Liquidity, Capital Pledgeability and Inflation Redistribution

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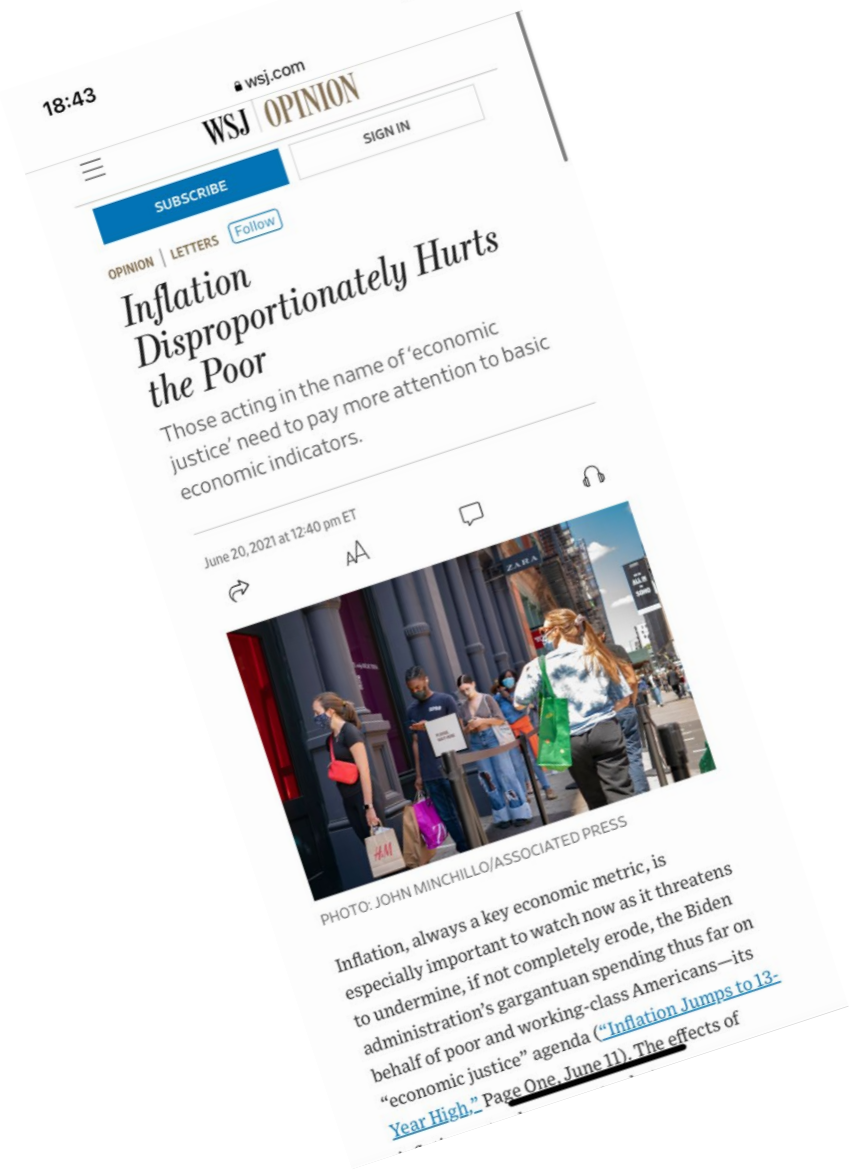
Inflation and redistribution



... Does inflation disproportionately hurt the poor?

- Ongoing debate on monetary policy and inequality
  - Expansionary monetary policy can provide *partial insurance* to cash-poor agents (Levine, 1991, Imorohoroglu,1992 and Rocheteau, Weil and Wong, 2018).
  - Inflation can be viewed as a *progressive tax on savings* (Chatterjee and Corbae, 1992) reducing welfare of *lenders...*
  - ... or a *regressive tax on transactions (Erosa and Ventura, 2002, Albanesi, 2007 Boel and Camera, 2009).*

- In this paper
  - Evaluate the welfare costs for *borrowers* and *lenders* when inflation is a tax on savings *and* transactions.
  - Uncover a novel redistribution mechanism linked to the collateral channel of monetary policy.

Liquidity, capital plegeability and inflation redistribution

- Microfounded model of money with capital
  - Money is a *liquid* asset used as means of payment.
  - Capital is a *factor of production* and has *collateral value*.
- Heterogeneity in time preferences
  - (Collateralized) borrowing and lending.
- An increase in steady-state inflation
  - Endogenously reduces monetary transactions.
  - Drop in demand negatively affects capital formation...
  - ... and in turn on collateralized debt, thereby redistributing wealth from lenders to borrowers.
  - Calibrating our model on US data, we find that inflation acts as a progressive tax.

Smörgåsbord of the literature

- **New monetarist model of money**
  - Lagos and Wright (2005), Rochetau and Wright (2005), Boel and Waller (2009), Boel and Waller (2019).
  - Aruoba and Wright (2003), Lagos and Rochetau (2008), Aruoba, Waller and Wright (2011).

- **Collateralized debt**
  - Kiyotaki and Moore (1997), Del Negro, et al. (2017), Kiyotaki and Moore (2018), Ferraris and Watanabe (2008), Finocchiaro et al. (2018).

- **Distributional effects of expected inflation**
  - Erosa and Ventura (2002), Albanesi (2007), Boel and Camera (2009), Camera and Chien (2014).
  - Levine (1991), Imrohoroglu (1992), Bhattacharya, Haslag, and Martin (2005), Molico (2006), Manuelli and Sargent (2010), Rocheteau, Weill, and Wong (2018), Chiu and Molico (2010, 2011), Chatterjee and Corbae (1992).

The Model

Market structure

Two sequential rounds of trade, in both markets **competitive pricing**.

- In the **DM,** money (m) is *essential* for trade
  - Agents can trade (produce $f(k)$ or consume $u(q)$) with equal probability $\frac{\sigma}{2}$, or be idle with probability $1-\sigma$, i.e. money solves a double coincidence problem.
  - Anonymity, no record keeping and imperfect enforcement prevent the use of credit (Kocherlakota, 1998).
  - Capital (k) is used as a factor of production (but not as means of payment).
- In the **CM,** everyone can trade
  - Labor (n) is the only factor of production (baseline).
  - Quasi-linearity of utility suppresses wealth effects on money demand (and simplifies aggregation)
    $$U(x) - n.$$
  - Agents choose their portfolio: m', k' and a'.

The Model

Agents and monetary policy

- Two types of **agents**: patient (ρ) and impatient $(1-\rho)$, $\beta_H > \beta_L$
  - Interperiod credit flows from **CM** to **CM.**
  - All debt is collateralized $a'_L \leq \theta k'_L$.
- **Monetary policy**
  - Lump-sum nominal transfers in CM: $\tau = (\pi - 1) M_{-1}$.

Results: equilibrium properties

1. *Any stationary monetary equilibrium must be such that* $\pi \geq \beta_H$.
   - Return on cash $>$ Bond return cannot be a stationary equilibrium.
2. *A stationary monetary equilibrium exists with:*

$$p_a = \frac{\beta_H}{\pi},\ a_L = \theta k_L,\ a_H = -\frac{(1-\rho)}{\rho}\theta k_L,\ m_H > m_L$$

   - For L agents, borrowing at rate $\frac{\pi}{\beta_H}$ cheaper than carrying money across periods at cost $\frac{\pi}{\beta_L}$.
   - Price of bonds adjusts for expected inflation,but borrowing and lending still affected by inflation via collateral constraint.
3. *Let* $\pi \geq \beta_H$ *and* $a_L = \theta k_L$. *Then,* $dq_H/d\pi < 0$ *and* $dk_j/d\pi < 0$ *for* $j = L, H$.
   - If $\pi \uparrow$, real value of money and aggregate demand in DM market decrease, lower incentive to invest in capital if sellers $\left(dk_j/d\pi < 0\right)$.

Overall effects of inflation

- Increase in long-run inflation leads to
  - DM: Reduction in consumption and production.
  - CM: Reduction in capital, debt and labor.
- Collateralized debt reduces wealth inequality. ▸ Plot
  - Type L more exposed now to effects of inflation on capital. ▸ Plot
- Ambiguous balance of these effects on welfare $\Rightarrow$ overall must be determined quantitatively. ▸ US Calibration

Welfare costs of 10% inflation: results

Consumption units - Baseline

Table 2: Percentage welfare cost of 10% inflation relative to zero inflation and the Friedman rule.

	Zero Inflation			Friedman Rule		
Model	Type L	Type H	Average	Type L	Type H	Average
Collateralized borrowing	0.58	1.50	0.95	0.70	2.01	1.23
Uncollateralized borrowing	0.43	1.77	0.97	0.49	2.40	1.26
No credit	0.43	1.77	0.97	0.49	2.40	1.26

- Average costs of inflation for society in line with previous studies (without heterogeneity).
- Inflation acts a progressive tax overall.
- Collateralized borrowing
  - Increases inflation costs for borrowers (they invest more in capital).
  - Decreases its costs for society (capital productive only in the DM, smaller effects of inflation as an investment tax).
  - What if capital is productive also in the CM?

Welfare costs of 10% inflation: results

Consumption units - Capital productive also in the CM

	Zero Inflation			Friedman Rule		
Model	Type L	Type H	Average	Type L	Type H	Average
Collateralized borrowing	0.40	1.87	0.99	0.54	2.63	1.38
Uncollateralized borrowing	-0.26	2.46	0.82	-0.41	3.51	1.15
No credit	-0.28	2.47	0.82	-0.43	3.53	1.15

- Stronger effects of inflation as a tax on capital.
- Higher costs of inflation for type H.
- Lower costs for type L.
  - ...Even more when capital does not have collateral value.

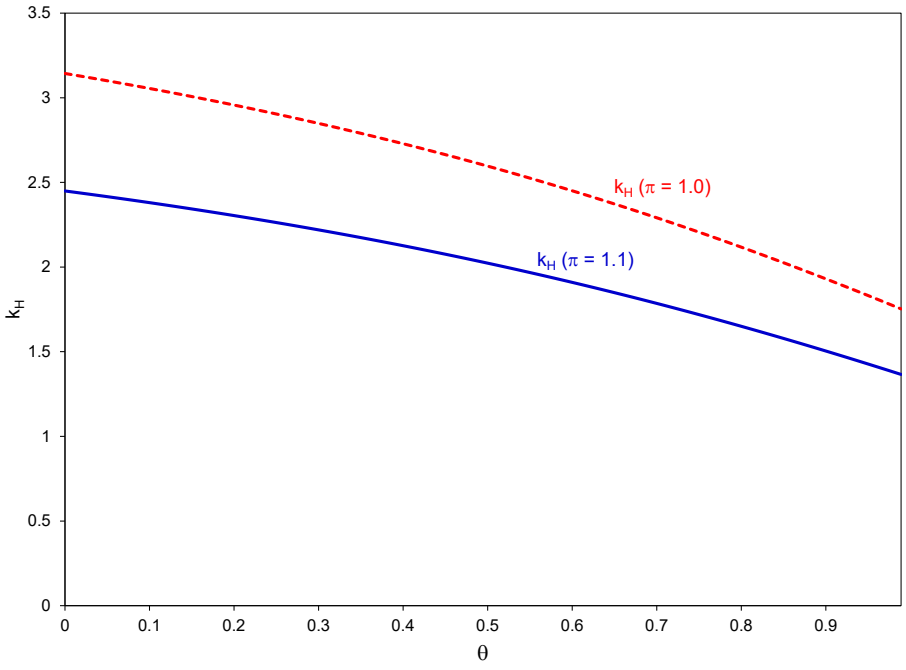
Conclusions

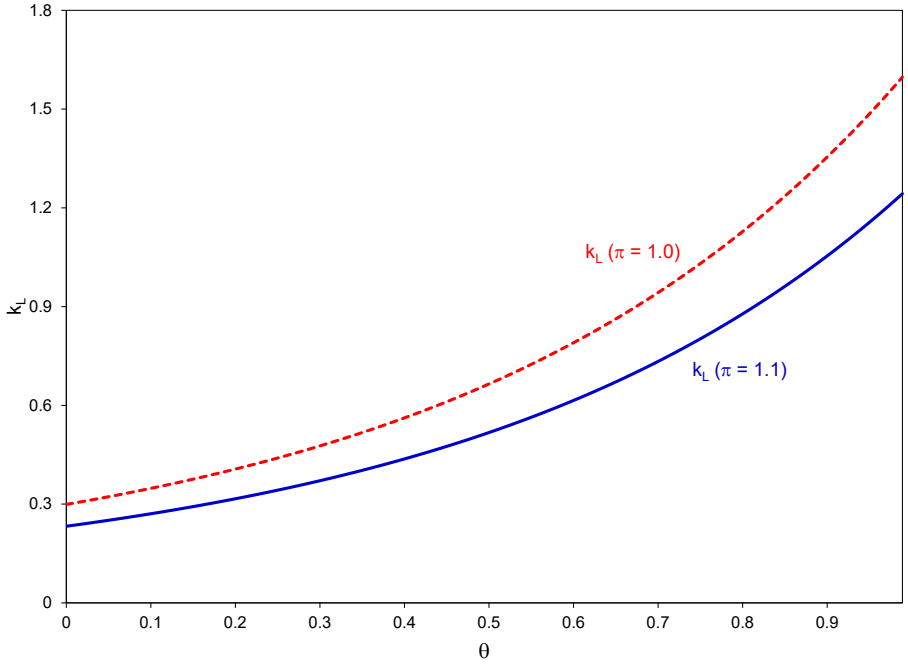
- A microfounded monetary model where money, capital and debt coexist.
- Inflation is detrimental to capital accumulation.
- Expected inflation affects borrowing and lending when collateral constraints are present.
- When we calibrate our model using US data, we find that inflation acts as a progressive tax through three different channels:
  1. Redistributes **monetary wealth** thanks to inequalities in the **inflation tax**.
  2. Reduces the value of debt in the long-run through the **collateral channel**.
  3. It decreases **capital earnings** of the rich, acting as an **investment tax**.

Ongoing work

- Improve fit of money demand.
  - More general utility in the DM.
- Recalibrate the model using a different measure of M1 (Benati et al., 2021).

Capital and LTV





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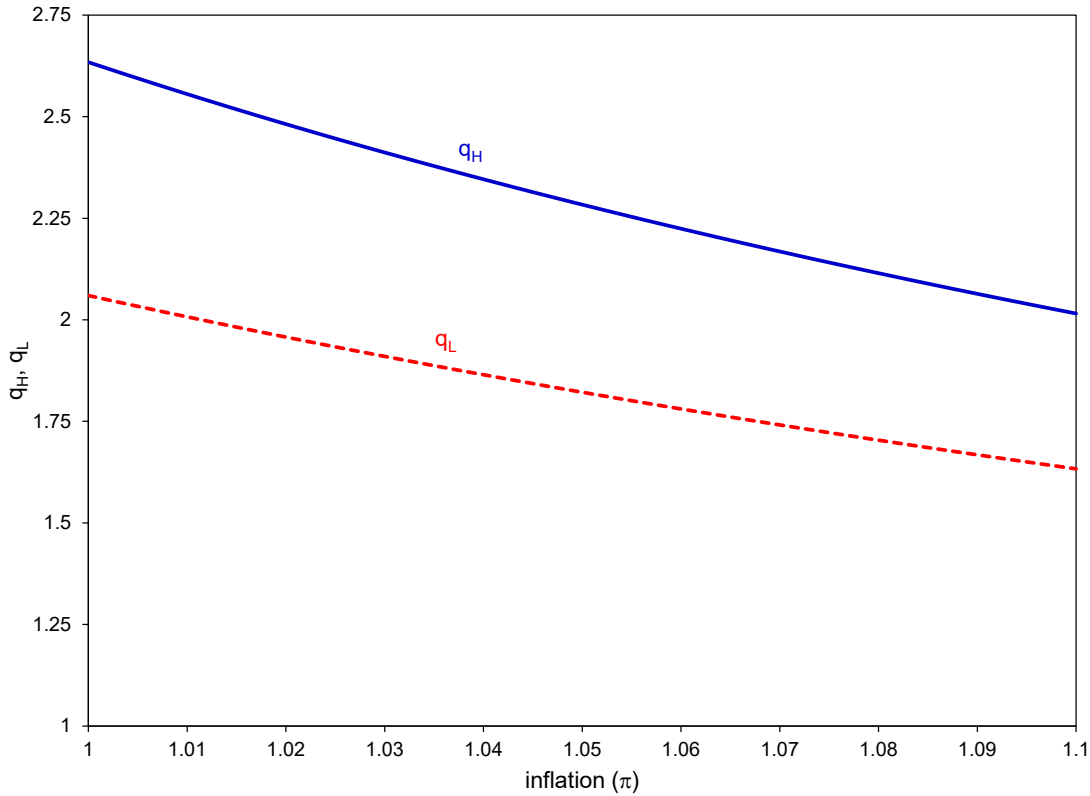
Inflation and Consumption



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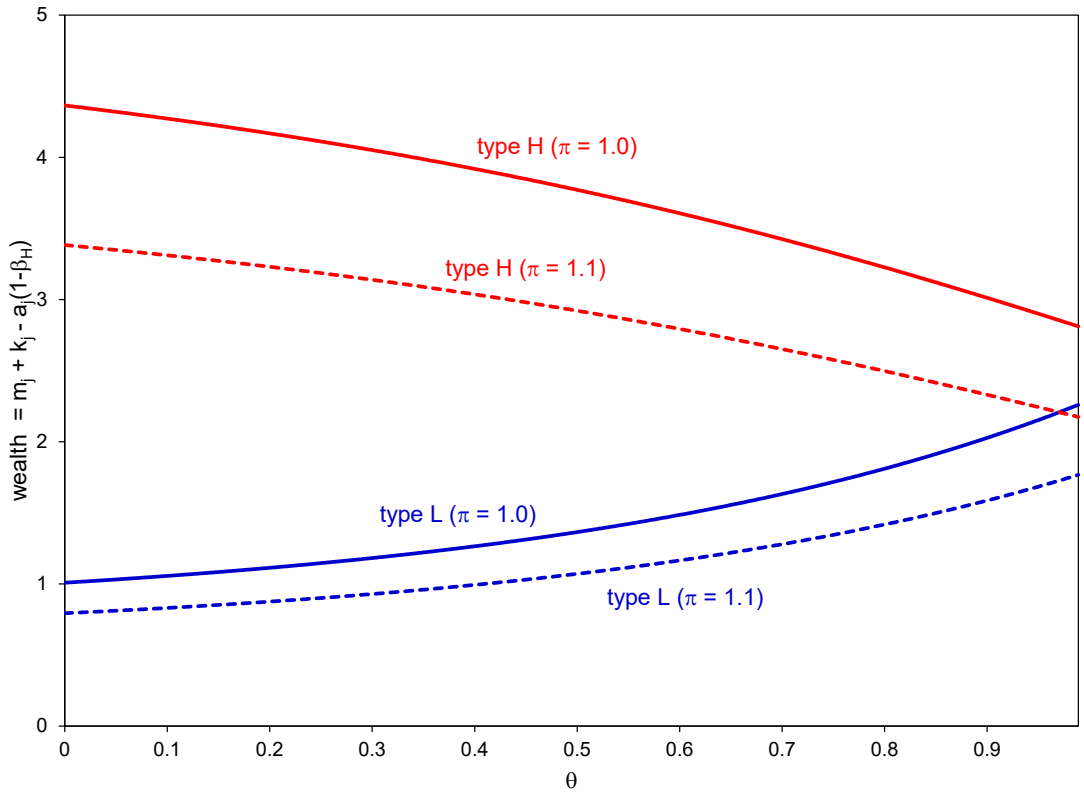
Collateralized debt and wealth inequality



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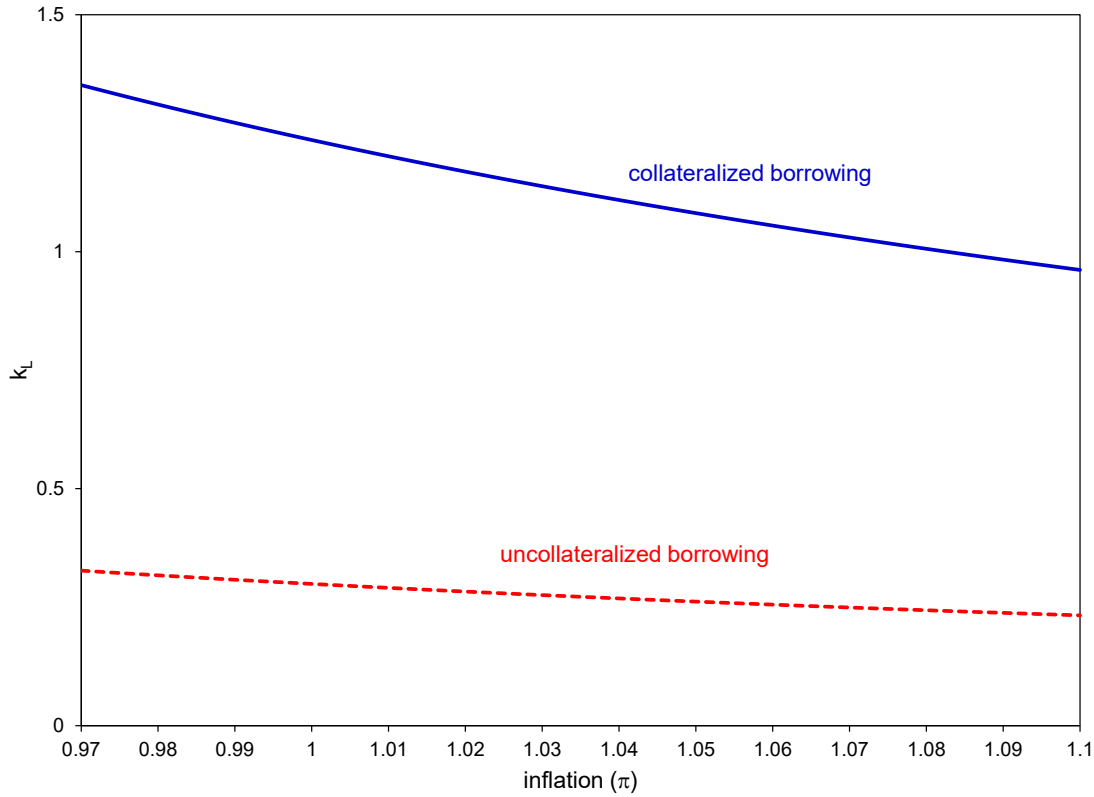
Inflation and Capital

Type L



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Calibration

Table 1: Calibrated parameters.

Parameter	β_H	β_L	θ	ρ	δ	B	σ	α
Value	0.97	0.89	0.85	0.40	0.07	2.84	0.60	0.73

- Some parameters are "off-the shelf" similar studies calibrated on US data:
  - δ, θ and ρ in line with Aruoba, Waller and Wright (2011), Iacoviello and Neri (2010) and Boel and Camera (2009).
- We calibrate $f(k) = k^a$, σ and B $(U(x) = Bln(x))$ simultaneously to match:
  - Money demand $L = M/PY$. Plot
  - Share of cash consumption transactions.
  - Debt to GDP ratio.

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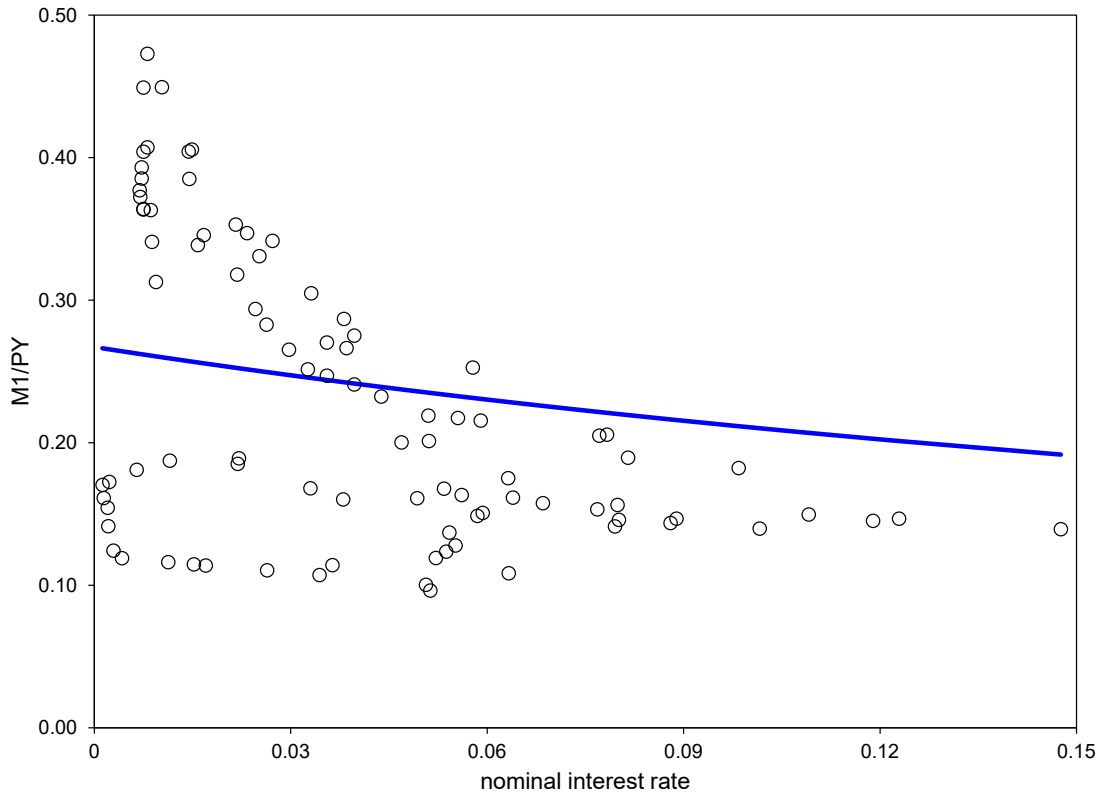
Money Demand



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The CM problem

- The problem of a type $j = \{H, L\}$ agent in the CM mkt

$$W_j(\omega_j^z) = \max_{x_j^z, n_j^z, m_j', k_j', a_j'} U(x_j^z) - n_j^z + \beta_j V_j'(\omega_j')$$

$$\text{s.t. } x_j^z + k_j' + \pi m_j' + a_j = n_j^z + (1-\delta)k_j + m_j^z + \tau + p_a \pi a_j'$$

$$a_j' \leq \theta k_j'$$

where $\pi = \frac{p_2'}{p_2}$ is the inflation rate and p_2 the numeraire.

- Agents choose how much to consume (x), work (n) and how to allocate wealth between capital, money and a nominal bond $\omega = \{k', m', a'\}$.
- The resources available in the CM (ω^z) depend on the realization of the trading shock in the DM $z = \{b, s, o\}$.
- Borrowing is subject to a collateral constraint.

The DM problem

- The problem of a type j agent in the DM mkt

$$V_j(\omega_j) = Max \frac{\sigma}{2} \underbrace{\left[u\left(q^b\right) + W_j(\omega_j^b) \right]}_{\text{Buyer}} + \frac{\sigma}{2} \underbrace{W_j(\omega_j^s)}_{\text{Seller}} + (1-\sigma) \underbrace{W_j(\omega_j^o)}_{\text{Idle}}$$

subject to

$$\begin{aligned} pq_j &\leq m_j \\ m_j^b &= m_j - pq_j \\ m_j^s &= m_j + pf(k_j) \\ m_j^o &= m_j \end{aligned}$$

where p is the relative price of the consumption good $\left(p = \frac{p_1}{p_2}\right)$.

- Buyers choose how much to consume (q) while the seller problem is trivial since capital has been already chosen in the previous CM.
- The inequality constraint is binding as long as $u_q(q) > p$, i.e. a measure of the "liquidity premium"

Optimality conditions

In a stationary equilibrium, consumption/saving decision must satisfy:

$$U_x = 1$$

$$\underbrace{\frac{\pi}{\beta_j}}_{\substack{\text{Cost of carrying money} \\ \text{accross periods}}} = 1 + \underbrace{\frac{\sigma}{2}\left(\frac{u_q\left(q_j\right)}{p} - 1\right)}_{\text{Liquidity Premium}}$$

$$\frac{1}{\beta_H} = \underbrace{\left[(1-\delta) + \frac{\sigma}{2} p f_{k_H}\right]}_{\text{Return on Capital}}$$

$$\frac{1}{\beta_L} = \left[(1-\delta) + \frac{\sigma}{2} p f_{k_L}\right] + \underbrace{\theta \frac{(\beta_H - \beta_L)}{\beta_L}}_{\text{Collateral value}}$$

$$\frac{1}{\beta_H} = \underbrace{\frac{1}{\pi p_a}}_{\substack{\text{bond return - cost of debt}}}$$

$$a'_L \leq \theta k'_L$$

Equilibrium

Given initial money stock $\bar{M} > 0$ and a government policy as specified by π, τ, a competitive stationary monetary equilibrium is a list of:
quantities $\left\{ m_j, k_j, a_j, x_j^z, n_j^z, q_j \right\}$ and prices $\{p, pa\}$ that:

- Solve the agents' problems in the DM and CM.
- Satisfy the government budget constraint.
- Satisfy the goods and assets market clearing conditions.