Global Banks' Leverage and its Macroeconomic Effects

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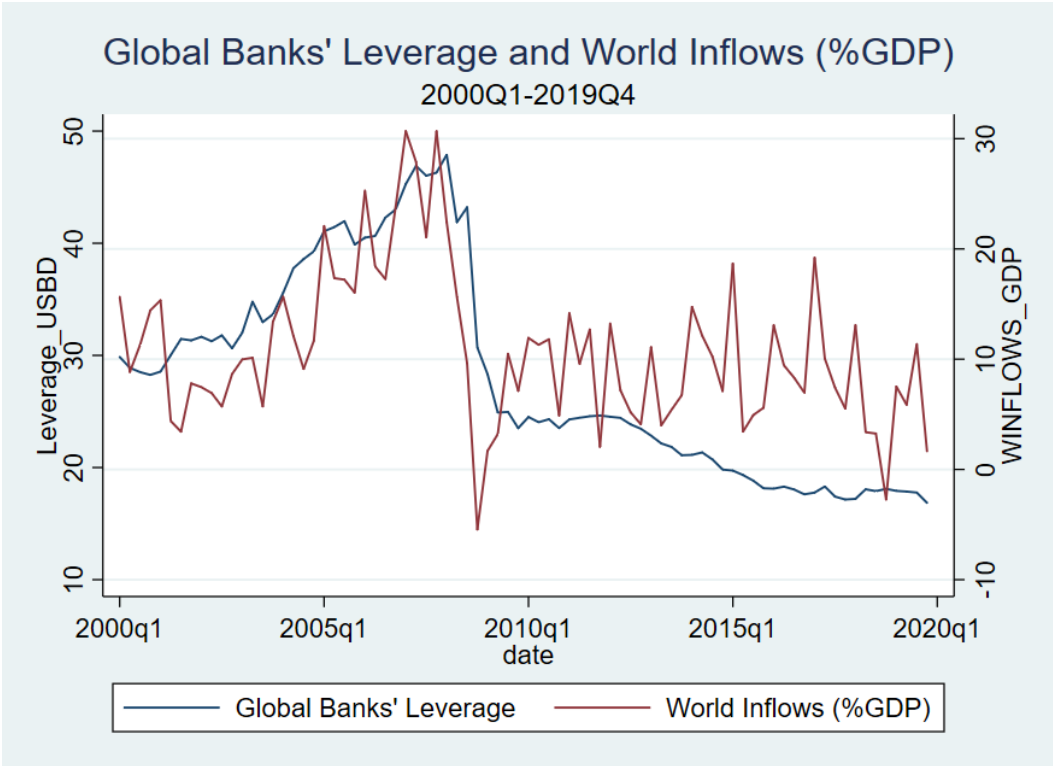
Motivation

- The literature has established a clear relation between global banks' leverage and gross capital flows [Rey (2013), Bruno and Shin (2015)].
- However, less studied is the relation between leverage and net flows.



Note. Leverage is defined as Assets/Equity of the U.S. broker dealer sector from the Federal Reserve's Flow of Funds. Global Corr(Leverage,Inflows)=0.62. Corr(d.Leverage,Inflows)=0.39. Corr(d.Leverage,Inflows)=0.33 after 2010.

This Paper

Questions:

- How does a change in the leverage of global banks affect macroeconomic outcomes (capital flows, current account, investment)?
- What can explain different sensitivities across countries?

Contributions:

- Theory: Multi-country model with both local and global banks.
- Empirical: Panel regressions for 46 countries over 2000Q1-2019Q4.

Main result:

- 1) A change in leverage has a differentiated impact on current account.
  2) The impact depends on the net external position against global banks.
  3) Impact through investment, not savings.
- Illustration: A 1-std change in leverage leads on average to a 1pp difference in the annualized change in the current account between Spain and Germany, or between Latvia and Israel.

Selected Related Literature

- **Global Financial Cycle**
  Rey (2013), Bruno and Shin (2015), Miranda-Agrippino and Rey (2015), Cerutti et al. (2019), Jeanne and Sandri (2020)

- **The Role of Global Banks**
  Cetorelli and Goldberg (2012), Boissay, Collard and Smets (2016), Gertler et al. (2016), Sheng (2021), Cao et al. (2021)

- **Macroeconomic Effects of Capital Flows**
  Blanchard et al. (2016), Cesa-Bianchi et al. (2018), Davis and van Wincoop (2021), Kalemli-Ozcan et al. (2021)

Outline

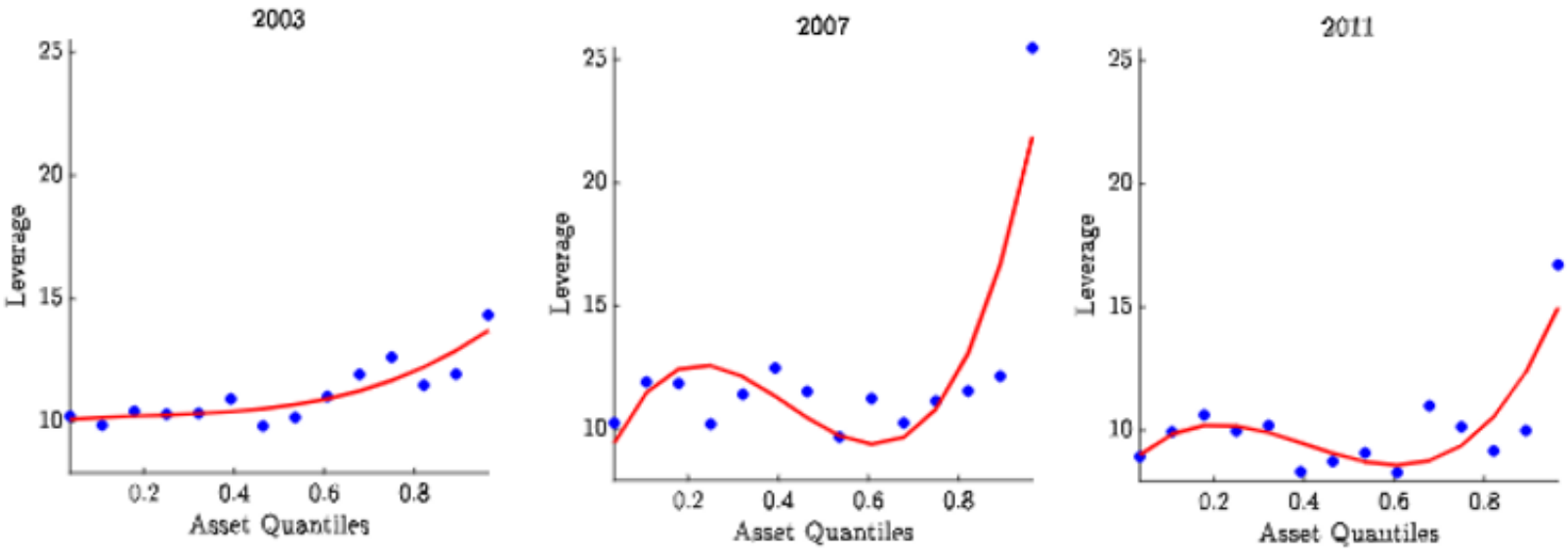
Stylized Facts

Global Banking

BIS Locational Banking Statistics - IMF BOP Database (2000Q1-2019Q4).

- **Stylized Fact #1 (Headquarters):** 42 out of 96 Headquarters of Global bank holdings are located in 5 countries (US, UK, JP, FR, DE). Details G-SIBs
- **Stylized Fact #2 (Global banks versus Local banks):** The leverage of global banks is higher and more volatile than the leverage of local banks. Chart
- **Stylized Fact #3 (Counter-party):** 60% of global banks claims are against other banks, 64% of global banks liabilities are against other banks. Details
- **Stylized Fact #4 (External positions):** The 5 countries (US, UK, JP, FR, DE) have larger external banking positions, but smaller net banking positions, than other countries. Chart

Banks' Leverage by Asset Quantiles



Note. This chart shows binned scatter plots of leverage as a function of asset quantiles for the years 2003, 2007 and 2011. Each bin contains roughly 30 intermediaries and each dot represents the median leverage for each bin. Leverage is not only largest for the bigger intermediaries, but it also more reactive over the cycle. Sources: Coimbra and Rey (2020), Bankscope.

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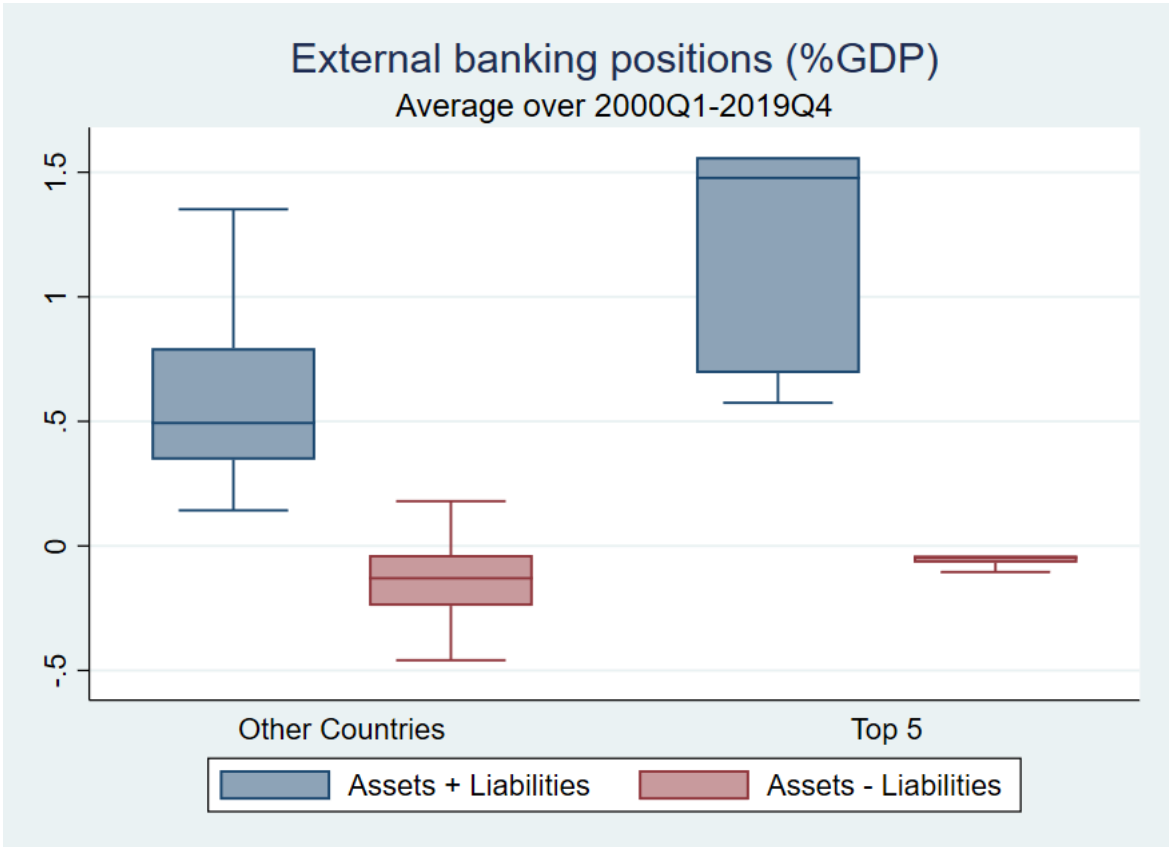
External Banking Positions



Note. This chart represents the distribution of the average external banking (other investment) position of individual countries over the period 2000Q1-2019Q4. Top 5: US, UK, JP, FR, DE. Sources: IMF BOP, Author's calculations.

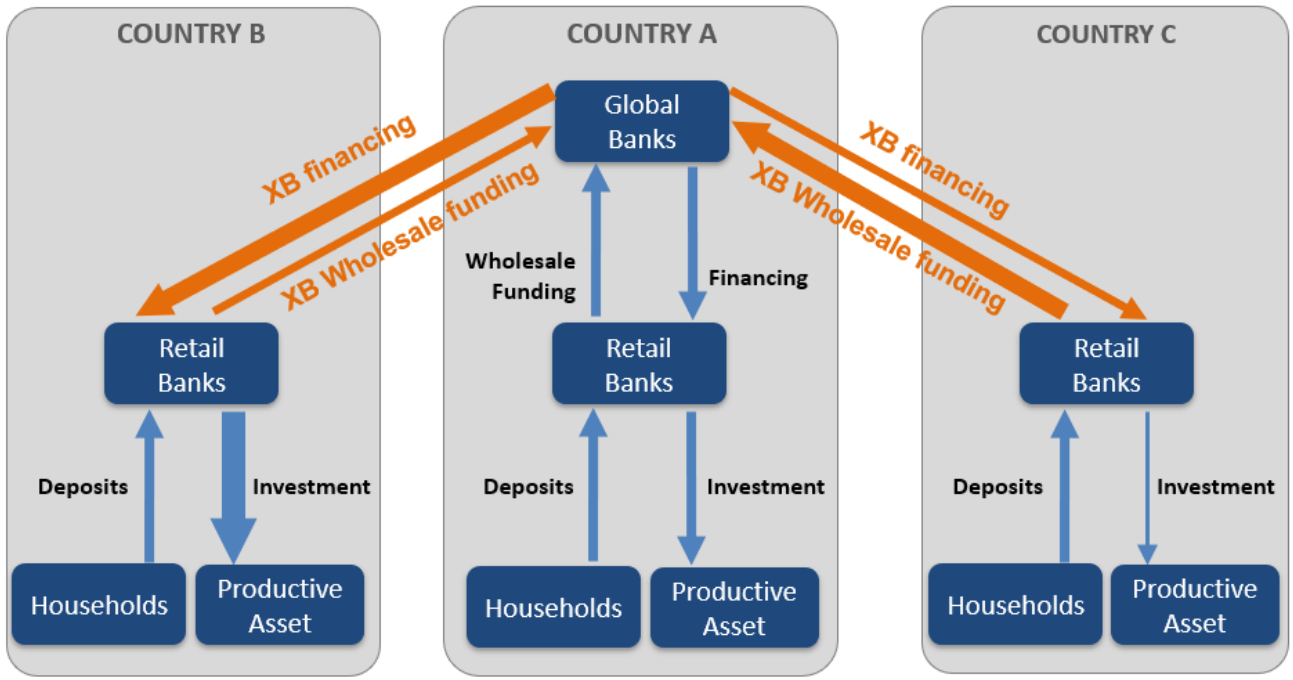
Vis-a-vis Global Banks

Multi-Country Model of Global Banking

Overview

- Two-period ($t = 1, 2$), N countries (indexed by i), single-good economy.
- In each country, a representative Household:
  - Receives endowment W^i in period 1, makes inter-temporal consumption-savings decision, can save through safe deposits d^i at rate R_H^i.
- In each country, unit continuum of Local Banks (indexed by i, j):
  - Raise deposits $d^{i,j}$ from their domestic Household, have access to a risky bank-specific project with return $R^{i,j}$, and can lend $l_M^{i,j}$ to or borrow $d_M^{i,j}$ from Global Banks.
- Across countries, unit continuum of competitive Global Banks (share s^i in country i):
  - Global financial inter-mediation: Reallocate funds by borrowing d_M^g from or lending l_M^g to Local Banks, subject to a **leverage constraint**.

Model - Overview



Note. This chart provides a schematic representation of the model for the case where $N = 3$, $s^A = 1$, and $R^C < R^A < R^B$.

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Timeline

1. Period 1:
   - 1.1 At the beginning of period 1, local banks raise deposits from their domestic household in the **retail market**.
   - 1.2 At the end of period 1, the stochastic returns are revealed and global banks reallocate capital across local banks worldwide, by borrowing and lending on the **wholesale market**, subject to a **leverage constraint**.
2. Period 2: The projects are financed and output is consumed by banks and households.

Projects' Returns

The project of local bank j located in country i produces output according to:

$$y^{i,j} = \left(\underbrace{R^i + \epsilon^j}_{\equiv R^{i,j}} \right) k^{i,j}$$

where R^i and ϵ^j are independent random variables.
$R^i \sim \mathcal{U}_{[\underline{R};\overline{R}]}$ is a country-specific stochastic productivity shock,
$\epsilon^j \sim \mathcal{U}_{[-\epsilon;\epsilon]}$ is a bank-specific stochastic productivity shock,
and $k^{i,j}$ is the capital invested by bank j located in country i in its project.

Notation:
$G(x)$ is the global c.d.f. of projects' returns at the end of period 1
$F_i(x)$ is the c.d.f. of projects' returns at the end of period 1 in country i.

Within-country heterogeneity: Gross flows. Cross-country heterogeneity: Net flows.

Local Banks

At the end of period 1, after uncertainty is resolved, local banks set their interbank borrowing $d_M^{i,j}$ and lending $l_M^{i,j}$ in order to maximize their profits in period 2:

$$\max_{d_M^{i,j} \geq 0, l_M^{i,j} \geq 0} \pi^{i,j} = \left(\underbrace{R^i + \epsilon^j}_{\equiv R^{i,j}} \right) k^{i,j} - R_H^i d^{i,j} + R_M^l l_M^{i,j} - R_M^d d_M^{i,j}$$

subject to a balance sheet identity:

$$k^{i,j} + l_M^{i,j} = E^{i,j} + d^{i,j} + d_M^{i,j}$$

and a leverage (or total assets under management) constraint:

$$k^{i,j} \leq \bar{k}$$

Corner solution where bank either lends its funds, borrows, or does not participate in wholesale market.

Global Banks

Global banks set their lending and borrowing to maximize their period 2 profits:

$$\max_{l_M^g, d_M^g} \pi^g = R_M^d l_M^g - R_M^l d_M^g$$

subject to a balance sheet identity:

$$l_M^g = E^g + d_M^g$$

and a **leverage constraint**:

$$d_M^g \leq \lambda^g$$

There is a spread between lending and borrowing rates if leverage is binding.

Equilibrium

Equilibrium in the wholesale market.
In equilibrium, the global supply of funds should be equal to the global demand for funds on the inter-bank market. The condition is:

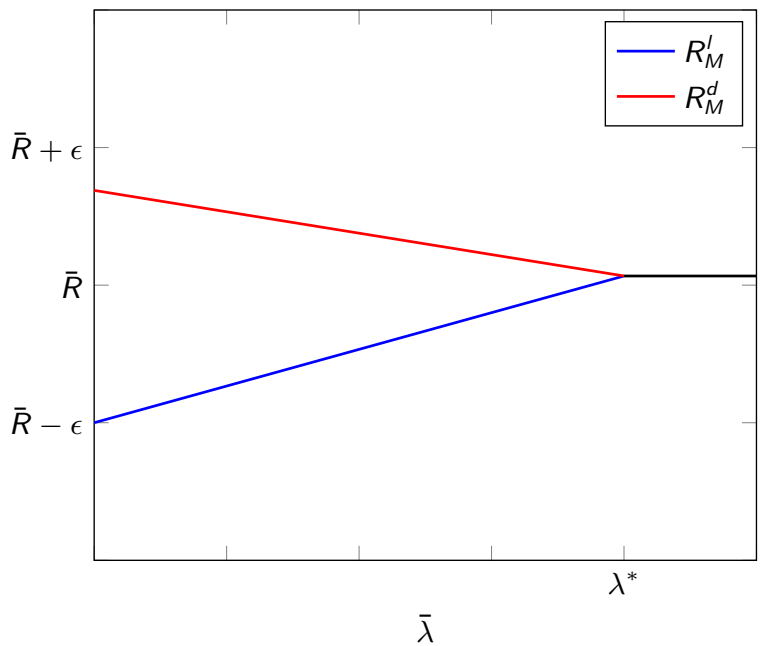
$$\underbrace{\underbrace{\int_g E^g}_{\text{Global banks' internal equity}} + \underbrace{\sum_{i=1}^{N} \int_j \left(E^{i,j} + d^{i,j}\right) \mathbb{I}(R^{i,j} < R_M^l)}_{\text{Local banks' lending}}}_{\text{Global banks' lending}} = \underbrace{\sum_{i=1}^{N} \int_j \left(\bar{k} - E^{i,j} - d^{i,j}\right) \mathbb{I}(R^{i,j} > R_M^d)}_{\text{Local banks' borrowing}}$$

$\mathbb{I}(R^{i,j} < R_M^l)$ is an indicator function equal to 1 if $R^{i,j} < R_M^l$ and 0 otherwise.
$\mathbb{I}(R^{i,j} > R_M^d)$ is an indicator function equal to 1 if $R^{i,j} > R_M^d$ and 0 otherwise.

Wholesale Rates

Assumption: $E^g = \bar{E}_G,\ \lambda^g = \bar{\lambda}\ \forall g,\ E^{i,j} = \bar{E}_L\ \forall i, j.$
This implies $d^{i,j} = d^i \equiv \bar{d}\ \forall i, j.$

Figure: Inter-bank Borrowing and Lending Rates



Note. This figure shows the inter-bank borrowing (red line) and lending (blue line) rates as a function of global banks' leverage, in the special case where $R^i = \bar{R}\ \forall i$. The value λ^* denotes the leverage level such that the constraint of global banks does not bind. Formulas Skip Retail

Local Banks

At the beginning of period 1, before uncertainty is resolved, local banks compete to raise deposits $d^{i,j}$ from their home representative household. Local banks set their deposits $d^{i,j}$ in order to maximize their expected profits in period 2:
The profits of local bank j located in country i in period 2 are:

$$\pi^{i,j} = \begin{cases} R_M^l \left(E^{i,j} + d^{i,j}\right) - R_H^i d^{i,j} & \text{with probability } G(R_M^l) \\ R^{i,j} \left(E^{i,j} + d^{i,j}\right) - R_H^i d^{i,j} & \text{with probability } G(R_M^d) - G(R_M^l) \\ R^{i,j} \left(E^{i,j} + d^{i,j}\right) - R_H^i d^{i,j} + \left(R^{i,j} - R_M^d\right) d_M^{i,j} & \text{with probability } 1 - G(R_M^d) \end{cases}$$

Their supply of deposits is given by:

$$G(R_M^l) R_M^l + \left(1 - G(R_M^l)\right) \mathbb{E}\left[R^{i,j} | R^{i,j} > R_M^l\right] = R_H^i$$

Both $\frac{dR_M^l}{d\bar{d}} < 0$ and $\frac{d\,\mathbb{E}\left[R^{i,j} | R^{i,j} > R_M^l\right]}{d\bar{d}} < 0$, thus the supply of $\bar{d}$ is decreasing in R_H^i.

Households

In each country i, there is a representative household. Households are born with a wealth endowment W^i in period 1, optimally consume and save through local bank deposits d^i at the gross competitive deposit rate R_H^i.

Households in country i maximize:

$$\max_{d^i} U^i = u(c_1^i) + \beta^i \, \mathbb{E}[c_2^i]$$

Their budget constraints in period 1 and 2 are given by:

$$c_1^i + d^i = W^i$$
$$c_2^j = R_H^i d^i$$

The demand for deposits is given by households' FOC:

$$\frac{dU^i}{dd^i} = 0 \;:\; u'(c_1^j) = \beta^i R_H^i$$

The demand for deposits is increasing in R_H^i.

Competitive Equilibrium

The competitive equilibrium is such that:

- (i) Global banks set their levels of lending l_M^g and borrowing d_M^g so as to maximize their profits subject to their balance sheet and leverage constraints, taking the interbank rates as given;
- (ii) Local banks raise deposits $d^{i,j}$ so as to maximize their expected profits, and set their levels of interbank lending $l_M^{i,j}$ and borrowing $d_M^{i,j}$ contingent on their productivity parameter, taking the interbank rates and the bank deposit rate as given;
- (iii) Households set their level of deposits d^i so as to maximize their utility, taking the bank deposit rate as given;
- (iv) The lending and borrowing interbank rates, R_M^l and R_M^d, and the bank deposit interest rates, R_H^i, clear the global wholesale market and the local retail markets for household deposits in all countries.

Country Aggregates

Proposition.
The external assets of country i are given by:

$$A^i = \underbrace{\left(1 - s^i\right) \frac{\bar{\lambda}}{N}}_{\text{Local Banks}} + \underbrace{s^i \left(\bar{E}_G + \bar{\lambda}\right) \left[\frac{N-1}{N}\right]}_{\text{Global Banks}} \quad \text{if } R^i = R \; \forall i$$

A^i is increasing in s^i (Stylized Fact #4) and in $\bar{\lambda}$.
General case:

$$A^i = \underbrace{\left(1 - s^i\right) \frac{\bar{\lambda}}{N} \frac{F_i(R_M^l)}{G(R_M^l)}}_{\text{from Local Banks}} + \underbrace{s^i \left(\bar{E}_G + \bar{\lambda}\right) \left[\frac{N\left(1 - G(R_M^d)\right) - \left(1 - F_i(R_M^d)\right)}{N\left(1 - G(R_M^d)\right)}\right]}_{\text{from Global Banks}}$$

Country Aggregates

Proposition.
The net external assets of country i, are given by:

$$N^i \equiv A^i - L^i = \frac{\bar{\lambda}}{N}\left[\underbrace{\frac{F_i(R_M^l)}{G(R_M^l)} - \frac{1-F_i(R_M^d)}{1-G(R_M^d)}}_{\equiv \xi}\right] + \frac{\bar{E}_G}{N}\left[s^i N - \frac{1-F_i(R_M^d)}{1-G(R_M^d)}\right]$$

$\frac{dN^i}{d\bar{\lambda}} > 0$ if and only if $\xi > 0$.

The higher a country's external net assets on global banks, the higher its increase in net external assets in response to an increase in global leverage.

Comparative Statics

Main Prediction 1: The response of the current account to a change in global leverage depends on the country's initial net external position against global banks.

Main Prediction 2: This differentiated response of the current account is driven by investment, not savings.

Extra Prediction 1: The response of other domestic macroeconomic variables to a change in global leverage depends on the country's initial net external position against global banks.

Extra Prediction 2: External positions are increasing in global banks' leverage.

Extra Prediction 3: Inter-bank funding and Global banks' lending interest rates respectively increase and decrease with global banks' leverage.

Empirical Evidence

Variables and Sources

Panel of 47 countries, quarterly data from 2000Q1-2019Q4.

- Global variables:
  - Global banks' leverage: U.S. Broker-Dealers' leverage. Leverage
    Leverage is defined as Assets/Equity of the U.S. broker dealer sector from the Federal Reserve's Flow of Funds.
  - VIX
  - WRGDP
- Country-specific variables:
  - IMF BOP (Inflows, Outflows, Current Account)
  - IMF IFS (GDP, Investment, Equity prices, Price level)
  - BIS (Positions vis a vis Global Banks, all sectors and banking sector)

Regressions Specification

Estimate two sets of regressions:

$$Y_{i,t} = c_i + \beta_0^i t + \beta_1 L_t + \beta_2 L_t * NA_{i,t-1} + \beta_3 NA_{i,t-1} + \alpha_1 \mathbb{X}_t + \beta_4 Y_{i,t-1} + \epsilon_{i,t} \quad (1)$$

$$\Delta Y_{i,t} = c_i + \beta_0^i t + \beta_1 \Delta L_t + \beta_2 \Delta L_t * NA_{i,t-1} + \beta_3 NA_{i,t-1} + \alpha_1 \tilde{\mathbb{X}}_t + \alpha_2 \Delta Y_{i,t-4_1} + \epsilon_{i,t} \quad (2)$$

where $Y_{i,t}$ is either the current account to GDP, gross capital formation to GDP, savings to GDP, or the real equity price index. L_t is the leverage of US Broker-Dealers. $NA_{i,t-1}$ is the net external assets of all counter-party resident sectors of country i on global banks at $t-1$. $\mathbb{X}_t$ is a vector including the world real GDP growth rate and the VIX. $\tilde{\mathbb{X}}_t$ is a vector including the world real GDP growth rate and the first-difference of the VIX. $\Delta Y_{i,t-4_1}$: 4 lags of the endogenous variable.

All specifications are estimated via OLS, include country fixed effects and country-specific linear time trend, and double-clustured standard errors by country and time.

Current Account

The current account responds to leverage.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	CA_GDP			OUTMINFLOWS_GDP		
Leverage	-0.058*	-0.036	-0.017	-0.072	-0.032	-0.016
	[0.034]	[0.036]	[0.041]	[0.044]	[0.049]	[0.048]
Leverage#NA_GDP	**0.170*** **	**0.351** **	**0.287*** **	**0.318*** **	**0.534*** **	**0.324*** **
	[0.054]	[0.145]	[0.067]	[0.063]	[0.171]	[0.116]
Observations	4,040	3,594	3,364	4,037	3,591	3,361
R-squared	0.604	0.602	0.581	0.438	0.475	0.432
r2_within	0.102	0.133	0.039	0.063	0.124	0.020
Controls	YES	YES	YES	YES	YES	YES

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. (1) and (4): Entire sample. (2) and (5): Excluding Financial centers. (3) and (6): Excluding years 2007-2008.

Full Table Net Assets - Banks Net Banking Assets

Current Account - Decomposition

Gross capital formation responds to leverage, but savings does not.

VARIABLES	(7)	(8)	(9)	(10)	(11)	(12)
	GCF_GDP			S_GDP		
Leverage	0.111***	0.099**	0.096**	0.047	0.062	0.072
	[0.030]	[0.039]	[0.039]	[0.031]	[0.044]	[0.044]
Leverage#NA_GDP	**-0.162*** **	**-0.267** **	**-0.230** **	**-0.046**	**0.054**	**-0.051**
	[0.034]	[0.124]	[0.087]	[0.055]	[0.129]	[0.144]
Observations	3,572	3,098	2,987	3,524	3,078	2,939
R-squared	0.542	0.581	0.544	0.722	0.686	0.734
r2_within	0.138	0.171	0.068	0.061	0.047	0.040
Controls	YES	YES	YES	YES	YES	YES

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. (7) and (10): Entire sample. (8) and (11): Excluding Financial centers. (9) and (12): Excluding years 2007-2008.

Full Table Net Assets - Banks

Change in Current Account

A positive change in leverage is associated with a higher increase in the current account in countries with higher net assets against global banks.

VARIABLES	(1) CA_GDP_CHG	(2) CA_GDP_CHG	(3) OUTMINFLOWS_GDP_CHG	(4) OUTMINFLOWS_GDP_CHG
Leverage_CHG	-0.049	0.038	0.098	0.119
	[0.089]	[0.088]	[0.091]	[0.086]
Leverage_CHG#NA_GDP	**0.086***	**0.471*****	**0.499*****	**0.367****
	[0.049]	[0.112]	[0.165]	[0.177]
Observations	3,832	3,410	3,825	3,403
R-squared	0.631	0.717	0.405	0.426
r2_within	0.631	0.717	0.405	0.426
Controls	YES	YES	YES	YES

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. (1) and (3): Entire sample. (2) and (4): Excluding Financial centers.

Net Assets - Banks Net Banking Assets

Change in Current Account - Decomposition

Same message as before, but financial centers may play a special role.

VARIABLES	(5) GCF_GDP_CHG	(6) GCF_GDP_CHG	(7) S_GDP_CHG	(8) S_GDP_CHG
Leverage_CHG	0.037	-0.024	-0.024	0.025
	[0.087]	[0.084]	[0.041]	[0.045]
Leverage_CHG#NA_GDP	**-0.078*** **	**-0.178***	**-0.001**	**0.271** **
	[0.023]	[0.105]	[0.050]	[0.127]
Observations	3,384	2,934	3,336	2,914
R-squared	0.655	0.770	0.750	0.778
r2_within	0.654	0.769	0.750	0.777
Controls	YES	YES	YES	YES

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. (5) and (7): Entire sample. (6) and (8): Excluding Financial centers.

Net Assets - Banks

Extra: Real Equity Returns

A positive change in leverage is associated with a higher increase in real asset prices in countries with higher net liabilities against global banks.

VARIABLES	(9) REQUITY	(10) INDEX_CHG
Leverage_CHG	-0.465	-0.555*
	[0.285]	[0.312]
Leverage_CHG#NA_GDP	**-0.248*** **	**-0.910** **
	[0.040]	[0.396]
Observations	2,833	2,383
R-squared	0.487	0.468
r2_within	0.471	0.452
Controls	YES	YES

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. (9): Entire sample. (10): Excluding Financial centers.

Net Assets - Banks

Conclusion

- This paper develops a multi-country model with both local and global banks.
- Changes in global banks' leverage not only has impact on gross flows, but also on net flows.
- The net external position of a country against global banks explains the differentiated impact of changes in global banks' leverage across countries.
- Next: Welfare analysis / Macro-prudential implications

Appendix

Global Banking Positions - by Counter-party Sector

Sector	% Total
Total claims - All sectors	1.00
Total claims - Banks, total	0.60
Total claims - Non-banks, total	0.39
Total claims - Unallocated by sector	0.01
Total liabilities - All sectors	1.00
Total liabilities - Banks, total	0.64
Total liabilities - Non-banks, total	0.29
Total liabilities - Unallocated by sector	0.07

Note. This table provides a decomposition of total claims and liabilities of BIS reporting banks by counter-party sector. The numbers represent the average over the period 2000Q1-2019Q4. Sources: BIS, Author's calculations.

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Global Banking Positions - by Instrument

Instruments	**% Total**
Total claims - All instruments	1.00
Total claims - Loans and deposits	0.72
Total claims - Debt securities	0.21
Total claims - Other instruments	0.07
Total liabilities - All instruments	1.00
Total liabilities - Loans and deposits	0.88
Total liabilities - Debt securities	0.08
Total liabilities - Other instruments	0.04

Note. This table provides a decomposition of total claims and liabilities of BIS reporting banks by instrument. The numbers represent the average over the period 2000Q1-2019Q4. Sources: BIS, Author's calculations.

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Headquarters

The distribution of controlling parent by country (number of banks) is as follows: US (15), CN (12), FR (7), JP (7), DE (7), GB (6), CA (5), IT (4), ES (4), KR (4), AU (4), BR (3), SE (3), BE (2), CH (2), NL (2), RU (2), SG (2), AT (1), DK (1), FI(1), IN (1), NO (1).

Note. Using the BIS Banking List of internationally active banking entities, Aldoraso et al. (2021) obtain a dataset comprising 96 of the largest bank holding companies (BHCs) in the world, including most of the sample used by the Basel Committee on Banking Supervision (BCBS) in the GSIB assessment exercise. Sources: BIS, Author's calculations.

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G-SIBs

List of Global Systemically Important Banks (G-SIBs) as of November 2021:

- U.S. (8): JP Morgan Chase, Citigroup, Bank of America, Goldman Sachs, Bank of New York Mellon, Morgan Stanley, State Street, Wells Fargo.
- China (4): Bank of China, China Construction Bank, Industrial and Commercial Bank of China, Agricultural Bank of China.
- France (4): BNP Paribas, Groupe BPCE, Groupe Crédit Agricole, Société Générale.
- U.K. (3): HSBC, Barclays, Standard Chartered.
- Japan (3): Mitsubishi UFJ FG, Mizuho FG, Sumitomo Mitsui FG.
- Canada (2): Royal Bank of Canada, Toronto Dominion.
- Switzerland (2): Credit Suisse, UBS.
- Germany (1): Deutsche Bank.
- Italy (1): UniCredit.
- Netherlands (1): ING Bank.
- Spain (1): Santander.

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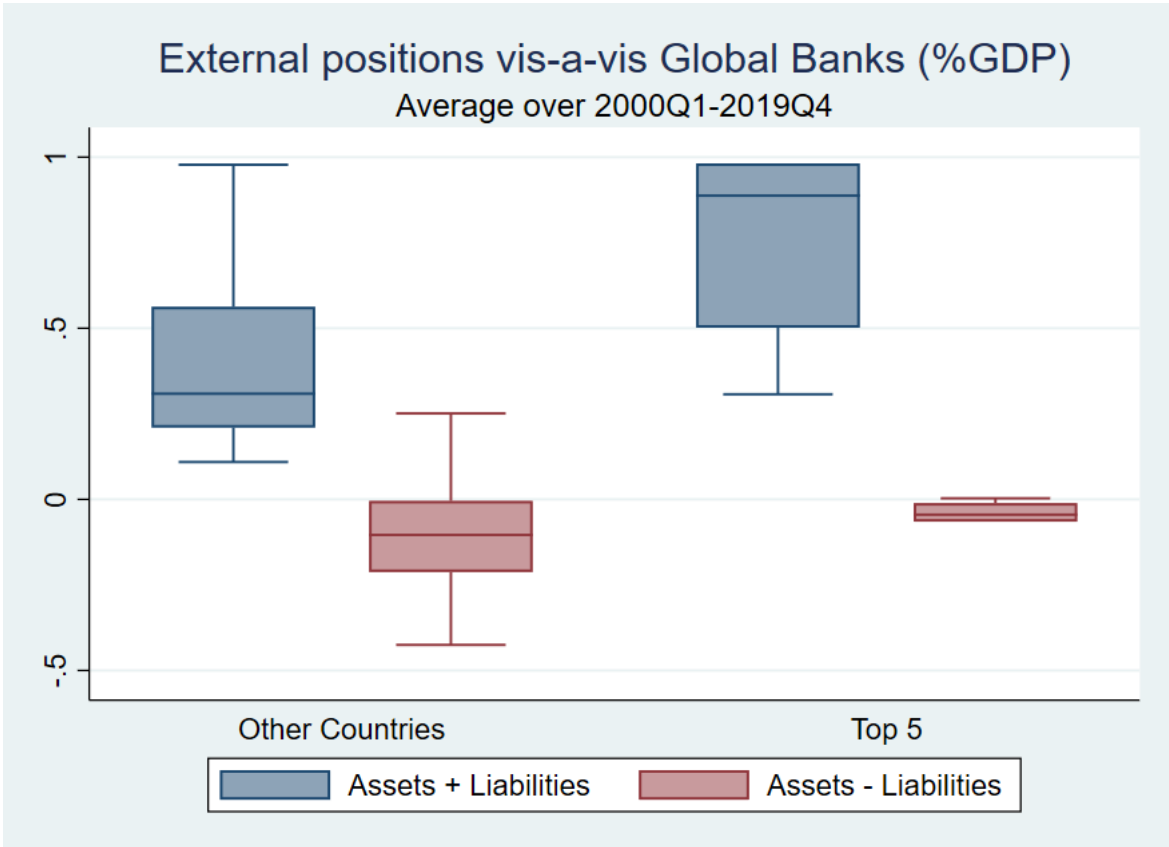
Positions vis-a-vis Global Banks



Note. This chart represents the distribution of the average position of individual countries against Global Banks over the period 2000Q1-2019Q4. Top 5: US, UK, JP, FR, DE. Global Banks: BIS reporting banks. Sources: BIS, IMF, Author's calculations.

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Equilibrium

Equilibrium in the wholesale market.

Assumption: $E^g = \bar{E}_G,\ \lambda^g = \bar{\lambda}\ \forall g,\ E^{i,j} = \bar{E}_L\ \forall i,j.$
This implies $d^{i,j} = d^i \equiv \bar{d}\ \forall i,j.$

Lemma: If the above Assumption holds, then:

$$R_M^l = G^{-1}\left(\frac{\bar{\lambda}}{N\left(\bar{E}_L + \bar{d}\right)}\right) \tag{1}$$

$$R_M^d = G^{-1}\left(1 - \frac{\bar{\lambda} + \bar{E}_G}{N\left(\bar{k} - \bar{E}_L - \bar{d}\right)}\right) \tag{2}$$

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Local Banks

Local Banks' balance sheet:
We can distinguish 3 cases, depending on the realization of $R^{i,j}$:

$$\begin{cases} d_M^{i,j} = \bar{k} - E^{i,j} - d^{i,j} \text{ and } l_M^{i,j} = 0 & \text{if } R^{i,j} > R_M^d \\ d_M^{i,j} = 0 \text{ and } l_M^{i,j} = 0 & \text{if } R_M^d > R^{i,j} > R_M^l \\ d_M^{i,j} = 0 \text{ and } l_M^{i,j} = E^{i,j} + d^{i,j} & \text{if } R^{i,j} < R_M^l \end{cases} \tag{3}$$

Equilibrium

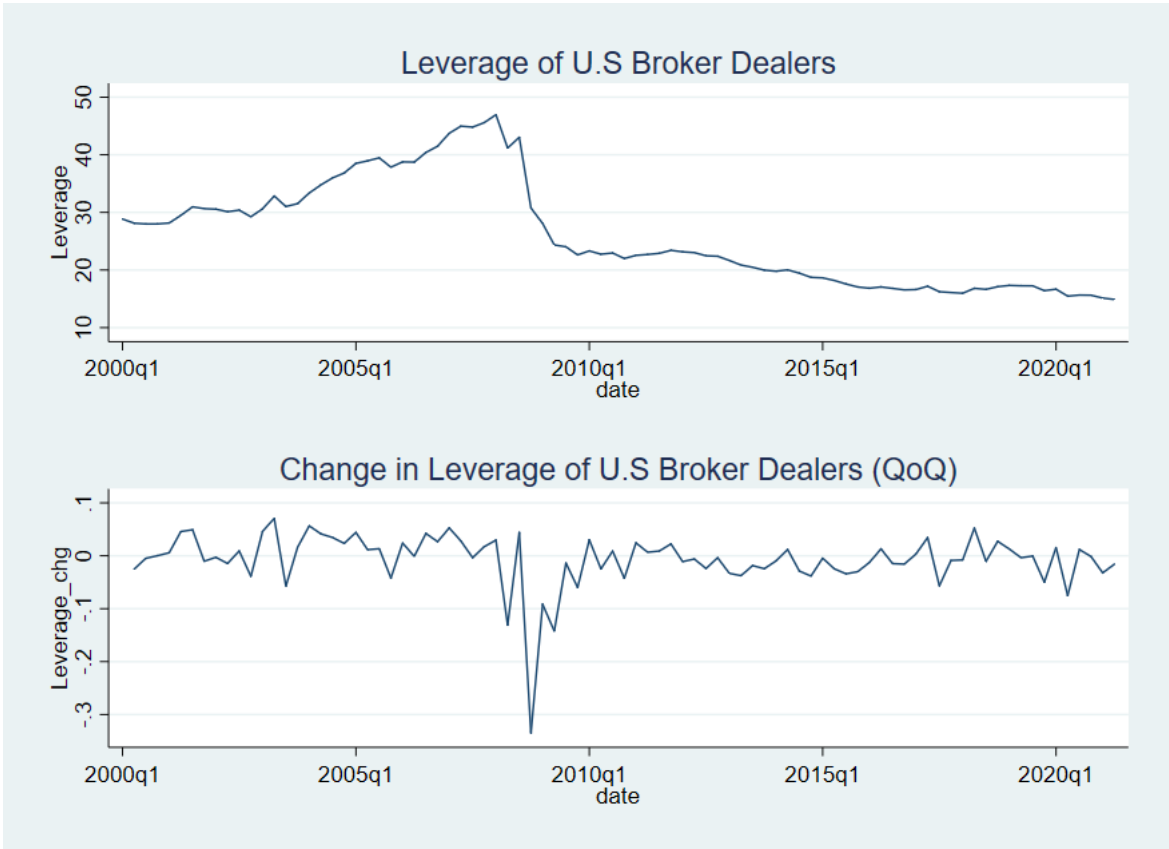
Equilibrium in the retail markets for local deposits.
In a symmetric equilibrium, the amounts of deposits raised by every local bank, both within and across countries, are equal. We have: $\int_j d^{i,j} = d^i = \bar{d}$.

Using this equilibrium condition, the supply of deposits , and the demand for deposits , we can solve for the equilibrium domestic bank deposits $\bar{d}$:

$$u'(c_1^j) = \beta^i \left(\frac{\bar{\lambda}}{N\left(\bar{E}_L + \bar{d}\right)} G^{-1}\left(\frac{\bar{\lambda}}{N\left(\bar{E}_L + \bar{d}\right)} \right) + \left(1 - \frac{\bar{\lambda}}{N\left(\bar{E}_L + \bar{d}\right)} \right) \mathbb{E}\left[R^{i,j} | R^{i,j} > G^{-1}\left(\frac{\bar{\lambda}}{N\left(\bar{E}_L + \bar{d}\right)} \right) \right] \right) \tag{4}$$

And finally, for the bank deposit interest rates R_H^i in all countries.

Leverage U.S. Broker Dealers



Note. This chart represents the leverage of U.S. Broker Dealers. Sources: Federal Reserve - Flows of Funds.

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Positions vis-a-vis Global Banks

meanNA_GDP

Percentiles			
1%	-.4252673	Obs	48
5%	-.2817654	Sum of Wgt.	48
10%	-.2760051		
25%	-.1821198	Mean	-.1002886
		Std. Dev.	.1286146
50%	-.0753762		
		Variance	.0165417
75%	-.0061125	Skewness	-.0439615
90%	.0165955	Kurtosis	3.122868
95%	.0959418		
99%	.2510316		

Note. This chart represents the distribution of the average position of individual countries against Global Banks over the period 2000Q1-2019Q4. Sources: BIS, IMF, Author's calculations.

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Current Account

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	CA_GDP			OUTMINFLOWS_GDP		
Leverage	-0.058*	-0.036	-0.017	-0.072	-0.032	-0.016
	[0.034]	[0.036]	[0.041]	[0.044]	[0.049]	[0.048]
Leverage#NA_GDP	**0.170*** **	**0.351** **	**0.287*** **	**0.318*** **	**0.534*** **	**0.324*** **
	[0.054]	[0.145]	[0.067]	[0.063]	[0.171]	[0.116]
NA_GDP	-2.040	-7.151	-4.672**	-7.179***	-11.940**	-4.943
	[1.556]	[4.951]	[1.867]	[1.804]	[5.752]	[4.146]
WRGDP_CHG	0.072	-0.107	0.090	-0.347	-0.459	-0.279
	[0.248]	[0.260]	[0.418]	[0.298]	[0.318]	[0.410]
VIX	-0.024	-0.028	-0.011	-0.079***	-0.066***	-0.054***
	[0.020]	[0.022]	[0.023]	[0.025]	[0.022]	[0.019]
L1.Y	0.229*	0.269**	0.117	0.131	0.236***	0.046
	[0.115]	[0.132]	[0.107]	[0.087]	[0.054]	[0.091]
Constant	1.895	1.183	0.539	3.458**	2.053	1.581
	[1.190]	[1.279]	[1.279]	[1.526]	[1.664]	[1.394]
Observations	4,040	3,594	3,364	4,037	3,591	3,361
R-squared	0.604	0.602	0.581	0.438	0.475	0.432
r2_within	0.102	0.133	0.039	0.063	0.124	0.020

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. (1) and (4): Entire sample. (2) and (5): Excluding Financial centers. (3) and (6): Excluding years 2007-2008.

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Current Account - NAB

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	CA_GDP			OUTMINFLOWS_GDP		
Leverage	-0.067*	-0.053	-0.033	-0.090**	-0.058	-0.035
	[0.034]	[0.037]	[0.042]	[0.044]	[0.047]	[0.048]
Leverage#NAB_GDP	**0.228****	**0.485****	**0.398*****	**0.428*****	**0.724****	**0.395****
	[0.087]	[0.234]	[0.099]	[0.110]	[0.283]	[0.171]
Observations	4,040	3,594	3,364	4,037	3,591	3,361
R-squared	0.602	0.600	0.580	0.436	0.471	0.431
r2_within	0.098	0.127	0.036	0.060	0.117	0.017

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. (1) and (4): Entire sample. (2) and (5): Excluding Financial centers. (3) and (6): Excluding years 2007-2008.

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Current Account - Decomposition

VARIABLES	(7)	(8)	(9)	(10)	(11)	(12)
	GCF_GDP			S_GDP		
Leverage	0.111***	0.099**	0.096**	0.047	0.062	0.072
	[0.030]	[0.039]	[0.039]	[0.031]	[0.044]	[0.044]
Leverage#NA_GDP	**-0.162*** **	**-0.267** **	**-0.230** **	**-0.046**	**0.054**	**-0.051**
	[0.034]	[0.124]	[0.087]	[0.055]	[0.129]	[0.144]
NA_GDP	5.500***	8.171**	6.733**	3.659**	2.097	3.494
	[1.896]	[3.715]	[3.205]	[1.778]	[4.404]	[3.633]
WRGDP_CHG	0.301	0.423	0.075	0.335	0.246	0.166
	[0.438]	[0.494]	[0.298]	[0.349]	[0.396]	[0.452]
VIX	0.022	0.028	0.021	-0.005	-0.001	0.009
	[0.025]	[0.027]	[0.020]	[0.024]	[0.027]	[0.025]
L1.Y	0.232***	0.266***	0.160**	0.185***	0.160**	0.147**
	[0.060]	[0.062]	[0.061]	[0.062]	[0.066]	[0.059]
Constant	14.132***	13.525***	16.365***	17.331***	17.257***	17.473***
	[1.665]	[1.768]	[1.856]	[1.546]	[1.701]	[2.033]
Observations	3,572	3,098	2,987	3,524	3,078	2,939
R-squared	0.542	0.581	0.544	0.722	0.686	0.734
r2_within	0.138	0.171	0.068	0.061	0.047	0.040

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. (7) and (10): Entire sample. (8) and (11): Excluding Financial centers. (9) and (12): Excluding years 2007-2008.

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Current Account - Decomposition - NAB

VARIABLES	(7)	(8)	(9)	(10)	(11)	(12)
	GCF_GDP			S_GDP		
Leverage	0.119***	0.113***	0.108***	0.048	0.053	0.072*
	[0.030]	[0.037]	[0.038]	[0.030]	[0.041]	[0.042]
Leverage#NAB_GDP	**-0.244*** **	**-0.353***	**-0.348** **	**-0.076**	**0.066**	**-0.077**
	[0.057]	[0.194]	[0.131]	[0.068]	[0.178]	[0.176]
Observations	3,572	3,098	2,987	3,524	3,078	2,939
R-squared	0.542	0.580	0.545	0.721	0.684	0.733
r2_within	0.139	0.170	0.069	0.057	0.042	0.037

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. (6) and (10): Entire sample. (8) and (11): Excluding Financial centers. (9) and (12): Excluding years 2007-2008.

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Change in Current Account

VARIABLES	(1) CA_GDP_CHG	(2) CA_GDP_CHG	(3) OUTMINFLOWS_GDP_CHG	(4) OUTMINFLOWS_GDP_CHG
Leverage_CHG	-0.052	0.023	0.075	0.113
	[0.089]	[0.088]	[0.090]	[0.084]
Leverage_CHG#NAB_GDP	**0.090**	**0.705*** **	**0.668** **	**0.629** **
	[0.073]	[0.249]	[0.276]	[0.248]
Observations	3,832	3,410	3,825	3,403
R-squared	0.632	0.717	0.406	0.426
r2_within	0.631	0.717	0.405	0.426

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. (1) and (3): Entire sample. (2) and (4): Excluding Financial centers.

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Change in Current Account - Decomposition

VARIABLES	(5) GCF_GDP_CHG	(6) GCF_GDP_CHG	(7) S_GDP_CHG	(8) S_GDP_CHG
Leverage_CHG	0.041	-0.017	-0.023	0.012
	[0.086]	[0.085]	[0.040]	[0.043]
Leverage_CHG#NAB_GDP	**-0.110****	**-0.284***	**-0.019**	**0.365***
	[0.051]	[0.164]	[0.075]	[0.183]
Observations	3,384	2,934	3,336	2,914
R-squared	0.655	0.770	0.750	0.777
r2_within	0.655	0.769	0.750	0.777

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. (5) and (7): Entire sample. (6) and (8): Excluding Financial centers.

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Real Equity Returns

VARIABLES	(9) REQUITYINDEX_CHG	(10)
Leverage_CHG	-0.448	-0.479
	[0.285]	[0.310]
Leverage_CHG#NAB_GDP	**-0.265*** **	**-0.868**
	[0.052]	[0.531]
Observations	2,833	2,383
R-squared	0.487	0.467
r2_within	0.472	0.451

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Note. (9): Entire sample. (10): Excluding Financial centers.

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