



# DOES A LOW-INTEREST-RATE REGIME HARM SAVERS?

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Unstable World*  
Norges Bank

Jan. 26, 2018  
Oslo, Norway

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# Overview

## THIS TALK

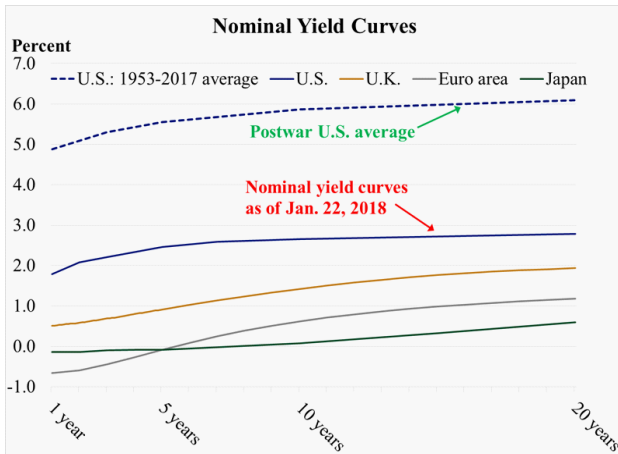
- This academic talk was previously presented in London, UK, in July 2017, in San Jose, Costa Rica, in August 2017, and at the Advanced Workshop for Central Bankers—Northwestern University, in September 2017.
- The results here are preliminary and theoretical in nature.
- Feedback is welcome.

# Low Interest Rates and Saving

## LOW INTEREST RATES AND SAVING

- Since the 2007-2009 financial crisis and recession, real and nominal interest rates in advanced economies have been exceptionally low compared with postwar norms.
- I call this a “low-interest-rate regime.”
- A criticism of monetary policy in advanced economies following the crisis has been that the low-interest-rate regime has been detrimental for savers.
- This presentation suggests that the low-interest-rate regime may not be “harmful to savers.”

## LOW INTEREST RATES EMPIRICALLY



**FIGURE:** Source: Federal Reserve Board, U.S. Department of the Treasury, Bank of England, European Central Bank and Japan's Ministry of Finance. Last observation: Jan. 22, 2018.

## THE LINE OF ARGUMENT

- In the model presented here, household credit markets will play an essential role.
- There are no “sticky prices.” Instead, the key friction in the economy is *non-state contingent nominal contracting* (NSCNC) in household credit markets.
- Monetary policy will be able to repair this friction entirely by using a version of nominal GDP targeting.
- There will be an aggregate productivity shock following a regime-switching stochastic process, yielding a high-real-interest-rate and a low-real-interest-rate regime.
- *Main result: Under the optimal monetary policy, the allocation of resources will be first-best intratemporally in either the high or the low regime.*
- In this sense, a low-interest-rate regime will not be detrimental to savers (or any other households).

# Credit Market Friction



## HOUSEHOLD CREDIT IN A DSGE MODEL

- I study an economy with a large private credit market that is *essential* to good macroeconomic performance.
  - If the household credit market is not working properly, some households will consume much less than others.
  - The NSCNC friction means this market will not work well on its own.
  - The role of monetary policy will be to repair this friction by restoring complete markets.
- I ignore ZLB issues in this talk. See the companion paper by Azariadis, Bullard, Singh and Suda (2015), available on my web page.

## INCOME AND WEALTH INEQUALITY

- There is a lot of income and wealth inequality in this stylized model.
- The role of credit markets, if they work correctly, will be to reallocate uneven income across the life cycle into perfectly equal per capita consumption.
- The model equilibrium will naturally rank:
  - the wealth Gini coefficient  $>$  the income Gini coefficient  $>$  the consumption Gini coefficient.

## HOW LARGE ARE THESE MARKETS?

- According to Mian and Sufi (*AER*, 2011), the ratio of household debt to GDP in the U.S. was about 1.15 before it ballooned to 1.65 during the 2000s.
- In today's dollars, that would be equivalent to going from about \$19.5 trillion to about \$28 trillion in household debt, comprised mostly of mortgage debt.
- Disrupting these markets might be quite costly for the economy, so the NSCNC friction could be quite important.

# Environment

## SYMMETRY ASSUMPTIONS

- I make a set of important “symmetry assumptions” so that we can better understand the equilibrium of the model even with substantial heterogeneity.
- These assumptions involve the symmetry of the life cycle productivity endowment pattern of the households, along with log preferences, no discounting, and no population growth.
- These assumptions help deliver the result that in the equilibrium I study:
  - *The real interest rate is exactly equal to the output growth rate at every date, even in the stochastic economy.*
- This in turn creates a set of easy to understand baseline results for this economy.

## LIFE CYCLE MODELS

- General equilibrium life cycle economy = many-period overlapping generations.
- Key variables are *privately-issued* debt, real interest rates and inflation.
- Think of privately-issued debt = “mortgage-backed securities.”
- This talk has inelastic labor supply. Elastic labor supply can be added—for more on this, see the companion paper by Bullard and Singh (2017), available on my web page.

## ENVIRONMENT DETAILS

- The model is a standard  $T + 1$ -periods DSGE life-cycle endowment economy.
- A new generation of identical households is born at each date. Households live for  $T + 1$  periods. Any  $T \geq 2$  will work; I prefer  $T + 1 = 241$  (quarterly); odd values are convenient.
- The monetary policymaker as controlling the price level  $P(t)$  directly. For a more elaborate version with explicit money demand, see Azariadis, Bullard, Singh, and Suda (2015).

## PREFERENCES

- All participant households entering the economy at date  $t$  have log preferences with no discounting

$$V_t = E_t \sum_{j=0}^T \ln c_t(t+j),$$

where  $c_t(t+j) > 0$  is the date  $t+j$  consumption of the household born at date  $t$ .

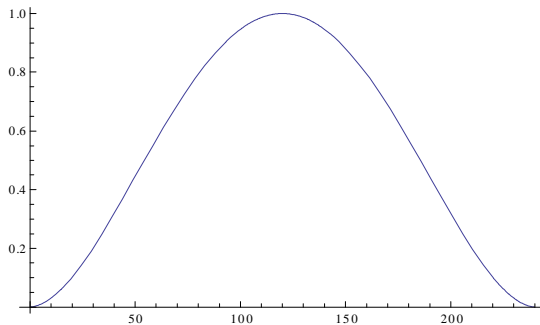
- Households that entered the economy at previous dates have similar preferences and carry a net-asset-holding position into date  $t$ . Households enter the economy and leave the economy with zero net assets.
- Other assumptions: Within-cohort agents are identical, no population growth, no capital, no default, flexible prices, no borrowing constraints.



## LIFE-CYCLE PRODUCTIVITY

- All participant households are endowed with an identical productivity profile over their lifetime.
- The profile begins at a low value, rises to a peak in the middle period of life, and then declines to the low value.
- I assume the “low value” is bounded away from zero for this talk.
- The productivity profile is symmetric.
- Agents can sell their productivity units available at date  $t$  in the labor market at the competitive real wage.
- The cross-sectional income distribution in the economy is this profile multiplied by the real wage at that date.

## LIFE-CYCLE PRODUCTIVITY = CROSS SECTION



**FIGURE:** A schematic productivity endowment profile for credit market participants also represents the cross section of households at date  $t$ . The profile is symmetric and peaks in the middle period of the life cycle. About 50 percent of the households earn 75 percent of the labor income in the credit sector for  $\eta = 1$ .

## KEY FRICTION: NSCNC

- *Loans are dispersed and repaid in the unit of account—that is, in nominal terms—and are not contingent on income realizations.*
- There are two aspects to this friction:
  - The non-state contingent aspect means that real allocations will be perturbed by this friction, and
  - The nominal aspect means that the monetary authority may be able to repair the distortion.

## STOCHASTIC STRUCTURE

- Aggregate real output is produced as  $Y(t) = Q(t)L(t)$ , where  $L(t)$  is the labor input and  $Q(t)$  is the level of technology.
- The technology  $Q(t)$  improves at a stochastic rate  $\lambda(t, t+1)$ .
- The competitive real wage per productivity unit,  $w(t)$ , is then given by

$$w(t+1) = \lambda(t, t+1) w(t), \quad (1)$$

where  $w(0) > 0$ .

- I will make assumptions concerning  $\lambda(t, t+1)$  such that the economy grows on average.

## REGIME SWITCHING

- I follow Bullard and Singh (*IER*, 2012, Section 2.4) to define a two-state regime-switching process for  $\lambda$ .
- There is a high-growth state with mean  $\lambda^H$  and a low-growth state with mean  $\lambda^L$ , such that  $1 < \lambda^L < \lambda^H$ .
- Within each regime, there is additive noise described by  $\sigma \epsilon(t)$ , where  $\sigma$  is a scale factor and  $\epsilon(t) \sim i.i.d. N(0, 1)$ .
- A latent variable  $s(t)$  determines the regime and follows a first-order Markov process.
- The resulting process for  $\lambda(t, t+1)$  can be written as an  $AR(1)$  process with a nonstandard error term.

## TIMING PROTOCOL

- At the beginning of date  $t$ , nature moves first and chooses  $\lambda(t-1, t)$ , which implies a value for  $w(t)$ .
- The policymaker moves next and chooses a value for the price level,  $P(t)$ .
- Households then decide how much to consume and save.

## NOMINAL INTEREST RATE

- Participant households contract by fixing the nominal interest rate one period in advance.
- The non-state contingent gross nominal interest rate, the contract rate, is given by

$$R^n(t, t+1)^{-1} = E_t \left[ \frac{c_t(t)}{c_t(t+1)} \frac{P(t)}{P(t+1)} \right]. \quad (2)$$

- This rate depends on the expected gross rate of consumption growth and the expected gross rate of inflation.
- In the equilibrium I study, consumption growth rates are the same for all households, so this condition is also the same for all the households born at previous dates.

## COMPLETE MARKETS WITH NSCNC

- The countercyclical price level policy rule delivers complete markets allocations:

$$P(t) = \frac{R^n(t-1, t)}{\lambda^r(t-1, t)} P(t-1), \quad (3)$$

where  $\lambda^r$  indicates a realization of the shock and  $R^n$  is the expectation given in the previous slide.

- This is similar to Sheedy (BPEA, 2014) and Koenig (IJCB, 2013).
- Given this policy rule, households will consume equal amounts of available production in the credit sector. This is “*equity share contracting*,” which is optimal under homothetic preferences.
- This price level rule renders the households’ date- $t$  decision problem deterministic because it perfectly insures the household against future shocks to income.
- Consumption and asset holdings fluctuate from period to period, but in proportion to the value of  $w(t)$ .

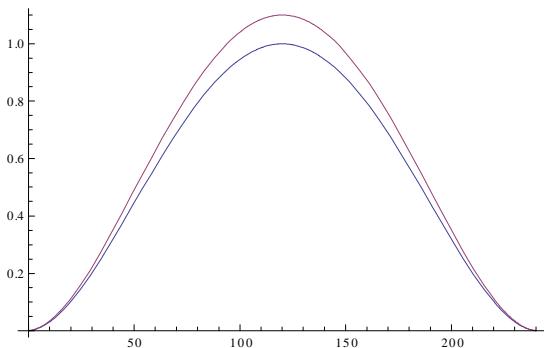


## STATIONARY EQUILIBRIA

- We let  $t \in (-\infty, +\infty)$ .
- We only consider stationary equilibria under the perfectly credible policy rule governing  $P(t)$ .
- We let  $R(t)$  be the gross real rate of return in the credit market.
- Stationary equilibrium is a sequence  $\{R(t), P(t)\}_{t=-\infty}^{+\infty}$  such that markets clear, households solve their optimization problems, and the policymaker credibly adheres to the stated policy rule.
- The key condition is that net aggregate asset holding,  $A(t)$ , nets out among participant households.

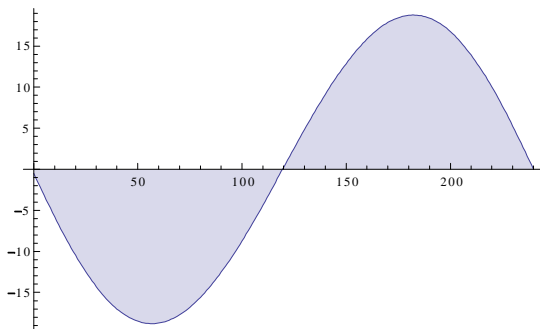
# Graphs

## LABOR INCOME CHANGES IN CROSS SECTION



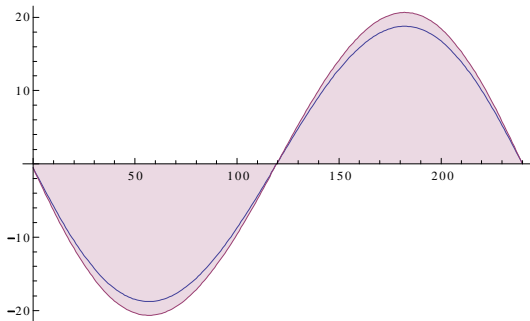
**FIGURE:** How labor income changes across cohorts when the real wage increases 10 percent for  $\eta = 1$ .

## NET ASSET HOLDING IN CROSS SECTION



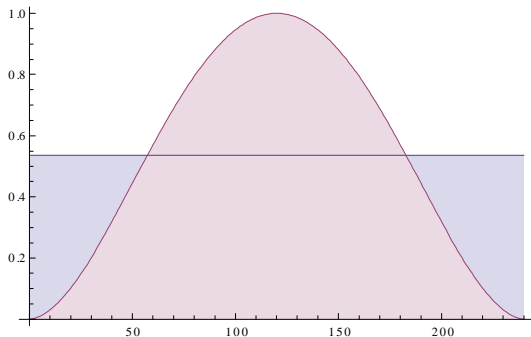
**FIGURE:** Net asset holding by cohort along the complete markets balanced growth path with  $\eta = 1$ . Borrowing, the negative values to the left, peaks at stage 60 of the life cycle (age ~35), while positive assets peak at stage 180 of the life cycle (age ~65). About 25 percent of the population holds about 75 percent of the assets.

## CHANGE IN NET ASSET HOLDING IN CROSS SECTION



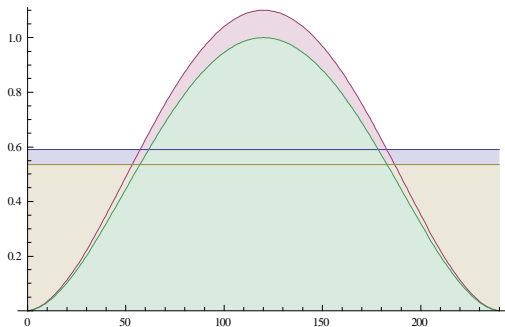
**FIGURE:** How net asset holding changes by cohort when the real wage increases by 10 percent when  $\eta = 1$ .

## CONSUMPTION IN CROSS SECTION



**FIGURE:** Schematic representation of consumption, the flat line, versus labor income, the bell-shaped curve, by cohort along the complete markets balanced growth path with  $w(t) = 1$  and  $\eta = 1$ . The private credit market completely solves the point-in-time income inequality problem.

## CHANGE IN CONSUMPTION IN CROSS SECTION



**FIGURE:** How labor income and consumption change by cohort when the real wage increases by 10 percent with  $\eta = 1$ .

# Complete Markets



## COMPLETE MARKETS VIA NGDP TARGETING

- This economy could be mired in the low-interest-rate regime for a long time, depending on assumptions concerning the persistence of the productivity regimes.
- Nevertheless, monetary policy can deliver first-best intratemporal allocations via the price level rule described earlier which induces “equity share contracting.” This occurs both with regimes and across regimes.
- *The policymaker is completely mitigating the NSCNC friction and restoring the Wicksellian natural rate of interest.*
- There is no sense in which savers are “hurt” in the low-interest-rate regime (nor are borrowers “helped”).

## CAVEATS

- The policymaker here is allowed to observe the shock and then offset it with the appropriate setting for  $P(t)$ . This is unrealistic, but similar to baseline New Keynesian models in which policymakers can appropriately offset incoming shocks.
- The low-real-interest-rate regime is associated with a slower rate of growth in real wages and real output. Households would rather be in the higher growth regime in this sense. But the productivity growth regime is taken as an exogenous process chosen by nature here.
  - Monetary policy cannot switch the economy to the high-growth regime, but it can conduct an optimal policy given the regime. Monetary policy can be useful, but not so useful as to create high real growth.

## MORE CAVEATS

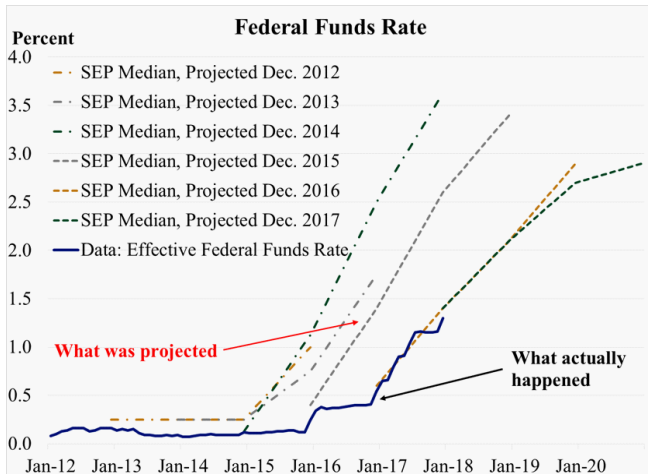
- I focus on an equilibrium where the real interest rate equals the output growth rate every period in the stochastic economy. There may be other equilibria.
- Results would still hold if there were two or more lifetime productivity profiles, allowing for intracohort income inequality.

# Perceptions

## INACCURATE PERCEPTIONS OF REGIMES

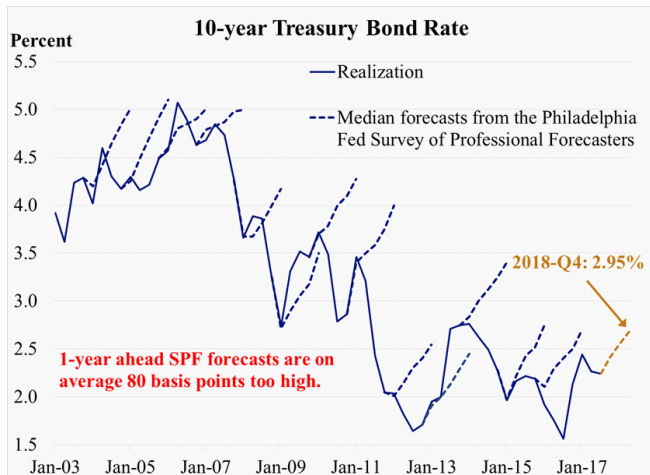
- In this presentation, the policymaker and the private sector agents have rational expectations, meaning they understand the nature of the regime-switching process driving the economy.
- What if they had a misspecified model in which they expected the economy to return to a fixed mean?
- It remains for future research to understand how these results may be altered in this scenario.
- Nevertheless, this may be occurring in actual U.S. monetary policy.
- The following charts illustrate this possibility using recent U.S. data.

## POLICYMAKER PERCEPTIONS



**FIGURE:** Source: Federal Reserve Board and author's calculations. Last observation: December 2017.

## PRIVATE SECTOR PERCEPTIONS



**FIGURE:** Source: FRB of Philadelphia and author's calculations. Last observation: 2017-Q3.

# Conclusions



## CONCLUSIONS

- The desire behind many actual policy choices over the last several years has been to help household credit markets, especially mortgage markets, perform better.
- The credit market here can be interpreted as a residential mortgage market—"mortgage-backed securities."
- Monetary policy can alleviate the NSCNC friction and restore the smooth functioning of the credit market.
- This policy result remains even if the economy switches infrequently between high- and low-real-interest-rate regimes.
- One sentence summary: "One cannot read welfare implications off of the observation of the real interest rate alone."

## NATURAL VS. UNNATURAL REAL INTEREST RATES

- Here the monetary policymaker can restore the first-best intratemporal allocation of resources by moving the price level to achieve the Wicksellian natural real rate of interest for the economy, with the natural rate itself fluctuating according to a regime-switching process.
- This analysis can provide a good baseline for thinking about the current situation in advanced economies if low real interest rates can be *mostly attributed to factors exogenous to monetary policy*.
- However, what if low real interest rates are *attributed to monetary policy itself* (as many critics no doubt would argue)?
  - Then it may be the case that those rates are distortionary and could hurt some segments of society. That could be analyzed here, say by having the policymaker set the “wrong value for  $P(t)$ ” each period. That would require a computational solution as opposed to the pencil-and-paper solution used in this talk.