Optimal Monetary Policy with Redistribution

Jennifer La'O   Wendy Morrison

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Should monetary policy incorporate distributional concerns?

- recent call for central banks to take heed of rising inequality
- some have suggested that central banks broaden their mandate to include such concerns
- not obvious from a theoretical perspective what monetary policymakers are supposed to do

Available Models

- standard NK model makes representative agent assumption
  - not built to address these questions
- recent HANK literature incorporates heterogeneity
  - Kaplan, Moll, Violante (2018)
  - Bewley-Imrohoroglu-Huggett-Aiyagari economies $\rightarrow$ uninsurable idiosyncratic income risk
  - numerical solution methods
  - inequality due to missing insurance markets, i.e. ex post heterogeneity
- but ex-ante heterogeneity is also quantitatively important
  - systematic, forecastable differences in income growth rates are large
  - households are able to smooth a substantial fraction of income shocks
  - Guvenen and Smith (2014); Guvenen, Ozkan, Song (2014); Schulhofer-Wohl (2011)

Our Questions

Given a set of available tax instruments (Ramsey approach):

1. under what conditions should monetary policy be used for redistributional purposes?
2. when such conditions hold, how should monetary policy be conducted?

Our Framework

- heterogeneous agent economy à la Werning (2007)
  - workers differ in type-specific labor productivities, "skills"
  - skills are state-contingent, but markets are complete
  - all heterogeneity is ex ante, not ex post (no missing insurance markets)
- firms face nominal rigidities = informational friction (Woodford, 2003; Mankiw Reis, 2002)
  - must set nominal prices before observing demand
- shocks to aggregate productivity, government spending, and the labor skill distribution
- Ramsey taxation: restricted set of available fiscal instruments
  - full set of non-state-contingent linear taxes
  - state-contingent lump sum transfers: uniform across types

What we do

- we consider a utilitarian planner with arbitrary Pareto weights
- we solve for optimal monetary and fiscal policy jointly using the primal approach
- we identify sufficient conditions under which it is optimal to implement flexible-price allocations
- when such conditions do not hold, we characterize in what manner monetary policy should deviate from implementing the flexible-price benchmark

What we show

- When shocks to the skill distribution are proportional (no movement in *relative* productivities):
  - all redistribution is done via the tax system
  - optimal monetary policy implements flexible-price allocations
  - targets price stability in response to TFP, govt spending, and proportional skill shocks
- When shocks affect relative productivities:
  - tax instruments are insufficient to implement constrained efficient optimum
  - optimal for monetary policy to deviate from implementing flexible-price allocations
  - monetary policy targets a state-contingent markup
  - optimal markup co-varies positively with a sufficient statistic for labor income inequality

Related Literature

- Primal approach to Ramsey taxation
  - representative agent: Lucas Stokey (1983), Chari, Christiano, Kehoe (1991, 1994), Chari Kehoe (1999)
  - with heterogeneity: Werning (2007), Judd (1985), Chari Kehoe (1999)
  - with nominal rigidities: Correia, Nicolini, Teles (2008), Correia, Nicolini, Farhi Teles (2013), Angeletos and La'O (2020), La'O and Tahbaz-Salehi (2022)

- Optimal Monetary Policy in HANK/TANK
  - het-agent: Bhandari, Evans, Golosov, Sargent (2021), Nuno and Thomas (2022), Le Grand, Martin-Baillon, and Ragot (2021), Davila Schaab (2022), McKay and Wolf (2023), Acharya, Challe, Dogra (2023)
  - two-agent: Bilbiie (2008, 2021), Bilbiie and Ragot (2017), Challe (2020), Debortoli and Galí (2017)

The Environment

The Environment

- $t = 0, 1, \ldots$
- finite states $s_t \in S$
- history $s^t = (s_0, ..., s_t) \in S^t$
  - conditional probabilities $\mu(s^t | s^{t-1})$
  - unconditional probabilities $\mu(s^t)$

Household Preferences

- unit mass continuum of households with identical preferences

$$U(c,h) = \frac{c^{1-\gamma}}{1-\gamma} - \frac{h^{1+\eta}}{1+\eta}$$

- finite types $i \in I$ of relative size π^i
- types correspond to state-contingent worker skill $\theta^i(s_t) > 0$
- efficiency units of labor

$$\ell^i(s^t) = \theta^i(s_t) h^i(s^t)$$

- expected lifetime utility

$$\sum_t \sum_{s^t} \beta^t \mu(s^t) U(c^i(s^t), \ell^i(s^t)/\theta^i(s_t))$$

Household Budgets

$$(1+\tau_c)P(s^t)c^i(s^t) + b^i(s^t) + \sum_{s^{t+1}|s^t} Q(s^{t+1}|s^t)z^i(s^{t+1}|s^t)$$

$$\leq (1-\tau_\ell)W(s^t)\ell^i(s^t) + P(s^t)T(s^t) + (1-\tau_\Pi)\Pi(s^t) + z^i(s^t|s^{t-1}) + (1+i(s^{t-1}))b^i(s^{t-1})$$

Firms

- intermediate good firms, monopolistically-competitive, indexed by $j \in \mathcal{J} = [0,1]$

$$y^j(s^t) = A(s_t) n^j(s^t)$$

$$\text{profits}^j(s^t) = (1-\tau_r) p_t^j(\cdot) y^j(s^t) - W(s^t) n^j(s^t)$$

- final good firm, perfectly competitive:

$$Y(s^t) = \left[\int_{j \in J} y^j(s^t)^{\frac{\rho-1}{\rho}} \mathrm{d}j \right]^{\frac{\rho}{\rho-1}} \qquad \rightarrow \qquad y^j(s^t) = \left(\frac{p_t^j(\cdot)}{P(s^t)} \right)^{-\rho} Y(s^t)$$

The Government

- consolidated fiscal and monetary authority with commitment
- tax revenue

$$\mathcal{T}(s^t) \equiv \tau_c P(s^t)C(s^t) + \tau_\ell W(s^t)L(s^t) + \tau_r P(s^t)Y(s^t) + \tau_\Pi \Pi(s^t)$$

- budget constraint

$$(1+i(s^{t-1}))B(s^{t-1}) + Z(s^t) + P(s^t)T(s^t) + P(s^t)G(s_t) \leq B(s^t) + \sum_{s^{t+1}|s^t} Q(s^{t+1}|s^t)Z(s^{t+1}) + \mathcal{T}(s^t)$$

- monetary authority directly controls nominal aggregate demand

$$M(s^t) = P(s^t)C(s^t)$$

Nominal Rigidities

Nominal Rigidity = Informational Friction

- Nature draws the aggregate state

$$s_t \in S, \qquad \mu(s^t | s^{t-1})$$

- aggregate state determines

$$A(s_t), G(s_t), (\theta^i(s_t))_{i \in I}$$

- $\kappa \in [0,1)$ of intermediate-good firms, $j \in \mathcal{J}^s \subset \mathcal{J}$, are "inattentive" to the current state

- $1-\kappa$ of intermediate-good firms, $j \in \mathcal{J}^f \subset \mathcal{J}$, are "attentive" to the current state

Nominal Rigidity = Informational Friction

- inattentive, "sticky-price" firms do not observe s_t
  - make their pricing decisions based only on knowledge of past states

$$p_t^s(s^{t-1}), \qquad \forall j \in \mathcal{J}^s$$

- attentive, "flexible-price" firms observe s_t perfectly
  - make their pricing decisions under complete information

$$p_t^f(s^t), \qquad \forall j \in \mathcal{J}^f$$

Feasible Allocations

- allocation

$$x \equiv \{(c^i(s^t), \ell^i(s^t))_{i \in I}, (y^j(s^t), n^j(s^t))_{j \in \mathcal{J}}, C(s^t), G(s_t), Y(s^t), L(s^t)\}_{s^t \in S^t}$$

Definition

An allocation x is feasible if it satisfies technology and resource constraints.

- let $\mathcal{X}$ denote the set of all feasible allocations
- we are interested in allocations $x \in \mathcal{X}$ that can be supported as part of a competitive equilibrium

Equilibrium Definitions

Definition

A sticky-price equilibrium is an allocation x, price system, policy, and financial positions such that:

(i) $p_t^s(s^{t-1})$ is optimal for firms $j \in \mathcal{J}^s$; $p_t^f(s^t)$ is optimal for firms $j \in \mathcal{J}^f$;

(ii) prices and allocations jointly satisfy the CES demand function;

(iii) the allocation and financial asset holdings solve household i's problem, for each $i \in I$;

(iv) the government budget constraint is satisfied;

(v) aggregate nominal demand satisfies $P(s^t)C(s^t) = M(s^t)$;

(vi) markets clear: $C(s^t) + G(s_t) = Y(s^t)$ and $L(s^t) = \int_{j \in J} n^j(s^t)\mathrm{d}j$.

Definition

A flexible-price equilibrium is an allocation x, price system, policy, and financial positions such that:

$p_t^f(s^t)$ is optimal for firms $j \in \mathcal{J}$, and parts (ii)-(vi) of the previous definition hold.

Equilibrium Characterization

The “Fictitious” Representative Household

Lemma

(Werning, 2007) For any equilibrium there exist market weights $\varphi \equiv (\varphi^i)_{i \in I}$ *with* $\varphi^i \geq 0$ *such that*

$$\{c^i(s^t), \ell^i(s^t)\}_{i \in I}$$

solve the following static sub-problem

$$U^m(C(s^t), L(s^t); \varphi) \equiv \max \sum_{i \in I} \varphi^i \pi^i U(c^i(s^t), \ell^i(s^t)/\theta^i(s_t))$$

subject to

$$C(s^t) = \sum_{i \in I} \pi^i c^i(s^t), \qquad \text{and} \qquad L(s^t) = \sum_{i \in I} \pi^i \ell^i(s^t)$$

- the superscript “m” stands for “market”

Equilibrium prices thereby satisfy

$$-\frac{U_L^m(s^t)}{U_C^m(s^t)} = \left(\frac{1-\tau_\ell}{1+\tau_c}\right)\frac{W(s^t)}{P(s^t)}$$

$$\frac{U_C^m(s^t)}{P(s^t)} = \beta(1+i(s^t))\sum_{s^{t+1}|s^t}\mu(s^{t+1}|s^t)\frac{U_C^m(s^{t+1})}{P(s^{t+1})}$$

$$Q(s^{t+1}|s^t) = \beta\mu(s^{t+1}|s^t)\frac{U_C^m(s^{t+1})}{U_C^m(s^t)}\frac{P(s^t)}{P(s^{t+1})}$$

- solution to sub-problem:

$$c^i(s^t) = \omega_C^i(\varphi)C(s^t) \qquad \text{and} \qquad \ell^i(s^t) = \omega_L^i(\varphi, s_t)L(s^t),$$

$$\omega_C^i(\varphi) \equiv \frac{(\varphi^i)^{1/\gamma}}{\sum_{j\in I}\pi^j(\varphi^j)^{1/\gamma}}, \qquad \omega_L^i(\varphi, s_t) \equiv \frac{(\varphi^i)^{-1/\eta}\theta^i(s_t)^{\frac{1+\eta}{\eta}}}{\sum_{k\in I}\pi^k(\varphi^k)^{-1/\eta}\theta^i(s_t)^{\frac{1+\eta}{\eta}}}$$

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$$Q(s^{t+1}|s^t) = \beta\mu(s^{t+1}|s^t)\frac{U_C^m(s^{t+1})}{U_C^m(s^t)}\frac{P(s^t)}{P(s^{t+1})}$$

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Primal approach: implementability conditions

$$\sum_t \sum_{s^t} \beta^t \mu(s^t) \left[U_C^m(s^t) \omega_C^i(\varphi) C(s^t) + U_L^m(s^t) \omega_L^i(\varphi, s_t) L(s^t) \right] \leq U_C^m(s_0) \bar{T}, \quad \forall i \in I$$

$$\bar{T} \equiv \frac{1}{U_C^m(s_0)(1+\tau_c)} \sum_t \sum_{s^t} \beta^t \mu(s^t) U_C^m(s^t) \left[T(s^t) + (1-\tau_\Pi) \frac{\Pi(s^t)}{P(s^t)} \right]$$

- Werning (2007) implementability conditions: one for each type $i \in I$
  - similar to Lucas Stokey (1983) implementability condition for rep household's budget constraint
  - however, unlike Lucas Stokey: existence of lump-sum taxes + multiple household types
  - profits are isomorphic to lump-sum transfers

Firm Optimality

- flex-price firm: price = mark-up over marginal cost

$$p_t^f(s^t) = \left[(1-\tau_r)\left(\frac{\rho-1}{\rho}\right)\right]^{-1}\frac{W(s^t)}{A(s_t)}$$

- sticky-price firm: price = mark-up over expected marginal cost

$$p_t^s(s^{t-1}) = \left[(1-\tau_r)\left(\frac{\rho-1}{\rho}\right)\right]^{-1}\sum_{s^t|s^{t-1}}\left[\frac{W(s^t)}{A(s_t)}\right]q(s^t|s^{t-1})$$

Firm Optimality

- flex-price firm: price = mark-up over marginal cost

$$p_t^f(s^t) = \left[(1-\tau_r)\left(\frac{\rho-1}{\rho}\right)\right]^{-1} \frac{W(s^t)}{A(s_t)}$$

- sticky-price firm: price = mark-up over realized marginal cost, modulo a forecast error

$$p_t^s(s^{t-1}) = \left[(1-\tau_r)\left(\frac{\rho-1}{\rho}\right)\right]^{-1} \varepsilon(s^t)\frac{W(s^t)}{A(s_t)}, \qquad \varepsilon(s^t) \equiv \frac{\sum_{s^t|s^{t-1}} q(s^t|s^{t-1})W(s^t)/A(s_t)}{W(s^t)/A(s_t)}$$

Proposition

A feasible allocation $x \in \mathcal{X}$ *is implementable as a* *flexible-price equilibrium* *iff*

$\exists$ *market weights* $\varphi \equiv (\varphi^i)$ *and constants* $\bar{T} \in \mathbb{R}$ *and* $\chi \in \mathbb{R}_+$*, such that:*

(i) for all $s^t \in S^t$*:*

$$-\frac{U_L^m(s^t)}{U_C^m(s^t)} = \chi A(s_t);$$

(ii) for all $s^t \in S^t$*:*

$$y^j(s^t) = y^k(s^t) \qquad \forall j,k \in \mathcal{J};$$

(iii) for all $i \in I$*:*

$$\sum_t \sum_{s^t} \beta^t \mu(s^t) \left[U_C^m(s^t)\omega_C^i(\varphi)C(s^t) + U_L^m(s^t)\omega_L^i(\varphi, s_t)L(s^t) \right] \leq U_C^m(s_0)\bar{T}.$$

- the labor wedge results from linear tax rates and firm markup

$$\chi \equiv \left(\frac{\rho - 1}{\rho} \right) \frac{(1-\tau_\ell)(1-\tau_r)}{1+\tau_c}$$

Proposition

A feasible allocation $x \in \mathcal{X}$ *is implementable as a sticky-price equilibrium iff* $\exists$ *market weights* $\varphi \equiv (\varphi^i)$, *constants* $\bar{T} \in \mathbb{R}$ *and* $\chi \in \mathbb{R}_+$, *and function* $\varepsilon : S^t \to \mathbb{R}_+$, *such that:*

(i) for all $s^t \in S^t$*:*

$$-\frac{U_L^m(s^t)}{U_C^m(s^t)} = \chi \left[\kappa \varepsilon(s^t)^{1-\rho} + (1-\kappa)\right]^{-\frac{1}{1-\rho}} A(s_t),$$

where $\varepsilon(s^t)$ *is a forecast error;*

(ii) for all $s^t \in S^t$*:*

$$\left.\begin{array}{ll} y^j(s^t) = y^f(s^t), & \forall j \in \mathcal{J}^f \\ y^j(s^t) = y^s(s^t), & \forall j \in \mathcal{J}^s \end{array}\right\} \quad \text{where} \quad \frac{y^s(s^t)}{y^f(s^t)} = \varepsilon(s^t)^{-\rho}$$

(iii) for all $i \in I$*:*

$$\sum_t \sum_{s^t} \beta^t \mu(s^t) \left[U_C^m(s^t)\omega_C^i(\varphi)C(s^t) + U_L^m(s^t)\omega_L^i(\varphi, s_t)L(s^t)\right] \leq U_C^m(s_0)\bar{T}.$$

Lemma

Let $\mathcal{X}^f$ denote the set of flexible-price allocations. Let $\mathcal{X}^s$ denote the set of sticky-price allocations.

$$\mathcal{X}^f \subset \mathcal{X}^s \subset \mathcal{X}.$$

Proof.

Take any $x \in \mathcal{X}^f$. x can be implemented under sticky prices with $\varepsilon(s^t) = 1$ for all $s^t \in S^t$. □

The Ramsey Problem

Utilitarian Welfare Function

- social welfare function with Pareto weights $\lambda^i > 0$

$$\mathcal{U} \equiv \sum_{i \in I} \lambda^i \pi^i \sum_t \sum_{s^t} \beta^t \mu(s^t) U(c^i(s^t), \ell^i(s^t)/\theta^i(s_t))$$

- goal: characterize the social welfare-maximizing allocation $x \in \mathcal{X}^s$

Definition

A Ramsey optimum x^* is an allocation that maximizes welfare subject to

$$x^* \in \mathcal{X}^s.$$

The Relaxed Ramsey Planner

- $\mathcal{X}^s$ is a complicated set

- we first solve an "easier" problem called the "relaxed Ramsey planner problem"
  - we relax all equilibrium conditions (constraints) imposed on $\mathcal{X}^s$
  - except we keep the implementability conditions that ensure budgets are satisfied

Definition

The relaxed set of allocations $\mathcal{X}^R$ is the set of all feasible allocations $x \in \mathcal{X}$ that satisfy, for all $i \in I$:

$$\sum_t \sum_{s^t} \beta^t \mu(s^t) \left[U_C^m(s^t) \omega_C^i(\varphi) C(s^t) + U_L^m(s^t) \omega_L^i(\varphi, s_t) L(s^t) \right] \leq U_C^m(s_0) \bar{T}.$$

A relaxed Ramsey optimum x^{R*} is an allocation that maximizes welfare subject to

$$x^{R*} \in \mathcal{X}^R.$$

- our relaxed Ramsey planner = "Lucas-Stokey-Werning" planner

Corollary

The relaxed set is a strict superset of $\mathcal{X}^s$

$$\mathcal{X}^f \subset \mathcal{X}^s \subset \mathcal{X}^R \subset \mathcal{X}.$$

Why look at the Relaxed Ramsey planner's problem?

- the relaxed set is a strict superset

$$\mathcal{X}^f \subset \mathcal{X}^s \subset \mathcal{X}^R$$

- we will derive sufficient conditions under which

$$x^{R*} \in \mathcal{X}^f$$

  which immediately implies:

$$x^{R*} \in \mathcal{X}^s$$

- under these conditions, x^{R*} solves the (unrelaxed) Ramsey problem!

Relaxed Ramsey Planner's Problem

- let $\pi^i \nu^i$ be the Lagrange multiplier on the implementability condition of type i
- define the pseudo-welfare function by:

$$\mathcal{W}(C,L;\varphi,\nu,\lambda) \equiv \sum_{i\in I} \pi^i \left\{ \lambda^i U^i(\omega_C^i(\varphi)C(s^t), \omega_L^i(\varphi,s_t)L(s^t)) + \nu^i \left[U_C^m(s^t)\omega_C^i(\varphi)C(s^t) + U_L^m(s^t)\omega_L^i(\varphi,s_t)L(s^t) \right] \right\}$$

Relaxed Ramsey Planner's Problem

$$\max_{x,\varphi,\bar{T}} \quad \sum_t \sum_{s^t} \beta^t \mu(s^t) \mathcal{W}(C(s^t),L(s^t);\varphi,\nu,\lambda) - U_C^m(s_0) \sum_{i\in I} \pi^i \nu^i \bar{T}$$

subject to feasibility.

Proposition

The relaxed Ramsey optimum $x^{R*} \in \mathcal{X}^R$ *satisfies*

$$-\frac{\mathcal{W}_L(s^t)}{\mathcal{W}_C(s^t)} = A(s_t), \qquad \forall s^t \in S^t$$

and

$$y^j(s^t) = y^k(s^t) \qquad \forall j,k \in \mathcal{J}, s^t \in S^t$$

- Lucas-Stokey-Werning optimum features zero output dispersion across firms
- preserves Diamond and Mirrlees (1971) production efficiency

When can you implement x^{R*} under flexible prices?

Theorem

If $\exists$ *positive scalars* $(\vartheta^1, \vartheta^2, \ldots \vartheta^I) \in \mathbb{R}^I_+$ *and a function* $\Theta : S \to \mathbb{R}_+$ *such that*

$$\theta^i(s_t) = \vartheta^i \Theta(s_t), \qquad \forall s_t \in S,$$

then

$$x^{R*} \in \mathcal{X}^f.$$

It follows that

$$x^{R*} \in \mathcal{X}^s.$$

On the optimality of implementing flexible-price allocations

- relaxed Ramsey planner uses distortionary taxes to redistribute: $\chi \neq 1$
  - high-skilled, rich households pay more taxes than low-skilled, poor households
  - higher tax rate implies more redistribution (Werning 2007, Correia 2010)
- planner trades-off the benefit of distortionary taxation (redistribution) with cost (efficiency)
- when there are no shocks to the *relative* skill distribution and preferences are homothetic:
  - both the marginal cost & marginal benefit of taxation are invariant to the state
  - it follows that the optimal tax rate is constant, as in Lucas Stokey (1983)
- as a result, optimal level of redistribution is accomplished through the tax system
  - monetary policy implements flexible-price allocations, preserves production efficiency

The (Unrelaxed) Ramsey Problem

Definition

A Ramsey optimum x^* is an allocation that maximizes welfare subject to

$$x^* \in \mathcal{X}^s.$$

Implicit Monetary Wedge

- we define an implicit monetary wedge $1 - \tau_M^*(s^t)$ by

$$-\frac{U_L^m(s^t)}{U_C^m(s^t)} = \chi^*(1 - \tau_M^*(s^t))\frac{Y(s^t)}{L(s^t)}$$

- portion of the labor wedge implemented by monetary policy at the Ramsey optimum

Optimal Monetary Wedge

Theorem

Let $G(s_t) = 0$ *for all* $s_t \in S$. *Let* $\mathcal{I} : S \to \mathbb{R}_+$ *be a function defined by:*

$$\mathcal{I}(s_t) \equiv \frac{\sum_{i \in I} \tilde{\pi}^i (\varphi^i)^{-1/\eta} (\theta^i(s_t))^{\frac{1+\eta}{\eta}}}{\sum_{i \in I} \pi^i (\varphi^i)^{-1/\eta} (\theta^i(s_t))^{\frac{1+\eta}{\eta}}} > 0, \qquad \text{where} \qquad \tilde{\pi}^i \equiv \pi^i \left[\frac{\lambda^i}{\varphi^i} + \nu^i (1+\eta) \right]$$

There exists a threshold $\bar{\mathcal{I}}(s^{t-1}) > 0$ *such that:*

$$\begin{aligned} \tau_M^*(s^t) > 0 \qquad & \text{if and only if} \quad \mathcal{I}(s_t) > \bar{\mathcal{I}}(s^{t-1}), \\ \tau_M^*(s^t) = 0 \qquad & \text{if and only if} \quad \mathcal{I}(s_t) = \bar{\mathcal{I}}(s^{t-1}), \\ \tau_M^*(s^t) < 0 \qquad & \text{if and only if} \quad \mathcal{I}(s_t) < \bar{\mathcal{I}}(s^{t-1}). \end{aligned}$$

- $\mathcal{I}(s_t)$ is a sufficient statistic for labor income inequality in our model

Optimal Monetary Policy: Numerical Illustration

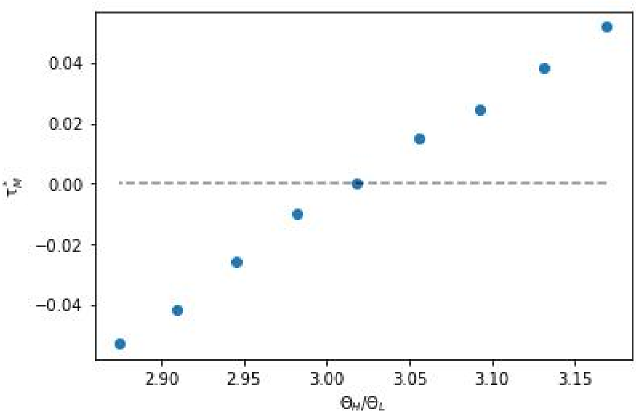

Figure: The optimal monetary tax $\tau_M^*(s^t)$ as a function of $\theta^H(s_t)/\theta^L(s_t)$

Optimal Monetary Policy: Intuition

- $\mathcal{I}(s_t)$ is a sufficient statistic for labor income inequality
- when $\mathcal{I}(s_t)$ increases above $\bar{\mathcal{I}}(s^{t-1})$:
  - marginal benefit of taxation (redistribution) increases
  - marginal cost of taxation (efficiency) remains the same
  - it follows that the optimal tax rate (were it state-contingent) should increase
- it is thus optimal for monetary policy to mimic a higher tax rate
- the monetary authority can do so by targeting a higher markup:

$$\log \mathcal{M}(s^t) \equiv \log P(s^t) - \log(W(s^t)/A(s^t))$$

- higher markup $\rightarrow$ high-skilled, rich households pay more than low-skilled, poor households

Conclusion

- When shocks to the skill distribution are proportional (no movement in *relative* productivities):
  - all redistribution is done via the tax system
  - optimal monetary policy implements flexible-price allocations
  - targets price stability in response to TFP, govt spending, and proportional skill shocks
- When shocks affect relative productivities:
  - tax instruments are insufficient
  - optimal for monetary policy to deviate from implementing flexible-price allocations
  - monetary policy targets a state-contingent markup
  - optimal markup co-varies positively with a sufficient statistic for labor income inequality