0.041)	(0.035)
log of GDP Per Capita (lagged)	1.182	1.275	0.707	-0.093	-1.550
	(2.024)	(2.847)	(3.331)	(3.810)	(4.314)
Institutional Quality	-0.675	-0.877	-0.932	-1.119	-1.485
	(0.955)	(1.202)	(1.310)	(1.376)	(1.508)
Linear Trend	-0.036	-0.054	-0.065	-0.069	-0.067
	(0.029)	(0.039)	(0.043)	(0.046)	(0.050)
Commodity Terms of Trade	-0.007	0.003	0.008	0.011	0.009
	(0.012)	(0.009)	(0.010)	(0.012)	(0.014)
F Statistics	42.2	16.1	8.4	9.5	6.7
Number of Observations	1,512	1,512	1,493	1,472	1,451

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the severity of a sudden stop with FXI accumulation, estimated by (4) for all countries when accumulating FX interventions for the previous 8 quarters. Driscoll and Kraay (1998) standard errors reported in parenthesis.

Appendix D

Table D1 - Ex-Post Severity of a Sudden Stop with FX Reserves Use - All Countries

	Y_{t+0}	Y_{t+1}	Y_{t+2}	Y_{t+3}	Y_{t+4}
Stop (lagged)	-1.225*	-1.277	-0.692	-0.476	0.165
	(0.613)	(0.811)	(0.804)	(0.676)	(0.474)
Stop * FXR Use (lagged)	0.449**	0.698***	0.624***	0.553***	0.137
	(0.187)	(0.230)	(0.206)	(0.155)	(0.208)
FXR Use (lagged)	0.074	0.018	0.138**	0.068	0.065
	(0.084)	(0.079)	(0.067)	(0.062)	(0.045)
GDP Growth (lagged)	0.706***	0.537***	0.425***	0.220***	0.143**
	(0.085)	(0.086)	(0.074)	(0.060)	(0.060)
GDP Gap (lagged)	-0.056**	-0.141**	-0.163***	-0.179***	-0.144***
	(0.021)	(0.059)	(0.053)	(0.044)	(0.036)
log of GDP Per Capita (lagged)	0.750	0.723	0.509	-0.148	-1.397
	(1.994)	(3.022)	(3.708)	(4.192)	(4.571)
Institutional Quality	-0.594	-0.616	-0.645	-0.798	-0.978
	(0.927)	(1.163)	(1.387)	(1.542)	(1.672)
Linear Trend	-0.032	-0.049	-0.060	-0.064	-0.061
	(0.028)	(0.040)	(0.046)	(0.049)	(0.054)
Commodity Prices	-0.007	0.003	0.008	0.010	0.009
	(0.012)	(0.010)	(0.012)	(0.013)	(0.015)
F Statistics	46.1	15.5	6.7	5.9	5.6
Number of Observations	1,562	1,543	1,522	1,501	1,480

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the ex-post severity of a sudden stop with FXI deccumulation, estimated by (5) for all countries. Driscoll and Kraay (1998) standard errors reported in parenthesis.

Table D2 - Ex-Post Severity of a Sudden Stop with FX Reserves Use - Floater Countries

	Y_{t+0}	Y_{t+1}	Y_{t+2}	Y_{t+3}	Y_{t+4}
Stop (lagged)	-1.111*	-0.993	-0.299	-0.226	0.430
	(0.554)	(0.640)	(0.681)	(0.620)	(0.641)
Stop * FXR Use (lagged)	0.688***	1.310***	1.190***	0.828***	0.097
	(0.131)	(0.138)	(0.201)	(0.171)	(0.249)
FXR Use (lagged)	0.013	-0.176	-0.050	-0.044	0.041
	(0.076)	(0.141)	(0.167)	(0.147)	(0.117)
GDP Growth (lagged)	0.643***	0.461***	0.377***	0.180**	0.158*
	(0.097)	(0.097)	(0.084)	(0.075)	(0.076)
GDP Gap (lagged)	-0.070*	-0.175*	-0.210***	-0.253***	-0.224***
	(0.035)	(0.086)	(0.067)	(0.060)	(0.060)
log of GDP Per Capita (lagged)	1.510	2.704	3.910	4.734	4.992
	(2.662)	(3.414)	(3.651)	(3.710)	(3.856)
Institutional Quality	0.207	0.760	0.796	0.684	0.038
	(1.079)	(1.444)	(1.824)	(1.915)	(1.963)
Linear Trend	-0.040	-0.065	-0.083*	-0.097**	-0.103**
	(0.032)	(0.040)	(0.042)	(0.043)	(0.046)
Commodity Prices	0.004	0.016*	0.022*	0.024*	0.019
	(0.008)	(0.008)	(0.011)	(0.013)	(0.014)
F Statistics	32.4	37.1	12.2	20.2	7.7
Number of Observations	877	866	854	842	830

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the ex-post severity of a sudden stop with FXI deccumulation, estimated by (5) for floater countries. Driscoll and Kraay (1998) standard errors reported in parenthesis.

Table D3 - Ex-Post Severity of a Sudden Stop with FX Reserves Use - Pegger Countries

	Y_{t+0}	Y_{t+1}	Y_{t+2}	Y_{t+3}	Y_{t+4}
Stop (lagged)	-1.426*	-1.736	-1.309	-0.910	-0.113
	(0.767)	(1.182)	(1.215)	(1.117)	(0.708)
Stop * FXR Use (lagged)	0.189	0.078	-0.023	0.112	-0.073
	(0.251)	(0.234)	(0.237)	(0.283)	(0.363)
FXR Use (lagged)	0.060	0.037	0.171*	0.059	0.028
	(0.097)	(0.086)	(0.085)	(0.095)	(0.072)
GDP Growth (lagged)	0.739***	0.569***	0.429***	0.221***	0.115
	(0.074)	(0.082)	(0.088)	(0.070)	(0.071)
GDP Gap (lagged)	-0.025	-0.084	-0.084	-0.066	-0.020
	(0.024)	(0.050)	(0.053)	(0.058)	(0.060)
log of GDP Per Capita (lagged)	-1.110	-2.684	-4.845	-7.737	-10.397
	(2.671)	(4.271)	(6.014)	(7.555)	(8.519)
Institutional Quality	1.501	1.899	2.216	2.645	2.786
	(1.448)	(2.140)	(2.924)	(3.501)	(3.827)
Linear Trend	-0.025	-0.034	-0.035	-0.025	-0.008
	(0.032)	(0.050)	(0.062)	(0.072)	(0.080)
Commodity Terms of Trade	-0.034	-0.031	-0.028	-0.025	-0.017
	(0.024)	(0.021)	(0.020)	(0.023)	(0.025)
F Statistics	37.2	14.1	6.7	5.3	7.6
Number of Observations	685	677	668	659	650

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the ex-post severity of a sudden stop with FXI deccumulation, estimated by (5) for pegger countries. Driscoll and Kraay (1998) standard errors reported in parenthesis.

Table D4 - Ex-Post Severity of a Sudden Stop with FX Reserves Use- All Countries

	Y_{t+0}	Y_{t+1}	Y_{t+2}	Y_{t+3}	Y_{t+4}
Stop (lagged)	-1.794**	-2.162*	-1.823	-1.392	-0.247
	(0.752)	(1.152)	(1.137)	(0.919)	(0.618)
Stop * FXR Use (lagged)	0.325*	0.551**	0.518**	0.573**	0.260
	(0.164)	(0.224)	(0.218)	(0.213)	(0.277)
FXR Use (lagged)	0.094	0.058	0.161**	0.116	0.115
	(0.100)	(0.110)	(0.075)	(0.082)	(0.079)
GDP Growth (lagged)	0.733***	0.565***	0.426***	0.227***	0.154**
	(0.077)	(0.083)	(0.083)	(0.067)	(0.069)
GDP Gap (lagged)	-0.049**	-0.132**	-0.167**	-0.197***	-0.150***
	(0.020)	(0.053)	(0.061)	(0.059)	(0.042)
log of GDP Per Capita (lagged)	1.010	1.048	1.206	0.555	-1.336
	(2.531)	(4.110)	(5.378)	(6.327)	(7.103)
Institutional Quality	-0.372	-0.311	-0.325	-0.412	-0.608
	(1.021)	(1.644)	(2.202)	(2.546)	(2.805)
Linear Trend	-0.030	-0.047	-0.061	-0.068	-0.063
	(0.028)	(0.041)	(0.051)	(0.056)	(0.062)
Commodity Terms of Trade	-0.001	0.006	0.012	0.020	0.019
	(0.005)	(0.008)	(0.013)	(0.016)	(0.018)
Stop * Reserves-to-GDP (lagged)	0.000*	0.000**	0.000**	0.000**	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Reserves-to-GDP (lagged)	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
F Statistics	53.3	20.5	10.0	9.1	6.3
Number of Observations	1,104	1,093	1,080	1,067	1,054

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the ex-post severity of a sudden stop with FXI deccumulation, estimated by (5) for all countries when controlling for reserves-to-GDP ratio. Driscoll and Kraay (1998) standard errors reported in parenthesis.

Appendix E

Table E1 - Response of a Credit-to-GDP Gap - Floater Countries

	Gap_{t+0}	Gap_{t+1}	Gap_{t+2}	Gap_{t+3}	Gap_{t+4}
Surge (lagged)	0.424*	0.414	0.098	0.191	-0.274
	(0.208)	(0.324)	(0.450)	(0.455)	(0.709)
Surge * FXI (lagged)	0.002	-0.015	-0.123	-0.385	-0.017
	(0.186)	(0.257)	(0.228)	(0.341)	(0.432)
FXI (lagged)	-0.007	-0.013	-0.007	0.014	0.020
	(0.044)	(0.067)	(0.069)	(0.059)	(0.054)
GDP Growth (lagged)	0.646***	0.464***	0.323**	0.090	0.052
	(0.084)	(0.079)	(0.111)	(0.089)	(0.102)
GDP Gap (lagged)	-0.010	-0.095	-0.096*	-0.114**	-0.059
	(0.037)	(0.071)	(0.050)	(0.041)	(0.055)
VIX Growth (lagged)	-3.865*	-6.469**	-8.833**	-10.230***	-10.616***
	(1.834)	(2.599)	(3.057)	(3.051)	(3.062)
Monetary Policy Rate (lagged)	-0.094**	-0.149**	-0.177**	-0.184**	-0.142**
	(0.041)	(0.062)	(0.071)	(0.069)	(0.065)
Surge * Macroprudential Policy (lagged)	-0.116	0.052	-0.344	0.091	-0.142
	(0.388)	(0.430)	(0.740)	(0.507)	(0.450)
Macroprudential Policy (lagged)	0.265	0.110	0.057	-0.158*	-0.493
	(0.281)	(0.164)	(0.153)	(0.078)	(0.296)
Credit-to-GDP Gap (lagged)	-0.016	-0.014	-0.012	-0.012	-0.000
	(0.010)	(0.021)	(0.025)	(0.028)	(0.032)
F Statistics	56.7	14.2	8.5	6.2	8.5
Number of Observations	787	778	766	754	742

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the response of credit-to-GDP gap to a surge with FXI accumulation, estimated by (6) for floater countries. Driscoll and Kraay (1998) standard errors reported in parenthesis.

Table E2 - Response of a Credit-to-GDP Gap - Pegger Countries

	Gap_{t+0}	Gap_{t+1}	Gap_{t+2}	Gap_{t+3}	Gap_{t+4}
Surge (lagged)	-0.303	-0.151	-0.286	-0.424	-0.893
	(0.722)	(0.673)	(0.537)	(0.866)	(1.122)
Surge * FXI (lagged)	0.585	0.363*	0.607	0.226	-0.142
	(0.314)	(0.164)	(0.393)	(0.439)	(0.422)
FXI (lagged)	0.021	0.023	0.027	0.012	-0.007
	(0.020)	(0.026)	(0.032)	(0.038)	(0.036)
GDP Growth (lagged)	0.724***	0.456***	0.126	-0.201	-0.330
	(0.054)	(0.110)	(0.160)	(0.207)	(0.217)
GDP Gap (lagged)	-0.046	-0.118	-0.154*	-0.172**	-0.127**
	(0.040)	(0.070)	(0.068)	(0.067)	(0.048)
VIX Growth (lagged)	-0.014*	-0.019*	-0.026**	-0.024	-0.034*
	(0.007)	(0.008)	(0.009)	(0.015)	(0.016)
Monetary Policy Rate (lagged)	-0.053	-0.103	-0.141	-0.196	-0.179
	(0.059)	(0.081)	(0.086)	(0.118)	(0.132)
Surge * Macroprudential Policy (lagged)	-0.188*	-0.108**	-0.186	-0.072	0.052
	(0.087)	(0.042)	(0.129)	(0.147)	(0.145)
Macroprudential Policy (lagged)	0.102	0.053	0.038	-0.032	-0.420
	(0.127)	(0.190)	(0.235)	(0.178)	(0.246)
Credit-to-GDP Gap (lagged)	0.011	0.019	-0.000	-0.023	-0.055
	(0.035)	(0.060)	(0.074)	(0.088)	(0.091)
F Statistics	76.9	18.7	3.4	1.5	2.8
Number of Observations	210	207	204	200	196

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the response of credit-to-GDP gap to a surge with FXI accumulation, estimated by (6) for pegger countries. Driscoll and Kraay (1998) standard errors reported in parenthesis.

Table E3 - Response of House Prices - All Countries

	$House\ Price\ Growth_{t+0}$	$House\ Price\ Growth_{t+1}$	$House\ Price\ Growth_{t+2}$	$House\ Price\ Growth_{t+3}$	$House\ Price\ Growth_{t+4}$
Surge (lagged)	-2.720**	-1.816*	-0.674	0.863	1.032
	(0.992)	(0.982)	(0.946)	(1.050)	(0.996)
Surge * FXI (lagged)	-0.081	-0.343	-0.526	-0.513	-0.276
	(0.336)	(0.487)	(0.411)	(0.302)	(0.192)
FXI (lagged)	-0.100	-0.006	0.076	0.148*	0.097
	(0.095)	(0.092)	(0.086)	(0.078)	(0.073)
GDP Growth (lagged)	0.000	0.039	0.160	0.229	0.119
	(0.137)	(0.119)	(0.164)	(0.169)	(0.174)
GDP Growth (lagged twice)	0.006	-0.017	0.014	0.005	0.005
	(0.021)	(0.032)	(0.028)	(0.023)	(0.021)
Change in Monetary Policy (lagged)	-0.780***	-0.685***	-0.403**	-0.057	0.171
	(0.125)	(0.133)	(0.170)	(0.178)	(0.177)
VIX Growth (lagged)	-0.011	-0.015	-0.014	-0.015*	-0.010
	(0.012)	(0.011)	(0.010)	(0.008)	(0.007)
House Price Growth (lagged)	0.290***	-0.013	-0.331***	-0.608***	-0.552***
	(0.079)	(0.078)	(0.080)	(0.081)	(0.068)
F Statistics	9.8	4.3	4.3	9.7	26.9
Number of Observations	919	916	911	905	888

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the response of a house price growth to a surge with FXI accumulation, estimated by (7) for all countries. Driscoll and Kraay (1998) standard errors reported in parenthesis.

Table E4 - Response of House Prices - Floater Countries

	$House\ Price\ Growth_{t+0}$	$House\ Price\ Growth_{t+1}$	$House\ Price\ Growth_{t+2}$	$House\ Price\ Growth_{t+3}$	$House\ Price\ Growth_{t+4}$
Surge (lagged)	-1.219	-0.054	1.183	1.835*	0.910
	(1.142)	(1.060)	(1.027)	(0.978)	(0.885)
Surge * FXI (lagged)	-0.202	-0.294	-0.175	0.167	1.027
	(0.739)	(0.687)	(0.739)	(0.750)	(0.616)
FXI (lagged)	-0.090	-0.037	-0.003	0.048	0.007
	(0.087)	(0.094)	(0.098)	(0.091)	(0.109)
GDP Growth (lagged)	-0.013	-0.055	-0.058	-0.028	-0.028
	(0.123)	(0.133)	(0.185)	(0.187)	(0.185)
GDP Growth (lagged twice)	-0.007	-0.015	0.010	0.002	-0.003
	(0.024)	(0.044)	(0.031)	(0.030)	(0.029)
Change in Monetary Policy (lagged)	-0.889***	-0.753***	-0.449**	-0.071	0.255
	(0.139)	(0.158)	(0.183)	(0.178)	(0.203)
VIX Growth (lagged)	-0.007	-0.013	-0.011	-0.005	0.007
	(0.008)	(0.009)	(0.007)	(0.005)	(0.005)
House Price Growth (lagged)	0.275***	-0.045	-0.364***	-0.617***	-0.510***
	(0.086)	(0.078)	(0.077)	(0.098)	(0.067)
F Statistics	12.6	4.3	9.7	13.7	24.2
Number of Observations	634	632	628	624	613

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the response of a house price growth to a surge with FXI accumulation, estimated by (7) for floater countries. Driscoll and Kraay (1998) standard errors reported in parenthesis.

Table E5 - Response of House Prices - Pegger Countries

	$House\ Price\ Growth_{t+0}$	$House\ Price\ Growth_{t+1}$	$House\ Price\ Growth_{t+2}$	$House\ Price\ Growth_{t+3}$	$House\ Price\ Growth_{t+4}$
Surge (lagged)	-4.522*	-4.433	-4.016*	-1.791	-0.682
	(2.417)	(2.453)	(2.097)	(1.786)	(1.745)
Surge * FXI (lagged)	-0.044	-0.236	-0.426	-0.402	-0.265*
	(0.335)	(0.478)	(0.421)	(0.258)	(0.130)
FXI (lagged)	-0.077	-0.047	-0.025	0.010	-0.018
	(0.101)	(0.088)	(0.071)	(0.055)	(0.062)
GDP Growth (lagged)	0.075	0.297*	0.705**	1.141***	0.745*
	(0.247)	(0.143)	(0.240)	(0.258)	(0.340)
GDP Growth (lagged twice)	0.012	-0.024	0.026	0.018	0.026
	(0.030)	(0.040)	(0.030)	(0.026)	(0.033)
Change in Monetary Policy (lagged)	-0.358	-0.325	-0.020	0.405	0.452*
	(0.232)	(0.206)	(0.212)	(0.235)	(0.235)
VIX Growth (lagged)	-0.029	-0.026	-0.030	-0.049*	-0.056**
	(0.026)	(0.023)	(0.024)	(0.025)	(0.023)
House Price Growth (lagged)	0.358**	-0.013	-0.461***	-0.911***	-0.872***
	(0.153)	(0.121)	(0.136)	(0.145)	(0.165)
F Statistic	1.9	4.3	3.7	9.5	13.5
Number of Observations	285	284	283	281	275

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Note: Table shows the response of a house price growth to a surge with FXI accumulation, estimated by (7) for pegger countries. Driscoll and Kraay (1998) standard errors reported in parenthesis.