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Investigating the relationship between financial liberalization and capital flow waves: A panel data analysis

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ABSTRACT

This paper examines whether financial liberalization predisposes countries to capital flow waves. After identifying the waves of FDI, portfolio and other flows, we investigate the relationships between those waves and financial liberalization. Our results demonstrate that waves of these three kinds of capital flows respond quite differently to financial liberalization. Specifically, in emerging countries, surges for the type of other flows show a higher propensity following financial liberalization, while the likelihood of surge episodes of portfolio flows significantly decrease for developed countries. In addition, liberalization may eventually trigger capital flight in portfolio flows in emerging economies. Our conclusions are tested for various scenarios and prone to be robust.

1. Introduction

During the past three decades, the volatility of capital flows has been increasing significantly. Many countries experienced ups and downs in international capital flows around the Asian financial crisis. With the 21st century came another storm, when most countries, especially emerging economies, had to struggle with surges of capital inflows in the mid-2000s, and then underwent a sharp reversal of those inflows during the Global Financial Crisis (GFC) of 2008–2009. Capital waves can present substantial macroeconomic challenges, for example, extreme volatility of capital flows can increase financial system vulnerabilities by amplifying economic cycles. What's more, the extreme volatility of capital has been closely linked with a number of financial crises (see, for example, Milesi-Ferretti & Tille, 2011; Reinhart & Reinhart, 2009). There is no denying that capital waves have become both a significant economic research topic¹ and serious practical issue encountered by governments. According to Forbes and Warnock (2012), capital flow waves are episodes of extreme volatility, including Surges, Stops, Flight and Retrenchment. Surges mean sharp increase in gross capital inflows, Stops mean sharp decrease in gross capital inflows, Flight is sharp increase in gross capital outflows, and Retrenchment is sharp decrease in gross capital outflows. It seems to be that financial liberalization² provides opportunities for the development of extreme capital flow waves. The exact answer to this problem is of obvious importance to policymakers hoping to reduce these vulnerabilities and mitigate the

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¹ The existing empirical literature has examined the extreme movements of a single type of capital flow in isolation. For examples of the literature on sudden stops, see Calvo, 1998; and Calvo, Izquierdo and Meijía (2004), bonanzas/surges (Reinhart & Reinhart, 2009; Caballero, 2012; and; Cardarelli, Elekdag, & Kose, 2009), and flight (Schneider, 2003; Demir, 2004; Yalta, 2010 and Yalta and Yalta, 2012).

² In this paper, financial liberalization mainly focuses on the liberalization of capital accounts.

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negative outcomes of capital waves. However, little evidence has been presented so far to shed light on the link between financial liberalization and extreme capital flow waves for the components of gross capital flows. Thus, we focus on these components, namely FDI, portfolio flows, and other capital flows, and their response to financial liberalization.

Many have suggested that financial globalization has gone too far. They argue that it is financial liberalization that has provided the favorable conditions for extreme capital flow episodes. This has revived the debate on the effects of capital control on capital flows. Among the skeptics of international financial integration, some argue that financial liberalization can cause financial crashes and that capital controls might be rewarding, given the ups and downs of capital flows (Rodrik, 1998, 2000) with the deepening of financial liberalization. Krugman (1998) also mentions that countries should resort to capital controls during full-blown crises. However, others confirm the benefits of liberalization. Financial liberalization can directly reduce financing constraints making more foreign capital available, and foreign investors could insist on better corporate governance. The improvement of governance can promote transparency and accountability, reduce adverse selection and moral hazard, and increase the efficiency level of financial systems (Mishkin, 2001; Stulz, 1999), which helps to stabilize capital flows. In addition, Chinn and Ito (2006) suggest that to benefit from more open cross-border financial transactions, financial systems need to be equipped with reasonable legal and institutional infrastructure. With little empirical evidence so far, except Forbes and Warnock (2012), the conflicting views still remain. Considering financial liberalization policies undertaken by both developed economies and emerging countries, it is obviously and critically important to examine the possible empirical relationship between financial liberalization and waves in capital flows. In addition, understanding the possible causal nexus of the relationship can help to suggest some corresponding policy recommendations for policymakers hoping to reduce the vulnerabilities and mitigate the negative outcomes of capital waves.

Further, as the three primary forms of international capital flows (FDI, portfolio and other flows) have different patterns of dynamics and drivers (Bank for International Settlements (BIS) (2009); Broto, Diaz-Cassou, & Erce, 2011; Neumann, Penl, & Tanku, 2009), some important results may be masked when only focusing on the analysis of total capital waves, which will pose dilemmas for policy-makers in achieving stability when managing capital flows.

Therefore, the objective of this paper is to shed some light on the issue of the impact of financial liberalization on waves of various kinds of capital flows. In this context, we mainly address the following questions: are there empirical links between the degree of international financial liberalization and capital waves? If so, does financial liberalization have the same impact on certain episodes of the three primary forms of capital flows, namely FDI, portfolio flows, and other investment flows? Does financial liberalization affect developed countries the same way as it affects emerging markets?

To answer these questions, this paper conducts the following empirical research. Firstly, this paper establishes a database of extreme episodes, that is “surge,” “stop,” “flight,” and “retrenchment,” of three different categories of capital flows. Our database covers 20 developed countries and 28 emerging economies over the period from January 1980 through June 2010. With the data, we report the mean frequency of three primary capital waves over ten years, broken down by episodes and for different types of flows. It is found that there exist significant differences in the dynamics of certain episodes for the three types of flows and that the differences occur in both mature countries and emerging economies, which justifies our proposed decomposition of the total flows.

Next, we discuss the central contribution of our study, which is to fill a gap in the existing literature by providing the first empirical evidence on financial liberalization and the subcomponents of those capital flow waves using a broad sample of emerging markets and developed economies, which hopefully helps to answer the questions asked above. More specifically, in addition to analyzing total flow waves, we also focus on the relationship between financial liberalization and waves of three different categories of capital flows. As for identifying the capital flow waves, we follow the approach of Forbes and Warnock (2012), which captures distinctions in the behavior of domestic and foreign investors by using gross instead of net flows, and allows a more nuanced understanding of extreme capital flow episodes.

Our paper extends several related strands of existing empirical literature. Firstly, it relates to a growing literature on the impact of financial liberalization on domestic economic variables (Kose, Prasan, and Terrones, 2003; Quinn & Toyoda, 2008; Dell’Ariccia, 2008; Umutlu, Akdeniz, & Altay-Salih, 2010). Secondly, with recent work underlining the importance of the variations of international capital flows, more literature has emerged on how financial liberalization affects the level of capital flows (Kose, Prasad, & Terrones, 2008; Yalta, 2010; Milesi-Ferretti and Tille, 2011). Finally, a third related strand of the literature is the study on extreme capital flow episodes (Calvo, 1998; Cowan, Gregorio, Micco, & Neilson, 2007; Prati, Schindler, & Valenzuela, 2012; Reinhart & Reinhart, 2009; Rothenberg & Warnock, 2011).

The findings indicate that financial liberalization affects extreme episodes asymmetrically. It seems that the surge and flight episodes are more sensitive to liberalization than the stop and retrenchment episodes. Another important finding of this paper is that capital flow waves of mature countries respond to liberalization differently than those of emerging markets. With the deepening of financial liberalization, other flows in emerging markets register a higher propensity to turn into surges, while the likelihood of surges of portfolio flows for their counterparts is significantly reduced. This unusual finding can be justified by their specific national and institutional conditions. Generally, with a lower level of liberalization, which is shown in Fig. 1, most foreign capital sneaks into emerging countries through the channel of other capital accounts, which makes the surges of other flows more sensitive to liberalization. For mature markets that are equipped with developed securities markets, improved risk-sharing post-liberalization can promote transparency and accountability, reduce adverse selection and moral hazard, improve the functioning of financial systems, and further help to stabilize capital flows. Third, an increase in the degree of liberalization may trigger capital flight in portfolio flows for emerging countries, while reducing the flights of total flows for their peers, which might be due to the poorer circumstances of stock markets for emerging countries. Thus, our results provide some evidence in theories of the relationship between financial liberalization and the extreme movements of capital flows.

Finally, we also conduct a number of experiments to check the robustness of the findings reported above, to provide more confidence

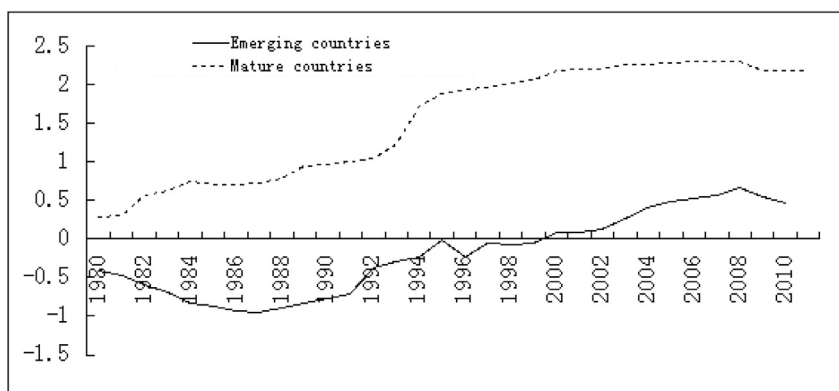


Fig. 1. Financial liberalization developments for mature and emerging countries. ⁵

that our results will not be impacted by model specification and the identification of capital waves. It turns out that our results remain intact.

The remainder of the paper is organized as follows. Section 2 delineates the development of financial liberalization and characterizes waves of the different types of capital flows by separating emerging countries from mature countries. Section 3 outlines the data, methodology and empirical results. Section 4 performs several tests of the robustness of the results. Finally, Section 5 concludes and points out some potential directions for future research.

2. The variables and descriptive statistics

2.1. Development of global financial liberalization

Referring to the measurement of financial liberalization, the chronology developed by the Chinn and Ito (2008) is the most commonly cited index in the literature, and has been employed in recent studies including Schindler (2008), Lane, Lane, and Milesi-Ferretti (2008) and Forbes and Warnock (2012). The building of Chinn-Ito index is based on the information from the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER), and it is a de jure measures for capital controls, which, comparing to de facto measures, can avoid the endogeneity of the financial liberalization to the dynamics of capital flows in some degree. Fig. 1 depicts the development of financial liberalization evaluated by the KAOPEN index³ for 48 countries, including 20 developed countries and 28 emerging economies⁴ over the period from 1980 through 2010, developed by Chinn and Ito (2008). This index evaluates development of capital account liberalization, with the value being calculated by cross-country average. The mature countries include most of those high income economies classified by World Bank, and the emerging markets (EMEs) included in the sample are mainly those covered by the IMF's Early Warning Exercise (IMF, 2010). A larger value means a higher level of liberalization. As Fig. 1 shows, the degree of financial liberalization is accentuated for both mature and emerging markets, and mature financial markets are on average less regulated. The index for mature countries and emerging markets averages 1.64 and 0.34, respectively. The liberalization degree of mature markets increases from an initial value of -0.5 to 0.46 toward the end of the sample, compared to that of emerging economies ranging from 0.45 to 2.23 . Moreover, we can observe different patterns in the dynamics of financial liberalization from Fig. 1. It seems that emerging markets suffer several liberalization reversals, whereas the increase of liberalization in mature markets is overall uninterrupted. In the regression analysis, we examine the nexus between capital flow waves and financial liberalization controlling on international interest rate, domestic output growth, and worldwide growth.

2.2. The behavior of extreme capital flow episodes

We obtain quarterly data of FDI, portfolio and other flows for 20 mature countries and 28 emerging economies over the period from

³ KAOPEN index constructed by Chinn and Ito (2008) is based on the reverse values of binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). Chinn and Ito (2008) construct the financial liberalization index as the first standardized principal component of the degree of liberalization for multiple exchange rates, current account transactions, capital account transactions and the requirement of the surrender of export proceeds. The index makes a substantial contribution in terms of its wide coverage of countries and time period, and the data are available for 181 countries for the period of 1970–2010.

⁴ The developing markets include: Argentina, Belarus, Brazil, Bolivia, Bulgaria, Chile, Colombia, Costa Rica, Croatia, Estonia, Hungary, India, Indonesia, Jordan, Kyrgyz Republic, Korea, Latvia, Mexico, Panama, Peru, Philippines, Romania, Russian Federation, Slovak Republic, South Africa, Sri Lanka, Thailand, and Turkey. The mature countries consist of: Australia, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, United Kingdom, and United States.

⁵ Notes: the KAOPEN index, developed by Chinn and Ito (2008), is a cross-country average and evaluates development of capital account liberalization. A larger value means a higher degree of liberalization.

January 1980 through June 2010, which are determined by data availability. To capture the distinctions in the behavior of domestic and foreign investors, this data set includes not only aggregate capital inflows and outflows, but also their components. The data come from the analytic presentation of the IMF's Balance of Payments Statistics Yearbooks (BOP) (more details are in [Appendix A](#)). To generate different types of capital flow waves, we employ the methodology of [Forbes and Warnock \(2012\)](#). We show the calculation of surge and stop episodes to provide the methodology of identifying extreme episodes. Let C_t denote the 4-quarter moving sum of a given type of gross capital inflow (INFLOW), measured by the liabilities of the reporting country, then the annual year-over-year changes ΔC_t can be expressed as the following:

$$C_t = \sum_{i=0}^3 \text{INFLOW}_{t-i}, \text{ with } t = 1, 2, \dots, N,$$

$$\Delta C_t = C_t - C_{t-4}, \text{ with } t = 5, 6, \dots, N.$$

Next, we compute rolling means (MEAN) and standard deviations (SD) of ΔC_t over the last 3 years.⁶ Referring to [Forbes and Warnock \(2012\)](#), a surge is at first defined as a period which starts with the first month t_1 that ΔC_t increases more than one standard deviation above its rolling mean and ends at the time t_2 once ΔC_t falls below one standard deviation above its mean. Secondly, there must be at least one quarter t_i when ΔC_t increases at least two standard deviations above its mean. In addition, the length of the episode is greater than one quarter. Therefore, a surge can be defined as:

$$\text{surge}_{t_i} = \begin{cases} 1 & \text{if } \Delta C_{t_1} > \text{MEAN} + \text{SD}, \Delta C_{t_2} < \text{MEAN} + \text{SD}, \text{ and } \Delta C_{t_i} > \text{MEAN} + 2\text{SD}, t_1 \leq t_i \leq t_2 \\ 0 & \text{if otherwise} \end{cases} \quad (1)$$

Using a symmetric approach, a stop episode is defined as:

$$\text{stop}_{t_i} = \begin{cases} 1 & \text{if } \Delta C_{t_1} < \text{MEAN} - \text{SD}, \Delta C_{t_2} > \text{MEAN} - \text{SD}, \text{ and } \Delta C_{t_i} < \text{MEAN} - 2\text{SD}, t_1 \leq t_i \leq t_2 \\ 0 & \text{if otherwise} \end{cases} \quad (2)$$

The episodes of flight and retrenchment are defined similarly using the data of gross outflows, measured by the assets of the reporting country. To calculate these episodes, our primary data source is the quarterly data from the International Monetary Fund's International Financial Statistics. The resulting samples are listed in [Appendix B1-B3](#).

[Figs. 2 and 3](#) show evolution of the incidence of each type of episode for mature and emerging markets, broken down by type of capital flows. It suggests that there are significant divergences in the dynamics of certain episodes for the three flow types and in both mature economies and their counterparts, which justifies our decomposition of the total flows into FDI, portfolio and other flows. Taking the surges in mature markets as an example, the incidence of surge episodes for FDI comes to a climax for mature markets in 1987, while the frequency for portfolio inflows shows a large decrease. In addition, there also exist differences across the four waves in the same kind of capital flow. Importantly, this illustrates that the incidence of the same episode for various types of capital flows and the four episodes of the same type of capital flows indeed evolved differently. It is interesting to note, finally, that the frequency of stops of other flows as a whole is found to be relatively higher than the stop episodes for other types of capital flows for mature countries.

Comparing [Figs. 2 to 3](#), we find significant divergence in the dynamics of capital flow waves in mature and emerging economies. For example, the frequency of retrenchment shows a large increase, while flight greatly decreases from 2001 to 2003 for mature markets. With the total frequency of the four episodes for FDI staying unchanged, the frequency of other capital flows shows a 50 percent reduction from 2000 to 2001 for emerging economies.

2.3. The relationship between financial liberalization and capital flow waves

The dynamic patterns of three primary forms of international capital flows (FDI, portfolio and other flows) are different. Among them, FDI is generally attracted by macroeconomic fundamentals, and we conjecture that the waves of FDI show little response to financial liberalization. In contrast, portfolio flow and other flow are short-term capitals, sometimes for speculation, and may be more likely to wave sensitively to financial liberalization. In addition, portfolio flow typically involves transactions in securities that are highly liquid, including groups of assets such as stocks, bonds and cash equivalent, while other flow includes capital from the monetary authority, banks and others, which may lead to the results that portfolio flow and other flow response differently to liberalization. What's more, the depth and breadth of financial market for mature and emerging countries are different, and this can make the problem more complicated.

Using the average statistics of [Figs. 1–3](#) as a guide, financial liberalization appears to have little association with average capital flow waves, especially for mature economies, the average degree of financial liberalization for which had remained nearly unchanged from 1996 to 2008, quite different from the pattern of frequency of capital waves. As we do not control for any other influences on capital flow waves, we explore this further in the next sections.

[Table 1](#) reports correlations between financial liberalization and the frequency of various types of capital flow waves. [Table 1](#) implies

⁶ Considering the limited data length, we choose a 3-year horizon, which is a trade-off between the number of countries and the consistency with [Forbes and Warnock \(2012\)](#), whose horizon is 5 years. We have checked the 5 year versus the 3 year window and find that there is little difference. Thus, we report only the 3 year window here. In addition, we also consider a broader window for the capital flow waves (using additional months around the episode period) and find similar results in the part of sensitivity test.

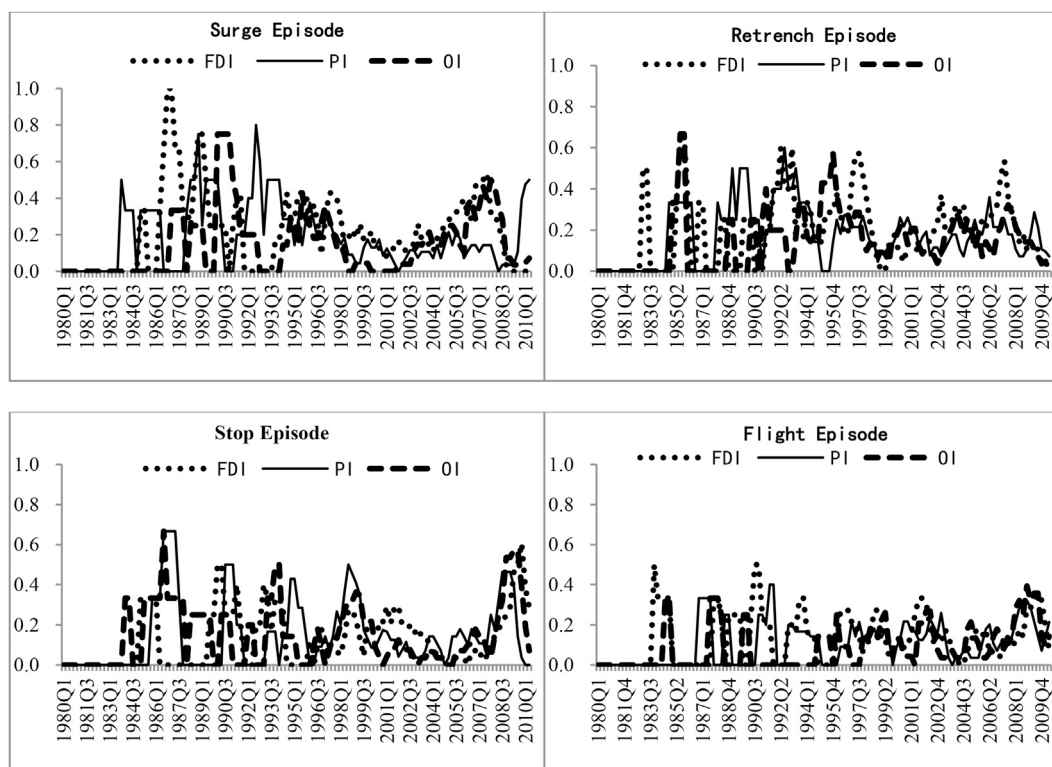


Fig. 2. Percentage of countries with each type of episode for emerging markets: by type of capital.

that financial liberalization may have different effects on the extreme episodes of three types of capital flows for mature and emerging countries. Generally, the coefficients of the correlations are small, and this may be reasonable because our extreme episodes of capital flows are dummy variables, and it is difficult for the linear correlation coefficient to fit the relation between a dummy and a continuous variable. Here we only use the correlations to provide a first look at the relationship between capital liberalization and the capital flow waves, and a further analysis will be detailed in our next section. Note that here, it appears that the surge episodes of portfolio flows for mature countries, the surges of other flows and the flight of portfolio flows for emerging markets are more relevant to liberalization.

3. Financial liberalization and capital flow waves

This section examines the relationship between financial liberalization and the four kinds of capital flow waves. We start by outlining the empirical approach we employ. Then, we describe the main results for different types of flow. Tables 2–5 report the estimates for waves of total flows, FDI, portfolio, and other flows respectively. Finally, we discuss the impacts of liberalization on the waves of each type of flow, and compare the empirical results of emerging countries with their counterparts.

3.1. Empirical estimation technique

To examine the existence of a possible causal linkage between financial liberalization and the probability of experiencing a surge, a stop, a flight, or a retrenchment, we use the following estimation equation:

$$\text{Prob}(Y_{it} = 1) = F(\beta \text{Lib}_{i,t-1} + \gamma Q_{i,t-1}) \quad (3)$$

where Y_{it} is an extreme episode dummy variable that takes the value of 1 if country i is experiencing an episode (surge, stop, flight, or retrenchment) in quarter t . All the explanatory variables are lagged one-quarter relative to the dependent variable. $\text{Lib}_{i,t-1}$ refers to the financial liberalization variable from Chinn and Ito (2008). β is the coefficient on liberalization, which means that one percent rise in the financial liberalization can lead to the results that the probability of extreme episodes increases by $\exp(\beta\%)$ powers of the prior probability. $F(\cdot)$ is the cumulative distribution function of the extreme value distribution. As episodes occur irregularly (85% of the sample are zeros), and $F(\cdot)$ is asymmetric, we estimate Eq. (3) using the complementary logarithmic (or cloglog) framework.⁷

⁷ Complementary logarithmic framework assumes that $F(\cdot)$ is the cumulative distribution function (cdf) of the extreme volatility event distribution. Forbes and Warnock (2012) argue this method may be suited for the skewed distribution of dependent variables. The estimation strategy of which is: $F(x) = 1 - \exp[-\exp(x)]$.

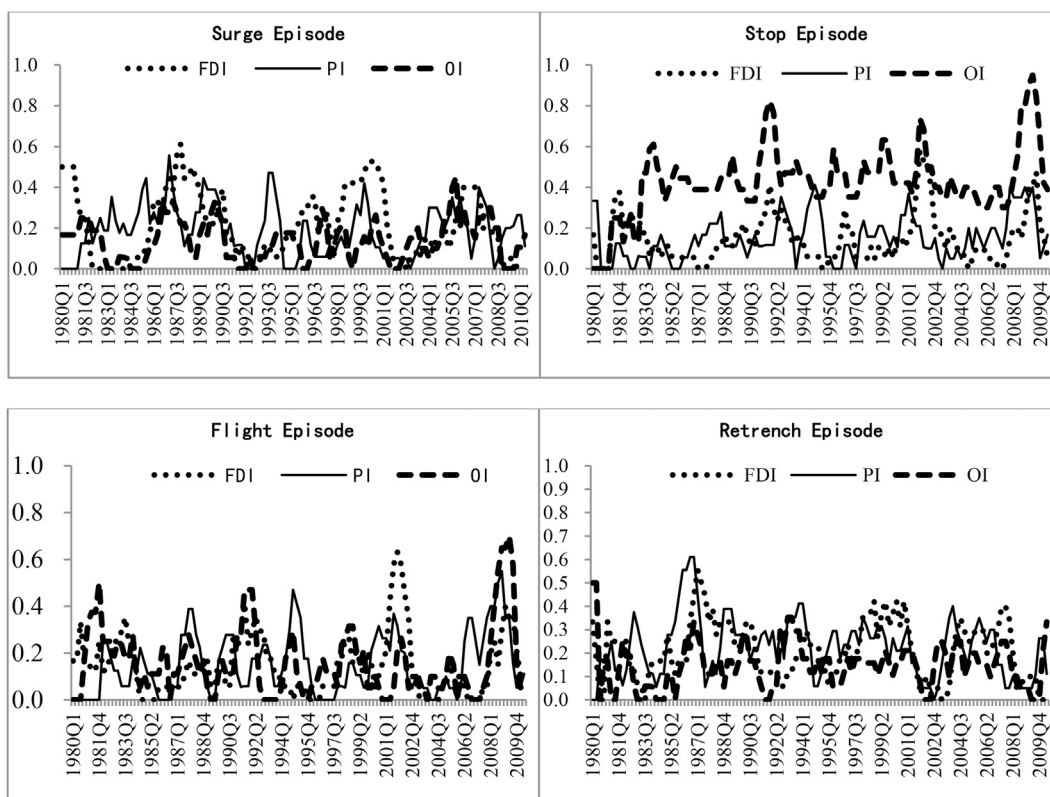


Fig. 3. Percentage of countries with each type of episode for mature markets: by type of capital.

Table 1

Correlations between liberalization and frequency of various types of capital flow waves.

		Mature markets	Emerging markets
		Financial liberalization	Financial liberalization
FDI	Surge	-0.0174	-0.0002
	stop	0.0583	0.0087
	Flight	0.0418	-0.0173
	Retrenchment	-0.0017	-0.0243
PI	Surge	-0.1085	-0.0173
	stop	0.0751	-0.0243
	Flight	0.0524	0.1066
	Retrenchment	-0.0240	0.0183
OI	Surge	0.0002	0.1066
	stop	0.0365	0.0183
	Flight	-0.0143	-0.0002
	Retrenchment	-0.0169	0.0087
Total flows	Surge	-0.0038	0.0895
	stop	0.0189	0.0710
	Flight	-0.0357	0.0295
	Retrenchment	0.0369	0.0712

Q_{it-1} represents a set of control variables that include changes in world real interest rates, changes in world output growth, changes in domestic output growth, and global liquidity—the sum of M2 in the United States, Euro-zone and Japan, all converted into US dollars. γ refers to a vector of unknown coefficients. The chosen control variables in this basic regression pick up some of the primary factors that may affect the probability of capital flow waves. In this analysis, the set is kept fairly small so as to retain some interpretability of the correlations. The rationale for using these control variables follows the past literature, including Kaminsky and Schmukler (2003), and Neumann et al. (2009), Forbes and Warnock (2012) who study the relationship between financial liberalization and the stock market cycle and capital volatility, respectively. As those variables are consistent with those used in studies on the level and volatility of capital flows, we conjecture that they may influence the probability of extreme episodes of capital flow. In addition, as Forbes and Warnock (2012) pointed out global factors, contagion and domestic financial development are relevant for capital flow waves, we had planned to include those variables to our empirical model as control variables. However, the data of contagion and domestic variable acquired for

Table 2
Regression results: episodes of extreme capital flows of total flows.

Total	Mature markets				Emerging markets			
	Surge		Stop		Surge		Stop	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Liberalization	-.01 (-0.12)	-.01 (-0.06)	.06 (1.41)	.02 (0.31)	.23*** (3.79)	.19*** (3.11)	.14*** (2.87)	.07 (1.21)
World interest		.03 (1.47)		.02 (1.58)		.04 (1.72)		-.01 (-0.52)
GDP		.04*** (4.49)		-.19*** (-12.00)		.01 (1.62)		-.11*** (-11.55)
World output		.01 (1.46)		.01*** (2.69)		.02*** (3.94)		.03*** (5.56)
Global liquidity		2.91** (2.33)		.09 (0.08)		3.85** (2.343)		1.16 (0.76)
Constant	-1.37*** (-12.64)	-2.33*** (-4.74)	-1.24*** (-12.96)	-1.97*** (-4.41)	-1.61*** (-18.60)	-4.41*** (-13.66)	-1.45*** (-16.42)	-4.15*** (-5.79)
Observations	2143				1617			
Total	Flight		Retrenchment		Flight		Retrenchment	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Liberalization	-.22*** (-3.44)	-.24*** (-3.46)	.06 (1.51)	.04 (0.84)	.13** (2.11)	.10 (1.56)	.14** (2.13)	.08 (1.27)
World interest		-.03 (-1.49)		.01 (0.41)		.001 (0.14)		.01 (0.11)
GDP		.07*** (3.45)		-.11*** (-7.04)		.01 (1.44)		.01* (1.73)
World output		-.01 (-1.48)		.005 (1.07)		.01** (2.14)		.02** (2.50)
Global liquidity		-.72 (-0.65)		1.59 (1.34)		2.14 (1.40)		1.17 (0.75)
Constant	-1.23*** (-11.3)	-.56 (-1.09)	-1.29*** (-13.22)	-2.20*** (-4.22)	-1.83*** (-20.25)	-4.71*** (-4.94)	-1.88*** (-12.71)	-3.27*** (-6.32)
Observations	2143				1617			

Notes. The dependent variable is a 0–1 variable indicating if there is an episode (surge, stop, flight, or retrenchment). See Appendix A for a complete description of explanatory variables and data sources. Figures in parentheses are z-statistics. * is significant at 10%. ** is significant at 5%. *** is significant at 1%. The capital account openness index is normalized with the highest degree of financial openness captured by the value of 100 and the lowest by the value of zero. The data of the extreme episodes for the total capital flows comes from Forbes and Warnock (2012), and the episodes of Jordan, Belarus, Costa-Rica, and the Kyrgyz Republic are gained by using the authors' calculations.

many sample country start with the 90s, while the sample period of our paper is from 1980. Including those control variables would shorten the sample period, which cannot catch the change of financial liberalization bringing to capital waves, and considering the four control variable added can control the exogenesis factors, we don't include the contagion and domestic variables. To check the sensitivity of the results, we also perform a series of robustness tests.

3.2. Results and discussion

We firstly use the full sample, including both mature countries and emerging countries, to examine the relationship between financial liberalization and waves of total capital flows to provide benchmark to compare with Forbes and Warnock (2012) more directly. The results are reported in Table 9, and show that the financial liberalization is more significantly related to a sharp increase in gross capital inflows for foreign residents, Forbes and Warnock (2012) found that capital controls are more associated with flight. This difference may be caused by the divergence of sample countries. In addition, as the data of risk or contagion variables in our study period are not available, we also use a relative shorter sample, including risk and contagion variables, to take a robustness test, which can further help to verify whether it is the lack of important variables that make the financial liberalization outstanding in the part of sensitivity tests.

Then we divided the samples into two groups of mature countries and emerging countries. The regression results for the model specified in equation (1) are reported in Tables 2–5, subdivided into mature economies and emerging countries. We analyze the response of waves of total capital flows to financial liberalization, which is probably the most relevant variable for policy-makers (see Table 2). As the methodology for identifying episodes of extreme capital flow movement is almost the same as Forbes and Warnock (2012), whose data of extreme episodes for total capital flows is used in our empirical model, and the country and year observations for total capital flows are the same as individual subcategories of capital flow waves. For each table, the dependent variable is a 0–1 variable indicating if there is an episode (surge, stop, flight, or retrenchment) of direct investment (Table 3), portfolio investment (Table 4) and other investment (Table 5). We present results with the liberalization variable only (column 1) with the control variables (column 2).

As shown in Table 2, it seems that liberalization can only significantly decrease the likelihood of experiencing flight episodes for the mature markets, with most episodes for emerging markets found to respond positively and significantly to liberalization in the single variable regression analysis, and the liberalization effect is diminished by the inclusion of the control variables, except the surges, the probability of which is markedly elevated by liberalization. This means that the liberalization for mature countries can sharply reduce of outflows of domestic residents, while the inflows of foreign capital are significantly increased by liberalization. The divergences mirror

Table 3
Regression results: episodes of extreme capital flows of FDI.

FDI	Mature markets				Emerging markets			
	Surge		Stop		Surge		Stop	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Liberalization	-.03 (-0.75)	-.07 (-1.32)	.10** (1.85)	0.09 (1.45)	-.01 (-0.14)	.01 (0.18)	.06 (1.04)	.03 (0.50)
World interest		0.12*** (6.04)		-0.02 (-1.04)		.16*** (6.64)		-.13*** (-4.44)
GDP		0.05*** (6.37)		-0.10*** (-7.06)		.001 (0.17)		-.05*** (-4.66)
World output		0.03*** (6.13)		-0.01 (-0.58)		.03*** (4.35)		-.21** (-2.52)
Global liquidity		2.45* (1.83)		-1.24 (-0.78)		1.31 (0.82)		.73** (0.40)
Constant	-1.41*** (-13.51)	-4.88*** (-9.56)	-1.99 (-17.56)	-1.31** (-2.24)	-1.39*** (-18.20)	-4.75*** (-7.23)	-1.82*** (-19.78)	.84 (1.05)
Observations	2143				1617			
	Flight		Retrenchment		Flight		Retrenchment	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Liberalization	0.06 (1.17)	0.07 (1.38)	-0.01 (-0.24)	.01 (0.19)	-.001 (-0.18)	-.03 (-0.40)	-.02 (-1.20)	-.04 (-0.73)
World interest		-0.04 (-1.62)		0.09*** (4.35)		-.06* (-1.92)		.02 (1.08)
GDP		-0.10*** (-6.64)		0.05*** (6.23)		-.05*** (-4.47)		.006 (1.22)
World output		-0.01 (-0.98)		0.16*** (3.79)		-0.003 (-0.39)		.02** (2.56)
Global liquidity		0.04 (0.25)		1.00 (0.76)		-1.61 (-0.68)		-0.24 (-0.15)
Constant	-1.96 (19.86)	-1.05* (-1.9)	-1.38 (-12.83)	-3.48*** (-19.58)	-1.81*** (-18.25)	-1.08 (-1.31)	-1.51*** (-15.43)	-3.31*** (-4.18)
Observations	2143				1617			

Notes. The dependent variable is a 0–1 variable indicating if there is an episode (surge, stop, flight, or retrenchment). See [Appendix A](#) for a complete description of explanatory variables and data sources. Figures in parentheses are z-statistics. * is significant at 10%. ** is significant at 5%. *** is significant at 1%. The capital account openness index is normalized with the highest degree of financial openness captured by the value of 100 and the lowest by the value of zero.

that our grouping into mature and emerging markets is meaningful.

The estimate results on FDI are shown in [Table 3](#). Overall, the extreme movements of FDI are found to have no marked association with financial liberalization. This is reasonable because FDI may be generally attracted by macroeconomic fundamentals. Also noteworthy is that the signs of the liberalization effect across four episodes are consistent for emerging markets, in contrast to its counterpart.

[Table 4](#) provides the results for portfolio flows. There is a remarkable heterogeneity in the liberalization effect between mature countries and their peers. It is found that financial liberalization can statistically reduce the probability of experiencing surge episodes only for mature countries. This could be due to the higher efficiency securities markets in developed countries, which can improve the risk-sharing level post-liberalization and further help to stabilize capital flows. This might also be similar to the case of [Alfaro, Kalemli-Ozcan, and Volosovych \(2007\)](#), who argue that a country must cross a threshold level of appropriate institutions before it can benefit from financial globalization. We do not include institutional quality as the variables for most of the countries are not available. Secondly, as we can see, portfolio flows are more likely to experience flight from emerging countries along with the liberalization, which stands in contrast to flight of total flows reduced by liberalization for their peers. Due to poorer circumstances regarding stock market for emerging countries, the investors consider advanced countries as relatively safer, and the liberalization may facilitate the flight-to-safety of portfolio capitals in emerging countries.

The results of other flows are shown in [Table 5](#). It is interesting to note, then, that the waves for mature countries have no significant association with liberalization, while liberalization is significantly correlated with a higher probability of surges for the emerging countries. Generally, with lower levels of liberalization (which is shown in [Fig. 1](#)), most foreign capital may sneak into those countries through the channel of other capital accounts, which accounts for the sensitive response of surges of other flows to liberalization. As we know, the category of other flows includes capital from the monetary authority, banks and others. Namely, liberalization could bring risks to emerging markets through those sectors.

Given all that, financial liberalization affects the extreme episodes of capital inflow and capital outflow asymmetrically. It seems that the surge and the flight episodes of are more likely to significantly respond to liberalization than the stop and retrenchment episodes. What's more, financial liberalization may have different impacts on different episodes for the same kind of capital flows and the same extreme volatility episode of different types of capital flows, which adds additional difficulties to the analysis of possible causal nexus between financial liberalization and the extreme movements in capital flows, thereby providing mixed support for theoretical work. Therefore, we should discern which effect predominates in the overall waves of capital flows. In principle, we find three possible outcomes.

Table 4
Regression results: episodes of extreme capital flows of portfolio flows.

PI	Mature markets				Emerging markets			
	Surge		Stop		Surge		Stop	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Liberalization	-.21*** (-4.42)	-.19*** (-3.49)	.15** (2.54)	.03 (0.48)	-.03 (-0.46)	.06 (0.90)	-.03 (-0.46)	.06 (0.90)
World interest		-.03** (-1.12)		.01 (0.18)		-.07** (-2.35)		-.07** (-2.35)
GDP		.03** (2.23)		-.03 (-1.49)		.02*** (3.05)		.02*** (3.05)
World output		-.01** (-1.09)		.02*** (3.15)		-.04*** (-4.81)		-.04* (-4.81)
Global liquidity		-.53 (-0.39)		.30 (0.19)		-2.48 (-1.31)		-2.48 (-1.31)
Constant	-1.30 (-10.81)	-.64 (-1.18)	-2.07*** (-15.86)	-3.43*** (-5.84)	-1.97*** (-15.75)	1.78** (2.25)	-1.97*** (-15.75)	1.78** (2.25)
Observations	2143				1617			
	Flight (1)	Retrenchment (2)	Flight (1)	Retrenchment (2)	(1)	(2)	(1)	(2)
Liberalization	.11** (2.10)	.03 (0.12)	-.02 (-0.23)	.06 (1.38)	0.16*** (3.32)	0.12* (1.94)	-.04 (-0.54)	-.01 (-0.12)
World interest		.06** (2.71)		-.02 (-1.08)		-.01 (-0.27)		.04 (1.29)
GDP		-.04** (-2.34)		.008 (0.61)		-.03** (-2.60)		-.01 (-1.31)
World output		.02*** (4.48)		-.02*** (-3.66)		.02** (2.10)		-.001 (-0.05)
Global liquidity		2.27 (1.47)		0.85 (0.68)		-2.22 (-1.08)		-2.27 (-1.27)
Constant	-1.96*** (-16.83)	-3.45*** (-6.27)	-1.33*** (-8.77)	.21 (0.43)	-2.02*** (-20.47)	-3.64*** (-4.07)	-1.87*** (-11.26)	-1.82** (-2.44)
Observations	2143				1617			

Notes. The dependent variable is a 0–1 variable indicating if there is an episode (surge, stop, flight, or retrenchment). See Appendix A for a complete description of explanatory variables and data sources. Figures in parentheses are z-statistics. * is significant at 10%. ** is significant at 5%. *** is significant at 1%. The capital account openness index is normalized with the highest degree of financial openness captured by the value of 100 and the lowest by the value of zero.

First, financial liberalization may be associated only with certain episodes of one specific type of flow, and this effect might outweigh the effect of liberalization on other types of capital flows and shape the waves of aggregate flows. For example, for emerging markets, we find the surge episode of other flows is positively related to financial liberalization (see Table 5), and Table 2 shows it is the liberalization effect on the other flows that predominates in total flows. Next, liberalization might significantly affect particular episodes of one type of capital flow, but the relationship might be masked in total flows. In this case, our disaggregated analysis of total capital flows is justified and a study limited to total flows can overlook some significant associations (i.e., Forbes & Warnock, 2012). For instance, for surges of portfolio flow in mature economies, the coefficient on the liberalization variable is negative, indicating an increase in the probability of experiencing an episode of surge (Table 4). However, this effect disappears in the aggregate analysis (Table 2). This kind of outcome supports financial liberalization as a tool against the sharp increases of portfolio inflows for mature countries. However, this may not be the panacea for sharp increases of FDI and other inflows. In addition, the flight episode for emerging countries is also in this case. Finally, none of the same episodes of the three types of capital flows significantly respond to financial liberalization, which is the case for the stop and retrenchment episodes for both mature and emerging countries. Finally, liberalization can significantly affect the episodes of total flows, but not any of its subcomponents, which is the case of flights for mature countries.

As expected, the variability in domestic economy affects the extreme volatility of capital flows oppositely to world output growth. Although these three variables vary in their statistical significance, they generally enter each equation with right signs. As all the variables are non-dimensional, a much larger coefficient doesn't mean greater effect.

4. Sensitivity tests

We have firstly considered using the Lane and Milesi-Ferretti measure as an alternative de facto measure compared to the de jure measure used by this paper. However, we found that the de facto measure (the stock of capital) is closely related to our waves of capital (the explained variable). Since adopting the de facto measure can cause endogeneity, this section performs an extensive series of robustness checks focusing on the model specification and the coverage of capital waves.

Firstly, although we have controlled the factors that may influence the probability of capital flow waves, it is important to restate that we are probably overestimating the explanatory power of these variables as we might be ignoring other potentially important variables that may influence the dynamics of extreme capital flow movements. Therefore, two sets of control variables are considered to check robustness. We first add time trend in equation (3), shown in panel A of Table 6. Panel B of Table 6 provides the second perturbation by adding crisis events, which can trigger ups and downs of capital flows. The results for the control variables are omitted for brevity. Those

Table 5
Regression results: episodes of extreme capital flows of other flows.

OI	Mature markets				Emerging markets			
	Surge		Stop		Surge		Stop	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Liberalization	.08 (1.38)	.03 (0.41)	.10* (1.67)	.08 (1.08)	.33*** (4.98)	.34*** (4.72)	.03 (0.53)	-.02 (-0.22)
World interest		.09*** (3.64)		-.03 (-1.23)		.15*** (4.93)		-.09*** (-2.91)
GDP		.04*** (3.17)		-.15*** (-10.91)		.01*** (3.21)		-.10*** (-7.92)
World output		.02*** (3.78)		-.001 (-0.22)		.03*** (4.25)		-.01 (-0.68)
Global liquidity		2.19 (1.34)		-1.51 (-0.94)		5.80*** (3.10)		.97 (0.54)
Constant	-2.08 (-12.33)	-4.78*** (-7.51)	-2.02 (-13.23)	-1.40** (-2.33)	-1.97*** (-17.50)	-6.00*** (-7.52)	-1.80*** (-20.08)	-.67 (-0.82)
Observations	2143				1617			
OI	Flight		Retrenchment		Flight		Retrenchment	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Liberalization	-.001 (-0.01)	.01 (0.18)	-.07 (-1.40)	-.13** (-2.05)	.12** (2.09)	.02 (0.36)	.05 (0.70)	.07 (1.08)
World interest		-.001 (-0.01)		-.003 (-0.12)		-.07** (-2.33)		.06** (2.16)
GDP		-.11*** (-6.41)		.01 (1.36)		-.04*** (-3.48)		.01*** (2.62)
World output		-.004 (-0.67)		.007 (1.22)		.03*** (3.25)		.006 (0.77)
Global liquidity		0.92 (0.60)		-0.44 (-0.28)		1.30 (0.63)		0.95 (0.51)
Constant	-1.96*** (-14.12)	-1.13** (-1.98)	-1.79 (-15.39)	-2.31*** (-3.99)	-2.05*** (-20.92)	-4.27*** (-4.91)	-1.85*** (-14.37)	-2.78*** (-3.52)
Observations	2143		1617					

Notes. the dependent variable is a 0–1 variable indicating if there is an episode (surge, stop, flight, or retrenchment). See Appendix A for a complete description of explanatory variables and data sources. Figures in parentheses are z-statistics. * is significant at 10%. ** is significant at 5%. *** is significant at 1%. The capital account openness index is normalized with the highest degree of financial openness captured by the value of 100 and the lowest by the value of zero.

tests essentially give similar results for sign, magnitude, and significance to our benchmark results. What's more, we also find that the crises are closely linked to stop episodes for all types of capital flows, except FDI, which is in line with Reinhart and Reinhart (2009) and Milesi-Ferretti and Tille (2011).

We also check whether the estimates are driven by our strict definition of extreme episodes, which may run the risk of losing some points of relatively large volatility for those capital flows. We extend our observed extreme episodes with a one-month window, which means the non-episode months immediately before and after the episodes are also treated as the episode month. We use this new data set of episodes to re-estimate equation (3), and the results for this exercise are reported in Table 7, which shows that this exercise does not seem to significantly change our benchmark results, and none of the important results are affected. What stands out is that the estimated coefficients of the financial effect on some episodes are now significant, e.g., the flight of total capital flows, stops and retrenchment episodes of other flows for mature markets.

Finally, as mentioned above, the data of contagion and global risk acquired for many sample countries start with the 90s, considering those control variables would shorten the sample period, which cannot catch the change of financial liberalization bringing to capital waves. Considering Forbes and Warnock (2012) find that global risk is consistently significant in predicting all types of episodes, and to exclude that it is the leaving out of particularly global risk factor that makes the liberalization statistically related, we also add the global risk and regional contagion factor⁸ into our model to, and use the relative short sample data, to further test the robustness of our results, shown in Table 8, which only include results for those variables found to be significant in Tables 2–4. It's worth pointing out that column one and three of Table 8 can be compared to results in Table 2, column 2 and 5 can be compared to results in Table 4, and column 4 can be compared to results in Table 5. The robust test proves that adding the risk and contagion variables does not change our main conclusions.

To sum up, extensive sensitivity tests show that our important results do not appear to change basically.

5. Conclusion

With the existing empirical evidence of Forbes and Warnock (2012) on the relationship between total international capital waves and financial liberalization, this paper attempts to provide some evidences on extreme movements in subcomponents of total capital

⁸ A measure of geographic proximity, with a dummy variable equal to one if a country in the same region, and the regions include North America, South America, Central America, Western Europe, Eastern Europe, southern Europe, Northern Europe, Asia, Oceania and Africa.

Table 6
Sensitivity test.

		Mature markets				Emerging markets			
		Total	FDI	Portfolio	Other	Total	FDI	Portfolio	Other
Panel A Sensitivity tests with time trend									
Surge	Liberaliz-ation	.01 (0.20)	-.05 (-0.86)	-.18*** (-3.17)	.02 (0.28)	.19*** (3.20)	-.01 (-0.21)	.11* (1.66)	.35*** (4.91)
	time trend	-.01** (-2.43)	-.01*** (-2.82)	-.003 (-2.10)	-.01*** (-3.52)	.01 (1.05)	-.01** (-2.01)	.01*** (3.37)	.004 (0.97)
Stop	Liberaliz-ation	.01 (0.02)	.09 (1.55)	.06 (0.90)	.08 (1.15)	.10 (1.5)	.06 (0.89)	-.03 (-0.45)	.003 (0.04)
	time trend	.01 (1.31)	-.001 (-0.57)	-.01** (-2.13)	-.004 (-1.05)	.02*** (4.25)	.01* (1.73)	.01 (1.57)	.02*** (3.04)
Flight	Liberaliz-ation	-.19*** (-2.74)	.08 (1.35)	.03 (0.57)	.02 (0.36)	.01 (1.60)	-.004 (-0.07)	.13** (2.09)	.07 (1.17)
	time trend	-.02*** (-4.64)	-.01 (-1.46)	-.001 (-0.37)	-.001 (-0.65)	.01** (-2.55)	.007* (1.96)	0.002 (0.72)	.01*** (2.93)
Re-trench-ment	Liberaliz-ation	.04 (0.85)	.03 (0.60)	.10* (1.87)	-.07 (-1.03)	.03 (0.47)	-.04 (-0.83)	0.01 (-0.15)	.07 (0.98)
	time trend	-.001 (-0.11)	-.01*** (-3.09)	-.01*** (-3.08)	-.01*** (-4.37)	.02*** (3.49)	-.003 (-0.81)	0.001 (-0.08)	-.005 (-1.15)
Panel B Sensitivity tests with crisis events									
Surge	Liberaliz-ation	-.01 (-0.03)	-.07 (-1.32)	-.19*** (-3.49)	.03 (0.43)	.19*** (3.08)	.002 (0.04)	.06 (0.84)	.33*** (4.66)
	crisis	.10 (0.86)	-.20 (-0.23)	-.01 (-0.02)	.09 (0.61)	-.03 (-0.28)	-.24* (-1.87)	-.19 (-1.16)	-.23 (-1.44)
Stop	Liberaliz-ation	.02 (0.40)	.09 (1.55)	.03 (0.47)	.08 (1.07)	.05 (0.94)	.03 (0.51)	-.06 (-1.03)	-.04 (-0.53)
	crisis	.19** (1.78)	.42*** (2.96)	-.09 (-0.65)	-.05 (-0.32)	-.54*** (-3.70)	.46 (0.29)	-.49*** (-2.99)	-1.21*** (-5.40)
Flight	Liberaliz-ation	-.23*** (-3.32)	.08 (1.33)	0.03 (0.50)	.01 (0.14)	.08 (1.27)	-.02 (-0.72)	.11* (1.86)	.02 (0.30)
	crisis	.24** (1.97)	0.65*** (4.76)	-0.01 (-0.06)	-0.21 (-1.31)	-.35*** (-2.59)	.19 (1.23)	-.29* (-1.73)	-0.25 (-1.43)
Re-trenchment	Liberaliz-ation	.04 (0.95)	.01 (0.23)	.07 (1.41)	-.13* (-2.03)	.05 (0.66)	-.052 (-0.93)	-.01 (-0.17)	.07 (1.10)
	crisis	.31*** (2.94)	.22 (1.91)	0.14 (1.13)	0.01 (0.86)	.79*** (4.44)	-.46*** (-3.21)	.09 (0.64)	.05 (0.34)

Notes. See notes to Tables 1–4 Crisis events include the Southeast Asia financial crisis of 1997 and the global financial crisis of 2008.

Table 7
Sensitivity tests– extended coverage of episodes.

			Surge	Stop	Flight	Retrenchment
Mature markets	Total	Liberalization	-.003 (–0.06)	.02 (0.31)	-.09* (–1.74)	.04 (0.79)
	FDI	Liberalization	-.06 (–1.38)	.11** (2.12)	.07 (1.34)	-.01 (–0.07)
	Portfolio	Liberalization	-.19*** (–3.97)	.06 (1.15)	.03 (0.71)	.06 (1.33)
	Other	Liberalization	.01 (0.17)	.16 (1.52)	-.01 (–0.34)	-.13** (–2.42)
Emerging markets	Total	Liberalization	.20*** (3.11)	.07 (1.21)	.10 (1.59)	.04 (0.61)
	FDI	Liberalization	.12 (0.37)	-.03 (–0.07)	-.01 (–0.01)	-.06 (–1.24)
	Portfolio	Liberalization	.04 (0.64)	-.06 (–1.20)	.12** (2.17)	-.02 (–0.33)
	Other	Liberalization	.43*** (5.87)	-.02 (–0.32)	.05 (0.97)	.12** (2.12)

Notes. See notes to Tables 2–5

Table 8
Sensitivity tests including the VIX and regional contagion variable.

	mature countries		emerging countries		
	Column 1	Column 2	Column 3	Column 4	Column 5
	Flight for total capital	Surges for portfolio flows	Surges for total flows	Surges for other flows	Flights for portfolio flows
Liberalization	-.25*** (–3.46)	-.16** (–2.38)	.15** (2.38)	.32*** (4.62)	.16*** (2.77)
regional contagion	-.05 (–1.06)	.001 (–0.17)	-.03 (–0.86)	.01 (0.20)	.06** (2.40)
VIX	-.07*** (–7.56)	-.03*** (–3.14)	-.02*** (–3.80)	-.04*** (–4.46)	.04*** (5.44)
Observations	1526	1526	1526	1526	1526

Notes. Here we only give the results of the concerned variables.

Table 9
Regression results: episodes of extreme capital flows of total flows.

	Surge	Stop	Flight	Retrenchment
Liberalization	.091*** (2.73)	.06* (1.92)	-.02 (0.45)	.07 (1.21)
World interest	.05*** (3.44)	.01 (0.71)	-.003 (–0.19)	-.01 (–0.52)
GDP	.01*** (3.27)	-.12*** (–15.67)	.01** (2.16)	-.11*** (–11.55)
World output	.01*** (3.16)	.01 (0.69)	-.001 (–0.47)	.03*** (5.56)
Global liquidity	3.56*** (3.65)	.58 (0.63)	2.45** (2.52)	1.16 (0.76)
Constant	–2.92*** (–7.68)	–2.13*** (–5.88)	–1.05*** (–2.51)	–4.15*** (–5.79)
Observations	3760			

flows following the liberalization of financial markets. Based on an analysis of a panel data set for both emerging markets and developed countries, we investigate the response of the extreme volatility of FDI, portfolio and other flows to financial liberalization. The liberalization variable comes from the chronology and index developed by [Chinn and Ito \(2008\)](#). To complete our analysis, we also focus our study on the extreme episodes at aggregated levels. Our empirical analysis indicates that there exist different responses across various types of capital flows, which justifies the decomposition of total flows.

Our key empirical results suggest that: (i) Financial liberalization affects the extreme episodes asymmetrically. The episodes of surge and flight exhibit a relatively high degree of association with liberalization, which appears to have a limited role in the other episodes. (ii) The effects of liberalization on the same extreme episode for different capital flows between mature countries and emerging markets could both be significant but with opposite trends. With the deepening of financial liberalization, other flows in emerging markets register a higher propensity to enter into surges, while the likelihood of surges of portfolio flows for their counterparts is significantly reduced. This unusual finding can also be justified by specific national conditions. For mature markets, with developed securities markets, liberalization can lead to international risk sharing, which should further help to stabilize capital flows. On the other hand, with a lower level of liberalization (shown in [Fig. 1](#)), most foreign capital sneaks into emerging countries through the channel of other capital accounts. Due to their imperfect financial markets, the benefits of international risk sharing cannot be realized, which makes the surges of other flows more sensitive to liberalization instead. This might also be due to the dimensions of institutional quality, as argued by [Alfaro et al. \(2007\)](#), that a country must cross a threshold level of appropriate institutions before it can benefit from financial globalization. (iii) Compared with flight of total flows reducing for mature countries, an increase in the degree of liberalization may trigger capital flight in portfolio flows for emerging countries, which might be due to its under-developed stock markets relative to their peers. In addition, we also find the sudden stops of capital inflow, except for FDI, are significantly associated with financial crises, which corroborate the evidence of [Reinhart and Reinhart \(2009\)](#), and [Milesi-Ferretti and Tille \(2011\)](#). Our conclusions are tested for various scenarios and are prone to be robust.

From a more positive perspective, this study is of great significance both in practice and in theory. On the one hand, with little empirical evidence on the relationship between sharp movements in subcomponents of total capital flows and financial liberalization, this paper is only a first attempt. On the other hand, our comprehensive analysis of the relationship between financial liberalization and waves of disaggregated capital flows provides certain basic results for further theoretical and empirical research in this field. In the

search for the stability of capital flows, policymakers should try to take advantage of these findings. Future research on this subject could be directed along two paths. Firstly, the reaches of country-specific investigations should be advocated. Secondly, it would be informative to couple the financial development and dimensions of institutional quality with our models to explain the extreme volatility of capital flows.

Contributors

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Appendix A. Data.

Capital inflows: Purchases by non-residents of domestic assets minus their sales of such assets. Source: International Financial Statistics (IFS), IMF.

GDP: quarterly percentage growth rate of GDP at market prices based on constant local currency. Source: IFS, IMF.

World real interest rates: the US real federal funds rate (quarterly%). Source: IFS, IMF.

World output growth: the index of industrial production for the industrial countries (quarterly%). Source: IFS, IMF.

Global liquidity: the sum of M2 in the United States, Euro-zone and Japan, all converted into US dollars.

Crisis: dummy variable, including financial crisis in southeast Asia and United States subprime mortgage crisis.

Appendix. B1-B4

Table B1
Statistics of surge episodes

Countries	Obs.	Mean	Std.	Min	Max
Mature markets					
Australia	118	0.35	0.48	0	1
Canada	122	0.16	0.36	0	1
Denmark	114	0.16	0.37	0	1
Finland	114	0.28	0.45	0	1
France	114	0.16	0.37	0	1
Germany	109	0.28	0.45	0	1
Italy	117	0.21	0.41	0	1
Japan	114	0.19	0.40	0	1
Norway	114	0.21	0.41	0	1
Netherlands	117	0.25	0.43	0	1
Iceland	49	0.27	0.45	0	1
Greece	79	0.23	0.42	0	1
Ireland	49	0.37	0.49	0	1
New Zealand	105	0.19	0.39	0	1
Israel	122	0.20	0.40	0	1
Portugal	114	0.35	0.48	0	1
Spain	114	0.12	0.33	0	1
Sweden	114	0.27	0.45	0	1
uk	122	0.17	0.38	0	1
United States	122	0.22	0.42	0	1
Emerging Markets					
Argentina	45	0.47	0.50	0	1
Belarus	28	0.25	0.44	0	1
Bolivia	55	0.20	0.40	0	1
Brazil	77	0.17	0.38	0	1
Bulgaria	49	0.31	0.47	0	1
Chile	57	0.18	0.38	0	1
Colombia	49	0.24	0.43	0	1
Costa Rica	33	0.00	0.00	0	0
Croatia	54	0.33	0.48	0	1
Estonia	52	0.12	0.32	0	1
Hungary	38	0.37	0.49	0	1
India	64	0.19	0.39	0	1
Indonesia	50	0.12	0.33	0	1

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Table B1 (continued)

Countries	Obs.	Mean	Std.	Min	Max
Jordan	67	0.27	0.45	0	1
korea	32	0.16	0.37	0	1
Kyrgyz Republic	110	0.23	0.42	0	1
Latvia	58	0.26	0.44	0	1
Mexico	49	0.08	0.28	0	1
Panama	48	0.27	0.45	0	1
Peru	50	0.24	0.43	0	1
Philippines	49	0.18	0.39	0	1
Romania	54	0.15	0.36	0	1
Russian Federation	50	0.18	0.39	0	1
Slovak Republic	56	0.36	0.48	0	1
South Africa	122	0.20	0.41	0	1
Sri Lanka	27	0.00	0.00	0	0
Thailand	105	0.24	0.43	0	1
Turkey	89	0.21	0.41	0	1

Table B2

Statistics of stop episodes

Countries	Obs.	Mean	Std.	Min	Max
Mature markets					
Australia	118	0.26	0.44	0	1
Canada	122	0.23	0.42	0	1
Denmark	114	0.37	0.48	0	1
Finland	114	0.20	0.40	0	1
France	114	0.22	0.42	0	1
Germany	109	0.25	0.43	0	1
Italy	117	0.31	0.46	0	1
Japan	114	0.34	0.48	0	1
Norway	114	0.23	0.42	0	1
Netherlands	117	0.27	0.45	0	1
Iceland	49	0.29	0.46	0	1
Greece	79	0.22	0.41	0	1
Ireland	49	0.24	0.43	0	1
New Zealand	105	0.17	0.38	0	1
Israel	122	0.37	0.48	0	1
Portugal	114	0.32	0.47	0	1
Spain	114	0.35	0.48	0	1
Sweden	114	0.27	0.45	0	1
uk	122	0.28	0.45	0	1
United States	122	0.30	0.46	0	1
Emerging Markets					
Argentina	45	0.27	0.45	0	1
Belarus	28	0.50	0.51	0	1
Bolivia	55	0.31	0.47	0	1
Brazil	77	0.30	0.46	0	1
Bulgaria	49	0.12	0.33	0	1
Chile	57	0.21	0.41	0	1
Colombia	49	0.31	0.47	0	1
Costa Rica	33	0.21	0.42	0	1
Croatia	54	0.30	0.46	0	1
Estonia	52	0.25	0.44	0	1
Hungary	38	0.11	0.31	0	1
India	64	0.11	0.31	0	1
Indonesia	50	0.16	0.37	0	1
Jordan	67	0.16	0.37	0	1
korea	32	0.00	0.00	0	0
Kyrgyz Republic	110	0.22	0.41	0	1
Latvia	58	0.28	0.45	0	1
Mexico	49	0.18	0.39	0	1
Panama	48	0.21	0.41	0	1
Peru	50	0.12	0.33	0	1
Philippines	49	0.37	0.49	0	1
Romania	54	0.20	0.41	0	1
Russian Federation	50	0.32	0.47	0	1
Slovak Republic	56	0.21	0.41	0	1
South Africa	122	0.29	0.45	0	1
Sri Lanka	27	0.15	0.36	0	1
Thailand	105	0.21	0.41	0	1
Turkey	89	0.27	0.45	0	1

Table B3
Statistics of flight episodes

Countries	Obs.	Mean	Std.	Min	Max
Mature markets					
Australia	118	0.22	0.42	0	1
Canada	122	0.24	0.43	0	1
Denmark	114	0.17	0.37	0	1
Finland	114	0.29	0.46	0	1
France	114	0.18	0.39	0	1
Germany	109	0.24	0.43	0	1
Italy	117	0.15	0.35	0	1
Japan	114	0.18	0.39	0	1
Norway	114	0.19	0.40	0	1
Netherlands	117	0.16	0.37	0	1
Iceland	49	0.43	0.50	0	1
Greece	79	0.06	0.25	0	1
Ireland	49	0.33	0.47	0	1
New Zealand	105	0.24	0.43	0	1
Israel	122	0.19	0.39	0	1
Portugal	114	0.27	0.45	0	1
Spain	114	0.24	0.43	0	1
Sweden	114	0.27	0.45	0	1
uk	122	0.17	0.38	0	1
United States	122	0.24	0.43	0	1
Emerging Markets					
Argentina	45	0.33	0.48	0	1
Belarus	28	0.00	0.00	0	0
Bolivia	55	0.27	0.45	0	1
Brazil	77	0.27	0.45	0	1
Bulgaria	49	0.24	0.43	0	1
Chile	57	0.21	0.41	0	1
Colombia	49	0.31	0.47	0	1
Costa Rica	33	0.00	0.00	0	0
Croatia	54	0.15	0.36	0	1
Estonia	52	0.15	0.36	0	1
Hungary	38	0.16	0.37	0	1
India	64	0.11	0.31	0	1
Indonesia	50	0.08	0.27	0	1
Jordan	67	0.00	0.00	0	0
Korea	32	0.19	0.40	0	1
Kyrgyz Republic	110	0.26	0.44	0	1
Latvia	58	0.28	0.45	0	1
Mexico	49	0.22	0.42	0	1
Panama	48	0.35	0.48	0	1
Peru	50	0.12	0.33	0	1
Philippines	49	0.43	0.50	0	1
Romania	54	0.35	0.48	0	1
Russian Federation	50	0.22	0.42	0	1
Slovak Republic	56	0.41	0.50	0	1
South Africa	122	0.34	0.47	0	1
Sri Lanka	27	0.33	0.48	0	1
Thailand	105	0.20	0.40	0	1
Turkey	89	0.18	0.39	0	1

Table B4
Statistics of retrench episodes

Countries	Obs.	Mean	Std.	Min	Max
Mature markets					
Australia	118	0.23	0.42	0	1
Canada	122	0.23	0.42	0	1
Denmark	114	0.26	0.44	0	1
Finland	114	0.29	0.46	0	1
France	114	0.17	0.37	0	1
Germany	109	0.35	0.48	0	1
Italy	117	0.30	0.46	0	1
Japan	114	0.32	0.47	0	1
Norway	114	0.21	0.41	0	1
Netherlands	117	0.30	0.46	0	1
Iceland	49	0.35	0.48	0	1
Greece	79	0.08	0.27	0	1

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Table B4 (continued)

Countries	Obs.	Mean	Std.	Min	Max
Ireland	49	0.29	0.46	0	1
New Zealand	105	0.25	0.43	0	1
Israel	122	0.30	0.46	0	1
Portugal	114	0.25	0.44	0	1
Spain	114	0.36	0.48	0	1
Sweden	114	0.34	0.48	0	1
uk	122	0.25	0.44	0	1
United States	122	0.25	0.43	0	1
Emerging Markets					
Argentina	45	0.11	0.32	0	1
Belarus	28	0.00	0.00	0	0
Bolivia	55	0.16	0.37	0	1
Brazil	77	0.21	0.41	0	1
Bulgaria	49	0.41	0.50	0	1
Chile	57	0.16	0.37	0	1
Colombia	49	0.24	0.43	0	1
Costa Rica	33	0.21	0.42	0	1
Croatia	54	0.30	0.46	0	1
Estonia	52	0.15	0.36	0	1
Hungary	38	0.00	0.00	0	0
India	64	0.08	0.27	0	1
Indonesia	50	0.20	0.40	0	1
Jordan	67	0.00	0.00	0	0
korea	32	0.50	0.51	0	1
Kyrgyz Republic	110	0.26	0.44	0	1
Latvia	58	0.28	0.45	0	1
Mexico	49	0.10	0.31	0	1
Panama	48	0.19	0.39	0	1
Peru	50	0.12	0.33	0	1
Philippines	49	0.18	0.39	0	1
Romania	54	0.22	0.42	0	1
Russian Federation	50	0.18	0.39	0	1
Slovak Republic	56	0.13	0.33	0	1
South Africa	122	0.11	0.32	0	1
Sri Lanka	27	0.00	0.00	0	0
Thailand	105	0.11	0.32	0	1
Turkey	89	0.20	0.40	0	1

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