No. 2011 [EN]

IMI Working Paper

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By Haichao Fan, Qin Gou, Yuchao Peng and Wenjing Xie[1]

Abstract

This paper aims to explicitly investigate the multilateral effects of capital controls on capital flows and the risk contagion from global financial shocks to emerging market economies (EMEs). Using a comprehensive portfolio allocation data set from EPFR and a newly constructed high-frequency similarity-weighted average capital control (SWACC) index of the rest of the world in 19 EMEs from 2001 to 2015, this paper then empirically explore the spillover effect of capital controls on capital flow and capital price co-movement. We find that SWACC is positively associated with the global fund's portfolio weight allocated to a country, the total portfolio flows into that country, and the capital market co-movement between that country and the advanced countries. Further analysis shows that these impacts are more pronounced for capital inflow control or, in extreme circumstances, when capital flows are extremely high or low. Our results are robust to a variety of alternative measures, regression designs, and methods.

Key words: capital control; capital flow; spillover effect; risk contagion; emerging market

JEL Classification: F3, F42, G32

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1. Introduction

The past decade has witnessed an impressive increase in the capital flow volatility of emerging market economies (EMEs), an increase that raises both macroeconomic challenges and financial stability concerns. Historically, such volatility is nothing new as flows have been episodic (Ghosh et al., 2014), but increased volatility has reignited debates about the necessity of using capital controls in managing capital flows into EMEs. Economists and policy makers in support of capital controls have written a series of theoretical papers modeling how capital controls can increase social welfare (Korinek, 2010, 2011; Jeanne and Korinek, 2010; Costinot et al., 2014; Jeanne, 2012; Prasad, 2018; Devereux and Yu, 2019; Devereux et al., 2019), a series of IMF reports to develop scenarios in which capital controls could be "part of a policy toolkit" (IMF, 2011a, 2011b, 2012a, 2012b, 2017, 2018; Ostry et al., 2010, 2011), and a series of policies aimed at reducing portfolio inflows and at avoiding financial risk as well as aimed at other macroeconomic purposes.[2]

In contrast to the massive attention in the abovementioned literature given to the economic benefits of implementing capital controls, research on the multilateral effect of capital controls on other countries is scant. It has long been studied in the trade literature that an increase in tariffs of one importing market can deflect exports to other markets. This effect is called the "deflection effect" (Bown and Crowley, 2006, 2007). In the same spirit, if capital controls in one country could potentially deflect capital flows into another and transfer the corresponding financial risk from one economy to another, this multilateral effect should be incorporated when reassessing the desirability of capital controls and calls for international policy coordination of the use of capital controls (Forbes et al., 2016).

As Ghosh et al. (2014) noted, capital flows to recipient countries must be determined by both supply-side (push) and demand-side (pull) factors. Meaningfully, if one country implements capital inflow controls that increase funding costs and

[2] For example, Brazil reinstated a 2% tax on portfolio inflows (IOF) in October 2009 to discourage carry trade and increased it twice to 6% on debt inflows in October 2010 in the face of exchange rate appreciation. Peru introduced additional capital requirements for FX credit risk exposure in July 2010. Indonesia implemented a 1-month minimum holding period for central bank papers in June 2010. See IMF (2011a) for more information about managing capital inflows since the 2008 financial crisis.

thereby reduce capital inflows to this country, it may deflect international capital flows and bring corresponding challenges to other recipient countries on the demand side. Several recent papers have shed some light on the externalities of capital controls on capital flows to other countries (Forbes et al., 2016; Giordani et al., 2017). There is also a growing theoretical literature attempting to pin down the multilateral externalities on social welfare (Korinek, 2011; Costinot et al., 2014, Jeanne, 2012; Giordani et al., 2017). Yet, to date, there has been little evidence on whether capital controls can make other countries' capital market more sensitive to global financial shocks, namely increasing risk contagion from global market to receipt countries. It can be also regarded as a important spillover effect to inflict financial risks on other countries. As well, the literature is silent on offering direct empirical evidence of the degree to which the similarity inherent to the economies, such as region, market size, trade openness, and capital market risk, affect the spillover effects of capital controls.

This paper aims to explicitly test for the multilateral effects of capital controls on capital flows and the financial risk contagion from the global shocks to EMEs. By employing a novel and high-frequency quarterly index of capital control and global portfolio flows stemming from Emerging Portfolio Fund Research (EPFR) in 19 EMEs from 2001 to 2015, we empirically investigate whether capital controls deflect capital flows. In order to simultaneously identify the effect that capital controls of all other EMEs have on one EME's capital flow, we construct a "similarity-weighted average capital control" index, or SWACC. We calculate country-pair similarity across four dimensions for EMEs, specifically region, market size, trade openness, and capital market risk. Data on portfolio flows contain not only information about portfolio investment flows on equity markets at the fund level but also weekly micro-details of the weights allocated to each recipient economy from the global funds. These novel data sets allow us to identify the deflection effect of capital controls on a fund's weight allocation across recipient countries at the fund-country level and the deflection effect on the aggregate portfolio investment flows at the country level with high frequency.

The baseline empirical results, further confirmed by robustness checks, first show that capital controls may deflect the portfolio share allocation of global funds to other countries with similar economic and regional characteristics. Furthermore, when we aggregate the portfolio flows across all funds in each period for each economy, the empirical results further support the existence of a deflection effect. Lastly, we find that the deflection effect is mainly driven by inflow controls rather than by outflow controls, and both controls on portfolio flows and those on the overall capital account have similar deflection effects on portfolio investments.

Subsequently, we empirically explore whether one EME's capital market is more sensitive to the global capital market shocks, namely financial risk contagion, in response to a reinforcement of other EME capital controls. Specifically, we measure the financial risk contagion by the co-movements between each EME's capital market index and the overall capital market index of all developed countries. We consistently find that SWACC is positively associated with the financial risk contagion. To our knowledge, this is the first paper that investigates the spillover effect of capital controls on risk contagion.

Finally, to support our empirical findings, we also build a parsimonious multinational model based on Giordani et al. (2017), to identify a cross-border effect of capital controls on capital flows to the other EMEs and financial risk contagion. All propositions are in line with our empirical results. We put the model in Appendix A to save the space.

This paper contributes to the literature on twofold. First, this paper adds to the literature on the deflection effect of capital controls on capital flows. A growing literature considers the deflection effect. Based on the event study approach, Forbes et al. (2016) and Lambert et al. (2011) present evidence of the deflection effects on the capital flows of the capital control policies implemented in Brazil. Giordani et al. (2017) and Gurnain et al. (2018) are among the first to provide cross-sectional evidence that capital controls in one economy will shift capital flows to other countries with similar economic characteristics in a deflection effect. In contrast, Boero et al. (2019) construct a global econometric model to capture the dynamic interactions between capital flows and domestic and global fundamentals and find only limited evidence of the deflection effect for a small number of emerging market countries. In this paper, we provide both micro-fund-country-level and macro-country-level evidence of the deflection effect based on novel global fund-level data and in cross-sectional study approach. In this way, we are different from Forbes et al. (2016) and Lambert et al. (2011) that we investigate the deflection effect of weighted multi-country policies rather than just one event in the Brazilian economy.

Second, we contribute to literature on the multilateral effect of capital controls on macro challenges and financial risk. In contrast to the abundance of attention given to the deflection effect on capital flows, less evidence is found about whether capital controls generate meaningful externalities on other countries. Several theoretical studies find that capital controls in one economy might generate positive or negative externalities on the welfare in other economies based on different model assumptions (Korinek, 2011; Costinot et al., 2014; Jeanne, 2012). However, there has been little empirical evidence of whether one EME's capital control could lead to an increase of financial risk contagion from developed countries to other EMEs. We contribute to the literature by providing the very first evidence that capital controls from one EME have increased the extreme capital market co-movement between other EMEs with regional and economical similarity and developed countries. This finding has an important policy implication: multilateral coordination on managing capital flows is urgent.

The rest of the paper proceeds as follows. In the next section we provides information about the empirical methodology and available data. Section 3 presents our main empirical findings, followed by a robustness check in Section 4. Section 5 concludes.

2. Data and Empirical Specification

2.1 Data

Our sample mainly contains three aspects of data: capital controls, country portfolio allocations, and capital market price. A tremendous literature assesses country-level capital controls and constructs indicators (see, e.g., Chinn and Ito 2008 for the Chinn-Ito index). However, most indicators are at the year level. To capture the instantaneous response of capital flow to the change of capital control policy, we use quarterly data on capital controls sourced from Gurnain et al. (2018). In this database, we have not only the overall capital control index but also the portfolio investment (referred as "hot money") control index. Moreover, the capital control index can be separated into inflow and outflow controls.

To analyze the spillover effects of capital controls on a country's portfolio allocation, we use a novel data set stemming from EPFR. EPFR contains both weekly portfolio investment flows at the fund level and portfolio holding data at the fund-country level. The EPFR data have several advantages. First, they present good representativeness (Fratzscher, 2012; Forbes et al., 2016). For example, EPFR tracks equity and bond funds that invest globally and held $2.8 trillion in total assets in 2018. Another strength of the data comes from its high time frequency disaggregated information at the fund level. Specifically, EPFR contains information on daily, weekly, and monthly fund flows, tracking the amount of cash flowing into and out of thousands of investment funds. At a country's portfolio allocation level, the EPFR database has a sub-data-set called "Country Weightings," which includes actual country and regional weightings, expressed as a percentage, of individual funds at the end of each month.

The MSCI indices, which are popular among researchers, have covered the majority of the stock markets in the world (Jotikasthira et al., 2012; Korbes et al, 2016). Therefore, this paper follows the relevant literature in using the MSCI country indices to proxy the capital price in corresponding emerging market countries and uses the MSCI developed country indices to proxy the overall capital price of developed countries. The MSCI has adjusted the range of emerging market countries many times, but we use 19 emerging market countries[3] for consistency.

The data for the other control variables come from a standard global database. Monetary policy rates and exchange rates are extracted from BIS, and the return and risk of local capital markets are calculated using MSCI indices.

Because our main focus is on stock markets, we only use equity fund data. To avoid outliers or the survival issue of some individual funds, we exclude small funds with less than USD 5 million. Finally, because of data availability, our sample covers 19 emerging market countries from January 2001 through December 2015. The fund-group-level sample contains 419 active equity fund groups, and 489,934 fund-group-

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[3] See Table C1 in Appendix C for the country list. In our sample, both Hong Kong and China mainland belong to one nation; however, because of their different economic policies, we follow the literature and treat them as two emerging market economies. Here, "country" indexes region. To simplify the expression, we use "emerging market countries" and "emerging market economies" interchangeably.

country-month observations. The majority of fund groups in the sample are registered in advanced countries, and the remaining groups are registered in tax-free islands.

2.2 Measurement

To analyze the spillover effect of multiple countries' capital controls simultaneously, we first construct a weighted average index to capture the overall degree of capital controls from other similar countries, in a similar spirit to Giordani et al. (2017). However, different from Giordani et al. (2017), we choose multi dimensions of country-pair similarity as the weight, instead of gross domestic product (GDP). When investors cannot allocate assets in one country because of exogenous restrictions, they will try to find a substitute to reallocate their portfolio. The substitute should be geographically and economically similar to the original country (Forbes, et al., 2016). Therefore, we propose a new measure, e.g., "the similarity-weighted average capital controls of other countries" (SWACC), and measure it for country c in quarter q as

$$SWACC^{ex}_{c,q} = \frac{\sum_{d \in S^{-c}} \left(Control_{d,q} \times Similarity_{c,d} \right)}{\sum_{d \in S^{-c}} Similarity_{c,d}} , \tag{1}$$

where subscript c indexes the country; q indexes the quarter; $Control$ is the capital control index; and S^{-c} means the country set, except for country c. $Similarity_{c,d}$ is the similarity between country c and country d. Similarity is calculated as the multiplicative inverse of the Euler distance:

$$Similarity_{c,d} = \frac{1}{\left[\sum_i \left(\chi^i_c - \chi^i_d \right)^2 \right]^{\frac{1}{2}}} , \tag{2}$$

where χ refers to standardized country characteristics.[4] Forbes et al. (2016) document that, when reallocating assets in response to changes in capital control conditions, investors mainly consider the following four major factors: region, market size, dragon play[5], and control risk. Similarly, this paper calculates the country-pair similarity by adopting a series of characteristics including region, market size, trade openness, and capital market risk.[6] See the appendix for more details about the

[4] For example, if country c and country d belong to the same region, $\chi_c - \chi_d = 0$; otherwise, $\chi_c - \chi_d = 1$.

[5] This factor is proposed by Forbes et al. (2016) to capture countries' benefits from strong growth of China , and it is measured as one country's exports to China as percent of GDP.

[6] Korbes et al. (2016) focus on the spillover effect of one country's capital account control (Brazil), whereas our

measurements of each characteristic and for details about country-pair similarities.

Similarly, we construct "the similarity-weighted average capital inflow control of other countries" (SWACC_in) and "the similarity-weighted average capital outflow control of other countries" (SWACC_out) by separating the capital control index by capital inflow control and capital outflow control.

We use two measures of capital flow. One is the global fund's portfolio allocation weights across countries, which is the level of accumulated capital flow. Another is "flow-implied fund allocation changes" (*FIFA*), which was proposed by Jotikasthira et al. (2012) and measures the net capital flow to each country. *FIFA* is constructed as follows:

$$FIFA_{c,m} = \sum_{i} \left(f_{i,m}^{*} \times \omega_{i,c,m-1} \times TNA_{i,m-1} \right) , \tag{3}$$

where $f_{i,m}^{*} = \sum_{s=1}^{6} f_{i,m+s-1}$ is the sum of capital flows experienced by fund i over two quarters after and including month m.[7] $\omega_{i,c,m-1}$ is the percentage of fund i's total net asset investment in country c at the end of month t-1, and $TNA_{i,m-1}$ is the total net asset of fund i at the end of month m-1. To eliminate the impact of dimension, we scale *FIFA* by the size of the stock market of country c at the end of month m.

Besides capital flow, this paper focuses on the capital market co-movement across countries as well. After the global financial crisis, a growing literature focuses on global systemic risk, that is, capital market co-movement under extreme condition, especially when a stock market crash occurs. To analyze the spillover effects of capital controls on global systemic risk, we construct a measurement of the extreme co-movement using the dynamic symmetrized Joe-Clayton Copula method (Patton, 2006; Huang et al., 2019).[8] We first calculate the daily return rate of each country's capital market, that is, the logarithm difference of the closing price of stock market index. Then we use the

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paper focuses on the multinational spillover effect. "Dragon play," which means trading with China, is not a proper characteristic for our research. Instead, we take trade openness into account. Meanwhile, control risk is an important factor considered by investors to allocate assets, but we already introduce capital controls in our main regressions. Considering that capital market risk also affects fund managers' investment decisions, we use capital market risk instead of control risk. Moreover, another reason to take capital market size into account is that financial development has an important impact on capital inflows Desbordes and Wei (2017).

[7] When calculating *FIFA*, we extend the measure to two quarters in order to capture a longer impact of capital control policy. For robustness, we also try the measure of short-term FIFA and only consider a one-quarter flow, in line with Jotikasthira et al. (2012). The results hold.

[8] See Huang et al. (2019) for more information on the method.

Copula method to calculate the daily lower tail co-movement rate between each emerging market country c and the advanced country index.[9] Finally, we use the median value in 1 calendar month as the extreme co-movement rate of country c in month m.[10]

2.3 Empirical Strategy

This paper estimates spillover effects of capital controls through both micro-level and macro-level regressions. First, we analyze the spillover effects of capital controls on portfolio allocations of global fund groups across countries. Based on the setting of Korbes et al. (2016), we include both variables capturing the domestic and the spillover effect of capital controls from other countries:

$$\omega_{c,f,m} = \beta Control_{c,q-1} + \gamma SWACC_{c,q-1} + \delta X_{c,m} + \mu_m + e_f + v_c + \xi_{c,f,m} \quad (4)$$

In Equation (4), subscript f denotes the global fund group, whose funds are issued by the same company; c indexes the country that the fund flows into; and q and m index the quarter and month, respectively. $\omega_{c,f,m}$ measures the allocation weights of global fund group f to country c in month m. $Control_{c,q-1}$ measures the capital control policy of country c in quarter q-1, whereas $SWACC_{c,q-1}$ is the similarity-weighted average of capital controls of all other countries for country c, measuring the spillover effect of other countries.[11] In the regression, we consider two kinds of capital control index. One is the capital control policy only restricting the cross-border portfolio investment (e.g., short-term equity and bond investment), and the other is the overall capital control policy restricting all kinds of capital flows. Furthermore, we separate the index into capital inflow control and capital outflow control, and we re-estimate Equation (4) to determine whether different policies have different spillover effects.

X is a series of variables that may affect the portfolio allocation of global funds, including the first difference of the real effective exchange rate (*Deer*), the first difference of the monetary policy rate (*Dcbrate*), the recipient country's capital market

[9] We also try the co-movement rate between emerging market countries and the MSCI global index. The results hold.

[10] For robustness, we also try to use the mean value in 1 calendar month as the extreme co-movement rate of country c in month t. The results are consistent with those from the baseline regression.

[11] Because of data availability, the data for capital controls are at a quarterly frequency.

return rate (*Return*), and the recipient country's capital market risk (*Risk*).[12] We include country fixed effects and fund group fixed effects to capture all the time-invariant country and fund group characteristics, which might influence the outcome of interest. We also include year and month fixed effects to control global shocks in a particular year and month likely to have affected all countries in a similar manner.

Second, we analyze the spillover effects of capital controls on *FIFA*, which is at the macro level. The empirical model is as follows:

$$FIFA_{c,m} = \beta Control_{c,q-1} + \gamma SWACC_{c,q-1} + \delta X_{c,m} + \mu_m + v_c + \xi_{c,m}. \quad (5)$$

This regression is at the country-month level, and FIFA measures net capital inflows. The control variables *X* are the same as those used in Equation (4). Both country fixed effects and year-month fixed effects have been controlled.

In the Appendix A, we have built a parsimonious multinational model based on Giordani et al. (2017), to identify a cross-border effect of capital controls on capital flows to the other EMEs and financial risk contagion. According to **Proposition A1**, we predict that both coefficients of $SWACC_{c,q-1}$ in Equations (4) and (5) are significantly positive, which means that the capital controls of one emerging market country will bubble thy neighbor, in line with Forbers et al., (2016).

Third, we examine the spillover effect of capital controls on financial risk contagion by employing the following empirical model:

$$ExComove_{c,m} = \beta Control_{c,q-1} + \gamma SWACC_{c,q-1} + \delta X_{c,m} + \mu_m + v_c + \xi_{c,m} \quad (6)$$

where $ExComove_{c,m}$ is the extreme capital market co-movement rate between country *c* and developed countries in month *m* that measures risk contagion. The control variables *X* are the same as those used in Equation (4). Both country fixed effects and year-month fixed effects have been controlled. As Proposition A2 shows, we predict that the coefficient of $SWACC_{c,q-1}$ will be significantly positive, indicating that an increase in other similar countries' capital controls leads to more exposure to global financial risk.

Table 1 reports the summary statistics of the main variable. Figure 1 shows the

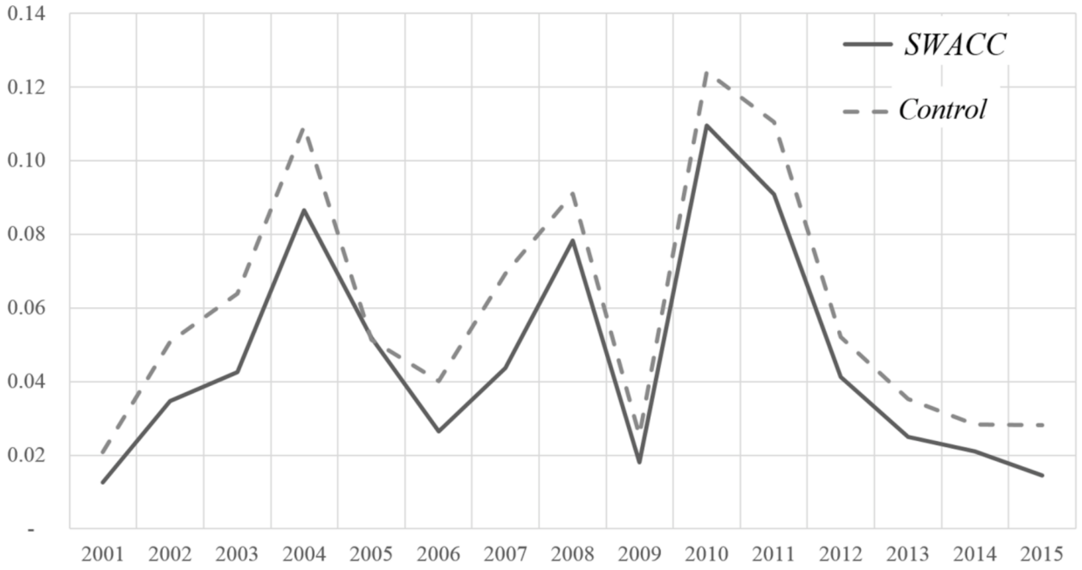
[12] According to general theory and the literature, we predict that the coefficient of the first difference of the real effective exchange rate is positive; the coefficient of the first difference of the monetary policy rate is positive (because of a decline in the capital price in response to a tightening monetary policy); the coefficient of the capital market return rate is positive; and the coefficient of capital market risk is negative.

summary of the hot money capital control index and the weighted average hot money capital control index of the other countries. According to Panel A of Figure 1, we can observe that the trend of two kinds of policy is volatile and highly correlated. It reveals that one country's policy simultaneously affects itself and other similar countries. Panel B reports the bin chart of two kinds of capital control across countries. We first find that the two indexes are significantly uncorrelated, meaning the capital control policies do not respond to the spillover effect from other countries. This finding is in line with that of Giordani et al. (2017). Meanwhile, although some countries do not implement capital control policies to manage capital flow, they are still affected by other countries' capital control policies.

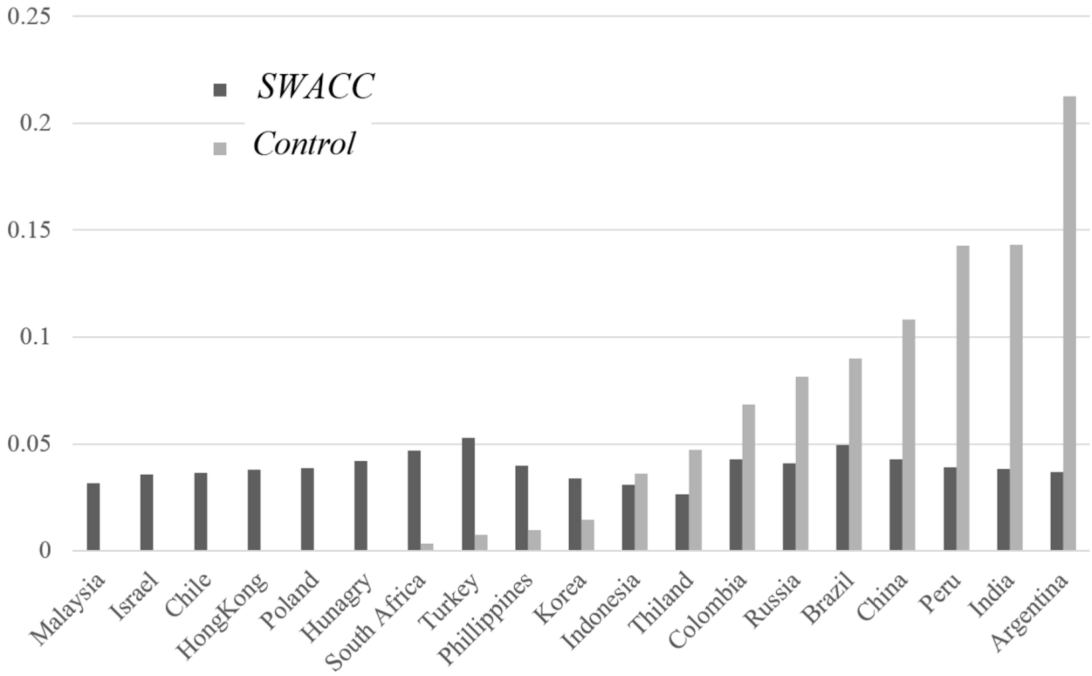
Table 1. Summary statistics

Variable	Obs.	Mean	SD	Median
ω	489,934	1.81	3.51	0.03
FIFA (%)	3,466	0.02	0.15	0.01
ExComove (%)	3,954	65.23	3.49	65.26
SWACC (Portfolio investment)	3,954	0.04	0.05	0.02
Control (hot money)	3,954	0.05	0.25	0.00
SWACC (overall capital account)	3,954	0.03	0.04	0.02
Control	3,954	0.04	0.20	0.00
Return	3,954	0.01	0.17	0.02
Risk	3,954	0.67	0.40	0.58
Deer	3,954	-0.04	3.00	0.10
Dcbrate (%)	3,954	-0.03	12.24	0.00

Figure 1. Capital controls on hot money and the SWACC



Panel A: Yearly trend



Panel B: Nineteen emerging market economies

3. Empirical Results

3.1 Fund Weight

We begin by reporting the spillover effect of capital controls onto fund's portfolio allocation weights across countries in Table 2, by estimating specification (4). Columns (1)–(3) report results when the capital control index measures the de jure control on cross-border portfolio investment. Robust standard errors clustered by fund group and country are reported for all estimates. All the specifications are able to explain more than 30% of the variation in country portfolio weights. All control variables, except for risk, are significant determinants of country portfolio weights, and their coefficients have the expected signs.

Table 2. Spillover effects of capital controls onto the funds' portfolio allocation weights

This table reports the spillover effect of capital controls on country portfolio weights, using specification (12). The unit of analysis is a country-fund-month. The dependent variable is the share of a fund group's portfolio allocated to a country. The variable SWACC denotes the similarity-weighted average capital controls of the rest of the world. SWACC_in and SWACC_out measure the similarity-weighted average capital inflow and outflow controls of the rest of the world, respectively. The variable Control measures the capital controls of own country. In columns (1)–(3) all the index of capital control measures the de jure control on the cross-border portfolio investment, and in columns (4)–(6) all the index of capital control measures the de jure control on all types of cross-border investments through the capital account, including the portfolio investment, FDI and other investments. Appendix B defines the control variables. Country fixed effects, fund group fixed effects, and year and month fixed effects are included. Robust standard errors, clustered by fund group and country, are presented in parentheses. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

	(1)	(2)	(3)	(4)	(5)	(6)
	ω	ω	ω	ω	ω	ω
	Index of capital controls on portfolio investment			Index of capital controls on all investment		
SWACC	1.021***	0.807***		1.736***	1.649***	
	(0.249)	(0.293)		(0.357)	(0.419)	
SWACC_in			0.776***			1.769***
			(0.296)			(0.450)
SWACC_out			0.946			1.273
			(0.698)			(0.907)
Control		-0.0516	-0.0511		-0.0209	-0.0225
		(0.0335)	(0.0341)		(0.0450)	(0.0458)
Return	0.175***	0.175***	0.175***	0.173***	0.173***	0.174***
	(0.0281)	(0.0281)	(0.0282)	(0.0281)	(0.0280)	(0.0280)
Risk	-0.0012	-0.0002	0.000	0.0006	0.0010	0.0003
	(0.0348)	(0.0348)	(0.0345)	(0.0348)	(0.0348)	(0.0345)
Deer	0.0106***	0.0104***	0.0104***	0.0105***	0.0105***	0.0105***
	(0.0013)	(0.0013)	(0.0014)	(0.0013)	(0.0014)	(0.0014)
Ccbrate	0.0002**	0.0002**	0.0002**	0.0002**	0.0002**	0.0002**
	(0.0001)	(0.0001)	(0.000)	(0.0001)	(0.0001)	(0.0001)
Constant	1.768***	1.777***	1.777***	1.753***	1.756***	1.757***
	(0.0407)	(0.0413)	(0.0411)	(0.0408)	(0.0415)	(0.0414)
Observations	489,934	489,934	489,934	489,934	489,934	489,934
R-squared	0.313	0.313	0.313	0.313	0.313	0.313
Country FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year & month FEs	Yes	Yes	Yes	Yes	Yes	Yes
Fund group FEs	Yes	Yes	Yes	Yes	Yes	Yes

For our key variable of interest, SWACC, the results show a positive and statistically significant relationship between it and the country portfolio weights, whether or not including the country's capital controls index itself in columns (1) and (2). This finding implies that the portfolio capital controls may have deflected portfolio allocation to other countries with similar economic and regional characteristics. Using the estimate in column (2), the 0.807 coefficient indicates that increasing SWACC by a standard deviation of 0.05, the fund groups correspondingly allocate 0.04 percentage points more to one country. Although this effect seems to be small in the magnitude, it is strong for emerging countries, because it is larger than the median of emerging countries' monthly weight of 0.03. But we find that the capital controls of the recipient country have an insignificant effect on the country's portfolio weights.

According to our theoretical model's predictions, the spillover effect of capital inflow controls should be positive, while that of capital inflow controls should be negative. Column (3) reports results when we further divide the portfolio capital controls into capital inflow controls (SWACC_in) and capital outflow controls (SWACC_out). We find SWACC_in show significant deflection effects on portfolio allocation, which is in line with our model prediction. However, capital outflow controls (SWACC_out) have no significant spillover effects. This is due to two reasons. First, the fund groups are mainly from developed countries (Jotikasthira et al, 2012). According to the IMF database from 2008 to 2018, for portfolio investment the capital flow from developed countries to emerging economies accounts for 80.8% in the total capital flow to emerging countries, but the capital flow from emerging economies to developed countries only accounts for 11.8% in total capital flow to developed countries. Compared with the capital outflow from emerging economies, the capital inflow to emerging economies is crucial to explain the real global capital flow. Compared with the capital outflow from emerging economies, the capital outflow from developed countries is crucial to explain the capital inflows to emerging economies. Our empirical regressions focus on emerging economics. As a result, only the capital inflow control (measured by SWACC_in) has the significant spillover effect. Second, the capital outflow controls have subtle effects on net capital flows. On one hand, the capital outflow controls can directly limit the capital outflow. On the other hand, the signal of strengthening controls on capital outflows indirectly leads to smaller capital inflows (Bartolini and Drazen, 1997). Due to contradictory effects, the effect of capital outflow controls on net capital flow should be small. This further explains why the impact of capital outflow controls (measured by SWACC_out) is not significant.

In columns (4)–(6), the capital control index measures the de jure control on all types of cross-border investments through the capital account, including the portfolio investment, foreign direct investment (FDI), and other investments. We consistently find a positive and statistically significant effect of the overall capital controls and the capital inflow controls, despite a significant increase in its estimated magnitude.

3.2 Portfolio Flows at the Country Level: FIFA

If the deflection effect of capital controls on a fund's portfolio share allocation is important, one may expect a deflection effect on the aggregate portfolio flows at the country level. Then we aggregate the portfolio flows across all funds in each period for each country to FIFA and estimate specification (5) to examine the deflection effect of capital controls at the country level.[13] Table 3 presents the results.

[13] As a robustness check, we reconstruct the measurement of FIFA in two different ways. One is to scale FIFA by GDP, and another is to shorten the window during which we calculate cumulative capital flow from 6 months to 3 months. The results hold. See Table A1 in the appendix for details.

Table 3. Spillover effects of capital controls onto the funds' portfolio allocation flows

This table reports the spillover effect of capital controls on country portfolio flows, using specification (13). The unit of analysis is a country-month. The dependent variable is the country-specific portfolio flows of all allocated fund groups. The variable SWACC denotes the similarity-weighted average capital controls of the rest of the world. SWACC_in and SWACC_out measure the similarity-weighted average capital inflow and outflow controls of the rest of the world, respectively. The variable Control measures the capital controls of own country. In columns (1)–(3) all the index of capital control measures the de jure control on the cross-border portfolio investment, and in columns (4)–(6) all the index of capital control measures the de jure control on all types of cross-border investments through the capital account, including the portfolio investment, FDI, and other investments or whole capital account. Appendix B defines the control variables. Country fixed effects and year-month fixed effects are included. Robust standard errors are presented in parentheses. $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

	(1)	(2)	(3)	(4)	(5)	(6)
	FIFA	*FIFA*	*FIFA*	*FIFA*	*FIFA*	*FIFA*
	Index of capital controls on portfolio investment			Index of capital controls on all investment		
SWACC	0.290***	0.267***		0.419***	0.398***	
	(0.0845)	(0.0959)		(0.116)	(0.130)	
SWACC_in			0.293***			0.452***
			(0.103)			(0.144)
SWACC_out			0.136			0.209
			(0.180)			(0.253)
Control		-0.00623	-0.00661		-0.00562	-0.00618
		(0.00648)	(0.00643)		(0.00920)	(0.00901)
Observations	3,466	3,466	3,466	3,466	3,466	3,466
R-squared	0.397	0.397	0.397	0.397	0.397	0.398
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Country FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year & month FEs	Yes	Yes	Yes	Yes	Yes	Yes

In columns (1) and (2) when the capital control index measures the control on cross-border portfolio investment, we find that an increase in the SWACC significantly increases aggregate portfolio flows to a country. The estimates in column (2) indicate that if SWACC increases by a standard deviation of 0.05 for a country, this country will receive an increase of portfolio inflows by 0.01 percentage points as a ratio of its capital market size. This effect is strong for emerging countries, because it is almost equal to the median of the monthly portfolio inflows. Furthermore, the deflection effect is mainly driven by inflow controls on portfolio investment rather than by outflow controls on portfolio investment as shown in column (3). All these results are in line with our predictions.

When we apply the measure of the overall control on the capital account, we find consistently significant results for the deflection effect of capital controls in portfolio flows in columns (4) and (5) and that of inflow control in column (6), despite a slight increase in the economic magnitudes. But the results still show that capital controls themselves have an insignificant effect on portfolio inflows, consistent with the results of Forbes et al. (2015).

3.3 Financial Risk Contagion

So far, we have shown the deflection effect of capital controls in fund group's portfolio shares allocated to countries. A natural question is to what degree does this deflection on the portfolio flows affect financial risk contagion between capital markets, as the trading of global funds is found to be significantly associated with price effects (Jotikasthira et al., 2012). We next investigate the spillover effect of capital controls onto capital market co-movements between EMEs and developed countries by estimating specification (6). Table 4 reports the results.

Table 4. Spillover effects of capital controls onto capital market co-movement

This table reports the spillover effect of capital controls on capital market co-movement, using specification (14). The unit of analysis is a country-year. The dependent variable is co-movement between emerging markets and the developed markets. The variable SWACC denotes the similarity-weighted average capital controls of the rest of the world. SWACC_in and SWACC_out measure the similarity-weighted average capital inflow and outflow controls of the rest of the world, respectively. The variable Control measures the capital controls of own country. In columns (1)–(3) all the index of capital control measures the de jure control on the cross-border portfolio investment, and in columns (4)–(6) all the index of capital control measures the de jure control on all types of cross-border investments through the capital account, including the portfolio investment, FDI, and other investments or whole capital account. Appendix B defines the control variables. To save space, we have not reported the results of the control variables, but they are available on request. Country fixed effects and year-month fixed effects are included. Robust standard errors are presented in parentheses. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

	(1)	(2)	(3)	(4)	(5)	(6)
	ExComove	*ExComove*	*ExComove*	*ExComove*	*ExComove*	*ExComove*
	Capital controls on portfolio investment			Capital controls on all investment		
SWACC	3.331***	2.416**		4.278***	2.639*	
	(1.041)	(1.083)		(1.407)	(1.479)	
SWACC_in			2.517**			3.233*
			(1.159)			(1.721)
SWACC_out			1.943			0.688
			(2.990)			(3.655)
Control		-0.224	-0.226		-0.403**	-0.411**
		(0.139)	(0.140)		(0.174)	(0.176)
Observations	3,954	3,954	3,954	3,954	3,954	3,954
R-squared	0.792	0.792	0.792	0.792	0.792	0.792
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Country FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year & month FEs	Yes	Yes	Yes	Yes	Yes	Yes

The results in the first two columns show a significantly positive association between SWACC, when the control index measures controls on portfolio investment, and the co-movement between EMEs and the developed countries. These findings indicate that EME capital controls have significant spillover effect other EMEs by make them exposed to more financial risks from developed countries. The coefficient of 2.416 in column (2) implies that if SWACC of a country increases by a standard deviation of 0.05, the co-movement of the country with the developed countries increases by 1.21%. Besides, the domestic effect of capital controls on financial risk contagion is negative but insignificant.

Column (3) further shows that controls on the portfolio inflow, not the outflow controls, induce a significant spillover effect. This finding implies that if a country tightens its capital controls on portfolio investment, especially on portfolio inflow, it increases the capital market co-movement of the other emerging countries with developed countries, while it has no influence on its own correlation with developed markets.

Columns (4)–(6) reports results when the capital control index captures the controls on the whole capital account, and we obtain consistent findings for the significant and positive spillover effects of capital controls on co-movement, which is also driven by the capital inflow controls, except for two differences. One is that the economic magnitudes of spillover effects are slightly larger in columns (4)–(6) than in columns (1)–(3). Second, and more importantly, the domestic effect of capital controls on financial risk contagion is significantly negative.[14]

3.4 Influence of Global Financial Crisis

The 2008 global financial crisis witnessed huge cross boarder capital flows in to and out from EMEs, which induced many EMEs to tighten their capital control policy in order to manage capital flows and the associated macro-impacts and financial risk. One may wonder whether the spillover effects of capital controls might be different in

[14] For the capital controls themselves, we find that capital controls on portfolio investment are insignificant, but capital controls on the whole capital account are negatively significant. This indicates that "wall"-type capital controls on the whole account can effectively reduce financial risk contagion, which is consistent with the findings of Forbes et al. (2015), but "gate"-type capital controls on portfolio investment cannot.

the global financial crisis period from that in non-crisis period. Therefore, we compare the spillover effects of capital controls by interacting the SWACC with a variable of Crisis, which equals to one in 2008 and zero otherwise. The results are shown in Table 5.

The results show that for the spillover effects of capital controls on portfolio allocation weight and portfolio flows in column (1) to (4), the SWACC are still significant but its interaction term with Crisis are insignificant. This implies that there are deflection effects of capital controls on capital flows in both crisis and non-crisis period and they are not significantly different. For capital market co-movement, we also find that SWACC are significant but its interaction term with Crisis are not (in column (5) and (6). This implies again that the spillover effects of capital controls on capital market co-movement exist in both crisis and non-crisis period and there is no significant difference between these two effects. Moreover, we find that only inflow control generates significant spillover effects and outflow control has insignificant spillover effects in column (2), (4) and (6). Overall, our empirical results in Table 5 illustrate that the spillover effects of capital control on capital flows and the associated capital market co-movement not only exist in crisis period but also in non-crisis period.

Table 5. Spillover effects of capital controls: influence of global financial crisis

This table reports the spillover effect of capital controls on capital flows and capital market co-movement during and without crisis period. The unit of analysis is a country-year. The dependent variable is the share of country-specific fund groups' allocated portfolio investment in columns (1) and (2), the portfolio flows to a country from all the fund groups in columns (3) and (4), and the co-movement of emerging markets and developed markets in columns (5) and (6). The variable SWACC denotes the similarity-weighted average capital controls of the rest of the world. SWACC_in and SWACC_out measure the similarity-weighted average capital inflow and outflow controls of the rest of the world, respectively. The variable Crisis equals to one if it is the year is 2008 and equals to zero otherwise. The variable Control measures the capital controls of own country. All the index of capital control measures the de jure control on the cross-border portfolio investment. Appendix B defines the control variables. To save space, we have not reported the results of the control variables, but they are available on request. Country fixed effects and year-month fixed effects are included. Robust standard errors are presented in parentheses. $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

VARIABLES	(1) ω	(2) ω	(3) *FIFA*	(4) *FIFA*	(5) *ExComove*	(6) *ExComove*
*SWACC*Crisis*	1.644		0.201		1.177	
	(1.416)		(0.241)		(4.983)	
SWACC	0.691**		0.252**		2.330**	
	(0.301)		(0.100)		(1.106)	
*SWACC_in*Crisis*		1.351		0.188		0.357
		(1.292)		(0.252)		(5.156)
*SWACC_out*Crisis*		12.43		-0.0761		24.37
		(10.74)		(0.819)		(29.00)
SWACC_in		0.651**		0.277**		2.467**
		(0.309)		(0.108)		(1.181)
SWACC_out		0.858		0.136		1.744
		(0.699)		(0.182)		(3.007)
Control	-0.0551*	-0.0550	-0.00651	-0.00680	-0.226	-0.229
	(0.0335)	(0.0340)	(0.00649)	(0.00645)	(0.138)	(0.140)
Observations	489,970	489,970	3,466	3,466	3,954	3,954
R-squared	0.313	0.313	0.397	0.397	0.792	0.792
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Country FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year & month FEs	Yes	Yes	Yes	Yes	Yes	Yes
Fund group FEs	Yes	Yes	–	–	–	–

4. Robustness Checks

To address concerns about the identification assumptions that could potentially confound our inference and corroborate the findings, we conduct a battery of robustness checks.

4.1 Alternative Measure of Similarity

Above all, we change the definition of similarity and correspondingly construct two alternative index of SWACC. First, we further take institutional environment into account when calculating country-pair similarity, as it is found to be important driven factor of capital flows (Alfaro et al., 2008; Gelos and Wei, 2005; Papaioannou, 2009). We reconstruct an alternative country-pair similarity based on the original four characteristics, corruption and government stability.[15] Empirical results with this new measure of similarity are presented in Table 6. It indicates that SWACC is again found to have increased the fund groups' portfolio share of a country and the total portfolio flows allocated to a country and to have driven up the capital market co-movement with developed countries (see columns 1, 3, and 5).[16] The spillover effects on capital flow and financial risk contagion are mainly driven by the inflow controls (see columns 2, 4 and 6), while capital outflow controls are not significant. These results are in line with our baseline results.

Second, in the baseline regression the risk of local capital markets is one dimension of country-pair similarity and also one of control variables, thus for fear of collinearity we reconstruct country-pair similarity based on the other three characteristics. Empirical results based on the second new measures of SWACC are reported in Table 7. Results show similar results to the baseline models, except a few differences. Domestic effect of capital controls are significant in reducing the share of fund groups' portfolio allocation and decreasing this country's co-movement with developed markets (see column 1, 5 and 6), which is however neither robust nor as economically significant as the spillover effect of other countries' capital controls.

[15] The data is sourced from International Country Risk Guide (ICRG).

[16] We also estimate the spillover effect of similarity-weighted average capital controls on all kinds of capital flow, and the results are nearly in line with those in Table 6 and Table 7. Because of limited space, we do not report the results.

Table 6. Robustness check: consider the similarity on institutions

This table reports the robustness check of the spillover effect of capital controls by including a new dimension of country-pair similarity of institutional environment. The unit of analysis is a country-month. The dependent variable is the share of country-specific fund groups' allocated portfolio investment in columns (1) and (2), the portfolio flows to a country from all the fund groups in columns (3) and (4), and the co-movement of emerging markets and developed markets in columns (5) and (6). The variable SWACC denotes the similarity-weighted average capital controls of the rest of the world. SWACC_in and SWACC_out measure the similarity-weighted average capital inflow and outflow controls of the rest of the world, respectively. Control measures the capital controls of own country. All the index of capital control measures the de jure control on the cross-border portfolio investment. Appendix B defines the control variables. To save space, we have not reported the results of the control variables, but they are available on request. Country fixed effects, year and month fixed effects are included in all columns, and fund group fixed effects are included in columns (1) and (2). Robust standard errors are presented in parentheses. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

VARIABLES	(1) ω	(2) ω	(3) *FIFA*	(4) *FIFA*	(5) *ExComove*	(6) *ExComove*
SWACC	1.028**		0.228**		2.923*	
	(0.478)		(0.0978)		(1.646)	
SWACC_in		0.941*		0.314***		2.911*
		(0.485)		(0.111)		(1.713)
SWACC_out		1.264		-0.0596		2.955
		(0.839)		(0.141)		(3.413)
Control	-0.0364	-0.0369	-0.00581	-0.00542	-0.184	-0.184
	(0.0408)	(0.0404)	(0.00682)	(0.00669)	(0.152)	(0.151)
Observations	489,970	489,970	3,466	3,466	3,954	3,954
R-squared	0.313	0.313	0.396	0.397	0.792	0.792
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Country FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year & month FEs	Yes	Yes	Yes	Yes	Yes	Yes
Fund group FEs	Yes	Yes	–	–	–	–

Table 7. Robustness check: Alternative measure of similarity

This table reports the robustness check of the spillover effect of capital controls with alternative measure of country-pair similarity. The unit of analysis is a country-month. The dependent variable is the share of country-specific fund groups' allocated portfolio investment in columns (1) and (2), the portfolio flows to a country from all the fund groups in columns (3) and (4), and the co-movement of emerging markets and developed markets in columns (5) and (6). The variable SWACC denotes the similarity-weighted average capital controls of the rest of the world. SWACC_in and SWACC_out measure the similarity-weighted average capital inflow and outflow controls of the rest of the world, respectively. Control measures the capital controls of own country. All the index of capital control measures the de jure control on the cross-border portfolio investment. Appendix B defines the control variables. To save space, we have not reported the results of the control variables, but they are available on request. Country fixed effects, year and month fixed effects are included in all columns, and fund group fixed effects are included in columns (1) and (2). Robust standard errors are presented in parentheses. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

VARIABLES	(1) ω	(2) ω	(3) *FIFA*	(4) *FIFA*	(5) *ExComove*	(6) *ExComove*
SWACC	0.830***		0.245***		2.382**	
	(0.274)		(0.0891)		(1.109)	
SWACC_in		0.592**		0.264***		2.260*
		(0.274)		(0.0924)		(1.195)
SWACC_out		1.872***		0.148		2.949
		(0.690)		(0.183)		(2.998)
Control	-0.0538*	-0.0505	-0.00766	-0.00788	-0.232*	-0.230*
	(0.0325)	(0.0330)	(0.00627)	(0.00624)	(0.138)	(0.138)
Observations	489,970	489,970	3,466	3,466	3,954	3,954
R-squared	0.313	0.313	0.397	0.397	0.792	0.792
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Country FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year & month FEs	Yes	Yes	Yes	Yes	Yes	Yes
Fund group FEs	Yes	Yes	–	–	–	–

4.2 Alternative Measure of Co-movement

We then change the construction of another key variable, e.g., the lower tail capital market co-movement, to check whether our baseline results are driven by some measurement error. We first replace the monthly lower tail capital market co-movement rate from the median value of daily extreme co-movement rate with the mean value of it. The first three columns of Table 8 present the results. In addition, we calculate the extreme co-movement between EMEs and the MSCI global market index instead of that between EMEs and advanced economics. The last three columns of Table 8 report the results. All the results in Table 8 are consistent with our baseline findings that capital controls have a spillover effect on extreme capital market co-movement.

Table 8. Robustness check: Alternative measure of co-movement

This table reports the robustness check of the spillover effect of capital controls using the alternative measure of co-movement, using specification (13). The unit of analysis is a country-month. The dependent variable is the co-movement of emerging markets and developed markets. The variable SWACC denotes the similarity-weighted average capital controls of the rest of the world. SWACC_in and SWACC_out measure the similarity-weighted average capital inflow and outflow controls of the rest of the world, respectively. Control measures the capital controls of own country. The index of the capital control measures the de jure control on the cross-border portfolio investment. Appendix B defines the control variables. To save space, we have not reported the results of the control variables, but they are available on request. Country fixed effects and year and month fixed effects are all included. Robust standard errors are presented in parentheses. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

	(1) *ExComove2*	(2) *ExComove2*	(3) *ExComove2*	(4) *ExComove3*	(5) *ExComove3*	(6) *ExComove3*
SWACC	3.097***	2.311**		0.0326***	0.0236**	
	(0.999)	(1.041)		(0.0106)	(0.0110)	
SWACC_in			2.224**			0.0244**
			(1.102)			(0.0117)
SWACC_out			2.716			0.0199
			(2.904)			(0.0310)
Control		-0.192	-0.191		-0.0022	-0.00221
		(0.135)	(0.135)		(0.0014)	(0.0014)
Observations	3,954	3,954	3,954	3,954	3,954	3,954
R-squared	0.805	0.806	0.806	0.762	0.762	0.762
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Country FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year & month FEs	Yes	Yes	Yes	Yes	Yes	Yes

In addition, to complement our baseline analysis, we calculate the daily upper tail extreme co-movement rate between each emerging economy and the advanced country index. The results presented in Table 9 show that capital controls have a significant spillover effects on upper tail extreme capital market co-movement, which are also mainly driven by the capital inflow controls rather than outflow controls. Therefore, our results are robust to different measures of capital market co-movement.

Table 9. Robustness check: measuring capital market co-movement by upper tail risk

This table reports the spillover effect of capital controls on upper tail extreme capital market co-movement, using specification (14). The unit of analysis is a country-year. The dependent variable is upper tail extreme co-movement of stock price between emerging market economies and the developed economies. The variable SWACC denotes the similarity-weighted average capital controls of the rest of the world. SWACC_in and SWACC_out measure the similarity-weighted average capital inflow and outflow controls of the rest of the world, respectively. The variable Control measures the capital controls of own country. In columns (1)–(3) all the index of capital control measures the de jure control on the cross-border portfolio investment, and in columns (4)–(6) all the index of capital control measures the de jure control on all types of cross-border investments through the capital account, including the portfolio investment, FDI, and other investments or whole capital account. Appendix B defines the control variables. To save space, we have not reported the results of the control variables, but they are available on request. Country fixed effects and year-month fixed effects are included. Robust standard errors are presented in parentheses. *p < 0.1; **p < 0.05; ***p < 0.01.

	(1)	(2)	(3)	(4)	(5)	(6)
	Upper tail Risk	*Upper tail Risk*	*Upper tail Risk*	*Upper tail Risk*	*Upper tail Risk*	*Upper tail Risk*
	Capital controls on portfolio investment			Capital controls on all investment		
SWACC	0.114***	0.100**		0.153***	0.118**	
	(0.0359)	(0.0390)		(0.0490)	(0.0532)	
SWACC_in			0.0887**			0.114**
			(0.0397)			(0.0576)
SWACC_out			0.153			0.127
			(0.105)			(0.130)
Control		-0.00349	-0.00330		-0.00875	-0.00871
		(0.00436)	(0.00437)		(0.00548)	(0.00554)
Observations	3,954	3,954	3,954	3,954	3,954	3,954
R-squared	0.772	0.772	0.772	0.772	0.772	0.772
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Country FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year & month FEs	Yes	Yes	Yes	Yes	Yes	Yes

4.3 Exclude Mainland China

As some literature stresses, mainland China may play an important role in the externality effect of capital controls (Forbes et al., 2016), which may lead to concerns that the baseline results are mainly driven by mainland China. In this regard, we exclude mainland China when constructing the similarity-weighted capital control index (SWACC_exCN, SWACC_in_exCN, SWACC_out_exCN), drop the observations of mainland China, and repeat our analysis in Table 8 to check whether the spillover effect of capital controls is still meaningful. Results in Table 10 show a similar results, despite even larger magnitudes.

Table 10. Robustness check: Excluding China

This table reports the robustness check of the spillover effect of capital controls when excluding the influence of China. The unit of analysis is a country-month. The dependent variable is the share of country-specific fund groups' allocated portfolio investment in columns (1) and (2), the portfolio flows to a country from all the fund groups in columns (3) and (4), and the co-movement of emerging markets and developed markets in column (5) and (6). The variable SWACC_exCN denotes the similarity-weighted average capital controls of the rest of the world, while excluding China. SWACC_in_exCN and SWACC_out_exCN measure the similarity-weighted average capital inflow and outflow controls of the rest of the world, while excluding China, respectively. Control measures the capital controls of own country. The index of the capital control measures the de jure control on the cross-border portfolio investment. Appendix B defines the control variables. To save space, we have not reported the results of the control variables, but they are available on request. Country fixed effects and year and month fixed effects are included in all columns, and fund group fixed effects are included in columns (1) and (2). Robust standard errors are presented in parentheses. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

	(1) ω	(2) ω	(3) *FIFA*	(4) *FIFA*	(5) *ExComove*	(6) *ExComove*
SWACC_exCN	1.024***		0.306***		3.049***	
	(0.298)		(0.106)		(1.151)	
SWACC_in_exCN		1.077***		0.335***		3.310***
		(0.298)		(0.115)		(1.234)
SWACC_out_exCN		0.771		0.157		1.798
		(0.728)		(0.195)		(3.205)
Control	-0.0207	-0.0215	-0.00287	-0.00320	-0.194	-0.198
	(0.0351)	(0.0358)	(0.00741)	(0.00736)	(0.153)	(0.155)
Observations	465,397	465,397	3,285	3,285	3,741	3,741
R-squared	0.296	0.296	0.398	0.399	0.797	0.797
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Country FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year & month FEs	Yes	Yes	Yes	Yes	Yes	Yes
Fund group FEs	Yes	Yes	–	–	–	–

4.4 Extreme Flows

Existing research argues that the financial risk contagion is more likely to take place under the extreme conditions because of long tail distributions of financial variables (Agarwal and Naik, 2004). The volatility of the global financial market is associated with the frequency of cross-country capital flows. Therefore, we can predict that capital flows and risk contagion is more sensitive to the deflection effects of capital control policy when capital flows are extremely high or low. To test this hypothesis, we re-estimate the heterogonous impact of SWACC on international fund portfolio weights, FIFA, and capital market co-movement by introducing an interaction term of extreme flow. We first sort the FIFA and then define the top quartile of FIFA as the extreme high capital flow (a dummy named HiFIFA); the bottom quartile of FIFA as the extreme low capital flow (a dummy named LowFIFA); and the rest as normal capital flow (a dummy named MiFIFA).

Table 11 reports the empirical results of the spillover effects of capital controls through extreme flows. Columns (1), (3), and (5) consider the overall capital controls on all kinds of capital flow, whereas columns (2), (4), and (6) separate the capital control index into inflow control and outflow control. From the table, we can find that the impacts of SWACC on the country weight of the international fund group, FIFA, and capital market co-movement are more pronounced when the capital flow is extremely high or low. The results are consistent with our prediction. In the extreme circumstance, a minor change of capital control policy can bring out a large impact due to the investor’s confidence and foresight. For fear of the subsequent capital controls of other recipient countries and the sharp crash of stock market, investors immediately respond to changes in the capital control policy. As a consequence, the deflection effect of capital controls is strengthened.

Table 11. Robustness check: Spillover effects of capital controls through extreme flows

This table reports the spillover effect of capital controls on capital flows and capital market co-movement. The unit of analysis is a country-month. The dependent variable is the share of country-specific fund groups' allocated portfolio investment in columns (1) and (2), the portfolio flows to a country from all the fund groups in columns (3) and (4), and the co-movement of emerging markets and developed markets in column (5) and (6). The variable SWACC denotes the similarity-weighted average capital controls of the rest of the world. SWACC_in and SWACC_out measure the similarity-weighted average capital inflow and outflow controls of the rest of the world, respectively. Control measures the capital controls of own country. In columns (1)–(3) all the index of capital control measures the de jure control on the cross-border portfolio investment, and in columns (4)–(6) all the index of capital control measures the de jure control on all types of cross-border investments through the capital account, including the portfolio investment, FDI, and other investments or whole capital account. HiFIFA, MiFIFA, and Low FIFA are dummy variables defined as the top quartile of FIFA to measure extreme high capital flow, the bottom quartile of FIFA to measure extreme low capital flow, and the rest to measure normal capital flow. Appendix B defines the control variables. Country fixed effects and year and month fixed effects are included in all columns, and fund group fixed effects are included in columns (1) and (2). Robust standard errors are presented in parentheses. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

	(1)	(2)	(3)	(4)	(5)	(6)
	ω	ω	*FIFA*	*FIFA*	*ExComove*	*ExComove*
*SWACC*HiFIFA*	2.972***		0.506***		3.512**	
	(0.474)		(0.145)		(1.573)	
*SWACC *MiFIFA*	0.269		0.00640		2.084*	
	(0.293)		(0.0534)		(1.098)	
*SWACC *LowFIFA*	2.264***		0.350***		2.603*	
	(0.484)		(0.0794)		(1.548)	
*SWACC_in*HiFIFA*		3.684***		0.445***		6.064***
		(0.519)		(0.146)		(1.702)
*SWACC_in *MiFIFA*		0.374		-0.0105		1.756
		(0.308)		(0.0594)		(1.214)
*SWACC_in *LowFIFA*		2.642***		0.280***		2.694*
		(0.528)		(0.0915)		(1.633)
SWACC_out		0.771		0.410***		1.521
		(0.705)		(0.132)		(2.992)
Control	-0.0176	-0.0157	0.00252	0.00260	-0.221	-0.207
	(0.0351)	(0.0358)	(0.0048)	(0.0049)	(0.139)	(0.140)
HiFIFA	-0.13***	-0.120***	0.128***	0.134***	-0.240**	-0.31***
	(0.0324)	(0.0313)	(0.0054)	(0.0049)	(0.0998)	(0.0941)
LowFIFA	0.176***	0.192***	-0.14***	-0.14***	0.0929	0.0960
	(0.0319)	(0.0303)	(0.0060)	(0.0055)	(0.113)	(0.107)
Observations	489,934	489,934	3,466	3,466	3,954	3,954
R-squared	0.314	0.314	0.612	0.611	0.792	0.793
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Country FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year & month FEs	Yes	Yes	Yes	Yes	Yes	Yes
Fund group FEs	Yes	Yes	–	–	–	–

5. Conclusion

A growing evidence indicates that capital controls in one country will shift capital flows to other countries in a deflection effect and generate multinational externalities on the welfare in other countries. Yet, to date, there has been little evidence on whether capital controls can increase other countries' capital market co-movement with the global market associated with capital flows.

This study estimates the deflection effect of capital controls on capital flows and the explicit spillover effect on financial risk contagion. Both the simple theoretical model and cross-country empirical analysis show the deflection effect of one country's capital controls on capital flows of other countries with regional and economic similarities, as well as the spillover effect on extreme capital market co-movements of EMEs with the developed countries. Meanwhile, we find little evidence of the domestic effect of capital controls in reducing both portfolio capital inflows and financial risk contagion.

Together, these findings show strong evidence on multilateral effect of capital controls in EMEs, which is more important than generally thought, and non-ignorable for policy makers. We find clear evidence that tightening capital control can increase other similar countries exposure to global financial risk via capital flows. These substantial externalities call for an important role of multilateral coordination in using capital controls in order to incorporate these externalities.

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Appendix A: the model

Based on a seminal work of Giordani et al. (2017), we build a two-period multicountry model to uncover the spillover effect of capital controls onto capital flow and capital price co-movement. In the model economy, there is a set S consisting of finite countries indexed by i. In the first period, the identical representative household in the country i has an endowment y_1^i, consumes c_1^i, and invests k^i with local capital price of q^i. Then $flow^i \equiv q^i k^i + c_1^i - y_1^i$ is the trade deficit (surplus) or net capital inflow (outflow) of country i if it is positive (negative). The net capital inflow (outflow) exists as a formation of loan demand (supply). The world gross interest rate is R, which will be determined later. In the second period, the identical representative household in the country i obtains an output, $A^i\left(k^i\right)^{\alpha}\left(l^i\right)^{1-\alpha}$. The country pays back the loan and consumes the rest of the output, c_2^i. The utility function of representative household in country i is

$$\log(c_1^i) + \beta^i \log(c_2^i),$$

where β^i is the discount factor of country i. The budget constraint is

$$\left(q^i k^i + c_1^i - y_1^i\right)\left(1+\tau^i\right)R = \pi^i + w^i l^i - c_2^i + T^i. \tag{7}$$

where w^i is wage rate and l^i is labor. $w^i l^i$ denotes the wage income and $\pi^i = A^i (k^i)^{\alpha}\left(l^i\right)^{1-\alpha} - w^i l^i$ is the profit of production. τ^i is capital inflow tax (or outflow subsidy) rate charged by country i's government, and T^i is a lump-sum transfer, which is defined as

$$T^i \equiv \left(q^i k^i + c_1^i - y_1^i\right)\tau^i R. \tag{8}$$

First-order conditions on k^i, c_1^i, and c_2^i yield

$$\frac{1}{c_1^i} = \beta^i R\left(1+\tau^i\right)\frac{1}{c_2^i} \tag{9}$$

and

$$q^i\left(1+\tau^i\right)R = \alpha A^i\left(k^i\right)^{\alpha-1}\left(l^i\right)^{\alpha-1}. \tag{10}$$

Equation (10) is the demand curve of capital. To endogenize the local capital price q^i, following Dornbusch et al.(1980), Huang et al. (2017), and Devereux et al. (2019) we assume that capital supply and labor supply are fixed, that is, $l^i \le 1$, and $k^i \le \bar{k}^i$, where the capped capital supply $\bar{k}^i$ is a constant. Equations (7) and (8) yield the resource constraint of country i:

$$\left(q^i\bar{k}^i + c_1^i - y_1^i\right)R = A^i(\bar{k}^i)^\alpha - c_2^i. \tag{11}$$

If the world gross interest rate, R, is given, then (9), (10), and (11) can have

$$c_1^i = \frac{1}{1+\beta^i\left(1+\tau^i\right)}\left[\left(1-\frac{\alpha}{1+\tau^i}\right)\frac{A^i(\bar{k}^i)^\alpha}{R} + y_1^i\right]. \tag{12}$$

The capital flow can be expressed as

$$flow^i = \frac{1}{1+\beta^i\left(1+\tau^i\right)}y_1^i + \frac{1+\alpha\beta^i}{1+\beta^i\left(1+\tau^i\right)}\frac{A^i(\bar{k}^i)^\alpha}{R} - y_1^i. \tag{13}$$

The equilibrium of the world loan market in the first period is $\sum_i\left(flow^i\right)=0$, or

$$\sum_{i\in S}\left(\frac{1}{1+\beta^i\left(1+\tau^i\right)}y_1^i + \frac{1+\alpha\beta^i}{1+\beta^i\left(1+\tau^i\right)}\frac{A^i(\bar{k}^i)^\alpha}{R} - y_1^i\right) = 0. \tag{14}$$

Equation (14) determines the world gross interest rate, R.

Let us focus on a net inflow country i. We first consider the impact of one country's capital control policy on the world interest rate.

Lemma A1: If arbitrary one country, except country i (denoted by j), sets a higher inflow tax τ^j, then the world interest rate R decreases, or $dR/d\tau^j < 0$.

See Online Appendix A1 for the proofs. Lemma 1 is straightforward. Capital controls on inflow may lead to a decline in total capital demand in the international financial market, or a subsidy on outflow may lead to a surge in total supply, so the world interest rate will decrease.

For the influence of one country's capital control on capital flows into other countries. Combining $dR/d\tau^j < 0$ in Lemma A1 and $\mathrm{d}flow^i/\mathrm{d}R < 0$ implied in Equation (13), we could easily obtain proposition A1.[17]

Proposition A1: If any other country j sets a higher inflow tax, τ^j, then country i's net inflow increases, or $dflow^i/d\tau^j > 0$, which is referred as the deflection effect.

The intuition is straightforward: a tightening of capital inflow in country j decreases the world interest rate, leads to higher demand of capital for other countries to invest, and, hence, increases capital inflows to those countries.

To further investigate how capital control policy affects co-movement of capital

[17] The literature argues that international financing cost is related to similarity of country characteristics (Bell et al, 2012; Gu et al., 2019). If we assume the financing cost of country i decreases in the average similarity of country characteristics (s^i), e.g., $R^i = R/e\left(s^i\right)$, with $e'\left(s^i\right) > 0$, **Proposition A1** still hold. Moreover, we find that the deflection effect is stronger when the average similarity is higher. See Online Appendix A3 for the proofs.

price, we assume there is a shock ε on capital supply $\bar{k}^m$, where $\varepsilon \backsim f(0,\sigma^2)$ is i.i.d.[18] This is to say, the capital supply in country m should be $\bar{k}^m(1+\varepsilon)$.

Let's consider a negative shock, $\varepsilon < 0$, on country m's capital supply, $\bar{k}^m$. The capital price in country m (q^m) intermediately increases, whereas the total value of investment in the first period, $q^m(1+\varepsilon)\bar{k}^m$, still decreases according to Equation (10). Therefore, owing to the resource constraint, the capital outflow of country m increases and the world interest rate decreases. As the world interest rate declines, country i's local capital price rises according to Equation (10). As a consequence, we can observe the capital prices of countries i and m positively co-moving under the capital supply shock of country m. In the online Appendix A2, we prove the inflow tax would increase the capital price covariance. Hence, we have the following Proposition:

Proposition A2: Around the steady state, if any other net inflow country j sets a higher inflow tax τ^j, then the capital price covariance between net inflow country i and country m will increase , $dCov(q^i, q^m)/d\tau^j > 0$.

[18] In this paper, we focus on capital controls and capital price co-movement, so we consider a capital shock. Consistent with the real data, the sign of correlation of q is positive under the capital shock. In our sample, the mean of the correlation on capital returns is 0.42.

Online Appendix

Online Appendix A: Proofs of the Model

A1. Proof of Lemma A1

Define the function

$$F(R;\tau^j) \equiv \sum_{i\in S}\left(\frac{1}{1+\beta^i\left(1+\tau^i\right)}y_1^i + \frac{1+\alpha\beta^i}{1+\beta^i\left(1+\tau^i\right)}\frac{A^i(k^i)^\alpha}{R} - y_1^i\right) = 0 \tag{15}$$

The previous equation implies $\partial F/\partial R<0$ and $\partial F/\partial \tau^j<0$. According to the implicit function derivation theorem, we have:

$$\frac{dR}{d\tau^j} = -\frac{\partial F/\partial R}{\partial F/\partial \tau^j}<0 \tag{16}$$

Hence, Lemma 1 holds.

A2. Proof of Proposition A2

In order to prove how inflow tax affect the capital price co-movement, there are two steps.

First, we show that the capital price covariance are positive. We perform a first-order expansion around the steady state $q^i \approx \left.\frac{dq^i}{dk^m}\right|_{\varepsilon=0}\bar{k}^m\varepsilon+\bar{q}^i$ and $q^m \approx \left.\frac{dq^m}{dk^m}\right|_{\varepsilon=0}\bar{k}^m\varepsilon+\bar{q}^m$, where $\bar{q}^i$ and $\bar{q}^m$ is the steady state of q^i and q^j, respectively. Then the capital price covariance can be simplified as

$$Cov\left(q^i,q^m\right) \approx \left.\frac{dq^i}{dk^m}\right|_{\varepsilon=0}\left.\frac{dq^m}{dk^m}\right|_{\varepsilon=0}\sigma^2 \tag{17}$$

According to Equation (10), we have

$$\frac{dR}{dk^m} = \frac{\frac{1+\alpha\beta^m}{1+\beta^m\left(1+\tau^m\right)}\alpha A\left(\bar{k}^m\right)^{\alpha-1}}{\sum_i\left[y_1^i - \frac{1}{1+\beta^i\left(1+\tau^i\right)}y_1^i\right]}>0 \tag{18}$$

$\frac{dq^i}{dk^m}$ and $\frac{dq^m}{dk^m}$ satisfy:

$$\frac{dq^i}{dk^m} = -\frac{\alpha A^i\left(k^i\right)^{\alpha-1}}{\left(1+\tau^i\right)}\frac{1}{R^2}\frac{dR}{dk^m}<0$$

$$\frac{dq^m}{dk^m} = \frac{\alpha A^i}{\left(1+\tau^i\right)}\left[-\left(\bar{k}^m\right)^{\alpha-1}\frac{1}{R^2}\frac{dR}{dk^m} - (1-\alpha)\left(\bar{k}^m\right)^{\alpha-2}\frac{1}{R}\right] < 0$$

Hence, the capital price covariance are positive.

Second, we show that how the inflow tax affect the capital price co-movement.

$$\frac{dCov\left(q^i, q^m\right)}{d\tau^j} \approx \sigma^2\left[\frac{d^2 q^i}{dk^m d\tau^j}\frac{dq^m}{dk^m} + \frac{d^2 q^m}{dk^m d\tau^j}\frac{dq^i}{dk^m}\right]\Bigg|_{\varepsilon=0}.$$

where

$$\frac{d^2 q^i}{dk^m d\tau^j} = -\frac{\alpha A^i\left(k^i\right)^{\alpha-1}}{\left(1+\tau^i\right)}\left[-\frac{2}{R^3}\frac{dR}{d\tau^j}\frac{dR}{dk^m} + \frac{1}{R^2}\frac{d^2 R}{dk^m d\tau^j}\right] < 0$$

$$\frac{dq^j}{dk^m d\tau^j} = -\frac{\alpha A^i}{\left(1+\tau^i\right)}\left[\left(\bar{k}^m\right)^{\alpha-1}\left[-\frac{2}{R^3}\frac{dR}{d\tau^j}\frac{dR}{dk^m} + \frac{1}{R^2}\frac{d^2 R}{dk^m d\tau^j}\right] - (1-\alpha)\left(\bar{k}^m\right)^{\alpha-2}\frac{1}{R^2}\frac{dR}{d\tau^j}\right] < 0$$

The proofs of the previous two equations less than zero base on the following equation

$$\left[-\frac{2}{R^3}\frac{dR}{d\tau^j}\frac{dR}{dk^m} + \frac{1}{R^2}\frac{d^2 R}{dk^m d\tau^j}\right] > 0 \tag{19}$$

Thus, around the stead state, we have

$$\frac{dCov\left(q^i, q^m\right)}{d\tau^j} > 0.$$

Proof of Eq.(19):

First, we calculate

$$\frac{dR}{d\tau^j} = \left[\frac{\left(1+\alpha\beta^j\right)A^j\left(k^j\right)^\alpha}{\sum_i\left[y_1^i - \frac{1}{1+\beta^i\left(1+\tau^i\right)}y_1^i\right]} + \frac{y_1^j\sum_i\frac{1+\alpha\beta^i}{1+\beta^i\left(1+\tau^i\right)}A^i\left(k^i\right)^\alpha}{\left\{\sum_i\left[y_1^i - \frac{1}{1+\beta^i\left(1+\tau^i\right)}y_1^i\right]\right\}^2}\right]\frac{-\beta^j}{\left(1+\beta^j\left(1+\tau^j\right)\right)^2}$$

$$\frac{d^2 R}{d\tau^j dk^m} = \frac{y_1^j\frac{1+\alpha\beta^m}{1+\beta^m\left(1+\tau^m\right)}\alpha A^m\left(k^m\right)^{\alpha-1}}{\left\{\sum_i\left[y_1^i - \frac{1}{1+\beta^i\left(1+\tau^i\right)}y_1^i\right]\right\}^2}\frac{-\beta^j}{\left(1+\beta^j\left(1+\tau^j\right)\right)^2}$$

According to above two equations and Eq. (18), we have

$$\frac{2}{R}\frac{dR}{d\tau^j}\frac{dR}{dk^m} - \frac{d^2 R}{dk^m d\tau^j} = \left\{-y_1^j - \frac{2\left(1+\alpha\beta^j\right)A^j\left(k^j\right)^\alpha}{R}\right\}\frac{\frac{1+\alpha\beta^m}{1+\beta^m\left(1+\tau^m\right)}\alpha A^m\left(k^m\right)^{\alpha-1}}{\left\{\sum_i\left[y_1^i - \frac{1}{1+\beta^i\left(1+\tau^i\right)}y_1^i\right]\right\}^2}\frac{\beta^j}{\left(1+\beta^j\left(1+\tau^j\right)\right)^2} < 0$$

Then, we have the equation (19):

$$-\frac{2}{R^3}\frac{dR}{d\tau^j}\frac{dR}{dk^m}+\frac{1}{R^2}\frac{d^2R}{dk^m d\tau^j}=-\frac{1}{R^2}\left[\frac{2}{R}\frac{dR}{d\tau^j}\frac{dR}{dk^m}-\frac{d^2R}{dk^m d\tau^j}\right]>0$$

A3. Proof of model with similarity

Let s^i denote the country *i*'s average similarity to other countries. Then, budget constraint is

$$\left(q^i k^i + c_1^i - y_1^i\right)\left(1+\tau^i\right)R/e\left(s^i\right) = A^i (k^i)^\alpha - c_2^i + T^i. \tag{20}$$

Where, $1/e\left(s^i\right)$ is a cost function faced by country *i*, $e'\left(s^i\right)>0$. T^i is a lump-sum transfer, which is defined as

$$T^i \equiv \left(q^i k^i + c_1^i - y_1^i\right)\tau^i R/e\left(s^i\right). \tag{21}$$

First-order conditions (FOCs) on k^i, c_1^i, and c_2^i yield

$$\frac{1}{c_1^i} = \beta^i\left(1+\tau^i\right)\frac{1}{c_2^i}R/e\left(s^i\right) \tag{22}$$

and

$$q^i\left(1+\tau^i\right)R = \alpha A^i e\left(s^i\right)(k^i)^{\alpha-1}. \tag{23}$$

Thus, net capital inflow can be expressed as,

$$flow^i = \frac{1}{1+\beta^i\left(1+\tau^i\right)}y_1^i + \frac{1+\alpha\beta^i}{1+\beta^i\left(1+\tau^i\right)}\frac{A^i e\left(s^i\right)(\bar{k}^i)^\alpha}{R} - y_1^i \tag{24}$$

The equilibrium of the world loan market in the first period is $\sum\left(flow^i\right)=0$, or

$$\sum_{i\in S}\left(\frac{1}{1+\beta^i\left(1+\tau^i\right)}y_1^i + \frac{1+\alpha\beta^i}{1+\beta^i\left(1+\tau^i\right)}\frac{A^i e\left(s^i\right)(\bar{k}^i)^\alpha}{R} - y_1^i\right)=0. \tag{25}$$

The world interest rate R satisfies:

$$R=\frac{\sum_i \frac{1+\alpha\beta^i}{1+\beta^i\left(1+\tau^i\right)}A^i e\left(s^i\right)\left(k^i\right)^\alpha}{\sum_i\left[y_1^i - \frac{1}{1+\beta^i\left(1+\tau^i\right)}y_1^i\right]} \tag{26}$$

which implies that the impact of inflow tax τ^j on the world interest rate equals to:

$$\frac{dR}{d\tau^j}=\frac{\left(1+\alpha\beta^j\right)A^j e\left(s^j\right)\left(k^j\right)^\alpha \sum_i\left[y_1^i-\frac{1}{1+\beta^i\left(1+\tau^i\right)}y_1^i\right]+y_1^j\sum_i\frac{1+\alpha\beta^i}{1+\beta^i\left(1+\tau^i\right)}A^i e\left(s^i\right)\left(k^i\right)^\alpha}{\left\{\sum_i\left[y_1^i-\frac{1}{1+\beta^i\left(1+\tau^i\right)}y_1^i\right]\right\}^2}\frac{-\beta^j}{\left(1+\beta^j\left(1+\tau^j\right)\right)^2}$$

Let $X^i = \dfrac{1+\alpha\beta^i}{1+\beta^i\left(1+\tau^i\right)} A^i(\bar{k}^i)^\alpha > 0$. Then, we know:

$$\frac{dflow^i}{dR} = -X^i e\left(s^i\right)\frac{1}{R^2}$$

Hence, we have:

$$\frac{dflow^i}{d\tau^j} = \frac{dflow^i}{dR}\frac{dR}{d\tau^j}$$

$$= \frac{X^i e\left(s^i\right)}{R^2} \frac{\left(1+\alpha\beta^j\right)A^j e\left(s^j\right)\left(k^j\right)^\alpha \sum_i\left[y_1^i - \frac{1}{1+\beta^i\left(1+\tau^i\right)}y_1^i\right] + y_1^j \sum_i X^i e\left(s^i\right)}{\left\{\sum_i\left[y_1^i - \frac{1}{1+\beta^i\left(1+\tau^i\right)}y_1^i\right]\right\}^2} \frac{\beta^j}{\left(1+\beta^j\left(1+\tau^j\right)\right)^2}$$

which implies that due to $e'\left(s^i\right) > 0$, $\dfrac{dflow^i}{d\tau^j}$ will increase as s^i increases. Hence, the deflection effect is stronger when the average similarity is higher.

Online Appendix B. Data Definitions

ω(%): The actual country and regional weightings for each fund group, expressed as a percentage, at the end of month

FIFA (%): Flow-implied fund allocation changes scaled by the market size of each country, expressed as a percentage. FIFA is calculated by $FIFA_{c,m} = \sum_i \left(f_{i,t}^{*} \times \omega_{i,c,m-1} \times TNA_{i,m-1} \right)$, where $f_{i,m}^{*} = \sum_{s=1}^{6} f_{i,m+s-1}$ is the sum of capital flows experienced by fund i over the two quarters after and including period t

ExComove (%): Extreme co-movement by the dynamic symmetrized Joe-Clayton Copula method (Patton, 2006; Huang et al., 2019) based on the daily return rate of each country's capital market and daily return rate of developed country stock market index (all from MSCI indices). We use the Copula method to calculate the daily lower tail extreme co-movement rate between each emerging market country c and the developed country index. Finally, we use the median value in 1 calendar month as the extreme co-movement rate of country c in month m

Control: The capital control index on portfolio investment or the capital control index on all kinds of capital flow sourced from Gurnain et al. (2018)

SWACC: The similarity-weighted average of the capital control index on portfolio investment or the weighted average degree of the capital control index on all kinds of capital flow. The weight is the country-pair similarity. Similarity is calculated by the multiplicative inverse of the Euler distance: $Similarity_{c,d} = \left[\sum_i \left(\chi_c^i - \chi_d^i \right)^2 \right]^{-\frac{1}{2}}$, where χ is standardized country characteristics, including region, market size, trade openness, and capital market risk

SWACC_in: The similarity-weighted average of the capital inflow control index on portfolio investment or the weighted average degree of the capital inflow control index on all kinds of capital flow

SWACC_out: The similarity-weighted average degree of the capital outflow control index on portfolio investment or the weighted average degree of the capital outflow control index on all kinds of capital flow

Return: Month-average daily return rate of each country's capital market. The daily return rate is the logarithm difference of the closing price of the stock market index (MSCI)

Risk: The risk of each country's capital market, and the standard deviation of the daily return rate of each country's capital market

Deer: The first difference of the real effective exchange rate of each country

Dcbrate (%): The first difference of each country's central bank interest rate

Online Appendix C

Figure C1. Matrix of country-pair similarity

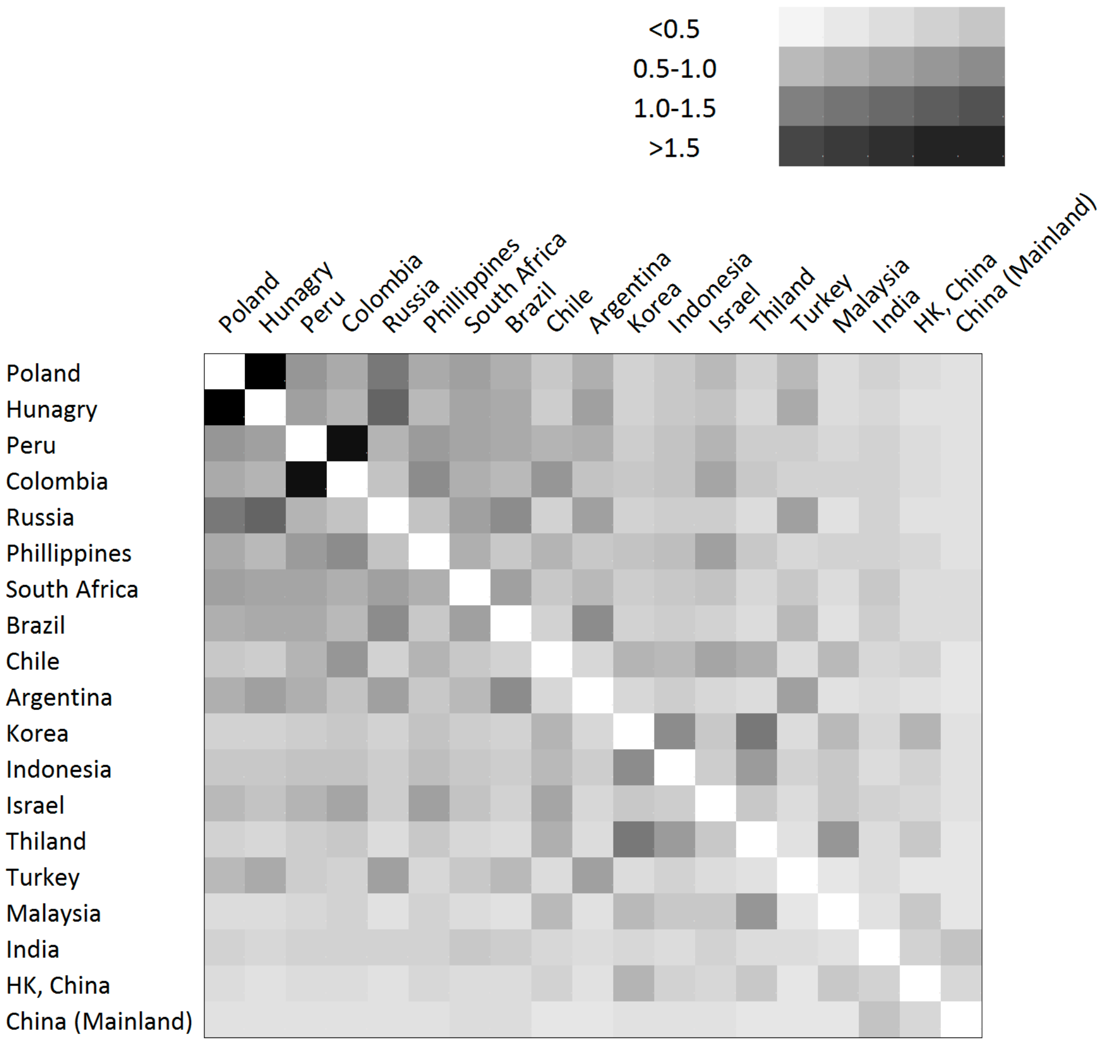

Table C1. Robustness check: Alternative measure of FIFA

This table reports the robustness check on the spillover effect of capital controls on country-portfolio flows, using specification (13). The unit of analysis is a country-month. The dependent variables are alternative measure of the portfolio flows of all fund groups allocated to a country. The variable SWACC denotes the similarity-weighted average capital controls of the rest of the world. SWACC_in and SWACC_out measure the similarity-weighted average capital inflow and outflow controls of the rest of the world, respectively. Control measures the capital controls of own country. In columns (1)–(3), all the index of capital control measures the de jure control on the cross-border portfolio investment, and in columns (4)–(6) all the index of capital control measures the de jure control on all types of cross-border investments through the capital account, including the portfolio investment, FDI and other investments or whole capital account. Appendix B defines the control variables. Country fixed effects and year-month fixed effects are included. Robust standard errors are presented in parentheses. *p < 0.1; **p < 0.05; ***p < 0.01.

	(1)	(2)	(3)	(4)	(5)	(6)
	FIFA2	*FIFA2*	*FIFA2*	*FIFA3*	*FIFA3*	*FIFA3*
SWACC	0.746***	0.413**		0.197***	0.194**	
	(0.219)	(0.174)		(0.0668)	(0.0768)	
SWACC_in			0.525***			0.189**
			(0.196)			(0.0794)
SWACC_out			-0.111			0.217
			(0.532)			(0.139)
Control		-0.0809**	-0.0828**		-0.000877	-0.000811
		(0.0320)	(0.0326)		(0.00482)	(0.00480)
Observations	3,705	3,705	3,705	3,466	3,466	3,466
R-squared	0.267	0.272	0.272	0.451	0.451	0.451
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FEs	Yes	Yes	Yes	Yes	Yes	Yes