Capital Control and Heterogeneous Impact on Capital Flows

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15 August 2022

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August 16, 2022

Abstract

This paper analyzes the heterogeneous direct and spillover effect of capital control on gross capital flows across three major institutional sectors namely public sector, banks and corporate. The paper examines the possible heterogeneity in the effect of capital control on the capital inflows to these institutional sectors using spatial econometric models. The empirical findings indicate that the direct effect of capital control moderates portfolio inflows to public sector whereas the portfolio inflows to banks and corporate sector does not respond to the capital control measures. The spillover effect of capital control increases capital inflows to all sectors in other countries. The paper explains the observed heterogeneity in the capital control effects by introducing signaling effect in a portfolio choice model. The paper argues that the heterogeneous direct effect is driven by private signals of capital control received by the investors about the state of economy whereas the spillover effect of capital control is mainly driven by the hedging and search for better yield.

Keywords: Capital control, Spillover effect, Portfolio Choice, Signaling effect, Spatial Durbin Model

JEL Codes: F32,F41, C21

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Capital Control and Heterogeneous Impact on Capital Flows

1 Introduction

As global integration increased, emerging market economies experienced greater association with global financial cycles. Accessibility to cheap foreign capital increased during boom phase of financial cycle whereas sudden stops triggered capital flight translating into macroeconomic crisis. In this context, capital control appeared to be a suitable policy measure for safeguarding the domestic economy from volatility of foreign capital flows (Korinek, 2010, 2011; Jeanne and Korinek, 2010; Costinot et al., 2014). However, capital control measures also imparts signaling effect to foreign investors about the state of domestic economy. Bartolini & Drazen (1997) and Drazen (1997) argued that the signaling effect of capital control policies paints adverse image in the minds of foreign investors in terms of lack of domestic controls. On the other hand, capital control also leads to have spillover to other countries as capital flows diverts to other destination countries. The direct and spillover effect, thereby, modulates the flows of international capital across destination countries. However, the nature of the capital flows varies widely across different institutional sectors namely Public sector, Corporate and Banks. Following recent papers by Avdjiev et. al (2018) and Emter, Killeen McQuade (2021), the drivers of capital flows to these institutional sectors can be very different. According to their findings, the global risk aversion appears to drive capital flows to banking and corporate sectors whereas the effect of global risk aversion is muted in case of capital flows to public sector. Following the heterogeneity of capital flows across these institutional sectors, this paper evaluates the heterogeneous effect of capital control as policy measures on gross capital inflows to different sectors of economy in terms of the direct effect and the spillover effect. Further, the paper provides a structural interpretation of such heterogeneity by incorporating signaling effect in a portfolio choice model.

This paper addresses three major strand of literature. First, the paper analyzes the effect of capital control in terms of direct effect and spillover effects. Second, the paper extends the effect of capital controls on capital flows across different institutional sectors and lastly, the paper proposes a structural framework to explain the heterogeneous effect of capital control using a portfolio choice model with signaling effect. Capital control emerged as policy toolkit for countries facing volatile capital flows. Emerging market economies started liberating capital accounts since early 1990. Greater accessibility of foreign financial markets lead to portfolio rebalancing decisions of global investors as investors search for higher yield. On the recipient side, these countries experienced cheap foreign capital during financial boom. However, the bust episodes of global financial cycle also lead to adverse impact on these economies. As optimism about global financial cycle faded, the foreign capital started to withdraw from these countries, leading to currency depreciation and balance of payment crisis. The financial integration lead to heightened macroeconomic and financial instability (Reinhart and Rogoff, 2009). The policymakers responded by restricting the capital flows. In this context, capital control emerged as a possible toolkit to modulate capital flows in these countries. Capital control, more aptly known as a tool for controlling capital account of any country, is often considered as a part of macroprudential toolkit. The effectiveness of capital control measures are often debated in literature. Capital control restricts the volatility of capital flows and thereby, safeguards domestic economy from sudden stops and currency fluctuations, thereby leading to macroeconomic and financial stability. Following the cue, the welfare gains from capital controls provides policy justifications (Korinek et. al. (2010); Jeanne and Korinek, 2010; Costinot et al., 2014). Apart from the macroeconomic stability, the financial stability is ensured by the capital controls (IMF, 2011, 2012). The effectiveness of capital control, thereby, provides a strong justification towards its inclusion in policy tool (Ostry, 2011 & 2011). However, the effectiveness of capital control was questioned by the signaling effect of capital controls (Bartolini & Drazen (1997) and Drazen (1997)). The imposition of capital account restrictions appeared to be hostile policy measures by the foreign investors. Bartolini & Drazen (1997) argued that the foreign investors viewed these controls as lack of domestic controls and instability of domestic economy. Capital controls, thereby, appeared to have longer lasting effect on capital flows to the recipient countries. In recent times, Jinjarak, Noy, and Zheng (2013) observed similar signaling effect of capital controls in their empirical analysis. Forbes et. al. (2016) also observed similar effect of capital controls in an interview with top fund managers of global banks ad the effect was more prominent for public sector flows. The spillover effect of capital control, on the other hand, is observed in the deflection of capital flows to other destination countries. Following Forbes et. al. (2016),Giordani et. al.

(2017),Pasrica et. al. (2018), the spillover effect of capital control is mainly driven by risk transfer motive of the global investors. As one country increases capital account restrictions, capital flows diverts to other destinations in search of higher return. However, the spillover exposes other destination countries to multilateral externalities on social welfare (Korinek, (2011); Costinot et al. (2014)). This paper analyzes the direct and spillover effect of capital control in a multi-country set up by focusing on portfolio inflows and other investment inflows separately. The rationale of differentiating between these two types of inflows is that the nature of these flows are very different from each other. Existing literature suggests that the portfolio inflows are mainly adjusted in short term and thereby, are more responsive to capital controls (Forbes et. al. (2016)). Beyond this segmentation of inflows, the paper adopts a noble identification for analyzing the direct effect and spillover effect of capital controls in a more parsimonious way. The empirical specification of existing literature on capital control effects, imposes identifying restrictions on the particular propagation of capital control shocks across countries. These recent works used a panel of countries for analyzing the direct effect of capital controls where the direct effect originates from own countries' capital account openness and spillover effect emerges from capital controls of another set of countries. This paper extends the spatial Durbin model to analyze the impact of direct effect and spillover effect by introducing own-country capital account openness and spatial lagged values of capital account openness of other countries (except own country) in the panel regression. The benefit of using such spatial models lies in the fact that the identification of spillover impact is governed by the spatial dependence and thereby, becomes more parsimonious in nature.

Apart from the identification, the paper also augments the heterogeneous effect of capital controls on global capital flows on different institutional sectors - public, banks and corporate. Recent research by Avdjiev et. al (2018) observed that the capital flows to different institutional sectors are heterogeneous in nature. The factors influencing these flows varies across the sectors. Global risk aversion modulates capital flows to banks and corporate more prominently whereas the effect of global risk aversion is not significant in case of capital flows to public sector. On similar topic, Emter et.al. (2020) analyzed the cross-border claims of banking sector to non-banking institutions for Ireland and they observed that the cross border flows to non-financial institutions are affected by tightening of monetary policy and macro prudential policies. Kim and Zhang (2020) observed that the business cycle fluctuation of global capital flows differ between private sector and public sector flows - the private sector capital flows are generally pro-cyclical in nature whereas flows to public sector is counter-cyclical in nature. Such heterogeneity in the drivers and the nature of these flows underlines the importance of sector-wise analysis of capital flows in the context of capital control shock. The capital control shocks are often designed to manage capital account openness and thereby, affects the capital flows at aggregate level. However, the effect of such capital account restrictions, can be different across sectors due to the underlying heterogeneity. Hence a detailed analysis of heterogeneous impact of capital controls may provide better insights to policymakers in terms of designing suitable policy measures. Beyond the nature of the institutional flows, the role of these institutional flows also varied across different crisis episodes. For instance, sovereign debt was mainly influential in Latin American balance of payment crisis during early 1990's (Aguiar and Amador, 2011; Gourinchas and Jeanne, 2013) whereas private sector flows dried up in case of East Asian Crisis in 1997 (Corsetti et. al. 2000; Rajan, 2009). I analyze the direct and spillover effect of capital control on capital inflows across these institutional sectors to unveil any heterogeneity in the effect of capital control.

Using capital flows data on quarterly frequency, the paper observes that the capital control measures moderates portfolio inflows to public sector significantly. The direct effect of capital control reduces portfolio inflows significantly in public sector. The inflows to banks and corporate is less effected by the direct effect of capital controls. This heterogeneity in capital control effect, can be linked to the signaling effect of capital control. One can argue that the investors perceive the capital control measures as lack of domestic control in the destination countries. The private signal of investors dictate the global investors to rebalance their portfolio away from the public sector of foreign countries. Following Forbes et. al. (2016), the fund managers highlighted that the capital control signals control risk for sovereign bonds. The heterogeneity in the direct effect of capital control aligns with the view. Further, the spillover effect of capital control was observed across all sectors. The spillover effect was marginally higher in case of corporate, followed by the banking sector. The findings of spillover effect can be explained by the hedging mechanism and risk aversion of investors. The effect of capital control follows similar pattern in case of other investments. However, the effects are not statistically significant. Further, the portfolio adjustment due to direct and spillover effect appeared to be immediate in nature. As investors face the shock of higher capital account restrictions, they adjust their portfolio debts immediately away from the destination country imposing capital controls. The adjustment happens in case of portfolio flows to public sector. The spillover effect, on the other hand, starts immediately as investors start aligning their portfolio to other destination countries and the adjustments happen over time. The corporate flows respond more strongly than public sector flows and the adjustment takes 1-3 quarter. Combining these observations, it can be argued that the effect of capital control on capital flows is highly heterogeneous in nature. Further, the signaling effect appears to be one of the dominating factors inducing such heterogeneity. In order to support the signaling mechanism, the paper proposes a portfolio choice model in multi-country set up. Following Devereux & Sutherland (2006,2010) and Tille & Van-wincoop (2011), the paper extends the portfolio choice into three country set up where the capital control shock is modelled as iceberg trade cost. The signaling effect of capital control is introduced as incomplete information in the investors' portfolio choice problem. The paper argues that the heterogeneity in signaling effect introduces the heterogeneity in the portfolio choice which corroborates with the empirical findings. The comparative statics, further, demonstrates that the direct effect and spillover effect of capital control is homogeneous in nature in the absence of the signaling effect. The main contribution of the paper is to validate the heterogeneity in the effect of capital control across different institutional sectors and extending the findings to a portfolio choice model for identifying the signaling mechanism of capital control.

Remaining of the paper is organized as follows - **Section 2** describes the empirical framework, data descriptions are provided in **section 3**, empirical findings are illustrated in **Section 4**. The structural model is demonstrated in **Section 5**, followed by the effect of signals in **Section 6**. The paper concludes with summarizing of the findings in **Section 7**.

2 Empirical Framework

I use multi country panel data set up to estimate the direct and spillover effect of capital control using a spatial Durbin model. Before getting into details, I discuss the rationale behind the choice of spatial models. The empirical framework is designed to estimate the direct and spillover effect of capital control. Though the direct effect is relatively easier to identify, the spillover effect is difficult to quantify without suitable identifying restrictions. Unlike existing literature, the spillover shock of capital control is defined as weighted average of capital account restrictions of other countries. For instance, the spillover effect of capital control on any particular country (say, Brazil) depends upon the capital account openness of other similar countries. These other countries can be considered as destination substitutes for capital flows. Hence, increase in capital account restrictions in any one of these countries can divert capital flows towards Brazil. Hence the spillover effect is a combined measure of capital account restrictions in other countries (except own country). More specifically, the spillover shock variable can be written as

$$Cap_{it}^{Spill} = \sum_{j \neq i} W_{ij} Cap_{jt} \tag{1}$$

where W_{ij} suitable choice of weight matrix which estimates spillover and Cap_{jt} is the capital account restrictions/ openness in country j at time t. We assume that the weights are time invariant to avoid possible endogeneity in the estimation. The choice of w_{ij} dictates the spillover effect. w_{ij} can be interpreted as the weight of capital account openness/ restrictions of country j on country i. Since the choice of this weight matrix influences the empirical specification, a detailed discussion on w_{ij} is provided after the empirical specification.

Following the definition of spillover and suitable choice of weight matrix, the empirical framework can be described as follows

$$C_{it} = \gamma_D Cap_{i,t-1} + \gamma_S \sum_{j \neq i} w_{ij} Cap_{j,t-1} + \theta_D^M Macro_{i,t-1} + \beta X_{i,t-1} + \alpha_i + \epsilon_{it} \tag{2}$$

Here, i and j stands for destinations of capital flows and t represent time stamp. C_{it} is the cross - border gross flows of capital to country i at time t, $Cap_{i,t-1}$ is the measure of capital account restrictions at time (t-1), $\sum_{j \neq i} w_{ij} Cap_{j,t-1}$ is the spillover measure, $Macro_{i,t-1}$ is the macro prudential policy in country i at time (t-1), $X_{i,t-1}$ is the pull-push factors of capital flows which act as controls in the regression. α_i is the spatial fixed effects which captures country heterogeneity. The primary coefficients of interest are γ_D and γ_S. γ_D measures the direct effect of capital control and

γ_S is the spillover estimate. Here capital account restrictions, macro prudential policies and other controls are included with a lag of 1 quarter to avoid endogeneity bias.

Eq. 2 is equivalent to Spatial lagged exogenous model (SLX in short) where w_{ij} are the bilateral spatial weights. The model can be estimated using ordinary least squares. However, Eq. 2 fails to include the unobserved characteristics of investors which dictates capital flows to foreign countries. A typical example of such unobserved characteristics include investor sentiments towards these destination countries. These unobserved effects pose threat to the coefficient estimates due to omitted variable bias. In order to over the bias, I use an instrument which is weighted average of capital inflows to other destinations as proxy of investor unobserved characteristics. The rationale behind the instrument, can be drawn from the seminal work of Autor, Dorn and Hanson (2013). If the other destination countries are experiencing higher capital flows, the global investors are likely to be upbeat about their investment sentiment and that is likely to increase capital flows to destination country i. I use the same weight matrix w_{ij} to estimate the instrument variable. Here the underlying assumption is that the influence of other country's capital control spillover is proportional to the weight of those countries capital flows.

With this modification, the revised version of Eq. 2 can be written as

$$C_{it} = \rho^S \sum_{j \neq i} w_{ij} C_{jt} + \gamma_D Cap_{i,t-1} + \gamma_S \sum_{j \neq i} w_{ij} Cap_{j,t-1} + \theta_D^M Macro_{i,t-1} + \beta X_{i,t-1} + \alpha_i + \epsilon_{it} \quad (3)$$

Here the first term i.e. $\sum_{j \neq i} w_{ij} C_{jt}$ is the instrument controlling for unobserved investor characteristics.

Eq. 3 includes spatial lagged values of capital inflows and the specification follows Spatial Durbin Model (SDM). SDM models cannot be estimated using ordinary least squares due to the presence of spatial lagged terms (Elhorst, 2009). I follow the estimation methodology suggested by Elhorst (2009) and LeSage(2006,2010) to estimate the model at quarterly frequency.

Next, the empirical specification is modified by relaxing the assumption about lagged impact of capital control. Here Eq. 3 is modified by introducing different lag length (including positive and negative lags). The negative lag value corresponds to the leading effect of capital control. A significant value of direct and spillover effect should indicate possible anticipation effect given a negative lag value. On the other hand, statistically significant coefficient value corresponding to positive lag value refers to gradual adjustment of the portfolio choice given the capital control shocks. The empirical specification can be written as

$$
\begin{aligned}
C_{it} = \rho \sum_j W_{ij} log(C_{jt}) + \gamma_{D,k} Cap_{it-k} + \gamma_{S,k} \sum_j W_{ij} Cap_{jt-k} + \theta^M_{D,k} Macro_{i,t-k} \\
+ \beta X_{it-1} + \epsilon_{it} \text{ for k = -1(1)5}
\end{aligned}
\tag{4}
$$

Eq. 4 is estimated using the same quarterly data and the lag values varied over (-1) quarter to 5 quarters. All the lagged variables are not included at the same time in the regression due to possible multi-collinearity issue. As the capital account restriction are slow moving variables, the subsequent lag values can be exactly identical in nature and hence, multiple lag values will create multi-collinearity, resulting in oversize coefficient estimates.

2.1 Choice of spatial matrix

As indicated previously, the choice of weights w_{ij} plays crucial role in the estimation of the direct and spillover effect. The spatial weights are derived as correlation between cross-border gross capital flows to destination i and j over time. Here the rationale is that if two countries receive similar gross capital inflows i.e. high correlation in absolute terms, they are deemed to strategic complements (if correlation is positive) or strategic substitutes (if correlation is negative). A typical global investor is likely to consider Country j as destination for his investment portfolio when country i increases capital account restrictions. With this rationale, the weights are also justified for spatial lagged variable. The choice of correlation coefficient as weight matrix can be justified from the gravity models of portfolio flows. Following the gravity equations, two countries with highly correlated capital flows are likely to have similar profile in the investors' choice set and thereby should be highly influenced by capital account restrictions of each other. However, the criticism of using time invariant correlation comes with the choice of time episodes. As the countries experience different levels of capital account openness over time, I use full sample and sub-sample based correlation weights to quantify the spillover variable and lagged spatial variable. The weights w_{ij} is normalized such that sum of weights for country i adds up to 1 and own country weight become 0 i.e.

$$w_{ij} = \begin{cases} \frac{r_{ij}}{\sum_j r_{ij}} & \text{if } j \neq i \\ 0 & \text{if } j = i \end{cases} \tag{5}$$

where r_{ij} is the correlation coefficient between C_{it} and C_{jt} over time.

3 Data used

The Spatial Durbin Model (from Eq. 3) is estimated using quarterly data. This choice of high frequency is dictated by the findings of recent studies of capital flows (e.g. Avdjiev et. al (2018); Emter et. al. (2020) etc.). These studies observed immediate adjustments of capital flows in higher frequency. The time period of estimation is from Q1 1997 till Q4 2018. The choice of time period is dictated by the availability of quarterly cross border flows, capital account restriction index and other control variables. I consider 20 emerging market economies for the analysis given quarterly data availability. These countries are

Table 1: Choice of countries

Argentina	Brazil	Chile	Colombia	Mexico
Peru	China	India	Indonesia	Malaysia
Philippines	Thailand	South Africa	Costa Rica	Latvia
Poland	Romania	Hungary	Turkey	Ukraine

The effect of capital control is estimated on gross capital inflows given our choice of countries and the fact that majority of capital control measures adopted by these countries targeted capital inflows (Forbes et. al. (2016)). The cross-border gross capital flows data is sourced from BIS CBS and Avdjiev et. al (2018). BIS Consolidated Banking Statistics (CBS) provides cross border flows of capital inter-mediated by the banks. The data covers capital flows to banks and non-financial institutions. However, the coverage of capital flows in BIS data is mainly confined to cross-border loans and deposits. To get a better understanding about the overall portfolio and other investment flows, the newly constructed data from Avdjiev et. al (2018) is used. This quarterly gross capital flows data provides a comprehensive coverage of capital flows covering data from IMF Balance of payments, BIS LBS and CBS data, BIS Debt Securities, World Bank data (Quarterly Debt Statistics and Debt reporting system) data with suitable imputation methods following BPM 6 accounting techniques [1]. In this data, the capital flows are segregated into portfolio flows and other investment flows. Currency & Deposits, Loans, Trade credit and Account receivables constitute other investments. The portfolio flows mainly represent portfolio debt flows as portfolio debt constitute majority of portfolio flows in balance of payment.

The shock variable is sourced from the capital account restriction index constructed by Fernandez et. al. (2016) and Pasricha et. al. (2018). One of the advantage of using these capital account restriction index is that the indices differentiates between inflow and outflow based restrictions across different asset categories. Since the analysis primarily focuses on the portfolio flows and other investment flows, we use overall inflow based restriction index as our primary shock variable. The other and most commonly used index is due to seminal work of Chinn-Ito (2008). However Chinn-Ito index is constructed at aggregate level and does not differentiate between inflows and outflows. I provide the following comparison of these three indices for reference

[1] For more details, refer to the data appendix of Avdjiev et. al (2018)

Chinn & Ito (2008)	Fernandez (2016)	Pasricha (2018)
IMF Report on Exchange Control and Exchange Openness		
		Local authority announcement
4 asset classes	6 asset classes	6 asset classes
181 countries	100 countries	16 countries
1970-2021	1995-2019	2001-2015
Aggregate	Inflow - Outflow	6 dimensions
Multiple exchange Rate	Money Market	Portfolio Debt
Current Account	Bonds	Portfolio Equity
Capital Account	Equity	FDI
Export proceeds	Mutual Fund	Financial Derivatives
	Financial Credit	Other Investment
	Derivatives	
	Commercial Credit	
	Guarantees (LOC)	
	Real Estate	
	FDI	

(Source: Author's compilation from respective papers)

Next, the SDM model also includes country level macro-prudential policies as control of capital flows. The country level macro-prudential policy is sourced from IMF iMaPP database. The database provides the status of macroprudential policies by tagging binary dummy variables across each category of macro-prudential policies and the category-wise policy status is sourced from survey information sought from each country. The index, constructed by Alam et. al. (2019), is averaged across all policy categories to construct the overall index of macro-prudential policy.

The choice of control variables are sourced from existing literature of capital flows. Following Forbes and Warnock (2012), Ghosh et. al. (2014) and Giordani et. al. (2017), different pull and push factors of capital flows are included as controls in the main regression. The destination-wise pull factors include real GDP growth, domestic inflation, financial openness index (proxy by Chinn-Ito Index), exchange rate regime and exchange rate. The exchange rate regime data is sourced from Ilzetzki,Reinhart and Rogoff (2021). Domestic macro variables are sourced from IMF International

Financial Statistics database and real exchange rate data is sourced from BIS. The global push factors are global risk aversion (proxy by global VIX) and 2 years Treasury yield (as proxy of global interest rate).

Lastly, the spatial weight matrix is derived from the correlation coefficient of gross capital inflows between two countries for the full sample as well as sub-samples. I consider two sub-samples 2000-2007 and 2012-2018 to incorporate time variation in correlation values prior to global financial crisis and in recent times.

4 Empirical Findings

4.1 Direct and spillover effect of capital control

The first set of findings are reported from BIS CBS data. Table 2 reports the coefficients estimates of spatial lagged term, direct effect, spillover effect and effect of macro-prudential policy. The first few rows of the estimates are derived by using absolute value of correlation coefficient, the middle portion of the table reports the coefficient value for countries with positive correlation coefficient (i.e. strategic complement countries) and the last portion reports the coefficients for strategic substitutes. Following the coefficient values, the direct effect of own capital account restrictions is found to be negative which implies that greater capital account restrictions, reduces capital inflows to destination countries. The spillover effect, on the other hand, is positive and weakly significant. This implies that the capital inflows increase in response to capital account restrictions in other countries. Another noticeable feature from the coefficient estimates is that the estimates are stable with respect to strategic complements and strategic substitutes which implies symmetric effect. Further, it justifies to use absolute value of correlation coefficient to define spillover shocks.

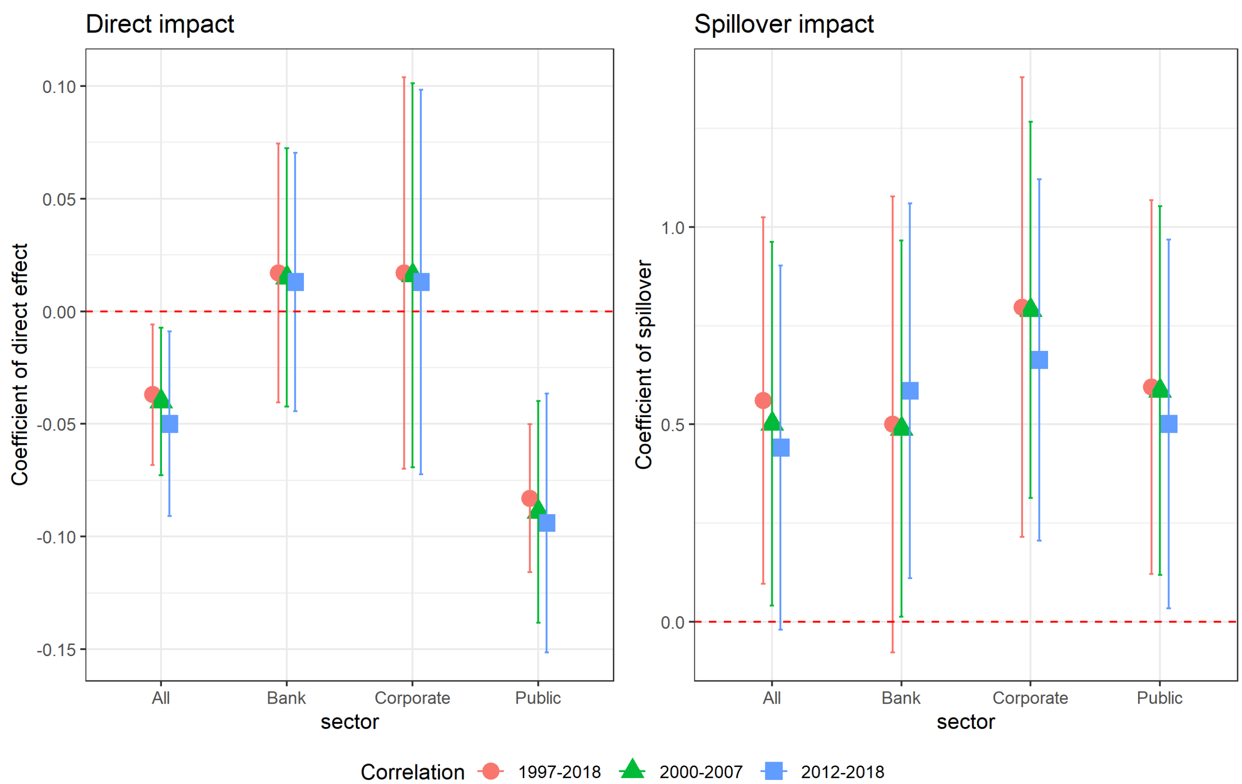
Table 2: Spatial Durbin Model Estimates using BIS CBS Data

	ρ^S (Spatial AR)	γ_D (Cap. A/C Openness)	γ_S	$(\theta_D)_M$ (Macro-pru)
Absolute value of correlation coefficient				
Full sample	0.38***	-0.05	0.18***	-0.01
(1997-2018)	(0.00)	(0.11)	(0.00)	(0.44)
Latest Period	0.37***	-0.05	0.12*	0.01
(2012-2018)	(0.00)	(0.12)	(0.09)	(0.44)
Strategic complements				
Full sample	0.38***	-0.04	0.15***	0.01
(1997-2018)	(0.00)	(0.11)	(0.00)	(0.44)
Latest Period	0.37***	-0.05	0.11*	0.01
(2012-2018)	(0.00)	(0.15)	(0.08)	(0.44)
Strategic substitutes				
Full sample	-0.38***	-0.03	0.22***	0.01
(1997-2018)	(0.00)	(0.12)	(0.00)	(0.46)
Latest Period	-0.39***	-0.05	0.20*	0.01
(2012-2018)	(0.00)	(0.11)	(0.08)	(0.34)

(p-value in the bracket)

Next, we run similar regression on the portfolio flows and other investment flows data from Avdjiev et. al (2018). The coefficient estimates of direct effect and spillover effect along with 90% confidence bands are reported in Fig 1. The direct effect of capital control appears to moderate capital inflows to public sector whereas the inflows to banks and corporate remain unaffected due to the own-country capital controls. On the other hand, the spillover effect of capital control appears to be broad based compared to the direct effect. The portfolio inflow increases in response to the capital account restrictions in other countries. The spillover effect appears to be higher in case of portfolio flows to corporate sector. These results correspond to the absolute value of correlation coefficient in the weight matrix [2]

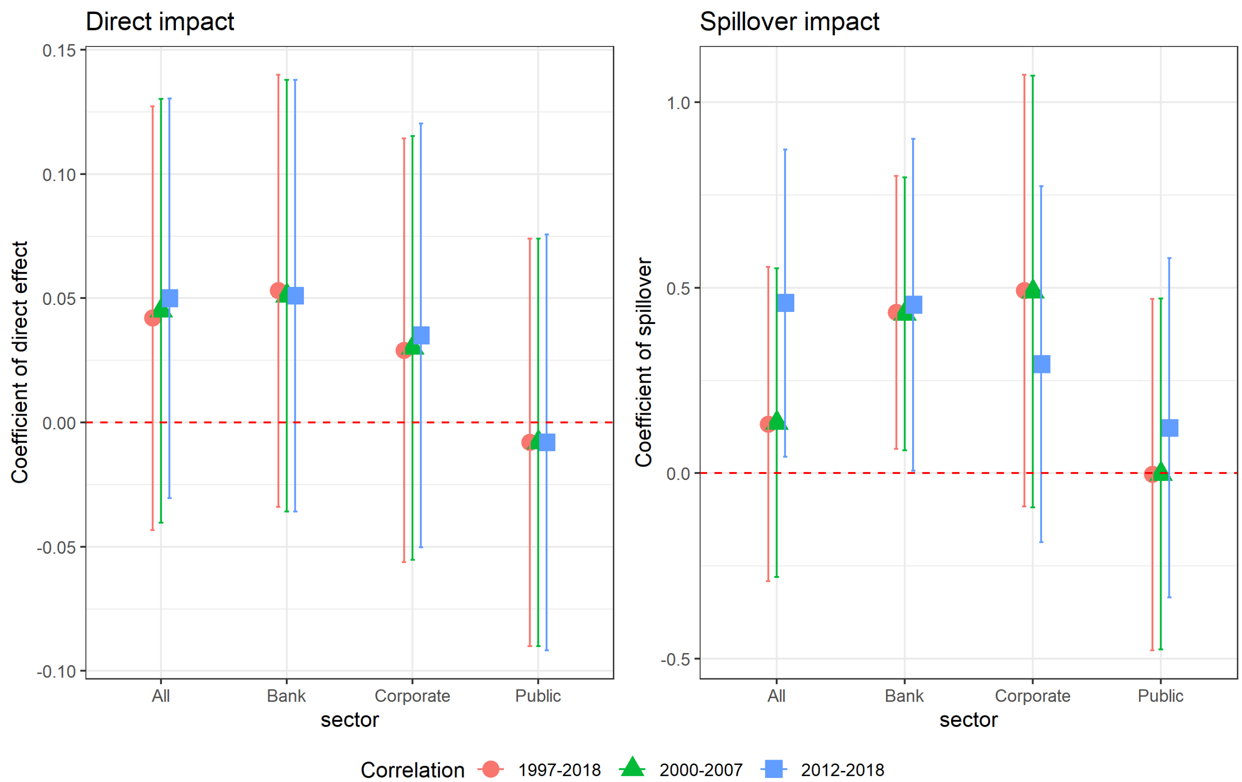
Figure 1: Direct and spillover effect on portfolio flows using Avdjiev et. al (2018)



Next, I analyze the coefficient plot of direct and spillover effect of capital control on other investment flows. The point estimates of direct effect indicates marginal negative effect of capital control on other investment inflows. However the effects appears to be statistically insignificant in nature. The spillover effect is found to be more pronounced in case the flows are directed towards corporate and banking sector. The spillover effect of capital control is almost in case of other investment flows going to public sector (refer to Figure 2).

[2]Separate regression is run for strategic complements and strategic substitute countries and results are found to be in similar lines

Figure 2: Direct and spillover effect on other investment flows using Avdjiev et. al (2018)



4.2 Direct and spillover effect of capital control with varying lags

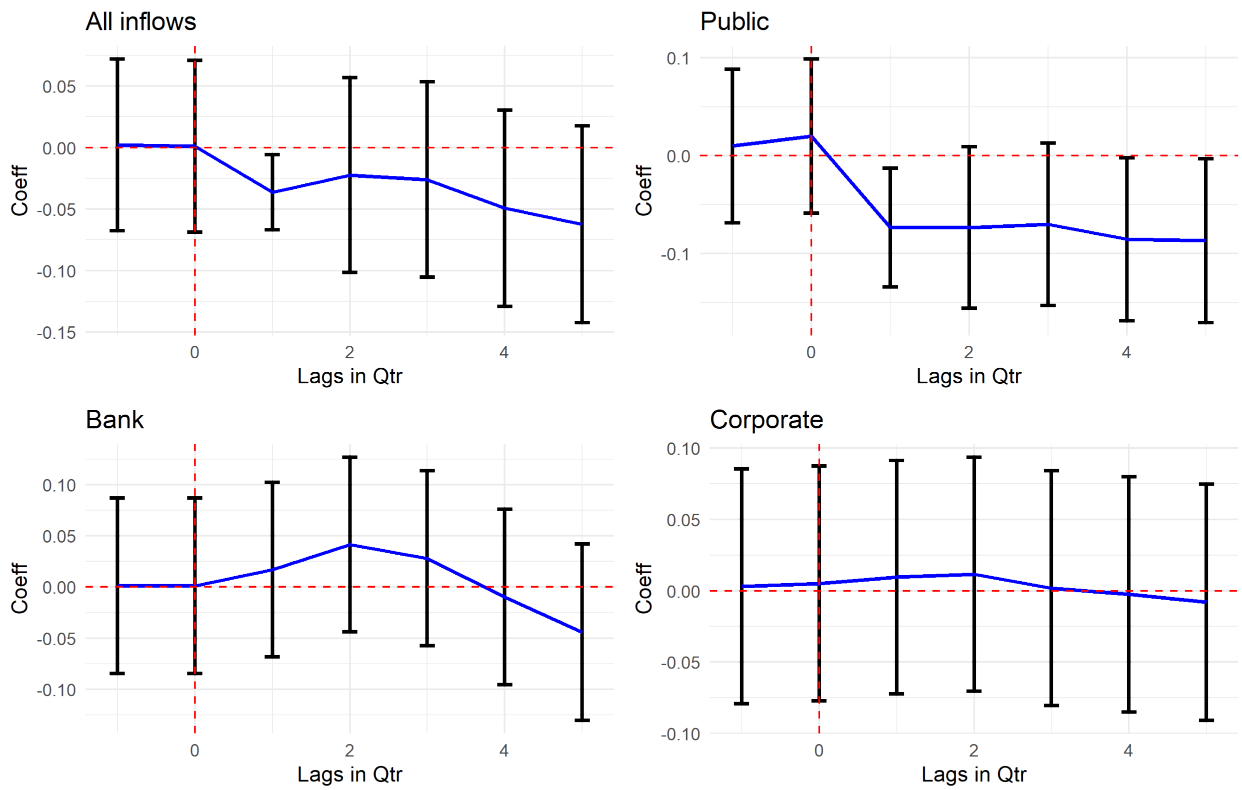
Next, the same SDM framework is estimated with varying lag structure. The effect of the capital control is represented in terms of coefficient plot with 90% confidence bands. The coefficient values along with confidence bands are plotted against the lag values for all inflows and inflows to different sectors. In the plots, the red vertical dotted line corresponds to lag value of 0 (i.e. current quarter). If the confidence bands of the coefficient estimates includes the zero line (red dotted horizontal line), the effect is considered to be insignificant in nature. I consider the correlation matrix from latest time period (i.e. 2012-2018) for the presentation of results. Similar findings were found using full sample correlation estimates also. Further we restrict our analysis on the portfolio flows only following the empirical findings from previous sub-section [3].

Following Figure 3, the direct effect of capital control appears to reduce overall portfolio inflows.

[3] The coefficient plots of lagged effect of capital control on other investment inflows is available in Appendix A1

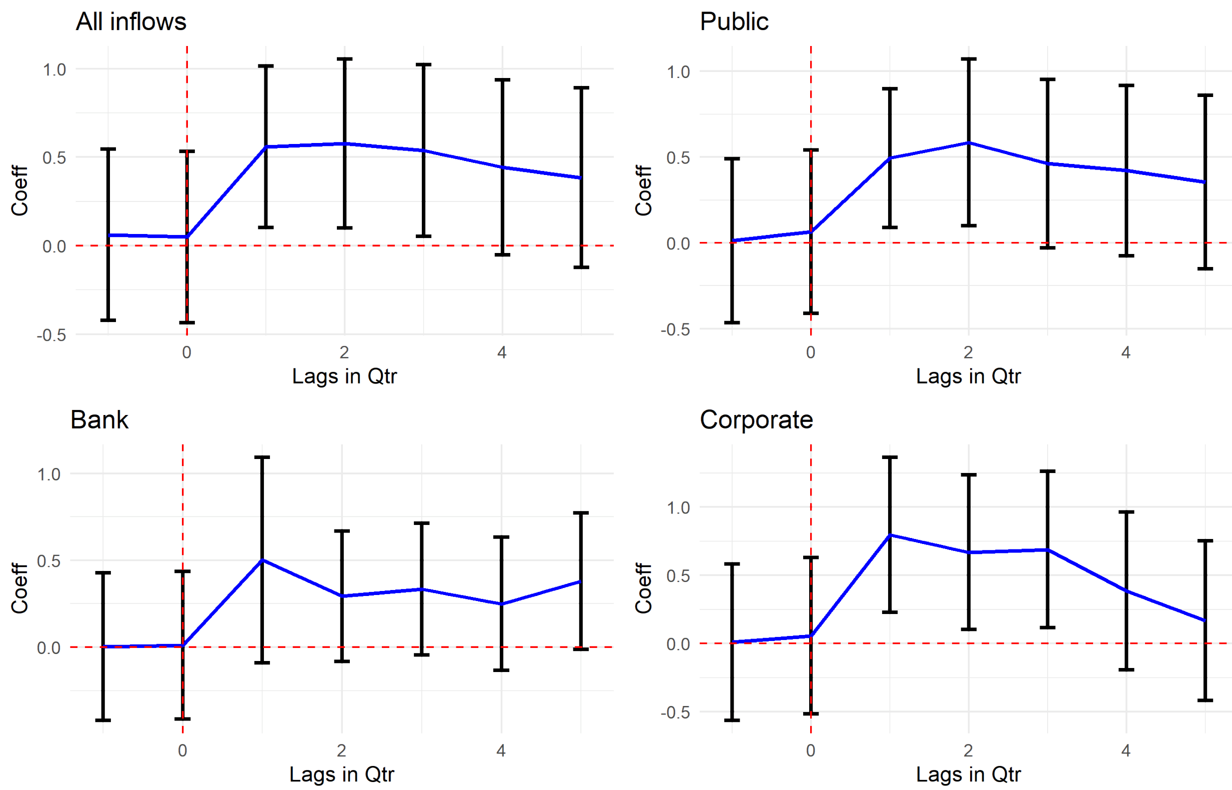
The rebalancing appears to immediate in nature as the direct effect dissipates with higher lags. The anticipation effect of capital control is also found to be muted in nature. Among the sectoral flows, the inflows to public sector adjusts in response to the capital control shock whereas inflows to banks and corporate does not demonstrate any statistically significant effect.

Figure 3: Lagged direct impact of capital control on portfolio inflows



The spillover effect, on the other hand, appears to be adjusting gradually and the effect persists over relatively longer horizon. Total portfolio inflows increase in response to capital account restrictions in other countries and the portfolio rebalancing effect continues till 3 quarters. The effect appears to be entirely driven by the flows going to the corporate sector and public sector. Similar effect is observed in the inflows to banks, However the effect is marginally insignificant in nature (refer to Figure 4).

Figure 4: Lagged spillover impact of capital control on portfolio inflows



4.3 Robustness checks

As indicated previously, the empirical specification heavily relies on the choice of spatial weight matrix w_{ij}. The choice of correlation coefficient in the weight matrix is based on well founded justification. In order to validate the robustness of empirical findings, some alternative choices are considered in the weight matrix. These alternatives include absolute distance measures between pair of countries. I use inverse of geo-distance of major populated cities and inverse of geo-distance between country capital cities for each pair of countries in the weight matrix. The distance data is sourced from CEPII. In order to standardize the distance measures, the spatial weights are normalized to the sum of 1 for each row i.e.

$$w_{ij} = \begin{cases} \frac{d_{ij}}{\sum_j d_{ij}} & \text{if } j \neq i \\ 0 & \text{if } j = i \end{cases} \tag{6}$$

where d_{ij} is the distance between country i and country j. The results appears to be resilient with respect to the distance measure in the choice of weight matrix.

Further, additional controls are introduced in the spatial regression model to factor in destination country heterogeneity. These additional controls are fiscal deficit as percentage of GDP and size of country (proxy by nominal GDP size). The results are found to be stable under these alternate specifications. Lastly, I exclude China from the collection of countries in the panel to check robustness. The results appears to be robust under alternate country choices also.

5 Heterogeneity of portfolio choice under signaling effect

Following the empirical findings, the direct and spillover effect of capital control appears to be heterogeneous in nature. The direct effect of capital control is found to be more pronounce on the inflows to public sector whereas the portfolio inflows to banks and corporate does not get impacted due to the direct effect. The spillover effect is found to be significant on capital inflows across all sectors. The spillover effect is marginally more pronounced on portfolio flows coming to the corporate. Further, the direct effects result in immediate adjustment of portfolios away from the country implementing the policy. The portfolio adjustments due to spillover effect, on the other hand, appears to be gradual in nature. These findings corroborate with the spillover literature of capital control at aggregate level. In this section, I try to explain the heterogeneity in the direct and spillover effect using a portfolio choice model with signaling effect in a multi-country set up. The rationale of using signaling effect in portfolio choice is drawn from Forbes et. al. (2016). In their paper, Forbes et. al. (2016) observed that the fund managers perceive capital control as an adverse signal towards the destination country. The signal effect is considered more severe in case of sovereign bonds. I extend the signaling effect in the investors' portfolio choice problem to explain the heterogeneity in direct and spillover effect of capital control.

5.1 Set up

The structural model is built upon the portfolio choice model of Tille & Van wincoop (2011). There are three countries - Country H, F1 and F2. Each country has one type of bond with maturity of 1 year. The net supply of bonds is unity in each country. One unit of capital and one unit of labor available for production in each country. Capital control in this model is introduced as iceberg trade cost - as investors invest outside their home country, they lose their return from foreign bonds due to capital control measures. Investors have different degree of risk aversion. The signaling effect is generated due to private signal received by the investors about the future state of economy and the signal is drawn from the announcement of capital controls. Investors can invest in home country as well as foreign country bonds. The investors' choice is dictated by the optimizing their portfolio return.

5.1.1 Production and consumption

The non-portfolio part of the model is kept simple. The production function is Cobb-Douglas with labor and capital as input of production. The production function can be written as

$$Y_{it} = A_{it}(L_{it})^{\theta}(K_{it})^{1-\theta} \tag{7}$$

where θ is the labor share in the production and $(1-\theta)$ is the capital share. I assume that each country is endowed with one unit of labor and one unit of capital. Hence the production function reduces to

$$Y_{it} = A_{it} \tag{8}$$

Household utility is a CES aggregator of home produced and foreign produced goods. The consumers have home bias in consumption i.e. they spend more home produced goods. The utility function of Coutry i household is given by

$$C_t^i = \left[\sum_{j=1}^{3} \alpha_j^{i\,\frac{1}{\sigma}} C_{jt}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \tag{9}$$

where σ is the elasticity of substitution and α_j^i is the relative preference towards commodity produced by country j. Under the assumption of home bias, $\alpha_i^i > 0.5$. The corresponding consumer price index can be written as

$$P_t^i = \left[\sum_{j=1}^{N} \alpha_j^i P_{jt}^{1-\sigma} \right]^{\frac{1}{1-\sigma}} \tag{10}$$

Under the assumption of one price, the assumption of home bias ensures that the relative price of the foreign goods vis-a-vis P_t^i / p_t^H captures the movement of real exchange rate.

5.1.2 Asset market

Each country has their domestic bond with maturity of 1 year. The net supply of bonds is kept as unity for simplicity. The price of country i bond is $Q_{i,t}$. The holder of country i bond has a claim of $(1-\theta)$ of the total production of country i. Hence the nominal return of bond i is given by

$$R_{i,t+1} = \frac{Q_{i,t+1} + (1-\theta) A_{i,t+1} P_{i,t+1}}{Q_{i,t}} \tag{11}$$

The portfolio choice of investors is given by $\kappa_{j,t}^i$ (for i,j = 1,2,3) where i represents the residence country of the investor and $\kappa_{j,t}^i$ stands for the destination country portfolio share of country j at time t by investor from country i. Hence, $\sum_{j=1}^{3} \kappa_{j,t}^i = 1$ for all i = 1(1)3. However, investing outside home country incurs an iceberg trade cost, represented by $\tau_{j,t}^i$. Hence the portfolio return of the investor from country i is given by

$$R_{t+1}^{p,i} = \left[\sum_{j=1}^{N} e^{-\tau_{j,t}^i} \kappa_{jt}^i R_{j,t+1} \right] \frac{P_t^i}{P_{t+1}^i} \tag{12}$$

Since the financial market is incomplete, the wealth distribution is non-stationary in nature. Hence we assume that ϕ proportion of investors die every year and new investors born with same probability. The dying investors consume their net worth whereas the new investors are not eligible to participate in the financial market. The new investors work for the first year and then they can participate in the financial market. Given that assumption, the total wealth of nation follows stationary distribution. The wealth accumulation of typical investor from country i is given by

$$\mathbf{W}^i_{t+1} = \mathbf{W}^i_t * R^{p,i}_{t+1} \tag{13}$$

The wealth accumulation of any nation differs from Eq. 13 as the iceberg trade cost are assumed to be paid to the new born investors as endowment [4]. This assumption is required to ensure that there is no permanent transfer of assets from any country. The nation's wealth accumulation is given by

$$W_{i,t+1} = (1-\phi) \underbrace{\left[\sum_j \kappa^i_{jt} R_{j,t+1}\right] W_{i,t} \frac{P^i_t}{P^i_{t+1}}}_{\text{Wealth accumulation from investment}} + \underbrace{\theta \frac{A_{i,t+1} P_{i,t+1}}{P^i_{t+1}}}_{\text{Labor income}} \tag{14}$$

5.1.3 Market clearing

The goods market clearing condition is given by

$$A_{i,t} = \phi \sum_{j=1}^{N} \alpha_j \left(\frac{P^j_t}{P_{i,t}}\right)^{\sigma} W_{j,t} \tag{15}$$

The financial market clears if

$$Q_{i,t} = (1-\phi) \sum_{j=1}^{N} \kappa^j_{it} W_{j,t} P^j_t \tag{16}$$

5.1.4 Signaling effect in portfolio choice

I assume that the investors get their private signal from the capital control policy. The actual iceberg trade cost is given by $\tau^i_{j,t}$. We assume that $\tau^i_{j,t}$ is solely due to capital control and $\tau^i_{j,t} > 0$. The private signal of the investors arises due to information asymmetry of investor from country i about the state of economy of country j when $i \neq j$. As foreign investors lacks information about the true state of economy of country j, the information asymmetry arises. The private signal of country i investor about country j is given by

$$\theta^i_{j,t+1} | \tau^i_{jt} \sim F^j(\tau^i_{jt}, \gamma^i) \tag{17}$$

[4] This assumption follows Tille & Van wincoop (2011)

Here, $F^j(\tau^i_{jt}, \gamma^i)$ is the distribution of the signal which depends upon the risk aversion of investor and their perception about country j.

Given the private signal, the investor from country i creates an additional wedge $\theta^i_{j,t+1}$ about the future state of economy and investor's perceived iceberg trade cost becomes [5]

$$\tau^{i*}_{jt} = \tau^i_{jt} + \theta^i_{j,t+1} \text{ for } j \neq i \tag{18}$$

Following the signaling effect from Eq. 18, the portfolio return of country i investor is now

$$R^{p,i}_{t+1} = \left[\sum_{j=1}^{N} \underbrace{e^{-\tau^{i*}_{j,t}}}_{\text{Perceived wedge}} \kappa^i_{jt} R_{j,t+1} \right] \frac{P^i_t}{P^i_{t+1}} \tag{19}$$

5.1.5 Investor problem

The decision space of any investor is the choice of $((\kappa^i_{jt}))$ so that they can maximize their utility. The investor's Bellman equation is given by

$$V(\mathbf{W}^i_t) = (1-\phi)\beta \mathbf{E} V(\mathbf{W}^i_{t+1}) + \phi\beta \mathbf{E} U(\mathbf{W}^i_{t+1}) \tag{20}$$

where $V(\mathbf{W}^i_t)$ is the value of wealth. The first part of the future value from Bellman Equation is due to the expected value of wealth given the investor survives and the last part is due to probability of dying. We assume that the utility function is given by

$$U(\mathbf{W}^i_{t+1}) = \frac{(\mathbf{W}^i_{t+1})^{1-\gamma^i}}{1-\gamma^i} \tag{21}$$

where γ^i is the coefficient of risk aversion of investor i. We further assume that

$$V(\mathbf{W}^i_{t+1}) = e^{v + f_i(S_{t+1})} \frac{(\mathbf{W}^i_{t+1})^{1-\gamma^i}}{1-\gamma^i} \tag{22}$$

where $f_i(S_{t+1})$ is the time variation of portfolio return which depends upon the current state of economy.

[5] We assume that the investor has complete information about the state of economy of his home country and hence the signaling effect is assumed to be zero for home country

The first order condition of investor choice problem is derived by maximizing the Bellman equation subject to the portfolio return from Eq. 19 and wealth accumulation equation Eq. 13. The first order condition can be derived as

$$
\begin{aligned}
\mathbf{E}_t \Lambda^i_{t+1} \Big(e^{-\tau^{i*}_{jt}} R_{j,t+1} - R_{i,t+1} \Big) = 0 \ \forall i \\
\Rightarrow \mathbf{E}_t \Lambda^i_{t+1} RX_{ij,t+1} = 0 \ \forall i
\end{aligned}
\tag{23}
$$

where Λ_{t+1} is pricing kernel,

$$
\Lambda^i_{t+1} = \Bigg((1-\phi) e^{v+f_i(S_{t+1})} + \phi \Bigg) \Bigg(R^{p,i}_{t+1} \Bigg)^{-\gamma^i} \frac{P^i_t}{P^i_{t+1}} \tag{24}
$$

The Bellman equation reduces to

$$
e^{v+f_i(S_t)} = \beta \mathbf{E} \Bigg((1-\phi) e^{v+f_i(S_{t+1})} + \phi \Bigg) \Bigg(R^{p,i}_{t+1} \Bigg)^{1-\gamma^i} \tag{25}
$$

5.1.6 Effect of capital control shock

When there is no signaling effect, the comparative statics of the first order condition of the investor with respect to $\tau^1_{2,t}$ is given by

$$
\begin{aligned}
\frac{\partial \kappa^1_{2t}}{\partial \tau^1_{2t}} &= \frac{1}{\Delta} * \left[-\frac{1}{\gamma} \right] * \mathbf{E}_t \Lambda^1_{t+1} (R^{p,1}_{t+1})^{-1} (RX_{13,t+1})^2 \leq 0 \\
\frac{\partial \kappa^1_{3t}}{\partial \tau^1_{2t}} &= \frac{1}{\Delta} * \left[-\frac{1}{\gamma} \right] * \underbrace{\mathbf{E}_t \Lambda^1_{t+1} (R^{p,1}_{t+1})^{-1} (RX_{13,t+1} * RX_{12,t+1})}_{\text{Hedge}}
\end{aligned}
\tag{26}
$$

where the first equation corresponds to the change in country 2 portfolio share in country 1's investor portfolio in response to capital control shock of country 2 and the second equation reflects the re-balancing towards other foreign country bonds in response to capital control of country 2. Here $RX_{13,t+1} = e^{-\tau^1_{3t}} R_{3,t+1} - R_{1,t+1}$ is the excess return of country 3 bonds with respect to return of investor's home country bonds. Following Eq. 26, the capital control shock reduces the portfolio share of country 2 whenever the capital account restrictions increase in country 2. The re- balancing part of the investor's portfolio is driven by the covariance of excess return between country 3 bonds and country 2 bonds. If country 3 bonds provide a perfect hedge against the risk of country 2 bonds, the investor is likely to re-balance his portfolio towards country 3.

Eq. 26 provides the mechanism of portfolio re-balancing in response to capital control shocks. The portfolio switching towards other foreign country bonds is dictated by hedging which explains relative broad-based impact of spillover effect of capital control. However, following the first equation of Eq. 26, the reduction in portfolio share of country 2 happens in every positive shock of τ^1_{2t} and hence it does not explain the heterogeneity of the direct effect of capital control on portfolio allocations. Here, the signaling effect comes into help. So we derive the same comparative statics under the assumption of signaling effect. The comparative statics is given by

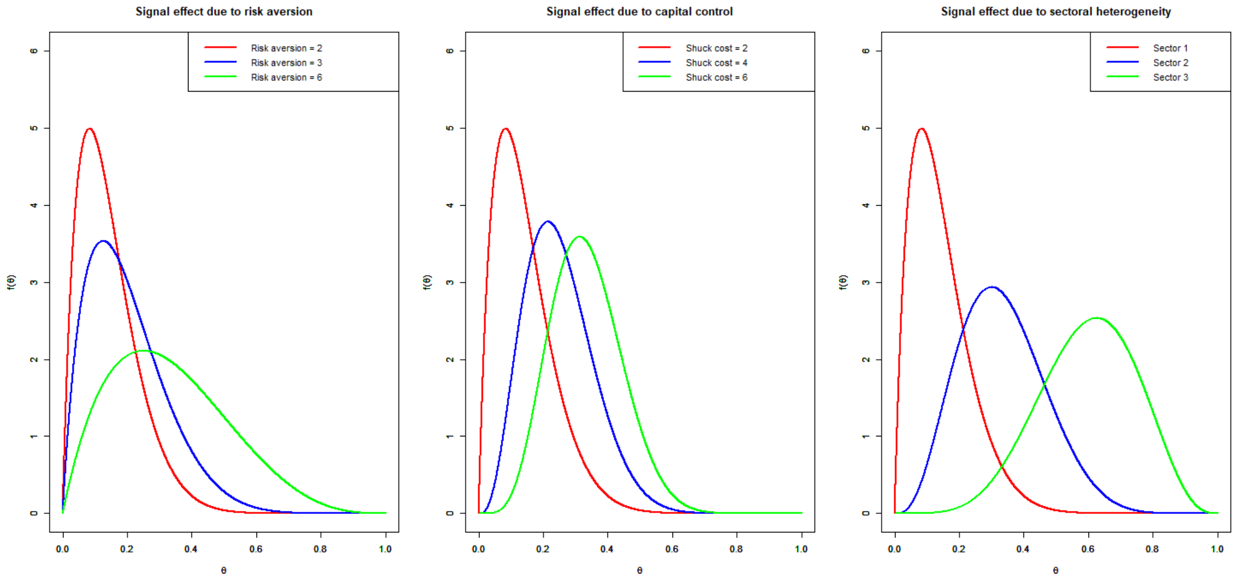
$$\begin{aligned}\frac{\partial\kappa^1_{2t}}{\partial\tau^1_{2t}} &= \frac{1}{\Delta} * \left[-\frac{1}{\gamma}\right] * \mathbf{E}_t\Lambda^1_{t+1}(R^{p,1}_{t+1})^{-1}\Big(1+\frac{\partial\theta^1_{2,t+1}}{\partial\tau^1_{2t}}\Big)(RX_{13,t+1})^2 \\ &= \frac{1}{\Delta} * \left[-\frac{1}{\gamma}\right] * \mathbf{E}_t\Lambda^1_{t+1}(R^{p,1}_{t+1})^{-1}\Big(1+\frac{\partial}{\partial\tau^1_{2t}}\mathbf{E}^*_t(\theta^1_{2,t+1})\Big)(RX_{13,t+1})^2 \\ \frac{\partial\kappa^1_{3t}}{\partial\tau^1_{2t}} &= \frac{1}{\Delta} * \left[-\frac{1}{\gamma}\right] * \underbrace{\mathbf{E}_t\Lambda^1_{t+1}(R^{p,1}_{t+1})^{-1}\Big(1+\frac{\partial\theta^1_{2,t+1}}{\partial\tau^i_{jt}}\Big)(RX_{13,t+1} * RX_{12,t+1})}_{\text{Hedge}}\end{aligned} \tag{27}$$

Compared to Eq. 26, the new comparative statics from Eq. 27 provides better insight about the role of signaling in the change of portfolio allocations due to capital control shock. Here, the additional term is i.e. $\Big(1+\frac{\partial}{\partial\tau^1_{2t}}\mathbf{E}_t\theta^1_{2,t+1}\Big)$ captures the change in investor's perception about the state of economy given the capital control shocks. The source of heterogeneity in the direct effect and spillover effect is derived from this additional term. The differential change in the expected value of $\theta^i_{j,t+1}$ represents the change in private signal of investor about country 2. Any investor will make greater change in the portfolio share of country 2 bonds in his portfolio depending upon the magnitude of $\frac{\partial}{\partial\tau^1_{2t}}\mathbf{E}_t\theta^1_{2,t+1}$.

Following the fund managers' view from Forbes et. al. (2016), the change in the investor sentiment about the future state of economy of country 2 dictates the change in the portfolio share from country 2 (direct effect). If the fund managers perceives worsening of public sector due to their private signal from capital control measures, the investors will change their portfolio from public sector of country 2 to a greater extent. On the other hand, if the investors' private signal does not provide worsening off signal about the other sectors of economy (like banks and corporate), the direct effect of capital control will be muted. In terms of the spillover effect, one can use similar justification to explain the broad-based spillover effect across all sectors. The degree of hedging along with investor's private signal dictate their decision to switch to other country bonds when country 2 increases capital control.

The source of heterogeneous direct effect and spillover effect of capital control is thereby, modulated by the change in expected private signal about future wedge in response to the capital control shocks. The expected value of $\theta^1_{2,t+1}$ depends upon the degree of risk aversion of investors and their assessment about the sector. The change in the distribution of the signal can be visually represented in following way - higher risk averse investors will adjust the value of θ^1_{2t} in greater magnitude than an investor with lower degree of risk aversion. Similarly, greater change in capital account restrictions leads to greater adjustment of θ^1_{2t} i.e. higher capital control in terms of greater tax on foreign investors will convey greater loss of investor sentiment. Finally, the sector heterogeneity in the private signal modulates the wedge parameter θ^1_{2t}. So combining these three factors, the final wedge θ^1_{2t} will be the source of heterogeneous direct effect and spillover effect (refer to Figure 5 for visual illustrations).

Figure 5: Distribution of investors' private signal



(High $\theta \rightarrow$ Low effective return)

6 Concluding remarks

Global financial integration provided investors with easy access of financial market across countries. The search for higher returns lead to greater portfolio allocations to emerging market economies. However, the financial integration also exposed these countries to the risk of sudden stops and capital flight resulting in currency depreciation and balance of payment crisis. In this context, capital control emerged as possible policy tool for managing the flow of foreign capital into domestic market and thereby, safeguarded the domestic economy from the disturbances in global financial cycle. Capital control measures helped in safeguarding domestic economy but the signaling effect of the capital control left an adverse impact on the investors about the future state of domestic economy. On the other hand, the capital controls adopted by one country lead to portfolio adjustments of global investors which lead to greater capital inflow to other destination countries. In this background, this paper analyzes the effect of capital control on capital inflows to different sectors in terms of the direct effect and spillover effect. The advantage of using sectoral analysis lies in the fact that the drivers of capital inflows to different sectors vary widely. Further, the nature of different sector-wise capital inflows vary with respect to business cycle and the resulting effect of these inflows to sectors can be very different. Aggregate analysis of the effect of capital control does not provide enough insight about the sector-wise heterogeneity.

The paper evaluates the direct and spillover effect of capital control using spatial econometric model on quarterly data. The reduced form specifications analyze the direct effect and the spillover effect of capital account restrictions on cross-border gross inflows of portfolio flows and other investment inflows using Spatial Durbin model. The spillover shocks are defined as spatial weighted shocks of capital account restrictions in other countries. The empirical findings indicates possible heterogeneity in the direct effect of capital control. Public sector inflows moderated whereas banks and corporate did not face any moderation of capital flows in response to capital control. The spillover effect of capital control was found to be broad-based as inflows to all sectors increased significantly in response to other country's capital account restrictions. The direct effect was found to be immediate in nature implying almost immediate adjustments of portfolios from public sector bonds in response to capital control. However the spillover effect appeared to be gradual in nature and the portfolio re-balancing persisted over 1-3 quarters after the change of capital account restrictions in other countries. The spillover effect was found to be marginally higher in case of inflows to corporate sector.

The paper, then provides an explanation of heterogeneity in the direct and spillover effect by extending the portfolio choice model in multi-country set up under the assumption of signaling effect. Inspired by the fund managers view about capital control from Forbes et. al. (2016), the paper introduces heterogeneous signaling effect of investors about the state of foreign country's economy when the foreign country imposes capital control measures. Using investor problem and the derived first order conditions, the analytical derivations of comparative statics provided a theoretical justification of the heterogeneity in the capital control effects as a change in private signal of the investors about the foreign economy. The private signal, derived from the investors' belief given capital control shock, modulates the wedge between tomorrow's expected return in the mind of the investors. The paper argues that the investors adjustment about future return from public sector accelerates their portfolio withdrawal from public sector bonds to a greater extent. The spillover effect, on the other hand, is purely driven by the change in private signal and the degree of hedging between two foreign country bonds.

The findings of the paper provides valuable insight for the policymakers. As capital control safeguards the domestic economy from foreign capital inflow fluctuations, the signaling effect moderates the investment sentiment of investors away from certain sectors. The portfolio re-balance become greater as the investors change their perception about the future state of economy. The paper identifies the importance of sector-wise analysis of the effects of capital control and provides justification towards more targeted policy approach to manage the direct effect and spillover effect of capital control. The future scope of this research is enormous - the optimal policy design in view of the sectoral heterogeneity and the resultant welfare analysis will provide a greater insight to the policymakers.

7 Conflict of Interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

8 Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or non-profit sectors.

References

[1] Alam,Zohair, Adrian Alter, Jesse Eiseman, Gaston Gelos, Heedon Kang, Machiko Narita, Erlend Nier, and Naixi Wang, 2019, Digging Deeper–Evidence on the Effects of Macroprudential Policies from a New Database, IMF Working Paper 2019, No. 19-66

[2] Avdjiev, S., McGuire, P., Wooldridge, P. (2015). Enhanced data to analyse international banking. BIS Quarterly Review, September 2015

[3] Avdjiev, S., Chui, M., Shin, H. S. (2014). Non-financial corporations from emerging market economies and capital flows. BIS Quarterly Review, December.

[4] Avdjiev, S., McCauley, R., Shin, H. S. (2016). Breaking free of the triple coincidence in international finance. Economic Policy, 31(87), 409–451.

[5] Baba, C. and A. Kokenyne. 2011. Effectiveness of Capital Controls in Selected Emerging Markets in the 2000's.IMF Working Paper No. 11/281, December.

[6] Bartolini, L. and Drazen, A. 1997a. Capital account liberalization as a signal.American Economic Review 87(1): 138154.

[7] Bartolini, L. and Drazen, A. 1997b. When Liberal Policies Reflect Shocks, What Do We Learn? Journal of International Economics 42 (3-4): 249-73.

[8] Eichengreen, B. and A. Rose. 2014. Capital Controls in the 21st Century.Journal of International Money and Finance 48: 1-16.

[9] Elhorst, J. Paul, 2014. Spatial Econometrics. Springer Berlin, Heidelberg, https://doi.org/10.1007/978-3-642-40340-8

[10] Emter, Lorenz Killeen, Neill McQuade, Peter, 2021. "Bank and non-bank financial institutions' crossborder linkages: New evidence from international banking data," Financial Stability Notes 3/FS/21, Central Bank of Ireland.

[11] Erten, B. and J.A. Ocampo. 2017. Macroeconomic Effects of Capital Account Regulations. IMF Economic Review 65 (2): 193-240.

[12] Fernández, A., M.W. Klein, A. Rebucci, M. Schindler, and M. Uribe. 2016. Capital Control Measures: A New Dataset. IMF Economic Review 64: 548-574.

[13] Fernández, A., M.W. Klein, A. Rebucci, M. Schindler, and M. Uribe. 2016. Capital Control Measures: A New Dataset. IMF Economic Review 64: 548-574.

[14] Forbes, K.J., M. Fratzscher and R. Straub. 2015. Capital-flow management measures: What are they good for?. Journal of International Economics, 96: S76-S97.

[15] Forbes, K.J., M. Fratzscher, T. Kostka, and R. Straub. 2016. Bubble Thy Neighbor: Portfolio Effects and Externalities from Capital Controls. Journal of International Economics 99: 85-104.

[16] Ghosh, A.R., J.D. Ostry and M.S. Qureshi. 2017a. Managing the tide: How do emerging markets respond to capital flows? IMF Working Paper No. 17/69.

[17] Ghosh, A.R., J.D. Ostry and M.S. Qureshi. 2017b. Taming the Tide of Capital Flows: A Policy Guide Cambridge: MIT Press.

[18] Giordani, P., M. Ruta, H, Weisfeld, and L. Zhu. 2017. Capital flow deflection. Journal of International Economics 105(C): 102-118.

[19] Korinek, A. 2007. Dollar Borrowing in Emerging Markets. Dissertation, Columbia University.

[20] Korinek, A. 2010. Regulating capital flows to emerging markets: An externality view. SSRN Working Paper

[21] Korinek, A. 2011a. Excessive Dollar Borrowing in Emerging Markets. Manuscript, University of Maryland. http://dx.doi.org/10.2139/ssrn.967524

[22] Korinek, A. 2011b. The new economics of prudential capital controls: A research agenda. IMF Economic Review 59 (3): 523-561.

[23] Korinek, A. 2016. Currency Wars or Efficient Spillovers? NBER Working Paper No. 23004.

[24] Korinek, A. 2018. Regulating capital flows to emerging markets: An externality view. Journal of International Economics 111: 61-80.

[25] Korinek, A. and D. Sandri. 2016. Capital Controls or Macroprudential Regulation? Journal of International Economics 99(S1): S27-S42.

[26] Korinek, A. and A. Simsek. 2016. Liquidity Trap and Excessive Leverage. American Economic Review 106(3): 699-738.

[27] LeSage, James and R. Kelley Pace. 2009. Introduction to Spatial Econometrics. January 2009, CRC Press/Taylor Francis Group

[28] Ostry, J.D., A.R. Ghosh, K. Habermeier, M. Chamon, M.S. Qureshi, and D.B.S. Reinhardt. 2010. Capital Inflows: The Role of Controls. IMF Staff Position Note 10/04. Washington: International Monetary Fund

[29] Ostry, J.D., A.R. Ghosh, K. Habermeier, L. Laeven, M. Chamon, M.S. Qureshi, and A. Kokenyne. 2011a. Managing Capital Inflows: What Tools to Use? IMF Staff Discussion Note 11/6. Washington: International Monetary Fund.

[30] Ostry, J.D., A.R. Ghosh, M. Chamon, M.S. Qureshi. 2011b. Capital Controls: When and Why? IMF Economic Review 59(3): 562-580.

[31] Ostry, J.D., A.R. Ghosh, M. Chamon, and M.S. Qureshi. 2012. Tools for managing financial stability risks from capital inflows. Journal of International Economics 88: 407-421.

[32] Pasricha, G.K., Falagiarda, M., Bijsterbosch, M. and Aizenman, J., 2018. Domestic and multilateral effects of capital controls in emerging markets. Journal of International Economics, 115, 48-58.

[33] Rebucci, A., and C. Ma. 2019. Capital Controls: A Brief Survey of the New Literature. Manuscript, Johns Hopkins University.

[34] Reinhart, Carmen M., and Kenneth S. Rogoff. 2009. "The Aftermath of Financial Crises." American Economic Review, 99 (2): 466-72.

[35] Reinhart, C.M., and K.S. Rogoff. 2009. This Time is Different: Eight Centuries of Financial Folly Princeton: Princeton University Press.

[36] Reinhart, C.M. and T. Smith, 1998. Too Much of a Good Thing: The Macroeconomic Effects of Taxing Capital Inflows. In R. Glick, editor. Managing Capital Flows and Exchange Rates: Perspectives from the Pacic Basin. Cambridge: Cambridge University Press, 436-464.

[37] Reinhart, C.M. and T. Smith, 1998. Too Much of a Good Thing: The Macroeconomic Effects of Taxing Capital Inflows. In R. Glick, editor. Managing Capital Flows and Exchange Rates: Perspectives from the Pacic Basin. Cambridge: Cambridge University Press, 436-464.

Appendix A1. Direct ad spillover effect of capital control on other investment inflows

Figure 6: Direct effect of other investment inflows over lags

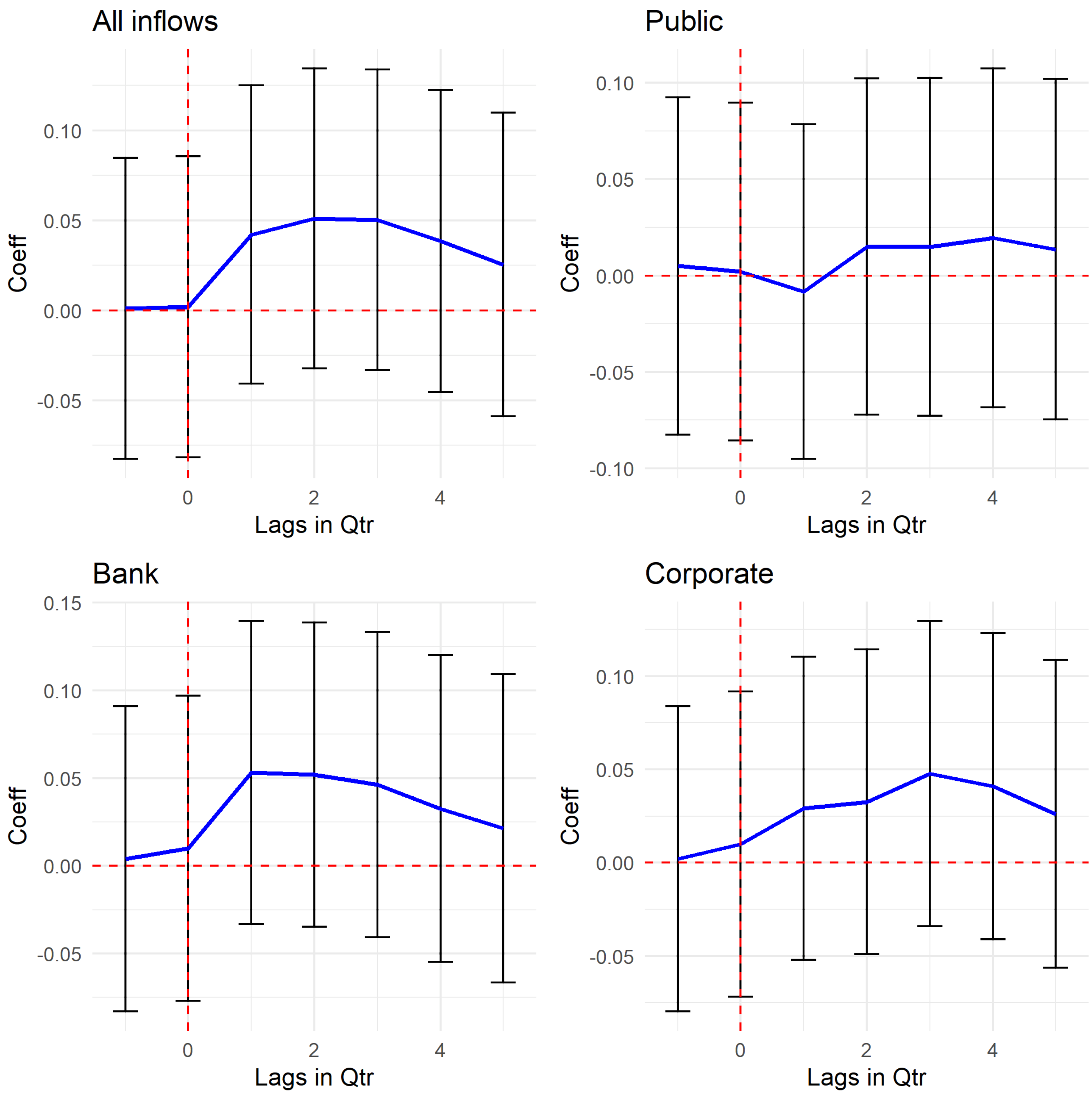


Figure 7: Spillover effect of other investment inflows over lags