Optimal Macro-Financial Policies in a New Keynesian Model with Privately Optimal Risk Taking

Alfred Duncan
University of Kent

João Pedro De Camargo Mainente
University of Kent

Charles Nolan
University of Glasgow

June 19, 2023

Overview

We present a model where

- worker-rentier households,
- entrepreneurs who borrow to fund production.
- Due to information asymmetries, entrepreneurs must retain some production risk.
- But entrepreneurs and households can trade aggregate risks.

Overview

We find

- A safety trap, where household risk aversion increases macro risk.
- A role for macroprudential policy, but cannot eliminate financial wedges.
- A financial role for monetary policy, but should not eliminate financial wedges.
- Persistence of shocks, costs of inflation important for monetary/prudential mix.

Related literature

- Risk sharing externality
  Di Tella (2017), Farhi and Werning (2016), Schmitt-Grohe and Uribe (2012)
- IS-PC curve distortions
  Curdia and Woodford (2016), Jermann and Quadrini (2012)
- Safety trap
  Caballero and Farhi (2017)
- Financial stability interest rate
  Akinci et al. (2021)
- Monetary policy and leverage
  Bhandari et al. (2021), Sheedy (2014)

The model - overview

The IS curve

$$x_t = \mathbb{E}[x_{t+1}] - \frac{\zeta}{\sigma + \zeta - 1}(i_t - \mathbb{E}_t[\pi_{t+1}]) - \frac{\zeta - 1}{\sigma + \zeta - 1}\left(l_t + \frac{\rho_\xi - \psi}{1 - \psi}\xi_t\right),$$

Canonical New Keynesian IS curve.

Aggregate elasticity of substitution now determined by both entrepreneurs and households.

Aggregate demand decreases in response to financial stress.

The model - overview

The Leverage curve

$$\Delta l_t = -\frac{\psi}{\zeta}(l_{t-1} + \xi_{t-1}) + \frac{\sigma\omega\psi}{\zeta}\Delta\xi_t - \frac{(\sigma - 1)}{\zeta}\Delta x_t - \delta_t,$$

Leverage is mean reverting.

Net wealth falls in response to uncertainty.

Financial accelerator: net wealth falls disproportionately in recessions.

Can be stabilised by macroprudential policy.

The model - overview

The IS curve

$$x_t = \mathbb{E}[x_{t+1}] - \frac{\zeta}{\sigma + \zeta - 1}\left(i_t - \mathbb{E}_t[\pi_{t+1}]\right) - \frac{\zeta - 1}{\sigma + \zeta - 1}\left(l_t + \frac{\rho_\xi - \psi}{1 - \psi}\xi_t\right),$$

The Phillips curve

$$\pi_t = \beta\mathbb{E}_t[\pi_{t+1}] + \lambda \mathrm{pp}_t,$$

The Leverage curve

$$\Delta l_t = -\frac{\psi}{\zeta}(l_{t-1} + \xi_{t-1}) + \frac{\sigma\omega\psi}{\zeta}\Delta\xi_t - \frac{(\sigma - 1)}{\zeta}\Delta x_t - \delta_t,$$

The model - overview

$$\mathsf{pp}_t = \underbrace{\left(\sigma + \frac{\varphi+\alpha}{1-\alpha}\right) x_t - \frac{1+\varphi}{1-\alpha}\, a_t}_{\text{benchmark model marginal costs}} + \underbrace{\sigma\omega(1-\psi) l_t - \sigma\omega\psi\xi_t}_{\text{consumption inequality wealth effect}} + \underbrace{\tau_t}_{\text{labour wedge}}, \quad (1)$$

where the labour wedge is increasing in both leverage and uncertainty,

$$\tau_t = \theta_l l_t + \theta_\xi \xi_t, \qquad \theta_l, \theta_\xi > 0. \quad (2)$$

The model - households

$$v(q_t) = \max_{z_t, c_t, n_t, q_{t+1}} \mathbb{E}_t \left\{ \frac{c_t^{1-\sigma}}{1-\sigma} - \frac{n_t^{1+\varphi}}{1+\varphi} + \beta v(q_{t+1}) \right\}$$

$$q_{t+1} = (1+r)q_t + w_t n_t + \Pi_t - c_t \underbrace{- \int_{s \in S} p_t(s) z_t(s) ds + z_t(s_{t+1})}_{\text{trade in aggregate risk}} .$$

The model - entrepreneurs

Intertemporal problem:

$$v^e(q_t^e) = \max_{z_t^e, c_t^e, q_{t+1}^e} \mathbb{E}_{\Phi,t} \left\{ \log c_t^e + \beta^e v^e(q_{t+1}^e) \right\}$$

subject to

$$q_{t+1}^e = R_t(\phi_t, s_t) q_t^e - c_t^e - \int_{s \in S} p_t(s) z_t^e(s) ds + z_t^e(s_{t+1})$$

Within period production/hiring/borrowing decisions and risk captured by R_t.

The model - entrepreneurs

Intratemporal problem:

Within period, entrepreneurs raise funds to purchase capital and hire labour.

Subject to costly and imperfect state verification problem (Duncan and Nolan, 2019).

Entrepreneurs can misreport their income to reduce repayments to financiers.

Financiers can audit, but these audits sometimes throw erroneous signals.

Generate tractable loan contracts as optimal under risk aversion.

Real world example: Carlos Ghosn (Renault Nissan) fraud case.

The model - entrepreneurs

Intratemporal problem:
Entrepreneurs produce output according to the function

$$f(k_t^e, n_t^e; a_t, \phi_t) = a_t \nu(\phi_t)(k_t^e)^{\alpha}(n_t^e)^{1-\alpha}$$

$$\frac{w_t}{\mathsf{PP}_t}\mathbb{E}_{\Phi,t}\left[\frac{1}{c_t^e(\phi_t)}\right] = \mathbb{E}_{\Phi,t}\frac{f_{n^e}(k_t^e, n_t^e; a_t, \phi_t)}{c_t^e(\phi_t)}$$

$$\frac{w_t}{\mathsf{PP}_t} = \mathbb{E}_{\Phi,t}\left[f_{n^e}(n_t^e; \phi_t)\right]\underbrace{\left(1 + \mathsf{cov}_{\Phi,t}\left(\frac{f_{n^e}(n_t^e; \phi_t)}{\mathbb{E}_{\Phi,t} f_{n^e}(n_t^e; \phi_t)}, \frac{1/c_t^e(\phi_t)}{\mathbb{E}_{\Phi,t}\left[1/c_t^e(\phi_t)\right]}\right)\right)}_{:=1-\tau}$$

The model - prudential policy

Rather than specifying a prudential instrument, we take a mechanism design approach to prudential policy.

What are the information constraints faced by the prudential authority?

Given those constraints, and assuming sufficient instruments, what is the frontier of what prudential interventions can achieve?

The model - prudential policy

Constraint

Hidden storage. Entrepreneurs can hide wealth across periods at the market risk free real interest rate.

The model - prudential policy

The hidden storage constraint implies that intertemporal risk sharing holds in expectation for any feasible prudential policy,

$$\sigma \mathbb{E}_t[\Delta c_{t+1}] = \mathbb{E}_t[\Delta c^e_{t+1}] - \mathbb{E}_t[\rho_{t+1}].$$

Lemma

The macroprudential wedge is unpredictable, $\mathbb{E}_t[\delta_{t+1}] = 0$.

Macropru

Prudential policy in the model limits the elasticity of firms' wealth to unexpected shocks.

The closest real-world instrument is probably the counter-cyclical buffer, or the stress-test exercises.

Both, in theory, reduce cyclical firms' access to loan funding.

The model - welfare

We use the Negishi (1960) method to construct Pareto weights consistent with the competitive equilibrium.

$$2\Lambda = (1+\omega)\frac{\varepsilon}{\lambda}\pi_t^2 + (1+\omega)\frac{1+\varphi}{1-\alpha}x_t(x_t - 2a_t) + (\sigma - 1)\,x_t^2$$
$$+\omega\left((\zeta-\psi)l_t + (\sigma-1)x_t\right)\left((1-\psi)l_t - \psi\xi_t\right)$$
$$+\,\omega l_t(\kappa_{ll} l_t + \kappa_{l\xi}\xi_t) + \text{t.i.p.}$$

First three terms isomorphic to canonical New Keynesian model.
Policymakers also concerned about fluctuations in the distribution of consumption, and entrepreneurs' consumption risk.

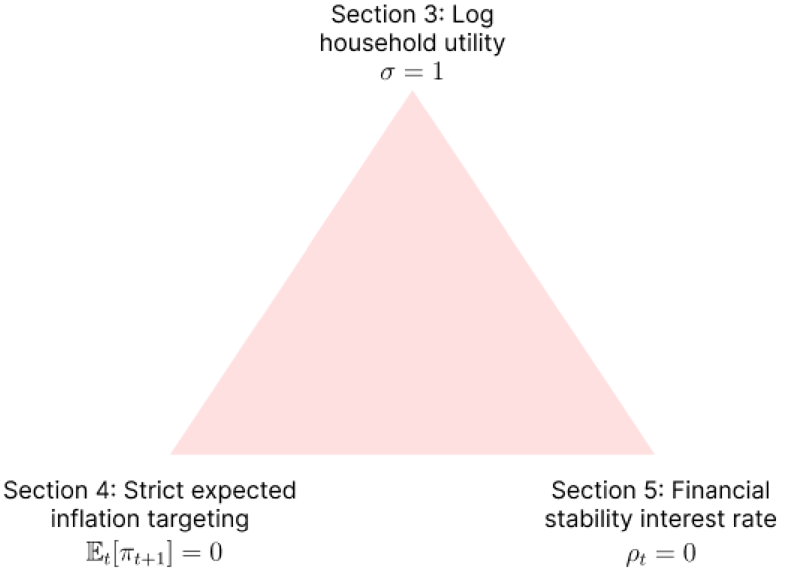
Proposition 1: Safety trap

The safety trap. An increase in the representative household's coefficient of relative risk aversion can increase the volatility of the path of output.

The safety trap - intuition

Individual risk averse households seek protection from aggregate fluctuations through their financial asset holdings.

This leaves risk concentrated among entrepreneurs, resulting in large procyclical fluctuations in entrepreneurial net wealth, and financial amplification of aggregate shocks.



Our tractability trilemma: We can depart from any two but not all three.

Section 3: Optimal policy under log household utility

The Leverage curve

$$\Delta l_t = -\frac{\psi}{\zeta}(l_{t-1} + \xi_{t-1}) + \frac{\sigma\omega\psi}{\zeta}\Delta\xi_t - \frac{(\sigma - 1)}{\zeta}\Delta x_t - \delta_t,$$

Under log utility,

$$\Delta l_t = -\frac{\psi}{\zeta}(l_{t-1} + \xi_{t-1}) + \frac{\sigma\omega\psi}{\zeta}\Delta\xi_t - \delta_t,$$

Net wealth moves one-for-one with output.

Leverage doesn't respond to aggregate demand (monetary policy).

Optimal monetary policy

$$p_t = \varphi_1 p_{t-1} + \frac{\beta^{-1}\lambda}{\varphi_2 - \phi_1} \left(\vartheta_l l_t + \vartheta_\xi \left(1-\gamma\right) \xi_t\right).$$

Monetary policymaker treats uncertainty shocks / leverage like New Keynesian cost-push shocks: trade-off between output and inflation stabilisation.

Optimal prudential policy

$$\delta_t = \left(\frac{\omega \hat{\kappa}_{I\xi} + (1+\omega)\chi^{-1}\vartheta_I \vartheta_\xi \varsigma (1-\gamma)}{\omega \hat{\kappa}_{II} + (1+\omega)\chi^{-1}\vartheta_I^2 \varsigma} \left(\frac{\phi_2 - \phi_1}{\phi_2 - \rho_\xi} \right) - \frac{1 - \omega(\phi_2 - 1)}{\phi_2 - \rho_\xi} \frac{\psi}{\zeta} \right) \varepsilon_{\xi t}$$

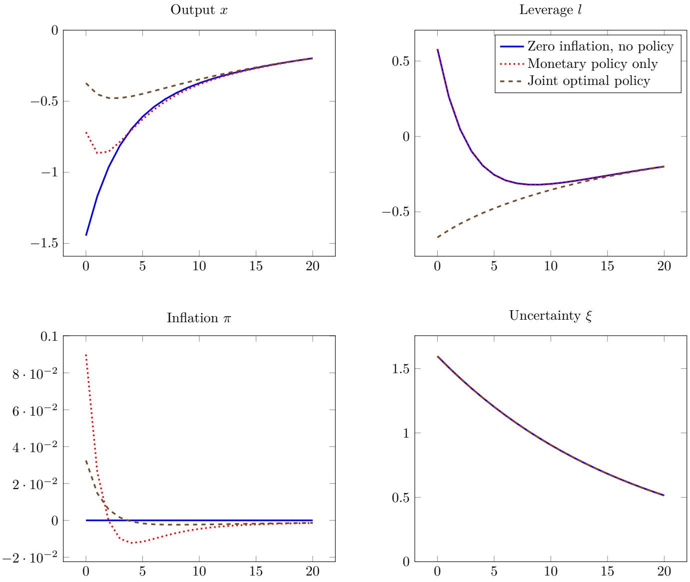
ς is large when inflation is particularly costly, which makes it difficult for monetary policy to address financial frictions.

Then, prudential policy more determined by marginal costs / aggregate demand management.

Otherwise, focuses on the direct financial friction costs.

Cost of policy is medium term inequality.

Optimal prudential policy



Further results

Section 4. Macropru should play a bigger role in addressing persistent shocks, monetary policy more temporary shocks.

Section 5. Monetary policy can stabilise financial frictions, at the cost of permanently high inflation. Prudential policy can reduce the harm but not eliminate it.

Section 6. Accommodative monetary policy does restore net wealth in downturns. In many models, this happens as a result of fixed nominal contracts. In our model, contracts are not fixed, can be conditioned on monetary policy. Accommodative policy increases the returns to entrepreneurial wealth, therefore changes equilibrium risk taking.