Liquidity Risk and U.S. Bank Lending at Home and Abroad

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June 2014 Views expressed are those of the author and do not necessarily reflect the position of the Federal Reserve Bank of New York, the Federal Reserve Board, or the Federal Reserve System.

Motivation

- Banking is increasingly globalized, with direct linkages internationally through cross-border transactions, and branches and subsidiaries established abroad.
- Global banks were central to the recent financial crises, and some flows through these banks were volatile.
- Little is known about reasons for the volatility and the consequences of various forms of official sector liquidity.
- Micro-banking data is key.
  - Provides an ability to see the (broad contours of the) balance sheets of banks, with domestic, internal, and international lending.
- Challenges: Getting data; appropriately designing analytical experiments; providing insights beyond country or episodic case studies.

One approach: the International Banking Research Network

IBRN Established in 2012, first project 2013.

- Transmission of liquidity risk into lending by banks
  - Conceptual: extends Khwaja and Mian *AER* 2008
  - Empirical: extends Cornett, McNutt, Strahan and Tehranian *JFI* 2011
  - International: continues development of insights on transmission through global banks, including on roles of internal capital markets, complex organizations, core and periphery locations for parents

Main issues addressed

- How does the structure of bank balance sheets influence the transmission of liquidity risk into their lending at home and abroad?
- Are there vulnerabilities to address?
- How do banks use their affiliates for liquidity? What is prioritized?
- What happens when official sector liquidity is provided?

Conceptual underpinnings

Baseline Scenario

From Khwaja and Mian (*AER* 2008)

In period *t*, a representative bank *i* and firm *j* negotiate a loan ${L_t}^{ij}$.

Bank *i* funding:

- Deposits ${D_t}^{ij}$, which are costless (or priced at a low fixed rate) , until a certain scale of activity is reached.
- Additional external financing ${B_t}^{i}$ available to bank *i* with the marginal cost of funds given by $\alpha_B {B_t}^{i}$ with $\alpha_B > 0$.

Firm *j* credit demand:

- Marginal returns on loans are decreasing in loan size with every counterparty $\bar{r}_t{}^{j} - \alpha_L {L_t}^{ij}$.

Baseline Scenario

At the end of period t, two types of shocks hit the economy.

- ✓ Aggregate credit supply shock $\bar{\delta}_t$
- ✓ Bank-specific or idiosyncratic shock ${\delta_t}^i$.

Also, credit demand shocks

- ✓ work through the marginal returns on loans, increasing with aggregate and idiosyncratic productivity shocks $\bar{\eta}_t$ and ${\eta_t}^j$.

Jointly solving the first order conditions for loan supply and demand in each period, KM 2008 derive (1), here amended with time subscripts:

$$\Delta L^{ij}_{t+1,t} = \frac{1}{\left(\alpha_L + \alpha_B\right)}\left(\alpha_B \cdot \bar{\delta}_{t+1} + \bar{\eta}_{t+1}\right) + \frac{\alpha_B}{\left(\alpha_L + \alpha_B\right)}\delta^i_{t+1} + \frac{1}{\left(\alpha_L + \alpha_B\right)}\eta^j_{t+1} \quad (1)$$

Baseline Scenario

Buch and Goldberg (2014) substitute $\delta_t{}^i \equiv \chi_t{}^i \cdot \Delta r_t{}^c$ and re-write (1)

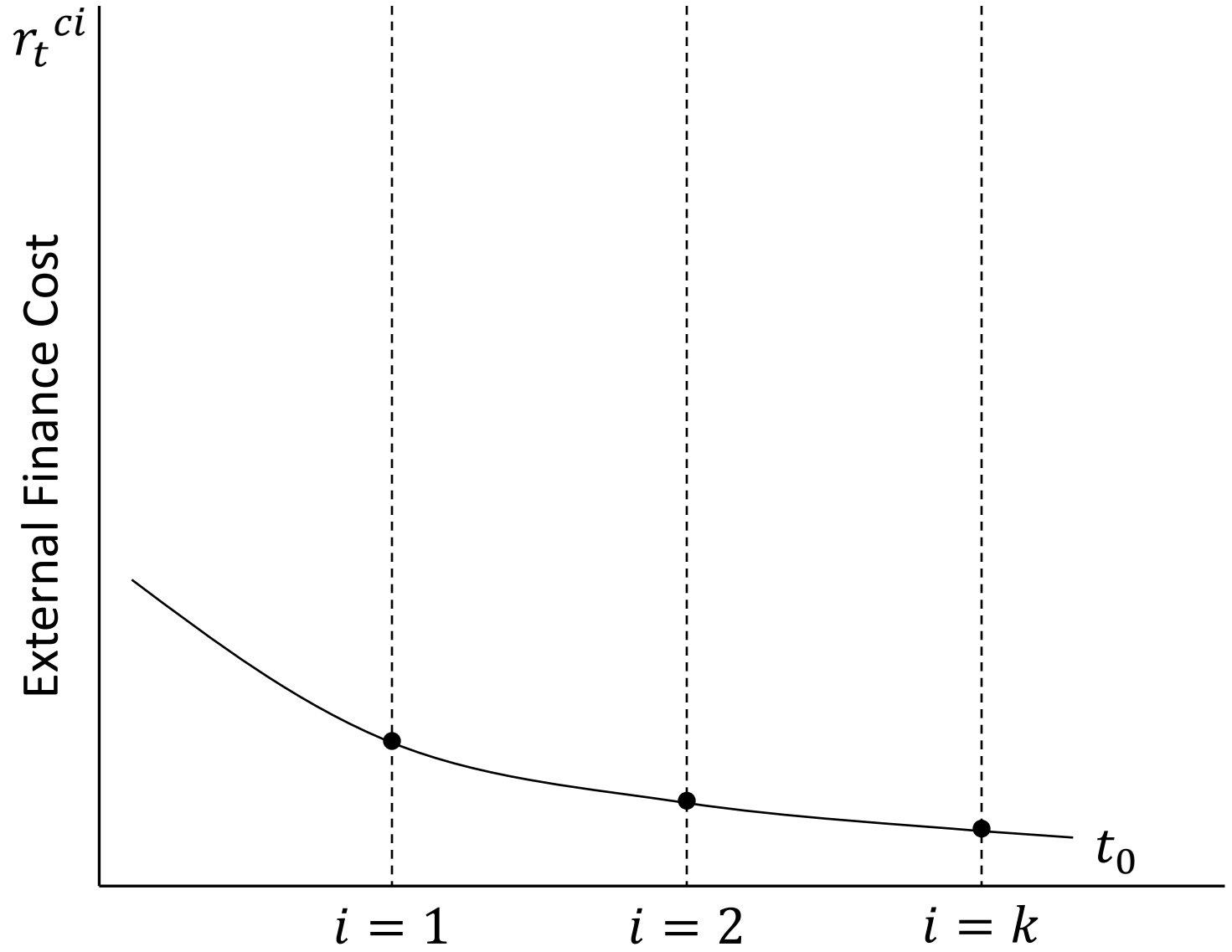
Result: time-series panel specification where ex-ante balance sheet composition influences the adjustment of lending to the market price of liquidity risk $\Delta r_t{}^c$:

$$(2) \quad \Delta L_{t+1,t}^{ij} = \frac{1}{(\alpha_L + \alpha_B)}\left(\alpha_B \cdot \bar{\delta}_{t+1} + \bar{\eta}_{t+1}\right) + \frac{\alpha_B}{(\alpha_L + \alpha_B)}\chi_t^i \cdot \Delta r_t^c + \frac{1}{(\alpha_L + \alpha_B)}\eta_{t+1}^j$$

The interactions between $\chi_t{}^i \cdot \Delta r_t{}^c$ show which balance sheet characteristics of banks drive responses of lending to liquidity risk, similar to Cornett, McNutt, Strahan and Tehranian *JFI* 2011.

Buch and Goldberg (2014) also derive a role for official liquidity provision in relation to firm characteristics, instead of splitting the sample period as CMST 2011 or just adding crisis dummy variables.

Baseline Scenario



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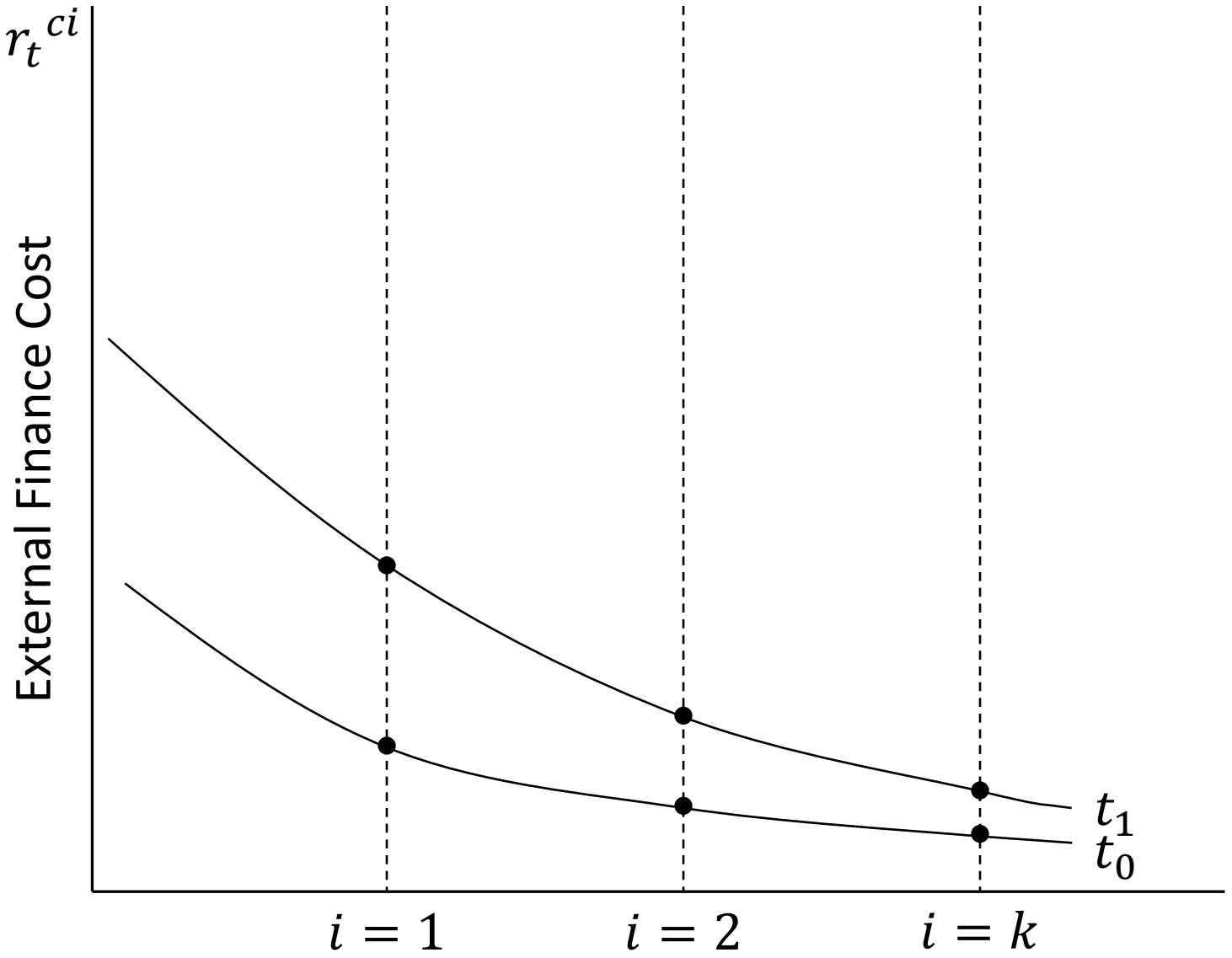
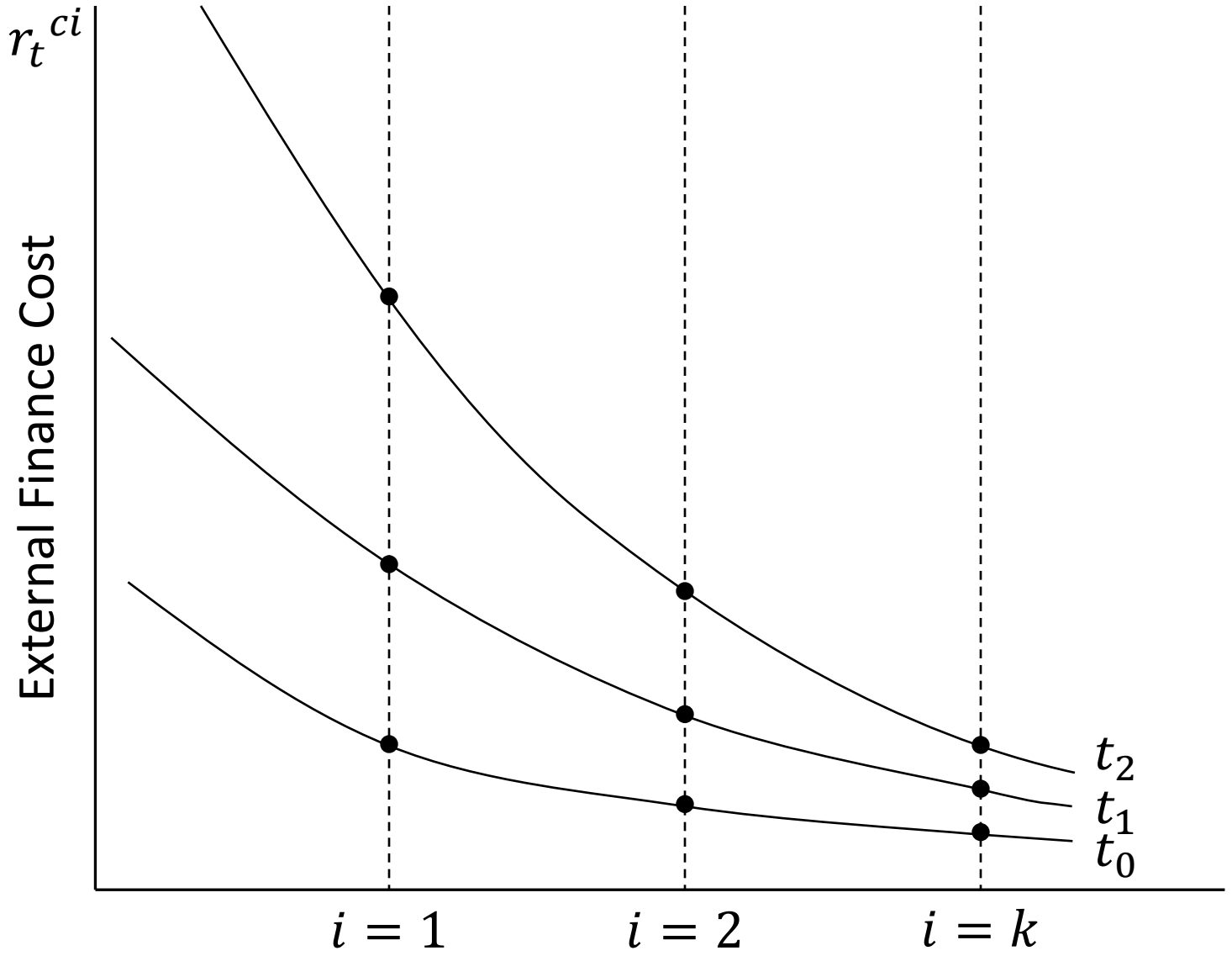


Baseline Scenario



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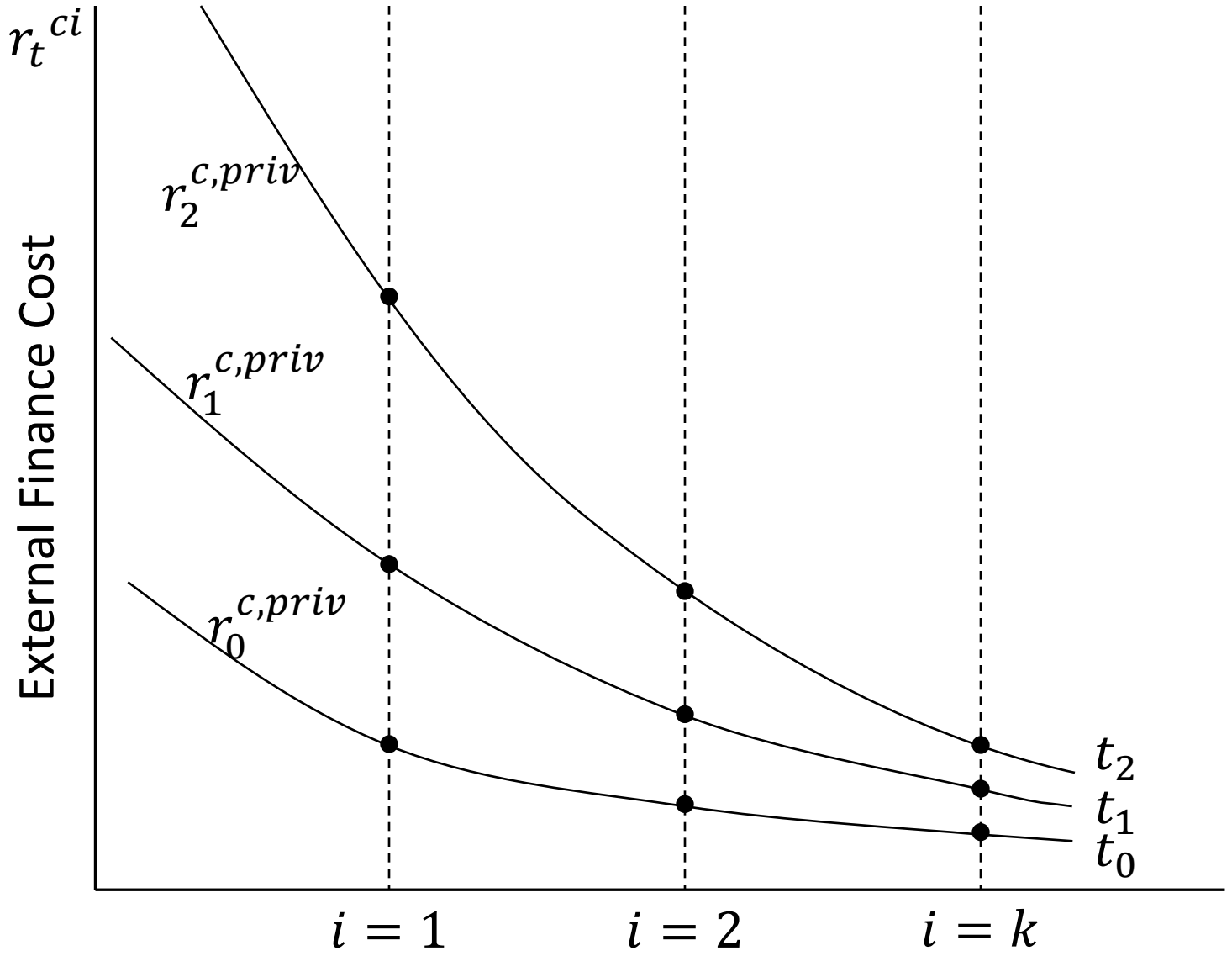
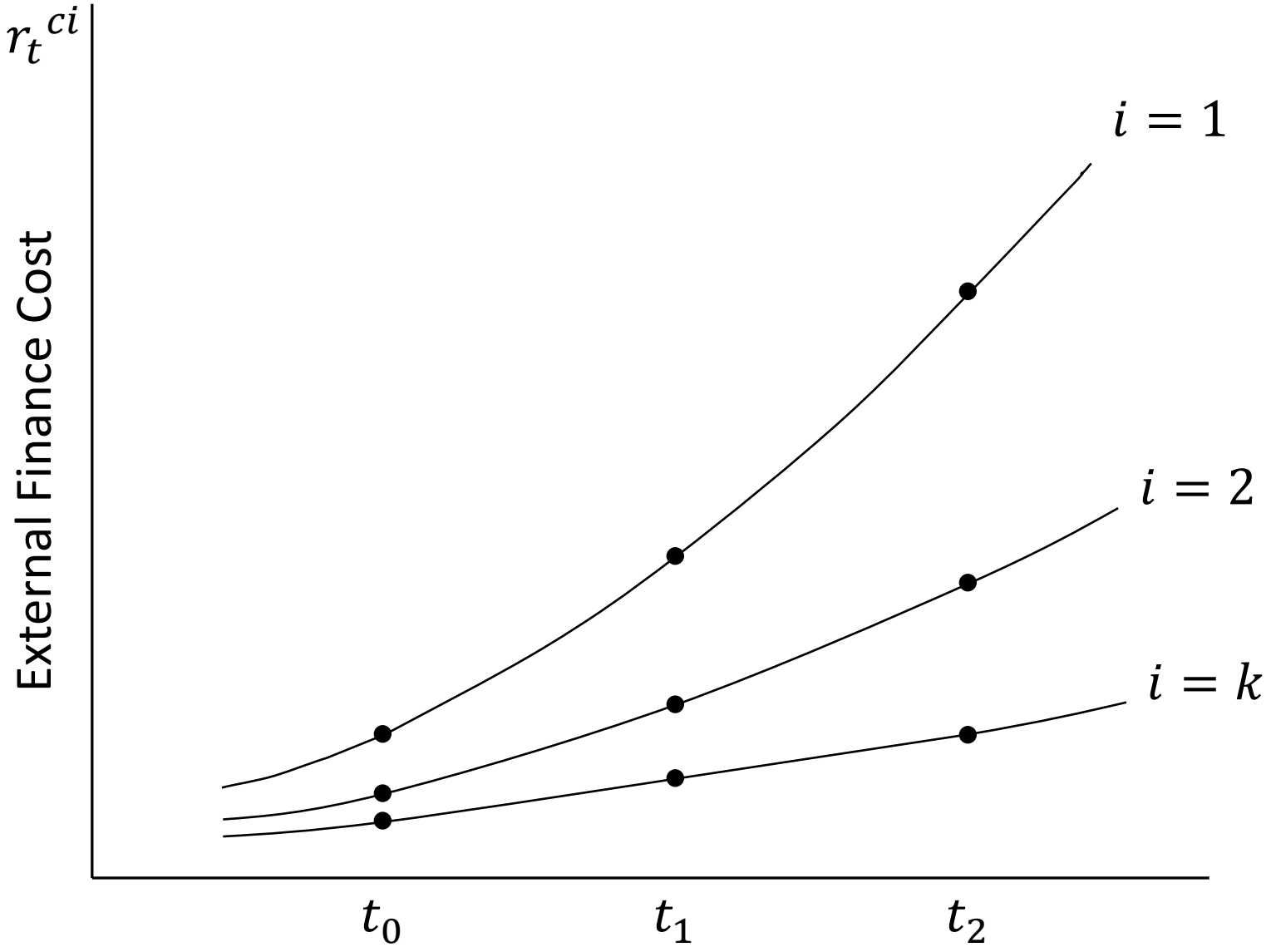
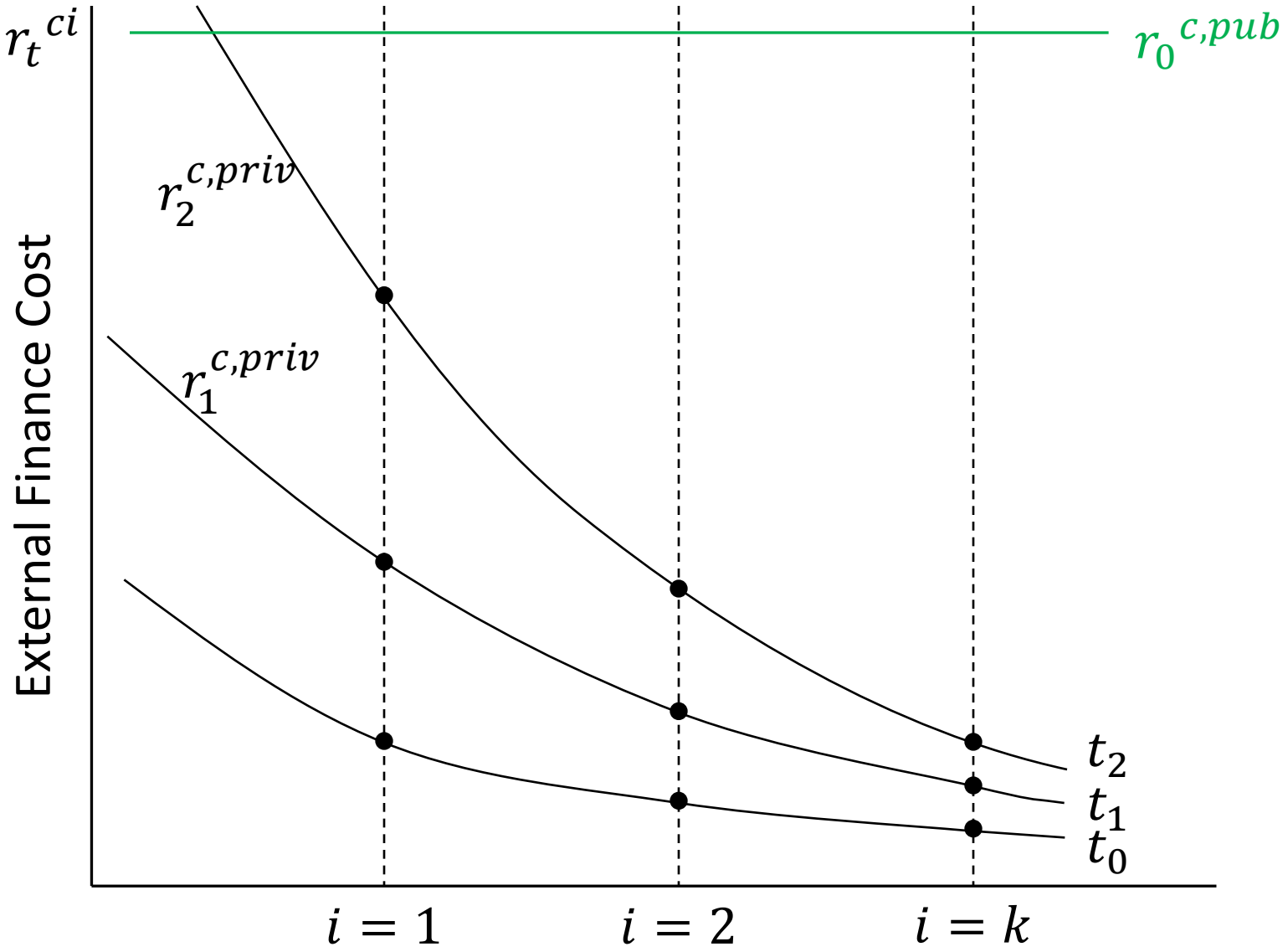


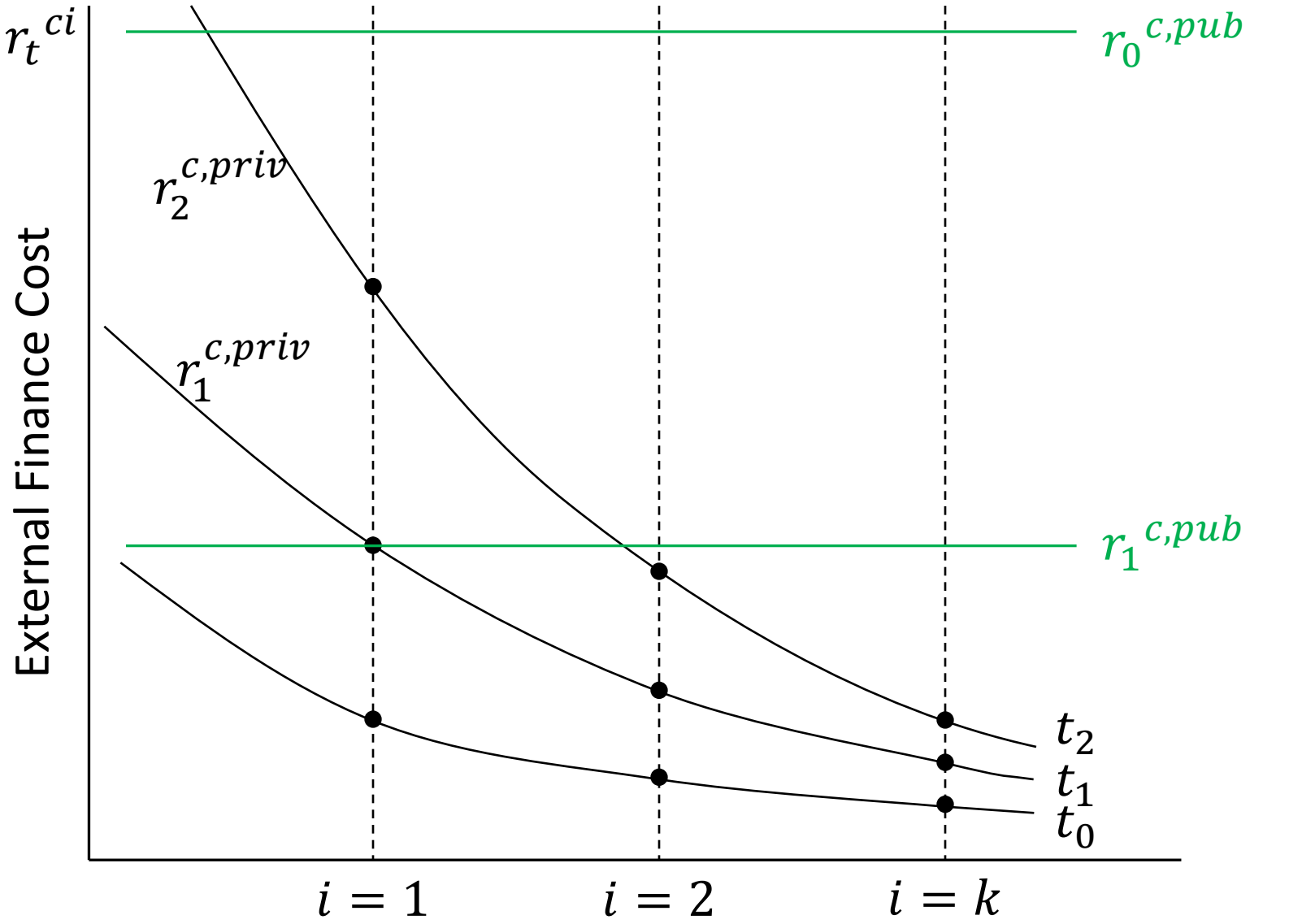
Baseline Scenario: effective price of liquidity varies over time and with bank characteristics *i*.



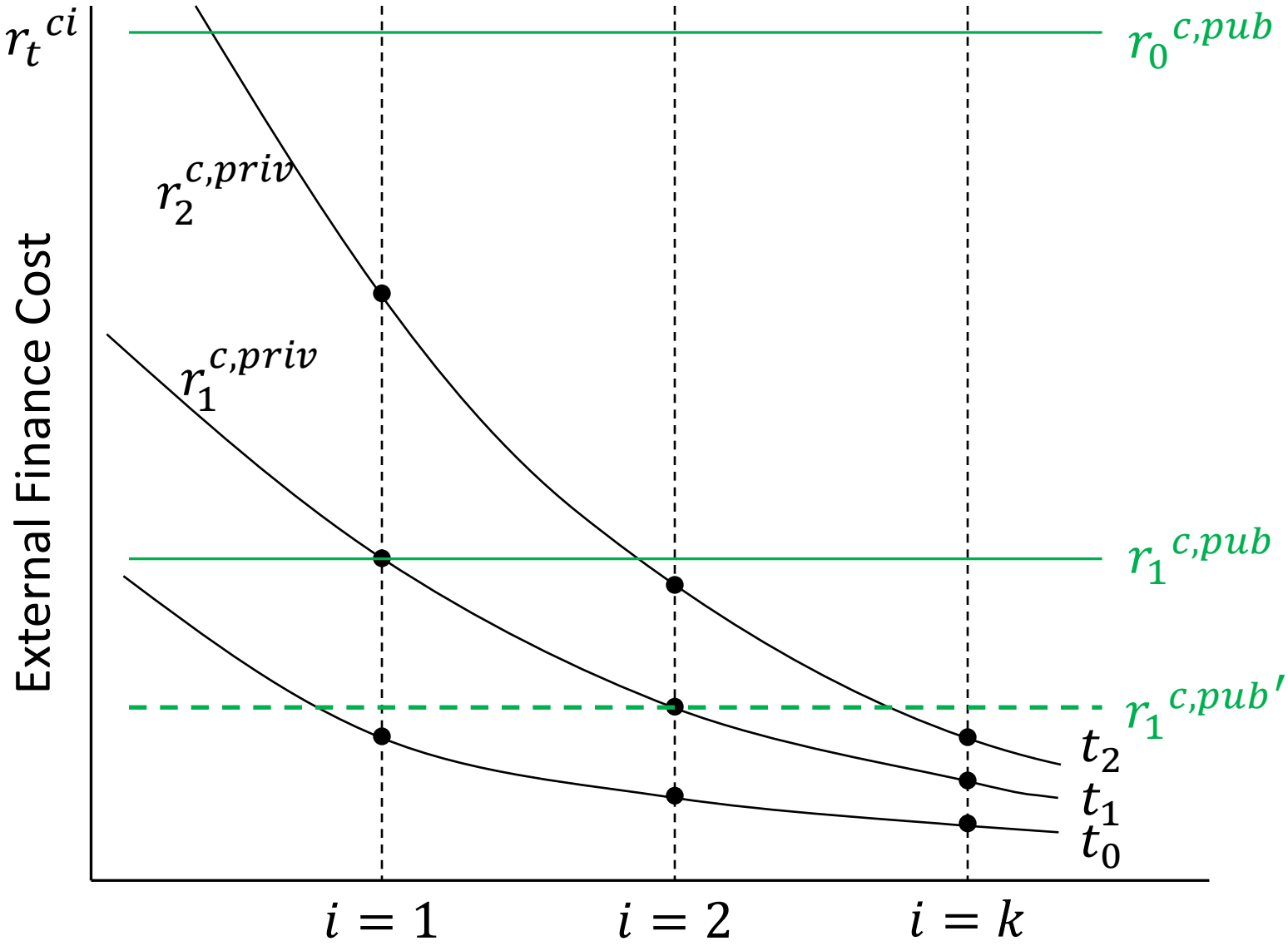
With Public Liquidity Provision: if high cost, no effect.



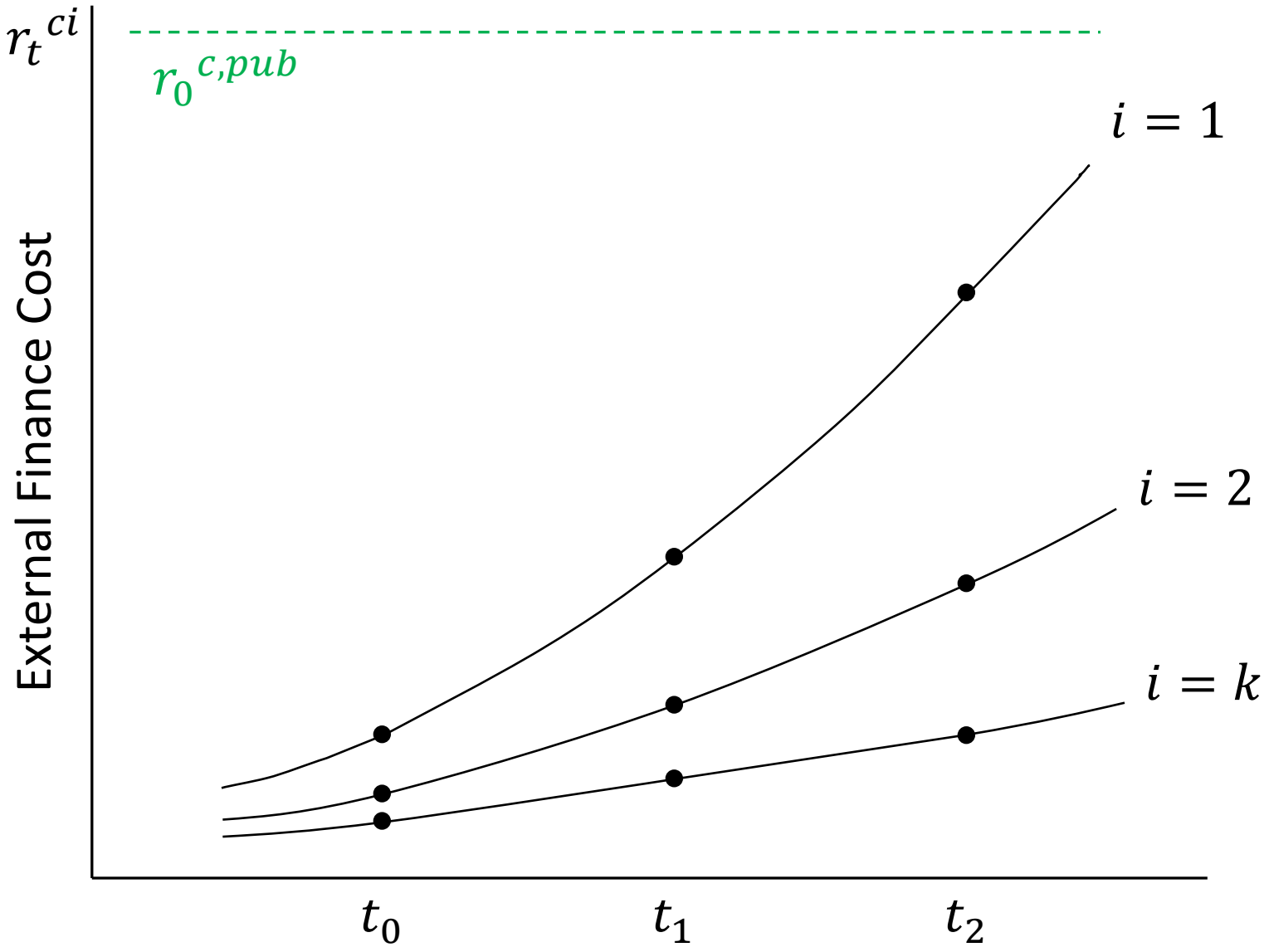
With Public Liquidity Provision: if cost declines, impact is on liquidity schedule for weaker banks.



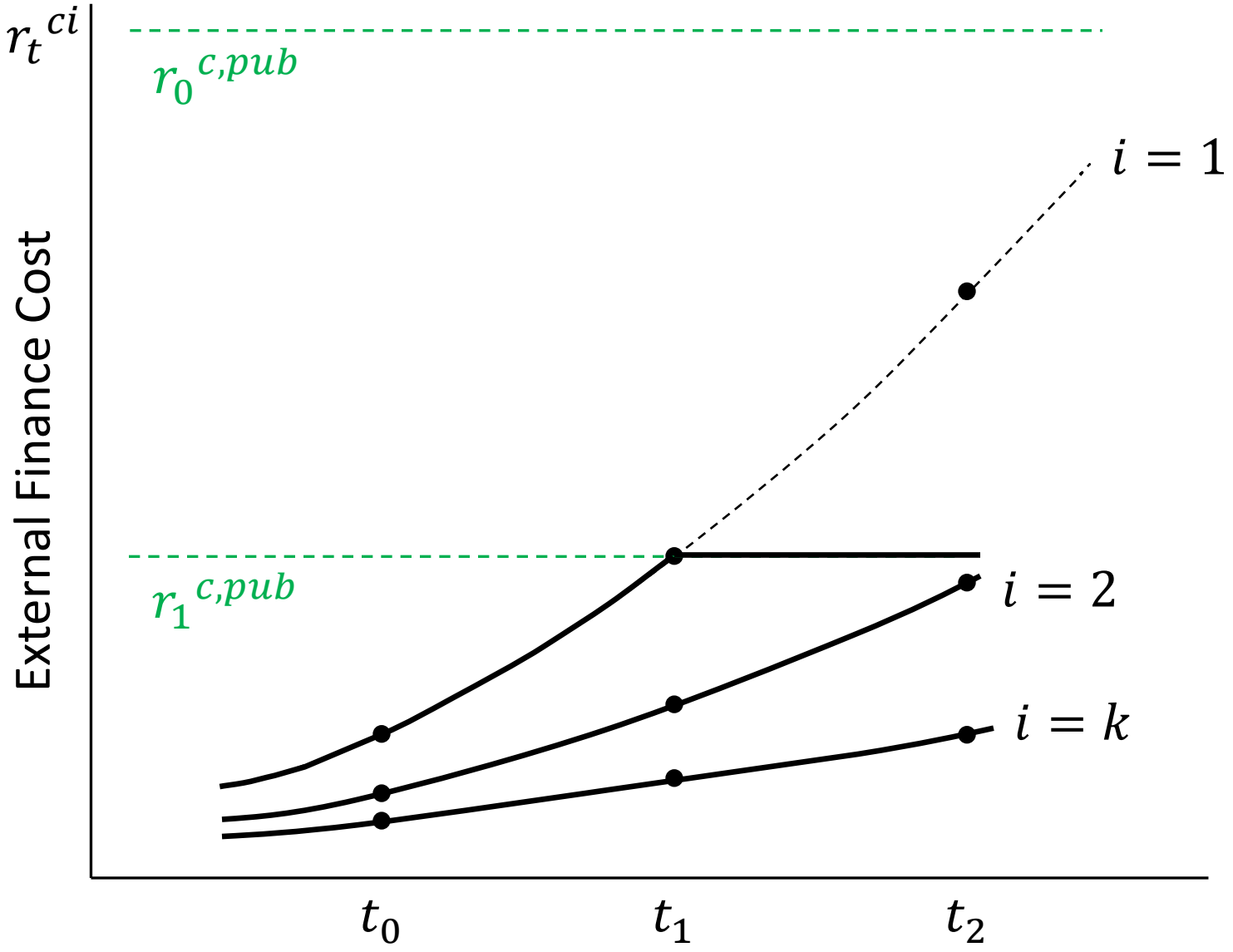
The lower the cost of emergency lending, the broader the group getting “non-market” funds.



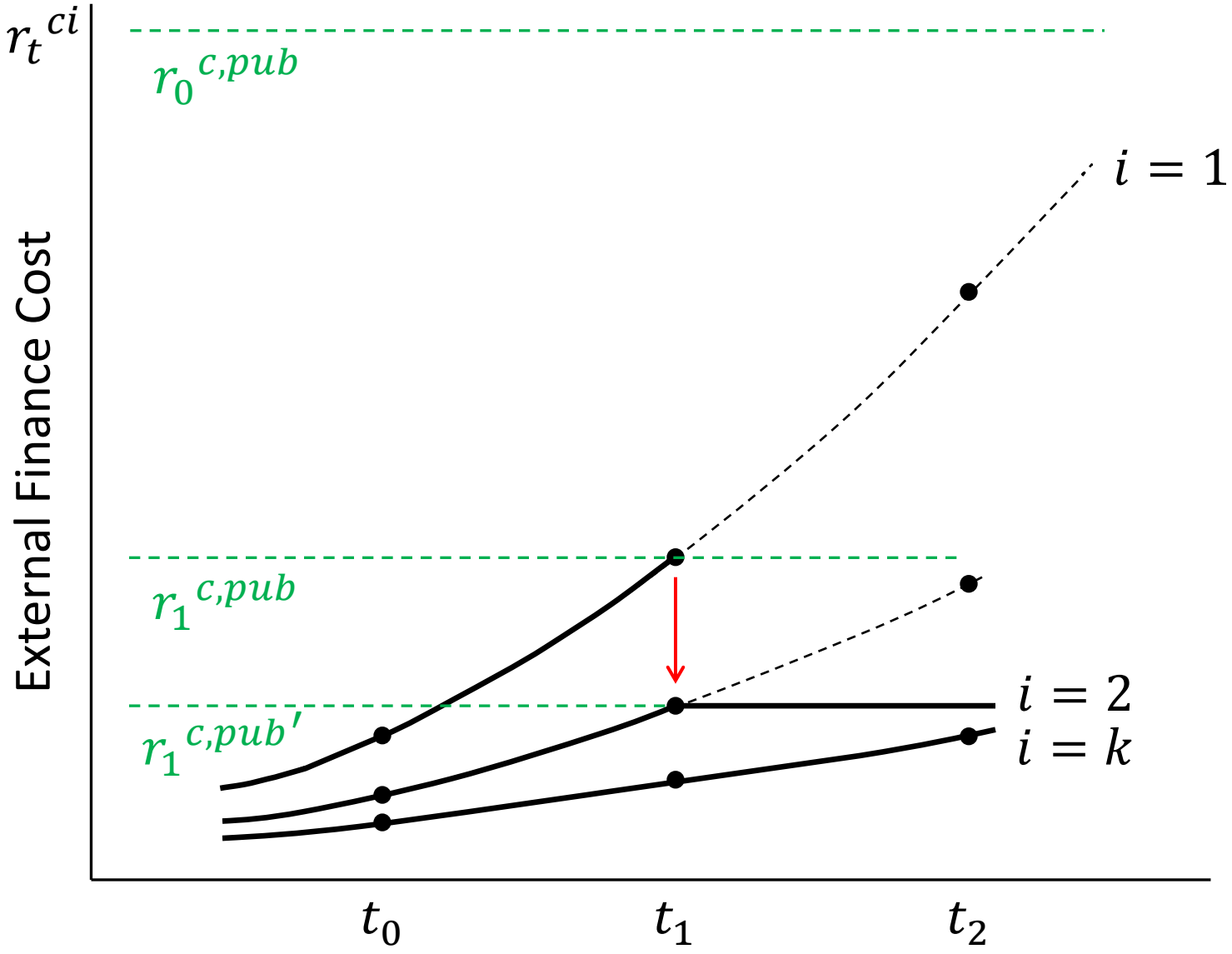
With Public Liquidity Provision



With Public Liquidity Provision: a kink introduced for some weaker borrowers in time-series.



With Emergency Lending, even stronger users will pay at official price, instead of market price.



Application to US micro-banking data

Regression Specification applied to US data on large banks

$$\Delta Y_{it} = \gamma_i + \mu_t + \left(\beta^0 + \beta^1 LIB\_OIS_t\right) X_{i,t-1} + \left(\alpha^0 + \alpha^1 LIB\_OIS_t \cdot X_{i,t-1}\right) F_{it} + \varepsilon_{it}$$

- Y_{it} : loans to domestic counterparties, loans to foreign counterparties, total credit extension, and net due to balances.
- $\chi_{i,t-1}$is a vector that captures the degree to which a bank is exposed to liquidity risk through ex ante balance sheet composition and market access, as in CMST2011.
- LIBOR over OIS spread as a measure of liquidity risk.
- Indicator variable F_{it} (Facility), 1 if a bank i accessed the discount window or the TAF in quarter t.
- Bank (γ_i) and time (μ_t) fixed effects included
- β^1 reflect cross-sectional differences in balance sheet compositions on the liquidity risk effects, or with facility use $\beta^1 + \alpha^1$

The regression sample: Large U.S. Bank-holding Companies

Variable	With Foreign Affiliates (**n=23**) Median	SD	Without Foreign Affiliates (**n=73**) Median	SD
Balance sheet data (for each bank *i* and quarter *t*): **2006Q1 to 2012Q4**				
Dependent Variables				
Δ Credit/(Assets + Commitments) (%)	0.18	2.73	0.55	2.48
Δ Domestic C&I Loans/Assets (%)	0.09	0.74	0.11	0.74
Δ Foreign C&I Loans/Assets (%)	0.00	0.17	0.00	0.06
Δ Cross-Border Claims/Assets (%)	0.01	1.19		
Δ Foreign-Office Claims/Assets (%)	0.01	0.90		
Δ Net Due To (Head Office)/Assets (%)	0.00	1.54		
Independent Variables				
Illiquid Assets/Assets (%)	75.32	18.28	78.75	14.60
Commitments Ratio (%)	27.48	10.90	19.02	11.32
Log Real Assets	18.89	1.60	16.72	1.01
Core Deposits/Liabilities (%)	51.47	21.46	67.85	16.70
Tier1 Capital/RWA (%)	10.90	2.90	11.05	10.90
Net Due To(Head Office)/Liabilities(%)	3.56	8.62		
Facility Use	0.00	0.39	0.00	0.37

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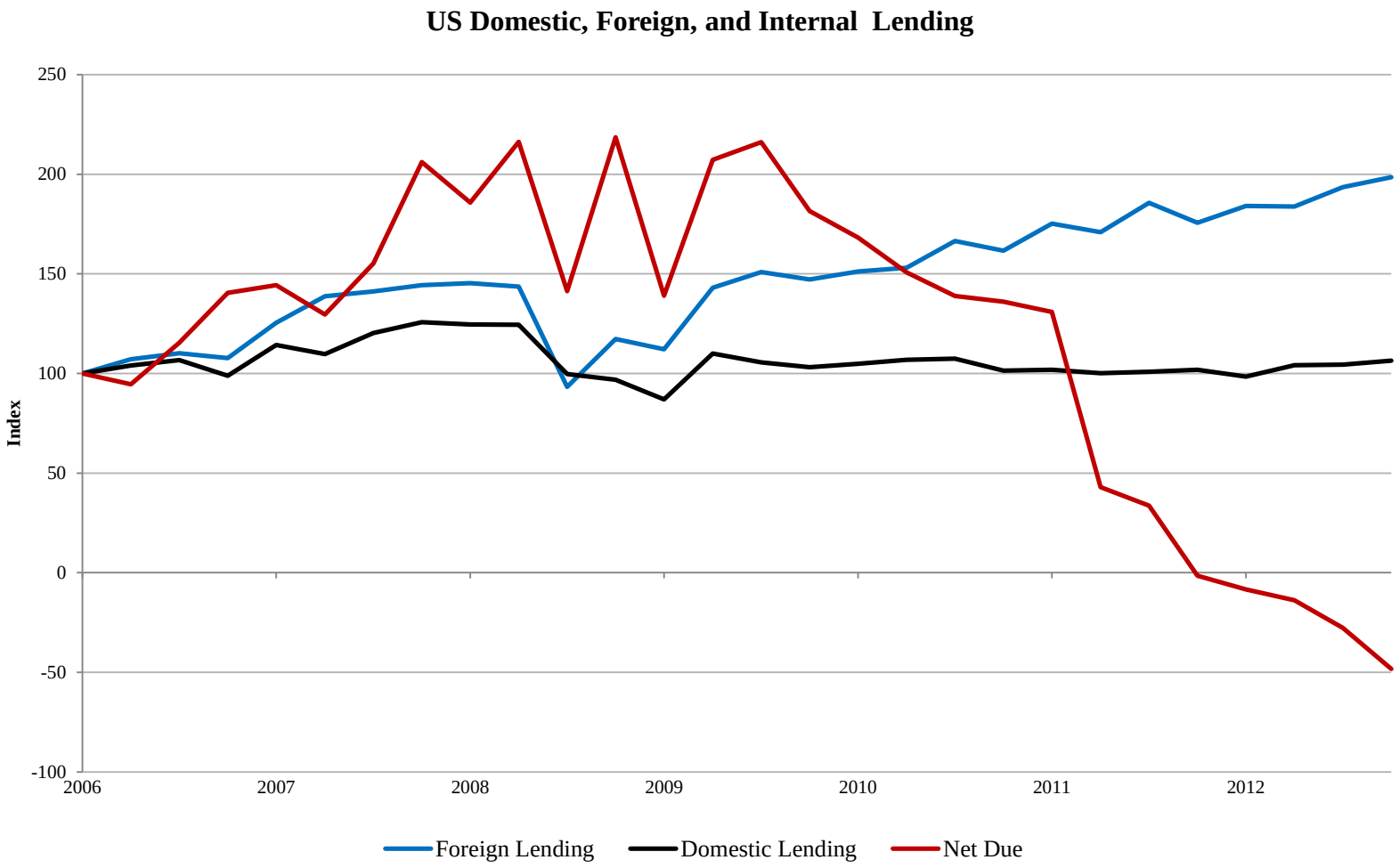
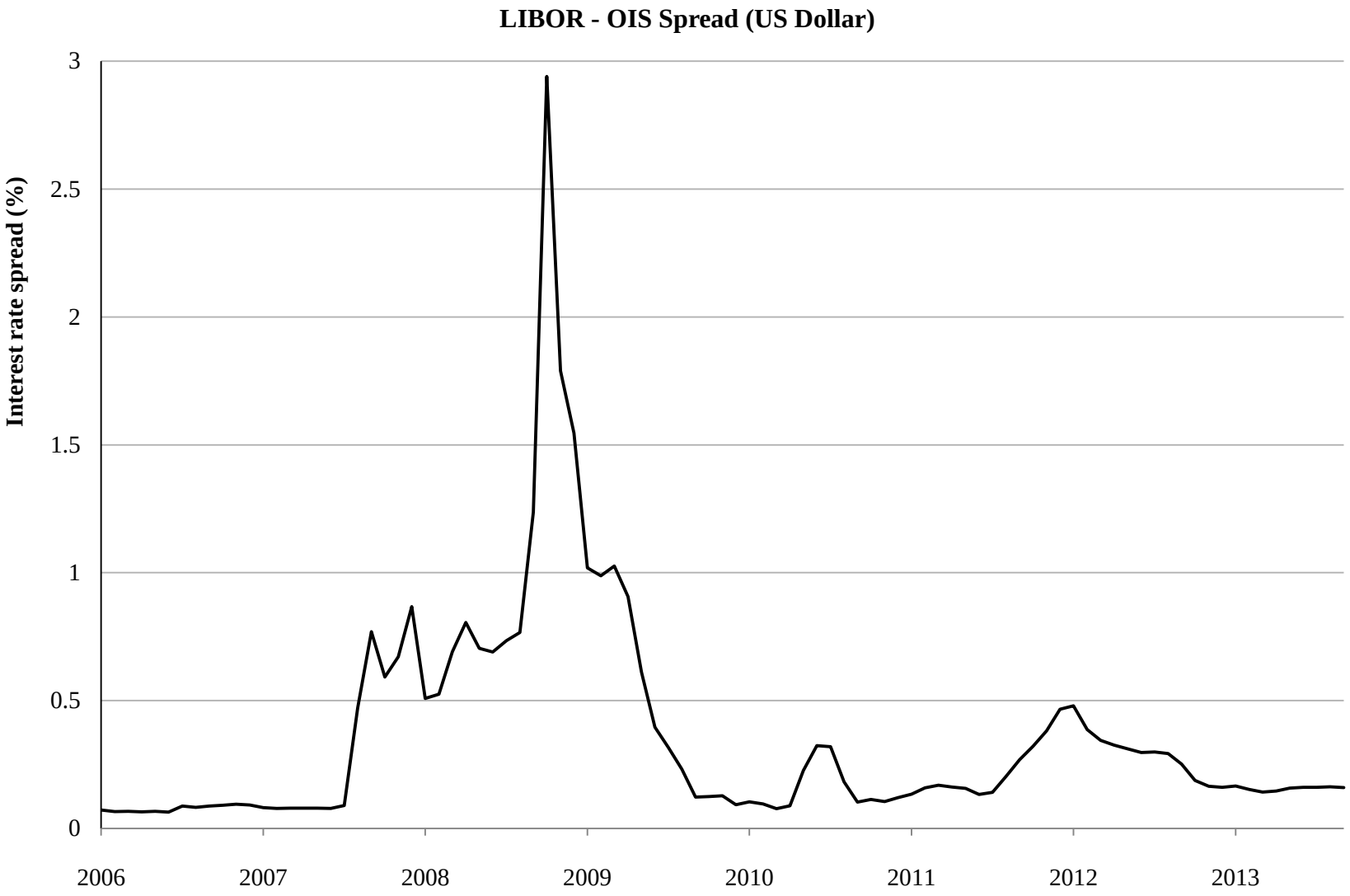
US Domestic, Foreign, and Internal Lending, aggregates



LIBOR – OIS Spread



Drivers of Cross-Sectional Differences in Credit and Lending Growth through Liquidity Risk (select coefficients shown) : 1

Panel A:* *Banks without Foreign Affiliates

Variables interacted with Libor_OIS	Δ Domestic C&I Loans/Assets	Δ Foreign C&I Loans/Assets	Δ Credit/ (Assets + Commitments)
Illiquid Assets	0.000	0.000	0.020
Illiquid Assets* Facility	-0.004	0.000	-0.018
Commitment Ratio	0.010	0.001	0.012
Commitment Ratio*Facility	-0.007	0.000	-0.014
Core Deposits	0.007**	-0.001***	0.007
Core Deposits*Facility	0.000	0.000	0.051**
Tier 1/RWA	0.003	-0.001	0.016
Tier 1/RWA*Facility	-0.004	0.000	0.011
Observations	1,415	1,415	1,415
Number of banks	73	73	73
Adjusted R-squared	0.15	0.02	0.18

Drivers of Cross-Sectional Differences in Credit and Lending Growth through Liquidity Risk (select coefficients shown) : 2

Panel A: Banks without Foreign Affiliates

	Δ Domestic C&I Loans/Assets	Δ Foreign C&I Loans/Assets	Δ Credit/ (Assets + Commitments)
During periods of Central Bank Facility Use			
Illiquid Assets	-0.005	-0.001	0.002
Commitment Ratio	0.003	0.000	-0.002
Core Deposits	0.006	-0.001***	0.058**
Tier 1/RWA	-0.001	-0.001	0.027

Drivers of Cross-Sectional Differences in Credit and Lending Growth through Liquidity Risk (select coefficients shown) : 3

Panel B:* *Banks with Foreign Affiliates

Variables interacted with Libor_OIS	Δ Domestic C&I Loans/Assets	Δ Foreign C&I Loans/Assets	Δ Credit/ (Assets + Commitments)
Illiquid Assets	0.013	0.007	0.102*
Illiquid Assets*Facility	-0.020	-0.007*	-0.034
Commitment Ratio	-0.004	0.002	-0.087
Commitment Ratio*Facility	0.005	-0.005	0.052
Core Deposits	0.007	-0.001	-0.001
Core Deposits*Facility	0.009	0.004	-0.001
Tier 1/RWA	-0.002	-0.018	0.250
Tier 1/RWA*Facility	0.104*	0.022	0.135
Net Due To (Head Office)	0.045***	0.010***	0.166***
Net Due To (Head Office)*Facility	-0.035**	-0.008*	-0.130**
Observations	505	505	505
Number of banks	27	27	27
Adjusted R-squared	0.40	0.07	0.38

Drivers of Cross-Sectional Differences in Credit and Lending Growth through Liquidity Risk (select coefficients shown) : 4

Panel B: Banks with Foreign Affiliates

	Δ Domestic C&I Loans/Assets	Δ Foreign C&I Loans/Assets	Δ Credit/ (Assets + Commitments)
During Periods of Central Bank Facility Use			
Illiquid Assets	-0.007	0.000	0.068**
Commitment Ratio	0.000	-0.003	-0.034
Core Deposits	0.016	0.003	-0.003
Tier 1/RWA	0.102***	0.003	0.385*
Net Due To (Head Office)	0.010	0.002	0.036

Drivers of Cross-Sectional Differences in Credit and Lending Growth through Liquidity Risk (select coefficients shown) : 5

Panel B: Banks with Foreign Affiliates

Variables interacted with LIBOR_OIS	Δ Cross-border Claims/Assets	Δ Foreign-office Claims/Assets	Δ Net Due To (Head Office)/ Assets
Illiquid Assets	0.045**	0.035	-0.026
Illiquid Assets*Facility	-0.040*	-0.039	-0.087*
Commitment Ratio	0.040**	0.005	0.066*
Commitment Ratio*Facility	-0.014	-0.020**	-0.034
Core Deposits	-0.019	-0.004	0.006
Core Deposits*Facility	0.029	0.027	0.091**
Tier 1/RWA	-0.148	-0.110	-0.248
Tier 1/RWA*Facility	0.031	0.064	-0.270***
Net Due To (Head Office)	0.059***	0.005	0.034
Net Due To (Head Office)*Facility	0.014	0.007	-0.082
Observations	502	483	505
Number of banks	27	27	27
Adjusted R-squared	0.08	0.12	0.23

Drivers of Cross-Sectional Differences in Credit and Lending Growth through Liquidity Risk (select coefficients shown) : 6

Panel B: Banks with Foreign Affiliates

	Δ Cross-border Claims/Assets	Δ Foreign-office Claims/Assets	Δ Net Due To (Head Office)/ Assets
During Periods of Central Bank Facility Use			
Illiquid Assets	0.005	-0.005	-0.112***
Commitment Ratio	0.026**	-0.015	0.032
Core Deposits	0.010	0.023	0.097***
Tier 1/RWA	-0.118	-0.046	-0.518***
Net Due To (Head Office)	0.073***	0.012	-0.048

Conclusions on responses to liquidity risks (1)

- ✓ Cross-border lending is more volatile and more prone to constraints on banks through their balance sheets.
- ✓ Local claims by affiliates less well explained by parent balance sheets.
- ✓ Large US global banks differ from large domestic banks
  - Banks without foreign affiliates: loan growth differs cross-sectionally with reliance on core deposits.
  - Global banks: loan growth differs with liquidity management within the broader organization.
    - more borrowing from affiliates associated with more stable domestic lending and credit growth as liquidity risk worsens.
    - borrowing and lending vis-à-vis affiliates adjusts in line with their balance sheet composition.

Conclusions on responses to liquidity risks (2)

When banks access official liquidity facilities,

- Different balance sheet characteristics matter for cross-sectional lending variation.
- Growth in net borrowing from affiliates falls more for banks with more illiquid assets and fewer core deposits.
- Internal net borrowing appears less important in differences in lending to domestic and foreign customers.

The results provided are economically significant.

Understanding these responses are important for understanding the large cycles in capital flows through banks as liquidity conditions change in normal times and crisis periods.

Thank you.

Second Methodology

$$\Delta Y_{it}^{c} = \gamma^{i} + \mu_{t}^{r} + \left(\beta^{0} + \beta^{1} LIB\_OIS_{t} + \beta^{2} X_{i,t-1}^{c} + \beta^{3} LIB\_OIS_{t} \cdot X_{i,t-1}^{c}\right) X_{i,t-1}$$
$$+ \left(\alpha^{1} LIB\_OIS_{t} + \alpha^{3} LIB\_OIS_{t} \cdot X_{i,t-1}^{c}\right) X_{i,t-1} \cdot F_{it} + \varepsilon_{it}$$

- ΔY_{it} is a claim of bank *i* on a resident of country *c* at time *t*, which can take the form of cross-border lending (claims) or local claims extended through overseas branches or subsidiaries.
- Strategic importance variables are measures of whether countries are core investment or funding location for each parent bank I within location c $\chi^{c}{}_{i,t-1}$).
  - Core funding location for bank *i* : the local foreign offices fund their operations largely through local borrowing,
  - Core investment location for bank *i* represents a large share of overall foreign investments (claims) of bank *i*.
- The estimating equation includes region-time fixed effects to absorb changes in demand conditions in each region ($\mu^{r}{}_{t}$).