Volume 37, Issue 3

Local Banking Systems and Sensitivity of Capital Inflows to Global Factors

Satoshi Tobe
Graduate School of Economics, Keio University

Abstract

This article explores the interaction between capital inflows and global factors. A panel regression analysis covering 39 developed and emerging countries reveals that capital inflows into each country are closely associated with the leverage of the U.S. financial intermediaries, and more importantly, the effects of this leverage on capital inflows are non-linear: they are stronger in economies with larger deviations of the bank credit-to-GDP ratio. The results suggest that economies that are further in the expansionary phase of the financial cycle are more strongly exposed to spillover effects of the U.S. monetary policies because the leverage of the U.S. financial intermediaries is closely tied with federal fund rate shocks.

1. Introduction

Calvo et al. (1993, 1996) revealed how financial and monetary conditions in core countries (i.e., global "push" factors) can drive capital inflows into emerging countries, whereas county-specific conditions (i.e., domestic "pull" factors) play a more limited role. More recently, Bruno and Shin (2015a, 2015b) and Forbes and Warnock (2012) found that the U.S. broker–dealer leverage and the CBOE volatility index (VIX) work well as global factors in explaining the dynamics of capital inflows, especially cross-border bank inflows. For example, when risk aversion or uncertainty in global financial markets (measured by the VIX) is low or when short-term dollar interest rates are low, the U.S. financial intermediaries increase their leverage by expanding short-term wholesale funding and channel liquidity to other countries, producing tight relations between capital inflows and global factors.

The literature provides substantial insights about the determinants of cross-border capital transactions. However, do capital-receiving countries respond to global factors in a homogenous or linear manner? Although Avdjiev et al. (2017), Cerutti, Claessens, and Puy (2015), and Cerutti, Claessens, and Ratnovski (2017) demonstrated that the sensitivity of capital inflows to global factors differs by country groups, types of inflows, and market structures, no study, to my knowledge, explores the sensitivity of capital inflows to global factors while focusing on the phase of local financial cycle measured by deviations of the bank credit-to-GDP ratio. As revealed by Jordà et al. (2016a), economies with a higher bank credit-to-GDP ratio may have different characteristics than economies with a lower ratio.

In this study, a panel regression analysis covering 39 developed and emerging countries reveals that the sensitivity of capital inflows to the U.S. broker–dealer leverage is higher in economies that experience larger deviations of the bank credit-to-GDP ratio compared with its trends. The result indicates that the effects of global factors on capital inflows are non-linear, depending on the phase of local financial cycle. This suggests that economies that are further in the expansionary phase of the financial cycle are more strongly exposed to spillover effects of the U.S. monetary policies because the U.S. broker–dealer leverage is closely tied with federal funds rate shocks, as revealed by Bruno and Shin (2015b) and Rey (2013). Thus, this study contributes to existing literature (e.g., McCauley et al., 2015; Miranda-Agrippino and Rey, 2015; Passari and Rey, 2015) by capturing non-linearity in an empirical model of the international spillovers of the U.S. monetary policy.

The reminder of this study is organized as follows: Section 2 describes material and methods, Section 3 presents results and discussion, and Section 4 concludes.

2. Material and Methods

Following previous literature (Avdjiev et al., 2017; Bruno and Shin, 2015a), the estimation consists of a panel regression with fixed effects and country-clustered standard errors:

$$Inflow_{j,t} = \beta_0 + \beta_1 Leverage_{t-1} + \beta_2\big(Leverage_{t-1} \times CreditDev_{j,t-1}\big) + \beta_3 VIX_{t-1}$$
$$+ \beta_4 DomesticFactor_{j,t-1\,or\,t-4} + \gamma_j + \varepsilon_{j,t} \tag{1}$$

where the dependent variable $Inflow_{j,t}$ is gross inflows divided by the external liability of borrower country j at time t; $Leverage_{t-1}$ is the log of the U.S. broker–dealer leverage at time *t-1*; $Leverage_{t-1} \times CreditDev_{j,t-1}$ is the interaction term of the log of the U.S. broker–dealer leverage, with a deviation of the bank credit-to-GDP ratio from its trend (calculated using a four-quarter moving average) of country j at time *t-1*; VIX_{t-1} is the log of VIX at time *t-1*; $DomesticFactor_{j,t-1\,or\,t-4}$ is the country-specific condition of country j

at time *t-1* or *t-4*; γ_j represents country fixed effects; and $\varepsilon_{j,t}$ is the error term.[1]

Table 1. Variables and Data Sources

Variable	Note	Source
Total Inflow	Gross capital inflow (divided by external liability)	IFS
Direct Investment	Direct investment (divided by external liability)	IFS
Portfolio Investment	Portfolio investment (divided by external liability)	IFS
Other Investment	Other investment (divided by external liability)	IFS
Bank-to-bank	Exchange-rate-adjusted change in cross-border bank claims of all BIS reporting countries on the banking sector (divided by external liability)	BIS, IFS
Bank-to-non-bank	Exchange-rate-adjusted change in cross-border bank claims of all BIS reporting countries on the non-bank sector (divided by external liability)	BIS, IFS
Leverage	U.S. broker-dealer leverage defined as the ratio of asset over equity (logged)	FRB
CreditDev	Deviation of bank credit to the non-financial private sector to the GDP ratio, from its trend, calculated by a four-quarter-moving average	BIS
CreditHP	Deviation of total credit to the non-financial private sector to the GDP ratio, from its trend, estimated by an HP filter	BIS
ΔCredit/GDP	Growth of bank credit to the non-financial private sector to the GDP ratio	BIS
VIX	CBOE VIX index of implied volatility of S&P index options (logged)	FRED
ΔGDP	GDP growth (year-on-year change)	OECD, IFS
Inflation	CPI change (year-on-year change)	IFS
ΔREER	Change in the real effective exchange rate (year-on-year change)	BIS
ΔDebt/GDP	Change in the government gross debt to GDP ratio (year-on-year change)	WEO

Table 2. Countries Included in the Sample

Developed Countries				
Australia	Austria	Belgium	Canada	Denmark
Finland	France	Germany	Greece	Ireland
Isreal	Italy	Japan	Korea	Luxemburg
Netherlands	New Zealand	Norway	Portugal	Spain
Switzerland	Sweden	United Kingdom	United States	

Emerging Countries				
Argentina	Brazil	Chile	China	Czech Republic
Hungary	India	Indonesia	Malaysia	Mexico
Poland	Russia	South Africa	Thailand	Turkey

The analysis uses six dependent variables: $Inflow_{j,t}$, total capital inflows to country j, direct investment flows into country j, portfolio investment flows into country j, other investment flows into country j, exchange-rate-adjusted changes in cross-border bank claims of all BIS reporting countries on the banking sector of country j (bank-to-bank flow), and exchange-rate-adjusted change in cross-border bank claims of all BIS reporting countries on the non-bank sector of country j (bank-to-non-bank flow). As country-specific conditions of country j, $DomesticFactor_{j,t-1\ or\ t-4}$, the regression includes the following variables: GDP growth rate of country j at time *t-1* ($\Delta GDP_{j,t-1}$), the inflation rate of country j at time *t-1* ($Inflation_{j,t-1}$), changes in the real effective exchange rate of country j at time *t-1*

---

[1] Data on capital inflows are divided by external liability to avoid undesirable effects of outliers that undertake large cross-border capital transactions relative to the size of their real economies (e.g., U.K., Switzerland, Netherlands, and Ireland). The combination of normalizing by GDP and winsorizing cannot fully resolve this problem.

($\Delta REER_{j,t-1}$), and changes in the government gross debt-to-GDP ratio of country *j* at time *t-4* ($\Delta Debt/GDP_{j,t-4}$).[2] Table 1 summarizes further details on the variables and data sources.

Finally, the sample comprises quarterly data spanning the first quarter of 1990 to the second quarter of 2016 for the 39 developed and emerging countries in Table 2. Limited data availability regarding bank credit-to-GDP ratios constrains the number of countries in the sample.

3. Results and Discussion

Table 3 shows the panel regression results. Specifications in columns 1 and 2 use total capital inflows as a dependent variable. As is evident, the coefficient for the U.S. broker–dealer leverage is positively significant, consistent with previous literature (Bruno and Shin, 2015a; Cerutti, Claessens, and Ratnovski, 2017). Moreover, the coefficient of the interaction term for the U.S. broker–dealer leverage, with deviations of the bank credit-to-GDP ratio from its trend, is also positively significant. These results indicate that capital inflows into each country are associated with the U.S. financial and monetary conditions, measured by the U.S. broker–dealer leverage. They also indicate that the sensitivity of capital inflows to conditions can vary, depending non-linearly on the phase of local financial cycle.

As for country-specific conditions, the coefficient for GDP growth rate is positively significant, implying pro-cyclicality of capital inflows. Coefficients for other country-specific conditions are insignificant in this specification, but the signs of coefficients are reasonable and consistent with findings in previous literature. Furthermore, the results hold when specifications include the VIX (column 2). In this specification, the coefficient of the VIX shows the expected negatively significant sign.

---

[2] Following Bruno and Shin (2015a), specifications use the four-quarter-lagged debt to GDP ratio because the original data is provided annually.

Table 3. Panel Regression Results

	Total Inflow		Direct Investment		Portfolio Investment		Other Investment		Bank-to-bank (BIS)		Bank-to-non-bank (BIS)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$Leverage_{t-1}$	5.570***	5.140***	2.008***	2.112***	1.380**	1.176*	1.944**	1.618*	1.647**	1.446*	1.044***	0.976***
	(1.359)	(1.357)	(0.540)	(0.551)	(0.584)	(0.583)	(0.956)	(0.944)	(0.766)	(0.764)	(0.296)	(0.302)
$Leverage_{t-1}$ *$CreditDev_{t-1}$	0.145**	0.148***	-0.015	-0.016	0.058***	0.059***	0.110***	0.113***	0.082***	0.083***	0.014	0.014
	(0.029)	(0.030)	(0.013)	(0.012)	(0.018)	(0.018)	(0.021)	(0.022)	(0.018)	(0.019)	(0.009)	(0.009)
VIX_{t-1}		-2.293***		0.581***		-1.131***		-1.740***		-1.131***		-0.383**
		(0.520)		(0.198)		(0.339)		(0.476)		(0.347)		(0.175)
ΔGDP_{t-1}	0.367***	0.329***	0.076***	0.085***	0.087	0.069	0.215***	0.187***	0.169***	0.152***	0.074**	0.069*
	(0.101)	(0.094)	(0.019)	(0.020)	(0.065)	(0.065)	(0.064)	(0.060)	(0.045)	(0.041)	(0.034)	(0.034)
$Inflation_{t-1}$	-0.097	-0.050	0.006	-0.005	-0.041	-0.018	-0.059	-0.023	-0.103*	-0.081	-0.008	0.000
	(0.120)	(0.119)	(0.058)	(0.056)	(0.038)	(0.034)	(0.065)	(0.063)	(0.057)	(0.052)	(0.018)	(0.018)
$\Delta REER_{t-1}$	0.034	0.033	0.001	0.001	-0.009	-0.009	0.044**	0.043**	0.041**	0.040**	0.003	0.002
	(0.025)	(0.023)	(0.011)	(0.011)	(0.013)	(0.012)	(0.019)	(0.018)	(0.019)	(0.019)	(0.009)	(0.009)
$\Delta Debt/GDP_{t-4}$	-0.023	-0.024	0.011	0.011	-0.001	-0.001	-0.030	-0.030	-0.036	-0.037	-0.016***	-0.016***
	(0.024)	(0.024)	(0.248)	(0.009)	(0.011)	(0.011)	(0.022)	(0.021)	(0.030)	(0.029)	(0.005)	(0.005)
constant	-13.090***	-4.904	-4.583**	-6.642***	-2.368	1.641	-5.392*	0.820	-5.111*	-1.110	-3.153	-1.795
	(4.379)	(5.093)	(1.820)	(2.114)	(1.984)	(2.415)	(3.106)	(3.528)	(2.601)	(2.950)	(0.987)	(1.311)
Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
R^2	0.095	0.107	0.042	0.045	0.018	0.028	0.060	0.071	0.061	0.068	0.038	0.042
Observation	2677	2677	2701	2701	2701	2701	2677	2677	2800	2800	2800	2800
#Country	39	39	39	39	39	39	39	39	39	39	39	39

Note: Standard errors clustering at the country level are reported in parentheses. ***, **, and * denote significance at 1, 5, and 10 percent levels, respectively.

Table 4. Panel GMM Results (Arellano–Bond procedure)

	Total Inflow		Direct Investment		Portfolio Investment		Other Investment		Bank-to-bank (BIS)		Bank-to-non-bank (BIS)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Leverage_{t-1}	4.773***	4.524***	1.509***	1.608***	1.343***	1.051**	1.495	1.707*	1.882**	1.779*	1.137***	1.045***
	(1.136)	(1.147)	(0.422)	(0.439)	(0.436)	(0.436)	(0.996)	(0.990)	(0.916)	(0.917)	(0.276)	(0.275)
Leverage_{t-1}	0.151***	0.154***	-0.017	-0.018	0.040***	0.045***	0.137***	0.122***	0.128***	0.130***	0.023***	0.024***
$*\text{CreditDev}_{t-1}$	(0.028)	(0.029)	(0.012)	(0.012)	(0.015)	(0.016)	(0.013)	(0.033)	(0.018)	(0.018)	(0.006)	(0.006)
VIX_{t-1}		-1.500***		0.550***		-1.875***		-0.161		-0.638**		-0.516**
		(0.457)		(0.164)		(0.340)		(0.962)		(0.286)		(0.212)
ΔGDP_{t-1}	0.380***	0.360***	0.052***	0.060***	0.093*	0.070	0.388***	0.278***	0.229***	0.220***	0.085***	0.079**
	(0.078)	(0.073)	(0.013)	(0.014)	(0.055)	(0.054)	(0.092)	(0.087)	(0.052)	(0.050)	(0.033)	(0.034)
Inflation_{t-1}	-0.046	-0.015	0.023	0.012	-0.043	-0.005	-0.048	-0.037	-0.113***	-0.100**	-0.018	-0.008
	(0.117)	(0.118)	(0.048)	(0.045)	(0.035)	(0.032)	(0.091)	(0.062)	(0.043)	(0.041)	(0.021)	(0.021)
ΔREER_{t-1}	0.053**	0.052**	-0.006	-0.006	0.035**	0.035***	0.041	0.013	0.071***	0.070***	0.026***	0.026***
	(0.023)	(0.022)	(0.009)	(0.008)	(0.013)	(0.012)	(0.026)	(0.024)	(0.023)	(0.023)	(0.008)	(0.008)
$\Delta\text{Debt/GDP}_{t-4}$	-0.543	-0.485	0.030	0.006	0.246	0.340	-0.424	-1.157	-0.698	-0.680	-0.167	-0.153
	(0.797)	(0.780)	(0.277)	(0.268)	(0.434)	(0.377)	(1.077)	(0.896)	(0.788)	(0.792)	(0.173)	(0.160)
AR(2) test	3.139	3.165	2.276	2.316	1.383	1.405	3.265	2.880	1.428	1.428	0.909	0.987
(p-value)	(0.001)	(0.001)	(0.022)	(0.020)	(0.166)	(0.159)	(0.001)	(0.004)	(0.153)	(0.153)	(0.362)	(0.323)
Sargan test	2614.2	2606.23	2608.39	2608.96	2643.21	2665.75	2810.58	2725.02	2812.39	2805.5	2804.33	2802.5
(p-value)	(0.473)	(0.511)	(0.613)	(0.616)	(0.413)	(0.303)	(0.002)	(0.045)	(0.101)	(0.118)	(0.121)	(0.126)
Observation	2650	2650	2674	2674	2674	2674	2650	2650	2779	2779	2779	2779
#Country	39	39	39	39	39	39	39	39	39	39	39	39

Note: Specifications treat all the regressors as endogenous and include one lag of the dependent variable. Robust standard errors are reported in parentheses. ***, **, and * denote significance at 1, 5, and 10 percent levels, respectively.

Table 5. Panel Regression Results (using deviation of credit-to-GDP ratio from its trend estimated by HP filter)

	Total Inflow		Direct Investment		Portfolio Investment		Other Investment		Bank-to-bank (BIS)		Bank-to-non-bank (BIS)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Leverage_{t-1}	6.245***	5.763***	1.878***	1.975***	1.700***	1.483**	2.483**	2.127**	1.998**	1.767**	1.100***	1.022***
	(1.339)	(1.322)	(0.460)	(0.469)	(0.575)	(0.572)	(1.026)	(1.007)	(0.849)	(0.841)	(0.284)	(0.290)
Leverage_{t-1}	0.023***	0.025***	0.000	0.000	0.009***	0.010***	0.013***	0.015***	0.009***	0.010***	0.003**	0.003**
$*\text{CreditHP}_{t-1}$	(0.006)	(0.005)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)
VIX_{t-1}		-2.485***		0.527**		-1.177***		-1.832***		-1.260***		-0.426**
		(0.547)		(0.213)		(0.342)		(0.512)		(0.362)		(0.189)
ΔGDP_{t-1}	0.392***	0.353***	0.095***	0.103***	0.088	0.070	0.220***	0.192**	0.171***	0.153***	0.084**	0.078**
	(0.115)	(0.110)	(0.020)	(0.021)	(0.071)	(0.071)	(0.077)	(0.074)	(0.052)	(0.048)	(0.037)	(0.037)
Inflation_{t-1}	-0.110	-0.068	0.011	0.002	-0.063	-0.043	-0.059	-0.029	-0.109	-0.090	-0.016	-0.009
	(0.105)	(0.105)	(0.056)	(0.054)	(0.047)	(0.043)	(0.060)	(0.060)	(0.067)	(0.064)	(0.020)	(0.020)
ΔREER_{t-1}	0.035	0.035	0.000	0.000	-0.006	-0.006	0.044**	0.044**	0.042**	0.042**	0.002	0.002
	(0.025)	(0.024)	(0.012)	(0.012)	(0.013)	(0.012)	(0.019)	(0.018)	(0.020)	(0.019)	(0.010)	(0.009)
$\Delta\text{Debt/GDP}_{t-4}$	-0.057*	-0.059**	0.004	0.005	-0.008	-0.009	-0.051*	-0.053**	-0.054	-0.056	-0.019***	-0.019***
	(0.029)	(0.028)	(0.009)	(0.008)	(0.014)	(0.013)	(0.026)	(0.026)	(0.034)	(0.033)	(0.006)	(0.005)
constant	-15.265***	-6.327	-4.336***	-6.213***	-3.302*	0.890	-7.036**	-0.448	-6.143**	-1.655	-3.342***	-1.825
	(4.266)	(4.842)	(1.559)	(1.839)	(1.942)	(2.344)	(3.323)	(3.680)	(2.843)	(3.133)	(0.946)	(1.288)
Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
R^2	0.116	0.130	0.050	0.052	0.022	0.031	0.067	0.079	0.065	0.073	0.046	0.051
Observation	2571	2571	2595	2595	2595	2595	2571	2571	2682	2682	2682	2682
#Country	39	39	39	39	39	39	39	39	39	39	39	39

Note: Standard errors clustering at the country level are reported in parentheses. ***, **, and * denote significance at 1, 5, and 10 percent levels, respectively.

Table 6. Panel Regression Results (using growth rate of bank credit-to-GDP ratio)

	Total Inflow		Direct Investment		Portfolio Investment		Other Investment		Bank-to-bank (BIS)		Bank-to-non-bank (BIS)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$Leverage_{t-1}$	6.135***	5.711***	1.985***	2.091***	1.587***	1.384**	2.336**	2.014*	1.905**	1.705**	1.050***	0.981***
	(1.451)	(1.458)	(0.534)	(0.544)	(0.588)	(0.586)	(1.028)	(1.024)	(0.827)	(0.831)	(0.289)	(0.295)
$Leverage_{t-1}$	0.061*	0.064**	-0.012	-0.013	0.025	0.027	0.052***	0.055***	0.040**	0.042**	0.014	0.014
*$\Delta Credit/GDP_{t-1}$	(0.030)	(0.031)	(0.016)	(0.016)	(0.016)	(0.016)	(0.018)	(0.017)	(0.015)	(0.015)	(0.010)	(0.010)
VIX_{t-1}		-2.263***		0.583***		-1.123***		-1.723***		-1.123***		-0.385**
		(0.547)		(0.197)		(0.342)		(0.491)		(0.357)		(0.176)
ΔGDP_{t-1}	0.325***	0.287***	0.080***	0.089***	0.070	0.052	0.184***	0.156**	0.146***	0.129***	0.072*	0.066*
	(0.105)	(0.099)	(0.019)	(0.020)	(0.065)	(0.066)	(0.068)	(0.064)	(0.047)	(0.043)	(0.035)	(0.036)
$Inflation_{t-1}$	-0.080	-0.032	0.000	-0.011	-0.034	-0.010	-0.042	-0.005	-0.092	-0.070	-0.002	0.005
	(0.128)	(0.127)	(0.061)	(0.059)	(0.040)	(0.036)	(0.072)	(0.070)	(0.058)	(0.053)	(0.020)	(0.020)
$\Delta REER_{t-1}$	0.027	0.026	0.001	0.002	-0.011	-0.012	0.039**	0.039**	0.038*	0.037*	0.002	0.002
	(0.024)	(0.022)	(0.011)	(0.011)	(0.012)	(0.012)	(0.018)	(0.017)	(0.019)	(0.018)	(0.002)	(0.009)
$\Delta Debt/GDP_{t-4}$	-0.033	-0.034	0.011	0.011	-0.005	-0.005	-0.037	-0.037*	-0.042	-0.042	-0.016***	-0.016***
	(0.025)	(0.025)	(0.009)	(0.009)	(0.012)	(0.011)	(0.022)	(0.022)	(0.029)	(0.029)	(0.005)	(0.005)
constant	-14.763***	-6.690	-4.505**	-6.573***	-2.974	-1.006	-6.568*	-0.419	-5.870**	-1.896	-3.183***	-1.819
	(4.645)	(5.470)	(1.792)	(2.077)	(2.003)	(2.417)	(3.318)	(3.810)	(2.785)	(3.202)	(0.957)	(1.274)
Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
R^2	0.083	0.095	0.040	0.043	0.013	0.022	0.049	0.060	0.053	0.060	0.038	0.042
Observation	2679	2679	2703	2703	2703	2703	2679	2679	2802	2802	2802	2802
#Country	39	39	39	39	39	39	39	39	39	39	39	39

Note: Standard errors clustering at the country level are reported in parentheses. ***, **, and * denote significance at 1, 5, and 10 percent levels, respectively.

Table 7. Panel Regression Results (advanced countries)

	Total Inflow		Direct Investment		Portfolio Investment		Other Investment		Bank-to-bank (BIS)		Bank-to-non-bank (BIS)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Leverage_{t-1}	6.237***	5.932***	1.382***	1.501***	1.930**	1.770**	2.924***	2.660**	2.414***	2.237***	0.782**	0.739**
	(1.244)	(1.239)	(0.405)	(0.410)	(0.721)	(0.712)	(1.012)	(0.996)	(0.670)	(0.674)	(0.282)	(0.298)
Leverage_{t-1} $*\text{CreditDev}_{t-1}$	0.129***	0.131***	-0.017*	-0.018*	0.053***	0.055***	0.093***	0.095***	0.087***	0.088***	0.008	0.008
	(0.028)	(0.029)	(0.010)	(0.009)	(0.018)	(0.018)	(0.027)	(0.027)	(0.022)	(0.023)	(0.011)	(0.011)
VIX_{t-1}		-1.741***		0.675**		-0.910**		-1.506**		-1.038**		-0.247
		(0.535)		(0.253)		(0.430)		(0.610)		(0.475)		(0.232)
ΔGDP_{t-1}	0.586***	0.547***	0.097***	0.113***	0.214**	0.193*	0.274*	0.240*	0.253***	0.230***	0.132**	0.126*
	(0.090)	(0.083)	(0.027)	(0.030)	(0.101)	(0.107)	(0.133)	(0.131)	(0.046)	(0.044)	(0.060)	(0.063)
Inflation_{t-1}	0.117	0.150	0.045	0.032	0.045	0.062	0.027	0.054	-0.064	-0.051	0.009	0.012
	(0.158)	(0.155)	(0.064)	(0.064)	(0.081)	(0.080)	(0.113)	(0.108)	(0.091)	(0.088)	(0.036)	(0.037)
ΔREER_{t-1}	0.003	0.004	-0.006	-0.006	-0.017	-0.016	0.027	0.028	0.051	0.051	-0.008	-0.008
	(0.034)	(0.031)	(0.009)	(0.009)	(0.022)	(0.021)	(0.030)	(0.028)	(0.034)	(0.033)	(0.016)	(0.015)
$\Delta\text{Debt/GDP}_{t-4}$	-0.006	-0.010	-0.004	-0.003	0.004	0.002	-0.005	-0.008	-0.005	-0.008	-0.017*	-0.018**
	(0.025)	(0.025)	(0.007)	(0.006)	(0.017)	(0.017)	(0.017)	(0.017)	(0.013)	(0.013)	(0.008)	(0.008)
constant	-16.298***	-10.116**	-3.161**	-5.560***	-4.366*	-1.133	-8.770**	-3.421	-7.798***	-4.115	-2.349**	-1.473
	(3.985)	(4.215)	(1.315)	(1.659)	(2.452)	(2.831)	(3.235)	(3.366)	(2.152)	(2.653)	(0.926)	(1.478)
Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
R^2	0.141	0.147	0.043	0.049	0.054	0.059	0.057	0.064	0.069	0.074	0.044	0.046
Observation	1902	1902	1902	1902	1902	1902	1902	1902	1989	1989	1989	1989
#Country	24	24	24	24	24	24	24	24	24	24	24	24

Note: Standard errors clustering at the country level are reported in parentheses. ***, **, and * denote significance at 1, 5, and 10 percent levels, respectively.

Table 8. Panel Regression Results (emerging countries)

	Total Inflow		Direct Investment		Portfolio Investment		Other Investment		Bank-to-bank (BIS)		Bank-to-non-bank (BIS)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Leverage_{t-1}	2.851	2.179	3.120**	3.174***	-0.490	-0.763	-0.353	-0.772	-0.325	-0.520	1.423*	1.310*
	(2.948)	(1.103)	(1.353)	(1.394)	(0.638)	(0.628)	(1.601)	(1.627)	(1.575)	(1.595)	(0.695)	(0.691)
Leverage_{t-1} $*\text{CreditDev}_{t-1}$	0.191***	0.189**	0.002	0.002	0.056*	0.054*	0.150***	0.150***	0.063**	0.062**	0.047***	0.046**
	(0.062)	(0.071)	(0.041)	(0.040)	(0.030)	(0.030)	(0.020)	(0.028)	(0.021)	(0.023)	(0.015)	(0.016)
VIX_{t-1}		-3.379***		0.308		-1.541***		-2.110**		-1.114***		-0.648**
		(1.103)		(0.305)		(0.464)		(0.730)		(0.283)		(0.236)
ΔGDP_{t-1}	0.203*	0.166*	0.057*	0.060**	-0.003	-0.020	0.171***	0.148***	0.116*	0.105*	0.027	0.020
	(0.101)	(0.093)	(0.026)	(0.024)	(0.040)	(0.038)	(0.042)	(0.034)	(0.056)	(0.052)	(0.021)	(0.018)
Inflation_{t-1}	-0.122	-0.056	-0.026	-0.032	-0.051	-0.022	-0.037	0.003	-0.076	-0.055	-0.012	0.000
	(0.134)	(0.134)	(0.075)	(0.075)	(0.041)	(0.034)	(0.085)	(0.082)	(0.080)	(0.074)	(0.020)	(0.022)
ΔREER_{t-1}	0.097***	0.093**	0.013	0.013	0.019	0.016	0.072***	0.069***	0.034*	0.033*	0.020***	0.019***
	(0.031)	(0.033)	(0.018)	(0.018)	(0.011)	(0.011)	(0.018)	(0.018)	(0.018)	(0.018)	(0.006)	(0.006)
$\Delta\text{Debt/GDP}_{t-4}$	-0.019	-0.013	0.040**	0.039**	0.006	0.010	-0.059	-0.055	-0.081	-0.079	-0.008*	-0.007
	(0.043)	(0.044)	(0.016)	(0.016)	(0.012)	(0.012)	(0.038)	(0.038)	(0.063)	(0.064)	(0.004)	(0.004)
constant	-2.919	9.199	-6.575	-7.658	3.707*	9.124	1.693	9.262	1.056	4.963	-4.328*	-2.055
	(9.411)	(11.920)	(4.429)	(5.211)	(2.095)	(2.710)	(4.990)	(6.632)	(4.992)	(5.481)	(2.268)	(2.371)
Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
R^2	0.064	0.091	0.059	0.059	0.017	0.039	0.125	0.146	0.100	0.110	0.078	0.089
Observation	775	775	799	799	799	799	755	775	811	811	811	811
#Country	15	15	15	15	15	15	15	15	15	15	15	15

Note: Standard errors clustering at the country level are reported in parentheses. ***, **, and * denote significance at 1, 5, and 10 percent levels, respectively.

Investigating further, columns 3–8 consider specifications in which total capital inflows split into direct investment flows, portfolio investment flows, and other investment flows. In these analyses, coefficients for the U.S. broker–dealer leverage are positively significant in all specifications. Coefficients for the interaction term of the U.S. broker–dealer leverage are also positively significant when we use portfolio investment and other investment flows as dependent variables (columns 5–8). Moreover, the exchange rate coefficient is positively significant in columns 7–8. Considering that other investment flows include cross-border bank flows, this result is consistent with Bruno and Shin (2015a). This result also corroborates the financial channel of exchange rates (Hofmann et al., 2017; Kearns and Patel, 2016; Shin, 2016)

Furthermore, to explore cross-border bank flow dynamics, columns 9–10 and 11–12 use bank-to-bank flows and bank-to-non-bank flows, respectively, as dependent variables. Again, coefficients for the U.S. broker–dealer leverage are positively significant in any specification. Conversely, coefficients for the interaction term for leverage, with a deviation of the bank credit-to-GDP ratio from its trend, are positively significant only when bank-to-bank flows are used as a dependent variable (columns 9–10). In addition, the results generally hold when (1) we perform the dynamic panel generalized method of moments (GMM) analysis, (2) models use the deviation of the credit-to-GDP ratio from its trend estimated by an HP filter instead of moving average, and (3) models use the growth rate of the bank credit-to-GDP ratio instead of deviations of the ratio from its trend (Table 4, 5, and 6, respectively).

Finally, when we split the sample into developed and emerging countries, results indicate heterogeneity between the two country groups as shown in Tables 7 and 8. The result on the U.S. broker–dealer leverage and its interaction term holds only when we use sub-sample only containing developed countries (Table 7). Moreover, the exchange rate coefficients are positively significant with sub-sample only containing emerging countries (Table 8), while they never become significant in Table 7. This result implies that the financial channel of exchange rates works mainly in emerging countries.

In sum, the following key results are obtained: (1) dynamics of gross capital inflows are closely associated with the U.S. broker–dealer leverage and (2) the sensitivity of capital inflows, in particular portfolio investment, other investment, and bank-to-bank flows, to leverage is higher in economies that experience larger deviations of the bank credit-to-GDP ratio from its trend. Result (2) indicates that the degree of linkage between capital inflows and the U.S. financial and monetary conditions, measured by the U.S. broker–dealer leverage, can vary, depending non-linearly on the phase of local financial cycle, even though previous literature stressed the dominant role of global "push" factors in explaining capital inflows into each country.

One explanation for this is that the bank credit-to-GDP ratio may contain information on levels of leverage or risk taking in each country. Gourinchas and Obstfeld (2012) and Jordà et al. (2016a) regarded the ratio as one measure of leverage. Moreover, Gourinchas and Obstfeld (2012) and Jordà et al. (2016b) revealed that the ratio performs as a reliable "early warning indicator" that informs us of excess risk taking by local agents. In general, economies or agents with higher leverage or risk taking are more vulnerable to external shocks. Thus, capital inflows into economies with higher bank credit-to-GDP ratios (compared with their trends) may be more sensitive to shocks in financial and monetary conditions in core countries.

4. Conclusion

This article explored the interaction between capital inflows and global factors. Empirical analysis revealed that capital inflows into each country are closely associated with the U.S. broker–dealer leverage, and more importantly, the effects of this leverage on capital

inflows are non-linear: they are stronger in economies with larger deviations of the bank credit-to-GDP ratio from its trend. Therefore, the results suggest that economies that are further in the expansionary phase of the financial cycle are more strongly exposed to spillover effects of the U.S. monetary policies because the U.S. broker–dealer leverage is closely tied with federal fund rate shocks. Interpreting the results with a degree of causality, countercyclical macroprudential policies regarding a bank's balance sheet may partly insulate local countries from shocks in financial and monetary conditions in center countries. However, conservatively speaking, we need further research on causal inference.

References

Agrippino, Silvia Miranda and Hélène Rey (2015) "World Asset Markets and the Global Financial Cycle," NBER Working Paper, No. 21722.

Avdjiev, Stefan, Bryan Hardy, and Sebnem Kalemli-Ozcan (2017) "Gross Capital Inflows to Banks, Corporates and Sovereigns," NBER Working Paper, No. 23116.

Bruno, Valentina and Hyun Song Shin (2015a) "Cross-Border Banking and Global Liquidity," Review of Economic Studies, 82, pp. 535-564.

Bruno, Valentina and Hyun Song Shin (2015b) "Capital Flows and the Risk-taking Channel of Monetary Policy," Journal of Monetary Economics, 71, pp.119-132.

Calvo, Guillermo, Leonardo Leiderman, and Carmen M. Reinhart (1993) "Capital Inflows and Real Exchange Rate Appreciation in Latin America," IMF staff papers, 40(1), pp.108-151.

Calvo, Guillermo, Leonardo Leiderman, and Carmen M. Reinhart (1996) "Inflows of Capital to Developing Countries in the 1990s," Journal of Economic Perspectives, 10(2), pp.123-139.

Cerutti, Eugenio, Stijn Claessens, and Damien Puy (2015) "Push Factors and Capital Flows to Emerging Markets: Why Knowing Your Lender Matters More Than Fundamentals," IMF Working Paper, No. 127.

Cerutti, Eugenio, Stijn Claessens, and Lev Ratnovski (2017) "Global Liquidity and Cross-border Bank flows," Economic Policy, 32(89), pp.81-125.

Forbes, Kristin J and Francis E. Warnock (2012) "Capital Flow Waves: Surges, Stops, Flight and Retrenchment." Journal of International Economics, 88(2), pp.235-251.

Gourinchas, Pierre-Olivier and Maurice Obstfeld (2012) "Stories of the Twentieth Century for Twenty First," American Economic Journal: Macroeconomics, 4(1), pp.226-265.

Hofmann, Boris, Ilhyock Shim, and Hyun Song Shin (2016) "Sovereign Yields and the Risk-taking Channel of Currency Appreciation," BIS Working Papers, No. 538, revised May 2017.

Jordà, Òscar, Moritz Schularick, and Alan M. Taylor (2016a) "Macrofinancial History and the New Business Cycle Facts," NBER Working Paper, No. 22743.

Jordà, Òscar, Moritz Schularick, and Alan M. Taylor (2016b) "The Great Mortgaging: Housing Finance, Crisis and Business Cycles," Economic Policy, 31(85), pp.107-152.

Kearns, Jonathan and Nikhil Patel (2016) "Does the Financial Channel of Exchange Rates Offset the Trade Channel?" BIS Quarterly Review, December.

McCauley, Robert, Patrick McGuire, and Vladyslav Sushko (2015) "Global Dollar Credit: Links to US Monetary Policy and Leverage," Economic Policy, 30(82), pp.188-229.

Passari, Evgenia and Hélène Rey (2015) "Financial Flows and the International Monetary System," The Economic Journal, 125(584), pp.675-698.

Rey, Hélène (2013) "Dilemma not Trilemma: The Global Financial Cycle and Monetary Policy Independence," A Symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming, August 22-24.

Shin, Hyun Song (2016) "Global Liquidity and Procyclicality," Speech to the World Bank

Conference, "The State of Economics, the State of the World," Washington DC, 8 June.