Global Risk Appetite, US Economic Policy Uncertainties and Cross-Border Capital Flow

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Abstract: *Based on the global asset portfolio model, this paper created a panel threshold model using EPFR fund data to empirically test the non-linear spillover effects of US economic policy uncertainties on cross-border capital flow for emerging economies. Our study led to the following findings: (1) When the level of global investor risk tolerance is high, rising US EPU will induce a capital inflow into emerging economies, as manifested in the "portfolio rebalancing effect." When the level of global investor risk tolerance is below a critical threshold, this gives rise to risk aversion and emerging economies will experience net capital outflow, i.e. the "flight to quality effect". (2) Equity fund investors have a lower risk tolerance threshold than bond fund investors. (3) According to our heterogeneity analysis, more attention should be paid to monitoring capital flow through actively managed funds, ETF funds, and retail investor funds. The economy should increase financial efficiency and economic resiliency to mitigate capital outflow pressures from the external environment.*

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1. Introduction

China's 14th Five-year Plan and Long-Range Objectives through the Year 2035 call for "improving the administrative framework for cross-border capital flow and stepping up regulatory cooperation to enhance risk control and response under the conditions of opening up". The Central Economic Work Conference held in December 2020 called for "raising risk foreseeability and preventing various risks and challenges". Economic policy uncertainty and global capital flow volatility are major external risks facing China. For China to open up wider to the outside world and access more foreign capital, there is a need to monitor the flow and size of cross-border capital flows and develop countermeasures to cope with their unexpected sudden-stop.

Economic policy uncertainty (EPU) refers to the situation in which economic entities cannot precisely forecast whether, when and how the government will reformulate or change its current economic policies. There are several reasons for this. Countries have enacted or adjusted a large number

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of economic policies since the global financial crisis of 2008, making economic policy response a major external risk to their financial security and economic development (Gulen and Ion, 2016). This has been exacerbated by the sharp rise in the size and volatility of cross-border capital flow since the 1990s (Agosin and Huaita, 2011; Zhang, 2011). Macroeconomic management is made even more complex by the volatility of securities investment, which is a key component of capital flow.

This paper tests the effects of US EPU on the capital flow for emerging economies via securities investment from the perspective of cross-border flow. An unpredictable economic environment tends to make economies less attractive to investment (Baker *et al.*, 2016). When US economic policies become more uncertain, investments tend to shift from the US to other economies, resulting in a capital inflow into emerging economies. A rising EPU will reduce investor risk tolerance (Pástor and Veronesi, 2013). To avoid risk, investors search for "safe havens" and flee the uncertainties of emerging economies for safe assets such as gold and US dollar bonds (Jotikasthira *et al.*, 2012), causing a capital outflow from the emerging economies.

Global risk appetite, often denoted by the VIX index as its proxy variable, reflects investors' financial risk tolerance and attitude (Shaikh, 2019). A greater value of VIX means a smaller risk tolerance of investors. Gauvin *et al*. (2014) found that not only was global risk appetite a key factor in cross-border capital flow, but it could also determine the impact of other factors on capital flow. The global risk appetite is a reflection of financial, economic and political incidents, whereas EPU is associated more with political incidents (Hartwell, 2018). While the global risk appetite has been the most prominent during the Asian Financial Crisis of 1997 and the global financial crisis of 2008, the EPU has been the most prominent during presidential elections, the September 11 terrorist attacks, and other major political incidents. Figure 1 shows the trends of US EPU, the VIX and cross-border bond funds and equity funds from January 2004 to January 2018, revealing some correlation between US EPU and the VIX. From September 2009 to May 2011, EPU stayed at a relatively high level due to the uncertainty of whether the Federal Reserve would continue to pursue quantitative easing (QE). However, interest rate cuts unleashed sufficient liquidity to assuage market nervousness. At this time, the VIX was at the median level. During the US presidential elections in 2012 and 2016, the trends of VIX and EPU also diverged. Moreover, at different VIX values, the correlation between capital flow and EPU varies as well.

The question is how and to what extent does the EPU of developed countries, led by the US, influences cross-border capital flows for emerging economies. Is there any heterogeneity of the effects on bond funds and equity funds? Is the mechanism of impact subject to the impact of global risk appetite? How should emerging economies guard against the risk of abnormal volatility in cross-border capital flows?

This paper introduces the "portfolio rebalancing effect" and the "flight to quality effect" into the theoretical model to discuss the effects of EPU on the cross-border fund investment of emerging economies. Based on the cross-border fund flow data of 21 emerging economies during 2004-2017, we use a panel threshold model to discuss the relative magnitude of both effects on different types of cross-border fund capital flow under various risk appetites. This paper's marginal contributions may be reflected in the following aspects: Theoretically, global risk appetite and EPU are introduced into the model to discuss the relative magnitude of the "portfolio rebalancing effect" and the "flight to quality effect" under different circumstances. Empirically, unlike most studies that analyze quarterly or annual cross-border capital flows based on international balance of payment data, this paper captures the short-term change and adjustment of investor behavior on a higher-frequency dimension and at a more delicate level based on the monthly fund capital flow data of the Emerging Portfolio Fund Research (EPFR) to enrich relevant research on cross-border capital flows. Based on the panel threshold model, we have identified specific threshold values of global risk appetite, and provide empirical evidence for safeguarding and resolving major external financial risks through fund-level and national-level heterogeneity tests.

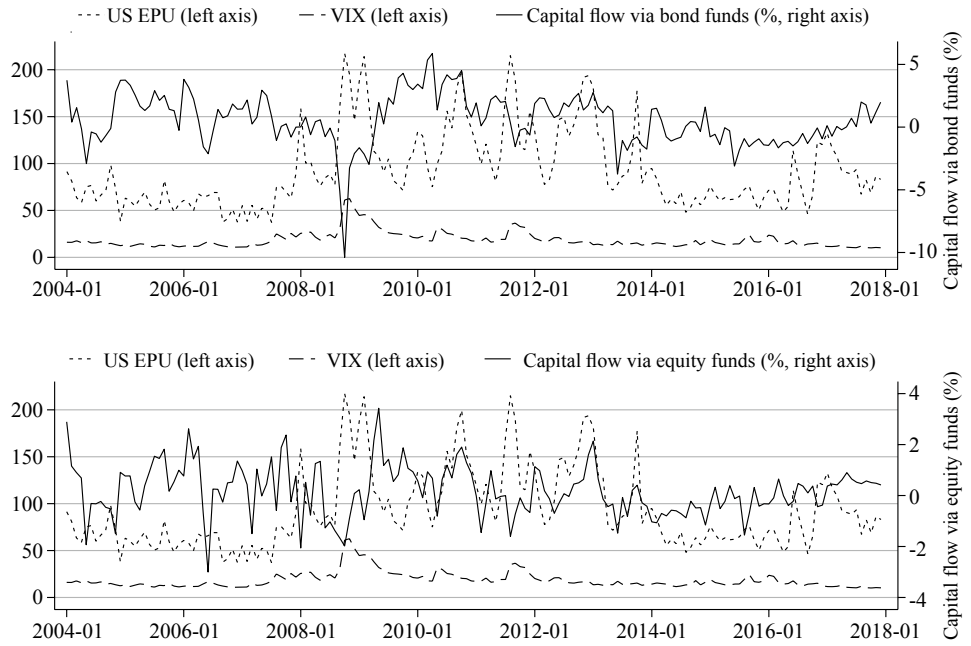

Figure 1: Bond and Equity Capital Flows for Emerging Markets, US EPU and Global Risk Appetite (VIX)

Source: EPFR Database, Wind, Baker *et al*. (2016).

2. Literature Review

This study is related to the following two types of literature: Driving factors of cross-border capital flow and channels for EPU to affect capital flow.

Regarding the driving factors of cross-border capital flow, Fratzscher (2012) integrated global and domestic factors into the "push-pull" factor framework, which became widely accepted. Push factors refer to external factors facing all economies and affecting investment decisions of global investors, such as global risk appetite, global interest rates, and growth rates of advanced economies (Nier *et al*., 2014). Pull factors highlight heterogeneous factors within individual economies, such as domestic economic growth rates, country risks, and domestic interest rates (Fratzscher, 2012; Wang, 2018). Since the global financial crisis in 2008, global risk appetites have become a focus of attention for academia, and empirical research has arrived at relatively robust and consistent conclusions, i.e. the VIX index became a proxy variable for global risk appetite, and an increase in the VIX will cause a capital outflow (Fratzscher, 2012; Ahmed and Zlate, 2014; Bruno and Shin, 2015). EPU is also a key driver of cross-border capital flow. By raising the bond risk premium, EPU nudges investors to change their domestic and foreign asset allocation strategies (Campbell *et al*., 2009). Bernal *et al*. (2016) found that rising uncertainty could affect capital flow by influencing the financing premium between domestic and foreign markets. Chinese academics Yang and Li (2018) found that the size of China's outward direct foreign investment (OFDI) was significantly positively correlated with China's EPU and significantly negatively correlated with host countries' EPU. Tan *et al*. (2018) identified global EPU as a dominant factor of cross-border capital flow for emerging economies. Based on the TVP-VAR model, Wang and Lu (2019) identified EPU as a key driving factor of China's cross-border capital flows.

In terms of influencing channel, a rising EPU will increase the risk of investment in the home country or region. Based on the needs of risk mitigation and capital maintenance, investments tend to

be drawn to countries or regions with a more stable macroeconomic policy environment and higher investment return. Fratzscher *et al*. (2018) defined the flow of capital from regions with an unstable macroeconomic environment and meagre return on assets to places with a more stable macroeconomic environment and higher return on assets as the "portfolio rebalancing effect". Amid the rising EPU of developed countries, overseas investors will transfer funds to emerging economies under the "portfolio rebalancing effect". On the flipside, the rising EPU of developed countries is associated with a sharp decrease in the stock market return of emerging economies and an increase in stock market risks (Tsai, 2017) with a negative impact on investment behavior. Zhao (2020) found that increasing external EPU would cause a capital flight from China's stock market by influencing investor expectations. When investment uncertainty increases, international investors become less tolerant of risk, as reflected in the flight to quality effect, i.e. they disinvest from high-risk assets such as stocks and bonds in emerging economies and shift to safe assets like the US dollar, gold and US treasury bonds (Jotikasthira *et al*., 2012). Using the Panel Smooth Transition Regression (PSTR) model, Gauvin *et al*. (2014) investigated the non-linear effects of the US and EU's EPU on capital flow for emerging economies, and identified global risk as a major threshold variable for the effects of EPU. However, they did not delve into the theoretical mechanisms and relative effects of the above-mentioned two mechanisms. Such a non-linear effect is consistent with the "multiple equilibria" identified in theoretical research. Based on a theoretical model, Bacchetta *et al.* (2012) analyzed the multiple equilibria of investor behaviors during a period of panic, and identified investors' risk tolerance as a key cause of multiple equilibria. From the perspective of transmission network, Li *et al*. (2020) discovered a sharp increase in the total spillover index of EPU under the shock of extreme events. Hence, global risk appetite could be a major variable for the mechanism of the effect of EPU. However, there has been a paucity of research papers that employ theoretical and econometric models to investigate the spillover effects of the EPU of advanced economies under different risk appetites.

3. Theoretical Mechanism

3.1 Building and Sloving of the Global Asset Portfolio Model

Following the above analysis, we constructed the "global asset portfolio model" based on the classical "mean-variance" theory referencing Bacchetta *et al*. (2008). Based on the investor expectation and decision-making model in Zhao (2020), our model investigates US economic policy uncertainty (EPU). The model assumes that international investors allocate investments between J emerging economies and G developed economies. Let a_{jt} be the share of investments in emerging economy j during period t, and a^*_{gt} be the share of investments in advanced economy g. Then, the total share of investments in emerging economies is $a_t=\sum_{j=1}^{J} a_{jt}$, the total share of investments in advanced economies is $a^*_t=\sum_{g=1}^{G} a^*_{gt}$, and $a_t+a^*_t=1$. Investment return for emerging and advanced economies is marked as μ_{jt} and μ^*_{gt}, respectively, and international investors' total return R_t is:

$$R_t=\sum_{j=1}^{J} a_{jt}\mu_{jt}+\sum_{g=1}^{G} a^*_{gt}\mu^*_{gt} \tag{1}$$

The risk aversion coefficient of international investors is marked as γ, and according to the "mean-variance" theory, investors maximize their objective function as:

$$\max_{a_{jt},\,a_{gt}} \; E(R_t)-\tfrac{\gamma}{2}Var(R_t) \tag{2}$$

With the definitions of $A=(a_{1t},a_{2t},\ldots,a_{Jt})$ and $M=(\mu_{1t},\mu_{2t},\ldots,\mu_{Jt})$, the expected return for international investors can be expressed as:

$$E(R_t)=A\overline{M}'+(1-a_t)\overline{\mu}^*_t \tag{3}$$

Where, $\overline{M}=E(M)=(\overline{\mu_{1t}},\overline{\mu_{2t}},\ldots,\overline{\mu_{Jt}})$, which denotes the expected return from emerging economies, and $\overline{\mu_t^*}$ is the total expected return from G advanced economies. Referencing Bacchetta *et al*. (2008), it is assumed that the variance of return for all emerging economies is σ_t^2, and the correlation coefficient between emerging economies is ρ_{EE}. The variance of return for advanced economies is σ_t^{*2}, and the correlation coefficient between advanced economies is ρ_{DD}. The correlation coefficient between emerging economies and advanced economies is ρ_{DE}. The variance-covariance matrix of return for emerging economies is defined as $\sum$.

The variance of the investment portfolio is:

$$Var(R_t)=A\Sigma A'+(1-a_t)^2\sigma_{Dt}^2+2a_t(1-a_t)\rho_{DE}\sigma_t\sigma_t^* \tag{4}$$

Where, $\sigma_{Dt}^2=\frac{1}{G}\sigma_t^{*2}+\left(1-\frac{1}{G}\right)\rho_{DD}\sigma_t^{*2}$, $\frac{\partial A\Sigma A'}{\partial a_{jt}}=2[a_{jt}(1-\rho_{EE})+\rho_{EE}a_t]\sigma_t^2$.

Introducing equations (3) and (4) into equation (2) and obtaining the first-order condition of a_{jt}, we have:

$$E(\mu_{jt})-\overline{\mu_t^*}-\gamma\left[a_{jt}(1-\rho_{EE})\sigma_t^2+a_t\rho_{EE}\sigma_t^2-(1-a_t)\sigma_{Dt}^2+(1-2a_t)\rho_{DE}\sigma_t\sigma_t^*\right]=0 \tag{5}$$

By solving a_{jt} based on equation (5), we have:

$$a_{jt}=\beta_{0t}+\beta_{1t}\left(E(\mu_{jt})-\overline{\mu_t^*}\right)+\beta_{2t}a_t \tag{6}$$

Where, $\beta_{0t}=\frac{\sigma_{Dt}^2-\rho_{DE}\sigma_t\sigma_t^*}{\sigma_t^2(1-\rho_{EE})}$, $\beta_{1t}=\frac{1}{\gamma\sigma_t^2(1-\rho_{EE})}$, and $\beta_{2t}=\frac{-\sigma_{Dt}^2+2\rho_{DE}\sigma_t\sigma_t^*-\rho_{EE}\sigma_t^2}{\sigma_t^2(1-\rho_{EE})}$.

By introducing equation (6) into $a_t=\sum_{j=1}^{J}a_{jt}$, we have:

$$a_t=J\left[\frac{\beta_{0t}+\beta_{1t}(\overline{\mu_t}-\overline{\mu_t^*})}{1-J\beta_{2t}}\right]=J\frac{\sigma_{Dt}^2-\rho_{DE}\sigma_t\sigma_t^*+\frac{\overline{\mu_t}-\overline{\mu_t^*}}{\gamma}}{\sigma_t^2(1-\rho_{EE})-J(\sigma_{Dt}^2+2\rho_{DE}\sigma_t\sigma_t^*-\rho_{EE}\sigma_t^2)}=\frac{\sigma_{Dt}^2-\rho_{DE}\sigma_t\sigma_t^*+\frac{\overline{\mu_t}-\overline{\mu_t^*}}{\gamma}}{\sigma_{Dt}^2+\sigma_{Et}^2-2\rho_{DE}\sigma_t\sigma_t^*} \tag{7}$$

Where, $\sigma_{Et}^2=\frac{1}{J}\sigma_t^2+\left(1-\frac{1}{J}\right)\rho_{EE}\sigma_t^2$, $\overline{\mu_t}$ is the expected return for total emerging economies, and $\overline{\mu_t^*}$ is the expected return for total advanced economies.

Here, we consider a simple situation in which advanced and emerging economies are respectively regarded as two sets of economies with similar macroeconomic fundamentals and similar investment risks. The correlation coefficients for the internal return on assets for the two sets are ρ_{DD} and ρ_{EE}, respectively. Since emerging economies lag behind advanced economies in terms of financial development and institutional quality, there is a small correlation of asset return between the two sets, which is determined by their respective own fundamentals. For the convenience of discussion, referencing Bacchetta *et al.* (2008), we assume the covariance between emerging and developed economies to be 0, i.e. $\rho_{DE}=0$. Then, equation (7) can be simplified as:

$$a_t=\frac{\sigma_{Dt}^2+\frac{\overline{\mu_t}-\overline{\mu_t^*}}{\gamma}}{\sigma_{Et}^2+\sigma_{Dt}^2} \tag{8}$$

Given the US EPU, investors' risk perceptions for various economic entities may change. Referencing Zhao (2020), an multiplicative term is introduced into the variance of return to denote the risk premium factor of investors for various economies after EPU is taken into account.

$$a_t=\frac{f(p)\sigma_{Dt}^2+\frac{\overline{\mu_t}-\overline{\mu_t^*}}{\gamma}}{g(p)\sigma_{Et}^2+f(p)\sigma_{Dt}^2} \tag{9}$$

Where, p is the US EPU index, $f(p)$ is the risk factor assigned by international investors to advanced economies when US EPU is taken into account, and $g(p)$ is the risk factor assigned by international investors to emerging economies. $f(p)$ and $g(p)$ are increasing functions whose values are greater than 0, i.e. $f(p)>0, f'(p)>0, g(p)>0, g'(p)>0$. In other words, the risk factor assigned by international investors to advanced and emerging economies will increase with growing US EPU. Since emerging economies are less developed than advanced economies in terms of financial development and credit disclosure, international investors will assign a higher risk factor to emerging economies than to advanced economies for the same US EPU, i.e. $g(p)>f(p)$.

3.2 Analysis of the Global Asset Portfolio Model

By taking derivative of a_t in equation (9) with respect to p, we obtain the impact of US EPU on the share of emerging economies in total investment funds:

$$\frac{\partial a_t}{\partial p}=\frac{\sigma_{Dt}^2\sigma_{Et}^2(f'(p)g(p)-g'(p)f(p))-\frac{\bar{\mu}_t-\bar{\mu}_t^*}{\gamma}(g'(p)\sigma_{Et}^2+f'(p)\sigma_{Dt}^2)}{(g(p)\sigma_{Et}^2+f(p)\sigma_{Dt}^2)^2} \tag{10}$$

Since emerging economies offer a higher investment return, i.e. $\bar{\mu}_t>\bar{\mu}_t^*$, $\frac{\bar{\mu}_t-\bar{\mu}_t^*}{\gamma}\left(g'(p)\sigma_{Et}^2+f'(p)\sigma_{Dt}^2\right)$ is positive, and denominator $\left(g(p)\sigma_{Et}^2+f(p)\sigma_{Dt}^2\right)^2$ is also positive. The sign equation (10) is subject to the relative magnitude of $f'(p)g(p)$ and $g'(p)f(p)$. When global risk is relatively low, investors are more risk tolerant and will focus more on high return. At this time, an increase in US EPU will give rise to the risk expectations of international investors for advanced economies, causing $f'(p)>g'(p)$. As analyzed before, if $f'(p)g(p)-g'(p)f(p)>0$, $\frac{\partial a_t}{\partial p}>0$, i.e. EPU has a positive effect on the share of investments in emerging economies. That is to say, rising US EPU will induce an inflow of capital into emerging economies, and the "portfolio rebalancing effect" outweighs the "flight to quality effect".

When global risk reaches a certain threshold, however, market panic will spread, and investors become less risk tolerant. Rising US EPU not only affects investors' risk perceptions for the US, but change their risk perceptions for emerging economies as well. Less risk-tolerant investors tend to invest more in advanced economies with more resilient financial markets and a secure investment environment. At this time, international investors will adjust their risk perceptions for emerging economies more than they do for advanced economies, i.e. $g'(p)>f'(p)$, which makes $f'(p)g(p)-g'(p)f(p)<0$, thus $\frac{\partial a_t}{\partial p}<0$. At this time, the "flight to quality effect" outweighs the "portfolio rebalancing effect," and rising US EPU will lead to a decrease in the share of investments in emerging economies and an outflow of cross-border capital from emerging economies.

The above mechanisms are illustrated with Figure 2.

Hence, we put forth the following hypotheses:

Hypothesis 1: When investors are more risk tolerant, rising US EPU will lead to a net inflow of cross-border capital into emerging economies, and a net capital outflow will occur only when risk tolerance is below a certain threshold.

Since equity investment is riskier than bond investment, with other external conditions being constant, equity investors are more sensitive to change in global risk, so the threshold of equity funds should be smaller than that of bond funds. Hence, we put forth the following assumption:

Hypothesis 2: The threshold of equity funds for global risk tolerance is lower than that of bond funds.

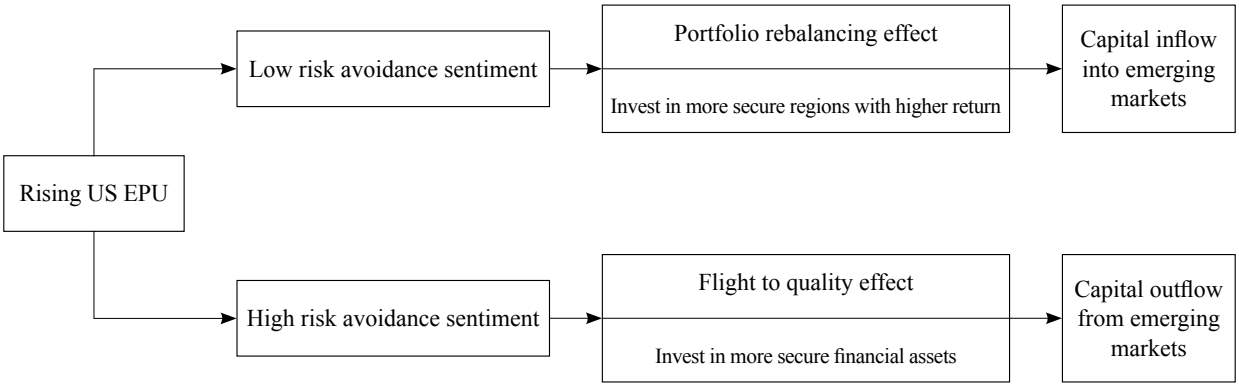

Figure 2: Effects of Global Risk Appetite and US EPU on Cross-Border Capital Flows

4. Data and Variable Explanation

4.1 Cross-border Capital Flow

This paper employs the EPFR database to examine the effects of US EPU on cross-border flow for emerging economies. This database tracks the monthly flow of over 9,000 bond funds and over 18,000 equity funds, which cover some 96% of global fund assets, for a statistical analysis from different dimensions as pricing currency, registration place, and fund type. This paper collects the monthly flow data of 21 emerging economies[1] from January 2004 to December 2017[2]. Jotikasthira *et al.* (2012) found a high degree of match between EPFR data and the international balance of payment data. To avoid the impact of outliers, we have winsorized the capital flow data at the [1% and 99%] percentiles.

4.2 US EPU

Consistent with the capital flow data frequency, we employ the monthly indicator of US EPU calculated by Baker *et al*. (2016) based on a statistical analysis of news keywords such as "uncertainty" and "economic policy" from over 2,000 US-based newspapers. Those monthly indicators have good continuity and time-variance properties.

4.3 Global Risk Appetite

Global risk appetite is denoted by the CBOE VIX index, which is an indicator of US stock market volatility based on short-term option prices on the Standard & Poor's 500 (S&P 500) stock index. Since VIX information is focused on the US, this paper employs investor sentiment from Baker and Wurgler's (2007) as the proxy variable of global risk appetite for robustness.

4.4 Control Variables

This paper has controlled for global push and pull factor variables. Global push factors include: (1) the monthly M2 growth rates of the United States and the eurozone for measuring global liquidity; (2) the US federal funds rate for measuring US domestic economic situation; (3) the crude oil price index and the dollar-based MSCI world index for measuring global asset returns.

Domestic pull factors include: (1) Money market interest rates of sample economies. Rising interest rates will induce a capital inflow; (2) Stock market returns. Since the exchange rate is a key variable of capital flow (Li and Qian, 2011), we have controlled for the stock market returns of economies adjusted for exchange rates. A higher stock market return will attract more international capital inflow; (3) Capital account openness (Chinn and Ito, 2008). Emerging economies that are more open will attract more capital inflow; (4) Financial development index (Svirydzenka, 2016). Emerging economies with a higher level of financial development will face greater capital flow shocks; (5) Quarterly real GDP growth rates. Since the economic outlook is a key variable for international investment, we have controlled for the difference between real GDP growth rate with those of G4 economies (the UK, the US, Japan and the EU); (6) Government debt as a share of GDP for measuring the sovereign debt risks and economies with higher risks are less attractive to investors.

Descriptive statistics are shown in Table 1.

5. Empirical Test and Analysis of Results

[1] Sample countries and regions include: (1) Asia: China, China's Hong Kong, India, Indonesia, Malaysia, Pakistan, the Philippines, South Korea, Thailand, Turkey and Singapore; (2) Europe: Czech Republic, Poland and Russia; (3) Latin America: Argentina, Brazil, Chile, Colombia, Mexico and Peru; (4) Africa: South Africa.

[2] Since the capital account openness indicator is updated by December 2017, the sample range of this paper is dated by December 2017.

Table 1: Descriptive Statistics

Variable	Number of samples	Mean value	Standard error	Min.	Max.	Data source
Cross-border bond fund flow (%)	3,525	0.7816	2.2377	-11.4318	11.2219	EPFR database
Cross-border equity fund flow (%)	3,528	0.2937	1.3017	-22.7696	9.0245	EPFR database
US EPU	168	92.7157	41.6772	37.2660	217.3120	Baker *et al.* (2016)
Global risk appetite	168	18.5233	8.7086	10.1255	62.6395	Wind database
M2 growth rates of the US and the eurozone	168	0.0047	0.01666	-0.0441	0.0725	Wind database and calculated by the authors.
Federal funds rate (%)	168	1.3409	1.7695	0.0664	5.2589	IFS
Crude price index yield rate (%)	168	0.0044	0.1076	-0.4449	0.2830	Wind database
MSCI world index yield rate (%)	168	0.5111	4.1752	-19.0445	10.9039	MSCI official website, and calculated by the authors.
Money market interest rate (%)	3481	5.4067	4.5758	0.0207	80	IFS
MSCI economies' index yield rate (%)	3528	0.9380	7.9163	-50.5052	44.9453	MSCI official website, and calculated by the authors.
Level of capital account openness	294	0.2846	1.3323	-1.9166	2.3467	Chinn and Ito (2008)
Financial development index	294	0.4902	0.1579	0.1709	0.8685	Svirydzenka (2016)
Actual GDP quarterly growth rate (%)	1176	4.5365	3.4988	-13.75	18.641	Wind database and calculated by the authors.
Government debt as a share of GDP (%)	1176	40.0498	20.5422	3.879	111.587	IFS

5.1 Linear Model

In this paper, the benchmark regression model is specified as follows:

$$Flows_{i,t}=\alpha+\beta_1 USuncertainty_{t-1}+\beta_3 X_{i,t-1}+\delta_i+\varepsilon_{i,t} \quad (11)$$

Where, $Flows_{i,t}$ is the net monthly capital flow of cross-border bond and equity funds, which is denoted by the purchase or redemption of funds as a share of total assets under management. $USuncertainty_{t-1}$ is the US EPU index, and $X_{i,t-1}$ is a series of control variables for capital flow with one-period lag to mitigate reverse causality. This paper has controlled for the economy fixed effect δ_i, as well as year fixed effect, for a robustness test. The benchmark regression results are shown in Table 2.

Columns (1) - (3) of Table 2 are the regression results of bond funds. Columns (4) - (6) are the regression results of equity funds. Among them, Columns (1) and (4) have not controlled for fixed effects, Columns (2) and (5) have controlled for the economy fixed effect, and Columns (3) and (6) have simultaneously controlled for the fixed effects of economy and year. The regression coefficient of US EPU is significantly positive at the 1% significance level, which indicates that US EPU is a major factor of global capital flow. When the US EPU increases, the "portfolio rebalancing effect" will outweigh the "flight to safety effect," causing capital to flow into emerging economies. The sign of control variable is consistent with expectation. Obviously, a high degree of global risk tolerance (lower VIX value), a higher domestic stock market yield, and the higher economic growth rate will all attract international investors to invest in emerging economies.

To investigate EPU's effects, we define the period of the 2008 global financial crisis as lasting from July 2008 to June 2009 referencing Ahmed and Zlate (2014). In this manner, our samples are divided into three parts with regression results shown in Table 3. In the precrisis era and the postcrisis recovery period, the level of global risk was lower than in the crisis era, global investors were more risk tolerant,

Table 2: Linear Regression Results

Variable	Cross-border bond funds			Cross-border equity funds		
	(1)	(2)	(3)	(4)	(5)	(6)
US EPU	0.0066***	0.0064***	0.0072***	0.0059***	0.0058***	0.0043***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Global risk appetite (VIX)	-0.0262***	-0.0250***	-0.0228***	-0.0172***	-0.0176***	-0.0131***
	(0.005)	(0.006)	(0.006)	(0.003)	(0.004)	(0.004)
M2 growth rates of the US and the eurozone	-8.8932***	-8.4142***	-14.1728***	-3.2640***	-3.0945**	-6.4539***
	(1.837)	(1.902)	(1.959)	(1.207)	(1.197)	(1.129)
Federal funds rate	-0.0218	-0.0405	-0.0147	0.1422***	0.1318***	0.1198***
	(0.036)	(0.046)	(0.046)	(0.016)	(0.019)	(0.020)
Crude oil price index yield rate	1.2207***	1.1752***	0.8200***	-0.0097	-0.0232	0.3324**
	(0.141)	(0.150)	(0.162)	(0.126)	(0.125)	(0.158)
MSCI global index yield rate (%)	0.1124***	0.1110***	0.1333***	-0.0401***	-0.0403***	-0.0245***
	(0.011)	(0.011)	(0.013)	(0.009)	(0.009)	(0.008)
Money market interest rate (%)	-0.0291**	-0.0452**	-0.0458**	0.0053	0.0049	0.0060
	(0.014)	(0.020)	(0.019)	(0.005)	(0.006)	(0.006)
MSCI economies' index yield rate (%)	0.0583***	0.0578***	0.0554***	0.0315***	0.0312***	0.0288***
	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)
Capital account openness	-0.0409	-0.0634	-0.0596	0.0128	0.0205	0.0239
	(0.057)	(0.129)	(0.127)	(0.013)	(0.051)	(0.053)
Financial development index	-0.2519	-4.1146*	-3.9894*	-0.1767	-1.5838*	-1.5187
	(0.382)	(2.053)	(2.020)	(0.150)	(0.912)	(0.902)
Actual quarterly GDP growth rate (%)	0.1031***	0.1100***	0.1101***	0.0002	0.0012	0.0044
	(0.029)	(0.036)	(0.036)	(0.006)	(0.008)	(0.008)
Government debt as a share of GDP	0.0023	0.0005	0.0015	0.0007	-0.0024	-0.0031
	(0.003)	(0.008)	(0.008)	(0.001)	(0.003)	(0.003)
Constant term	0.3291	2.3857*	2.6041**	-0.0876	0.7521	0.9638*
	(0.296)	(1.159)	(1.139)	(0.113)	(0.515)	(0.553)
Fixed effect of economy	No	Yes	Yes	No	Yes	Yes
Fixed effect of year	No	No	Yes	No	No	Yes
Observations	3461	3461	3461	3462	3462	3462
R^2	0.191	0.196	0.230	0.068	0.070	0.135
Number of countries (regions)	21	21	21	21	21	21

Note: (1) Numbers in parentheses are standard errors; (2) *, ** and *** denote significance at 10%, 5% and 1%, respectively, the same applies to the following tables.

and US EPU coefficient was significantly positive, suggesting that the "portfolio rebalancing effect" had outweighed the "flight to safety effect". To avoid investment uncertainties in the US and seek higher investment return elsewhere, international investors ploughed capital into emerging economies. When there is a sharp increase in global risk during a crisis situation, global investors will become less risk tolerant and withdraw their capital from emerging economies and increase their holdings of US Treasury bonds and other low-risk assets.

5.2 Non-Linear Effects

Based on the above theory and research, this paper has revealed EPU's non-linear effects on capital flow. Nier *et al*. (2014) identified the VIX index as an important indicator for the EPU's spillover effects. This paper adopts a panel threshold model to test the effect of global risk appetite on cross-border capital

Table 3: Regression Results before and after the Global Financial Crisis

Variable	Cross-border bond funds			Cross-border equity funds		
	(1) Before crisis	(2) During crisis	(3) After crisis	(4) Before crisis	(5) During crisis	(6) After crisis
US EPU	0.0093***	-0.1330***	0.0122***	0.0221***	-0.0176***	0.0058***
	(0.002)	(0.013)	(0.001)	(0.002)	(0.003)	(0.000)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effect of economy	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effect of year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1084	231	2104	1085	231	2104
R^2	0.298	0.972	0.378	0.150	0.825	0.367
Number of countries (regions)	21	21	21	21	21	21

flow. This model was introduced by Hansen (1999). In the single-threshold model, the basic model specifications are as follows:

$$Flow_{i,t}=\alpha+\beta_1\cdot I(VIX_{t-1}<\gamma_1)\cdot USuncertainty_{t-1}+\beta_2\cdot I(VIX_{t-1}\geq\gamma_1)\cdot USuncertainty_{t-1}+\beta_3 X_{i,t-1}+\varepsilon_{it} \quad (12)$$

In the dual-threshold model, the basic model specifications are as follows:

$$Flow_{i,t}=\alpha+\beta_1\cdot I(VIX_{t-1}<\gamma_1)\cdot USuncertainty_{t-1}+\beta_2\cdot I(\gamma_1\leq VIX_{t-1}\leq\gamma_2)\cdot USuncertainty_{t-1}+\beta_3\cdot I(VIX_{t-1}>\gamma_2)\cdot USuncertainty_{t-1}+\beta_4 X_{i,t-1}+\varepsilon_{it} \quad (13)$$

Where, $I(\cdot)$ is an indicative function. When the conditions are true, its value is 1; otherwise, it is 0. The threshold variable is global risk appetite indicator VIX, and γ_1 and γ_2 are the corresponding threshold values. By minimizing the residual sum of squares, this model identifies the threshold estimators $\widehat{\gamma_1}$ and $\widehat{\gamma_2}$ to further arrive at the parametric estimators of variables. Before conducting the model estimation, it is also necessary to create F statistic to test the threshold effect. Since the critical value of F statistic cannot be obtained by table look-up, the first-order asymptotic distribution of F statistic is obtained through the bootstrap method to test whether the null hypothesis is true or not. In this paper, 500 bootstraps are used to test the scenarios of no threshold effect, one threshold effect and two threshold effects. As a result, two threshold values are found for the bond funds, i.e. 17.705 and 29.916, and two are found for equity funds, i.e. 12.471 and 22.199. Since equity funds are riskier than bond funds, equity fund investors are less risk tolerant, and their acceptable threshold values is smaller than those of bond fund investors, which is consistent with Hypothesis 2. Figure 3 shows the function graph of likelihood ratios, and the horizontal axis corresponding to the lowest point is the specific threshold value identified in this paper.

Table 4 shows the testing results of the threshold effect. Dual thresholds exist for both bond funds and equity funds, and the threshold value of equity funds is smaller than that of bond funds. Hence, Hypothesis 2 is verified.

Table 5 shows the total sample regression results. Different value intervals of the VIX index have changed the direction and magnitude of EPU's impact on capital flow. This suggests that as the indicator for capital availability and global risk appetite, the VIX index not only affects capital flow by itself, but also determines other push factors' effects on capital flow. As can be seen from the results of Column (1), for bond funds, when VIX is below the threshold value of 29.916, EPU will have a positive effect on capital flow, i.e. the "portfolio rebalancing effect" will dominate as long as risks are within control, but beyond a certain threshold, rising US EPU will cause capital to flow out of emerging economies, which is consistent with the theoretical model laid out in the previous section. As can be seen from the results of Column (3),

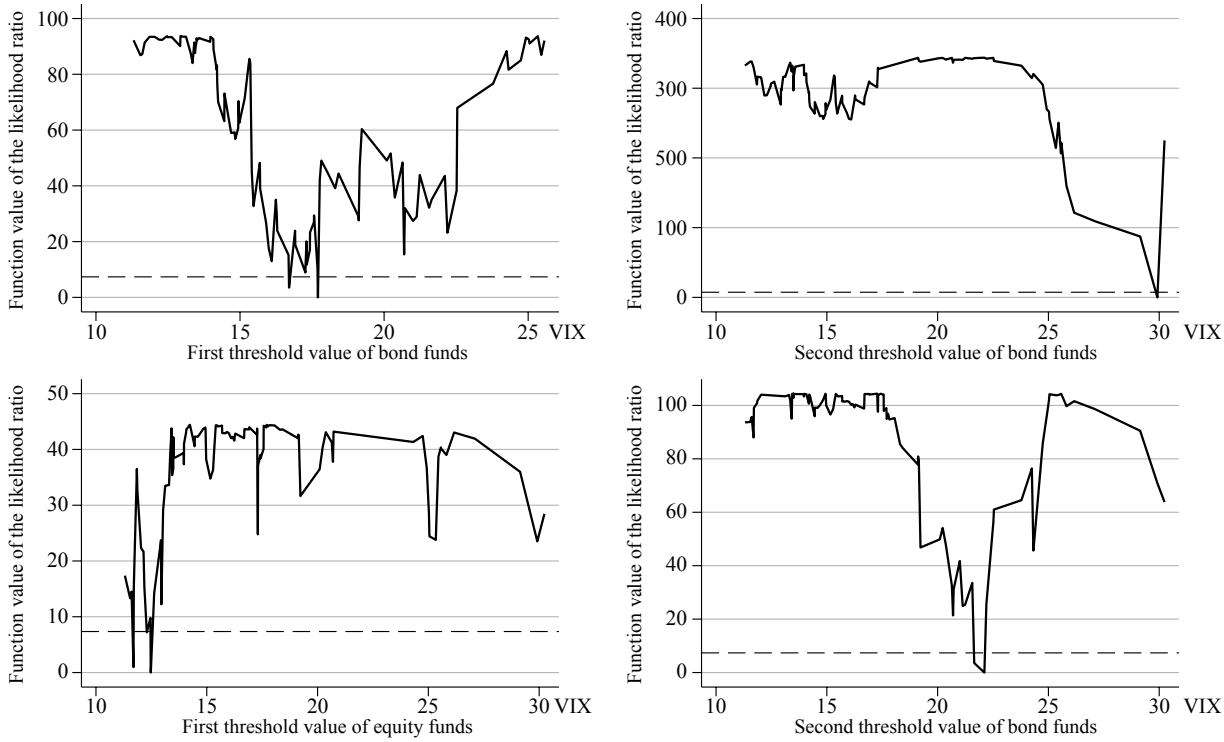

Figure 3: Function Graph of the Likelihood Ratio of Bond Funds (Upper) and Function Graph of the Likelihood Ratio of Equity Funds (Lower)

Table 4: Test of Threshold Effect

Place of fund registration		Bond funds			Equity funds		
	Null hypothesis	F statistic	p value	Threshold value	F statistic	p value	Threshold value
Total samples	I	351.07***	0.0000	17.705	136.77**	0.0180	12.471
	II	78.50***	0.0020	17.705, 29.916	115.53***	0.0000	12.471, 22.199
	III	51.91	0.9080	--	74.80	0.7740	--

Notes: null hypotheses I, II and III indicate the non-existence of threshold value, the existence of one threshold value, and the existence of two threshold values.

Table 5: Results of the Panel Threshold Model Regression

Variable	Bond funds		Equity funds	
	(1) Total samples	(2) Exclusion of offshore financial centers	(3) Total samples	(4) Exclusion of offshore financial centers
US economic uncertainty ($VIX<\gamma_1$)	0.0038***	0.0044***	0.0056***	0.0059***
	(0.001)	(0.001)	(0.001)	(0.001)
US economic uncertainty ($\gamma_1 \leq VIX \leq \gamma_2$)	0.0142***	0.0145***	0.0127***	0.0134***
	(0.001)	(0.001)	(0.001)	(0.001)
US economic uncertainty ($VIX>\gamma_2$)	-0.0098***	-0.0093***	0.0036***	0.0033***
	(0.001)	(0.001)	(0.001)	(0.001)
Control variable	Yes	Yes	Yes	Yes
Observations	2,919	2,641	2,919	2,641
R^2	0.277	0.277	0.121	0.123
Number of countries (regions)	21	19	21	19

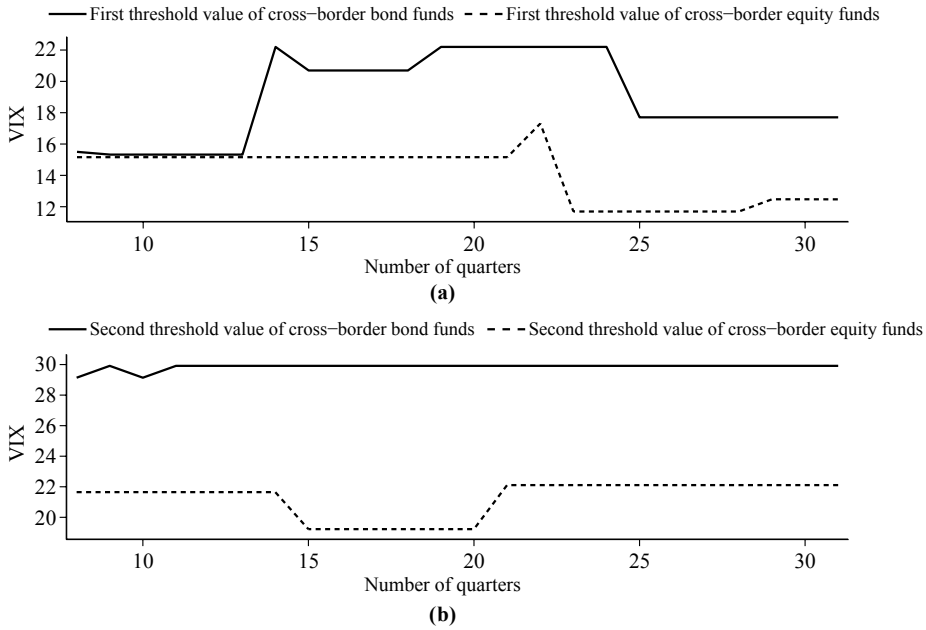

Figure 4: Comparison of Rolling Regression Threshold Values of Bond Funds and Equity Funds

for equity funds, the regression coefficient remains significantly positive when VIX is above 22.199, but the value is significantly smaller than that when VIX is smaller. To exclude the impact of samples with more volatile capital flows, the conclusions are still true after excluding China's Hong Kong and the Republic of Singapore.

To further verify the above-mentioned hypothesis that the "threshold value of equity funds is below that of bond funds," we gradually added three-month data on the basis of data from January 2004 to December 2009, and the results are shown in Figure 4. Horizontal axis is the number of quarters added. Vertical axis is the estimated threshold value. Solid line denotes the threshold value of bond funds. Dotted line is the threshold value of equity funds. Both the first and second threshold values of bond funds are substantially higher than those of equity funds. Hypothesis 2 is thus verified.

5.3 Heterogeneity Analysis

5.3.1 Fund type heterogeneity analysis

This paper further tests the heterogeneous effects of US EPU on fund types.[3] Table 6 reports the regression results of bond funds[4] The coefficient of proactively managed funds turns from positive to negative after the threshold value exceeds 29.9164, and passive funds are free from the threshold effect with a significantly negative regression coefficient. The same threshold value is adopted for ETF funds, mutual funds, retail investor funds and institutional investor funds. However, under a high VIX index, the absolute value of regression coefficient of ETF funds is greater than that of mutual funds, and the absolute value of regression coefficient of retail investor funds is greater than that of institutional investors. The above results indicate that in the bond fund category, passively managed funds, ETF funds and retail investor funds are more risk averse, causing capital flow to respond more to US EPU.

Table 7 reports regression results of equity funds. The threshold values of proactively managed

[3] Pakistan is excluded due to the lack of categorized fund data.
[4] In the interest of length, the result of threshold effect test is not presented here but available upon request. The same below.

Table 6: Regression Results of the Heterogeneous Characteristics of Bond Funds

Variable	(1) Active funds	(2) Passive funds	(3) ETF funds	(4) Mutual funds	(5) Retail investor funds	(6) Institutional investor funds
US EPU ($VIX<\gamma_1$)	0.0285***		0.0126**	0.0215***	0.0238***	0.0195***
	(0.001)		(0.005)	(0.001)	(0.001)	(0.001)
US EPU ($\gamma_1 \leq VIX \leq \gamma_2$)	0.0080***			0.0066***	0.0066***	0.0064***
	(0.001)			(0.001)	(0.001)	(0.001)
US EPU ($VIX>\gamma_2$)	-0.0196***			-0.0201***	-0.0253***	-0.0184***
	(0.001)			(0.001)	(0.002)	(0.001)
US EPU ($VIX \geq \gamma_1$)			-0.0612***			
			(0.007)			
US EPU		-0.0068***				
		(0.002)				
Control variable	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,500	2,200	2,200	2,540	2,540	2,540
R^2	0.351	0.117	0.306	0.343	0.320	0.292
Number of countries (regions)	20	20	20	20	20	20

Notes: Since passive funds demonstrate no threshold effect, we performed the estimation using Model (11).

Table 7: Regression Results of the Heterogeneous Characteristics of Equity Funds

Variable	(1) Active funds	(2) Passive funds	(3) ETF funds	(4) Mutual funds	(5) Retail investor funds	(6) Institutional investor funds
US EPU ($VIX<\gamma_1$)	0.0008*	0.0002	0.0011**	0.0045***	-0.0012***	0.0045***
	(0.000)	(0.001)	(0.000)	(0.002)	(0.000)	(0.001)
US EPU ($\gamma_1 \leq VIX \leq \gamma_2$)		0.0128***				0.0136***
		(0.002)				(0.001)
US EPU ($VIX>\gamma_2$)		-0.0100***				0.0032**
		(0.002)				(0.001)
US EPU ($VIX \geq \gamma_1$)	-0.0029***		-0.0024***	-0.0149***	-0.0075***	
	(0.001)		(0.000)	(0.002)	(0.001)	
Control variable	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,520	2,200	2,540	2,200	2,540	2,540
R^2	0.239	0.227	0.230	0.194	0.258	0.233
Number of countries (regions)	20	20	20	20	20	20

funds and ETF funds are 19.2275 and 20.6432, respectively, which are below the threshold values of passively managed funds and mutual funds (31.9295 and 29.9164). While rising US EPU has led retail investors to flee emerging economies, institutional investors will increase equity fund investments in emerging economies. The implication is that proactively managed funds, ETF funds and retail investor funds are more risk averse and sensitive to global risks.

Except for the differences of passive bond funds, the above findings are consistent with Brandão-Marques *et al*. (2015). Since passive funds are usually pegged to a specific index without pursuing excess return to beat market performance, their fund managers are not motivated to closely follow market situations and global risks. Hence, passive funds are less risk sensitive than proactively managed funds.

With their flexibility and liquidity, ETF funds have attracted a great deal of profit-seeking short-term investments (Sushko and Turner, 2018). Compared with such fundamental factors as growth prospects, short-term investors are more sensitive to changing risks. Without professional risk management competence and investment experience, retail investors are more sensitive to changing global risks compared with institutional investors. Rising US EPU will cause them to flee emerging economies.

5.3.2 Heterogeneity analysis at the level of economies

To investigate how the capital flow of various economies is influenced by such indicators as capital account openness, financial market development, and economic growth rate, we divided the samples into three groups by their medians. Regression results of cross-border bond funds are shown in Table 8, and those of cross-border equity funds are shown in Table 9. For bond funds, the thresholds for the coefficient of US EPU to turn from positive to negative are all 29.9164. After VIX crosses this threshold, countries (regions) with higher financial development and higher GDP growth have smaller absolute values of regression coefficients. This indicates that the level of financial development and GDP growth have somewhat eased EPU's negative capital flow effects. The same conclusion can be drawn for equity funds.

5.4 Robustness Test[5]

5.4.1 Replacing the EPU variable

We performed a regression analysis using global EPU as the instrumental variable for US EPU. Except for the negative correlation between bond funds and global EPU under the low VIX value, there is no significant change in the sign and magnitude of threshold effect and regression coefficient, i.e. our conclusions are robust.

5.4.2 Replacing the risk appetite variable

To test the sensitivity of regression results of the risk appetite, we replaced VIX with investor

Table 8: Heterogeneity Regression Results for Bond Funds at the Country (Region) Level

Variable	Capital account openness		Financial market development		GDP growth rate	
	(1) Low	(2) High	(3) Low	(4) High	(5) Low	(6) High
US EPU ($VIX<\gamma_1$)	0.0045***	0.0043**	0.0064***	0.0024	0.0276***	0.0044
	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)	(0.002)
US EPU ($\gamma_1 \leq VIX \leq \gamma_2$)	0.0152***			0.0135***	0.0059***	0.0161***
	(0.002)			(0.002)	(0.001)	(0.003)
US EPU ($VIX>\gamma_2$)	-0.0106***			-0.0095***	-0.0182***	-0.0098***
	(0.002)			(0.002)	(0.001)	(0.003)
US EPU ($VIX \geq \gamma_1$)		-0.0147***	-0.0152***			
		(0.002)	(0.001)			
Control variable	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,668	1,251	1,668	1,251	1,807	1,112
R^2	0.285	0.278	0.254	0.336	0.289	0.302
Number of countries (regions)	12	9	12	9	13	8

[5] In the interest of length, robustness test results are not shown but available from the authors upon request.

Table 9: Heterogeneity Regression Results for Equity Funds at the Country (Region) Level

Variable	Capital account openness		Financial market development		GDP growth rate	
	(1) Low	(2) High	(3) Low	(4) High	(5) Low	(6) High
US EPU ($VIX<\gamma_1$)	0.0067*** (0.001)	0.0043*** (0.001)	0.0065*** (0.001)			
US EPU ($\gamma_1 \leq VIX \leq \gamma_2$)	0.0144*** (0.002)	0.0110*** (0.002)				
US EPU ($VIX>\gamma_2$)	0.0050*** (0.001)	0.0026 (0.002)				
US EPU ($VIX \geq \gamma_1$)			-0.0027* (0.001)			
US EPU				0.0066*** (0.001)	0.0056*** (0.001)	0.0064*** (0.001)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,668	1,251	1,668	1,251	1,807	1,112
R^2	0.146	0.099	0.092	0.096	0.064	0.091
Number of countries (regions)	12	9	12	9	13	8

Notes: Since no threshold effect is demonstrated in Columns (4) - (6), we performed the estimation using Model (11).

sentiment from Baker and Wurgler's (2007) for a regression analysis. The sign of US EPU is consistent with benchmark regression, i.e. our conclusions are still valid using another method for measuring the critical threshold variable.

5.4.3 Controlling for the EPU of economies with capital inflows

We included in the control variables on EPU index for economies with capital inflows to exclude the EPU impact of such economies, and the regression results remain robust.

6. Conclusions and Policy Recommendations

With the cross-border portfolio capital flows of emerging economies as the subject of research, this paper created a theoretical model to explain the effects of US EPU on cross-border capital flow, and tested the theoretical model with the monthly cross-border fund data of 2004-2017. In the panel threshold model, we identified the thresholds of global risk appetite as the threshold variable. According to our analysis, when the VIX index is below the threshold, rising US EPU will cause securities investment to flow into emerging economies, i.e. the "portfolio rebalancing effect" holds sway; when VIX exceeds the threshold, rising US EPU will cause international capital to exit emerging economies. After classifying fund types, we found that proactively managed funds, ETF funds and retail investor funds were more sensitive to global risk appetites, and that increasing domestic GDP growth rates and financial market development were conducive to easing the negative impact of rising EPU on capital flow.

We put forth the following policy recommendations for emerging economies to cushion the capital flow effects of EPU.

First, global risk appetite and the EPU of countries have a major influence on cross-border capital flow. To minimize the negative impact of a worsening financial environment, countries should increase their observation and monitoring of the external financial environment and make targeted responses to

different types of global risk shocks.

Second, supervision of cross-border capital flow should focus on both the aggregate amount and the structural change of the cross-border capital flow. Sudden and significant short-term capital flows via securities investment will affect a country's asset prices and financial stability. Hence, countries should closely monitor their capital flow, pay attention to proactively managed funds, ETF funds and retail investor funds that are more sensitive to global financial situations, and improve market monitoring, early warning and response mechanisms.

Lastly, countries should improve their economic development while opening up their capital markets to maintain sound economic growth rates at home. They should develop and improve their domestic financial markets to attract cross-border capital. In the interest of global financial health and stability, they should also improve their monetary policy and macro-prudential policy, maintain policy transparency, reduce the impact of domestic policy uncertainty, step up international economic policy coordination, and prevent systemic financial risk.

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