


Life-cycle forces make monetary policy transmission wealth-centric*

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*The views expressed in this paper are those of the authors, and not necessarily those of the Bank of International Settlements, the Bank of England or its committees. 

Introduction

- Standard New Keynesian model has intertemporal substitution at its core
 - ▶ But empirical estimates suggest EIS =small (Best et al., 2020)
- Much recent progress in NK-style models featuring other transmission channels
 - ▶ Financial frictions
 - ▶ Informational frictions
 - ▶ Liquidity constraints
- This paper: how do life-cycle forces affect the MTM?
 - ▶ Central role to financial wealth

Core idea

- Standard intertemporal substitution logic: lower interest rates discourage saving
- Retirement preoccupations logic: lower interest rates reduce savings growth and their flow value
 - ▶ Rajan (2013): *“Persistently-low rates may not be expansionary as savers put more money aside (...) in order to meet the savings they think to need when they retire”*
 - ▶ ABP (2019): *“Pensions are becoming increasingly expensive (...) Given the current ambition and expectation that rates will remain low for a long time, higher premiums will be needed”*

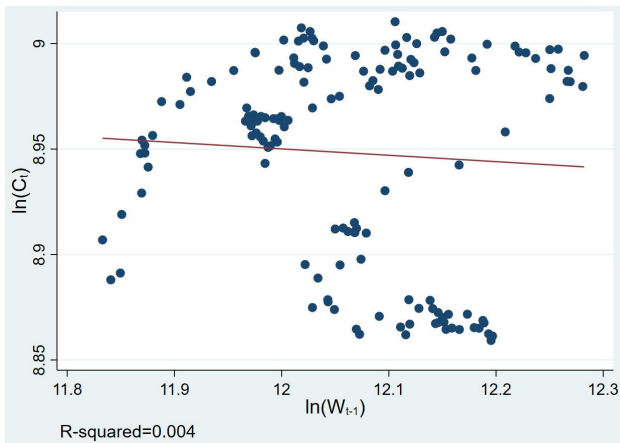
Empirical motivation

- Life-cycle forces create a “target” level for asset holdings (Modigliani)
- Not wealth *per se* that drives consumption, but wealth relative to targeted wealth (“excess wealth”)
 - ▶ Lower r tends to boost asset valuation \rightarrow expansionary
 - ▶ Lower r may also increase asset demand \rightarrow contractionary
- Important to control for the level of interest rates
 - ▶ Having \$100k is very different between $r = 1\%$ and $r = 5\%$
- Model tells us *how* to control for different values of r :

$$\mathcal{A}_t(r_t) = (\rho + \delta_2 + (\sigma - 1)r_t) (\rho + \delta_1 + \sigma g - r_t)^{1/\sigma}$$

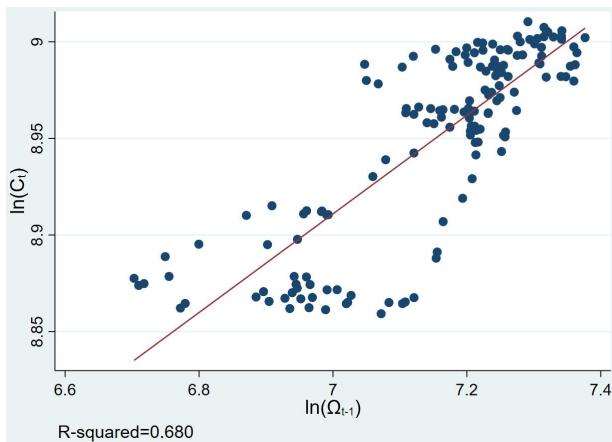
Empirical motivation

- “Raw” US household wealth levels are \sim uncorrelated with US consumption: $corr(\ln C_t, \ln W_{t-1}) = -0.064$



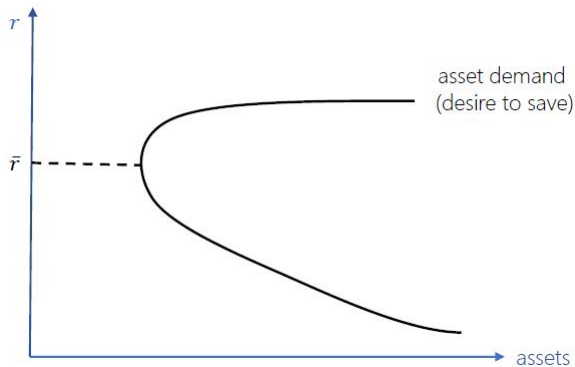
Empirical motivation

- Remarkable increase once one looks at $\Omega_t \equiv \mathcal{A}(r_t)W_t$:
 $corr(\ln C_t, \ln \Omega_{t-1}) = +0.825$



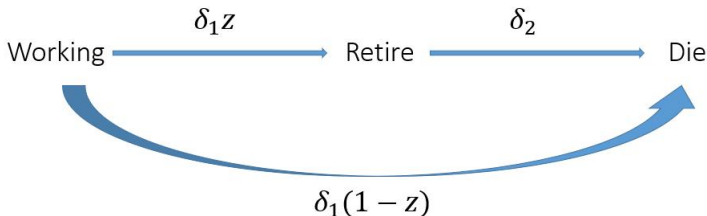
Empirical motivation

- When $\sigma > 1$ ($EIS < 1$), $\mathcal{A}_t(r_t)$ is C-shaped:



Model - demographic structure

- FLANK: Finitely-Lived Agent New Keynesian model
- Blanchard-Yaari + retirement state (as in Gertler 1999)
 - ▶ Measure 1 of households who work \rightarrow retire \rightarrow die
 - ▶ Working households retire with prob $\delta_1 z$; die immediately with prob $\delta_1 (1 - z)$
 - ▶ Retired households die with prob δ_2



Model - retired households

- Retired households only derive income from interest r on accumulated stock of savings, a_t^r

$$V^r(\tilde{a}_t^r) = \max_{c_t^r} \left\{ \frac{(c_t^r)^{1-\sigma}}{1-\sigma} + \beta \mathbb{E}_t [(1-\delta_2) V^r(\tilde{a}_{t+1}^r)] \right\}$$
$$s.t. \tilde{a}_{t+1}^r = r_{t+1}(\tilde{a}_t^r - c_t^r)$$

- Optimality conditions yield $V^r(\tilde{a}_t^r, \Gamma_t) = \frac{(\tilde{a}_t^r)^{1-\sigma}}{1-\sigma} \Gamma_t$ and

$$c_t^r = \tilde{a}_t^r \Gamma_t^{-\frac{1}{\sigma}}$$
$$\left(\Gamma_t^{\frac{1}{\sigma}} - 1 \right)^\sigma = (1-\delta_2) \beta \mathbb{E}_t \left[(r_{t+1})^{1-\sigma} \Gamma_{t+1} \right]$$

- ▶ Γ captures expected future rate path, working over \tilde{a}^r

Model - working households

- Households work and own firms:

$$V^w(\tilde{a}_t^w) = \max_{c_t^w, a_t^w} \left\{ \frac{(c_t^w)^{1-\sigma}}{1-\sigma} - \chi \frac{(\ell_t)^{1+\varphi}}{1+\varphi} + \beta \mathbb{E}_t \left[\begin{array}{l} (1-\delta_1) V^w(\tilde{a}_{t+1}^w) + \\ \delta_1 z_s V^r(\tilde{a}_{t+1}^r, \Gamma_{t+1}) \end{array} \right] \right\}$$

s.t. $\tilde{a}_{t+1}^w = r_{t+1}(\tilde{a}_t^w - c_t^w + w_t \ell_t + \tau_t)$

- $z_s = z + \varpi$ is *subjective* prob of surviving retirement shock

- Optimality conditions:

$$w_t = \chi (c_t^w)^\sigma (\ell_t)^\varphi$$
$$(c_t^w)^{-\sigma} = \beta \mathbb{E}_t \left\{ \begin{array}{l} (1-\delta_1) \left[(c_{t+1}^w)^{-\sigma} r_{t+1} \right] + \\ z_s \delta_1 (a_{t+1}^w)^{-\sigma} \Gamma_{t+1} r_{t+1} \end{array} \right\}$$

Model - good-producing firms

- A measure 1 of monopolistically competitive firms produce differentiated goods using technology:

$$y_t = A l_t$$

- Maximize profits subject to Rotemberg (1982) cost of price adjustment relative to trend inflation rate $\bar{\pi} = 1$
- Gives rise to the NKPC:

$$(\pi_t - 1) \pi_t = \kappa (mc_t - 1) + \mathbb{E}_t \left[\Lambda_{t,t+1} (\pi_{t+1} - 1) \pi_{t+1} \frac{y_{t+1}}{y_t} \right]$$

Model - public sector

- Government issues short- and long-term bonds, in constant supply:

$$s_t = s$$

$$b_t = b$$

- Let $\eta \equiv qb/(s + qb)$ denote the share of long-term bonds
 - ▶ $\eta \approx$ duration

- Monetary policy is set according to a Taylor-type rule:

$$i_t = r\bar{\pi} \left(\frac{\mathbb{E}_t[\pi_{t+1}]}{\bar{\pi}} \right)^{1+\phi} e^{\varepsilon_t}$$

Model - simplification

- Role played by retirees is relatively clear: lower r contracts their consumption possibilities
- Focus on the impact of life-cycle forces on working households
- “Prudent perpetual youth (PPY)” assumption
 - ▶ No household actually makes it to the retired state, yet they all *think* they will
 - ★ No household survives the retirement shock: $z = 0$
 - ★ Subjective survival probability is $z_s = \varpi > 0$ (ϖ is degree of over-estimation)
 - ▶ All retirement savings are “prudent”

Monetary transmission mechanism

- When introducing retirement preoccupations ($\delta_1 > 0$), MTM moves away from intertemporal substitution
- Log-linearized Euler equation:

$$\hat{y}_t = (1 - \delta_1) \left[\mathbb{E}_t \hat{y}_{t+1} - \frac{1}{\sigma} \mathbb{E}_t \hat{r}_{t+1} \right] + \delta_1 \left[\eta \hat{q}_t + \frac{\sigma - 1}{\sigma} \mathbb{E}_t \hat{r}_{t+1} - \frac{1}{\sigma} \mathbb{E}_t \hat{\Gamma}_{t+1} \right]$$

- Additional effects from $r \uparrow$
 - ① Higher current income flow on asset stock $\Rightarrow \hat{y}_t \uparrow$
 - ② Higher future income flow on asset stock $\Rightarrow \hat{y}_t \uparrow$
 - ③ Lower asset prices ($q_t \downarrow$) $\Rightarrow \hat{y}_t \downarrow$
- These factors become more important as $\delta_1 \uparrow$
 - ▶ For $\delta_1 < \bar{\delta}_1 \equiv (1 - \beta)/(\sigma - \beta)$, IS $>$ asset flow effect
 - ▶ For $\delta_1 > \bar{\delta}_1$, asset flow effect $>$ IS
 - ★ Asset valuation channel becomes *necessary* to obtain conventional signs

Effects of monetary shocks (i)

- We work with $\phi = 0$ (constant real rate) \Rightarrow determinacy
- Defining $\bar{\varepsilon} \equiv \sum_{t=0}^{\infty} \rho_{\varepsilon}^t v_0 = v_0 / (1 - \rho_{\varepsilon})$, impact responses are:

$$\hat{y}_0 = -\frac{1 - \rho_{\varepsilon}}{\sigma} \frac{1 - \delta_1 \frac{\sigma(1-\eta) - \rho_{\varepsilon}\beta}{1 - \rho_{\varepsilon}\beta}}{1 - \rho_{\varepsilon}(1 - \delta_1)} \bar{\varepsilon}$$
$$\hat{\pi}_0 = \kappa \frac{1 + \varphi}{1 - \rho_{\varepsilon}\beta} \hat{y}_0$$

- For $\delta_1 = 0$ (standard NKM):

$$\hat{y}_0 = -\frac{\bar{\varepsilon}}{\sigma}$$

Effects of monetary shocks (ii)

- **Proposition 1.** *The ability of a surprise interest rate cut $\bar{\varepsilon} < 0$ (hike, $\bar{\varepsilon} > 0$) to boost (contract) output and inflation is decreasing in retirement preoccupations δ_1 .*

- Defining $\hat{y}_0 = -\frac{1-\rho_\varepsilon}{\sigma} \frac{1-\delta_1}{1-\rho_\varepsilon(1-\delta_1)} \frac{\sigma(1-\eta)-\rho_\varepsilon\beta}{1-\rho_\varepsilon\beta} \bar{\varepsilon} \equiv -\frac{1-\rho_\varepsilon}{\sigma} \Psi \bar{\varepsilon}$, we get:

$$\frac{\partial \Psi}{\partial \delta_1} = -\frac{(1-\beta)\rho_\varepsilon + (1-\rho_\varepsilon)\sigma(1-\eta)}{(1-\rho_\varepsilon\beta)[1-\rho_\varepsilon(1-\delta_1)]^2} < 0$$

- ▶ Pushing $\delta_1 \uparrow$ (i) decreases role of IS, while (ii) increasing asset flow effect
- Proofs of other propositions are similar

Effects of monetary shocks (iii)

- **Proposition 2.** *With $\delta_1 > 0$, the ability of an interest rate cut ($\bar{\epsilon} < 0$) to boost output and inflation is increasing in the duration of assets held by the public (η).*
- When assets held by households are of lower duration, the asset valuation effect is weaker
 - ▶ On the lower arm of the C-shape, this is the crucial channel working in the conventional direction!
- QE can be seen as the central bank $\downarrow \eta \Rightarrow$ conventional MP less potent
 - ▶ In a post-QE world, rates may need to move *by more* to achieve a given effect
 - ★ Implications for financial stability

Effects of monetary shocks (iv)

- **Proposition 3.** *If $\eta < (\sigma - 1)/\sigma$, then there exists a $\delta_1^* \in (\bar{\delta}_1, 1)$ such that an interest rate hike becomes expansionary for all $\delta_1 > \delta_1^*$.*
- Can show that $\delta_1^* \in [\bar{\delta}_1, 1] \Rightarrow$ perverse effects can only occur on lower arm of C-shape
- On lower arm, asset flow effect $>$ IS \Rightarrow valuation effect *needed* to deliver conventionally-signed responses
 - ▶ Valuation effect is weak when η is low (assets are interest-rate insensitive)

Effects of monetary shocks (v)

- **Proposition 4.** *With $\delta_1 > 0$, the ability of a surprise rate cut ($\bar{\varepsilon} < 0$) to boost output is decreasing in its persistence ρ_ε .*

- Remember that standard NKM has
$$\hat{y}_0 = -\bar{\varepsilon}/\sigma \Rightarrow \partial^2 \hat{y}_0 / \partial \bar{\varepsilon} \partial \rho_\varepsilon = 0$$

- With $\delta_1 > 0$, more persistent changes affect output and inflation by less
 - ▶ Persistent rate changes do less to IS

Effects of monetary shocks (vi)

- Effect of time- T MP shock pre-announced at time-0 in FLANK:

$$\hat{y}_0 = \hat{y}_T + \left[1 - (1 - \delta_1)^T \right] (1 - \delta_1) (1 - \eta) \varepsilon_{T;0}$$

- ▶ Standard NKM ($\delta_1 = 0$) has:

$$\hat{y}_0 = \hat{y}_T$$

- **Proposition 5.** *When $\eta < 1$, the effect that pre-announced monetary policy shocks have on current output is decreasing in δ_1 and the announcement horizon T .*
 - ▶ FLANK mitigates FG puzzle by weakening IS
 - ▶ NKM has FG puzzle increase in the length of the pre-announcement horizon T
 - ▶ FLANK captures notion that pre-announced shocks far into the future ($T \rightarrow \infty$) do less today

Conclusions

- Retirement preoccupations matter for monetary policy!
 - ▶ Moves MTM away from intertemporal substitution, becomes “wealth-centric”
 - ▶ Financial channel reflects impact of Δr on both asset supply and asset demand
 - ★ Asset demand (flow): $r \uparrow \Rightarrow$ asset demand $\downarrow \Rightarrow$ expansionary
 - ★ Asset supply (price): $r \uparrow \Rightarrow q \downarrow \Rightarrow$ contractionary
- Implications:
 - ▶ Valuation effect becomes *crucial* on lower arm of C-shape
 - ▶ Potency of MP is decreasing in retirement preoccupations
 - ▶ Conventional MP less powerful in a post-QE world
 - ▶ “Smoother” MP less powerful
 - ▶ Financial shocks may require a “Greenspan put”