Fiscal Management of Aggregate Demand: The Effectiveness of Labor Tax Credits

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- A policy-driven approach
  - Quantitative HANK model
  - Effectiveness of various fiscal stabilization packages after a negative demand shock

Framework

- Standard HANK model with three additional components
  - Heterogeneous stochastic discount factors $\rightarrow$ heterogeneous mpc
  - An extensive labor supply margin $\rightarrow$ heterogeneous labor elasticities
  - Unemployment risk of heterogeneous incidence & varying with the cycle

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$\Rightarrow$ Relevant framework to quantify fiscal stabilization packages

- Demand-driven recession
  - Negative shock to marginal utility: unexpected, deterministic, transitory

Fiscal Stabilization Packages

- Three fiscal stabilization packages

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$\Rightarrow$ The TC Package is the most effective to stabilize the economy
  - Output multiplier above 0.9, compared to ≈ 0.6 for UI & 0.4 for TT
  - Despite the larger unemployment risk
  - Operates through both consumption and labor supply

- Robustness and implementability

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- Other fiscal packages: Consumption tax cuts?

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)

- Quantitative effects of UI extensions in recessions
  Mitman and Rabinovich (2015), Kekre (2022), Gorn and Trigari (2024), Bardoczy and Guerreiro (2023), Broer, Druedahl, Harmenberg, and Oberg (2024)

- Optimal fiscal and monetary policy in HANK
  Bhandari, Evans, Golosov, and Sargent (2021), Le Grand and Ragot (2024), McKay and Wolf (2023)

- Stabilization and labor taxes in HANK
  Broer et al. (2025), Le Grand, Ragot and Bourany (2024)

Environment

A HANK model with some twists

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

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- NK block with sticky prices
  - Linear technology in labor
  - Monetary authority implements a standard Taylor rule
- Government
  - Finances spending, transfers, and UI benefits with debt, labor taxes, and capital taxes

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

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

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

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

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  - 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)

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Firms

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- 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

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Calibration

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- Labor supply decisions
  - B to match employment $\approx 78\%$
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- Productivity $(\rho_x, \sigma_x) = (0.989, 0.287)$
  Chang and Kim (2007)

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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    $\chi = 0.15$ to match $C_u/C_e \approx 75\%$
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  - Automatic responses of inflation and debt: $\Phi_\Pi = 1.5$, $\Phi_D = 0.75$

Dividends

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- Job finding rates and separation rates across hourly wage distribution

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  - Monthly separation rates of $\approx 1.4\%$ and 0.7% below and above median, respectively

  $\Rightarrow$ $\pi_\eta(u|\ell, x) = \phi_0 x^{\phi_1}$, with $\phi_0 = 0.029$ and $\phi_1 = -0.446$

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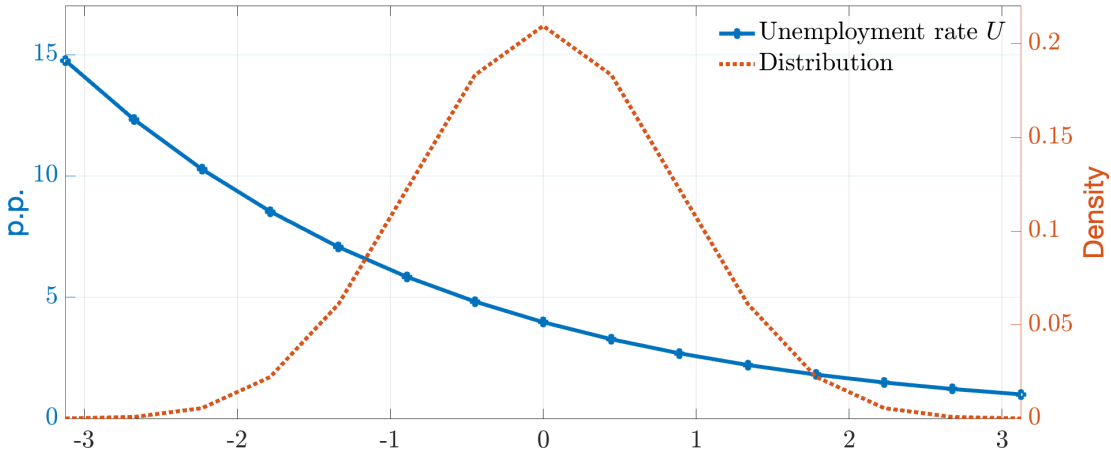
- Average unemployment rate at 4.3% with unequal incidence in the distribution

Steady State Unemployment in the Distribution



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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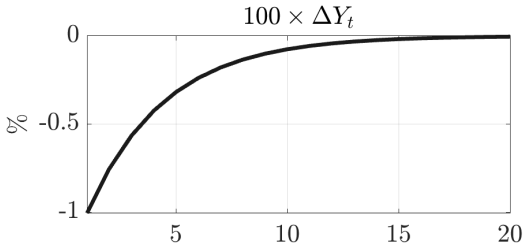
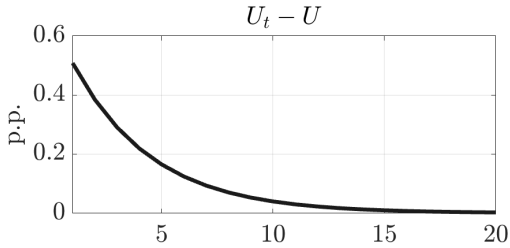
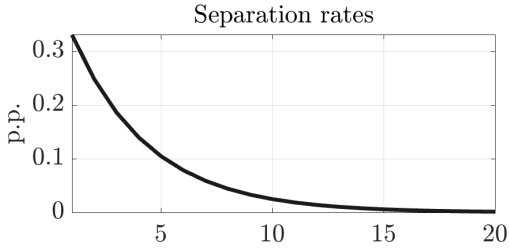
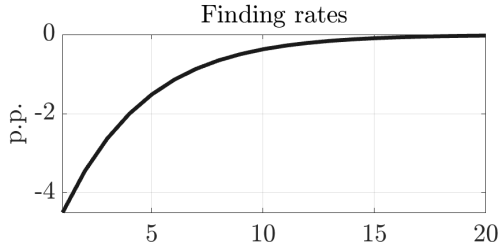
- Job separation rates decrease with ΔY_t
  - *Elasticity* of separation rates to aggregate unemployment larger for above-median workers
    Mueller (2017)
    + Homogeneous additive increase in separation rates

Unemployment and the Business Cycle Okun's law









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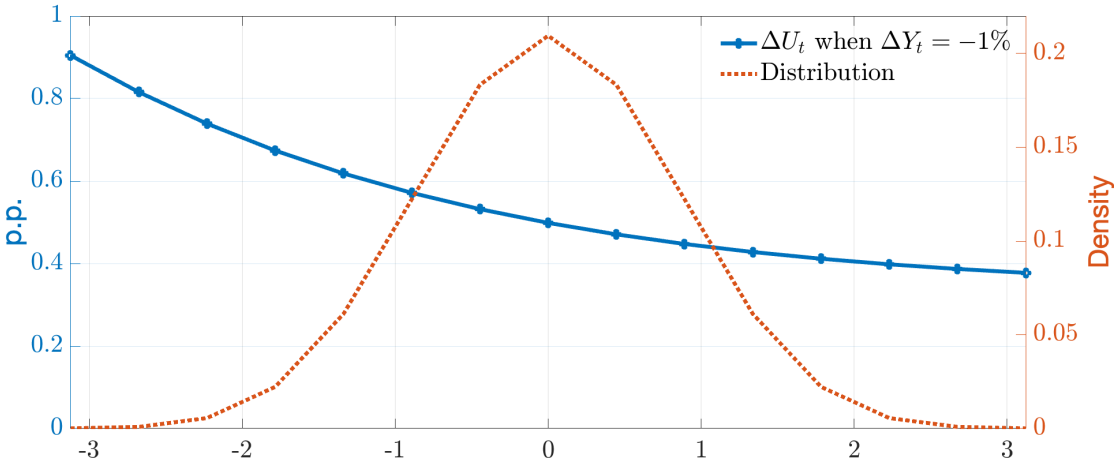

Investigating the Calibration

- Household responses: labor elasticities and MPCs
- Aggregate responses to changes in taxes

Investigating the Calibration **Household responses**

- 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

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- 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)

Micro labor elasticity mpc

Investigating the Calibration Tax shocks

- Further investigate aggregate effects of tax shocks

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- Replicate a tax shock on bottom-90 vs. top-10 as in Zidar (2019)
  - Tax cut on bottom-90 increases employment by 1% in the model vs. above 3% in the data
  - Tax cut on the top-10 has no effects
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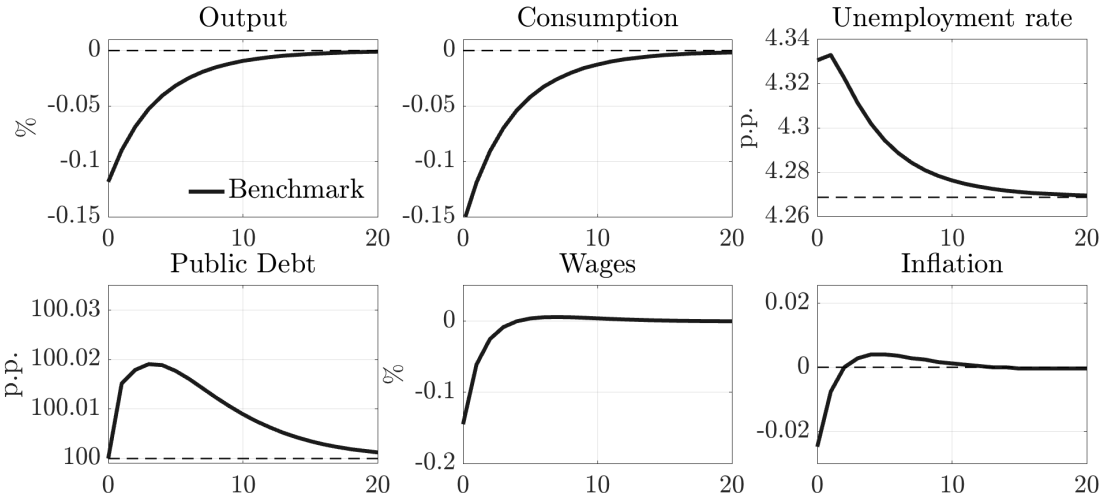
$\Rightarrow$ Conservative calibration regarding tax responses

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
- Unexpected, transitory, perfect foresight: a 'MIT' shock

Benchmark No Fiscal Stabilization



Three Fiscal Stabilization Packages TT Package

- A Targeted Transfer **(TT)** Package
  - Design to mimic checks sent in 2008: For all low-income households, based on last-year income
  - An "automatic stabilizer" flavor: Phase out over time with persistence ρ_ω

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  - Temporary transfer modeled as a logistic function
    Ferriere, Grübener, Navarro, and Vardishvili (2023)

$$\hat{T}_t(y) = m_t \frac{2\exp(-\chi y/\bar{y})}{1+\exp(-\chi y/\bar{y})}, \quad m_t \text{ the transfer at } y=0,\ \chi \text{ the phasing-out speed}$$

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$$\hat{T}_t(y) = m_t \frac{2\exp(-\chi y/\bar{y})}{1+\exp(-\chi y/\bar{y})}, \quad m_t \text{ the transfer at } y=0,\ \chi \text{ the phasing-out speed}$$

    + "Based on last-year income": $\tilde{y}(x,\eta,\beta)$

Three Fiscal Stabilization Packages TT Package

- A Targeted Transfer **(TT)** Package
  - Design to mimic checks sent in 2008: For all low-income households, based on last-year income
  - An "automatic stabilizer" flavor: Phase out over time with persistence ρ_ω
  - Temporary transfer modeled as a logistic function
    Ferriere, Grübener, Navarro, and Vardishvili (2023)

$$\hat{T}_t(y) = m_t \frac{2\exp(-\chi y/\bar{y})}{1+\exp(-\chi y/\bar{y})}, \quad m_t \text{ the transfer at } y=0,\ \chi \text{ the phasing-out speed}$$

    + "Based on last-year income": $\tilde{y}(x,\eta,\beta)$

  - Calibration such that *total cost* equals a one-time check of $\$200$ to all households
    + Initial check at $y=0$ is $m_0 = \$900$
    + Quick phase-out at $\chi = 12$: only 20% households receive more than $\$50$ at $t=0$

Three Fiscal Stabilization Packages UI Package

- A Unemployment Insurance **(UI)** Package
  - A check to all unemployed households, phase out with persistence ρ_ω

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- A Tax Credit **(TC)** Package
  - A check to working low-income households, phase-out over time at rate ρ_ω
    - + Phase out with current labor income $w_t x \bar{h}$
    - + Eligible **only if** $\eta = e$ and $h = \bar{h}$

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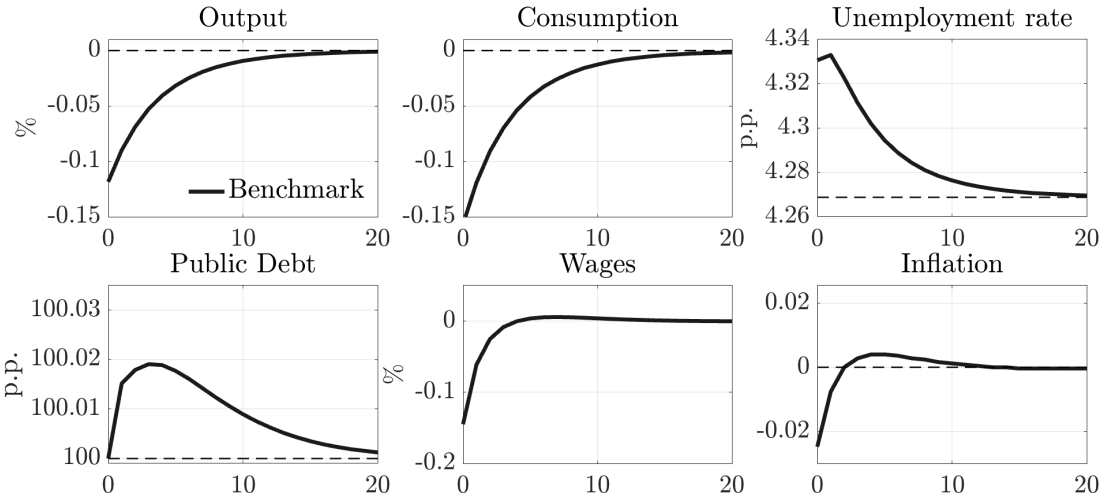
    - + Eligible **only if** $\eta = e$ and $h = \bar{h}$
  - Calibration such that equals a one-time lump-sum check of $\$200$
    - + Initial maximum check of $\$800$, slower phase-out at $\chi = 6$

Stabilization Packages Impulse Response Functions



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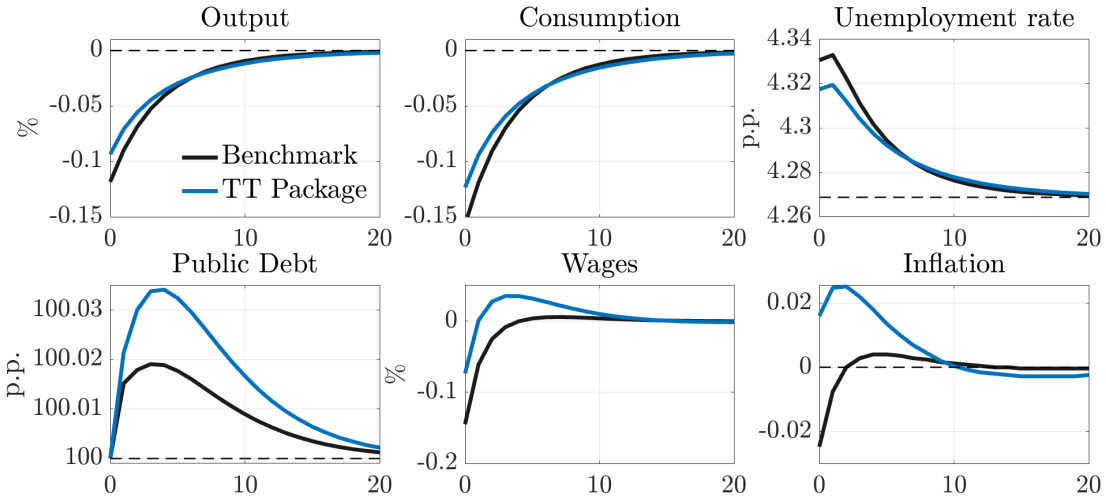

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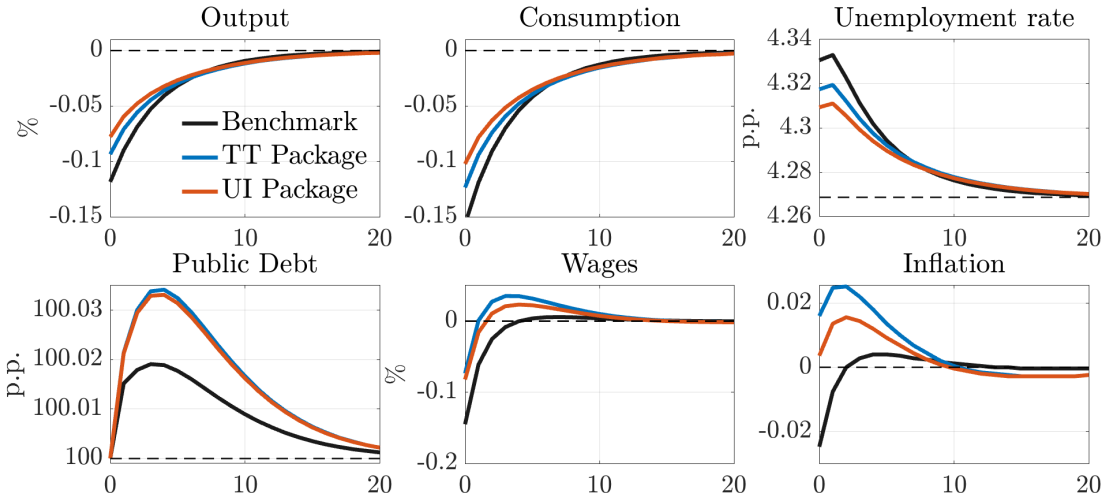

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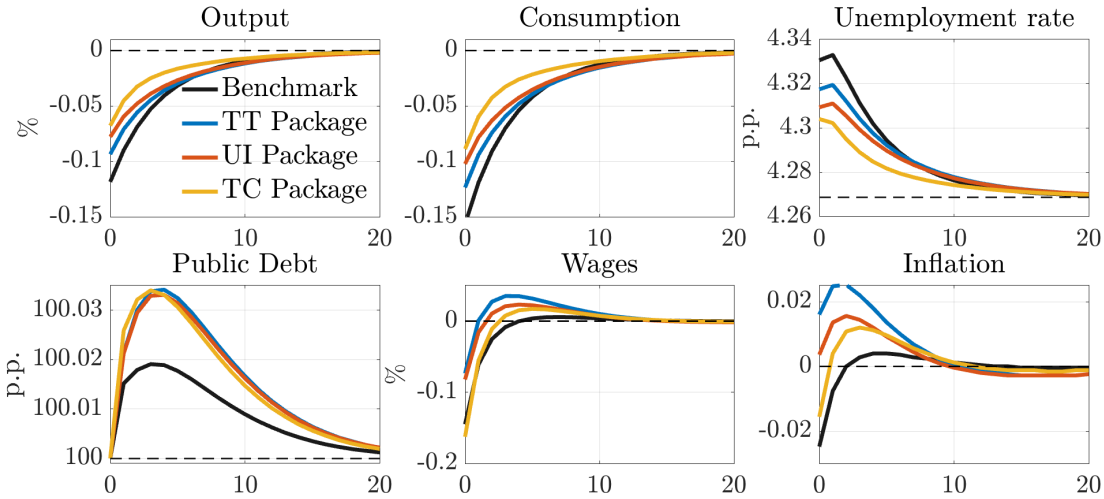
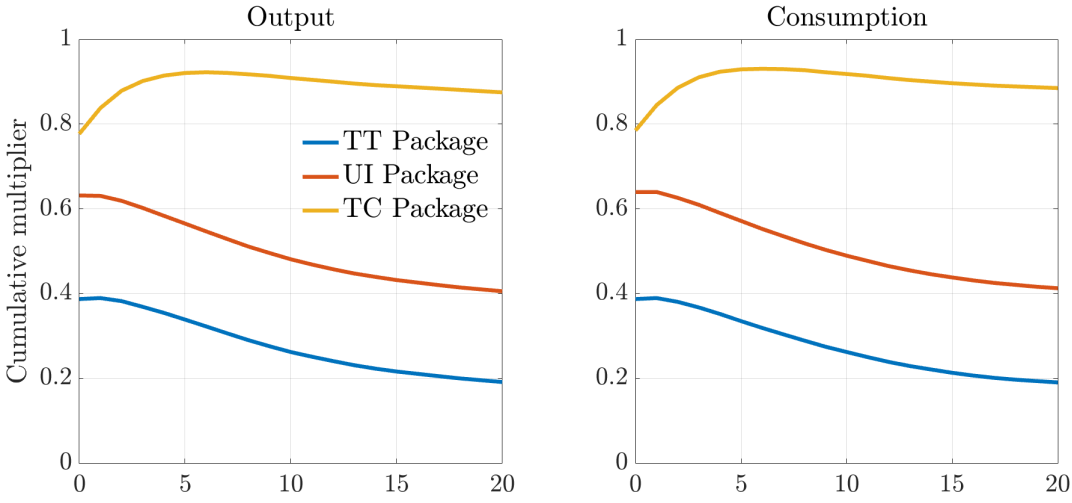


Stabilization Packages Multipliers



Deeper recession

Stabilization Packages Decomposition

- Decomposition between *consumption channel* and *labor channel*

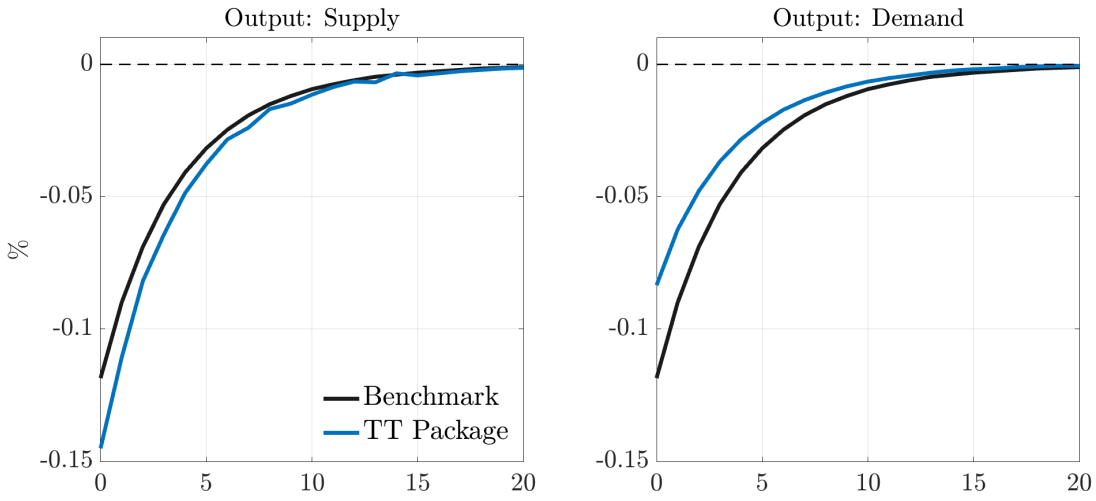
Stabilization Packages Decomposition

- Decomposition between *consumption channel* and *labor channel*
  - Use equilibrium prices and taxes and unemployment risk of the no-stabilization benchmark

$$\{r_t^b, w_t^b, \lambda_t^b, \pi_{\eta,t}^b, d_t^b\}$$

  - Compute for each package TT, UI, TC
    - + Supply output $Y_t^s = L_t$ using households' labor supply policy
    - + Demand output $Y_t^d = C_t + \Theta_t + G_t + f$ using households' consumption policy

Three Fiscal Stabilization Packages Decomposition



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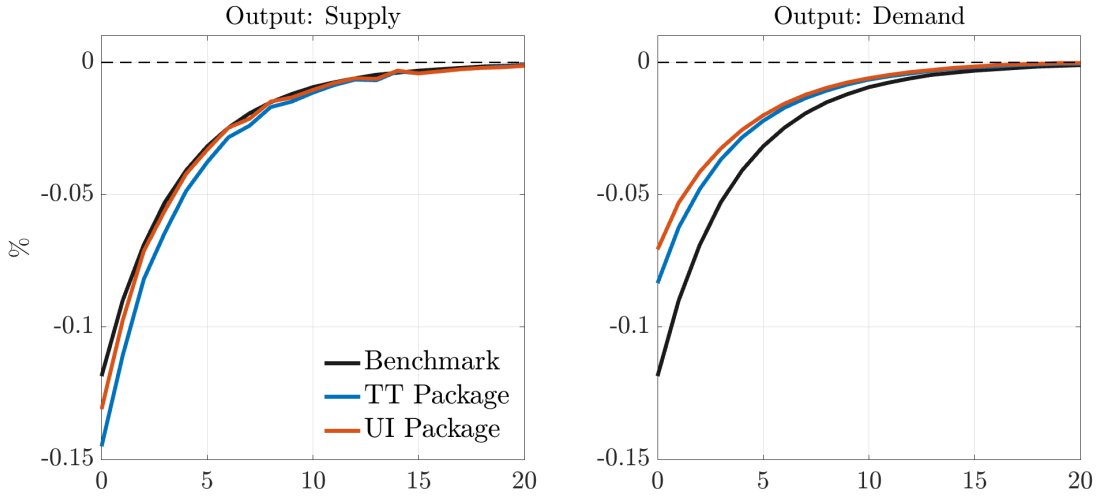

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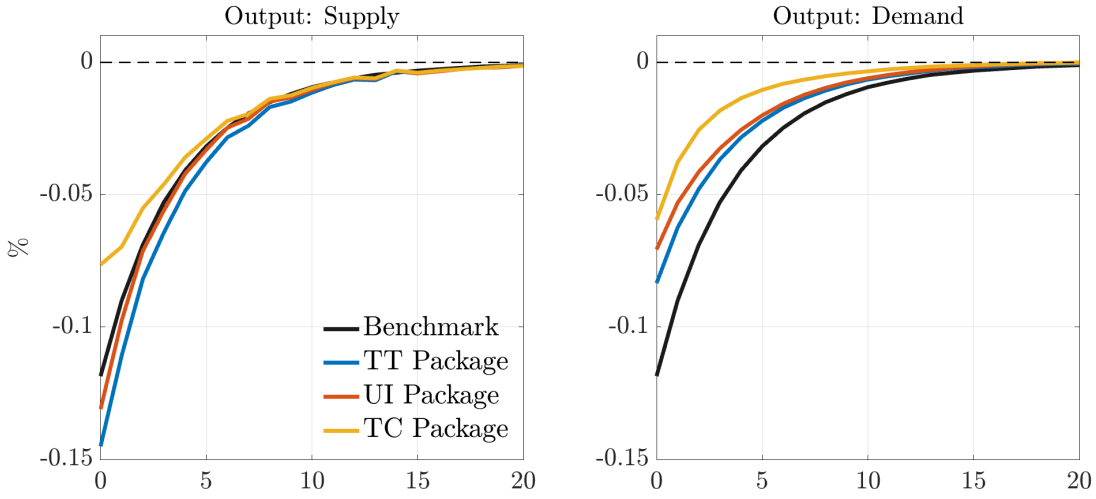

Taking Stock

- Temporary tax credits are an effective fiscal stimulus
  - Implement labor tax cuts targeted to low-income workers
- Caveats on the quantification of the UI package
  - Do not internalize the negative incentive effects on job search [overestimate]
  - Abstracts from heterogeneity between recipients and non-recipients [underestimate]

Investigating the Results

1. Role of public debt
2. Distributional effects across packages
3. Alternative rules for monetary policy
4. Implementability
5. (Deeper recessions)
6. (Steeper elasticities)

1. Role of Public Debt

- Compute benchmark and stabilization output paths with constant debt $\Phi_D = 0$

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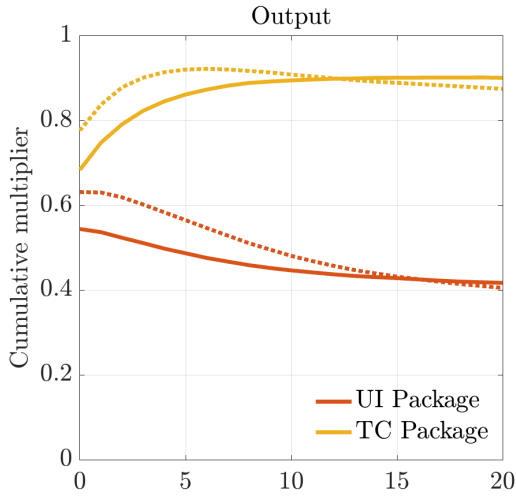
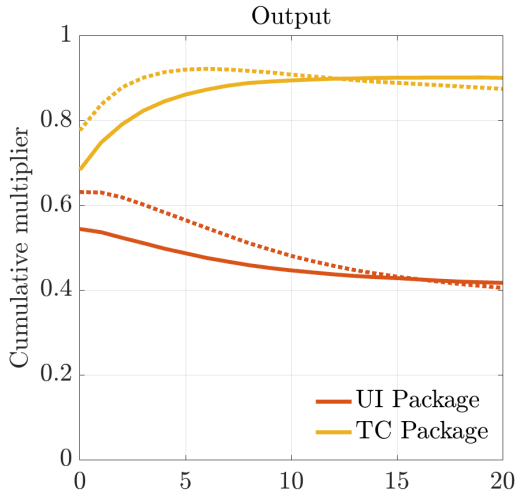


1. Role of Public Debt

- Compute benchmark and stabilization output paths with constant debt $\Phi_D = 0$
- Public debt does help to stabilize
- TC Package No Debt $\equiv$ temporary shock in labor tax progressivity

  $\Rightarrow$ Stabilizes the economy



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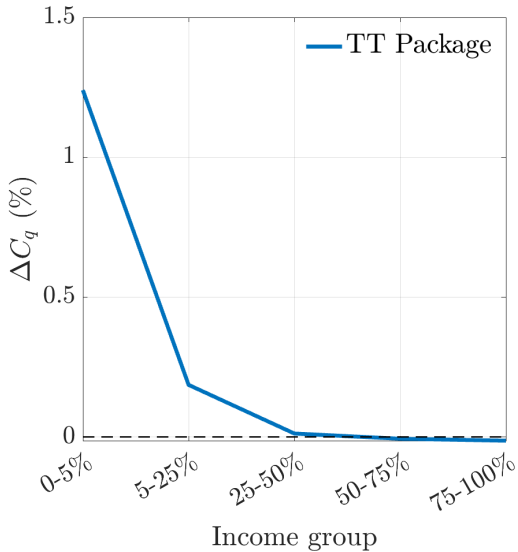

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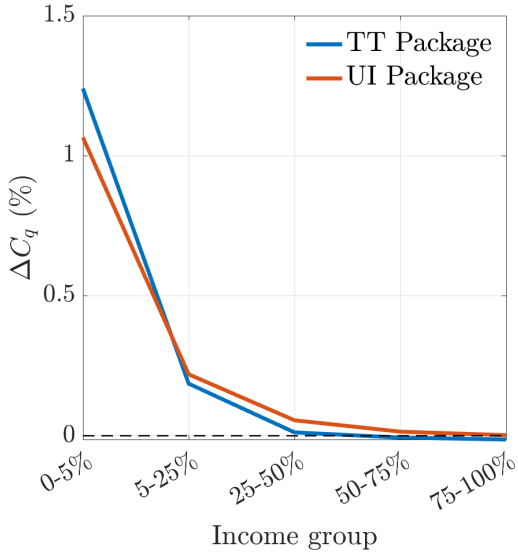
  - Better than UI Package



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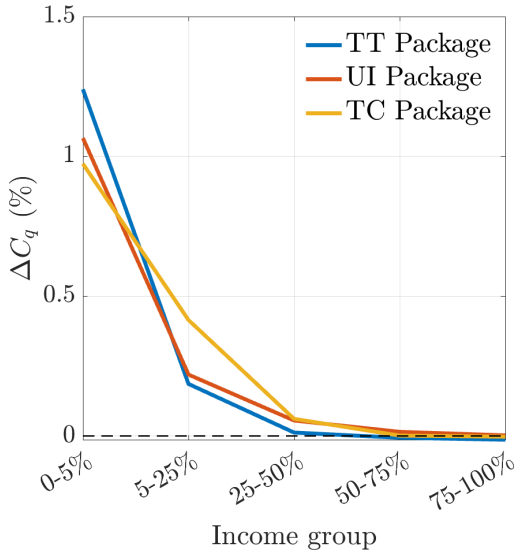

3. Monetary Policy **Identical real rate**

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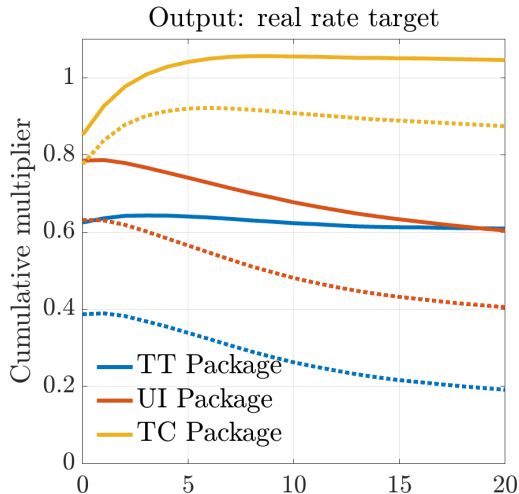
- Compare packages under benchmark real rate
- TC package remains most effective
  - Larger multipliers than with Taylor rule
  - Especially for the TT package, less for the TC package



3. Monetary Policy More accommodative policy rule

- 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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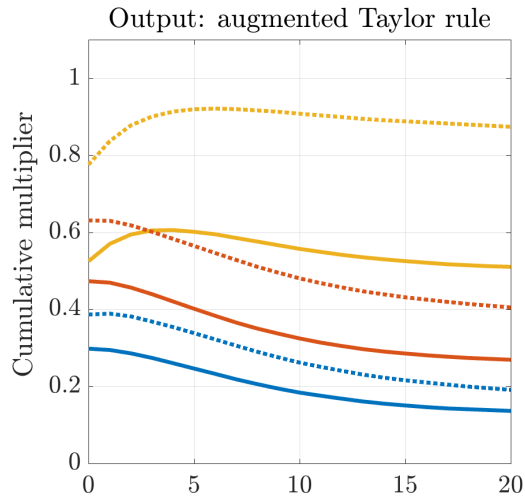
– TC package remains most effective
  – Lower multipliers than with Taylor rule



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  - Transfers are also commonly used
- A systematic response of the EITC could implement the TC package
- Systematic fluctuations in payroll taxes could implement the TC package
  - Easy to implement, would appear on the paycheck of workers every month

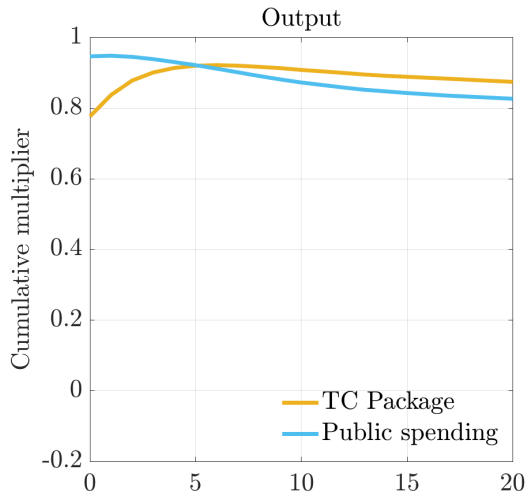
Further Fiscal Packages

- Two other typical fiscal stabilization packages
  - Government spending shock with persistence ρ_w
  - A one-time lump-sum check to all households, of an amount of $\$200$
- Consumption taxes?

Further Fiscal Packages G and T packages

– Public spending generates large output multiplier

  \+ . . . but negative consumption multiplier



Further Fiscal Packages G and T packages

– Public spending generates large output multiplier

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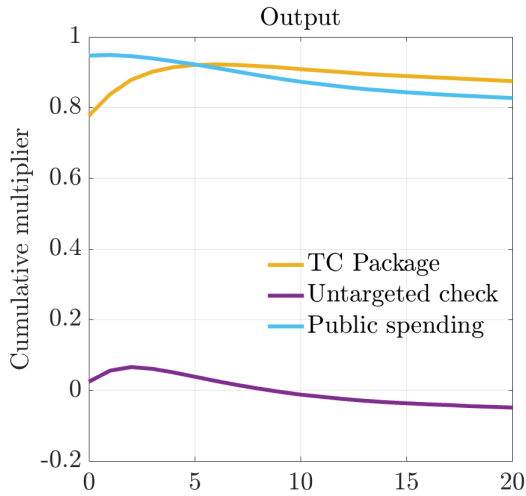
– Lump-sum check has modest stabilization properties



Further Fiscal Packages C package?

- New proposal to use consumption taxes as an automatic stabilizer
  Blanchard (2024)

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- A formal comparison of two fiscal stimulus:
  - A government spending (expansion) stimulus $\{\hat{G}_t\}_{t=0}^{T}$
    - + Fiscal cost $\{R_t^g = \hat{G}_t - G\}_{t=0}^{T}$
    - + Associated paths for allocations and prices: $\{Y_t^g, L_t^g, r_t^g, w_t^g, ...\}_{t=0}^{T}$
  - A consumption tax (cut) stimulus $\{\hat{\tau}_t^c\}_{t=0}^{T}$
    - + Fiscal cost $\{R_t^c = \tau^c C - \hat{\tau}_t^c C_t\}_{t=0}^{T}$
    - + Associated paths for allocations and prices: $\{Y_t^c, L_t^c, r_t^c, w_t^c, ...\}_{t=0}^{T}$

Further Fiscal Packages C package?

Proposition: Assume log separable preferences: $U = \log c - v(n)$.

If two stimulus are such that $R_t^c = R_t^g \ \forall t$, then:

- The paths for output and labor are identical across the two packages :

$$\{Y_t^c, L_t^c\} = \{Y_t^g, L_t^g\}$$

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- The paths for prices (and etc.) are identical across the two packages :

$$\{r_t^c, w_t^c, \Pi_t^c, d_t^c, \lambda_t^c, D_t^c\} = \{r_t^g, w_t^g, \Pi_t^g, d_t^g, \lambda_t^g, D_t^g\}$$

- The paths for consumption compare as follows:

$$C_t^c + G_t^c = C_t^g + G_t^g$$

Further Fiscal Packages Intuition

- With log preferences, using the budget constraint

$$(1+\tau_t^c)c + a' = y_t^\ell + y_t^k - \mathcal{T}_t + d_t + ...$$

to replace c in the household's problem delivers

$$V_t(a,x,.) = \max_{h,a'} \left\{ \log\left(y_t^\ell + y_t^k - \mathcal{T}_t + d_t + ... - a'\right) - Bh + \beta \mathbb{E}_t V_{t+1}(a',x',.) \right\} - \log(1+\tau_t^c)$$

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  - Consider household & firm decisions and prices & taxes for the G-stimulus
  - Consistent with households decisions for $\{h, a'\}$ in the C-stimulus as independent of τ_t^c
  - Consistent with firms decisions
  - Consistent with government's budget constraint if identical cost
  - Consistent with market clearing if and only if $C_t^c = C_t^g + (G_t^g - G_t^c)$

Further Fiscal Packages **Intuition**

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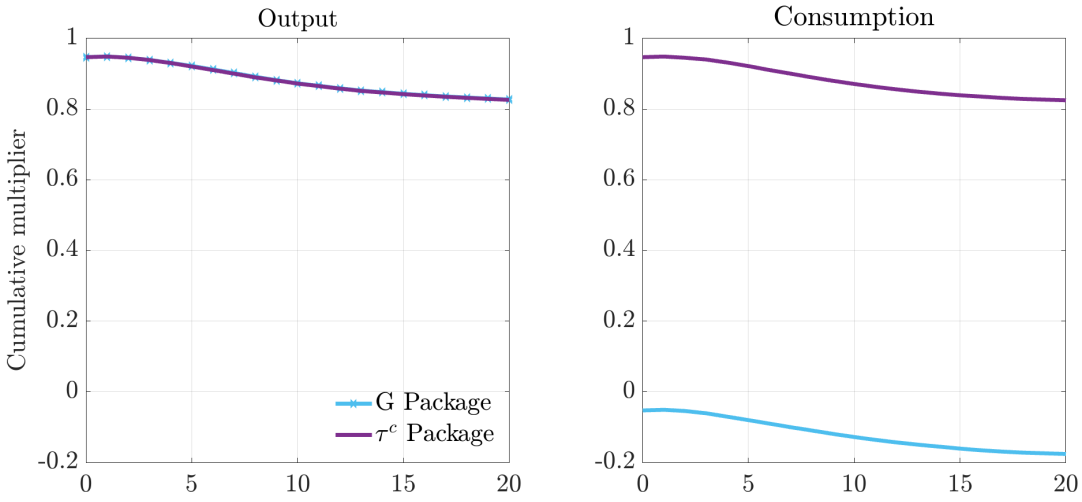
- Robust to: capital, sticky wages, also in RANK, etc. Key assumption: **log preferences**

Stabilization Packages Multipliers



Stabilization Packages Multipliers

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Stabilization Packages **Multipliers**

- Consumption tax cuts as automatic stabilizers
  - As effective as public spending to stimulate aggregate demand
  - Much more effective than direct transfers
  - Easy to implement, high pass-through
  - Welfare of private vs. public consumption?

- Financing a temporary military built-up with consumption tax
  - A one-to-one cut in private consumption, no effect on output $\Rightarrow$ a bad idea?

Conclusion

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- A temporary increase in labor income tax progressivity can stabilize the economy
  - Operates also through consumption and labor supply responses

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Thank you!

References

Alves, Felipe and Giovanni L. Violante (2023). Some Like It Hot: Monetary Policy Under Okunâs Hypothesis. Working Paper.

Auclert, Adrien, Matthew Rognlie, and Ludwig Straub (2023). The Intertemporal Keynesian Cross. Working Paper.

Ball, Laurence, Daniel Leigh, and Prakash Loungani (2017). "Okun's Law: Fit at 50?" Journal of Money, Credit and Banking 49.7, pp. 1413–1441.

Bardoczy, Bence and Joao Guerreiro (2023). Unemployment Insurance in Macroeconomic Stabilization with Imperfect Expectations. Working Papers.

Bhandari, Anmol, David Evans, Mikhail Golosov, and Thomas J. Sargent (2021). "Inequality, Business Cycles, and Monetary-Fiscal Policy". Econometrica 89.6, pp. 2559–2599.

Bilbiie, Florin O. (2020). "The New Keynesian cross". Journal of Monetary Economics 114, pp. 90–108.

Broer, Tobias, Jeppe Druedahl, Karl Harmenberg, and Erik Oberg (2024). Stimulus effects of common fiscal policies. Working Paper.

Chang, Yongsung and Sun-Bin Kim (2006). "From individual to aggregate labor supply: A quantitative analysis based on a heterogeneous agent macroeconomy". International Economic Review 47.1, pp. 1–27.

References (cont.)

Chang, Yongsung and Sun-Bin Kim (2007). "Heterogeneity and Aggregation: Implications for Labor Market Fluctuations". American Economic Review 5.97, pp. 1939–1956.

Chen, Kaiji, Aye Imrohoroglu, and Selahattin Imrohoroglu (2007). "The Japanese Saving Rate Between 1960 and 2000: Productivity, Policy Changes, and Demographics". Economic Theory 32.1, pp. 87–104.

Eissa, Nada and Jeffrey B Liebman (1996). "Labor supply response to the earned income tax credit". The Quarterly Journal of Economics 111.2, pp. 605–637.

Erceg, Christopher J, Dale W Henderson, and Andrew T Levin (2000). "Optimal monetary policy with staggered wage and price contracts". Journal of monetary Economics 46.2, pp. 281–313.

Erosa, Andrés, Luisa Fuster, and Gueorgui Kambourov (2016). "Towards a micro-founded theory of aggregate labour supply". The Review of Economic Studies 83.3, pp. 1001–1039.

Farhi, Emmanuel and Ivan Werning (2020). "Monetary Policy, Bounded Rationality, and Incomplete Markets". American Economic Review.

Ferriere, Axelle, Philipp Grübener, Gaston Navarro, and Oliko Vardishvili (2023). "On the Optimal Design of Transfers and Income Tax Progressivity". Journal of Political Economy Macroeconomics 1.2, pp. 276–333.

References (cont.)

Ferriere, Axelle and Gaston Navarro (2024). "The Heterogeneous Effects of Government Spending: Itâs All About Taxes". The Review of Economic Studies Forthcoming.

Galí, Jordi and Mark Gertler (1999). "Inflation Dynamics: A Structural Econometric Analysis". Journal of Monetary Economics 44.2, pp. 195–222.

Ganong, Peter and Pascal Noel (2019). "Consumer Spending during Unemployment: Positive and Normative Implications". American Economic Review 109.7, 2383â2424.

Gorn, Alexey and Antonella Trigari (2024). "Assessing the Stabilizing Effects of Unemployment Benefit Extensions". American Economic Journal: Macroeconomics 16.1.

Hagedorn, Marcus, Iourii Manovskii, and Kurt Mitman (2019). The Fiscal Multiplier. Working Paper.

Heathcote, Jonathan, Kjetil Storesletten, and Giovanni L. Violante (2017). "Optimal tax progressivity: An analytical framework". The Quarterly Journal of Economics 132.4, pp. 1693–1754.

Jang, Youngsoo, Takeki Sunakawa, and Minchul Yum (2023). "Tax-and-Transfer Progressivity and Business Cycles". Quantitative Economics 14 (4), pp. 1367–1400.

References (cont.)

Kaplan, Greg, Benjamin Moll, and Giovanni L. Violante (2018). "Monetary Policy According to HANK". American Economic Review 108.3, pp. 697–743.

Kaplan, Greg and Giovanni L Violante (2014). "A model of the consumption response to fiscal stimulus payments". Econometrica 82.4, pp. 1199–1239.

Kekre, Rohan (Dec. 2022). "Unemployment Insurance in Macroeconomic Stabilization". The Review of Economic Studies 90.5, pp. 2439–2480.

Kleven, Henrik Jacobsen and Claus Thustrup Kreiner (2006). "The Marginal Cost of Public Funds: Hours of Work Versus Labor Force Participation". Journal of Public Economics 90.10, pp. 1955–1973.

Krusell, Per and Anthony A Smith Jr (1998). "Income and Wealth Heterogeneity in the Macroeconomy". Journal of political Economy 106.5, pp. 867–896.

Le Grand F., Martin-Baillon A. and X. Ragot (2024). Should monetary policy care about redistribution? optimal fiscal and monetary policy with heterogeneous agents. Working Paper.

McKay, Alisdair and Christian Wolf (2023). Optimal policy rules in HANK. Working Paper.

References (cont.)

Meghir, Costas and David Phillips (2010). "Labour supply and taxes". Dimensions of tax design: The Mirrlees review, pp. 202–74.

Mertens, Karel and Morten O. Ravn (2013). "The Dynamic Effects of Personal and Corporate Income Tax Changes in the United States". American Economic Review 103.4, pp. 1212–47.

Mueller, Andreas I. (2017). "Separations, Sorting, and Cyclical Unemployment". American Economic Review 107.7, pp. 2081–2107.

Parker, Jonathan A., Nicholas S. Souleles, David S. Johnson, and Robert McClelland (2013). "Consumer Spending and the Economic Stimulus Payments of 2008". American Economic Review 103.6, pp. 2530–53.

Rogerson, Richard and Johanna Wallenius (2009). "Micro and macro elasticities in a life cycle model with taxes". Journal of Economic theory 144.6, pp. 2277–2292.

Saporta-Eksten, Itay (2014). Job Loss, Consumption and Unemployment Insurance. Working Paper.

Triest, Robert K (1990). "The Effect of Income Taxation on Labor Supply in the United States". Journal of Human Resources, pp. 491–516.

Uhlig, Harald (2010). "Some Fiscal Calculus". American Economic Review 2.100, pp. 30–34.

References (cont.)

Zidar, Owen (2019). "Tax Cuts for Whom? Heterogeneous Effects of Tax Changes on Growth and Employment". Journal of Political Economy 127.3, pp. 1437–1472.

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

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

Return

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)

Return

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

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

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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

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Deeper Recessions Bigger Fiscal Packages

- Consider a recession of about 1% on impact – compared to 12bp on impact in the baseline
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- 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%
- UI Package in the first quarter: equal to $\$2800$ per month for all unemployed

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- UI Package in the first quarter: equal to $\$2800$ per month for all unemployed
- Multipliers are similar to the baseline

Return

Robustness Steeper labor elasticities

– Lower variance ρ_h to reach steeper labor elasticities

  + 0.75 at Q1 (regression), 1.1 (tax shock)

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Robustness Steeper labor elasticities

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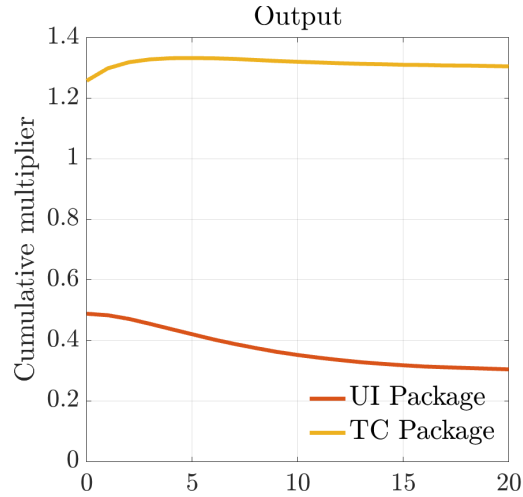
■ TC Package $\Rightarrow$ **large output** multiplier



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