Redistribution and the wage-price dynamics: Optimal fiscal and monetary policy

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Introduction

Motivation: Surge in inflation since 2020 partly handled with fiscal tools in Europe (tax shields) – but also more standard monetary tools.

→ **What is the right fiscal-monetary mix to deal with inflation while accounting for distributional issues?**

HANK models: credible setup to analyze these questions. But with rigidities?

- Debate about the "right" rigidity (Auclert et al. 2023a).
- With price rigidity alone: small role for inflation (LeGrand et al. 2023).

→ introduce both *wage* and *price* rigidities.

Introduction

Question: **What is the optimal joint monetary and fiscal policy with a rich set of tools, when both prices and wages are rigid after negative TFP (energy) shock?**

A small literature (with RANK and TANK) mostly.

- Blanchard (1986), Blanchard and Galí (2007a and 2007b).
- Optimal policies in Erceg et al. (2000), Galí (2015, chap. 6), Ascari et al. (2017), Lorenzoni and Werning (2023).

What we do

Theory side.

- Study HANK model with both sticky prices and sticky wages.
- Derive optimal monetary and fiscal policies with many fiscal instruments (see below).
- Compare HANK and RANK.

Quantitative side. Full-fledged quantitative model, with time-varying tax and monetary policy.

- Computation: Factorization of Lagrangian (Marcet & Marimon, 2019 and LeGrand and Ragot, 2022a).
- **Refined truncation** (improving on LeGrand and Ragot, 2022b) to solve for the curse of dimensionality.

What we find

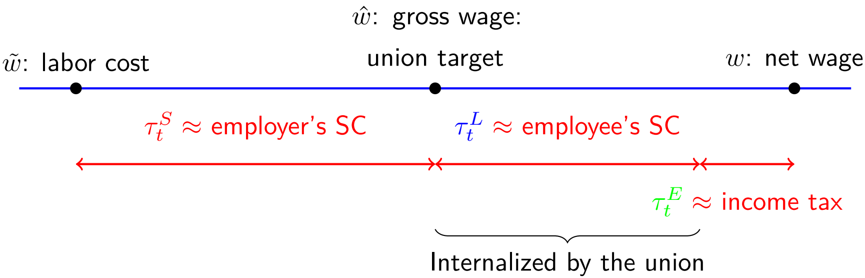
- When the fiscal system is sufficiently rich, we restore price and/or wage stability.

→ Prove equivalence results (in the spirit of Correia et al. 2008-2013 for RA and LeGrand et al. 2022 for HA) but need surprisingly *many* tools.

- Identification of a fiscal instrument that is key for the monetary response: the time-varying social contribution.
    - When *present*, almost price-wage stability.
    - When *absent*, important deviations from price stability + RA $\neq$ HA for policy recommendations.

The Model: Households

- Stochastic idiosyncratic productivity y_t^i, first-order Markov chain (Mitman, Krueger, Perri, 2018). Aggregate TFP shock.
- Separable utility function $u(c) - v(l)$ with constant IES and constant Frisch elast. (Auclert et al., 2023b or Lorenzoni and Werning, 2023).
- Labor unions set the common labor supply L_t.
- **A rich fiscal system:**



$+$ capital tax τ_t^K.

The Model: Households

- agent's choices: consumption $c_{i,t} > 0$ and savings $a_{i,t} \geq 0$.
- agent's budget constraint:

$$c_{i,t} + a_{i,t} = a_{i,t-1} + (1 - \tau_t^E)\left((1 - \hat{\tau}_t^K) \underbrace{\tilde{r}_t a_{i,t-1}}_{\text{capital income}} + (1 - \tau_t^L) \underbrace{\hat{w}_t y_{i,t} L_t}_{\text{labor income}}\right),$$

$$= a_{i,t-1} + (1 - \tau_t^K)\tilde{r}_t a_{i,t-1} + (1 - \tau_t^E)(1 - \tau_t^L)\hat{w}_t y_{i,t} L_t,$$

$$\hat{w}_t = (1 - \tau_t^S) \underbrace{\tilde{w}_t}_{\text{labor cost}} .$$

Sticky wages

Unions bargain for workers, same hours for all workers, Rotemberg adjustment cost for workers, as in Auclert et al. (2023b).

Wage Phillips curve:

$$\pi_t^W(\pi_t^W+1)=\frac{\varepsilon_W}{\psi_W}\left(v'(L_t)-\frac{\varepsilon_W-1}{\varepsilon_W}\frac{w_t}{1-\tau_t^E}\int_i y_{i,t}u'(c_{i,t})\ell(di)\right)L_t,$$
$$+\ \beta\mathbb{E}_t\left[\pi_{t+1}^W(\pi_{t+1}^W+1)\right].$$

- π_t^W: wage inflation;
- ψ_W: cost of wage inflation and $\frac{\varepsilon_W}{\psi_W}$: slope of the Phillips curve.

Sticky prices

Firms produce with labor (CRS) with productivity Z. Rotemberg pricing for firms.

Price Phillips curve:

$$\pi_t^P(1+\pi_t^P) = \frac{\varepsilon_P - 1}{\psi_P}\Big(\frac{w_t}{Z_t(1-\tau_t^E)(1-\tau_t^L)(1-\tau_t^S)} - 1\Big) + \beta\mathbb{E}_t\Big[\pi_{t+1}^P(1+\pi_{t+1}^P)\frac{Y_{t+1}}{Y_t}\Big].$$

- π_t^P: price inflation;
- ψ_P: cost of wage inflation and $\frac{\varepsilon_P-1}{\psi_P}$: slope of the Phillips curve.

Planner

Governmental budget constraint: financing of a public spending stream $(G_t)_t$:

$$G_t + (1+r_t)\int_i a_{i,t-1}\ell(di) + w_t L_t \leq \left(1 - \frac{\psi_P}{2}(\pi_t^P)^2\right) Z_t L_t + \int_i a_{i,t}\ell(di).$$

Objective:

$$\mathbb{E}_0\left[\sum_{t=0}^{\infty}\beta^t \int_i \omega(y_t^i)\left(u(c_t^i) - v(L_t)\right)\ell(di) - \frac{\psi_W}{2}(\pi_t^W)^2\right]$$

- $\omega(y_t^i)$: planner's weights associated to productivity level y_t^i for solving the *inverse optimum taxation problem*, as in Heathcote and Tsujiyama (2021).

The Ramsey problem

max over $(\tau_t^S, \tau_t^E, \tau_t^L, \pi_t^P, \pi_t^W, w_t, r_t, L_t, (c_{i,t}, a_{i,t})_{t\geq 0}$ of

$\mathbb{E}_0\left[\sum_{t=0}^{\infty} \beta^t \int_i \omega(y_t^i)\left(u(c_t^i) - v(L_t)\right)\ell(di) - \frac{\psi_W}{2}(\pi_t^W)^2\right]$ s.t.:

$$G_t + (1+r_t)\int_i a_{i,t-1}\ell(di) + w_t L_t \leq \left(1 - \frac{\psi_P}{2}(\pi_t^P)^2\right) Z_t L_t + \int_i a_{i,t}\ell(di),$$

for all $i \in \mathcal{I}$: $c_{i,t} + a_{i,t} = (1+r_t)a_{i,t-1} + w_t y_{i,t} L_t,$

$$u'(c_{i,t}) = \beta \mathbb{E}_t\left[(1+r_{t+1})u'(c_{i,t+1})\right] + \nu_{i,t},$$

$$\pi_t^W(\pi_t^W + 1) = \frac{\varepsilon_W}{\psi_W}\left(v'(L_t) - \frac{\varepsilon_W - 1}{\varepsilon_W}\frac{w_t}{1-\tau_t^E}\int_i y_{i,t}u'(c_{i,t})\ell(di)\right)L_t + \beta\mathbb{E}_t[\cdots],$$

$$\pi_t^P(1+\pi_t^P) = \frac{\varepsilon_P - 1}{\psi_P}\left(\frac{1}{Z_t}\frac{w_t}{(1-\tau_t^L)(1-\tau_t^S)(1-\tau_t^E)} - 1\right) + \beta\mathbb{E}_t[\cdots],$$

$$(1+\pi_t^W)\frac{w_{t-1}}{(1-\tau_{t-1}^E)(1-\tau_{t-1}^L)} = \frac{w_t}{(1-\tau_t^E)(1-\tau_t^L)}(1+\pi_t^P)$$

Equivalence result

Proposition (An equivalence result)

When all instruments are available, the government implements an allocation with zero inflation for prices and wages in all periods.

- τ_t^E neutralizes the gap between mrs and wage $\rightarrow$ turns off wage Phillips curve.
- τ_t^S neutralizes the gap between mpl and wage $\rightarrow$ turns off price Phillips curve.

$\Rightarrow$ inflation rates can be set to 0.

Remark. It *undoes* the union labor constraint. Higher welfare than in the flex-price allocation with union.

Other results

What about missing instruments?

Instruments	RA	HA
$\tau^L + \tau^S + \tau^E$	$\pi^P = 0$ and $\pi^W = 0$	$\pi^P = 0$ and $\pi^W = 0$
	(First-best)	(optimal labor supply)
$\tau^L + \tau^S$	$\pi^P = 0$ and $\pi^W = 0$	$\pi^P = 0$ and $\pi^W \neq 0$
		("better" than flex P)
τ^L	$\pi^P \neq 0$ and $\pi^W = 0$	$\pi^P \neq 0$ and $\pi^W \neq 0$

- Compared to price rigidity only (Le Grand et al, 2022): $+1$ friction (sticky wages) but $+2$ tools to restore price-wage stability.
- When removing τ^E: flex-price allocation can be implemented but τ^S is used to partly undo the union labor constraint.
- Missing fiscal tools: Deviation from price-wage stability, but precise quantification is needed to assess the importance of fiscal tools.

Quantitative exercise: the numerical method

Three aspects of the method:

1. The reformulation: Lagrangian Approach (Marcet and Marimon, 2019; Le Grand and Ragot, 2022; Acikgoz et al. 2022).
   - Introduce Lagrange multipliers λ_t^i on Euler equations. $\lambda_t^i = 0$ if credit constraints bind for agents i.
   - Introduce Lagrange μ_t on the budget of the state.
   - Rearrange the Lagrangian before taking the first-order conditions.
2. Simulate the FOCs of the planner: Truncation methods.
3. Compute the weights by solving inverse optimum taxation problem, i.e., such that the actual fiscal system is optimal at the steady state.

Calibration

Parameter	Description	Value
	Preference and technology	
β	Discount factor	0.99
σ	Curvature utility	2
$\bar{a}$	Credit limit	0
χ	Scaling param. labor supply	0.11
φ	Frisch elasticity labor supply	0.5
	Shock process	
ρ_y	Autocorrelation idio. income	0.993
σ_y	Standard dev. idio. income	6%
	Tax system	
τ^L	Labor tax	25%
τ^S	Labor subsidy	0%
	Monetary parameters	
$(\varepsilon_p - 1)/\psi_p$	Price Phillips slope	5%
ε_w/ψ_w	Wage Phillips slope	5%
ε_p	Elasticity of sub. between goods	7
ε_w	Elasticity of sub. labor inputs	31

Quantitative assessment

Key instrument: time-varying wage tax τ_t^S.

In the *presence* of τ_t^S:

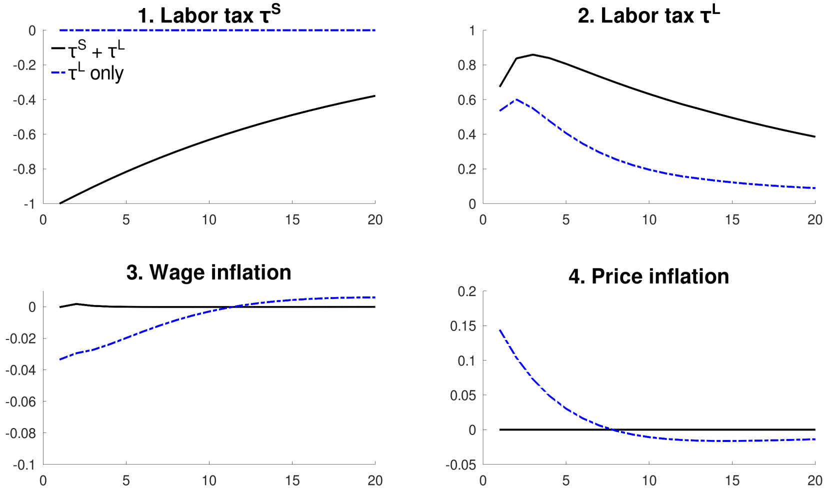
- small deviation from price-wage stability;
- quantitatively close predictions in HA and RA economies.

In the *absence* of τ_t^S:

- sizable deviation from price-wage stability + (small) drop in consumption.
- Optimal policies quantitatively differ in RA and HA economies.

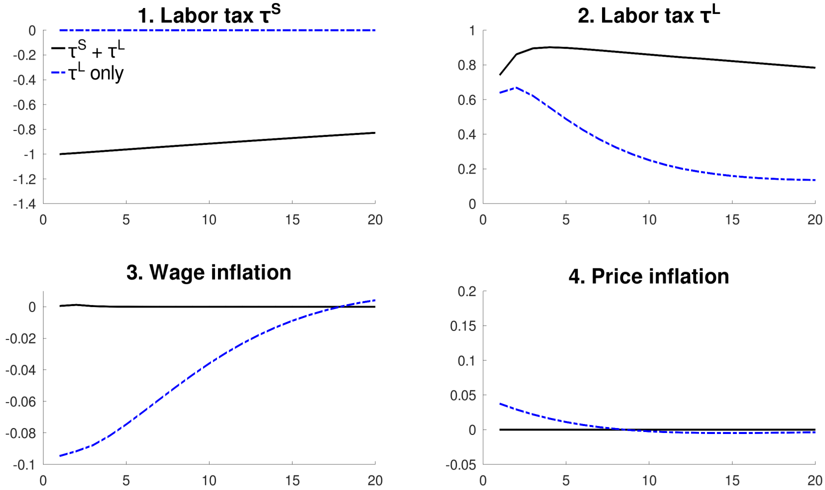
$\Rightarrow$ Relevant for fiscal and monetary policy making?

Simulation: Benchmark (0.95 persistence)



Simulation: Higher persistence (0.99)

Simulation: Role of Phillips curve slopes



Quantitative assessment (bis)

- Higher persistence increases the inflation responses (both for price and wage),...
- ...and makes the lack of τ_t^S costlier.
- Lowering the cost of wage inflation / increasing the cost of price inflation raises wage inflation and lowers price inflation, ...
- ...and makes the lack of τ_t^S cheaper.

$\rightarrow$ Easier to substitute wage inflation to τ_t^S.

Conclusion

- Possible new identification of stabilization tools.
- Sticky prices + wages HANK may be a relevant environment.
- More to come on the quantitative side.