Retirement in the Shadow (Banking)

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This is What We Do

- Life expectancy **conditional** on retirement has increased in the US from 77 to 83 years (this is, 50%!) since 1980.

- Does the "domestic savings glut" change financial intermediation?
  - $\uparrow$ savings demand $\implies$ $\downarrow$ savings returns $\implies$ reach for yields.
  - Securitization $\implies$ easier liquidation of productive assets.
    - $\downarrow$ intermediation costs (interest spreads from 4% to 3%).
    - $\uparrow$ credit (household debt from 1GDP to 1.66GDP).
    - $\uparrow$ shadow banking (from 10% to 50% of household debt).

- What are the quantitative implications for macro outcomes?
  - The gains from shadow banking net of the cost of the crisis (even though this paper is NOT about the crisis) - **around half a GDP**

This is How We Do It

- Theoretical
  - OLG model with retirement, credit and intermediation.
- Empirical
  - Measure of how much securitization reduced intermediation costs.
- Quantitative
  - Calibration and decomposition of the importance of retirement and securitization in credit and other macroeconomic variables.
- Counterfactual
  - Hypothetical economy without shadow banks (nor crisis).

Agents

- OLG of agents (population grows at rate η).
  - Working age $j \leq T$: Live with certainty and work.
  - Retirement $j > T$: Do not work and die each period with prob. δ.
  - When they die, they may leave bequests b_j.
    (equally distributed to younger agents of age $j = T_I < T$)

$$U(\alpha, \underline{c}, \underline{b}) = \sum_{j=0}^{T} \beta^j \log c_j + \sum_{j=T+1}^{\infty} \beta^j (1-\delta)^{j-T-1} [(1-\delta) \log c_j + \delta \alpha \log b_j]$$

$\alpha \geq 0$: heterogeneous strength of bequest motive

Firms

- Perfectly competitive firms that produce

$$Y_t = K_t^{\theta}(\Gamma_t L_t)^{1-\theta}.$$

- Productivity Γ_t grows at rate γ.
- Wages and stock returns

$$\begin{aligned} y &= F_L(K_t, \Gamma_t L_t) \\ r_e &= F_K(K_t, \Gamma_t L_t) - \delta_k \end{aligned}$$

Agents' Saving Choices

- Agents choose at birth how to save for retirement.
- **Capital Markets (C):** Buy equity. (or become entrepreneurs!)
  - Invest in firms such that
    - Working age: Accumulate stocks (with own funds and borrowing).
    - Retirement: Sell stocks to consume and leave bequest at death.

Agents' Saving Choices

- Agents choose at birth how to save for retirement.
- **Banks (B):** Buy debt. (or become depositors!)
  - Contract with a financial intermediary that specifies
    - Working age: Agent pays d_j to intermediary (who lends).
    - Retirement: Intermediary pays c_j to agent while alive, and b_j at death.
  - Choose whether to sign the contract with
    - Traditional Bank (TB): Return r at no cost.
    - Shadow Bank (SB): Securitization $\implies$ higher return r at utility cost κ
  - Benefits: A bank is a pool $\implies$ Insurance against living long.
  - Costs: A bank charges a fee $\implies$ Lower returns on savings.

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- B-agents demand **safe assets** (smooth consumption after retirement)
- Securitization improves liquidity and raises safe asset returns!

Agents' Wealth

- Consolidated wealth at birth (for $i \in \{B, S\}$).
  - All agents earn y_j when working. Labor taxes are τ.
  - All agents of age T_I obtain an inheritance of $\bar{b}$.
  - Agents i receive social security transfers Tr_i after retirement.
  - Savings of agents i pay a return $r_i \in \{r, r_e\}$.

$$v_0^i = \sum_{j=0}^{T-1} \frac{(1-\tau)y_j}{(1+r_i)^j} + \frac{\bar{b}}{(1+r_i)^{T_I}} + \frac{(1+r_i)}{r_i+\delta} \frac{Tr_i}{(1+r_i)^T}$$

When calibrating we will assume $Tr_i = ss_i y_T$.

Only source of uncertainty in the model is death!

Banks

- Balance sheet of perfectly competitive banks.
  - Liabilities: $D(1+r)$.
  - Assets:
    - Government bonds: $(1-f)A(1+r_L)$.
    - Loans: $fA(1+r_e)$.
  - Management cost: $A\widehat{\phi}$

- Banks choose A^*, f^* and r^* such that
  - Feasibility: $A^* \leq D$.
  - Zero-profit condition:

$$[f^*(1+r_e)+(1-f^*)(1+r_L)-\widehat{\phi}]A^*=(1+r^*)D$$

  - Liquidity: Use bonds and a fraction z of risky loans to face a run,

$$[z(1+q)+(1-f^*)(1+r_L)]A^* \geq (1+r^*)D \qquad \texttt{where } z \leq f^*$$

Banks

- Assumptions:
  - No arbitrage (agents can buy bonds): Implies $r_L = r$.
  - Relatively low operation costs ($r_e > \widehat{\phi}$): Implies $A^* = D$.
- Market for liquidated assets (fire sales):
  - Demand: Buyers can rematch the asset and obtain r_e.

$$\max_z \left[\underbrace{Pr(rematch)}_{(1+\Psi)\ln\zeta(1+z)\frac{1+r}{1+r_e}} (1+r_e) - (1+q)z \right] \implies 1+q_D = \frac{(1+\Psi)(1+r)}{1+z}$$

  - Supply: From liquidity constraint: $1+q_S = \frac{f(1+r)}{z}$.
  - Market clearing: $z^* = \frac{f}{1+\Psi-f}$ s.t. $z^* \leq f \implies f \leq \Psi$

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  - Market clearing: $z^* = \frac{f}{1+\Psi-f}$ $\quad \texttt{s.t.}\ z^* \leq f \quad \implies f \leq \Psi$
- Banks choose $f^* = \min\{1, \Psi\}$. From ZPC, $r^* = r_e - \frac{\widehat{\phi}}{f^*}$.

$$SPREAD : \phi \equiv r_e - r^* = \underbrace{\widehat{\phi}}_{VA} \underbrace{\max\{1, \Psi^{-1}\}}_{Liq\ cost}$$

Government

- Commitment to fiscal expenses, transfers and a debt policy.
- Set τ to balance the budget

$$\tau y_t L_t + (D^G_{t+1} - D^G_t) = gY_t + \overline{Tr}_t + r_L D^G_t.$$

Aggregates

- Let $\mu_j^i(\alpha)$ be the mass of age j agents with bequest motive α who choose savings $i \in \{C, B\}$. Aggregates, as functions of $(r_e, \bar{b})$, are

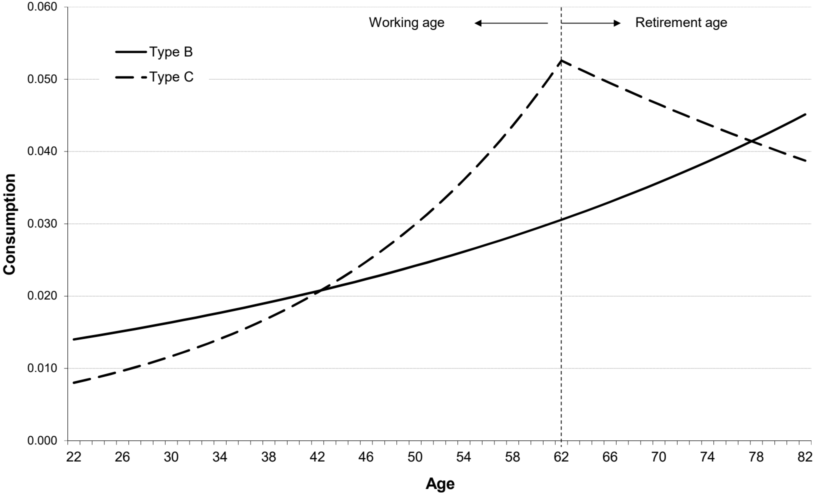
$$\begin{aligned}
\mathbb{C}(r_e, \bar{b}) &= \sum_{i=S,B} \sum_{j=1}^{\infty} \int c_j^i(r_e, \bar{b}; \alpha) \mu_j^i(\alpha) d\alpha \\
\mathbb{W}^i(r_e, \bar{b}) &= \sum_{j=1}^{\infty} \int w_j^i(r_e, \bar{b}; \alpha) \mu_j^i(\alpha) d\alpha \\
\mathbb{B}(r_e, \bar{b}) &= \sum_{i=S,B} \sum_{j=T+1}^{\infty} \delta \int b_j(r_e, \bar{b}; \alpha) \mu_{j-1}^i(\alpha) d\alpha \\
L_t &= \sum_{j=0}^{T-1} (1+\eta)^{t-j}
\end{aligned}$$

Stationary Equilibrium

Given fiscal policies $\{g, Tr_i, D^G\}$, a stationary equilibrium is characterized by individual allocations $\{\underline{c}(\alpha), \underline{w}(\alpha), \underline{b}(\alpha)\}_{\forall\alpha\geq 0}$ together with saving decisions $\{\{B_{TB}, B_{SB}\}, C\}$, aggregate allocations $\{Y, X, K, \mathbb{B}, \mathbb{C}\}$ and prices $\{y, r_e, r\}$ such that,

- Given prices and fiscal policies, agents maximize utility
- Given prices and fiscal policies, firms and banks maximize profits.
- The government budget constraint holds.
- Markets clear,
  - Feasibility: $Y = gY + \mathbb{C}(r_e, \bar{b}) + X + \phi\left[\frac{\mathbb{W}^B(r,\bar{b})}{1+r} - D^G\right]$
  - Assets market: $\frac{\mathbb{W}^B(r,\bar{b})}{1+r} + \frac{\mathbb{W}^S(r_e,\bar{b})}{1+r^e} = D^G + K$
  - Bequest=Inheritance: $\bar{b} = (1+\gamma)^{T_I}\mathbb{B}(r_e, \bar{b})$

Comparison of Consumption Patterns



Saving Decisions

Proposition 1: *Agents with high bequest motives save in capital markets*

If $\underline{\phi} \leq \widehat{\phi} \leq \bar{\phi}$, there exists a unique $\alpha^* > 0$ such that,

- if $\alpha \geq \alpha^*$ the agent saves in capital markets.
- if $\alpha < \alpha^*$ the agent saves in banks.

Proposition 2: *Longer-living agents will use shadow banking*

Among agents with low enough α, saving in banks, there is a unique $\delta^*(\alpha, \kappa) > 0$ (increasing in α and decreasing in κ) such that,

- if $\delta \geq \delta^*(\alpha, \kappa)$ uses traditional banking.
- if $\delta < \delta^*(\alpha, \kappa)$ uses shadow banking.

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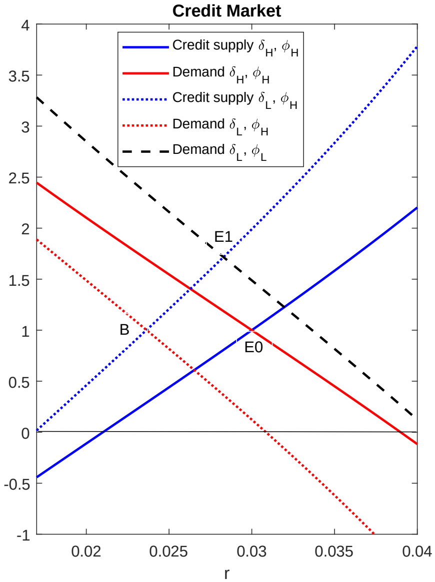
From now on we assume that μ agents have $\alpha = 0$ and the rest $\alpha = \widehat{\alpha} > \alpha^*$

Intuition of the Main Forces

Demand: $K(r_e) - \frac{\mathbb{W}^S(r_e, \bar{b})}{1+r^e}$

Supply: $\frac{\mathbb{W}^B(r, \bar{b})}{1+r} - D^G$

Spread: $r_e - r = \frac{\hat{\phi}}{f}$



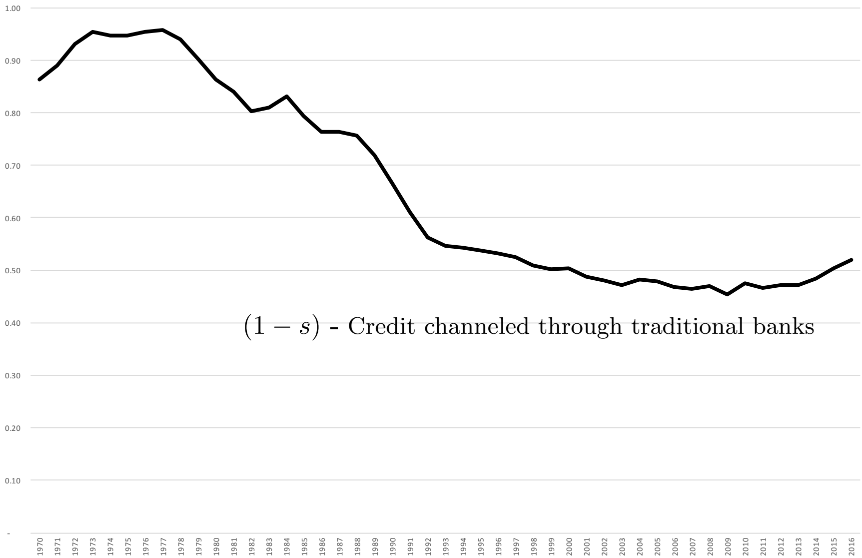
Spreads from NIPA Tables

- We want the spread $\phi \equiv r_e - r$

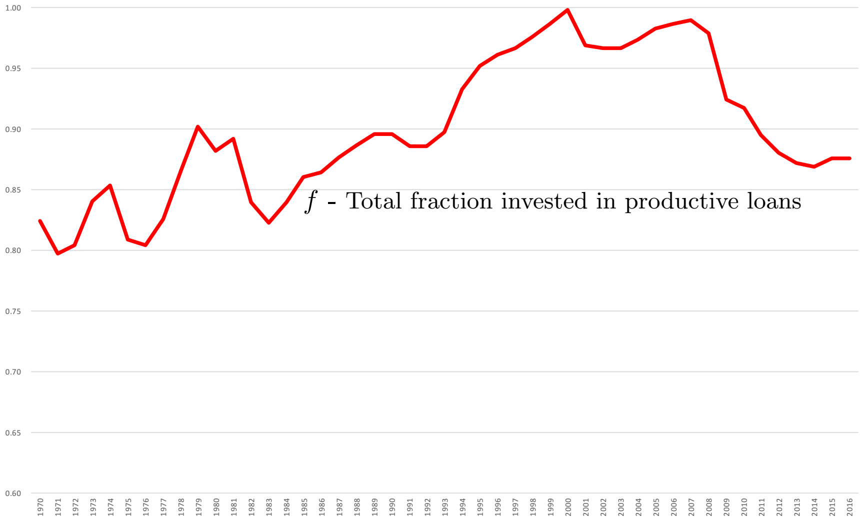
$$r_e - (\overbrace{r_L + r_s}^{r}) = \frac{\overbrace{r_T - (1-f)r_L}^{r_e}}{f} - (\overbrace{r_L + r_s}^{r}) = \frac{r_T - r_L}{f} - r_s$$

  - r_T =(Total private interest received - bad debt expenses)/hh's debt.
    (Table 7.11 line 28 - Table 7.1.6 line 12)/Table D.3.
  - r_L=(Total private interest paid)/hh's debt.
    (Table 7.11 line 4)/Table D.3.
  - r_s=(Services furnished without payment)/hh's debt.
    (Table 2.4.5 line 88)/Table D.3.
  - $f = s + (1-s)\widehat{f}$
    $(1-s)$ = Consumer credit and mortgages to hh's channeled by TB
    = (Table 110 lines 14 and 15)/(Table D.3 columns 3 and 4)
    $\widehat{f}$ = (Total TB loans)/ (total TB deposits).
    = (Table 110 lines 12, 14 and 15)/(Table 110 lines 23 and 24)

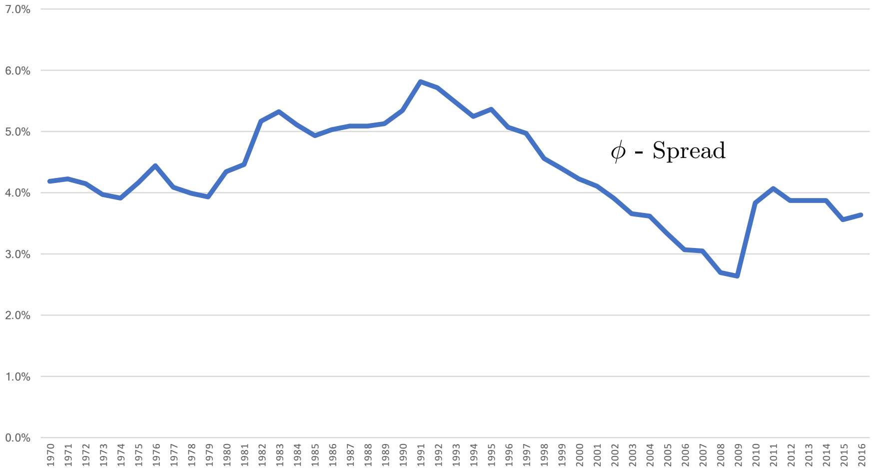
Size of Traditional Banking



Investment in Productive Loans



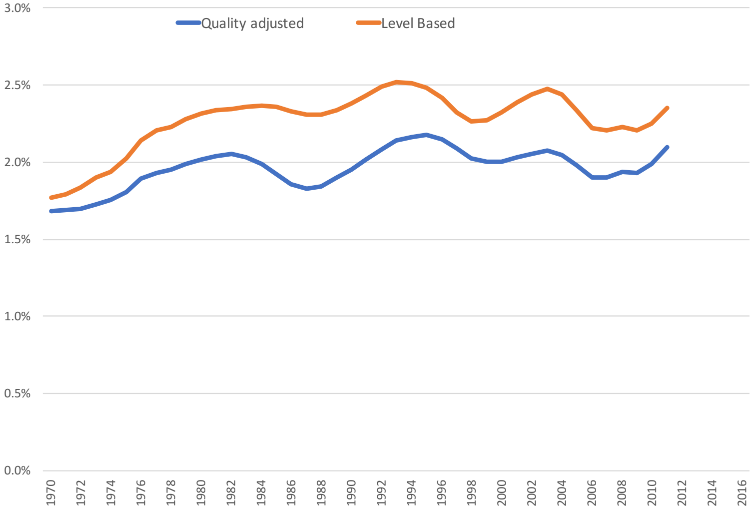
Spreads



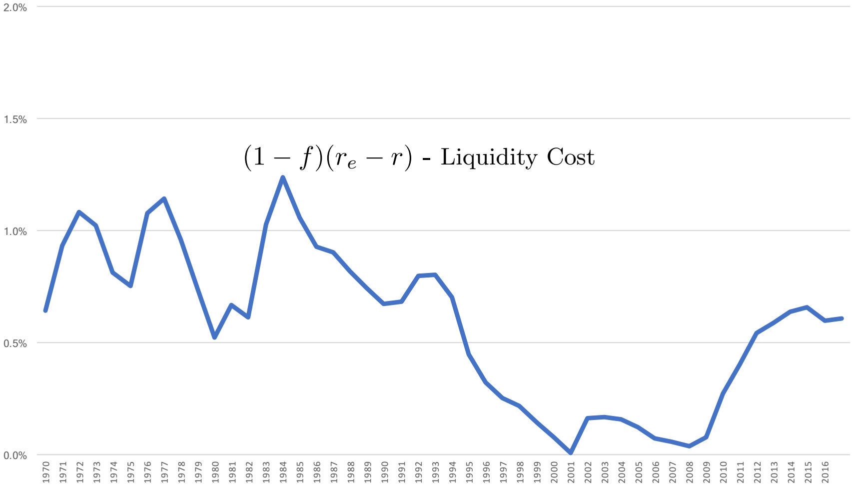
Corbae and D'Erasmo Spreads

Value Added: Philippon (AER, 2015)

The drop in spreads is not because an improvement in efficiency!



Liquidity Costs



Taking the Model to the Data

- Calibrate the model economy to 1980.
- Counterfactual in 2007.
  - Do life expectancy and shadow banking account for the aggregate changes we observed? What was their individual contribution?
- Counterfactual without shadow banking (and without crisis).

Calibration to 1980

Parameter	Notation	Value	Source
Discount Rate	β	0.99	Standard
Productivity Growth	γ	0.02	Standard
Population Growth	η	0.01	Standard
Capital Share	θ	0.33	Standard
Inheritance Age	T_I	29	Age 52
Retirement Age	T	40	Age 63
Fraction of agents with $\alpha = 0$	μ	0.75	Flow of Funds
Government Spending/GDP	g	0.20	NIPA Tables
Government Debt/GDP	D^G/Y	0.33	NIPA Tables
Depreciation Capital	δ_k	0.027	Match $K/Y = 3.4$
Bequest Motive	$\widehat{\alpha}$	4.64	Match $\frac{Hh\ Debt}{Y} = 1$
SS Transfers (fix $ss_S = 0$)	ss_B	0.55	Match $\frac{G\ Debt}{Y} = 0.33$

Counterfactual in 2007

- Life expectancy and spreads in 1980
  - $\delta = 0.072 \Rightarrow$ Post-retirement life expectancy of 14 years
  - $\phi = 0.04.$ As discussed above.

- Counterfactuals in 2007
  - $\delta = 0.052 \Rightarrow$ Post-retirement life expectancy of 20 years
  - $\phi = 0.03.$ As discussed above.

▸ We maintain debt/GDP constant at 33%

Counterfactual Decomposition

Economy	1980 Benchmark	Lower δ TB	Same δ SB	Lower δ SB
Interm. Cost (ϕ)	4%	4%	3%	3%
Survival prob. (δ)	0.072	0.052	0.072	0.052
Interest Rates				
Borrowing Rate (r)	0.030	0.023	0.034	0.028
Lending Rate (r_e)	0.070	0.063	0.064	0.058
National Accounts				
Output	1.000	1.035	1.031	1.070
Capital output ratio	3.40	3.65	3.62	3.90
Net Worth				
Total	3.73	3.98	3.95	4.23
Equity (Plan C)	2.40	2.68	2.08	2.28
Debt (Plan B)	1.33	1.30	1.86	1.94
Data (FF: Table L100)	*1.36*			*2.33*
Bequest/GDP	0.049	0.049	0.040	0.039
Government Debt/GDP	0.33	0.33	0.33	0.33
Households Debt/GDP	1.00	0.96	1.53	1.62
Data (FF: Table D3)	*1.00*			*1.66*

Welfare Effects

Economy	1980 Benchmark	Lower δ TB	Same δ SB	Lower δ SB
Interm. Cost (ϕ)	4%	4%	3%	3%
Survival prob. (δ)	0.072	0.052	0.072	0.052
Interest Rates				
Borrowing Rate (r)	0.030	0.023	0.034	0.028
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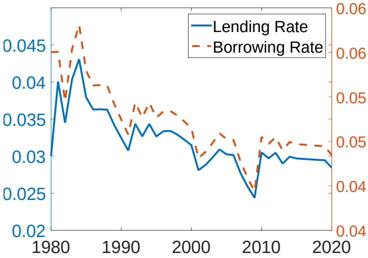
Debt (Plan B)	1.33	1.30	1.86	1.94
Data (FF: Table L100)	*1.36*			*2.33*
Change on welfare at birth	-	-	0.3%	0.4%
Plan C	-	-	-4.3%	-4.8%
Plan B	-	-	2.5%	2.8%

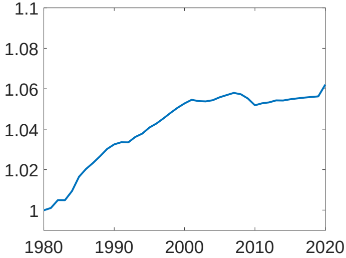
Alternative Gov. Debt/GDP

Economy	1980 Benchmark	2007 Calibration	Free D^G	All D^G Domestic
Interm. Cost (ϕ)	4%	3%	3%	3%
Survival prob. (δ)	0.072	0.052	0.052	0.052
Interest Rates				
Borrowing Rate (r)	0.030	0.028	0.027	0.029
Lending Rate (r_e)	0.070	0.058	0.057	0.059
National Accounts				
Output	1.000	1.070	1.071	1.060
Capital output ratio	3.40	3.90	3.91	3.85
Net Worth				
Total	3.73	4.23	4.21	4.47
Equity (Plan C)	2.40	2.28	2.28	2.36
Debt (Plan B)	1.33	1.94	1.93	2.11
Data (FF: Table L100)	*1.36*	*2.33*		
Bequest/GDP	0.049	0.039	0.039	0.041
Government Debt/GDP	0.33	**0.33**	0.30	**0.62**
Households Debt/GDP	1.00	1.62	1.63	1.49
Data (FF: Table D3)	*1.00*	*1.66*		

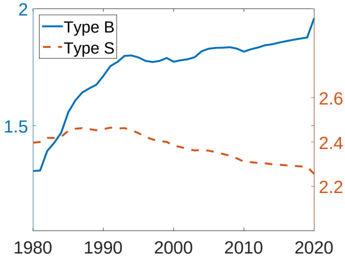
Transitions: Realized TFP



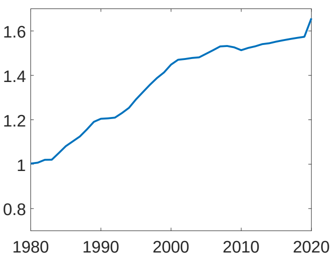
(a) Interest Rates



(b) Output

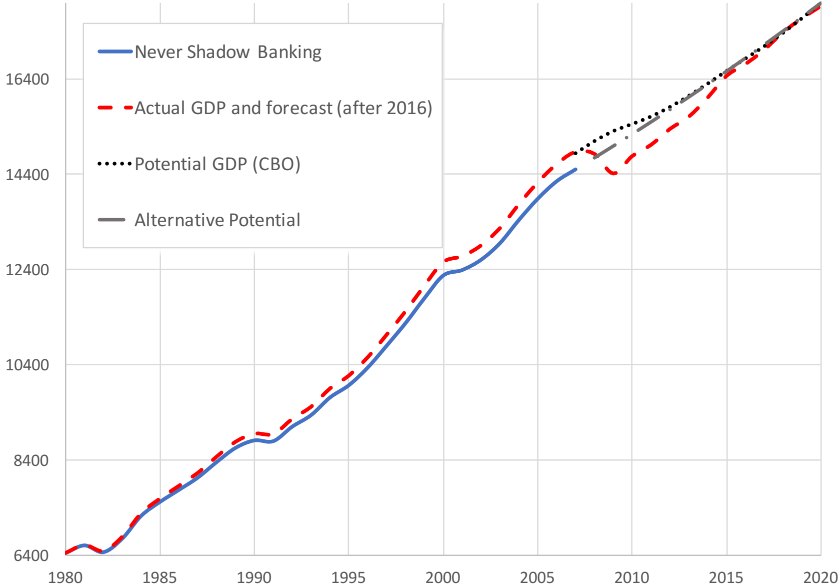


(c) Aggregate Assets/Output



(d) Household Debt/Output

Costs and Benefits of Shadow Banking



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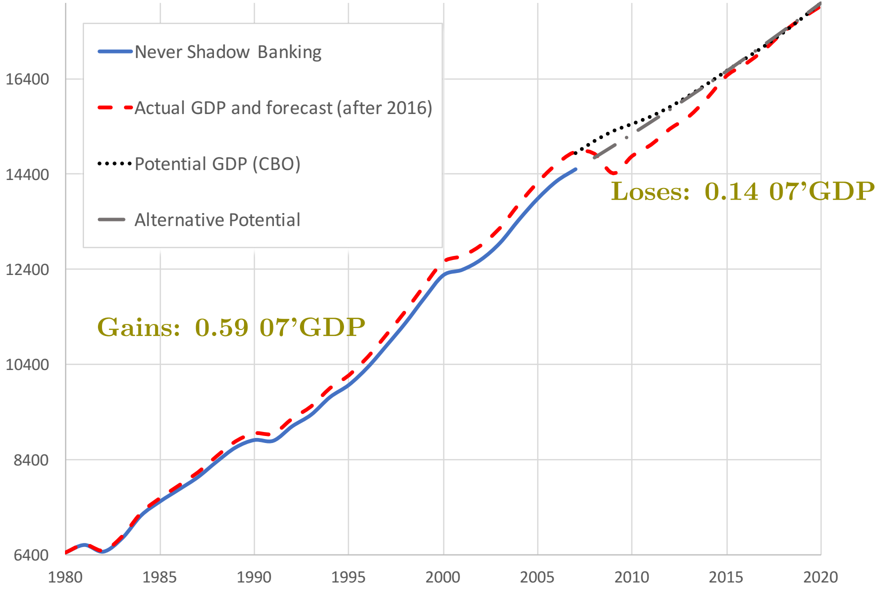
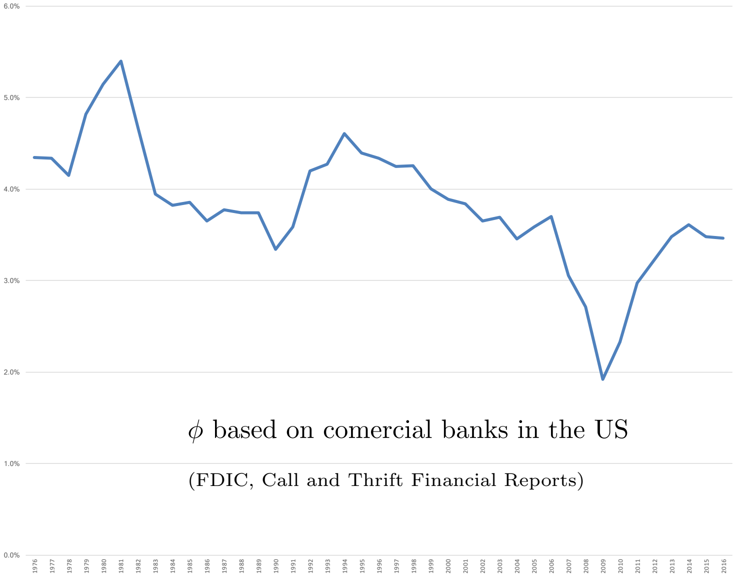


Final Remarks

- People lives longer $\Rightarrow$ "Domestic Saving Glut" $\Rightarrow \downarrow$ saving returns.
- Pressure for a new technology $\Rightarrow$ Shadow Banking$\Rightarrow \uparrow$ saving returns.
- This is why we need to go quantitative. In net
  - Large increase in credit.
  - Small reduction in returns.
  - Sizeable increase in output.
- Careful with asphyxiating shadow banking!

Corbae and D'Erasmo Spreads

back



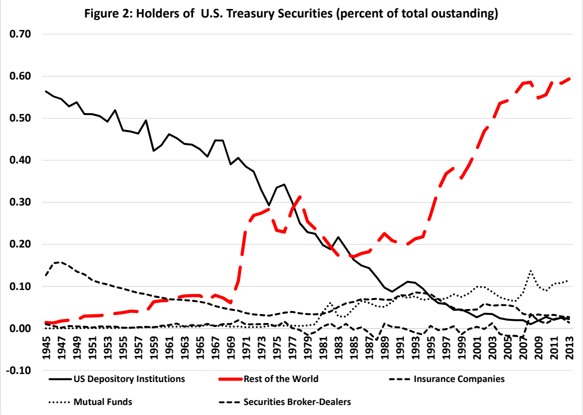
ϕ based on comercial banks in the US

(FDIC, Call and Thrift Financial Reports)

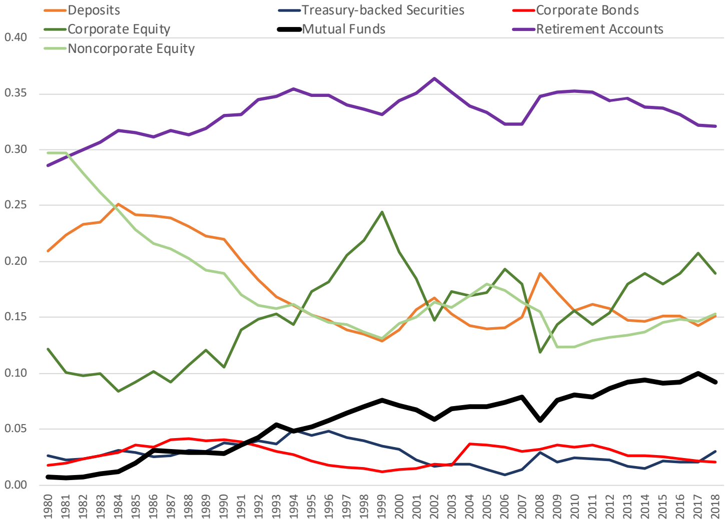
Maintaining Debt/GDP constant

back

- In 1980 $\frac{GDebt}{Y} = 0.37$, but 80% held domestically, then $\frac{D^G}{Y} \approx 0.3$.
- In 2007 $\frac{GDebt}{Y} = 0.62$, but 40% held domestically, then $\frac{D^G}{Y} \approx 0.3$.



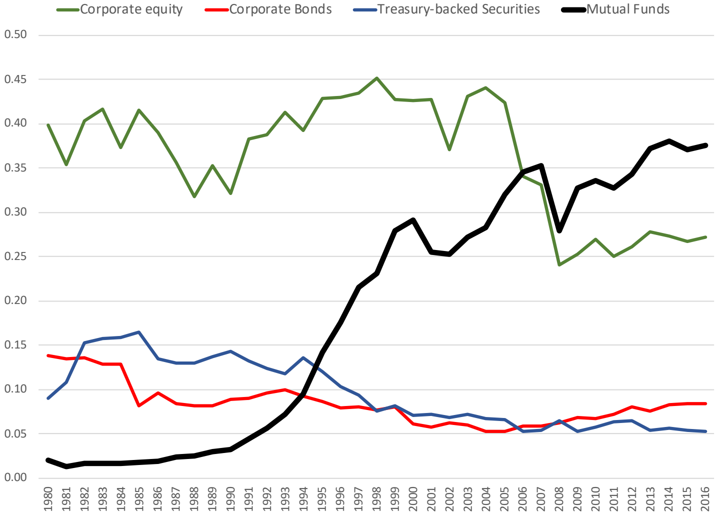
Composition of Financial Assets (B101-FF)



Large fraction of savings are channeled through intermediaries.

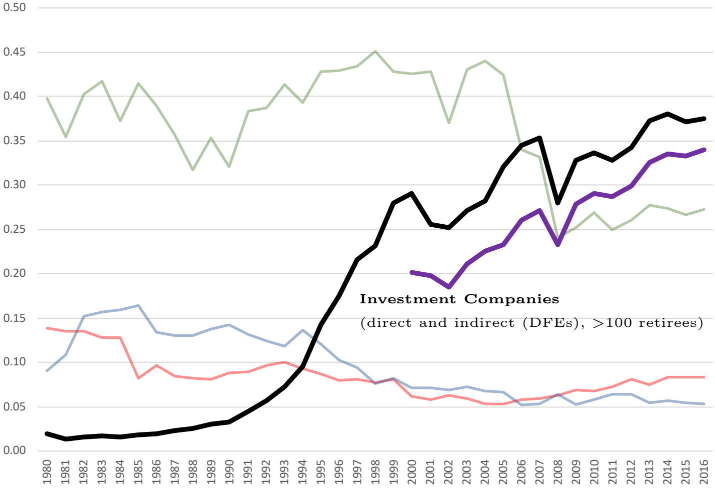
Shadow intermediaries replaced traditional ones

Composition of Pensions (L118-FF)



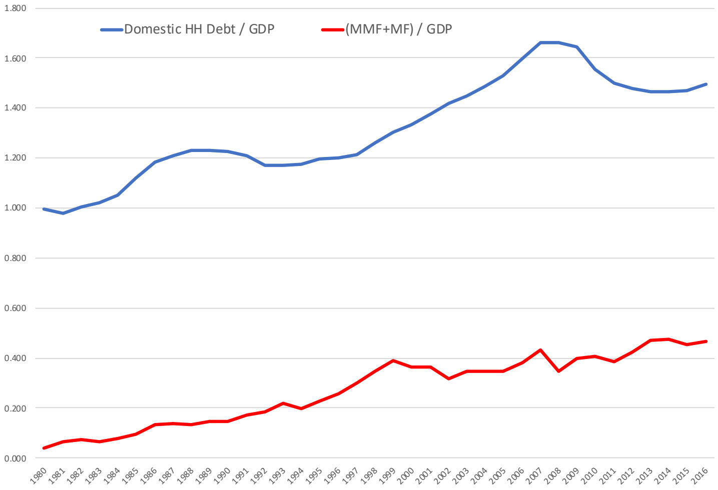
Securitization was also used by traditional intermediaries.....

Investment Companies in Pensions (5500-EBSA)



....and may have allowed expanding their productive investments

Shadow Banks and Credit (D3-NIPA and B101-FF)



....and expanding credit more generally in the economy.

Related Work

- Financial Effects of Savings for Retirement Needs
  - Scharfstein (2018), Shourideh and Troshkin (2019).
- Macroeconomics Effects of Shadow Banking
  - Moreira and Savov (2015), Begenau and Landvoigt (2017).
- Demand of Safe Assets
  - Caballero (2010), Caballero, Farhi and Gourinchas (2016).
- Supply of Safe Assets (via securitization and shadow banking).
  - Gorton and Ordonez (2014), Ordonez (2018a, 2018b)

    Farhi and Tirole (2017).