Managing Aggregate Demand with Consumption Taxes

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    Dot-com Recession: Defense spending, Economic Growth & Tax Relief Reconciliation Act (2001)

    Great Recession: Economic Stimulus Act (2008), American Recovery and Reinvestment Act (2009)

    Covid Recession: Coronavirus Aid, Relief, and Economic Security (2020)

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  - Transfers better for welfare, but multiplier $\approx$ MPC on impact

    Kaplan & Violante (2014), McKay & Wolf (2025), Ferriere & Navarro (2025), Ramey (2025), ...

Policy Proposal

- Alternative instrument: Consumption taxes
  - Used in some countries: UK 2009, Germany 2020
  - Proposed in the policy debate

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  - Effectiveness: Stimulates GDP as much as G
    - Novel theoretical equivalence result
  - Welfare: Crowds in private rather than public consumption
    - With additional distributional gains if recessions affect households unequally (Welfare^2)

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  - Quantitative evaluation of τ^c to stabilize the economy
  - Multipliers (starting from steady state)

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- Theoretical equivalence in the simplest possible setup
- Standard HANK model with an Okun's law
  - Quantitative evaluation of τ^c to stabilize the economy
  - Multipliers (starting from steady state)
  - Demand-driven recessions
    - Optimal systematic variation of consumption taxes with the business cycle

Literature

- Effects of monetary policy and government spending in HANK models

  Kaplan, Moll, and Violante (2018), Hagedorn, Manovskii, and Mitman (2019), Bilbiie (2020), Auclert, Rognlie, and Straub (2023), Ferriere and Navarro (2024), Alves and Violante (2023)

- Optimal fiscal and monetary policy in HANK

  Bhandari, Evans, Golosov, and Sargent (2021), Le Grand and Ragot (2024), McKay and Wolf (2023)
  Broer, Druedahl, Harmenberg, and Oberg (2025), Le Grand, Ragot and Bourany (2025)

- Stabilization and consumption taxes in HANK

  Parodi (2024), Bachmann, Born, Goldfayn-Frank, Kocharkov, Luetticke, & Weber (2025), Bartal & Becard (2025)

- Equivalence results in HANK

  Correia, Nicolini & Teles (2008), Correia, Farhi, Nicolini & Teles (2013), Seidl & Seyrich (2023), Wolf (2024), Wolf (2025)

- Evidence on consumption tax cuts

  Blundell (2009), Benzarti, Carloni, Harju, & Kosonen (2020), Bachmann et al. (2025)

A Theoretical Equivalence

The Simplest Model

- RBC model with no capital, no heterogeneity
- Representative household
  - Values consumption C_t and leisure $1 - N_t$
  - Can save in a risk-free bond A_t
- Representative competitive firm
  - Hires labor in a competitive labor market to produce output Y_t
- Government has to finance public good G_t
  - Uses labor and consumption taxes τ_t^n and τ_t^c
  - Issues public debt $B_t = A_t$ in equilibrium
- Prices: (r_t, w_t) the interest rate and the net-of-taxes wage

Two Expansions

- From steady state with $\tau^c_{ss} = 0$ (wlog), consider two temporary fiscal expansions.

1. Government spending (expansion) stimulus $\left\{\hat{G}_t\right\}_{t=0}^{T}$
   - Fiscal cost $\hat{F}_t \equiv \hat{G}_t - G$
   - Financed with any policy $\hat{\Pi}_t \equiv \left(\hat{\tau}^n_t, \hat{B}_t\right)$ converging back to steady state
   - Output & after-tax prices $\hat{X}_t \equiv \left(\hat{Y}_t, \hat{r}_t, \hat{w}_t\right)$ and consumption $\hat{C}_t$

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2. Consumption tax (cut) stimulus $\left\{\bar{\tau}^c_t < \tau^c_{ss} = 0\right\}_{t=0}^{T}$
   - Fiscal cost $\bar{F}_t \equiv -\bar{\tau}^c_t \bar{C}_t$ with policy $\bar{\Pi}_t \equiv (\bar{\tau}^n_t, \bar{B}_t)$
   - Output & after-tax prices $\bar{X}_t \equiv (\bar{Y}_t, \bar{r}_t, \bar{w}_t)$ and consumption $\bar{C}_t$

Equivalence Result

- **Assumption:** Assume log-separable preferences $U(c, n) = \log c - v(n)$.
- **Proposition:** Let the two policies be identical $\bar{\Pi}_t = \bar{\Pi}_t \ \forall t$. Then,
  - The equilibrium $\bar{\tau}_t^c$ is such that $\hat{F}_t = \bar{F}_t \ \forall t$;
  - Output and after-tax prices are identical: $\bar{X}_t = \bar{X}_t \ \forall t$;
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  ◦ The consumption tax cut that replicates the spending stimulus is given by:

$$\bar{\tau}_t^c = -\frac{\hat{G}_t - G}{\bar{C}_t} = \left(1 + \frac{\hat{G}_t - G}{\hat{C}_t}\right)^{-1} - 1$$

Intuition The log case

- A recursive formulation of the household problem reads:

$$V_t(A_t) = \max_{C_t, N_t, A_{t+1}} \{\log(C_t) - v(N_t) + \beta V_{t+1}(A_{t+1})\} \text{ s.t.}$$

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  - Consistent with firms decisions
  - Consistent with government's budget constraint as identical cost
  - Consistent with market clearing if and only if $\bar{C}_t = \hat{C}_t + \left(\hat{G}_t - G\right)$

Extending the Equivalence

- Works with aggregate shocks and non-zero consumption tax
  - Let X_t denote a variable in t in absence of fiscal stimulus;
  - Fiscal costs defined as:
    $\hat{F}_t \equiv (\hat{G}_t - G_t) - \tau_t^c(\hat{C}_t - C_t)$ and $\bar{F}_t \equiv -(\bar{\tau}_t^c - \tau_t^c)\bar{C}_t - \tau_t^c(\bar{C}_t - C_t)$
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- **Equivalence** of any $\{\tilde{G}_t, \tilde{\tau}_t^c\}$ that deliver the same fiscal cost:

  $\tilde{F}_t \equiv (\tilde{G}_t - G_t) - (\tilde{\tau}_t^c - \tau_t^c)\tilde{C}_t - \tau_t^c(\tilde{C}_t - C_t)$

  - Finance spending shock with consumption taxes $\Rightarrow$ multiplier $= 0$

Robustness

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  - Capital in the production function
  - Heterogeneous agents
  - Various labor supply arrangements (extensive margin)
  - Nominal rigidities: sticky prices, sticky wages

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    + Static response: wealth effects, MPE, labor supply elasticity (lotteries, ...)
    + Dynamic response: response of savings to changes in interest rates (UK mortgages, ...)

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- Heterogeneous goods?

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  - Seidl & Seyrich (2023): Extension in HANK
    - Requires additional adjustment in public debt; Holds in the cross-section
  - Wolf (2025): Equivalence of monetary policy with transfers
    - Holds for aggregates in a HANK with sticky wages and labor unions

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  - Conditions under which changes in private spending $\Leftrightarrow$ changes in public spending
    - Same path for aggregate demand
    - Same path of future taxes
  - Application: $G \Leftrightarrow T$
    - Same labor supply response: no wealth effects in labor supply, or fully demand-determined employment

Environment

A HANK model with some twists

- Households
  - Bond economy with borrowing constraint
  - Stochastic discount factors
  - Idiosyncratic labor productivity shocks + unemployment shocks

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- Government
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- Two labor market arrangements
  - Sticky prices and indivisible labor supply
  - Sticky wages and homogenous divisible labor supply

Households Working households

- Individual state: asset a, discount factor β, productivity x, and employment $\eta \in \{\ell, u\}$

- Value function when employment "island" $\eta = \ell$

$$V_t(a, x, \ell, \beta) = \max_{c,h,a'} \left\{ \log c - B\frac{h^{1+\varphi}}{1+\varphi} + \beta \mathbb{E}_t \left[V_{t+1}(a', x', \eta', \beta') | x, \beta, \ell) \right] \right\} \quad \text{s.t.}$$

$$c + a' = a + y^\ell + y^k - \mathcal{T}_t(y^\ell, y^k) + T_t + d_t^h(x),$$

$$y^\ell = w_t x h, \quad y^k = r_t a, \quad h \in \{0, \bar{h}\}, \quad a' \geq 0.$$

  - Preference shock on discrete labor choice, distributed Gumbel with variance ρ_h
    - $\rho_h \geq 0$ calibrated to discipline labor elasticities
  - AR(1) process for discount factor, productivity and employment status
  - Flat capital tax τ^k, progressive loglinear labor tax (λ_t, τ^ℓ)

    Heathcote, Storesletten, and Violante (2017)

Households Unemployed households

- Value function when in unemployment "island" $\eta = u$

$$V_t(a, x, u, \beta) = \max_{c,a'} \{\log c + \beta \mathbb{E}_t [V_{t+1}(a', x', \eta', \beta') | x, \beta, u)]\} \quad \text{s.t.}$$

$$c + a' = a + y^k + \mathcal{B}_t(w_t x) - \mathcal{T}_t(0, y^k) + T_t + d_t^h(x),$$

$$y^k = r_t a, \quad a' \geq 0.$$

  – Unemployment benefits function of hourly wage

    Kekre (2022)

$$\mathcal{B}_t(w_t x) = \zeta \min\left(\mathcal{R} w_t x \bar{h}, \overline{ui}\right) + \chi w_t x \bar{h}$$

    + ζ to match fraction of recipients, $\mathcal{R}$ the replacement rate, $\overline{ui}$ the UI cap

    + χ to capture household labor income received while in unemployment

  – AR(1) process for discount factors, productivity and employment status

Firms and Government

- Standard two-layer structure with a final-good producer and intermediate good producers
  - Case 1: Sticky prices a la Rotemberg, individual labor supply decisions at the hh level
  - Case 2: Sticky wages a la Rotemberg, unions & homogenous labor supply

- Monetary authority follows a Taylor rule: $1 + i_t = (1 + \bar{i}) \left(\frac{\Pi_t}{\bar{\Pi}}\right)^{\phi_\Pi}$

- Fiscal authority faces a standard borrowing constraint

$$G_t + (1 + r_t)D_t + T_t + \int \mathcal{B}_t(w_t x) d\mu_t = D_{t+1} + \int \mathcal{T}_t(y_t^\ell, y_t^k) d\mu_t$$

- Fiscal rule with parameter Φ_D for public debt, λ_t clears the budget constraint
  Uhlig (2010)
  - $\Phi_D = 0$ for constant debt, all adjustment in tax level
  - $\Phi_D \to 1$ for constant taxes, all adjustment in debt

Fiscal rule

Calibration Overview

- Quarterly model calibrated to liquid wealth
  - Stochastic β s.t. top-quintile liquid wealth $\approx 90\%$ (SCF)

- Extensive labor supply model: ρ_h to match average annual labor elasticity of ≈ 0.3
  Ferriere and Navarro (2024)
  - Intensive labor supply model: Frisch at $\varphi^{-1} = 0.4$

- Technology: $\varepsilon = 7$, $\Theta = 200 \rightsquigarrow$ Phillips curve slope $\varepsilon/\Theta = 0.035$
  Galí and Gertler (1999)

- Government
  - Standard calibration for taxes and unemployment benefits
  - Automatic responses of inflation and debt: $\Phi_\Pi = 1.5$, $\Phi_D = 0.75$

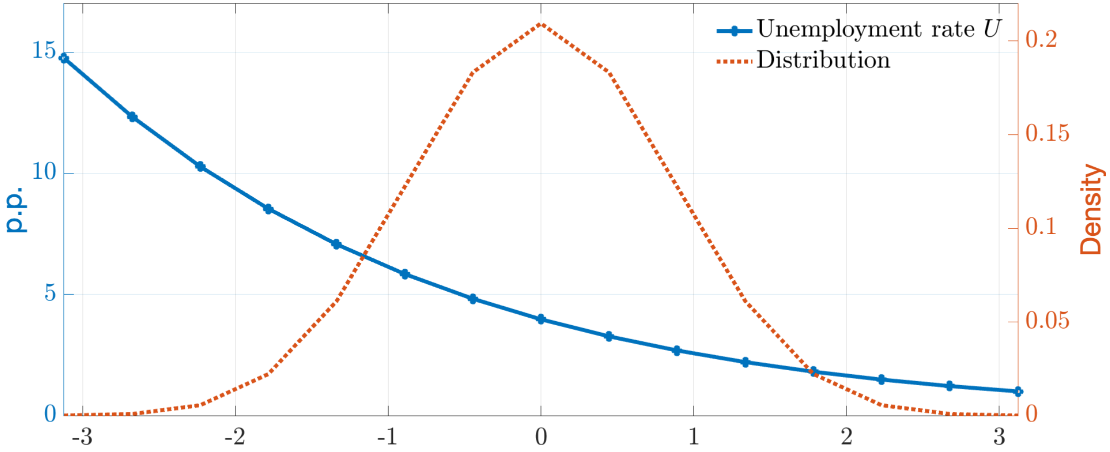
Unemployment Steady State and Business Cycles

- Job finding rates and separation rates across hourly wage distribution
  Mueller (2017)

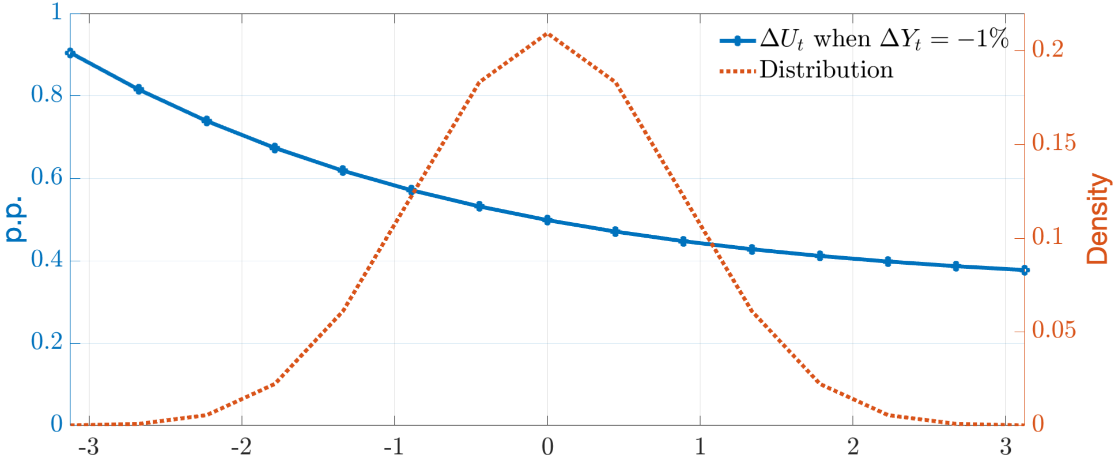
- Steady State
  - Job finding rates constant, separation rates falling in hourly wage/productivity x
  - Average unemployment rate at 4.3%

- Okun's law: Okun coefficient $c_{OK} = 0.5$
  Ball, Leigh, and Loungani (2017)
  - Job finding rates decrease (a lot) equally across households
  - Job separation rates decrease (a bit), higher elasticity for high-x households
    + Functional forms: additive fall in separation rates in recession delivers the pattern

Unemployment Steady State



Unemployment Business Cycles



Investigating the Calibration Household responses

- Marginal propensities to consume (mpc) Parker, Souleles, Johnson, and McClelland (2013), Kaplan and Violante (2014), ...
  - Compute mpc out of a \$500 rebate: average quarterly mpc at 0.13
  - Decline with wealth: from 0.20 to 0.03 from 1st to 4th wealth quartile
  - Larger for unemployed at 0.32, consumption drops by 10% when falling into unemployment Saporta-Eksten (2014), Ganong and Noel (2019)
- Extensive margin: Labor elasticities decline with income Triest (1990), Eissa and Liebman (1996), Kleven and Kreiner (2006), Meghir and Phillips (2010), ...
  - Compute labor responses to a 1% change in after-tax rate: average annual elasticity at 0.30 Erosa, Fuster, and Kambourov (2016)

Income quartile	1	2	3	4
Labor elasticity	0.44	0.34	0.25	0.22

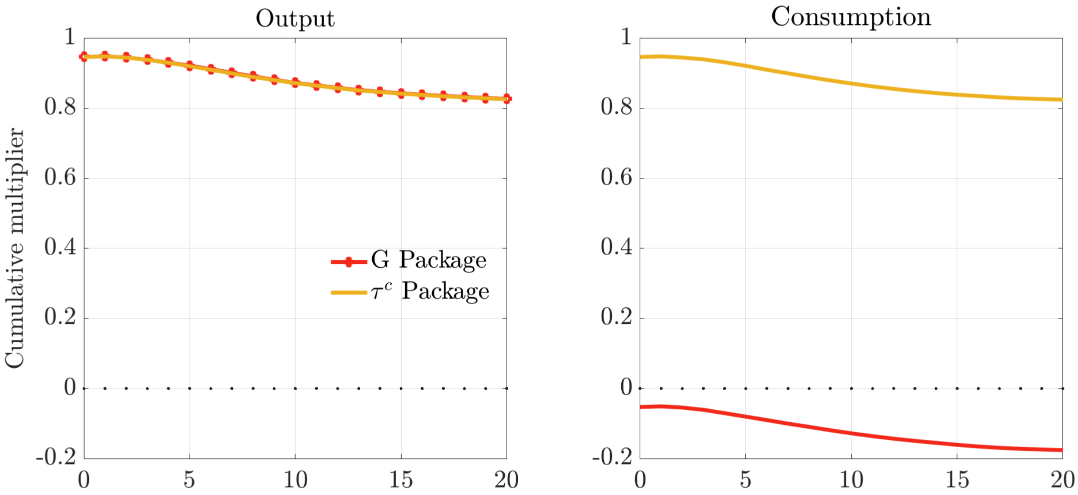
- Intensive margin: similar

Spending, Checks, and Consumption Taxes

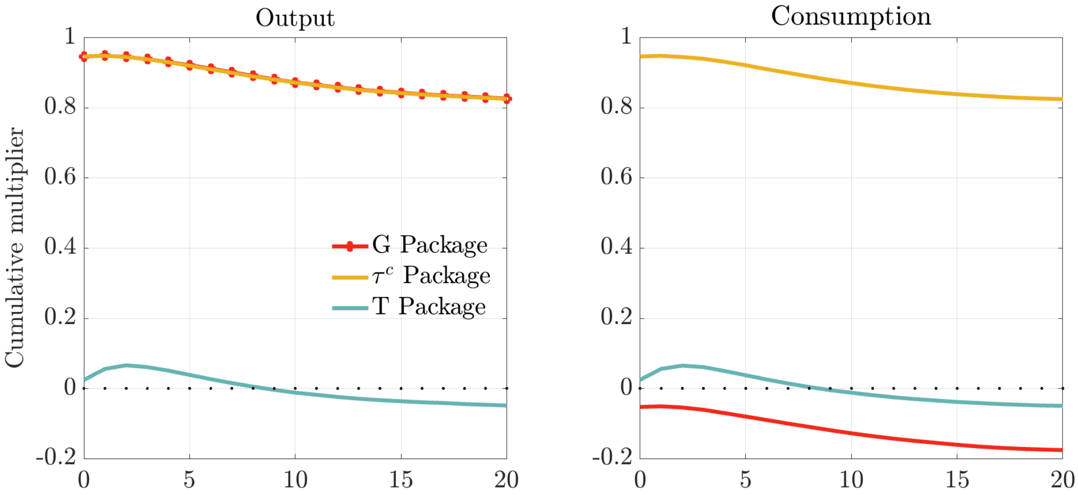
Three Fiscal Packages

- Three packages of equivalent cost
  - Government spending shock with persistence ρ_w
  - Consumption tax cuts with same persistence
  - A *one-time* (for now) lump-sum check to all households
- Two setups
  - Sticky prices/extensive labor supply
  - Sticky wages/homogeneous intensive labor supply

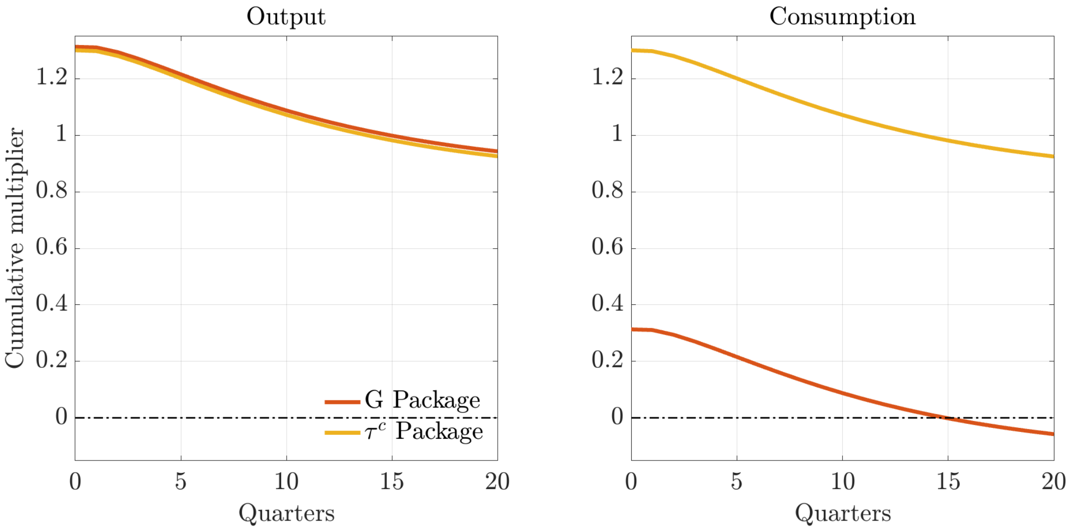
Stabilization Packages Extensive Labor & Sticky Prices



Stabilization Packages Extensive Labor & Sticky Prices



Stabilization Packages Homogenous Intensive Labor & Sticky Wages



Recession

Benchmark No Fiscal Stabilization

- Recession induced by a negative demand shock: $(1 - \omega_t)u(c_t, n_t)$
  - ω_0 such that $\Delta Y_t = -0.1\%$ on impact
  - Reverts to $\omega = 0$ with persistence $\rho_\omega = 0.75$ at the quarterly level
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- Unexpected, transitory, perfect foresight: a 'MIT' shock
- Systematic rule for consumption tax cuts: $\tau_t^c = \tau^c - c^c \Delta Y_t$

Stabilization: A Systematic Rule? Output responses when varying c^c

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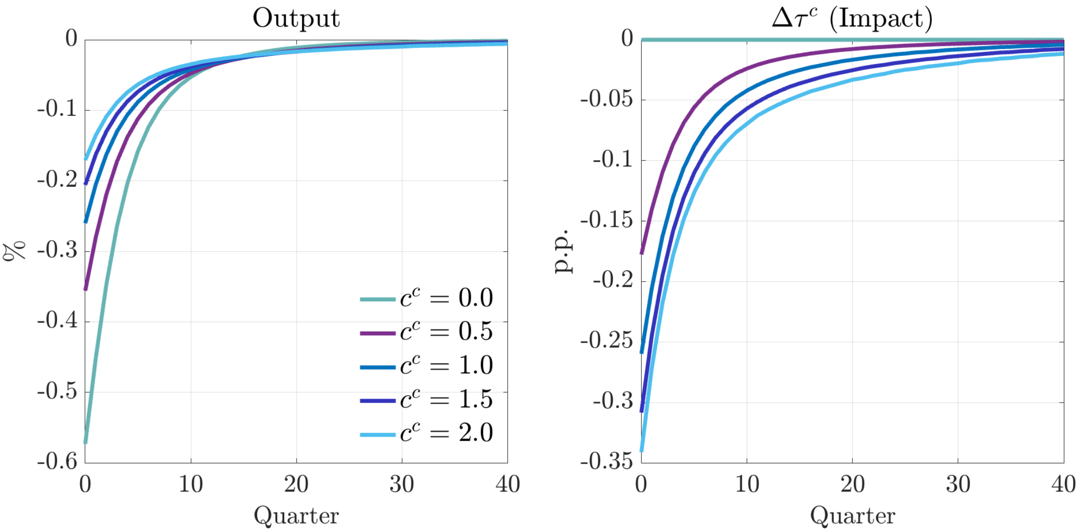
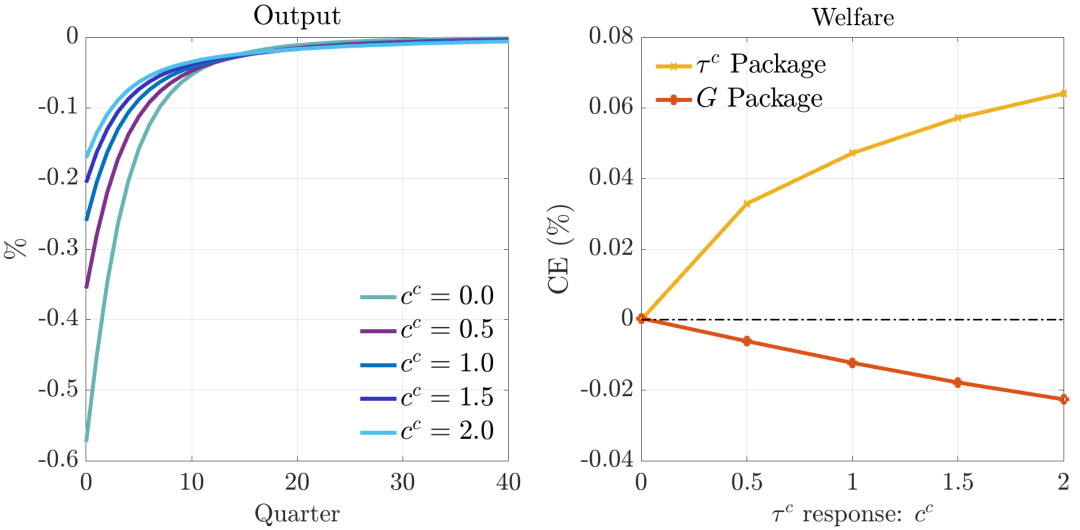


Stabilization: A Systematic Rule? $\tau^c_t = \tau^c - c^c \Delta Y_t$



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  - Easy to implement, high pass-through, salient

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  - Welfare: larger gains when the recession falls more on the poor?
    - Design of Okun's law
  - Aggregate uncertainty

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Thank you!

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Fiscal Rule

- Public debt adjusts as a function of Φ_D

$$D_{t+1} = (1-\phi_D)D + \phi_D \left(\hat{G}_t - \tau^k r_t A_t - \mathcal{R}_t^\ell\right),$$ where

  - $\hat{G}_t$ captures total government expenditures, including debt repayments

    $\hat{G}_t = G_t + T_t + \mathcal{U}_t + (1+r_t)D_t$

  - $\mathcal{R}_t^\ell$ captures fiscal revenues at steady-state labor tax schedule

    $\mathcal{R}_t^\ell = w_t L_t - \lambda \int (w_t x h_t(a,x,\eta,\beta))^{1-\tau^\ell} d\mu_t(a,x,\eta,\beta)$

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Steady State Households

- Quarterly model calibrated to liquid wealth

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- Stochastic $\beta \in \{\bar{\beta} - \Delta,\ \bar{\beta},\ \bar{\beta} + \Delta\}$, duration of 50 years
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  - ρ_h to match average annual labor elasticity of ≈ 0.3
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  Chang and Kim (2007)

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Steady State Firm and government

- Technology: $\varepsilon = 7$, $\Theta = 200 \rightsquigarrow$ Phillips curve slope $\varepsilon/\Theta = 0.035$

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- Dividends redistributed linearly in x: $d_t(x) = \bar{d}_t x$

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  - Automatic responses of inflation and debt: $\Phi_\Pi = 1.5$, $\Phi_D = 0.75$

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Dividends

- Assume dividends linearly distributed on x

$$\delta_t = \sum_x \tilde{\delta}_t(x)\pi(x) = \sum_x \left(\frac{\delta_t}{\mathbb{E}[x]}x\right)\pi(x)$$

  – Minimize wealth effects of fluctuations in dividends

    Farhi and Werning (2020)

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Steady State Unemployment

- Job finding rates and separation rates across hourly wage distribution

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- Average unemployment rate at 4.3% with unequal incidence in the distribution

Return

Unemployment and the Business Cycle

- Okun's law type of relation between output and unemployment
  - Okun coefficient $c^{OK} = 0.5$

    Ball, Leigh, and Loungani (2017)

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Unemployment and the Business Cycle Okun's law

- Finding and separation rates distribution depend on U_t Mueller (2017)
  - Finding rate elasticity decreases homogeneously with ΔY_t

$$\log \pi_{\eta,t}(\ell|u,x) = \log \pi_{\eta}(\ell|u) - \log\left(1 - \bar{\phi}_e \Delta Y_t\right)$$

  - Separation rate elasticity increases with ΔY_t

$$\pi_{\eta,t}(u|\ell,x) = \pi_{\eta}(u|\ell,x) - \bar{\phi}_u \Delta Y_t x^{-\phi_{u,x}}$$

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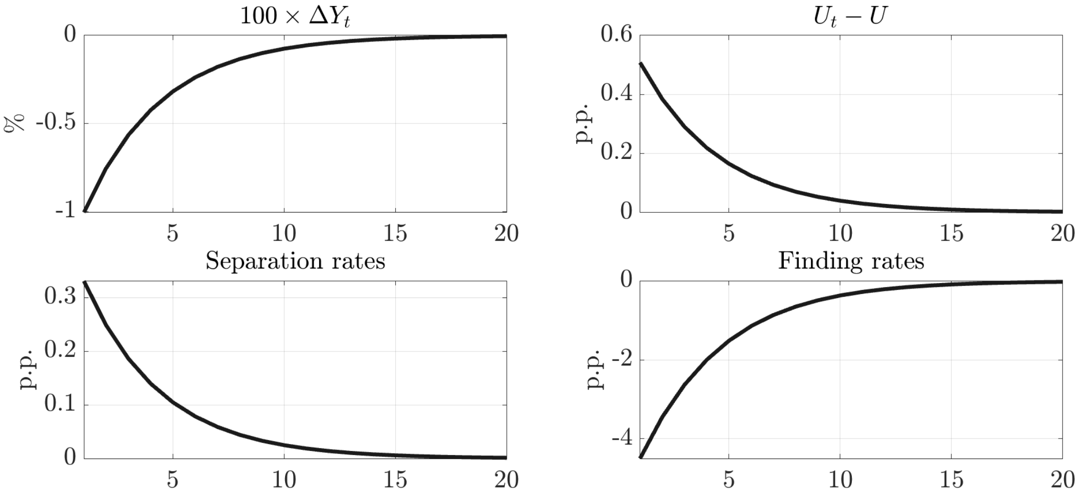
  - Joint calibration:
    - $\bar{\phi}_e$ s.t. finding elasticity to $U \approx -0.6$
    - $\phi_{u,x} = 0$ elasticity of separation rates larger for above-median workers
    - $\bar{\phi}_u = 0.33$ to get $c_{OK} = 0.5$

Return

Unemployment and the Business Cycle **Okun's law**



Return

Labor elasticities Two approaches

- Labor elasticities decline with income
  - Compute labor responses to a temporary tax shock
    Erosa, Fuster, and Kambourov (2016)
    - Annual hours response to a 1% change in after-tax rate for one year
    - Aggregate labor elasticity is 0.30, declining with income
  - Simulate steady-state model annually and run applied-micro regression
    Rogerson and Wallenius (2009), Chang and Kim (2006)
    - Estimate b_1 in $\log h_{in} = b_0 + b_1 \log \tilde{w}_{in} - b_2 \log c_{in} + \varepsilon_{in}$
    - Aggregate labor elasticity is 0.45, declining with income

Income quartile	1	2	3	4
Labor elasticity: tax shock	0.44	0.34	0.25	0.22
Labor elasticity: regression	0.56	0.59	0.50	0.26

Return

Marginal propensities to consume Distribution x wealth

- Marginal propensities to consume decline with wealth

Wealth quartile	1	2	3	4
mpc	0.20	0.15	0.07	0.03

Return

Deeper Recessions **Bigger Fiscal Packages**

- Consider a recession of about 1% on impact – compared to 12bp on impact in the baseline
- Implement fiscal packages costing $\$1500$ per household

Return

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- Consider a recession of about 1% on impact – compared to 12bp on impact in the baseline
- Implement fiscal packages costing $\$1500$ per household
- TT Package in the first quarter: equal to $\$1100$ per month for the bottom 5%, $\$500$ per month for the 5-15%
- TC Package in the first quarter: equal to $\$1100$ per month for the bottom 5%, $\$500$ per month for the 5-15%
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- Multipliers are similar to the baseline

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Robustness Monetary policy: Same real rate

- Fiscal packages affect inflation differently
  - Monetary policy and real rate differ
- Compare packages under benchmark real rate

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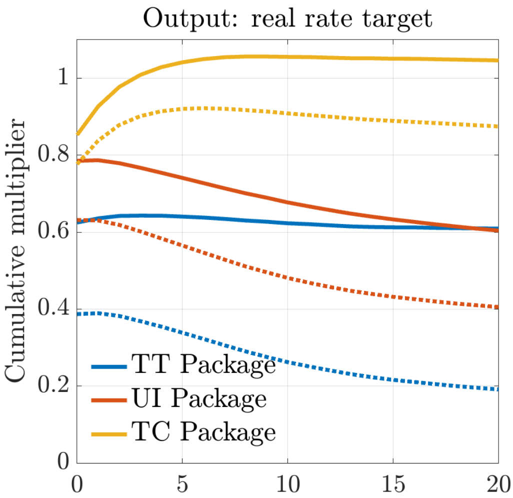
Robustness Monetary policy: Same real rate

- Fiscal packages affect inflation differently
  - Monetary policy and real rate differ
- Compare packages under benchmark real rate
- TC package remains most effective
  - Larger multipliers than with Taylor rule
  - Especially for the TT package, less for the TC package



Return

Robustness More accommodative monetary policy

- Effectiveness of fiscal packages depend on constraints on monetary policy

- Consider a richer Taylor rule:

$$\ln\left(\frac{1+i_{t+1}}{1+\bar{i}}\right) = \Phi_\Pi \ln\left(\frac{\Pi_t}{\bar{\Pi}}\right) + \Phi_Y \ln\left(\frac{Y_t}{\bar{Y}}\right)$$

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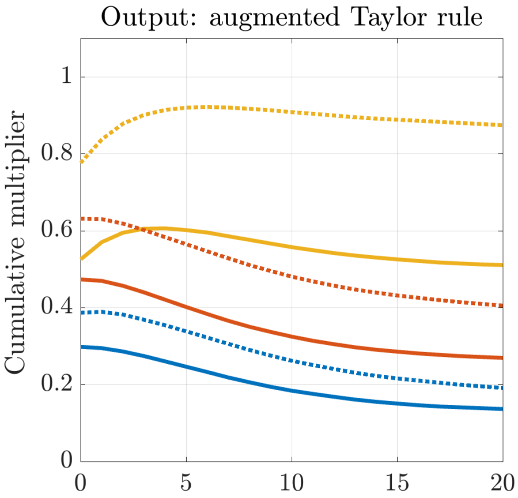
– TC package remains most effective

  – Lower multipliers than with Taylor rule



Return

Robustness Steeper labor elasticities

- Lower variance ρ_h to reach steeper labor elasticities
  - 0.75 at Q1 (regression), 1.1 (tax shock)

Robustness Steeper labor elasticities

- Lower variance ρ_h to reach steeper labor elasticities
  + 0.75 at Q1 (regression), 1.1 (tax shock)
- Closer to evidence on effects of tax shocks
  + Tax multipliers at 1.25 (model) vs. > 2 Mertens and Ravn (2013)
  + Bottom-90 tax cut increases employment by 2.7% (model) vs. 3% Zidar (2019)
- All other targets $\approx$ identical (mpc at 0.10)

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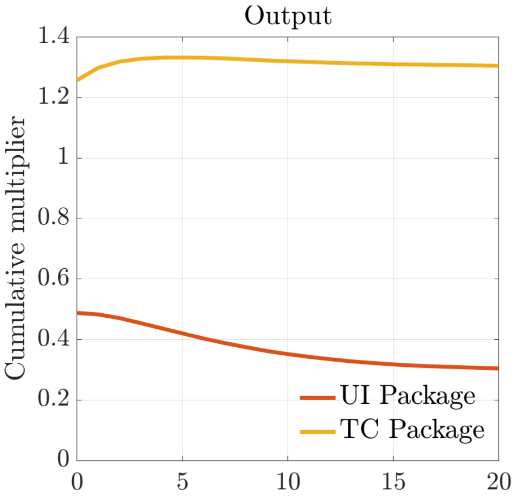
■ TC Package $\Rightarrow$ **large output** multiplier



Return

Robustness Sticky wages

- Alternative modeling of nominal rigidities with sticky wages
  Erceg, Henderson, and Levin (2000) Ferriere and Navarro (2024)
  - Two-layer structure with a labor packer and labor unions

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- Competitive labor packer
  - Produces a final labor bundle combining labor from unions $N_t = \left(\int_0^1 n_{kt}^{\frac{\varepsilon-1}{\varepsilon}} \right)^{\frac{\varepsilon}{\varepsilon-1}}$

  $\Rightarrow$ Implies labor demand $n_{kt}^d = (W_{kt}/W_t)^{-\varepsilon} N_t$, where $W_t = w_t P_t$

- Monopolist labor unions
  - Set wages w_t subject to adjustment cost
  - Hire households labor in a competitive market at wage rate w_t^h

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- Theorem: Under linear labor technology, **equivalence** between price and wage stickiness

Robustness Sticky wages

- Labor union maximization problem

$$J_t^w(W_{kt-1}) = \max_{W_{kt}, n_{kt}} \left\{ d_{kt}^w + \frac{1}{1+r_{t+1}} J_{t+1}^w(W_{kt}) \right\} \quad \text{s.t.}$$

$$d_{kt}^w = \left(\frac{W_{kt}}{P_t} - w_t^h \right) n_{kt} - \Theta_t^w(W_{kt}, W_{kt-1}) - f_w$$

$$n_{kt} = \left(\frac{W_{kt}}{W_t} \right)^{-\varepsilon_w} N_t$$

$$\Theta_t^w(W_{kt}, W_{kt-1}) = \frac{\Theta^w}{2} \left(\frac{W_{kt}}{W_{kt-1}} - \bar{\Pi} \right)^2 N_t$$

$\Rightarrow$ Implies a standard wage Philipps Curve