Inflation and U.S. Monetary Policy Transmission: At Home and Abroad

Şebnem Kalemli-Özcan
University of Maryland, CEPR, NBER

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Key Questions: Sources of Inflation and Transmission of U.S. Monetary Policy

1. Sectoral shocks, financial frictions and heterogeneity
2. Micro-macro approach for identification and policy implications What is the optimal policy response of other countries? Fragmentation/Coordination?

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International Spillovers of MP:

- Kalemli-Ozcan, **Jackson Hole Symposium**'19 "U.S. Monetary Policy and International Risk Spillovers"
- diGiovanni, Kalemli-Ozcan, Ulu, Baskaya'21 **RESTUD** "International Spillovers and Local Credit Cycles"
- Kalemli-Ozcan and Varela, **NBER WP** "Five Facts about UIP Premium"
- Akinci, Kalemli-Ozcan, and Queralto.**NBER WP** "Uncertainty Shocks, Capital Flows, and International Risk Spillovers"
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Domestic Transmission of MP:

- Caglio, Darst, Kalemli-Ozcan, **NBER WP** "Collateral Heterogeneity and Monetary Policy Transmission"

Current Events

Drivers of Inflation

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- Driven by large swings in economic activity over time and across sectors over Covid-19:
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  - Consumption substitution across sectors (goods for services and back)
  - Labor shortages across sectors/countries (pandemic/lockdowns and recovery)

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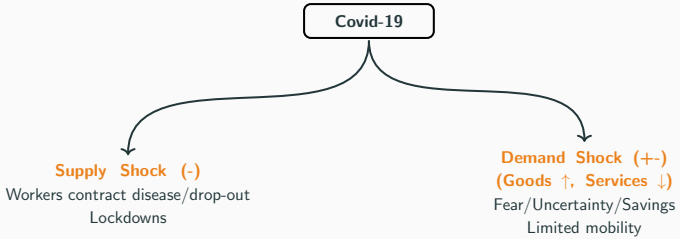
- **Global supply chains played a critical role in amplifying shocks within and across borders**

$\Rightarrow$ Macro/central banks "woke up" to importance of supply shocks and production resilience

$\Rightarrow$ Future risks: geopolitical, climate change, fragmentation of production

SECTORAL Supply-Demand Imbalances ↑ on a Global Scale During 2020–2021



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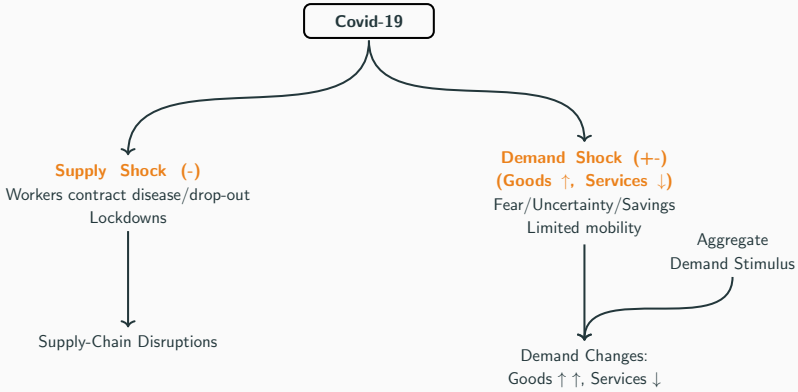

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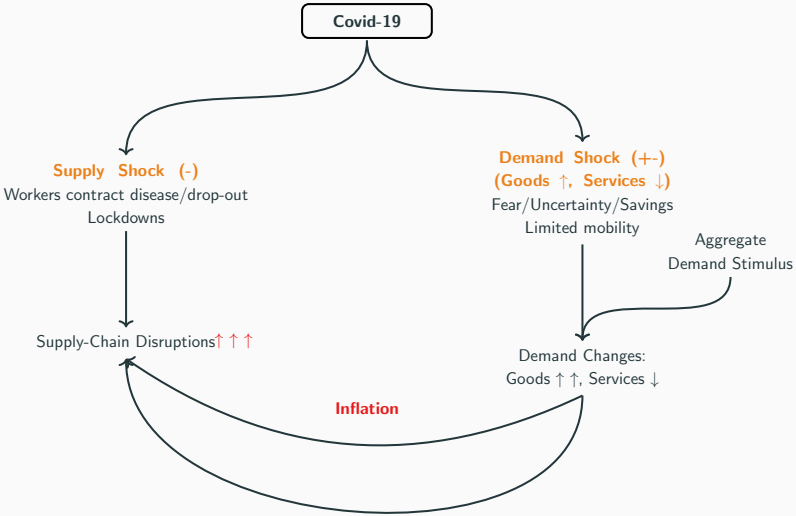
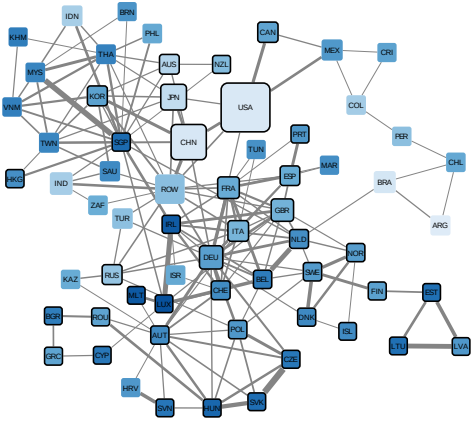
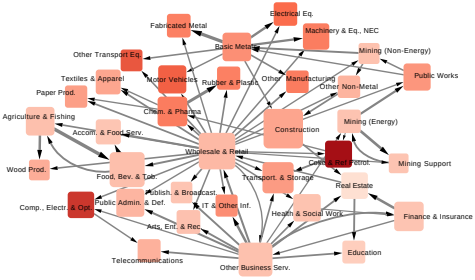


SECTORAL imbalances amplified via global trade and production network

(a) Countries



(b) Industries



Related literature

- **Theory-closed**: **Inflation, Production Networks, Sectoral Demand and Supply Shocks**

  Baqaee and Farhi (2022), La'O and Tahbaz-Salehi (2022), Rubbo (2022), Afrouzi and Bhattarai (2022), Pasten, Schoenle, and Weber (2020)

  Theory-closed/open: **Inflation, Demand and Supply Shocks**

  Guerrieri, Lorenzoni, Straub, and Werning (2021, 2022), Amiti, Heise, Karahan, and Sahin (2022), Ferrante, Graves, and Iacovello (2022)

- **Theory-open**
  - Production Networks and Trade with Supply Shocks

    Bonadio, Huo, Levchenko, and Pandalai-Nayar (2021), Boehm and Pandalai-Nayar (2022)
  - Production Networks and Trade with Demand and Supply Shocks

    Çakmaklı, Demiralp, Kalemli-Özcan, Yeşiltaş, Yıldırım (2022), Gourinchas, Kalemli-Özcan, Penciakova, Sander (2021)
- **Existing Empirical Work on Inflation**: Reduced form regressions, VAR sign restrictions

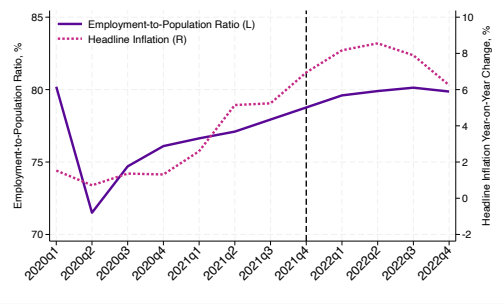
  Jorda, Liu, Nechio, and Rivera-Reyes (2022), LaBelle and Santacreu (2022), Shapiro (2022) ...

$\Longrightarrow$ **Our contribution:** a structural model with unrestricted I-O linkages and elasticities of substitution to quantify inflation drivers during Covid-19 collapse and recovery

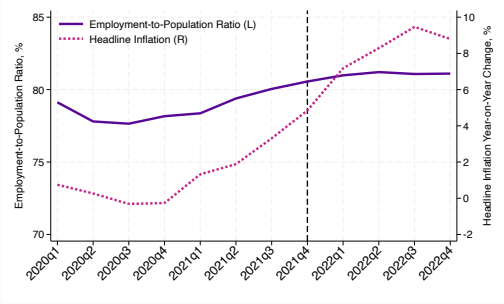
Stylized Facts

Simultaneous slack and inflation

(a) United States



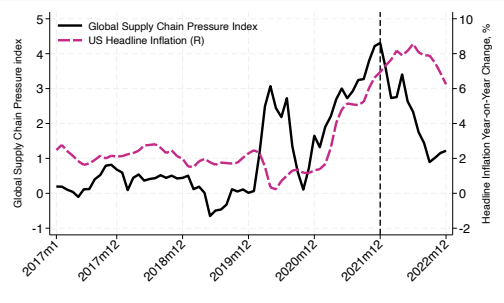
(b) Euro Area



Source: FRED

Simultaneous increase in inflation and supply chain pressures

(a) United States



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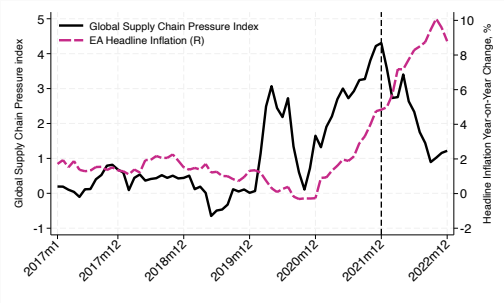
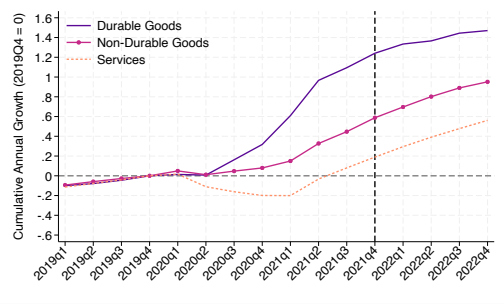


Source: FRBNY, FRED.

Substitution between goods and services consumption

(a) United States: Decomposition



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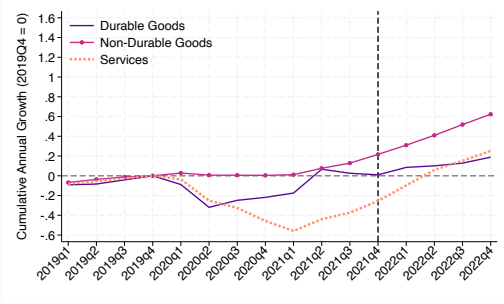
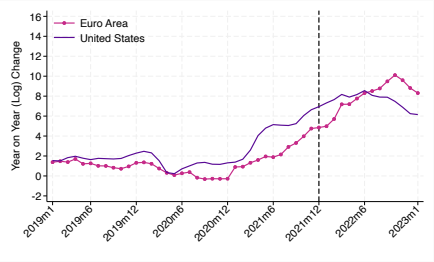


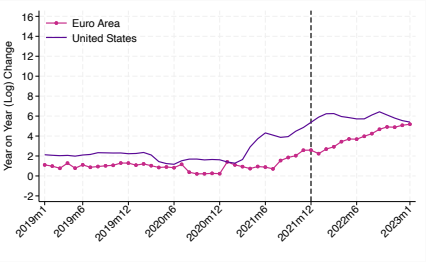
Notes: Seasonally-adjusted real private consumption. Source: OECD Quarterly National Accounts.

Inflation in goods picked up earlier than inflation in services

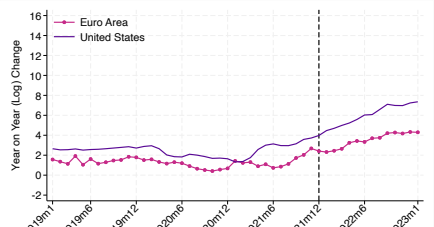
(a) Headline



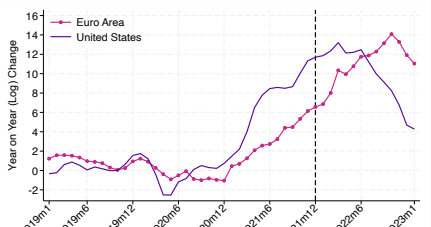
(b) Core



(c) Services



(d) Goods



Model

Inflation in a multicountry network-macro model

- We build on Baqaee and Farhi (2022) w/simplifications:
  - Two-period multicountry model ($n = 1, \ldots, \mathcal{C}$)
  - Ricardian households with perfect foresight
  - Multiple sectors ($i = 1, \ldots, \mathcal{J}$) produce using factors and intermediate inputs
  - Perfect competition in factors and good markets
  - Downward nominal wage rigidity + sector-specific labor, zero-lower bound
- Model allows for rich set of shocks:
  - Country level aggregate demand
  - Country-sector demand shifts
  - Country-sector factor supply and productivity (including energy shocks eventually...)

Inter-temporal maximization problem

$$\max_{\{C_{n,0}, C_{n,*}\}} (1-\beta_n)\log U(C_{n,0}) + \beta_n \log U(C_{n,*})$$

s.t.

$$P_{n,0}C_{n,0} + \frac{P_{n,*}C_{n,*}}{1+i_n} = I_{n,0} + \frac{I_{n,*}}{1+i_n}$$

$$U(C_n) = \frac{C_n^{1-\sigma}-1}{1-\sigma}; \qquad C_n = \prod_{j=1}^{\mathcal{J}} C_{nj}^{\Omega_{nj}}, \quad \sum_{j=1}^{\mathcal{J}} \Omega_{nj} = 1$$

$$C_{nj} = \left[\sum_{m=1}^{\mathcal{C}} \Omega_{nj,m} X_{nj,m}^{\frac{1-\xi}{\xi}}\right]^{\frac{\xi}{1-\xi}}$$

Note: Future variables (denoted by $*$) are exogenous

Cost minimization

$$\min_{\{VA_{ni}, M_{ni}\}} P_{ni}^{VA} VA_{ni} + P_{ni}^{M} M_{ni}$$

s.t.

$$Y_{ni} = A_{ni}\left[\Omega_{ni,VA} VA_{ni}^{\frac{1-\theta}{\theta}} + \Omega_{ni,M} M_{ni}^{\frac{1-\theta}{\theta}}\right]^{\frac{\theta}{1-\theta}}$$

$$VA_{ni} = \left[\Omega_{niVA,L} L_{ni}^{\frac{1-\gamma}{\gamma}} + \Omega_{niVA,K} K_{ni}^{\frac{1-\gamma}{\gamma}}\right]^{\frac{\gamma}{1-\gamma}}$$

Intermediate goods' aggregation

Across sectors: $M_{ni} = \left[\sum_{j=1}^{\mathcal{J}} \Omega_{nj,i} X_{nj}^{\frac{1-\varepsilon}{\varepsilon}}\right]^{\frac{\varepsilon}{1-\varepsilon}}$ Across countries: $X_{nj} = \left[\sum_{m=1}^{\mathcal{C}} \Omega_{nj,m} X_{nj,m}^{\frac{1-\xi}{\xi}}\right]^{\frac{\xi}{1-\xi}}$

Market clearing

- Goods market clearing: for each country n sector i:

$$Y_{ni} = \sum_{m \in \mathcal{C}} X_{mi,n}$$

- Segmented labor markets: the labor market in country n, sector i, with wage W_{ni} in *local currency*, satisfies

$$\overline{L}_{ni} \geq L_{ni}, \qquad W_{ni} \geq \overline{W}_{ni}, \qquad \left(\overline{L}_{ni} - L_{ni}\right)\left(W_{ni} - \overline{W}_{ni}\right) = 0$$

- Segmented capital markets with *no* price rigidities:

$$K_{ni} = \overline{K}_{ni}$$

Monetary policy and the inter-temporal budget

- Monetary policy: assume all countries at zero-lower bound ($i = 0$)
- Inter-temporal budget constraint becomes:

$$P_{n,0} C_{n,0} + P_{n,*} C_{n,*} = I_{n,0} + I_{n,*}$$

- Set $P_{n,*} = 1$ and $I_{n,*}$ to the steady-state expenditure level
- Inter-temporal optimization yields:

$$I_{n,0} = P_{n,0} C_{n,0} = \frac{1 - \beta_n}{\beta_n} I_{n,*}$$

- Note that the aggregate shock is driven by a change in β_n. Corresponding expenditure is given in local currencies.

The current account

- At the world level: Expenditure = GDP, but for individual countries: $I_n \neq \text{GDP}_n$

$$I_n = \text{GDP}_n + \underbrace{\text{Imports}_n - \text{Exports}_n}_{\text{-Current Account}}$$

- Define bilateral trade balance between countries m and n as:

$$D_{nm} \equiv \text{Exports}_{m \to n} - \text{Exports}_{n \to m}$$

- Assume that the bilateral trade balance is financed by the ownership of factors / industries of country m in country n:

$$\chi_{nm} \equiv \begin{cases} \frac{D_{nm}}{\text{GDP}_m} & \text{if } D_{nm} > 0 \\ 0 & \text{otherwise} \end{cases}$$

- Then the total income of country n is:

$$I_n = \text{GDP}_n - \underbrace{\sum_m \chi_{mn} \text{GDP}_n}_{\text{Factors owned by foreigners in } n} + \underbrace{\sum_m \chi_{nm} \text{GDP}_m}_{\text{Factors owned abroad by } n}$$

Exchange rates

- In terms of factor income, the GDP of country n can be written as:

$$\text{GDP}_n = \sum_i (W_{ni} L_{ni} + R_{ni} \overline{K}_{ni})$$

- This is given in the common world currency. Hence the income of country n is given in the common currency
- We know the expenditure in the local currency from the inter-temporal budget constraint
- The exchange rate of country n is then:

$$e_n \equiv \frac{\text{Local currency Income}}{\text{Common currency Income}} = \frac{(1-\beta_n) I_n / \beta_n}{(1 - \sum_m \chi_{mn}) \text{GDP}_n + \sum_m \chi_{nm} \text{GDP}_m}$$

- Downward wage limit is given in the local currency but the wage the model solves is in common currency. Therefore, the downward wage rigidity is given by:

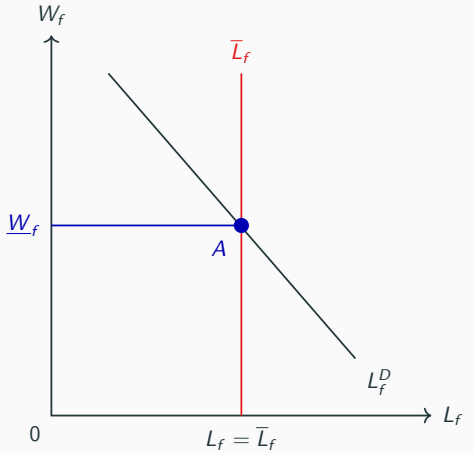
$$e_n W_{ni} \geq \overline{W}_{ni} \Rightarrow W_{ni} \geq \frac{\overline{W}_{ni}}{e_n}$$

Model solution method

- Calibrate the model with ICIO 2018 Table from OECD
  - Final use shares
  - Input shares
  - Value added shares
  - Expenditures
- Normalize all prices, wages and rents to 1 at steady state
- From this stable equilibrium introduce shocks
- AMPL / Knitro optimizer
- Calculate the relative changes in common currency
- Convert the common currency price changes to local currency by multiplying with the model-consistent exchange rate

Segmented factor (e.g., labor) markets during collapse and recovery

- $\overline{L}_f$: Potential level for factor f. Decrease due to sick workers, shutdowns, etc.



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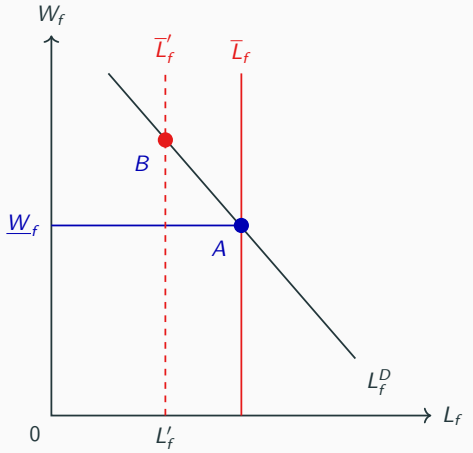

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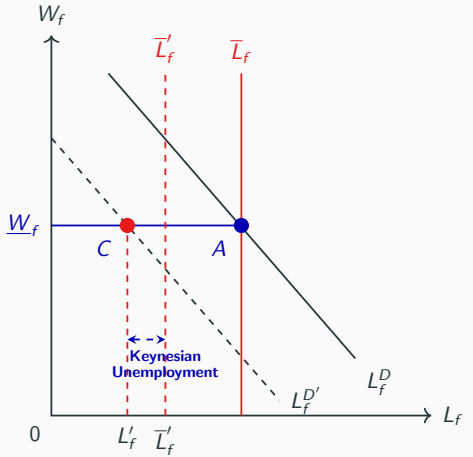
- Difference between $\overline{L}_f$ and L_f: Keynesian unemployment



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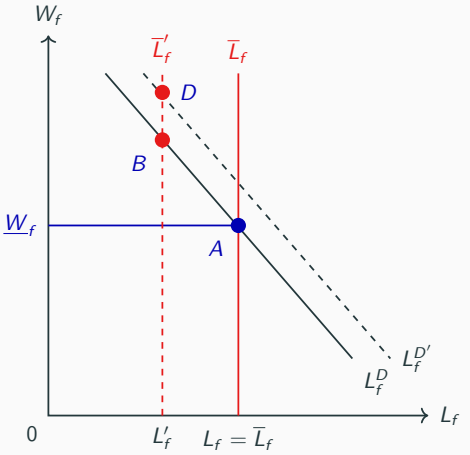
- During recovery – point D: where these unemployment gaps are closed (heterogeneous across sectors, may not be back to 2019 but still inflationary)



First-order approximation of domestic CPI inflation: closed economy

Domar Weights:

$$\lambda_i \equiv \frac{P_i Y_i}{GDP} \quad \text{and} \quad \Lambda_f \equiv \frac{W_f L_f}{GDP}$$

CPI:

$$\mathrm{d}\log CPI = \underbrace{\mathrm{d}\log \zeta}_{\text{Domestic AD shock}} - \boldsymbol{\Lambda}^T \mathrm{d}\log \boldsymbol{L} - \boldsymbol{\lambda}^T \mathrm{d}\log \boldsymbol{A}$$

- Same result as in Baqaee & Farhi (2022)
- Relative strength of sector-level labor or productivity shocks determined by the influence vector of sector-level factor or output shares, respectively
- Note that the sectoral demand shifts cancel out in the first-order approximation

Open-economy Domar weights

- We can relate the final consumption to production via global Leontieff inverse ($\boldsymbol{\Psi}$). Denote the total output of all industries globally with $\boldsymbol{Y}$, the total consumption of all industries with $\boldsymbol{C}$, then:

$$\boldsymbol{Y} = \boldsymbol{\Psi}\boldsymbol{C}$$

- Denote the consumption of country n in all industries globally with $\boldsymbol{C}^n$ and assign the portion of production to country n by

$$\boldsymbol{Y}^n = \boldsymbol{\Psi}\boldsymbol{C}^n$$

- Write the local Domar weights for country n using Y^n_{mi}:

$$\lambda^n_{mi} \equiv \frac{P_{mi} Y^n_{mi}}{I_n}$$

First-order approximation of domestic CPI inflation: open economy

Factor shares are governed by $\mathbf{\Omega}^F$.

We can define country-level Domar weights for all factors globally as:
$\mathbf{\Lambda}^n \equiv (\mathbf{\Omega}^F)^T \boldsymbol{\lambda}^n$

Then the CPI in country n can be written as:

$$\mathrm{d}\log CPI^n = \underbrace{\mathrm{d}\log \zeta^n}_{\text{AD shock}} - (\mathbf{\Lambda}^n)^T \mathrm{d}\log \boldsymbol{L} - (\boldsymbol{\lambda}^n)^T \mathrm{d}\log \boldsymbol{A}$$

- Labor shortages, at home and abroad, are inflationary domestically
- Positive productivity changes everywhere, $\mathrm{d}\log \boldsymbol{A}$, are deflationary
- AD Shock includes both domestic AD shocks and exchange rate change

Quantification

Data aggregation

- Three countries:
  - United States
  - Euro Area
  - Rest of the world
- Three sectors:
  - Durable
  - Non-durable
  - Services

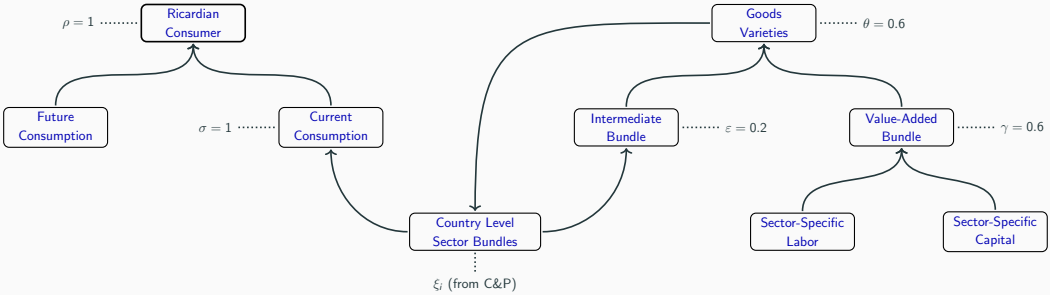
Mapping data to model shocks

1. Sectoral demand shocks ($\mathrm{d}\Omega_{nj}$): Observed sectoral expenditure shares changes in country n with $\sum_{j \in \mathcal{J}} d\Omega_{nj} = 0$
   - United States: BEA sectoral personal consumption expenditure
   - Euro Area: OECD Quarterly National Accounts
   - Rest of the world: estimates based on infection levels
2. Country-sectoral potential supply shocks ($\mathrm{d} \log \overline{L}_{ni}$): Observed changes in total hours worked in country n, sector i
   - United States: BLS tables B1 and B2
   - Euro Area: EuroStat
   - Rest of the world: estimates based on infection levels
3. Country-level aggregate demand shocks ($\mathrm{d} \log \zeta^n$): Nominal (l.c.) expenditure changes
   - United States: Gross national income
   - Euro Area: EuroStat
   - Rest of the world: country-weighted nominal GDP growth

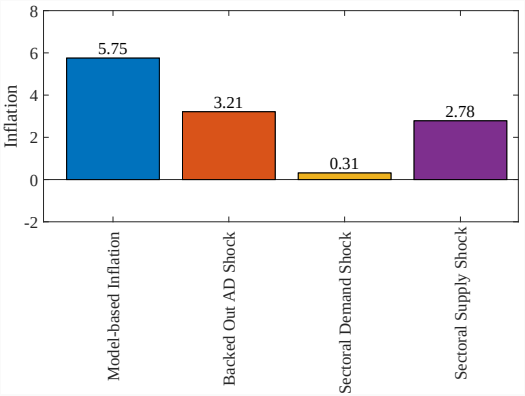
Parametrization

- Model requires initial consumption and input-output shares
  - We use the cross-country input-output database from the OECD year 2018
- Elasticities:
  - Between value added and intermediate inputs: $\theta = 0.6$ (Atalay, 2017; Carvalho et. al, 2021)
  - Between labor and capital: $\gamma = 0.6$ (Raval, 2019; Oberfield and Raval, 2021)
  - Among intermediates: $\varepsilon = 0.2$ (Atalay, 2017; Boehm, Flaaen, and Pandalai-Nayar, 2019)
  - Cross-country Armington: $\xi = 4.55$ (Caliendo & Parro, 2015)
- We set country-sector productivity changes to zero throughout
  - Recent evidence on pandemic suggests little changes in aggregate/sectoral productivity w/no labor reallocation across sectors in the US (Fernald and Li, 2022)
  - Want to give full chance to sectoral labor shocks to mimic the reality of sectoral shortages and demand-supply imbalances

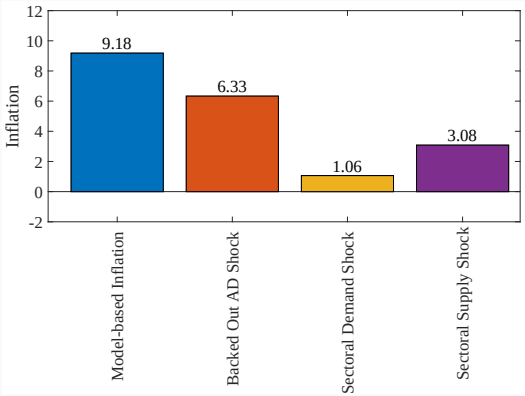
Model Structure



Inflation Drivers before Russia War



(a) Euro Area: 45 Sectors



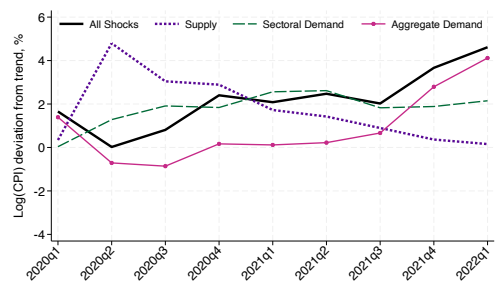
(b) U.S. 66 Sectors

$\Rightarrow$ **Supply-side account for $\approx 1/2$ for Euro Area and $\approx 1/3$ for US (rest is demand; fiscal stimulus is 65 percent of AD)**

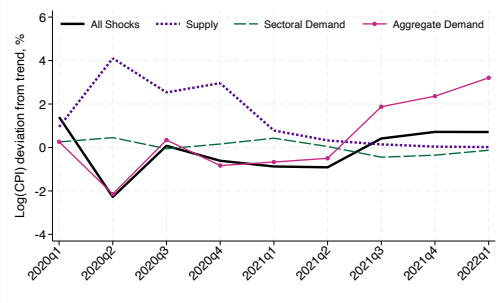
$\Rightarrow$ MP can be effective by $\downarrow$ AD but $\uparrow$ pressure in prices with sectoral supply shocks

Inflation Drivers over Time 2020-2022

(a) United States



(b) Euro Area



Extended period

US Monetary Policy Transmission At Home

Monetary Policy Transmission under Heterogeneity

$$\underbrace{\text{Interest rates} \Rightarrow \underbrace{\text{Firm Credit}}_{\text{Heterogeneity}} \Rightarrow \text{Investment, Employment}}_{\text{Monetary Policy Effectiveness}}$$

Monetary Policy Transmission under Heterogeneity

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Two types of heterogeneity are critical:

1. Size of the firm
2. Type of collateral

Monetary Policy with Heterogenous Agents

Extensive theoretical literature:

- Consumption: Kaplan et al. 2018, Auclert 2019, Wong 2019, ...
- Investment: Ottonello and Winberry, 2021.
- Hetero: Financial frictions/credit constraints faced by different types of households/firms.

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- SMEs defined by SBA as $<$500 employee, account for 54% of employment, 53% of output

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We use supervisory administrative data for a representative sample of the U.S. economy, composed of private firms and SMEs

Y-14: CCAR-Supervisory Data on Bank Lending

- Firm-bank-loan-quarter level with a reporting threshold of \$1 million.
- Contractual terms and firm balance sheet items.
- 2012Q3–2019Q4, **all sectors**. Almost 4 million loan-level observations for 150,000+ corporations, of which 60,000+ have assets less than 10 million. $\Rightarrow$ SME: Assets$<$ 10m, Revenue$<$50m

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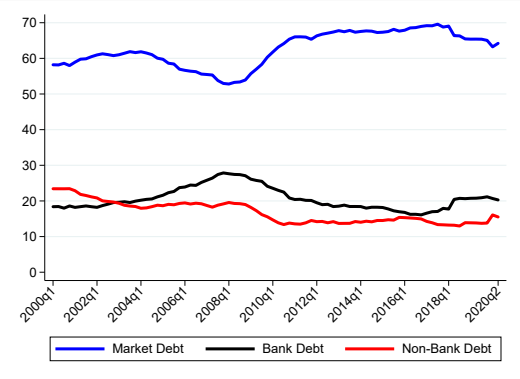
Coverage:

- The banks subject to CCAR account for over 85% of the total assets in the banking sector and provide around 70% of all commercial and industrial lending.
- **Supervisory data on private firms' financing: representative relative to Compustat, QFR, Dealscan, CapitalIQ, SBFS,...**
- Y14 firms account 65% of U.S. corporate sector debt and 78% of aggregate U.S. gross output.

What do we know: Flow of Funds Data

Non-Financial Corporate Business



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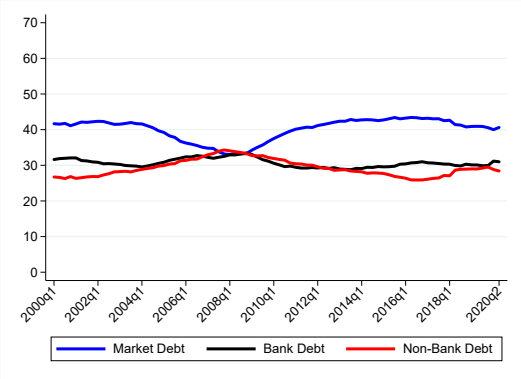
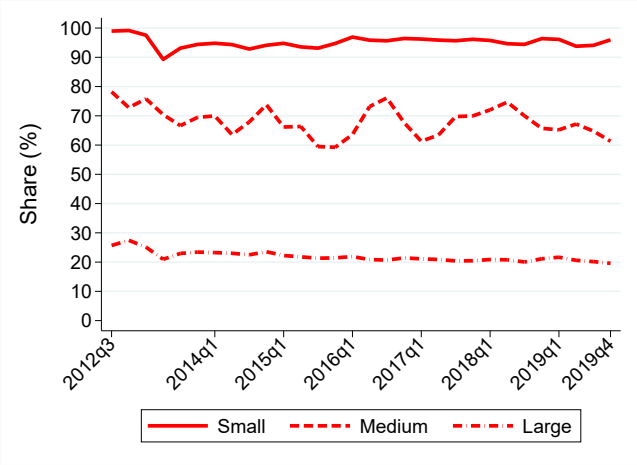


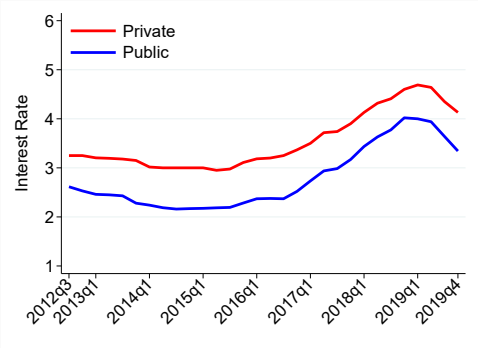
Private Firms' Share of Bank Debt in Total Debt: FR Y-14



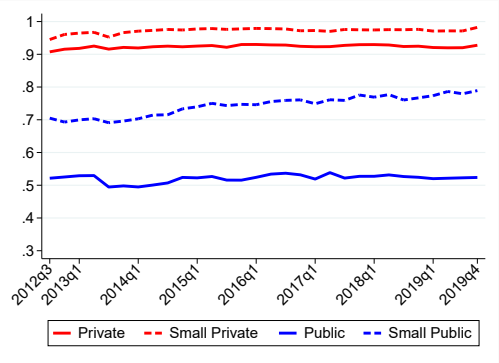
- The entire balance sheet debt of SMEs is bank debt

Private firms and SMEs pay higher interest rates and need collateral to borrow

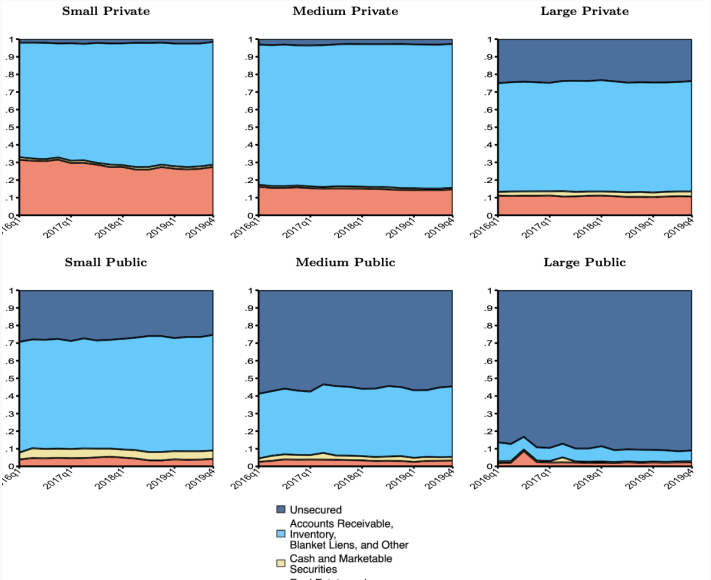
Median Interest Rate on Loans



Share of Loans Collateralized



Collateral Types and Financial Constraints



- $\Rightarrow$ Asset-based: Real estate, fixed assets, cash&securities
  $\Rightarrow$ Earnings and operation-based: Blanket-liens and accounts receivable & inventory
- Securing financing through AR&I and blanket liens falls monotonically across the size distribution and is replaced by unsecured lending.

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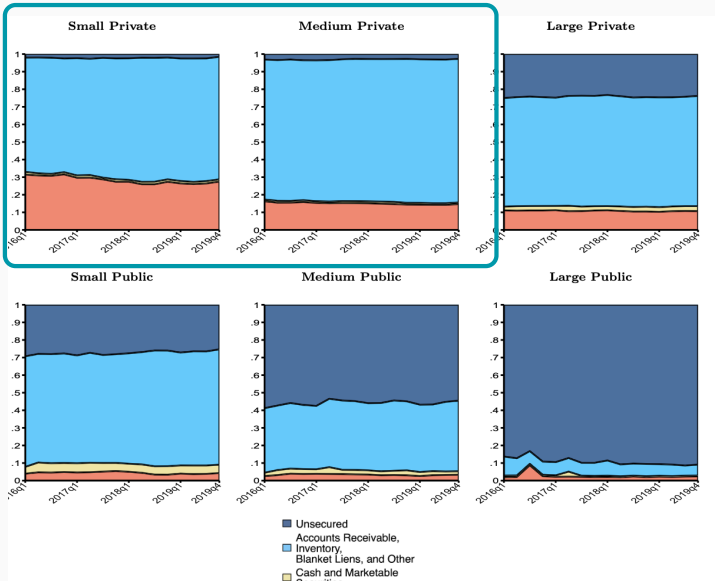

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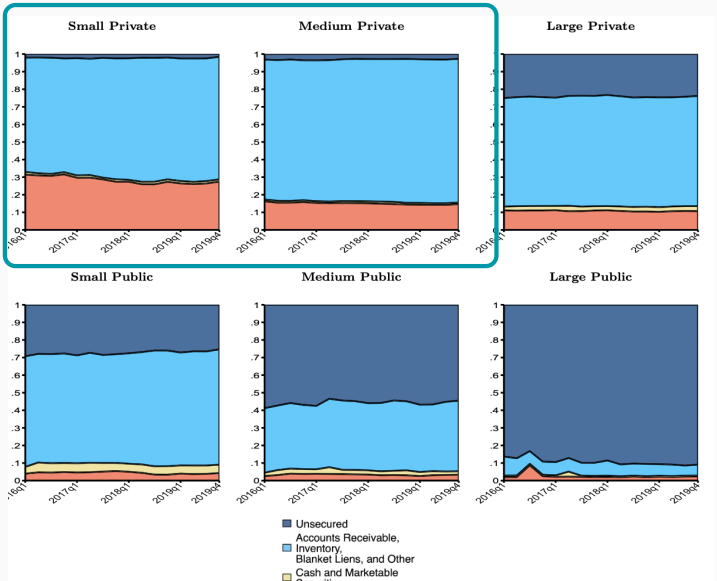

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- SMEs rely mostly on AR&I and blanket liens rather than real estate or fixed assets.
- **Lian and Ma (2021), Drechsel (2023)**: importance of earnings based-lending instead of asset based-lending for public/large firms in U.S.

  ⇒ More important for private firms and SMEs in U.S. based on actual collateral data.

Varying Firm Credit Demand Over Time (Aggregate Loans to Firm-Bank Level):

$$\log \sum_{l \in \mathcal{L}(f,b,q)} Y_{f,b,s,q}(l) = \alpha_{f,b} + \alpha_{s,q} + \alpha_{b,q} + \kappa \left(\textbf{High Leverage Firm}_f \times \text{MP}_q \right) + \vartheta_{f,b,s,q} \tag{1}$$

Y: **loan amount, loan spread.** $\mathcal{L}(f, b, q)$: set of loans between firm (f)-bank (b), quarter q.

Controls: Firm-quarter variables—sales growth, size, ...

Monetary Policy and Credit Outcomes: Benchmark Results

	Quantity: Log(Loan)			*Prices: Log(1+i)*		
	All	Private	Public	All	Private	Public
High Leverage Firm × MP Surprise$_q$	-0.4212***	-0.8478***	-0.0498	-0.0262***	-0.0395***	0.0156**
	(0.0772)	(0.1221)	(0.2075)	(0.0027)	(0.0035)	(0.0046)
Observations	2460475	2140482	319985	2472261	2150197	322056
Adjusted R^2	0.945	0.939	0.837	0.768	0.768	0.676
Bank × Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Bank × Time F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Firm × Time F.E.	No	No	No	No	No	No

- High leverage firms borrow more, paying higher rates during expansionary policy.
- All firm results are driven by private firms.

Mapping Credit Market Heterogeneity and Monetary Policy Transmission at the Loan Level: The Role of Collateral

$$\log Y_{l,f,b,q} = \alpha_{f,b,q} + \beta \textbf{Collateral Type}_l + \kappa(\textbf{Collateral Type}_l \times MP_q) + \vartheta_{l,f,b,q} \quad (2)$$

Control other loan level variables: maturity, loan types, new originations

Role of Collateral Type in Monetary Policy Transmission

	Quantity: Log(Loan)		**Prices: Log$(1+i)$**	
	Private Firms	*Public Firms*	*Private Firms*	*Public Firms*
Asset-based	0.0278	-1.6386***	-0.0010	0.0195***
	(0.0546)	(0.0719)	(0.0012)	(0.0010)
Earnings & Operations-based	0.6912***	-0.4388***	-0.0085***	0.0054***
	(0.0608)	(0.0949)	(0.0012)	(0.0009)
Asset-based $\times$ MP$_q$	-1.5839***	-0.3345	-0.0260*	0.0305*
	(0.4050)	(0.7612)	(0.0107)	(0.0120)
Earnings & Operations-based $\times$ MP$_q$	-2.5402***	-4.0888***	-0.0293*	-0.0300**
	(0.4689)	(0.9127)	(0.0107)	(0.0106)
Observations	1371794	485440	1377795	481327
Adjusted R^2	0.310	0.330	0.366	0.390
Bank $\times$ Firm $\times$ Time F.E.	Yes	Yes	Yes	Yes

$^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

- Normal times access to finance effect for private borrowers is from earnings and operation based collateral.

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- During expansionary policy both type of collateral increase borrowing, but only earnings and operation based

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- Both type of collateral signal distress in normal times and during expansionary policy for public firms.

Financial Constraints and Macro: Importance of Granular Data

Three ways of modeling borrowing constraints in Closed/Open Macro

1. Kiyotaki-Moore: Risk-free debt limited by future resale value of FIXED ASSETS/K

$$R_t b_t \leq q_{t+1} k_t$$

2. Bianchi-Mendoza: Risk-free debt limited by current value of assets since borrower can run away—future value cannot match sudden stops

$$R_t b_t \leq q_t k_t \leq \theta k_t$$

3. Earnings-based, Drechsel-Lian/Ma: Risk-free debt limited by current value of INCOME, lenders take over the firm

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Data: Risky debt limited by current income/earnings

$$(R_t + \alpha_i) b_t \leq q_t y_t \leq \theta_i y_t$$

b_t: debt, k_t: capital, R_t: safe-rate, α_i firm specific risk premium, θ_i: firm specific collateral

Policy implication differs drastically

1. Asset-based constraints:

   Externality: Firms do not take into account effect of their actions on assets prices, q_t or q_{t+1}

   Higher demand for borrowing, higher asset prices, more borrowing

   $\Rightarrow$ Policy attacks over-borrowing! (Macropru/capital control)

2. Earnings-based constraints:

   Current net income/profits=Ability to generate income now and future=Going concern value:

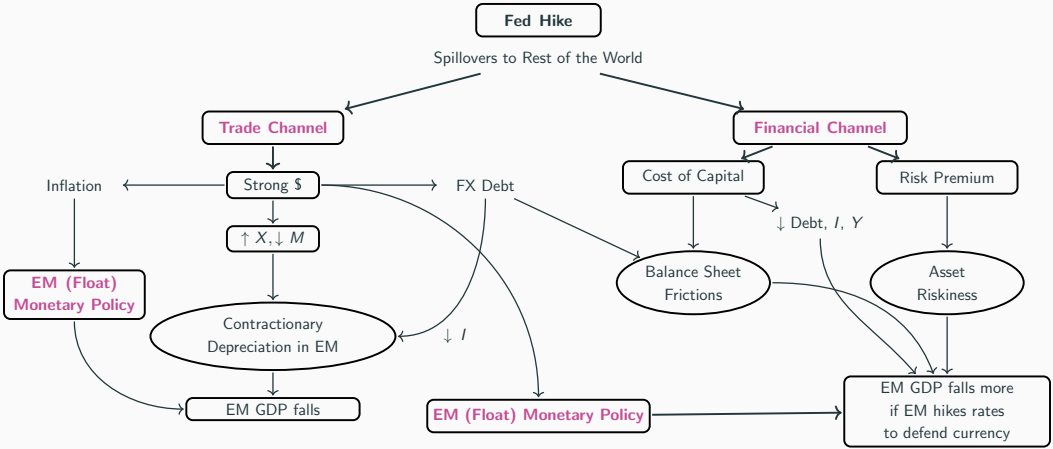
   $$y_t = \text{Sales} + q_t k_t - w_t L_t$$

   Externality: Firms do not take into account effect of their actions on all input prices

   Higher demand for borrowing, higher asset prices (higher income), higher wages (lower income) $\Rightarrow$ Policy attacks under-borrowing! (Japan-liquidity trap; COVID-PPP)

International Transmission of U.S. Monetary Policy

How US FED Hikes Transmit to the ROW?



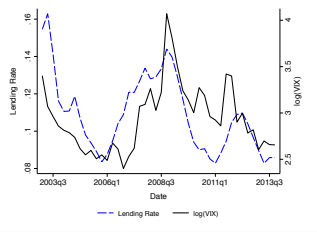
Importance of Borrower Heterogeneity

Not every country is the same in terms of:

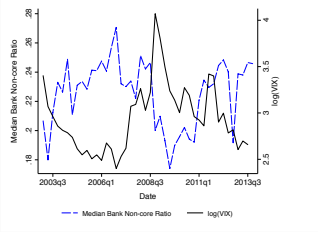
- Composition of capital flows
- Risk sentiments of investors
- FX debt and other fundamentals
- Credibility of monetary policies and institutional environment

Macro Facts

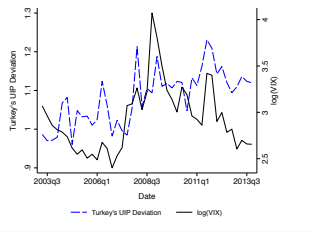
(a) GFC and Lending Rates ($\rho = 0.52$)



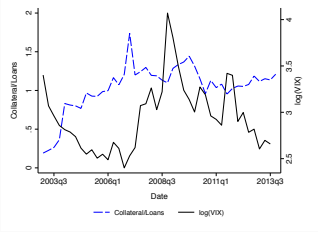
(b) GFC and Non-Core Liabilities ($\rho = -0.51$)



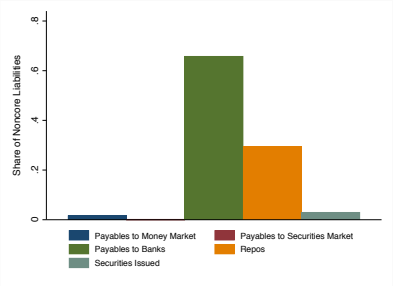
(c) GFC and UIP ($\rho = 0.61$)

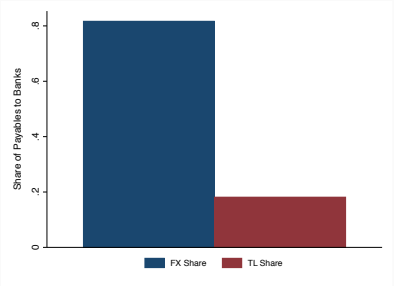


(d) GFC and Collateral ($\rho = 0.01$)



Decomposition of Non-Core Liabilities





How does U.S. Shocks connect to EM Credit Cycles?

- 43 % of cyclical credit growth is due to GFC
- Key channel is falling risk-premium, which lowers borrowing costs for average firm regardless of collateral constraints that are not impacted by GFC
- The pro-cylicality in the UIP risk premium with VIX implies that local currency borrowing becomes cheaper and increases during the boom phase of GFC

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- **Implication for macropru policies and theoretical work:**
  - Limiting private agents' foreign currency borrowing during credit boom events/lean against appreciation may not be sufficient
  - Lower borrowing costs also fuel local currency borrowing if banks can fund themselves cheaply in international markets

EMs Endogenous Policy Response

Monetary Policy in Emerging Economies

- **Emerging economies are largely exposed to global financial conditions**

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- **Changes in global financial conditions pose trade-off to central banks**
  - *Example*: U.S. monetary tightening $\rightarrow$ tighter global financial conditions
    (Miranda-Agrippino & Rey 20, Kalemli-Ozcan 19)
  - Central banks in emerging economies can:
    (a) increase their policy rate $\rightarrow$ curtail capital outflows & FX depreciation
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What do central banks in emerging economies do?

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   - market rates depart from policy rates over the business cycle
   - in advanced economies: market rates $\approx$ policy rates
3. **Short-term disconnect comoves with global financial conditions**
   - Short-term disconnect strongly related to Dollar Premium & CIP Premium
   - Consistent with simple model where financial intermediaries' funding conditions determine market rates: policy pass-through to market rates incomplete if funding is global

What do central banks in emerging economies do?

- **Empirical evidence on the behavior of policy rates:**
  1. policy rates around periods of global distress ("risk-off shocks")
     Global Financial Crisis, Taper Tantrum, COVID-19
  2. estimation of central bank reaction function
     OLS estimation of Taylor-type rules (Taylor 93, Carvalho et al. 21)

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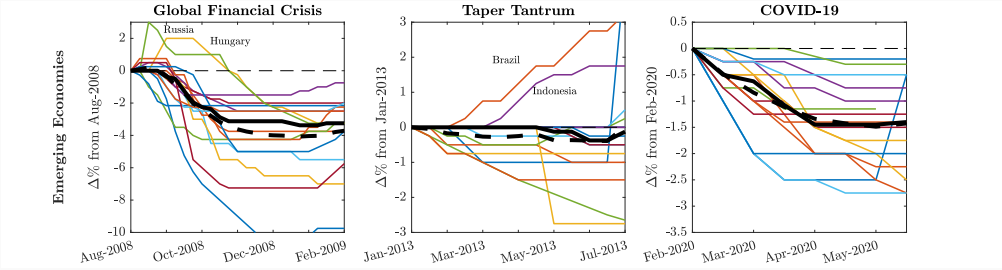
- **Focus on flexible exchange rate regime countries** (Ilzetki et al. 19)
- **Data sources**: *BIS, Bloomberg, IMF Int'l Financial Statitics*

Monetary policy rates around episodes of global distress



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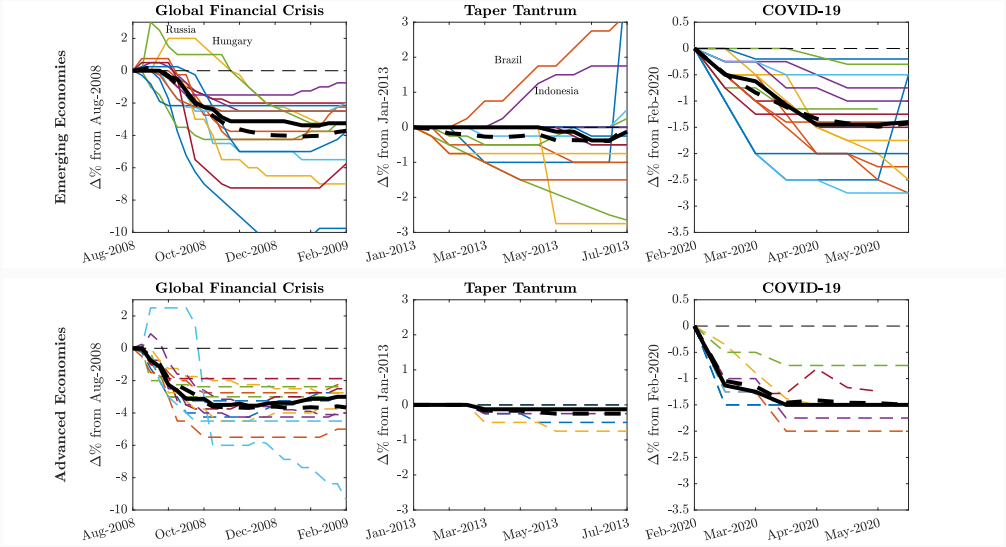


Estimated central banks' reaction function (1990-2018)

$$i_t^P = \alpha + \beta_1 i_{t-1}^P + \beta_2 \pi_t + \beta_3 \tilde{y}_t + \epsilon_t$$

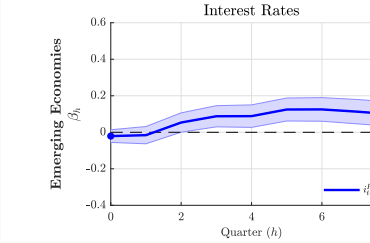
	Emerging Economies		Advanced Economies	
i_{t-1}^P	0.860***	0.826***	0.944***	0.930***
	(0.0058)	(0.0079)	(0.0075)	(0.0082)
π_t	0.394***	0.419***	0.304***	0.265***
	(0.027)	(0.034)	(0.029)	(0.028)
Δgdp_t	**0.00892****		**0.00133**	
	(0.0037)		(0.0017)	
Output gap$_t$		**0.0591*****		**0.0844*****
		(0.020)		(0.011)
R-Squared	0.93	0.87	0.96	0.95

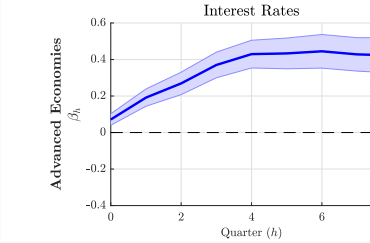
- A Taylor rule characterizes policy rates fairly well
- Estimates similar across emerging & adv. economies
- Estimates imply $\rho \approx 0.8$, $\phi_\pi \approx 2$, $\phi_y \approx 0.5$

- Estimates suggest that monetary policy stance is **countercyclical**

Cyclicality of policy rates (1990-2018)

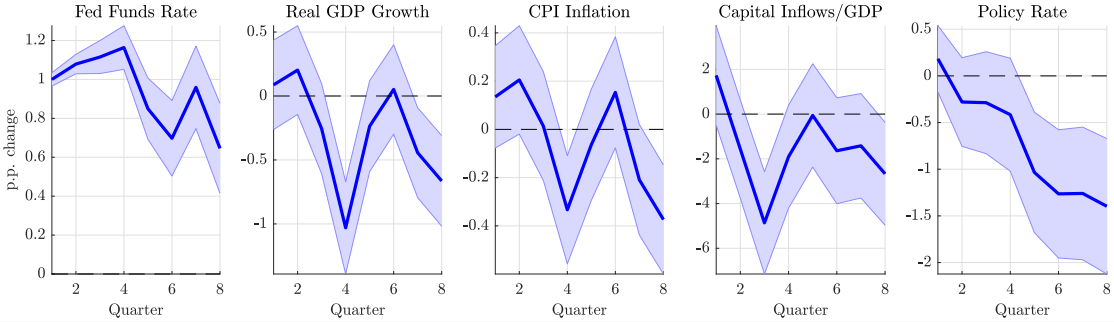
$$i^P_{t+h} = \alpha_h + \beta^P_h \Delta gdp_t + \gamma_h i^P_{t-1} + \epsilon^P_{t+h}$$





During good times, monetary policy is tighter

U.S. monetary policy tightening & policy rates in emerging econ.



Impulse: 1 p.p. exogenous increase in Fed Funds Rate (Gertler & Karadi 15)

- policy rates decline after US MP tightening
- amongst contracting GDP, CPI Inflation, capital inflows

(see also Dedola et al. 17 & Iacoviello & Navarro 19, Degasperi et al. 23)

Short-term rates in emerging economies

Policy Rates and Short-term Market Rates

- **Policy rates measure the stance of monetary policy**

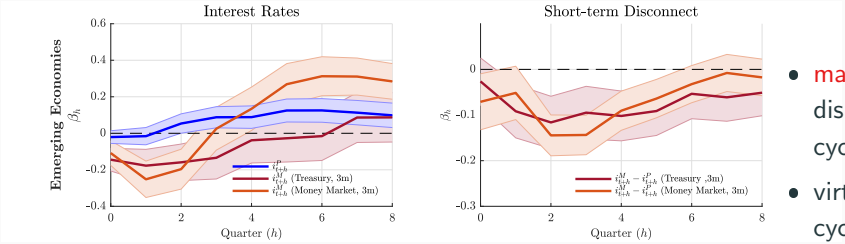
  "Target interest rate set by central banks in their efforts to influence short-term interest rates as part of their monetary policy strategy"

- **Short-term market rates measure the stance of monetary policy imperfectly**
  - Treasury rates: rates at which governments issue bonds
  - Money market rates: rates charged on loans among banks

- **Next: behavior of 3-month Treasury & Money market rates in AEs & EMEs**

Cyclicality of policy rates and market rates (1990-2018)

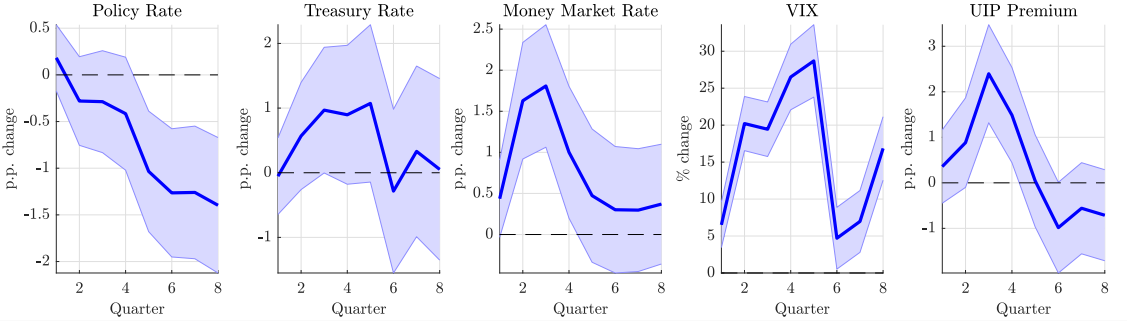
$$i^j_{t+h} = \alpha^j_h + \beta^j_h \Delta gdp_t + \gamma^j_h i^j_{t-1} + \epsilon^j_{t+h}$$



- market and policyx rates display opposite cyclicality in EMEs
- virtually identical cyclicality in AEs

- relevant distinction for Interpretation of **cyclical stance of monetary policy**

U.S. monetary policy tightening , policy rates & market rates



Impulse: 1 p.p. exogenous increase in Fed Funds Rate (Gertler & Karadi 15)

- market and policy rates display opposite response to US MP in EMEs
  - → policy rates decline after US MP tightening
  - → market rates increase after US MP tightening

Short-term disconnect & global financial conditions

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- **Consider three "financial wedges" that emerge in global financial markets**
  1. **Dollar Premium**: premium on country's dollar bond relative to US bond $\hat{i}_t^\star - i_t^\star$
     Bianchi & Lorenzoni 22
  2. **UIP Premium**: excess currency returns on the home-currency bond $i_t - i_t^\star - (E_t s_{t+1} - s_t)$
     Gabaix & Maggiori 15, Kalemli-Ozcan & Varela 22
  3. **CIP Premium** difference between synthetic dollar bond and cash dollar bond $i_t - i_t^\star - (f_t - s_t)$
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- **Use EMBI spread as proxy for Dollar Premium & 12-m market rates for UIP & CIP Premium.**

CIP Premium

Short-term disconnect comoves with global financial conditions

	Treasury rate disconnect		Money market rate disconnect	
	(1)	(2)	(3)	(4)
Dollar Premium	0.455***	0.406***	0.395***	0.367***
	(0.049)	(0.054)	(0.038)	(0.041)
UIP Premium	-0.008*	-0.010**	-0.002	-0.005
	(0.003)	(0.004)	(0.003)	(0.003)
CIP Premium	-0.080***	-0.071*	-0.203***	-0.103***
	(0.019)	(0.031)	(0.015)	(0.023)
R2 (within)	0.078	0.062	0.197	0.093

col.s (1) & (3): Treasury-based CIP & UIP Premium; col.s (2) & (4): Money-market-based CIP & UIP Premium

Includes country fixed effects; s.e.; * 5%, **1%, *** 0.1%

Other specs: Bivariate regressions, Survey-expected excess returns; Standardized coefficients

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How to Model the Short-rate Disconnect?

- A short rate disconnect can arise with collateral constraints on home banks' capital market access (Gertler-Karadi 15)

  $\Rightarrow$ (e.g Mendoza 10, Gabaix and Maggiori 15, Basu et al. 20)

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- It can also arise when international funding costs for home banks differ from the safe foreign rate and fluctuates with risk-on/off shocks

  $\Rightarrow$ tighter global financial conditions means higher funding costs for home banks

Takeaways

- Global production and trade network played a critical role in recent global inflation under sectoral demand, supply and AD shocks combined with input complementarity
- Earnings based constraints and bank dependent firms are important for domestic and international transmission of US monetary policy
- Risk premia is important for the heterogeneity in international transmission of US monetary policy
- EM's monetary policy stance, as implied by policy rates, is countercyclical
- Global financial cycle leads to limited monetary policy effectiveness in EM but not in AE