

Who Holds Sovereign Debt and Why It Matters

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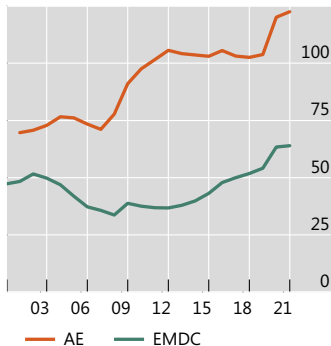
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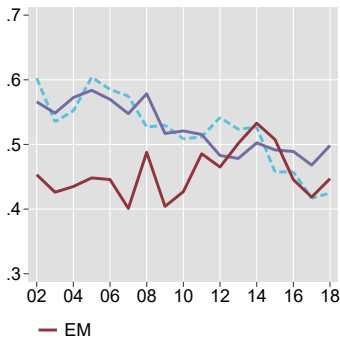
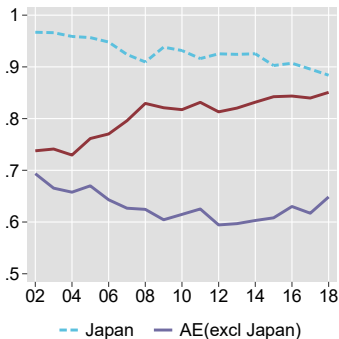
Rising Sovereign Debt Raises Questions about Investors

Figure: Government Debt to GDP by Country Groups



- Government debt rising for all countries
- Who is holding this debt?
- Might ownership affect borrowing cost exposure?

Some Breakdowns by Investor Groups



Share Held Domestically

Share Held by Non-banks

- Share of domestic holdings of debt have:
 - Increased for EMs
 - Decreased for AEs, particularly Japan

- Share of holdings by Non-banks show more short-term variation

Some Presumed Holders in the Sovereign Debt Literature

- Foreign investor "bank": EM Sovereign debt literature
 - e.g., Eaton and Gersowitz (1981), Arellano (2008), Arellano and Ramanarayanan (2012)
- Domestic banks: Sovereign-bank "doom loop" literature
 - e.g., Bocola (2016), Farhi and Tirole (2018), Perez (2018)
- Global banks: Sovereign debt crisis
 - e.g., Morelli, Ottonello and Perez (2021)
- Households and banks: Safe asset of AE debt
 - e.g., Vissing-Jorgenson and Krishnamurthy (2012), Jiang, Krishnamurthy, Lustig (2021)
- General Questions in this Paper
 - What do we know about who holds the debt?
 - Does this ownership matter to sovereign borrowers?

What we do to answer...

1. Construct aggregate data for investor holdings of govt debt

"Who holds the govt debt of a country?"

- Foreign versus Domestic
- Further disaggregated into
 - Private Banks, Private "Non-banks", Official holders
- Balanced sample: 95 countries from 1996 to 2018
- Full unbalanced sample: 152 countries beginning 1991

▶ [MaggioreNiemannSchreger](#)

▶ [ArsanalpTsuda](#)

What we do to answer...

1b. Decompose variations in debt into investor holdings

"Who holds expansions of govt debt?"

- Non-Bank Private Investors expand holdings the most
 - Non-Banks take on 69%, despite average holdings of only 46%
 - By contrast, Banks take on 20%, smaller than average of 28%

2. Disaggregated look at Nonbanks in Euro Area, US, UK

"Who are the Nonbank investors?"

- Biggest marginal investors are Mutual funds
- Exception UK: Pensions more important

What we do (cont.)...

3. Investor Demand Framework

"How do investors respond to yield and characteristics?"

Findings for EM investors: Nonbank foreign demand most elastic

4. Counterfactual Analysis "Why Ownership Matters"

Calculate borrowing cost exposure

Findings: Exposure to Nonbanks greatest

What we don't do yet ...

- Provide an equilibrium model

1.Data and Marginal Debt-holder Decomposition

Data Decomposition for Aggregate Set

- Total bookvalue of government debt for country j : D_j
- Total investor holdings for country j : \bar{H}_j
- Further decompose \bar{H}_j into three main groups
 - Private Banks
 - Private "NonBanks"
 - Official (Central Banks, IMF,etc)
- Next decompose each into Foreign and Domestic
- Therefore, total investor groups: $I = 6$
- Accounting Identity at time t

$$D_{j,t} = \sum_{i=1}^I H_{j,t}^i$$

Data Construction

Data construction is from annual aggregates

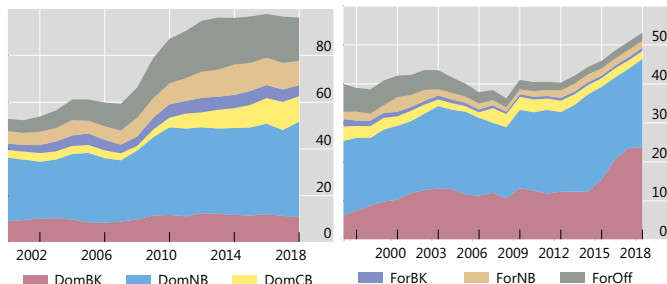
- Total debt outstanding
 - IMF Historical Public Debt Database
- Data on domestic bank and central bank holdings
 - IMF, Central bank websites
- Data on external holdings
 - Avdjiev et al (2022) - BIS, IMF, World Bank
- Data on foreign official holdings
 - Arslanalp and Tsuda (2012,2014) and World Bank

End result:

- 1744 country-year observations
- Spanning 95 countries over 1991-2018

Debt Levels and Investor Holder Composition

Figure: Debt Holdings by Investor Group (USD bill)



Advanced economies

Emerging markets

- AEs: Growing share of Dom & Foreign CBs (QE, safe assets)
- EMs: Growing share of Dom Banks & NonBanks

Who Holds Marginal Increases in Sovereign Debt?

Consider decomposition regression

$$\frac{H_{j,t}^i - H_{j,t-1}^i}{D_{j,t-1}} = \alpha_j + \alpha_t + \beta_0^i \frac{D_{j,t} - D_{j,t-1}}{D_{j,t-1}} + \varepsilon_{j,t}^i$$

- $H_{j,t}^i$ holding of country j 's debt by investor group i
- $D_{j,t}$ is the total debt of country j
- Then β_0^i captures the marginal variation in holdings as:

$$1 = \sum_i \beta_0^i$$

- Finding: When the sovereign debt increases by 1 unit
 - Nonbanks hold roughly 0.70 of the increase

Marginal Responses are Not Average Responses

► Different Episodes

	DomBK	DomNB	DomCB	ForBK	ForNB	ForCB
Panel A: Marginal Share β_0^i						
All	0.16	0.39	0.05	0.04	0.30	0.06
AE	0.02	0.39	0.09	0.06	0.40	0.04
EM	0.21	0.43	0.04	0.05	0.24	0.04
Panel B: Average Share						
All	0.22	0.28	0.07	0.06	0.18	0.19
AE	0.19	0.32	0.04	0.10	0.21	0.14
EM	0.26	0.28	0.07	0.06	0.17	0.16

Investor Decomposition Takeaways

In response to variations in government debt

- NonBank investors absorb largest share
- Banks absorb least
 - perhaps due to prudential policy
- Compared to standard literature
 - suggests greater role for Nonbank investors

2. Disaggregated Investor Groups

- "Non-Banks" -Large group including many investor types
 - Private Corporations
 - Pensions and Annuities
 - Endowments
 - Hedge Funds
 - Mutual Funds
 - Households
- Question: Which investors drive aggregate results?
- Analyze disaggregated securities holdings for:
 - Euro Area, United States, United Kingdom

Disaggregated NonBank Takeaways

Repeat decomposition for subgroups within Nonbank group

Marginal response β_0^i shows Nonbank behavior driven by:

- Mutual Funds absorb largest share $\beta_0^{MF} \approx 0.85$
- Insurance and Pensions also important but less $\beta_0^{IP} \approx 0.14$
 - except for UK
- Corporations, Households, others relatively unresponsive

▶ EA NonBank

▶ EA General

▶ USTreas

▶ UKGilts

But so far analysis reduced form

- Understanding behavior requires identification
- We turn to next...

3. General Framework: Investors and Issuers

General Conceptual Framework: Investors and Issuers

- Issuers: Standard decisions to borrow given price
 - Debt-to-Income policy function $d_t \equiv d(\mathbf{X}_{j,t}; P_{j,t})$
 - Defaultable Debt:
 - e.g., Eaton-Gersowitz (1981), Arellano (2008)
 - Safe asset:
 - e.g., Krishnamurthy Vissing-Jorgensen (2012), Jiang, et al (2019)
- Investors: Standard Asset Demand System (Kojen-Yogo)

Sovereign Debt Funding

Government targets Debt-to-GDP facing creditors

Each creditor i provides funding share of country j debt as:

$$h_{j,t}^i \equiv \left(\frac{H_{j,t}^i}{D_{j,t}} \right) d_{j,t}$$

So market clearing condition is:

$$P_{j,t} d_{j,t} = \sum_{i=1}^I P_{j,t}^i h_{j,t}^i$$

Funding Estimation

Instrument using market clearing (Koejin-Yogo)

- Calculate Market value $h_{j,t}^{i,m} = h_{j,t}^i P_{j,t}$
- Estimate market value for i given debt book value for j :

$$\ln h_{j,t}^{i,m} = \beta_0 + \beta_1' X_{j,t} + \theta_j + \varepsilon_{j,t}^i$$

- Impose market clearing with fitted values

$$\sum_i \widehat{h_{j,t}^{i,m}} = d_{j,t} P_{j,t} = d_{j,t} \exp(-T \bar{y}_{j,t})$$

- Use $\bar{y}_{j,t}$ as instrument for endogenous yield $y_{j,t}$

To address endogenous $d_{j,t}$, project on $d_{j,t-1}$, $X_{j,t}$

▶ DebtProjection

▶ ReturnProjections

Investor Funding Estimates: EM countries

	(1) Dom Bank	(2) Dom NonBank	(3) Dom Cen	(4) For Bank	(5) For NonBank	(6) For Cen
Sovereign yield	12.1** (6.8)	22.9** (8.8)	27.4 (17.2)	28.2** (13.7)	38.4** (19.7)	24.9** (14.5)
Inflation	-3.5** (0.9)	-3.5** (1.3)	-4.4* (2.3)	-6.0*** (1.9)	-4.0 (2.6)	-4.1** (2.0)
Observations	350	323	288	350	305	342

Country Controls include GDP, GDP growth, export share, sovereign ratings

- Higher yield, lower inflation => general increase
- Nonbanks have highest response within category (Dom or For)

AE Sovereign Nonbanks also most responsive

▶ AEFunding

Funding demand can also be viewed as Investor Demand

"Investors" vary by country

- Domestic banks for country A => Foreign Banks for country B
- Identity of foreign banks unknown

Assumptions to Relate to Demand:

- Focus on EM countries to mitigate identity problem
- Foreign investors are USD-based

Market clearing condition becomes (as in Kojen-Yogo)

$$P_{j,t} E_{j,t} Q_{j,t} = \sum_{i=1}^I \omega_{j,t}^i A_t^i = \sum_{i=1}^I P_{j,t}^i H_{j,t}^i$$

- where $E_{j,t}$ is USD price of currency j , A_t^i is wealth for i , $D_{j,t} = E_{j,t} Q_{j,t}$

Investor components

Investor demand H for country j 's portfolio demand depends on: ▶ CARA preferences

- Exogenous characteristics $X_{j,t}$
- Excess returns relevant to the investor $\mu_{j,t}$

Excess returns by investor type

- Domestic \Rightarrow local currency returns less risk-free
- Foreign \Rightarrow excess local currency returns plus currency change

Problem: Bond price and hence investor returns are endogenous to demand ▶ Instrument Returns

Results similar to funding results above ▶ Investor Demand

4. Borrowing sensitivity Analysis

What is the cost sensitivity for sovereigns given their investors?

- Sensitivity \equiv % change in yield for % change in debt

$$D_{jt}P_{jt} = \sum_{i=1}^6 H_{jt}^i P_j^i(H_{jt}^i)$$

Differentiating wrt the yield y :

$$\eta_{jt} \equiv \frac{\partial y_{jt}}{\partial D_{jt}/D_{jt}} = \sum_{i=1}^6 \left(\frac{\partial y_{jt}^i}{\partial D_{jt}/D_{jt}} \right) \frac{dH_j^i}{dD_j} = \sum_{i=1}^6 \left(\frac{a_j^i}{\nu_j^i} \right)$$

where

- a_j^i is marginal absorption of investor i
- ν_j^i is semi-elasticity of demand wrt yield

4. Emerging markets: Counterfactual Results

- Overall $\eta = 2.33\%$
- Excluding non-banks, this rises to 2.91%

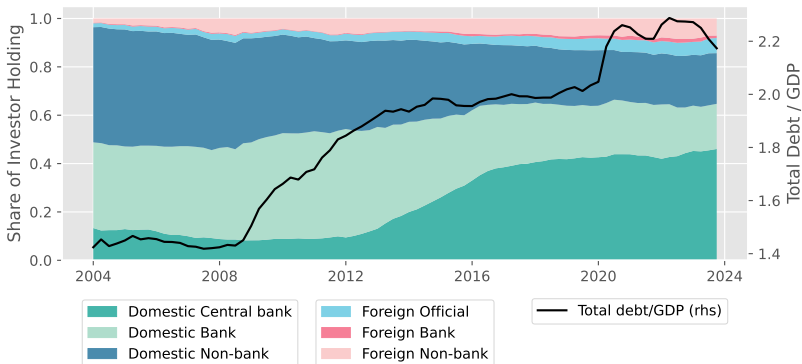
Investor Sensitivity Counterfactuals					
Overall	No Banks	No Non-banks	No Off	Inflation	GDP growth
2.33	2.09	2.91	2.25	1.48	-2.77

- EM countries most sensitive to (losing) Non-bank investors
- To keep current market-value of debt same
 - One point increase in inflation requires 10.4%
 - One percentage point drop in GDP requires 11.6%
- Based on Average 8.8% yield in sample

Conclusions

- Documented Who Holds Sovereign Debt
- Expansions in govt debt largely absorbed by private Nonbanks
- Investor demand for EMs most elastic by Nonbanks
- EMs have high exposure to borrowers
 - Greatest contribution from Nonbanks
- Therefore, Who Holds Sovereign Debt Matters

What about Holders of Japanese Debt?



- Domestic holdings shares have declined
- Greater share of Foreign Non-bank

THANK YOU!

Connection to Maggiori et al Data

- Maggiori, Neiman, and Schreger (2020)
 - Detailed mutual fund holdings of private debt only
- Coppola, Maggiori, Neiman, and Schreger (2021)
 - Private and public debt holdings, externally held only
 - No data on domestic holding breakdown
- On our "to do" list to crosscheck foreign holdings

Connection to Arsanalp and Tsuda

- Arsanalp and Tsuda (2012),(2014)
 - Develop similar data set for AE and EM, resp.
 - Updated quarterly on IMF website
- Main difference: Coverage
 - Time period
 - Basic data set begins 2004
 - Some earlier data but without investor groups
 - Countries
 - 24 AEs, 24 EMs
 - Extended data but without investor groups

Which Non-Bank Investors are Marginal?

To address - Analyze disaggregated EA securities holding data

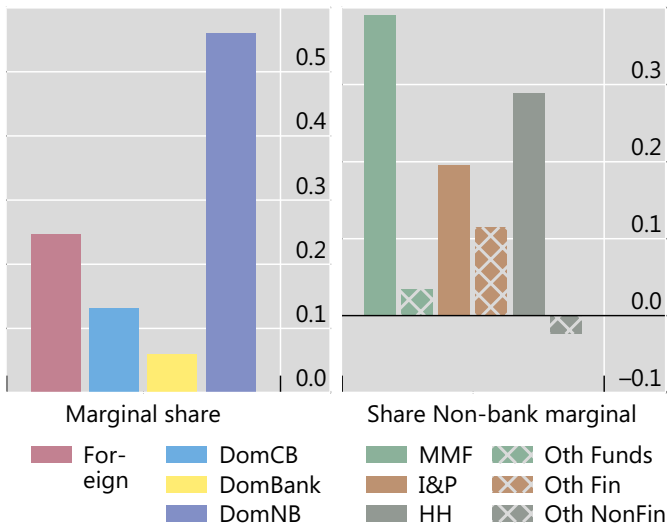
- Quarterly from 2013 to 2020, foreign only
- Repeat early decomposition using disaggregated groups

	HH	NFC	InsurPens	OthFin
All	0.01	0.00	0.14	0.85
AE	0.02	0.01	0.12	0.85
EM	0.01	0.00	0.14	0.85

- Within NonBanks, Hedge Funds and Mutual Funds account for 85%
 - Insurance and Pensions account for 14%
 - Other Nonbank groups unimportant

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Figure: Disaggregated Marginal Holders: US Treasuries



Portfolio Preferences with CARA

Standard Portfolio Optimization

$$V(h_{N,t}^i) = \underset{\{h_{N,t}^i\}}{\text{Max}} E(-e^{-AN_{t+1}^i}, u_{N,t}^i) \text{ given}$$

$$N_{t+1}^i = [R_{H,t}h_{N,t}^i + R_{0,t}(1 - h_{N,t}^i)]N_t^i$$

where $R_{H,t} = R_H(\mathbf{X}_t^w)$ for \mathbf{X}_t^w , vector of global variables

Implies solution $h_{N,t}^{i,*} = h_{N,t}^i(\mathbf{X}_t^w, u_{N,t}^i)$: Share of total debt held

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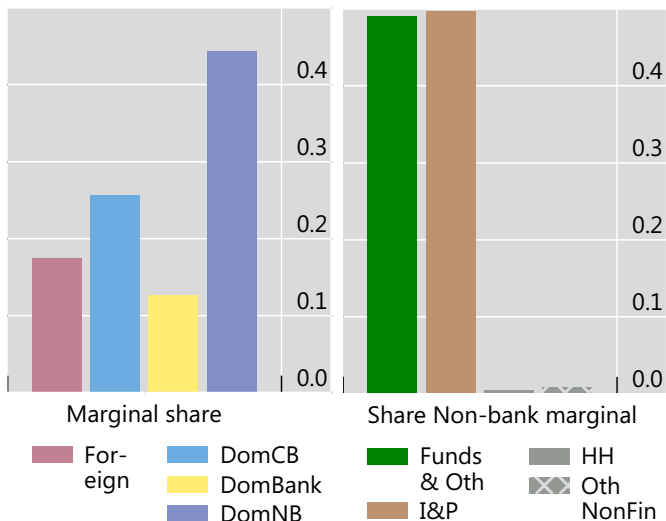
Euro Area: Foreign Sovereign Debt by General Groups

	Gov	Banks	NonBank
All	0.01 (0.00)	0.23*** (0.06)	0.77*** (0.06)
AE	0.01 (0.01)	0.27** (0.09)	0.73*** (0.09)
EM	0.01*** (0.00)	0.11** (0.04)	0.89*** (0.04)

Note: Debt-weighted holdings

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Figure: Disaggregated Marginal Holders: UK Gilts



Projecting returns

Foreign Investors: Expected holding returns in USD

$$r_{t+1}^j + s_{t+1}^j - s_t^j - y_t^{US} = \phi p_t^j + \psi(s_t^j - z_t^j) + \chi_j + \nu_{t+1}^j$$

- r_{t+1}^j is the holding return of sovereign debt of country j
- s_t^j is the log exchange rate, y_t^{US} is short term US treasuries.

Domestic Investors: Expected holding return in local currency

$$r_{t+1}^j - y_t^j = \tilde{\phi} p_t(j) + \tilde{\chi}_j + \tilde{\nu}_{t+1}^j$$

- y_t^j is the short term rate in local currency of country j .

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Counterfactual Analysis Details

Framework

Demand function of investor group i is

$$\frac{H_{j,t}^i}{Y_{j,t}} = a^i + b^i y_{j,t} + \theta_j^i + \varepsilon_{j,t}^i$$

$D_{j,t}$ exogenous

Investor group i holds $\bar{\alpha}_i$ fraction of total debt

The market clearing condition is

$$D_{j,t} \exp(-\bar{y}_{j,t})(1 - \bar{\alpha}_i) = Y_{j,t} \left(\sum_{k \neq i} a^k + \theta_j^k + b^k \bar{y}_{j,t} \right)$$

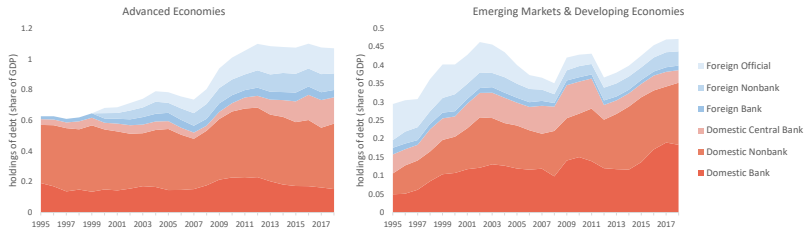
Compare the distance hypothetical $\bar{y}_{j,t}$ and actual observed $y_{j,t}$

link it to the share of investor group i .

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Debt Levels and Holder Shares

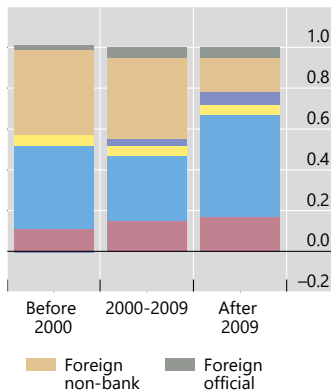
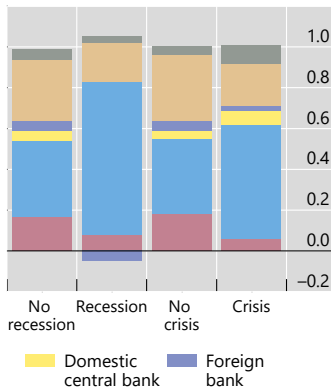
Debt Levels and Holder Shares



Holdings by investor groups vary along with size of debt [▶ Back](#)

Different Episodes

$$\frac{H_{j,t}^i - H_{j,t-1}^i}{D_{j,t-1}} = \alpha_j + \alpha_t + \beta_0^i \frac{D_{j,t} - D_{j,t-1}}{D_{j,t-1}} + \beta_1^i I_{j,t} + \beta_2^i \left(\frac{D_{j,t} - D_{j,t-1}}{D_{j,t-1}} \times I_{j,t} \right) + \varepsilon_{j,t}^i$$



EM Debt Projection Estimates

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	Debt-to-GDP
Lag Debt-to-GDP	0.72*** (0.03)
GDP Growth	-0.09 (0.11)
Inflation	0.11*** (0.04)
Exp-to-GDP	-0.03* (0.02)
Observations	362
R2	0.96

Investor Holding Estimates: AE countries

Table: Advanced Economy Funding: Instrumental Variable Estimates

	(1) DomBK	(2) DomNB	(3) DomCB	(4) ForBK	(5) ForNB	(6) ForCB
Log yield	1.377*** (0.497)	2.179** (0.865)	1.790** (0.782)	0.979** (0.391)	3.111** (1.373)	0.686** (0.301)
Inflation	3.705 (5.994)	4.007 (9.532)	20.007* (11.488)	9.769** (4.940)	8.820 (14.611)	11.810*** (3.801)
Observations	274	264	249	275	267	275

Country Controls include GDP, GDP growth, inflation, and sovereign ratings

Nonbanks most responsive to yield within Dom and For groups

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Shares and Elasticities: AE countries

	(1) Dom Bank	(2) Dom NonBank	(3) Dom Cen	(4) For Bank	(5) For NonBank	(6) For Cen
Elasticity	NA	0.79	NA	NA	0.92	NA
Mean Share	0.15	0.23	0.04	0.07	0.15	0.10

- Only NonBanks have well-defined elasticities
- And are less than one

Overall - AE debt relatively unaffected by yield

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Instrument for returns

- Three steps as above:

- 1 Compute ex-post market value: $H_{jt}^{i,m} = H_{jt}^i P_{jt}$
- 2 Estimate market value of demand for holdings:

$$\ln \left(H_{jt}^{i,m} \right) = \alpha_j^i + \alpha_t^i + \alpha_1^i X_{jt} + u_{jt}^i$$

- 3 Take fitted values and solve for the price that clears the market

$$\sum_{i=1}^6 \exp \left(\widehat{\ln H_{jt}^{i,m}} \right) = D_{jt} \tilde{P}_{jt}$$

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IV Results: Emerging Markets

	(1) Dom Bank	(2) Dom NB	(3) Dom CB	(4) For Bank	(5) For NB	(6) For Off
Expected Return	4.2* (2.2)	7.8*** (2.8)	10.3* (6.0)	8.0** (3.9)	10.1* (5.2)	6.4* (3.8)
GDP Growth	3.7* (2.0)	4.3 (2.6)	10.1* (5.9)	5.1 (4.9)	17.4** (7.0)	7.5 (4.8)
Inflation	-3.5*** (0.91)	-3.5*** (1.2)	-4.9** (2.4)	-7.2*** (2.5)	-5.1 (3.2)	-4.7** (2.4)
Observations	350	323	288	350	305	342

Note: Other controls include exports/GDP, log GDP, and sovereign credit rating.

- Non-banks' holdings most responsive to expected excess return
- Higher growth and lower inflation increases demand