Should Inequality Factor into Central Banks' Decisions?

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"A clear takeaway (...) was the importance of achieving and sustaining a strong job market, particularly for people from low- and moderate-income communities."— Jerome H. Powell, speech August 27, 2020

"(...) a faster return to full employment should in turn contribute to lower future inequality, since we know that if unemployment lasts too long it can lead to permanent income losses through labour market scarring". — Mario Draghi, lecture October 25, 2016

Should Inequality Factor into MP decisions?

- Study desirable monetary policy in a simple two-agent new keynesian model, based on Bilbiie (2008), Debortoli and Gali (2017):
  - Rich agent: owns all capital, income composed of after-tax dividends and wages.
  - Poor agent: receives only wages and a transfer from the government financed by the dividend tax.
- Positive productivity shocks exacerbate initial inequality through (i) higher profits accrue to rich, and (ii) wages are tech-biased towards the rich.

Findings

- Ramsey problem yields an “enlarged” loss function with terms on consumption inequality and the labor share.
- **Optimal policy:** a policy that *optimally* aims to stabilize inflation and output gaps alone is close to optimal.
- **Taylor rules:** the central bank should target the labor share in response to tech shocks.
  - This implies lower interest rates following a positive technology shock
  - which improves distributional but also aggregate outcomes.
  - Insights carry through beyond tech shocks.

Related Literature

1. Two-Agent models in a New Keynesian setup: Campbell and Mankiw (1989), Gali et al. (2007), Bilbiie (2008), Broer et al. (2020) and Walsh (2017)
2. Optimal monetary policy: Rotemberg and Woodford (1997), Erceg et al. (2000), Clarida et al. (1999), Woodford (2002), and **Benigno and Woodford (2005)**
3. Hetereogeneity and MP in a TANK model: Curdia and Woodford (2010), Nisticò (2016), and Bilbiie and Ragot (2021), **Bilbiie (2008)** and **Debortoli and Gali (2017).**
4. Also related MP in a HANK: Nuño et al. (2016), Ma and Park (2021), and Le Grand et al. (2021)

Contribution

Bilbiie (2008) and Debortoli and Gali (2017), plus:

- we study optimal monetary policy in the presence of **steady state inequality**;
- **technological bias in wages** to match the responses of consumption of different agents to productivity shocks in the U.S (De Giorgi and Gambetti, 2017);
- **Wages are also rigid**, beyond prices; and
- we study implications for alternative **Taylor rules.**

Outline

Outline

Model Overview

Markets
- Final goods
- Financial (bonds, stocks)
- Labor

Shocks
- TFP with skill biased effect on labor income

Households
- Supply labor
- Receive government transfers
- Two Types
  - Ricardian: mass 1-λ, access financial markets.
  - Keynesian: mass λ, do not access financial markets.

Firms
- Transform labor to final good
- Monopolistic competition
- Sticky Prices (Rotemberg)

Policies
- **Fiscal:**
  - Redistributes a share of profits from firms to households
- **Monetary:**
  - Optimal monetary policy
  - Taylor Rule

Ricardian Agent

- A Ricardian agent, r, solves

$$\max E_0 \sum_{t=0}^{\infty} \beta^t \left[\ln C_{rt} - \chi \frac{N_t^{1+\phi}}{1+\phi} \right]$$

$$\text{s.t. } C_{rt} + b_{rt} = b_{rt-1} \frac{R_{t-1}}{\Pi_t} + Y_{rt}$$

Keynesian Agent

- A Keynesian agent, k, solves

$$\max E_0 \sum_{t=0}^{\infty} \beta^t \left[\ln C_{kt} - \chi \frac{N_t^{1+\phi}}{1+\phi} \right]$$
$$\text{s.t. } C_{kt} = Y_{kt}$$

- Has **no access** to financial markets.
- Keynesian agents are effectively **hand-to-mouth.**

Supply Side - Labor Market

- Workers assumed to supply the same amount of labor:

$$w_t^* = \chi Y_t N_t^{\phi}$$

ϕ is the inverse Frisch elasticity, χ governs labor disutility.
w^* is real wage norm (real wage absent rigidites).
"Trick": abstract from inequality in labor supply.

- Wages are rigid following Eggertsson et al. (2019)

$$w_t = \left(\frac{w_{t-1}}{\Pi_t}\right)^{\psi_w} {w_t^*}^{1-\psi_w}$$

where ψ_w is the degree of nominal wage rigidity.

Supply Side - Firms

- An intermediate producer j, concave production function $y_{jt} = A_t N_{jt}^{1-\alpha}$ and demand function $y_{jt} = \left(\frac{p_{jt}}{P_t}\right)^{-\theta_p} Y_t$ solves

$$\max_{p_{jt}} (1 + T_p)\, p_{jt} y_{jt} - W_t N_{jt} - \frac{\psi}{2} Y_t \left[\frac{p_{jt}}{p_{jt-1}} - 1\right]^2 +$$
$$+ \beta \frac{C_{rt}}{C_{rt+1}} \left\{ (1 + T_p)\, p_{jt+1} y_{jt+1} - W_{t+1} N_{jt+1} - \frac{\psi}{2} Y_{t+1} \left[\frac{p_{jt+1}}{p_{jt}} - 1\right]^2 \right\}$$

Fiscal Policy

- Fiscal Transfers

$$t_{kt} = (1 - \tau)\, d_t$$
$$t_{rt} = \frac{d_t - \lambda t_{kt}}{1 - \lambda}.$$

- $\tau \in [0, 1]$, governs steady-state inequality.

Incomes

- Income is distributed as follows.

$$Y_{kt} = \left(\frac{A_t}{\overline{A}}\right)^{-\gamma} w_t N_t - T_p Y_t + t_{kt}$$

$$Y_{rt} = \frac{1 - \lambda \left(\frac{A_t}{\overline{A}}\right)^{-\gamma}}{1-\lambda} w_t N_t - T_p Y_t + t_{rt}$$

- $\gamma > 0$ generates skill biased tech change.

Market Clearing

We have the following market clearing conditions.

$$Y_t = \lambda C_{kt} + (1-\lambda) C_{rt} + \frac{\psi_p}{2} Y_t (\Pi_t - 1)^2$$

$$\int b_{it} di = 0$$

Exogenous Productivity

Standard AR(1) productivity process

$$A_t = \overline{A} \exp^{\epsilon_t}$$
$$\epsilon_t = \rho \epsilon_{t-1}$$
$$\epsilon_0 = 0.01$$

Log-Linearized Equilibrium Conditions

- Equilibrium is $\left\{\hat{Y}_t, \hat{C}_{rt}, \hat{C}_{kt}, \hat{N}_t, \hat{R}_t, \hat{\Pi}_t, \hat{w}_t, \hat{w}_t^*, \hat{d}_t, \hat{t}_{rt}, \hat{t}_{kt}\right\}_{t=0}^{\infty}$, given exogenous process $\left\{\hat{A}_t\right\}_{t=0}^{\infty}$ such that

$$\hat{C}_{rt} = E_t\hat{C}_{rt+1} - \hat{R}_t + E_t\hat{\Pi}_{t+1} \qquad \hat{Y}_t = \lambda\frac{\overline{C}_k}{\overline{Y}}\hat{C}_{kt} + (1-\lambda)\frac{\overline{C}_r}{\overline{Y}}\hat{C}_{rt}$$

$$\hat{w}_t = \phi\hat{N}_t + \hat{Y}_t \qquad \hat{w}_t = (1-\psi_w)\left(\hat{w}_t^* - \hat{\Pi}_t\right) + \psi_w\hat{w}_{t-1}$$

$$\hat{d}_t = \hat{t}_{kt} \qquad \hat{d}_t = \frac{(1-\lambda)\,\bar{t}_r}{\overline{d}}\hat{t}_{rt} + \frac{\lambda\bar{t}_k}{\overline{d}}\hat{t}_{kt}$$

$$\frac{\overline{C}_k}{\overline{w}\overline{N}}\hat{C}_{kt} + \frac{T_p\overline{Y}}{\overline{w}\overline{N}}\hat{Y}_t - \frac{\bar{t}_k}{\overline{w}\overline{N}}\hat{t}_{kt} = -\gamma\hat{A}_t + \hat{w}_t + \hat{N}_t \qquad \hat{\Pi}_t = \beta E_t\hat{\Pi}_{t+1} + \frac{\theta_p}{\psi_p}\left(\hat{w}_t + \frac{\alpha}{1-\alpha}\hat{Y}_t - \frac{1}{1-\alpha}\hat{A}_t\right)$$

$$(1+T_p)\,\hat{Y}_t = \frac{\overline{d}}{\overline{Y}}\hat{d}_t + \frac{\overline{w}\overline{N}}{\overline{Y}}\left(\hat{w}_t + \hat{N}_t\right) \qquad \hat{Y}_t = \hat{A}_t + (1-\alpha)\,\hat{N}_t$$

and a condition for monetary policy.

Calibration

	Value	Concept	Source
α	0.25	Profits Share	Galí (2015)
β	0.9925	Discount Factor	Galí (2015)
λ	0.4	Share of Keynesian	Coenen et al. (2012)
χ	1	Disutility of Labor	Galí (2015)
ϕ	1	Frisch Elasticity	Galí (2015)
θ_p	9	Elasticity Intermediate Goods	Galí (2015)
ψ_p	372.8	Rotemberg Cost	Debortoli and Gali (2017)
ψ_w	0.75	Wage Rigidity	Smets and Wouters (2007)
ρ	0.9	Persistence Of Tech Shock	Galí (2015)
τ	0.93	Degree of Redistribution	SCF, match ratio of non-labor income
γ	2.21	Tech Bias	TR + De Giorgi and Gambetti (2017)

Outline

Model

Optimal Policy

Taylor Rules

Ramsey optimal monetary policy (Rotemberg and Woodford, 1997)

- Problem of a central bank that equally weights all agents:

$$\mathbb{W} = E_0 \sum_{t=0}^{\infty} \beta^t \left[\lambda \ln C_{kt} + (1-\lambda) \ln C_{rt} - \chi \frac{N_t^{1+\phi}}{1+\phi} \right]$$

- If $\tau > 0$, 2nd order approximation as in Woodford, or Galì, yields a linear term.
- Bilbiie (2008) and Debortoli and Gali (2017) assume that away with no inequality in steady-state.

Welfare approximation under a distorted steady-state

- Use Benigno and Woodford (2005): replace linear term by using a second order approximation of the Phillips curve

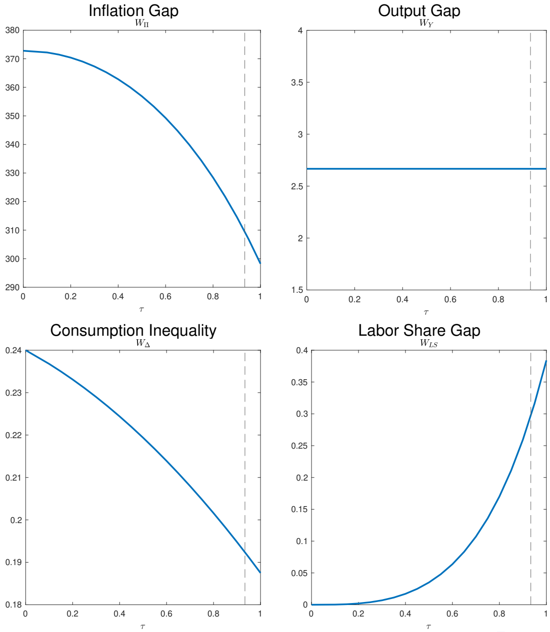
$$\mathbb{W} \approx -\frac{1}{2}\sum_{t=0}^{\infty}\beta^t\{W_\Pi \hat{\Pi}_t^2 + W_Y\left(\hat{Y}_t - \hat{A}_t\right)^2 + W_{\Delta_c}\underbrace{\hat{\Delta}_{ct}^2}_{=(\hat{C}_{rt}-\hat{C}_{kt})^2} +$$

$$W_{LS}\left(\widehat{LS}_t - \widehat{LS}_t^*\right)^2\} + T_0 + \text{t.i.p.}$$

- $T_0 = f\left(\hat{Y}_0, \hat{\Pi}_0, \hat{C}_{r0}\right)$ has linear terms and gives an initial condition
- "Timeless Commitment": the new rule applies from next period on, or the central bank wants to maintain a past commitment.
- The labor share shows up: $\widehat{LS}_t = \widehat{w}_t + \widehat{N}_t - \widehat{Y}_t$

▸ Analytical expression for weights

Welfare weights vary with steady-state inequality



How important are the "new" components?

- Take a central bank with a dual mandate. It maximizes:

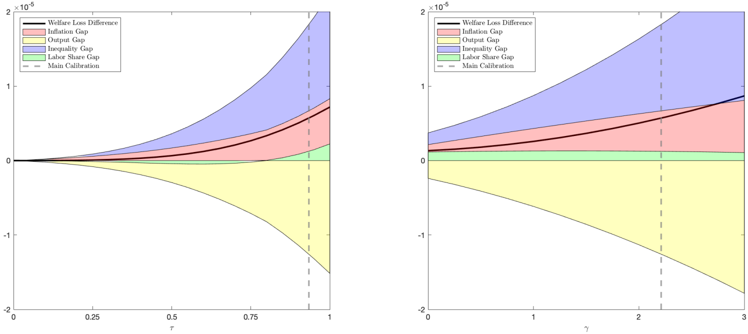
$$\mathbb{W} = -\frac{1}{2}\sum_{t=0}^{\infty}\beta^t\left\{W_\Pi \hat{\Pi}_t^2 + \frac{1+\phi}{1-\alpha}\left(\hat{Y}_t - \hat{A}_t\right)^2\right\}$$

where T_0 is constrained to be the same as in fully optimal policy.

▸ IRF

Fully optimal monetary policy is not that better

Figure: Consumption-equivalent welfare gain of moving from RANK-optimal to fully optimal policy



Takeaway from optimal policy

- Ramsey problem in our TANK model implies changes to familiar terms (on inflation) and adds new terms (on consumption inequality and labor share)
- However, the conduct of monetary policy is not much changed by these if the central bank is pursuing a RANK-optimal policy to begin with
- Any gains come from adding consumption inequality weight in the welfare function

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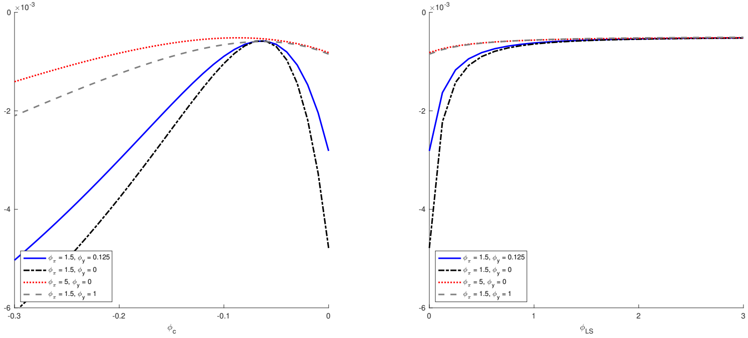
What about including inequality in Taylor Rules?

- Consider a central bank conducting MP using an augmented Taylor rule:

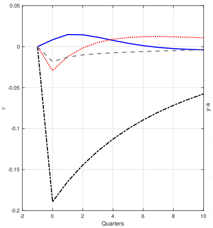
$$\hat{R}_t = \phi_\pi \widehat{\Pi}_t + \phi_y \left(\widehat{Y}_t - \widehat{A}_t \right) + \phi_c \left(\widehat{C}_{rt} - \widehat{C}_{kt} \right) + \phi_{LS} \left(\widehat{LS}_t \right)$$

Augmented Taylor rules fare better

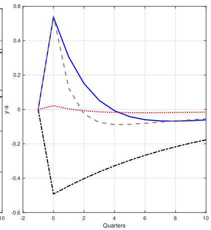
Figure: Welfare under augmented Taylor rules



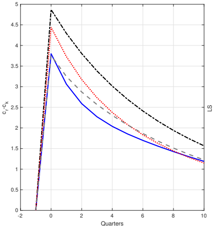
Augmented rules are better for different reasons



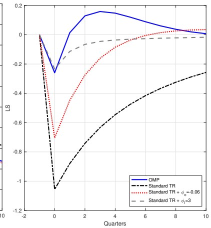
(a) Inflation



(b) Output Gap



(c) Inequality



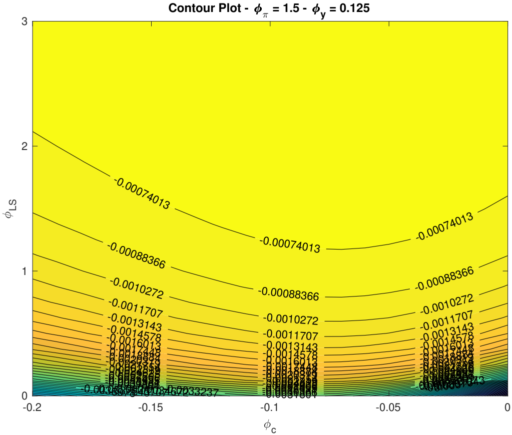
(d) Labor Share

Takeaway from taylor rules under TFP shock

- Augmented rules generate welfare gains relative to standard Taylor rules, either consumption inequality or labor share targeting
- The gains across the two types are similar, but targeting the labor share seems more robust
- Moreover, labor share targeting also generates less volatile inflation, which is always the most important gap to stabilize

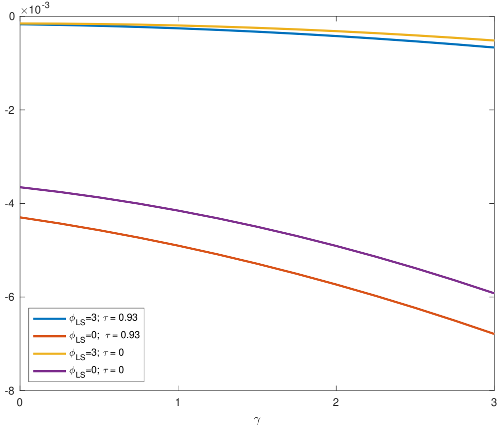
Ex-ante evaluation with broad set of shocks leads to similar conclusions

Figure: Welfare loss and policy reaction parameters



Targeting the labor share dampens losses from inequality and is robust

Figure: Welfare loss as function of inequality parameters across Taylor rules



Conclusion

- Should inequality change the conduct of monetary policy?
- We study this question within a stylized model with steady-state inequality and tech-biased wages.
- The answer is nuanced
- Under optimal policy, only small welfare gains from factoring in inequality, even for high steady-state inequality and tech-biased wages.
- Under Taylor rules,
  - explicitly targeting the labor share is welfare increasing vs standard rules
  - AND actually superior to targeting consumption inequality.

Extra slides

Welfare Weights

Define $\frac{\overline{C}_k}{\overline{Y}} = \overline{w}\frac{\overline{N}}{\overline{Y}} - T_p + (1-\tau)\frac{\overline{d}}{\overline{Y}} \equiv \Omega(\tau)$

$$W_\Pi = \psi_p \left\{ 1 - \frac{\lambda(1-\Omega(\tau))}{1-\lambda\Omega(\tau)} \left[1 - \frac{1-\tau}{\Omega(\tau)} \right] \right\}$$

$$W_{\Delta_c} = \lambda\Omega(\tau)(1-\lambda\Omega(\tau))$$

$$W_Y = \frac{1+\phi}{1-\alpha}$$

$$W_{LS} = \frac{\lambda(1-\Omega(\tau))}{(1-\lambda\Omega(\tau))^2} \left(\frac{(1-\alpha)\tau}{\Omega(\tau)} \right)^2$$

Note: Weights are a function of τ but not γ

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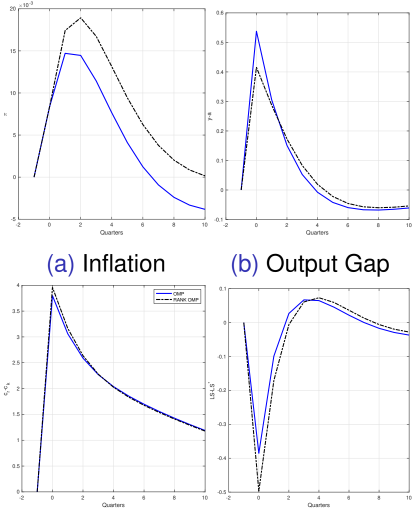
Figure: IRFs: Optimal vs RANK-Optimal Policy, with Wage Rigidity



(a) Inflation (b) Output Gap

(c) Inequality (d) Labor Share

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