Welfare Effects of Income-Stabilization Policies in a HANK Model with Unemployment Risk*

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Abstract

Understanding how policies can stabilize household welfare during recessions requires a framework that captures household heterogeneity, unemployment risk, and general-equilibrium labor market dynamics. We study a contractionary demand shock in a Heterogeneous-Agent New-Keynesian model with search-and-matching friction on the labor market (HANK-SAM) and compare the effectiveness of alternative income-stabilization policies. Using a common fiscal envelope, we compare increases in unemployment insurance generosity, targeted transfers to hand-to-mouth households, and labor-income tax cuts. Policy effectiveness is assessed through aggregate household welfare, measured in consumption-equivalent variation units. In an economy calibrated to U.S. data, unemployment insurance and labor-income tax cuts generate larger welfare gains than targeted transfers under realized fiscal costs. We also compare a state-contingent rule with an ad hoc policy path for each instrument, conditional on the downturn having occurred. The two forms of implementations generate similar welfare gains once direct fiscal costs are equalized.

Keywords: Income stabilization; Heterogeneous-agent New Keynesian (HANK); Search-and-matching; Unemployment insurance; Targeted transfers; Labor income taxation.
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1 Introduction

Over the past two decades, the global economy has been repeatedly hit by large and overlapping shocks—including pandemics, wars, energy price spikes, and rapid technological change—making macroeconomic volatility a defining feature of the current era (Gopinath, 2022). At the same time, public finances are under growing strain, with elevated debt levels, higher interest rates, and rising spending pressures sharply limiting fiscal space in many countries (IMF, 2025), which is further affected by the heightened economic volatility and geoeconomic fragmentation (Furceri et al., forthcoming). These constraints increase the importance of designing stabilization policies that deliver substantial insurance and macroeconomic support while making use of scarce fiscal resources. Moreover, economic shocks affect households unevenly, particularly through the labor market: while some workers experience job loss and sharp income declines, others remain employed and respond by increasing precautionary savings.

Against this backdrop, this paper asks two questions about the design of fiscal stabilization during downturns. First, given the same fiscal resources, which income-stabilization instrument delivers the largest welfare gain? Second, conditional on a downturn occurring, how much does welfare depend on whether support follows a state-contingent rule or an ad hoc policy path? These are distinct margins of policy design. Policies operating under the same fiscal envelope can differ substantially in whom they insure, how they affect labor supply and aggregate demand, and how their fiscal costs respond to the state of the economy. As a complementary dimension, a given instrument can also be delivered through different policy paths once the downturn has materialized.

In answering these questions, the paper contributes to the literature in three main ways. First, it provides an economic comparison of three income-stabilization policies, unemployment insurance (UI), targeted transfers to liquidity-constrained households, and labor-income tax cuts, in a Heterogeneous-Agent New Keynesian Model with Search and Matching Frictions in the Labor Market (HANK-SAM; see Ravn and Sterk, 2021, for example). We rank the three instruments by the welfare gain generated under a common fiscal implementation cost and study how endogenous changes in the number of unemployment-insurance beneficiaries and the labor-tax base affect their relative performance. As a complementary exercise, we compare a state-contingent rule with an ad hoc policy path for each instrument, conditional on the downturn occurring. Second, the paper computes household welfare directly from the cross-section of households along the full transition path returning to equilibrium. That is essential in set-ups in which unemployment risk and financial liquidity shape households' marginal utilities. To our knowledge, this is the first paper that computes households' welfare in a HANK-SAM setup. Third, the paper analyzes the distributional impacts in terms of welfare of the three income-stabilization policies.

The key dimensions of households' heterogeneity—i.e., differences in financial liquidity and exposure to income risk—drive the magnitude of the welfare loss in a recession and the effectiveness of the policy counteracting it. Abstracting from this heterogeneity, as in representative-agent models, risks misjudging both the size and the distribution of the income-stabilization support needed during downturns. Recessions raise unemployment and amplify the cash-flow risk. Liquidity-constrained households cut spending sharply, which depresses

demand, reduces hiring, and feeds back into higher unemployment. Representative-agent models flatten these distributional margins, offering weak guidance on who to support, when to intervene, and how to finance assistance without undermining economic stabilization.

To ensure a credible policy analysis, we proceed along three dimensions. First, we model a realistic household cross-section in terms of liquidity constraints and risk exposure. Second, we incorporate an explicit unemployment block that links aggregate demand to job losses and re-employment. Third, we compare the policy instruments within a common fiscal envelope, designing each intervention to generate the same present value of its direct fiscal cost, and then use the same framework to study alternative policy paths conditional on the downturn.[1]

Our analysis is conducted using a HANK-SAM model calibrated to the United States, featuring endogenous labor supply, sticky prices, a Diamond-Mortensen-Pissarides (DMP) labor market with firms' free entry, and an explicit government budget with government debt and tax smoothing similar to Broer et al., 2024. Households are heterogeneous in liquidity, comprising a hand-to-mouth group with high marginal propensities to consume and a buffer-stock saving group, and differ additionally by labor-market status (employed or unemployed). The government can implement alternative income-stabilization policies by increasing unemployment insurance generosity, targeting transfers to HtM households, or reducing the labor-income tax rate. Monetary policy follows an inflation-responsive Taylor rule.

With this model, we analyze a one-time, transitory, and unanticipated (MIT shock) demand shock, modeled as a temporary increase in households' discount factor that raises households' desired saving. The contractionary demand shock raises unemployment and lowers output. Our main quantitative exercise compares the three income-stabilization instruments under the same recessionary environment and fiscal-cost envelope.

As a complementary exercise, we also consider two policy paths for each instrument. The first follows a state-contingent rule that is inactive in steady state and responds endogenously to the deterioration in economic conditions, whereas the second follows an ad hoc path after the shock. For ease of reference, we refer to these as state-contingent and ad hoc interventions, respectively.[2] Because the aggregate disturbance is an MIT shock, such activation-mode exercise is conditional on the downturn having occurred.[3]

Our welfare computation is HANK-consistent throughout the analyses and aggregates utility over the full cross-section of households along the nonlinear transition path. At each point in time, individual-level utilities—indexed by assets, employment status, and type of households (HtM or not)—are weighted by the endogenous household distribution

[1]Equalizing the direct fiscal cost of the policy interventions does not imply that contemporaneous outlays, revenue losses, or their timing are identical across instruments. For each instrument and form of implementation, we independently scale the policy intervention so that the discounted present value of its instrument-specific direct fiscal cost equals the same target. Direct fiscal cost is measured by incremental outlays for UI, direct transfer expenditures for targeted transfers, and the realized loss of labor-tax revenue for labor-income tax cuts.

[2]Both paths start from the same steady state, face the same contractionary demand shock, and are compared under the same direct fiscal-cost envelope.

[3]Note that the model does not incorporate aggregate uncertainty before the shock and, therefore, does not capture households' ex-ante behavioral response to knowing that a contingent policy will be available in a future downturn. Accordingly, it is not able to measure the ex-ante insurance value of policy commitment and should not be interpreted as a full comparison between anticipated and unanticipated policy regimes.

according to these attributes and then aggregated through the three dimensions to obtain the economy-wide period utility. Lifetime welfare is then calculated as the discounted sum of these period utilities using a common monthly social discount factor, together with a steady-state continuation after the finite transition horizon. We map welfare changes into a path-based consumption-equivalent variation (CEV) relative to the solved no-policy-intervention baseline.

Under the common realized direct-cost normalization, our main result concerns the comparison across policy instruments. At the reference fiscal cost, unemployment insurance generates the largest welfare gain, followed closely by the labor-income tax cut, while targeted transfers to hand-to-mouth households deliver substantially smaller welfare gains. Unemployment insurance combines direct cash-flow support to unemployed households with an insurance channel that reduces precautionary saving and with general-equilibrium labor-market effects. Targeted transfers concentrate resources on households with high marginal propensities to consume, generating a strong but more limited cash-flow channel. Labor-income tax cuts raise disposable labor income and strengthen labor-supply incentives, supporting consumption, employment, and output.

In turn, our complementary exercise, investigating the state-contingent and ad hoc implementations of a given instrument, generates practically the same welfare gains for each instrument once direct fiscal costs are equalized. At the reference fiscal cost, the ratio of "state-contingent" to "ad hoc" welfare is approximately 0.96 for unemployment insurance, 1.00 for targeted transfers, and 0.99 for the labor-income tax cut. Again, these results characterize the relative performance of the two forms of policy implementation conditional on the ex-post realization of the downturn, abstracting from anticipation effects.

Our main policy implication is that, under realized fiscal costs, unemployment insurance narrowly delivers the largest welfare gain. Higher UI generosity reduces unemployment and therefore its own number of beneficiaries. Similarly (but with a marginally lower welfare gain), labor-income tax cuts recover part of their mechanical revenue loss through an expansion of the tax base. Indeed, these endogenous fiscal responses contribute to the close ranking between the two instruments. When both policies are instead priced using the fiscal exposure that would have prevailed in the untreated recession, the labor-income tax cut ranks above unemployment insurance, while targeted transfers remain third. Thus, the relative efficiency of unemployment insurance and labor-income tax cuts depends in part on whether endogenous fiscal-base feedback is treated as part of the policy efficiency. Moreover, conditional on an ex-post realization of the downturn, there is little difference in welfare between state-contingent and ad hoc implementations of the instruments.

Our paper contributes to three distinct strands in the literature, foremost among them the extensive body of work analyzing standard HANK models to investigate the transmission channels of macroeconomic policies. In particular, we focus on fiscal stabilization through household income-support policies and labor-income taxation. A rich and growing literature demonstrates that household heterogeneity significantly reshapes the effects of fiscal and monetary intervention (Kaplan and Violante, 2014; McKay and Reis, 2016; Kaplan et al., 2018; Auclert, 2019). These models highlight that disparities in liquid asset holdings and borrowing access generate substantial heterogeneity in marginal propensities to consume: a dollar given to a hand-to-mouth household triggers a larger boost to aggregate demand than the same dollar allocated to a wealthy saver. This mechanism, notably absent in representative-agent frameworks, explains why fiscal stimulus targeted at liquidity-constrained households achieves

amplified aggregate effects (Bayer et al., 2019; Auclert et al., 2021). Beyond aggregate demand dynamics, heterogeneity alters normative policy design considerations, as the efficacy of tax cuts or transfers depends critically on recipient characteristics, with precautionary saving motives either dampening or magnifying policy impacts (Werning, 2015; Oh and Reis, 2012; McKay and Reis, 2016). Relatedly, a subset of the literature examines the functioning of automatic stabilizers within incomplete markets (McKay and Reis, 2016). Building on these insights, we compare unemployment insurance, targeted transfers, and labor-income tax cuts under the same present-value fiscal-cost concept. This allows us to evaluate how differences in household exposure, labor-supply responses, and endogenous fiscal feedback affect the welfare generated by alternative stabilization instruments.

The second relevant strand extends HANK frameworks by embedding explicit labor-market/SAM structures, drawing on the influential *Diamond–Mortensen–Pissarides (DMP)* model of labor market frictions and its subsequent refinements (Mortensen and Pissarides, 1994; Pissarides, 2000; Shimer, 2005; Hagedorn and Manovskii, 2008; Hall and Milgrom, 2008; Michaillat and Saez, 2015). Integrating this framework into HANK models, Broer et al. (2025) develop a model featuring nominal rigidities and endogenous unemployment risk, showing how flows between employment and unemployment—i.e., the extensive employment margin—amplify macroeconomic shocks. In a follow-up study, Broer et al. (2024) explore fiscal stabilization policies within this HANK-with-search setting, underscoring the critical role of targeting transfers to high-MPC households for maximizing aggregate impacts. Their findings reveal that introducing unemployment risk substantially increases the insurance value of fiscal interventions: UI not only provides direct income replacement but also stabilizes aggregate demand by curtailing precautionary savings triggered by elevated job loss risk. Our work extends this literature by ranking the three instruments on a welfare basis under a common fiscal cost and by showing how endogenous fiscal feedback affects their relative performance.

Our paper is also related to the recent HANK literature with labor-market exposure investigating distributional and compositional effects of particular macroeconomic policies. Beyond the welfare effects of the three policy instruments analyzed, we further study their distributional incidence across liquid-wealth groups and, for unemployment insurance, decompose the welfare response into within-state and compositional effects. This comparative approach yields novel insights into the relative effectiveness of alternative fiscal stabilization instruments in heterogeneous-agent economies. Closely related are the recent contributions of Alves and Violante (2025) and Alves and Violante (2026), which study stabilization policy in HANK environments with heterogeneous labor-market exposure. Alves and Violante (2025) examine monetary policy in a frictional labor market where recessions generate persistent losses for low-wage workers and study the trade-off between inflation stabilization and a more inclusive labor-market recovery. Alves and Violante (2026) extend this analysis to the interaction of monetary and fiscal stimulus following the pandemic, emphasizing the welfare trade-off between labor-market inclusion and inflation. Our analysis is complementary to these papers. We focus on the design of fiscal stabilization conditional on a recession, comparing unemployment insurance, targeted transfers, and labor-income tax cuts under a common fiscal cost. We additionally show how endogenous changes in the unemployment-insurance caseload and the labor-tax base affect the welfare ranking of the instruments and report a complementary comparison of alternative forms of policy implementation conditional on the

recession.

The third related strand of literature centers on UI as a macroeconomic stabilizer in the presence of labor market search frictions. A substantial body of work investigates the design of UI and its broader macroeconomic consequences. Chetty (2006) provides a seminal framework analyzing the fundamental trade-off inherent in UI policy: while more generous benefits can prolong unemployment durations by weakening job-search incentives, they simultaneously ease liquidity constraints for unemployed workers, thereby improving welfare through consumption smoothing. Building on these insights, Landais et al. (2018) develop a dynamic general-equilibrium model and argue that optimal UI generosity should be countercyclical—i.e., higher during recessions—because the macroeconomic advantages of sustaining aggregate demand and alleviating job-search congestion externalities outweigh the moral hazard costs. Empirical evidence from the Great Recession offers support for both sides of this trade-off: extended UI benefits modestly increased the unemployment rate by lowering exit rates from unemployment (Hagedorn et al., 2015). Yet, these benefits also helped sustain consumption among affected households, potentially having a stabilizing aggregate demand effect in many of the severely impacted regions.

To mediate some of these effects discussed above, scholars usually advocate for UI policies that respond to local economic conditions. Kroft and Notowidigdo (2016), for example, propose more generous UI—when job availability is limited and the moral hazard costs are accordingly reduced—while scaling back benefits or making them less generous when labor markets strengthen. We extend this literature by embedding UI, targeted transfers, and labor-income tax cuts within a unified fiscal-cost framework, comparing their welfare performance and fiscal feedback, and evaluating their distributional welfare implications rather than focusing solely on aggregate outcomes.

The remainder of the paper presents the model in Section 2. Section 3 describes the calibration of the model, while Section 4 reports the recession experiment, the common fiscal envelope, and the macroeconomic effects of the policy instruments. Section 5 presents the welfare computation, ranks the three policy instruments, and reports the complementary policy activation-mode comparison. Section 6 analyzes endogenous fiscal feedback and alternative fiscal-cost measures. Section 7 studies the distributional effects of the policy instruments. Finally, Section 8 concludes the paper.

2 Model

This section describes our HANK–SAM model in discrete time ($t = 0, 1, 2, \ldots$) with endogenous labor supply, search frictions in the labor market, Rotemberg price adjustment, an inflation-targeting Taylor rule for monetary policy, and a fiscal rule that smooths labor taxes against a debt target.

2.1 Households: Heterogeneity, Utility, and Budget Constraint

A unit mass of households is split into I types indexed by $i \in \{1, \ldots, I\}$ that differ in their discount factor β_i and, therefore, in their marginal propensities to consume. In the baseline

calibration, we use two types of agents: hand-to-mouth (HtM)[4] and buffer–stock (BS) agents. The HtM group should be interpreted as a stylized proxy for households with low liquid-asset holdings and high short-run marginal propensities to consume. This is not meant to identify a literal group with zero total wealth. Rather, it captures households that remain highly cash-flow sensitive because their balance sheets are illiquid, even if they may hold positive illiquid wealth.[5]

Each household carries non-negative risk-free assets $a_{i,t} \geq 0$, which can be interpreted as real government bonds, and can be either employed or unemployed, $e_t \in \{E, U\}$. There is a single unemployment state, $N_u = 1$.[6]

We assume standard separable preferences over consumption and hours worked,

$$u(c, n) = \frac{c^{1-\sigma}}{1-\sigma} - \chi \frac{n^{1+\nu}}{1+\nu},$$

where $\sigma > 0$ is the coefficient of relative risk aversion, $\chi > 0$ governs the weight of labor disutility, and $1/\nu$ is the conditional Frisch elasticity of labor supply. Hence, given household type i, the Bellman problems for the expected, $\mathbb{E}_t$, net present welfare value as a function of assets, $V^E_{i,t}(a)$, depend on whether the household is employed or unemployed. They can be written as

$$V^E_{i,t}(a) = \max_{c,a',n} \Big\{ u(c, n) + \beta_i \, \mathbb{E}_t \big[V_{i,t+1}(a', e_{t+1}) \mid e_t = E \big] \Big\}, \tag{1}$$

$$\text{s.t.} \qquad c + a' = (1 + r^{hh}_t)a + (1 - \tau_t) w_t n + \text{div}_t + \text{tr}_t + T_{i,t}, \tag{2}$$

$$V^U_{i,t}(a) = \max_{c,a'} \Big\{ u(c, 0) + \beta_i \, \mathbb{E}_t \big[V_{i,t+1}(a', e_{t+1}) \mid e_t = U \big] \Big\}, \tag{3}$$

$$\text{s.t.} \qquad c + a' = (1 + r^{hh}_t)a + y^{\text{UI}}_t + \text{div}_t + \text{tr}_t + T_{i,t}, \tag{4}$$

where $a' \geq 0$ is the borrowing constraint; r^{hh}_t is the realized real return on beginning-of-period household assets; τ_t is the labor-income tax rate; w_t is the real wage rate; n denotes hours worked by an employed household; div_t denotes firm dividends rebated lump-sum to households; and tr_t denotes the common lump-sum transfer from the government. The term $T_{i,t}$ denotes the targeted-transfer intervention and is positive only for HtM households in that policy experiment; it is zero otherwise.

For an employed household with an interior labor-supply choice, the intratemporal first-order condition is

$$\chi n^{\nu}_{i,t} = (1 - \tau_t) w_t c^{-\sigma}_{i,t}. \tag{5}$$

Thus, labor-income taxation affects households not only through disposable income but also through the return to supplying an additional unit of labor.

[4] HtM households can be seen as an extreme case of rule-of-thumb spenders: c^{HtM}_t equals current disposable income. This is equivalent to setting $\beta = 0$, which is a device to shut down intertemporal smoothing and not a literal preference calibration.

[5] Under this interpretation, transfers targeted to HtM households are best viewed as transfers directed to liquidity-constrained households with high spending sensitivity.

[6] Notice that i does not represent an individual household in this notation, as asset position a can vary depending on the realized history of employment.

Unemployment-insurance income is proportional to the wage and to steady-state hours per employed household. More generally, letting $\phi_t(e)$ denote the replacement rate associated with the household's unemployment state, disposable UI income becomes

$$y_t^{\text{UI}}(e) = \left(1 - \chi_{\text{tax}}^{\text{UI}} \tau_t\right) \phi_t(e) w_t n^{ss}, \tag{6}$$

where n^{ss} denotes steady-state hours per employed household. There is a single unemployment state, $N_u = 1$, so all unemployed households receive the same replacement rate. The distinction between the upper and lower UI replacement rates is retained for robustness and for consistency with the more general model specification.

The labor-tax base can be written as

$$\text{tax base}_t = w_t N_t + \chi_{\text{tax}}^{\text{UI}} \Phi_t, \qquad \chi_{\text{tax}}^{\text{UI}} \in \{0, 1\},$$

where $\chi_{\text{tax}}^{\text{UI}}$ governs whether unemployment-insurance payments enter the labor-tax base; and Φ_t denotes total unemployment-insurance outlays (see Subsection 2.6 below). Labor taxes apply to labor income and, in the alternative taxable-UI environment, to unemployment-insurance benefits. Dividends and lump-sum transfers are not taxed.

The shares of each of the two types of households are represented by μ_i, whereas the joint distribution of assets and employment for each agent type i is $\Lambda_{i,t}(a, e)$.

The ex-post gross real return on a bond purchased at date t is

$$R_t \equiv 1 + r_t = \frac{1 + i_t}{1 + \pi_{t+1}},$$

where i_t is the nominal interest rate set by monetary policy and π_{t+1} is next-period inflation. Consistent with the timing of beginning-of-period household assets, $r_0^{hh} = r^{ss}$ and $r_t^{hh} = r_{t-1}$ for $t \geq 1$.

2.2 Employment Risk and Aggregation

Let $1 - u_t$ denote the employment rate, given the labor force being normalized to one. Employment transitions follow the search block that we describe in the next subsection. Since employed households choose hours endogenously, aggregate labor input can be written as

$$N_t = \sum_i \mu_i \int n_{i,t}(a, e)\, d\Lambda_{i,t}(a, e), \tag{7}$$

where $n_{i,t}(a, U) = 0$ for unemployed households. Average hours conditional on employment are therefore

$$\bar{n}_t = \frac{N_t}{1 - u_t}.$$

Aggregate consumption and household assets correspond to

$$C_t^{hh} = \sum_i \mu_i \int c_{i,t}(a, e)\, d\Lambda_{i,t}(a, e), \qquad A_t^{hh} = \sum_i \mu_i \int a\, d\Lambda_{i,t}(a, e).$$

2.3 Production, Vacancies, and Labor market

Productivity in the model is normalized and kept fixed at

$$\mathrm{TFP}_t \equiv 1.$$

The real wage follows the inertial rule

$$w_t = \rho_w w_{t-1} + (1-\rho_w)\left[\eta_{EG} p_t^x + w^{ss} - \eta_{EG} p^{x,ss}\right], \tag{8}$$

where ρ_w governs wage persistence, η_{EG} governs the response of the real wage to the relative intermediate-good price p_t^x, $p^{x,ss}$ denotes its steady-state value, and w^{ss} is the steady-state real wage. We set $\eta_{EG} = 0$ and initialize wages at their steady-state value. Hence, $w_t = w^{ss}$ along the benchmark transition. This specification allows us to isolate the extensive employment margin and the endogenous intensive labor-supply margin from wage adjustment.

Since hours per employed worker are endogenous, the value of a filled job, J_t, is

$$J_t = (p_t^x \mathrm{TFP}_t - w_t)\,\bar{n}_t + \beta_f(1-\delta_{t+1})J_{t+1}, \tag{9}$$

where

$$\bar{n}_t = \frac{N_t}{1-u_t},$$

β_f is the firm discount factor, and δ_t is the separation rate.

Free entry implies

$$\kappa = \lambda_t^v J_t, \tag{10}$$

where κ denotes the vacancy-posting cost. In the quantitative specification, the vacancy-posting term κv_t is not modeled as a physical use of final goods and therefore does not enter firm dividends or the aggregate resource constraint. The Rotemberg adjustment term is treated analogously: it affects the pricing condition but is not subtracted from final output.[7]

The search frictions, in turn, are defined as

$$\lambda_t^u = A\,\theta_t^{1-\alpha}, \qquad \lambda_t^v = A\,\theta_t^{-\alpha}, \qquad \theta_t = \frac{v_t}{S_t}, \tag{11}$$

where λ_t^u is the job-finding rate per searcher; A is parameter capturing the matching efficiency; θ_t is the ratio of vacancies over the mass of job searchers, S_t, which is equal to u_t in steady state; and α represents the labor market matching elasticity.

The unemployment rate evolves according to

$$u_t \;=\; u_{t-1} \;-\; S_t\,\lambda_t^u \;+\; \delta_t\,(1-u_{t-1}). \tag{12}$$

Output, Y_t, is supply-determined by productivity and aggregate hours

$$Y_t = \mathrm{TFP}_t N_t. \tag{13}$$

With no capital in the model, firm dividends are equal to output minus labor costs

$$\mathrm{div}_t = Y_t - w_t N_t = (\mathrm{TFP}_t - w_t)N_t, \tag{14}$$

which are rebated lump-sum to households.

[7] At the steady state, $\kappa v/Y$ is approximately 0.0755. This number measures the scale of the recruiting wedge under the maintained convention and should not be interpreted as final-goods expenditure.

2.4 Price Setting (Rotemberg) and Inflation

Intermediate-good producers face a Rotemberg price-adjustment friction with slope parameter $\varphi_p > 0$. The pricing first-order condition delivers a New Keynesian Phillips curve in gross-rate form:

$$\underbrace{(1-\varepsilon)+\varepsilon\, p_t^x}_{\text{desired markup}} \;=\; \varphi_p\,\pi_t(1+\pi_t) \;-\; \beta_f\,\varphi_p\,\pi_{t+1}(1+\pi_{t+1})\,\frac{Y_{t+1}}{Y_t}, \tag{15}$$

with demand elasticity $\varepsilon > 1$ and inflation $\pi_t \equiv P_t/P_{t-1} - 1$. Equation (15) pins down π_t given (p_t^x, Y_t).

2.5 Monetary Policy

The central bank follows a pure inflation-gap Taylor rule

$$1 + i_t \;=\; (1+i^{ss})\Big(\frac{1+\pi_t}{1+\pi^{ss}}\Big)^{\delta_\pi}, \qquad \delta_\pi > 1, \tag{16}$$

where i^{ss} and π^{ss} are the nominal interest rate and inflation in steady state; δ_π is the policy response coefficient, and π^* is the inflation target. In our calibration, we normalize the target to zero inflation, $\pi^* = \pi^{ss} = 0$, and set the steady-state nominal rate to satisfy the Fisher relation

$$1 + i^{ss} = (1 + r^{ss})(1 + \pi^{ss}).$$

2.6 Government, Fiscal Rule, and Debt Dynamics

We start our description of the government by defining unemployment insurance (UI)

$$\Phi_t = \phi_t^o w_t n^{ss} U_t^{\text{UI}} + \phi_t^u w_t n^{ss}(u_t - U_t^{\text{UI}}), \tag{17}$$

where ϕ_t^o and ϕ_t^u denote the upper and lower UI replacement rates, respectively, and U_t^{UI} is the share of unemployed households receiving the upper replacement rate. Since $N_u = 1$, $U_t^{\text{UI}} = u_t$ and the second term is zero. Both baseline replacement rates are set to 0.50.

Common lump-sum transfers remain at their steady-state value

$$\text{tr}_t = \text{tr}^{ss}. \tag{18}$$

In the targeted-transfer experiment, HtM households additionally receive a per-recipient transfer T_t. Let m^{HtM} denote their population share. Aggregate targeted-transfer expenditures are therefore

$$\Phi_t^{\text{HtM}} = m^{\text{HtM}} T_t. \tag{19}$$

We set $m^{\text{HtM}} = 0.30$.[8]

[8] To isolate and focus on cyclical channels in this model, we neutralize steady-state profits that would be transferred to households by setting a constant transfer (with same value and opposite sign to the dividends) that offsets steady-state dividends, so only cyclical components of dividends matter for household disposable income.

Let q_t be the price of the real government bond B_t. Its next-period payoff is $1 + \delta_q q_{t+1}$, where δ_q controls the maturity component of the payoff. We set $\delta_q = 0$, so the bond is the one-period case of this specification. The government's flow budget constraint becomes then

$$(1 + \delta_q q_t)B_{t-1} + \underbrace{\left(\Phi_t + G_t + \mathrm{tr}_t + m^{\mathrm{HtM}} T_t\right)}_{X_t} = \tau_t \underbrace{\left[w_t N_t + \chi^{\mathrm{UI}}_{\mathrm{tax}} \Phi_t\right]}_{\text{tax base}} + q_t B_t, \tag{20}$$

where G_t corresponds to other government outlays and $T_t = 0$ outside the targeted-transfer experiment.

Taxes apply to labor income and, when $\chi^{\mathrm{UI}}_{\mathrm{tax}} = 1$, also to UI benefits. Hence, the tax base can be written as

$$w_t N_t + \chi^{\mathrm{UI}}_{\mathrm{tax}} \Phi_t.$$

Absent a labor-income tax intervention, the tax rate blends a debt-stabilizing target with the steady-state rate. We denote this baseline fiscal response by

$$\tau_t^{\mathrm{base}} = \omega \hat{\tau}_t + (1 - \omega)\tau^{ss}, \qquad \omega \in [0, 1], \tag{21}$$

$$\hat{\tau}_t = \frac{(1 + \delta_q q_t)B_{t-1} + X_t - q^{ss} B^{ss}}{w_t N_t + \chi^{\mathrm{UI}}_{\mathrm{tax}} \Phi_t}. \tag{22}$$

In the labor-income tax experiment, the effective tax rate faced by households and entering government revenue can be denoted by

$$\tau_t = \tau_t^{\mathrm{base}} + \tau_t^{\mathrm{pol}}, \tag{23}$$

where $\tau_t^{\mathrm{pol}} < 0$ represents the policy-induced tax cut, which is equal to zero in the other policy experiments; while τ^{ss}, q^{ss}, and B^{ss} represent the steady state levels of labor taxes, the price of the real government bond, and the public debt, respectively. Equation (22), together with Equation (21), determines the baseline tax response required to stabilize debt around its steady-state level.

Combining the effective tax rate with the government flow budget constraint in Equation (20), the law of motion for debt can be written as

$$B_t = \frac{(1 + \delta_q q_t)B_{t-1} + X_t - \tau_t \left[w_t N_t + \chi^{\mathrm{UI}}_{\mathrm{tax}} \Phi_t\right]}{q_t}. \tag{24}$$

Accordingly, the bond pricing is determined by the following equation, which is consistent with the household Euler equations

$$q_t \;=\; \frac{1 + \delta_q q_{t+1}}{R_t}. \tag{25}$$

2.7 Market Clearing

Under the resource convention described in Section 2.3, vacancy-posting and Rotemberg adjustment terms are not treated as physical uses of final goods. Goods-market clearing is therefore

$$Y_t = C_t^{hh} + G_t. \tag{26}$$

In asset-market clearing, aggregate household assets equal the market value of government bonds. In turn, the asset market clearing condition can be written as

$$q_t B_t = A_t^{hh}. \tag{27}$$

3 Calibration

This section documents the baseline calibration of our HANK–SAM model. The model is parameterized at a monthly frequency, with steady-state values designed to broadly reflect conventional benchmarks in the HANK and search-and-matching literature for the standard calibration for the United States economy (McKay and Reis, 2016; Auclert et al., 2021; Broer et al., 2024; Ravn and Sterk, 2021).[9]

3.1 Households

As previously mentioned, we distinguish between two types of households based on their discount factors. Hand-to-Mouth households, representing 30 percent of the population, are assigned a discount factor of $\beta = 0$. The remaining 70 percent are Buffer-Stock households with $\beta = 0.940^{1/12}$, consistent with a monthly discount factor of approximately 0.995. Preferences feature a CRRA coefficient σ equal to 2 (see Table 1). The inverse Frisch parameter is set to $\nu = 4$, implying a conditional Frisch elasticity of $1/\nu = 0.25$. The labor-disutility scale χ is calibrated so that average hours per employed household are approximately one third in steady state. We impose an upper bound on individual hours of $n_{\max} = 0.90$.

The asset grid spans 300 points with a maximum of 200 monthly income units, ensuring sufficient resolution of the cross-sectional wealth distribution.

3.2 Labor Market

The labor market consists of a search-and-matching structure following Pissarides, 2000. The steady-state separation rate is set to $\delta = 0.02$ per month (about 21 percent annually), whereas the job-finding rate is set to $\lambda_u = 0.30$, generating an average unemployment duration of roughly three months (see Table 2). With a steady-state tightness $\theta = 0.60$ and matching elasticity $\alpha = 0.60$, the implied steady-state unemployment rate is around 6 percent, broadly consistent with the long-run U.S. average.

3.3 Production and Prices

Intermediate goods producers operate under monopolistic competition. The elasticity of substitution is $\varepsilon = 6$, implying a steady-state markup of about 20 percent (see Table 3). Price adjustment costs are modeled à la Rotemberg with parameter $\varphi_p = 600$, ensuring realistic price stickiness. Steady-state real wages are set to $w^{ss} = 0.75$, corresponding to 0.90 times the steady-state intermediate-good price $p_x^{ss} = 5/6$. In the transition, we set $\eta_{EG} = 0$ in Equation (8), so real wages remain at their steady-state value. This allows the labor-market

[9] For the solution method of our model, see Appendix A for more details.

adjustment to operate through employment and endogenous hours rather than through wage movements.

3.4 Government and Fiscal Policy

Fiscal policy features a proportional labor-income tax with a steady-state rate of $\tau = 0.30$ (see Table 3). Unemployment insurance replacement rates are set at $\phi_o = \phi_u = 0.50$, with benefits independent of unemployment duration in the baseline. Government debt follows the bond specification in Section 2, with maturity parameter $\delta_q = 0$, corresponding to the one-period case. Tax adjustment is smoothed via

$$\tau_t^{\text{base}} = \omega\, \hat{\tau}_t + (1 - \omega)\, \tau^{ss}, \qquad \omega = 0.05,$$

implying a slow adjustment of taxes to debt deviations.[10] Common lump-sum transfers remain at their steady-state level, which offsets steady-state dividends in the baseline. Targeted-transfer interventions are paid only to the HtM group, which represents 30 percent of households, while the labor-income tax intervention enters as a temporary or state-contingent deviation from the baseline tax rule. Targeted transfers are untaxed.

3.5 Monetary Policy

The central bank follows a Taylor-type rule reacting to deviations of inflation from target (see Table 3):

$$i_t = (1 + i^{ss}) \left(\frac{1 + \pi_t}{1 + \pi^{ss}} \right)^{\delta_\pi} - 1, \qquad \delta_\pi = 1.5,$$

with no direct response to the output gap or unemployment.

The steady-state annual real interest rate is set to $r^{\text{ann}} = 0.02$, implying a monthly steady-state real rate

$$r^{ss} = (1.02)^{1/12} - 1,$$

with zero steady-state inflation.

3.6 Calibration Assessment

The calibration yields a steady-state unemployment rate of approximately 6 percent, average hours per employed household of approximately one third, a real interest rate of 2 percent annually, and a steady-state labor-income tax rate of 30 percent (see Table 4). The hand-to-mouth group represents 30 percent of households and provides a parsimonious source of strong heterogeneity in short-run spending responses. Together with the buffer-stock household type and the endogenous asset distribution, this generates the liquidity heterogeneity that is central to the policy experiments.

[10] In the baseline, unemployment-insurance benefits are not taxed, so $\chi_{\text{tax}}^{\text{UI}} = 0$. The robustness exercises additionally consider $\chi_{\text{tax}}^{\text{UI}} = 1$.

Table 1: Household (HA) Parameters — Monthly

Symbol	Description	Value	Source
σ	CRRA coefficient	2.00	Standard macro; paper baseline
ν	Inverse Frisch parameter	4.00	Paper baseline
$1/\nu$	Conditional Frisch elasticity	0.25	Implied by ν
n^{target}	Target hours per employed household	1/3	Calibration target
$n_{\max}$	Maximum individual hours	0.90	Numerical upper bound
β_{HtM}	Discount factor (HtM type)	0.000	Modeling device for HtM
β_{BS}	Discount factor (buffer-stock)	$0.940^{1/12}$	Calibrated to asset mkt clearing at r^{ann}=2%
β_{PIH}	Discount factor (PIH type)	$0.975^{1/12}$	Standard; PIH share = 0 in baseline
Θ	HtM population share	0.30	Johnson–Parker–Souleles (2006, AER)
$\text{share}_{\text{PIH}}$	PIH population share	0.00	Baseline simplification (two active types)
RR	UI replacement rate (baseline)	0.50	U.S. DoL/CBO averages; Kekre (2023)
r^{ann}	Steady real rate (annualized)	0.02	CBO; Laubach–Williams neutral rate
ρ_β	Persistence of β-mult shock	0.80	Baseline persistence

Source: Authors' calculations.
Notes: Θ governs the population share of the strict hand-to-mouth group and is motivated by empirical evidence on heterogeneous spending responses (Johnson et al., 2006). β_{BS} is chosen to clear the asset market at $r^{\text{ann}} = 2$ percent.

Table 2: SAM Labor-Market Parameters — Monthly

Symbol	Description	Value	Source
δ	Separation rate	0.020	BLS JOLTS; Davis–Faberman–Haltiwanger (2013)
λ^u	Job-finding rate	0.30	BLS JOLTS long-run average
θ_{ss}	Market tightness (SS)	0.60	Hagedorn & Manovskii (2008, REStud)
α	Matching elasticity	0.60	Petrongolo & Pissarides (2001, JEL)
u_{ss}	Implied steady unemployment	0.0625	$u = \delta/(\delta + \lambda^u)$
N_u	Number of unemployment states	1	Baseline

Source: Authors' calculations.
Notes: With δ=0.02 and λ^u=0.30, u_{ss}=6.25 percent. Matching efficiency set to hit λ^u at θ_{ss}.

4 Results: Macroeconomic Effects of the Instruments

With the model calibrated to the United States, this section first describes the macroeconomic effects of the contractionary demand shock that defines the recessionary environment studied in the paper. It then compares the macroeconomic effects of unemployment insurance, transfers targeted to hand-to-mouth households, and labor-income tax cuts under a common fiscal envelope. Finally, as a complementary exercise, it introduces the state-contingent and temporary policy paths considered for each instrument, conditional on the downturn having occurred. All policy experiments start from the same steady state and are evaluated relative to the same untreated recession.

Table 3: New Keynesian Block and fiscal parameters — monthly

Symbol	Description	Value	Source
ε	CES elasticity of substitution	6.0	Standard NK (e.g., Galí 2015)
μ	Price markup $= \varepsilon/(\varepsilon-1)$	1.20	Implied by ε
p_x	Relative price $(\varepsilon-1)/\varepsilon$	0.8333	Implied by ε
φ_p	Rotemberg price-adjustment parameter	600	Baseline calibration
δ_π	Taylor-rule inflation coefficient	1.5	Taylor (1993, 1999)
τ	Average labor(-income) tax rate	0.30	NIPA/OECD Taxing Wages
ω	Tax-smoothing weight	0.05	Baseline calibration
δ_q	Debt maturity parameter	0.00	One-period bond case
ϕ^o	UI replacement (upper tier)	0.50	U.S. DoL/CBO; Kekre (2023)
ϕ^u	UI replacement (lower tier)	0.50	U.S. DoL/CBO; Kekre (2023)
w_{share}	Steady-state wage share in p_x	0.90	Model choice[a]
w^{ss}	Steady-state real wage	0.75	Implied by $0.90\,p_x^{ss}$
η_{EG}	Wage response to p_x	0.00	Baseline
ρ_w	Wage-rule persistence	0.995	Paper baseline
$\rho_T, \rho_{\varphi^{UI}}, \rho_\tau$	Persistence of ad hoc policy interventions	0.80	Baseline persistence
β_f	Firm discount factor	$0.975^{1/12}$	Baseline calibration

Source: Authors' calculations.

[a] The wage-share parameter determines the steady-state wage, $w^{ss} = 0.90\,p_x^{ss} = 0.75$. With $\eta_{EG} = 0$, the transition keeps the real wage at this steady-state value.

Table 4: Endogenous steady-state objects (baseline)

Object	Value	Target/Comment	Source
u_{ss}	0.0625	From $\delta = 0.02$, $\lambda^u = 0.30$	Implied by SAM calibration
θ_{ss}	0.60	Calibrated tightness	Hagedorn–Manovskii target
λ^u_{ss}	0.30	Job-finding (monthly)	BLS JOLTS
N_{ss}	0.3127	Aggregate hours	Model-implied
$\bar{n}_{ss}$	≈ 0.334	Hours per employed household	Model-implied
Y_{ss}	0.3127	Steady-state output	Model-implied
w_{ss}	0.7500	Steady-state real wage	Calibration
r^{ann}	0.02	Neutral real rate	CBO; Laubach–Williams
μ	1.20	Price markup	Implied by $\varepsilon = 6$
p_x	0.8333	Relative price	Implied by $\varepsilon = 6$
Avg. quarterly MPC	≈ 0.40	Distributional target	Johnson–Parker–Souleles (2006)
HtM share Θ	0.30	Liquidity-heterogeneity calibration	Johnson–Parker–Souleles (2006)

Source: Authors' calculations.

4.1 The Demand-Driven Recession

Figure 1 reports the impulse responses to the demand shock with no additional policy response. The shock depresses household spending on impact. Consumption falls immediately as liquidity-constrained households reduce purchases and households with access to the bond market increase savings. Because prices adjust sluggishly, part of the decline in demand is

Table 5: Shock and Policy Parameters

Object	Parameter	Value
Demand-shock size	$\Delta\beta$	0.001
Demand-shock persistence	ρ_β	0.80
Ad hoc policy persistence	$\rho_{\varphi^{UI}} = \rho_T = \rho_\tau$	0.80
Tax-smoothing weight	ω	0.05
UI tax treatment	χ_{UI}^{tax}	0

Notes: All ad hoc interventions have persistence 0.80. UI benefits are untaxed in the baseline. The taxable-UI environment is reported in Appendix E.3. Source: Authors' calculations.

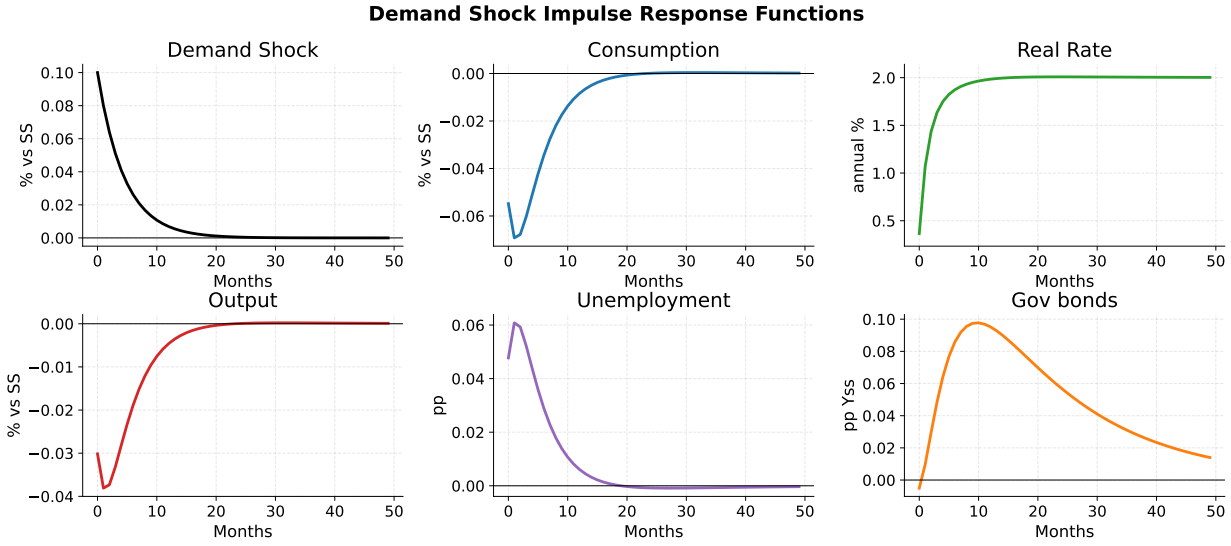


Figure 1: Monthly Macroeconomic Effects of a Negative Demand Shock

Note: SS = steady state. Source: Authors' calculations.

absorbed through quantities. Output consequently falls, while the real interest rate initially declines and gradually returns toward its steady-state level.

The labor market responds with a lag. Lower demand reduces the value of a filled job, vacancy posting declines, market tightness falls, and the job-finding rate decreases. Unemployment therefore rises more gradually than output falls and peaks after the initial decline in economic activity. Search frictions transmit the reduction in demand into the stock of unemployed over several months. At the same time, employed households adjust hours endogenously, so the reduction in aggregate labor input reflects both the extensive employment margin and the intensive labor-supply margin. Higher unemployment risk also strengthens precautionary saving among employed households, contributing to the persistence of the consumption response.

Fiscal dynamics are governed by the tax-smoothing rule, reported in Equation (21). The decline in employment and aggregate hours weakens the labor-tax base, while higher

unemployment raises unemployment-insurance expenditures. Public debt absorbs part of the resulting financing need and remains above its steady-state level as the economy recovers and taxes gradually adjust. The debt response is therefore an equilibrium outcome of the recession and the fiscal closure.

Household heterogeneity amplifies these dynamics. Rising unemployment shifts part of the household distribution toward lower-asset states, where marginal utility and spending sensitivity are higher. These distributional movements interact with unemployment risk and precautionary saving, strengthening the response of consumption to the recession. Overall, the demand shock generates a persistent decline in consumption and output together with higher unemployment and lower labor input.

4.2 Income-Stabilization Instruments and the Common Fiscal Envelope

To counteract the recession, we consider three income-stabilization instruments activated once the recessionary demand shock is observed. The first is an increase in unemployment-insurance generosity, which raises the replacement rate received by unemployed households. The second is a transfer targeted to hand-to-mouth households, who represent 30 percent of the household population. The third is a reduction in the labor-income tax rate. The three instruments operate through different channels. Unemployment insurance provides direct income support to unemployed households and reduces the income loss associated with unemployment. Targeted transfers direct cash toward households with high spending sensitivity. Labor-income tax cuts raise disposable labor income for employed households and increase the after-tax return to hours worked.

Policy sizes are compared using a common direct fiscal-cost envelope. Let superscript 0 denote the untreated recession and superscript j the recession with policy j. The realized direct fiscal-cost flows are defined as

$$d_t^j = \begin{cases} \Phi_t^j - \Phi_t^0, & j = \text{UI}, \\ m^{\text{HtM}} T_t^j, & j = \text{T}^{\text{HtM}}, \\ \tau_t^0 \mathcal{B}_t^0 - \tau_t^j \mathcal{B}_t^j, & j = \text{Tax}, \end{cases} \tag{28}$$

where $m^{\text{HtM}} = 0.30$, Φ_t denotes unemployment-insurance expenditures, and

$$\mathcal{B}_t = w_t N_t + \chi_{\text{tax}}^{\text{UI}} \Phi_t$$

is the labor-tax base. In the main specification, unemployment-insurance benefits are untaxed, so $\chi_{\text{tax}}^{\text{UI}} = 0$.

The present value of direct fiscal cost is

$$\mathcal{C}^j = \sum_{t=0}^{T-1} \beta_{\text{BS}}^t d_t^j. \tag{29}$$

For each instrument, the policy amplitude is chosen so that

$$\mathcal{C}^j = \mathcal{C}^*, \tag{30}$$

where $\mathcal{C}^*$ is the common reference fiscal target. The reference target corresponds to the realized direct fiscal cost of the automatic unemployment-insurance rule calibrated to generate a one-percentage-point peak increase in the UI replacement rate. Policy amplitudes for the remaining instruments and activation modes are determined independently to satisfy Equation (30).

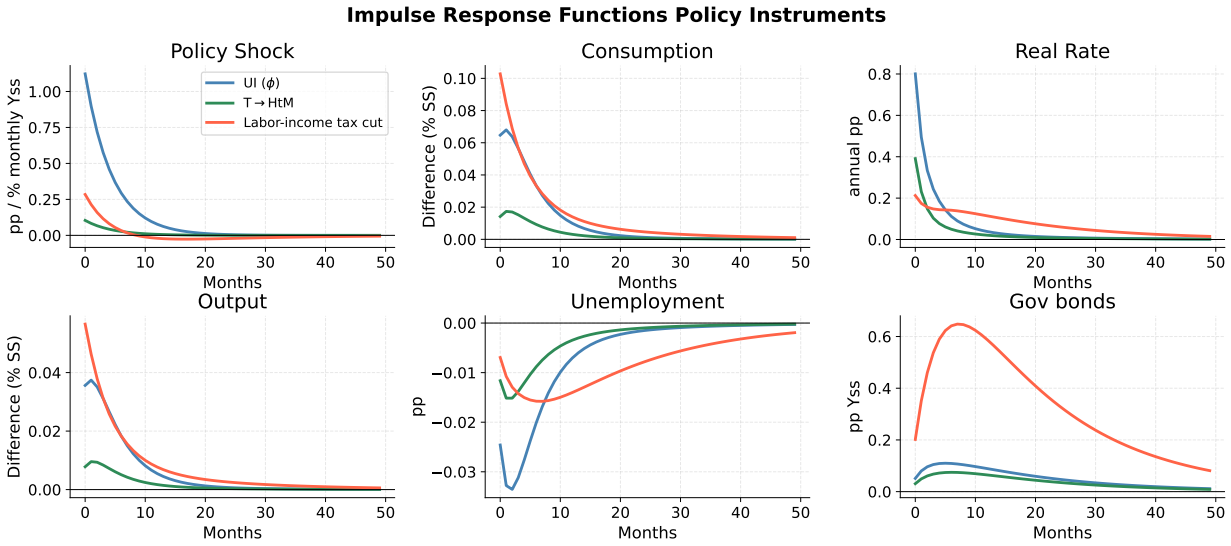


Figure 2: Macroeconomic Effects of Income-Stabilization Policies Under a Common Fiscal Envelope

Note: Each panel compares the responses induced by the three ad hoc policy interventions, independently scaled to the same present value of realized direct fiscal cost. Responses are measured relative to the untreated recession. In the Policy Shock panel, unemployment insurance and the labor-income tax cut are expressed in percentage points, while targeted transfers are expressed per recipient as a percent of monthly steady-state output. Source: Authors' calculations.

Figure 2 compares the macroeconomic effects of the three instruments at the common realized direct fiscal cost, assuming the ad hoc (instead of state-contingent) activation mode. Each response is measured relative to the untreated recession. This comparison isolates differences in the transmission of the policy instruments under the same recessionary environment and fiscal resources.

Unemployment insurance supports consumption through two channels. Higher benefits raise disposable income directly for unemployed households, whose marginal utility of consumption is high. Greater insurance against the income loss associated with unemployment also reduces precautionary saving among households that remain employed. Higher consumption supports firm revenues and vacancy creation, improves market tightness and job finding, and lowers unemployment relative to the untreated recession. The unemployment response is particularly pronounced under UI, reflecting the interaction between the insurance channel and labor-market dynamics.

Targeted transfers operate primarily through a cash-flow channel. Transfers are directed to the fixed group of hand-to-mouth households, whose consumption is highly sensitive to current resources. Consumption therefore rises following the intervention, which supports output, vacancy creation, and employment. The policy does not directly change the income

loss associated with unemployment, so its effect does not contain the same insurance channel as unemployment insurance. At the common fiscal cost, its aggregate effects are consequently more limited than those of unemployment insurance and the labor-income tax cut.

The labor-income tax cut operates through both disposable income and endogenous labor supply. A lower tax rate raises after-tax labor income for employed workers and increases the return to hours worked. Consumption, aggregate hours, and output therefore rise relative to the untreated recession. The expansion in labor input also increases the labor-tax base, an endogenous fiscal feedback that becomes important for the welfare and fiscal-cost comparison developed in Section 5. At the reference common cost, the tax cut generates a particularly strong response of consumption and output, while unemployment insurance produces a larger reduction in unemployment.

The public-debt paths in Figure 2 are equilibrium outcomes and are not equalized across instruments. The common fiscal envelope fixes the discounted present value of direct fiscal cost in Equation (30). Differences in the timing of fiscal flows, output, employment, the UI caseload, and the labor-tax base therefore generate different debt dynamics across the three policies. In particular, the labor-income tax cut generates a larger initial financing requirement, with the government-debt response peaking at 0.648 percentage points of monthly steady-state output, compared with 0.110 for unemployment insurance and 0.075 for targeted transfers. This reflects the initial reduction in labor-tax revenue and the timing of subsequent fiscal adjustment. Equalizing the present value of direct fiscal costs therefore does not imply identical borrowing requirements over the transition.

4.3 Policy Paths Under State-Contingent and Ad Hoc Instruments

As a complementary exercise, we next consider two forms of policy activation for each instrument. The first is an automatic intervention governed by a state-contingent rule that responds to the unemployment gap. The second is an ad hoc intervention following an exogenous, transitory policy path introduced after the shock. Both interventions are temporary, start from the same steady state, and are evaluated conditional on the downturn having occurred. The automatic policy rules are inactive in steady state. Let

$$g_t = \max\{u_t - u^{ss}, 0\} \tag{31}$$

denote the positive unemployment gap. The policy instruments in their automatic form can be written as

$$\phi_t^A = \phi^{ss} + \gamma_\phi g_t, \tag{32}$$

$$T_t^A = \gamma_T g_t, \tag{33}$$

$$\tau_t^A = \tau_t^{\text{base}} - \gamma_\tau g_t, \tag{34}$$

subject to the admissible bounds of each policy instrument. Since $g_t = 0$ in steady state, this format leaves the initial steady state of the instruments unchanged. The one-sided specification also implies that the automatic intervention switches off when unemployment returns to or falls below its steady-state level.

In turn, ad hoc interventions follow exogenous transitory paths after the demand shock that can be written as

$$\phi_t^T - \phi^{ss} = j_\phi \rho_\phi^t, \tag{35}$$

$$T_t^T = j_T \rho_T^t, \tag{36}$$

$$\tau_t^{\text{pol},T} = -j_\tau \rho_\tau^t, \tag{37}$$

with

$$\rho_\phi = \rho_T = \rho_\tau = 0.80.$$

For each instrument and activation mode, the coefficient governing the automatic form or the initial amplitude of the ad hoc intervention is chosen independently to satisfy the same realized direct fiscal-cost target in Equation (30).

Figure 3 compares the automatic and ad hoc activations within each policy instrument. These two activation modes generate different policy paths. Automatic interventions follow the endogenous unemployment gap and therefore respond to the evolution of labor-market conditions, while ad hoc interventions decay according to the exogenous persistence parameter. Despite these differences in timing, the resulting macroeconomic responses are quantitatively close once direct fiscal resources are equalized, conditional on the realization of the recessionary demand shock.

For unemployment insurance, the automatic activation mode responds strongly when unemployment rises and declines as the unemployment gap closes. The ad hoc activation mode has a smoother exogenous decay. Both forms of implementation raise consumption, lower unemployment, and increase aggregate hours relative to the untreated recession, with relatively small differences in the resulting paths. A similar pattern emerges for targeted transfers. Differences in the activation mode of the transfers translate into modest differences in consumption, unemployment, and aggregate hours.

The labor-income tax cut exhibits a somewhat different outcome in terms of policy path for the two forms of activation mode. That is because the state-contingent reduction in the tax rate interacts with the endogenous fiscal rule. The automatic tax cut responds to the unemployment gap, while the ad hoc policy component decays exogenously. Both policies generate a substantial increase in consumption and labor input. Their effects remain close after the common fiscal-cost normalization, even though the timing of the tax-rate response differs.

The macroeconomic evidence therefore shows that, conditional on the recession and after equalizing direct fiscal resources, the two policy paths generate relatively similar aggregate responses. Section 5 reports the corresponding welfare comparison after establishing the welfare ranking across instruments.

5 Welfare Computation and Policy Comparison

A key contribution of this paper is to calculate a consistent measurement of welfare in a heterogeneous-agent New Keynesian model with search-and-matching frictions (HANK–SAM), which allows us to compare the three income-stabilization instruments along this dimension. The first subsection describes our methodology to calculate this consistent measure of welfare

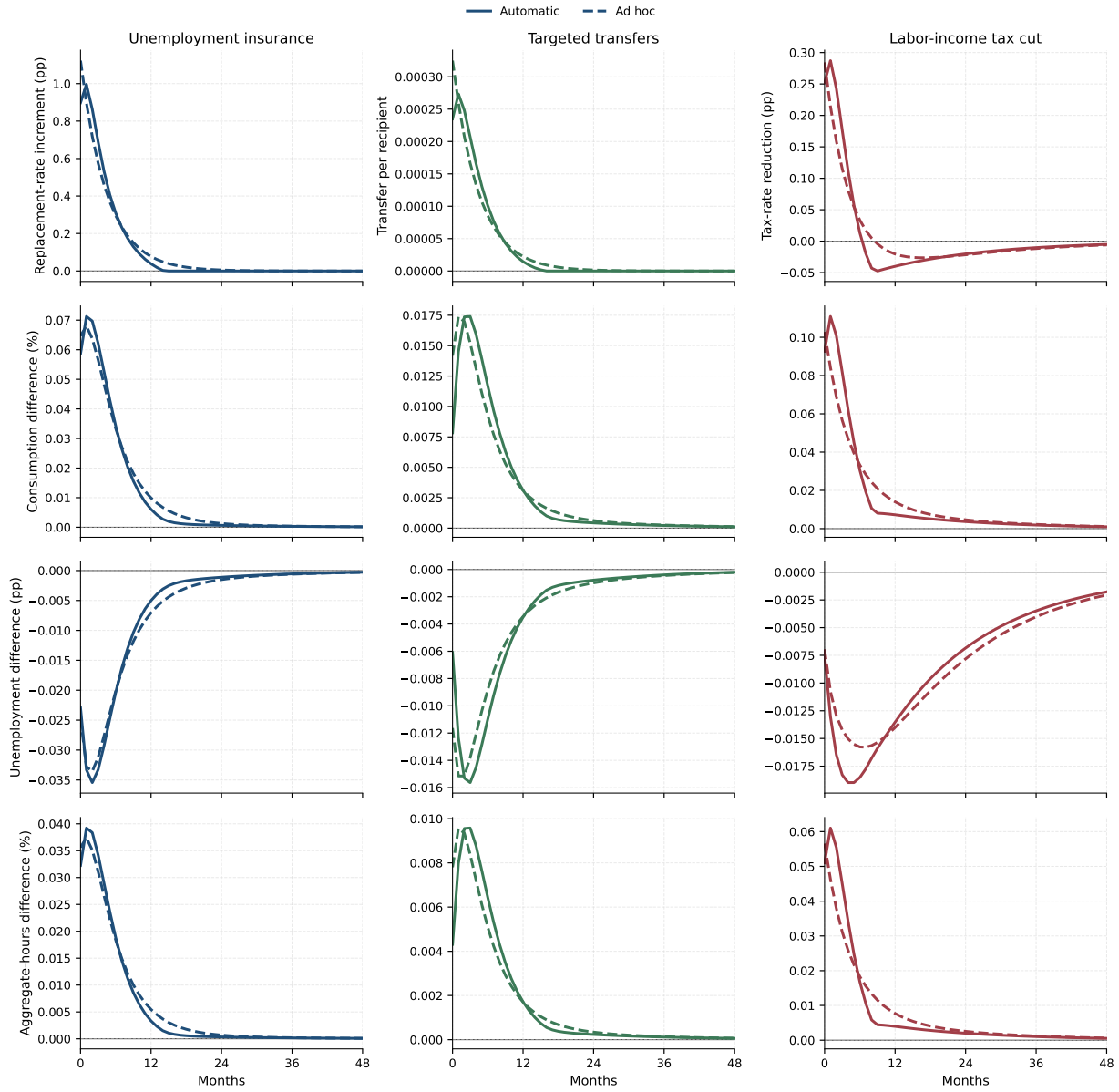


Figure 3: Macroeconomic Effects of Automatic and Ad hoc Income-Stabilization Policies

Note: Columns report unemployment insurance, transfers targeted to hand-to-mouth households, and the labor-income tax cut. Solid lines denote automatic policies and dashed lines denote ad hoc policies. Automatic and ad hoc interventions are independently scaled to the same present value of realized direct fiscal cost. Macroeconomic responses are measured relative to the untreated recession. Source: Authors' calculations.

calculation. Using our measure of welfare, we then rank the three policy instruments under the common fiscal envelope, report the complementary comparison across policy paths, and decompose the welfare effects into consumption and labor components.

5.1 Methodology: HANK Welfare Measurement

Standard representative-agent models measure welfare using the utility associated with a representative consumption and labor path. In the HANK–SAM environment, welfare also depends on the distribution of consumption, hours, assets, and employment states across households. The welfare calculation therefore uses the full household distribution along the nonlinear transition path.

Let j index a node in the joint grid of household type, liquid assets, and employment status. For each node, the household solution provides consumption $c_{j,t}$, hours $n_{j,t}$, and the corresponding cross-sectional mass $D_{j,t}$. Per-period utility can then be written as

$$u(c_{j,t}, n_{j,t}) = u_c(c_{j,t}) - u_n(n_{j,t}), \tag{38}$$

where

$$u_c(c) = \begin{cases} \log(c), & \sigma = 1, \\ \dfrac{c^{1-\sigma}}{1-\sigma}, & \sigma \neq 1, \end{cases} \qquad u_n(n) = \chi \frac{n^{1+\nu}}{1+\nu}. \tag{39}$$

Aggregate consumption utility and labor disutility at date t are obtained directly from the cross-sectional distribution:

$$U_{c,t} = \sum_j D_{j,t} u_c(c_{j,t}), \tag{40}$$

$$U_{n,t} = \sum_j D_{j,t} u_n(n_{j,t}), \tag{41}$$

so that aggregate welfare flow is

$$U_t = U_{c,t} - U_{n,t} = \sum_j D_{j,t} u(c_{j,t}, n_{j,t}). \tag{42}$$

The distribution $D_{j,t}$ evolves endogenously along the transition as households move across employment and asset states. Consequently, Equation (42) incorporates both changes in utility at a given household state and changes in the mass of households occupying different states.

Private discount factors determine household saving decisions. Welfare aggregation uses a common monthly social discount factor, denoted by β^S, which is set equal to the discount factor of the buffer-stock household type, $\beta^S = \beta_{\text{BS}}$. For a transition of length T, discounted consumption utility and labor disutility are

$$W_c = \sum_{t=0}^{T-1} (\beta^S)^t U_{c,t} + \frac{(\beta^S)^T}{1-\beta^S} U_c^{ss}, \tag{43}$$

$$W_n = \sum_{t=0}^{T-1} (\beta^S)^t U_{n,t} + \frac{(\beta^S)^T}{1-\beta^S} U_n^{ss}, \tag{44}$$

and lifetime welfare is

$$W = W_c - W_n. \tag{45}$$

The transition horizon is $T = 480$ months. The final terms in Equations (43) and (44) value the steady-state continuation after the finite transition horizon.

Welfare differences are expressed as a consumption-equivalent variation (CEV). Let superscript 0 denote the untreated recession and superscript 1 a recession with a policy intervention. The CEV is the constant proportional change g in consumption along the untreated path that makes households indifferent between the compensated untreated path and the policy path, leaving hours unchanged. For $\sigma \neq 1$,

$$(1+g)^{1-\sigma} W_c^0 - W_n^0 = W^1. \tag{46}$$

Using $W^0 = W_c^0 - W_n^0$, the corresponding CEV becomes

$$g = \left[1 + \frac{W^1 - W^0}{W_c^0}\right]^{\frac{1}{1-\sigma}} - 1. \tag{47}$$

The calibration has $\sigma = 2$. We report the consumption-equivalent variation in percentage terms, defined as $\text{CEV}(\%) = 100g$, where g is the unit-free proportional consumption change defined in Equation (47). For example, a reported CEV of 0.2 corresponds to a permanent 0.2 percent increase in consumption along the untreated path, including its steady-state continuation, that generates the same welfare as the policy intervention.

This welfare measure preserves the heterogeneity in marginal utility generated by the household distribution and includes the labor-supply effects introduced in Section 2. It also provides a common welfare metric for all policy experiments constructed under the fiscal normalization in Section 4.

5.2 Welfare Ranking across Policy Instruments

Given our welfare measure described above, we can now compare the three income-stabilization instruments at the same realized direct fiscal cost. Figure 4 reports the welfare gains over the range of common fiscal targets considered in the analysis for both the automatic and the ad hoc activation modes of interventions.

At the reference fiscal cost, unemployment insurance generates the largest welfare gain for both activation modes, followed closely by the labor-income tax cut. Transfers targeted to hand-to-mouth households generate a substantially smaller welfare gain. The difference between unemployment insurance and the labor-income tax cut is therefore small compared with the gap between either of these instruments and targeted transfers.

Unemployment insurance combines direct cash-flow support to unemployed households with insurance against the income loss associated with job loss. Greater insurance reduces precautionary saving among households that remain employed, while the resulting increase in demand supports vacancies, job finding, and employment. These channels are closely related to the insurance mechanisms emphasized in Chetty, 2006, Landais et al., 2018, and Broer et al., 2025.

Targeted transfers concentrate resources on households with high spending sensitivity. This channel is consistent with the high MPCs associated with liquidity-constrained households

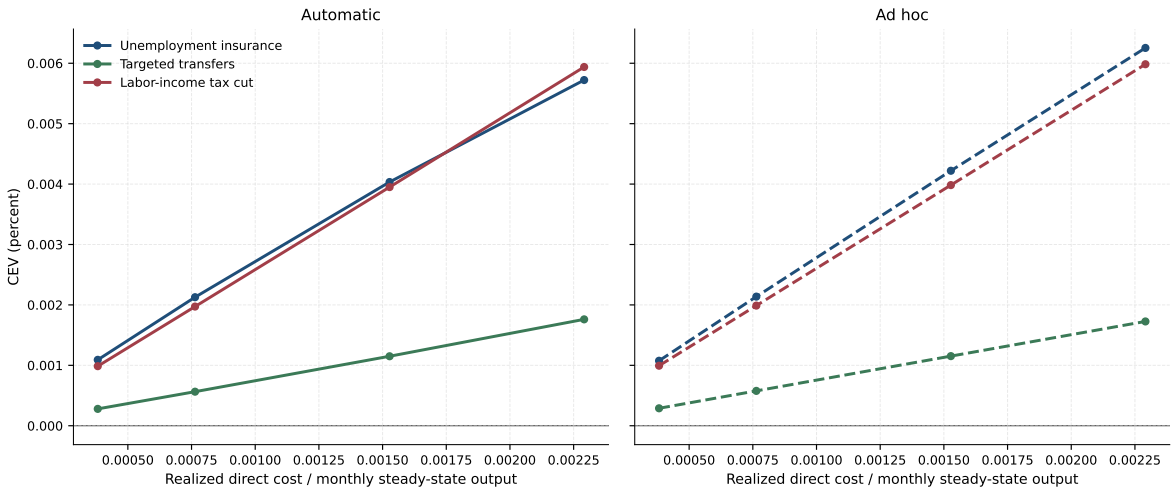


Figure 4: Welfare Ranking at Equal Realized Direct Fiscal Cost

Note: Each point reports the consumption-equivalent welfare gain relative to the untreated recession for policies independently scaled to the same present value of realized direct fiscal cost. The left panel reports automatic interventions and the right panel ad hoc interventions. Source: Authors' calculations.

documented by Kaplan et al., 2014. In the model, however, the transfer does not directly reduce the income loss associated with unemployment. Its welfare effects therefore arise mainly through direct cash-flow support and the resulting general-equilibrium response, consistent with the importance of household liquidity and risk emphasized by Auclert, 2019 and Consolo and Hänsel, 2024.

Labor-income tax cuts operate through disposable labor income and labor supply. Lower taxes increase the after-tax return to hours worked, raise consumption and aggregate labor input, and improve employment relative to the untreated recession. These effects generate welfare gains close to those obtained from unemployment insurance at the reference fiscal cost.

Figure 4 also shows that the ranking between unemployment insurance and the labor-income tax cut is sensitive to policy scale. Under an automatic activation mode of stabilization, UI ranks above the labor-income tax cut at the first three fiscal targets, while the labor-income tax cut generates the larger welfare gain at the highest evaluated target. Under an ad hoc mode of stabilization, UI remains above the labor-income tax cut over the evaluated range. Targeted transfers remain third for both activation modes throughout the realized-cost grid. This comparison shows that instrument choice has quantitatively important welfare consequences. Although unemployment insurance and labor-income tax cuts generate relatively similar welfare gains at the reference fiscal cost, their relative performance depends on policy scale and on the endogenous fiscal feedback analyzed in Section 6.

5.3 Activation-Mode Comparison

As a complementary exercise, we compare the welfare effects of the state-contingent and ad hoc implementations of each instrument. As described in Section 4, the two policy paths start from the same steady state, face the same contractionary demand shock, and are

independently scaled to the same present value of realized direct fiscal cost. The comparison therefore holds both the underlying recession and fiscal resources fixed and is conditional on the downturn having occurred.

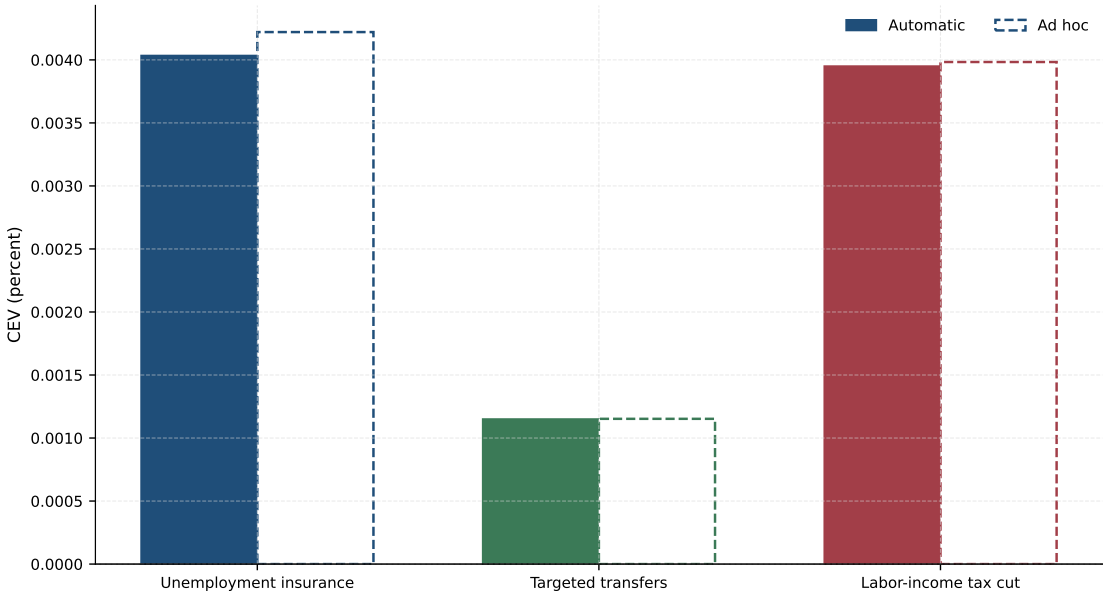


Figure 5: Welfare Effects of Automatic vs Ad hoc Stabilization at Equal Realized Fiscal Cost
Note: Bars report consumption-equivalent welfare gains relative to the untreated recession. For each instrument, the automatic and ad hoc interventions are independently scaled to the same present value of realized direct fiscal cost. Source: Authors' calculations.

Figure 5 shows that, conditional on the downturn having occurred, the activation mode has only a small effect on welfare at the reference fiscal cost. For unemployment insurance, the CEV is 0.00403 percent under the automatic intervention and 0.00422 percent under the ad hoc intervention. The corresponding values are 0.001150 and 0.001152 percent for targeted transfers, and 0.003950 and 0.003983 percent for the labor-income tax cut. The resulting automatic-to-ad-hoc welfare ratios are approximately 0.956, 0.998, and 0.992, respectively.

These results indicate that, conditional on the recession having occurred, the distinction between the two policy paths has limited quantitative importance once fiscal resources are equalized. This result complements the cross-instrument comparison above. Because aggregate uncertainty is absent from the exercise, it should not be interpreted as measuring the ex-ante insurance value of committing to a state-contingent policy before a future downturn.

5.4 Consumption and Labor Contributions to Welfare

The welfare measure in Equation (45) contains both consumption utility and labor disutility. To assess the contribution of these two margins, we decompose the welfare change associated with each policy as

$$\Delta W = \Delta W_c - \Delta W_n, \tag{48}$$

where ΔW_c is the change in discounted consumption utility and ΔW_n is the change in discounted labor disutility relative to the untreated recession.

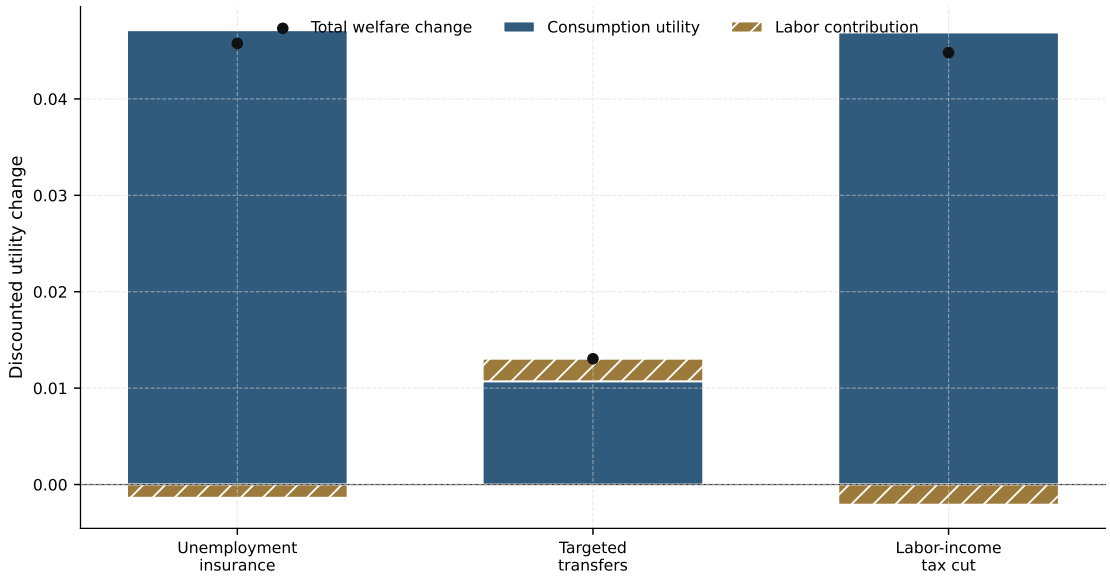


Figure 6: Consumption and Labor Contributions to Welfare

Note: Bars decompose the discounted welfare change relative to the untreated recession into consumption utility and the labor contribution. The black marker reports the total welfare change. Policies are evaluated at the reference realized direct fiscal cost. Source: Authors' calculations.

Figure 6 shows that consumption utility accounts for most of the welfare gain generated by unemployment insurance and the labor-income tax cut. For both instruments, the increase in labor input raises labor disutility and partially offsets the consumption-utility gain. The remaining welfare gain is nevertheless large, consistent with their leading positions under the realized-cost comparison.

For targeted transfers, the consumption-utility gain is smaller, but the labor contribution is positive in the discounted welfare decomposition. The labor component therefore reinforces the consumption gain for this instrument. Even with this contribution, total welfare remains below that generated by unemployment insurance and the labor-income tax cut at the common realized fiscal cost.

The decomposition confirms that the ranking does not arise from aggregate consumption alone. Endogenous labor supply affects welfare directly, while employment, household consumption, and the distribution of households across states jointly determine the total welfare effect. The period-by-period decomposition also indicates that both consumption utility and labor disutility respond on impact, although their subsequent contributions differ across policy instruments.

The welfare comparison so far evaluates each intervention using its realized direct fiscal cost. This cost can itself respond endogenously to the policy because unemployment insurance changes the number of benefit recipients and labor-income tax cuts change the tax base. The next section studies these fiscal feedbacks and evaluates how the policy ranking changes when fiscal costs are instead measured holding the relevant fiscal exposure fixed.

6 Fiscal Feedback and Alternative Fiscal-Cost Measures

The common fiscal envelope used in the previous section measures the realized direct fiscal cost of each policy intervention. This cost can depend on the macroeconomic response generated by the policy itself. In particular, higher unemployment-insurance generosity can reduce unemployment and therefore the number of benefit recipients, while a labor-income tax cut can expand employment and aggregate hours and therefore increase the labor-tax base. Targeted transfers differ from these two instruments because the recipient mass is fixed at the share of hand-to-mouth households.

6.1 Endogenous Fiscal Feedback

Figure 7 illustrates these mechanisms for unemployment insurance and the labor-income tax cut.

For unemployment insurance, the realized fiscal cost is lower than the cost obtained by evaluating the policy change using the unemployment exposure of the untreated recession. Higher UI generosity supports consumption and labor-market activity, reduces unemployment, and therefore lowers the number of households receiving benefits. At the reference fixed-base policy, this endogenous caseload response reduces the present value of the incremental direct fiscal cost of automatic UI by approximately 44.6 percent relative to fixed-exposure pricing.

A similar mechanism operates through the labor-tax base. The labor-income tax cut raises disposable income and the after-tax return to hours worked, increasing labor input and economic activity. The resulting expansion of the tax base recovers part of the mechanical revenue loss associated with the tax reduction. At the reference fixed-base policy, this tax-base response recovers approximately 35.5 percent of the mechanical revenue loss under the automatic intervention.

Targeted transfers do not feature an analogous fiscal-base response in the model. The transfer is paid to the fixed hand-to-mouth group, which represents 30 percent of households. Consequently, changes in the realized fiscal cost of this instrument are not driven by changes in the recipient mass.

6.2 Fixed-Base Fiscal Cost

To assess the importance of these endogenous fiscal responses for the policy ranking, we construct an alternative fiscal-cost measure that holds the relevant fiscal exposure at the level that would prevail in the untreated recession.

For unemployment insurance, the fixed-base direct cost is

$$d_t^{\mathrm{UI,FB}} = \left(\phi_t^j - \phi_t^0\right) w_t^0 n^{ss} u_t^0, \tag{49}$$

where superscript 0 denotes the untreated recession and superscript j denotes the recession with the policy intervention. The replacement-rate change is therefore evaluated using the unemployment exposure of the untreated recession.

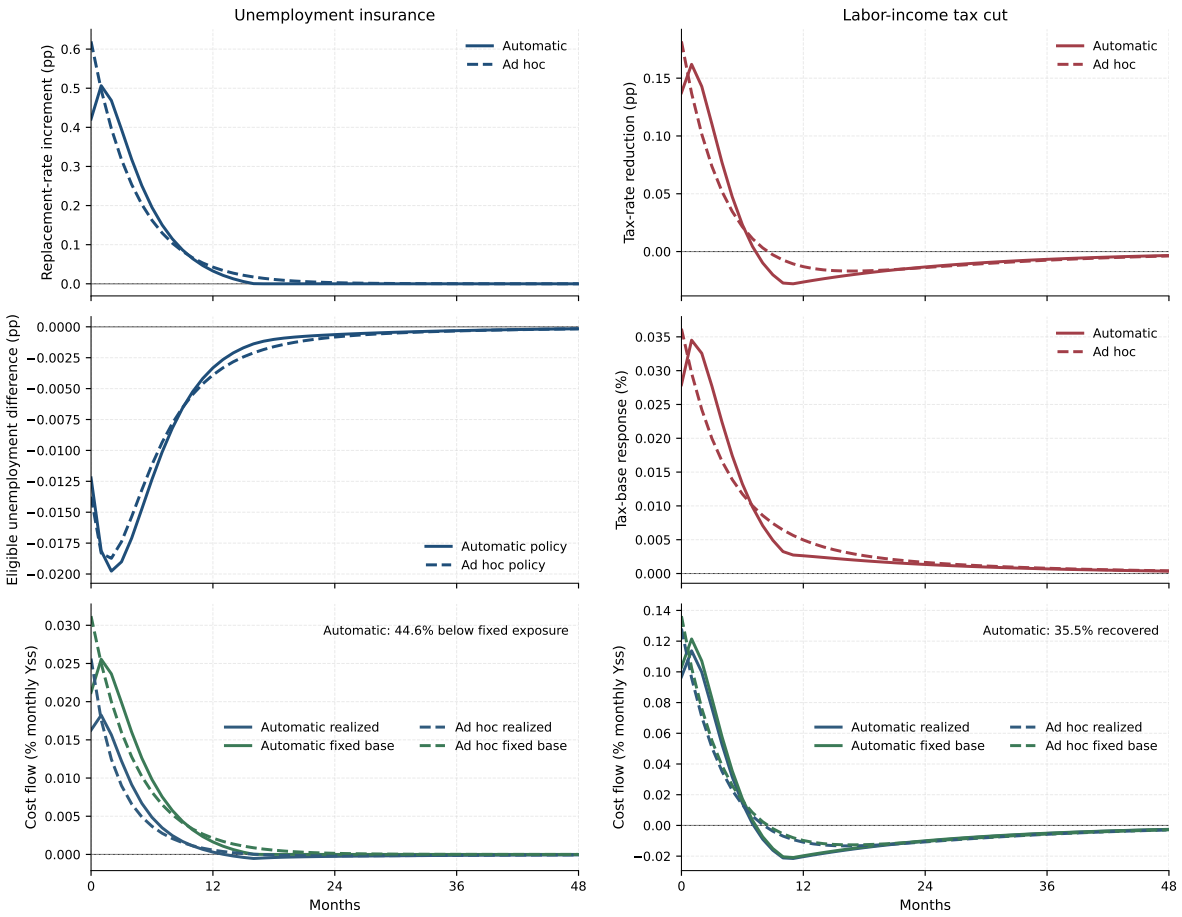


Figure 7: Endogenous Fiscal Feedback from Unemployment Insurance and Labor-Income Tax Cuts

Note: The figure uses the policies matched at the reference fixed-base fiscal target. For unemployment insurance, the figure separates the policy-induced change in the replacement rate from the endogenous change in the eligible unemployment mass. For the labor-income tax cut, it separates the tax-rate change from the endogenous change in the labor-tax base. Source: Authors' calculations.

For the labor-income tax cut, the corresponding cost is

$$d_t^{\text{Tax,FB}} = -\left(\tau_t^j - \tau_t^0\right) \mathcal{B}_t^0, \tag{50}$$

where

$$\mathcal{B}_t^0 = w_t^0 N_t^0 + \chi_{\text{tax}}^{\text{UI}} \Phi_t^0$$

is the labor-tax base in the untreated recession.

For targeted transfers, the fixed-base cost is

$$d_t^{\text{T}^{\text{HtM}},\text{FB}} = m^{\text{HtM}} \left(T_t^j - T_t^0\right), \tag{51}$$

which coincides with the direct transfer outlay because the recipient mass is fixed.

For each instrument and activation mode, the policy amplitude is independently chosen so that the discounted present value of the fixed-base fiscal cost reaches the same target.

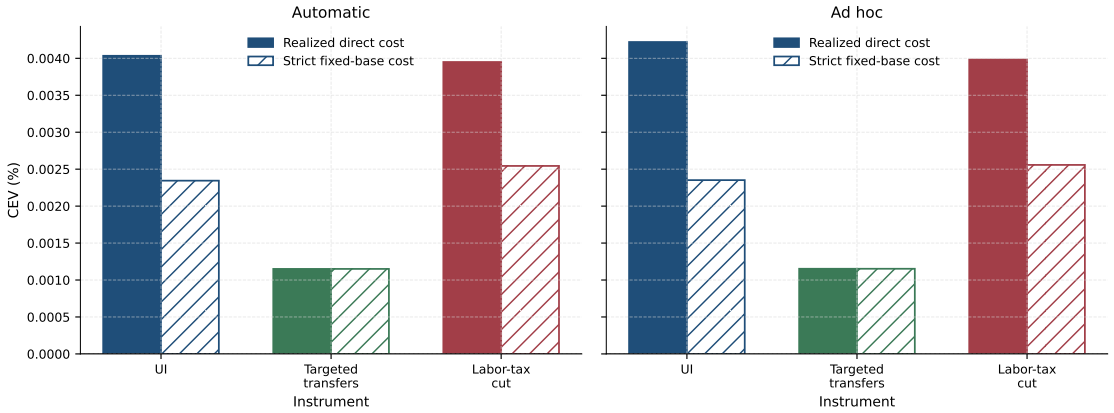


Figure 8: Welfare Ranking under Realized and Fixed-Base Fiscal Costs

Note: Policies under each fiscal-cost definition are independently scaled to the corresponding common fiscal target. Realized cost incorporates endogenous changes in the UI caseload and labor-tax base. Fixed-base cost evaluates policy changes using the fiscal exposure of the untreated recession. Source: Authors' calculations.

Figure 8 compares the welfare ranking under the two fiscal-cost definitions. Under realized direct fiscal cost, unemployment insurance generates the largest welfare gain at the reference target, followed closely by the labor-income tax cut, while targeted transfers rank third. When the policy changes are instead evaluated using the fiscal exposure of the untreated recession, the ranking of the first two instruments reverses. The labor-income tax cut generates the largest welfare gain, unemployment insurance ranks second, and targeted transfers remain third.

The change in ranking reflects the different strength of the endogenous fiscal feedbacks shown in Figure 7. Realized-cost comparisons assign unemployment insurance part of the fiscal saving generated by its effect on the lower number job losses given the policy (insurance) intervention. Labor-income tax cuts also recover part of their initial revenue loss through a larger tax base, but this feedback is smaller at the reference policy. Holding fiscal exposure fixed removes these effects from the policy-cost comparison and changes the relative ranking of the two instruments.

6.3 Policy Scale

Figure 9 examines whether the fixed-base ranking depends on the size of the fiscal intervention.

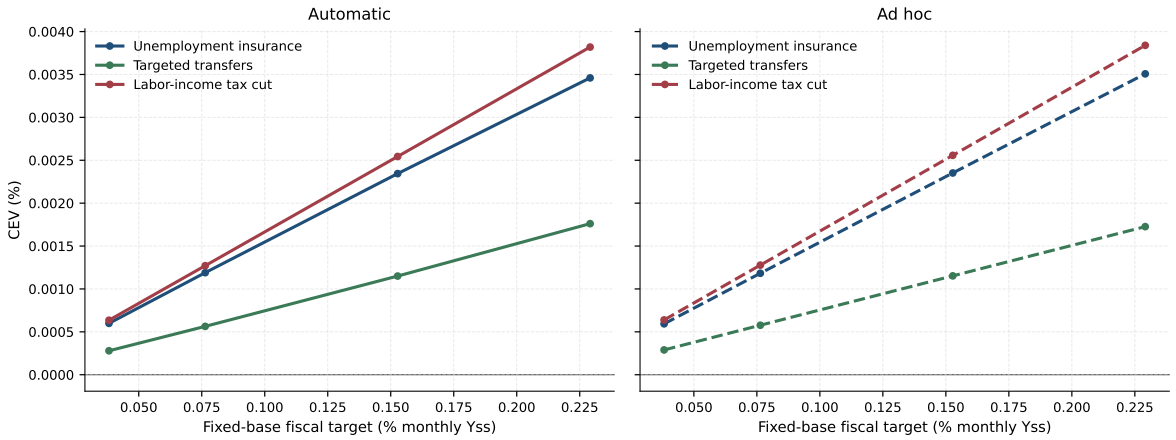


Figure 9: Welfare Ranking at Equal Fixed-Base Fiscal Cost

Note: Each point reports the consumption-equivalent welfare gain for policies independently matched to the same present value of fixed-base fiscal cost. The left panel reports automatic interventions and the right panel ad hoc interventions. Source: Authors' calculations.

The fixed-base ranking is stable across the evaluated fiscal targets. The labor-income tax cut generates the largest welfare gain at each of the four policy scales for both automatic and ad hoc interventions. Unemployment insurance ranks second and targeted transfers third. This result contrasts with the realized-cost comparison in Figure 4, where the ranking between unemployment insurance and the labor-income tax cut is closer and changes with policy scale for the automatic interventions.

Overall, these results show that endogenous fiscal feedback is quantitatively important for comparing income-stabilization policies. The main distinction is between unemployment insurance and labor-income tax cuts, whose fiscal bases respond endogenously to the policies, and targeted transfers, whose recipient mass remains fixed. The relative ranking between unemployment insurance and labor-income taxation therefore depends on whether these endogenous fiscal responses are included in the measure of policy cost, which is our preferred measure in the paper.

7 Distributional Effects of the Policy Instruments

This section studies how stabilization gains are distributed across households with different liquid-wealth positions.[11] The per-period welfare measure follows the HANK welfare calculation defined in Section 5. For each node i in the household state space,

$$U_t \equiv \sum_i D_{i,t}\, u(c_{i,t}, n_{i,t}), \tag{52}$$

[11] A recent strand of the literature also studies distributional effects for households with different liquid-wealth positions in response to various policies and macroeconomic shocks (see, for example, Pallotti et al., 2024, and Cicek et al., 2026, for inflation; and Furceri et al., 2018 for monetary policy).

where $D_{i,t}$ is the cross-sectional mass at node i, and $u(c_{i,t}, n_{i,t})$ is the utility function defined in Equation (38).

For the distributional analysis, households are grouped into wealth quartiles using the pre-shock liquid-wealth distribution across all household types. For subgroup g, average period utility is defined as

$$U_t^g = \frac{\sum_i D_{i,t} M_i^g u(c_{i,t}, n_{i,t})}{m_t^g}, \qquad m_t^g = \sum_i D_{i,t} M_i^g, \tag{53}$$

where M_i^g indicates whether node i belongs to wealth group g. The pre-shock wealth cutoffs remain fixed over the transition, while the mass occupying each wealth group can change as the household distribution evolves.

For the dynamic analysis, welfare responses are reported relative to the untreated recession:

$$\Delta U_t^g = 100 \frac{U_{t,\text{policy}}^g - U_{t,\text{untreated}}^g}{|U^{ss}|}. \tag{54}$$

Using $|U^{ss}|$ in the denominator keeps the scale common across groups. For the cross-policy comparison below, subgroup welfare is expressed in consumption-equivalent variation units using the same compensation criterion defined in Section 5, applied to the mass-normalized welfare path of each group.

7.1 Cross-Policy Distributional Comparison

Figure 10 compares welfare gains across liquid-wealth quartiles for the three instruments under the ad hoc activation mode, holding fixed the recessionary environment and the reference realized direct fiscal cost.

Figure 10 shows substantial heterogeneity in the incidence of the three policies. Under unemployment insurance, the largest welfare gain accrues to households in the first wealth quartile, followed by those in the second quartile. The CEV gains are approximately 0.0081 percent for Q1 and 0.0050 percent for Q2, while the effects for Q3 and Q4 are slightly negative and close to zero. More generous unemployment insurance therefore generates positive welfare effects for the lower half of the liquid-wealth distribution, where insurance against unemployment risk and additional resources in the unemployment state are particularly valuable.

Targeted transfers are even more concentrated at the bottom of the wealth distribution. The first quartile records a CEV gain of approximately 0.0045 percent, while the effects for the other quartiles are negative and considerably smaller in absolute value. This pattern reflects the direct incidence of the policy on hand-to-mouth households, which are concentrated in the lower part of the liquid-wealth distribution.

The labor-income tax cut generates an aggregate welfare gain close to that of unemployment insurance, but its distributional incidence is more uneven across liquid-wealth groups. The first quartile records a positive welfare gain, while the remaining quartiles have negative subgroup CEVs. The labor-income tax intervention affects both disposable labor income and hours worked, so its distributional welfare effects incorporate the consumption gains and the changes in labor disutility associated with the endogenous labor-supply response. The resulting pattern is not monotonic across wealth groups.

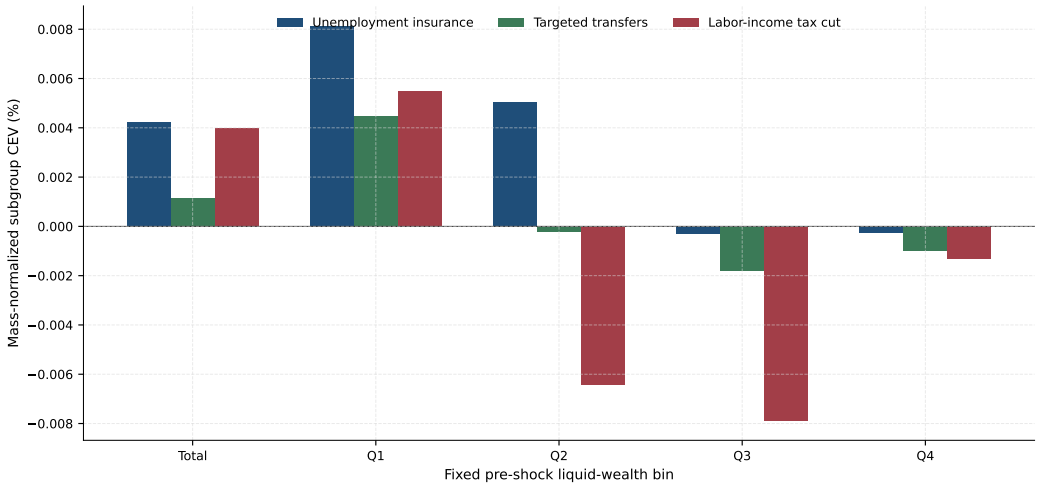


Figure 10: **Distributional Welfare Effects of Income-Stabilization Policies by Wealth Quartile**

Notes: Grouped bars report consumption-equivalent welfare gains for the aggregate economy and for each wealth quartile. All policies are assumed to follow an ad hoc activation mode evaluated under the common recession and the reference realized direct fiscal-cost target. Wealth groups use fixed pre-shock liquid-wealth cutoffs. Subgroup CEVs are based on average welfare among households occupying states in each wealth group, using the contemporaneous group mass and the labor-inclusive utility function. Q1, Q2, Q3, and Q4 denote the first, second, third, and fourth wealth quartiles, respectively. Source: Authors' calculations.

7.2 UI Generosity: Dynamics by Wealth Quartile

We next consider the full time path following the ad hoc increase in unemployment-insurance generosity. Figure 11 shows the welfare responses for each wealth quartile together with the aggregate response.

Aggregate welfare increases on impact and then gradually converges back toward the untreated-recession path. Distributionally, the first and second wealth quartiles experience the largest initial improvements. The impact welfare-flow changes are approximately 0.24 percent of aggregate steady-state utility for Q1 and 0.17 percent for Q2. The third and fourth quartiles experience small initial losses.

These responses change as the recession and the UI intervention fade. The welfare effects for Q1 and Q2 decline relatively quickly and later become slightly negative before converging back toward zero. The responses for Q3 and Q4 move from initial losses to small positive values during the early transition and subsequently return toward zero. Overall, the distributional differences are concentrated in the first months after the policy intervention and become small as the effects of the intervention and recession gradually dissipate.

7.3 UI Generosity: Within-State and Compositional Welfare Effects

To understand more clearly the mechanisms behind the aggregate welfare response, we decompose the change in welfare into a within-state component and a compositional component. Let superscript P denote the recession with the UI intervention and superscript 0 the untreated

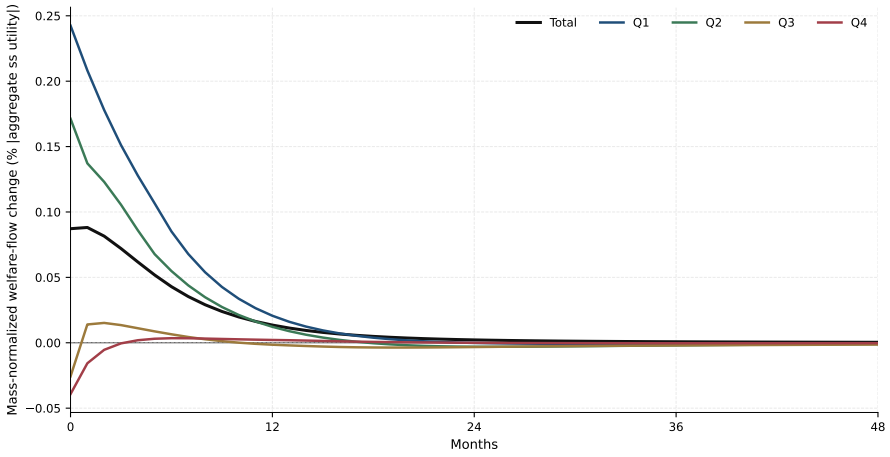


Figure 11: **Dynamic Welfare Responses by Wealth Quartile to Higher UI Generosity**
Notes: Solid colored lines plot the mass-normalized welfare-flow change for each wealth quartile, expressed in percent of the absolute value of aggregate steady-state utility. The black line reports the aggregate welfare-flow response. The policy is the ad hoc UI intervention under the common recession and the reference realized direct fiscal-cost target. Q1, Q2, Q3, and Q4 denote the first, second, third, and fourth wealth quartiles, respectively. Wealth groups use fixed pre-shock liquid-wealth cutoffs. Source: Authors' calculations.

recession. The decomposition can be written as

$$\underbrace{U_t^P - U_t^0}_{\text{total}} = \underbrace{\sum_i \left[u(c_{i,t}^P, n_{i,t}^P) - u(c_{i,t}^0, n_{i,t}^0)\right] D_{i,t}^0}_{\text{within-state effect}} + \underbrace{\sum_i u(c_{i,t}^P, n_{i,t}^P)\left(D_{i,t}^P - D_{i,t}^0\right)}_{\text{compositional effect}}. \tag{55}$$

The within-state component measures the change in utility generated by the policy while holding the household distribution at the untreated-recession distribution. The compositional component captures the contribution of the policy-induced change under an ad hoc activation mode in the distribution of households across asset and employment states.

Figure 12 shows that the within-state component accounts for most of the initial welfare gain from higher unemployment-insurance generosity. This component captures the direct improvement in household welfare at given asset and employment states, including the cash-flow and insurance effects of higher UI generosity.

The compositional component is smaller on impact but is positive during the early part of the transition. It becomes more important relative to the within-state component as the direct effect of the intervention declines and later becomes slightly negative as the household distribution moves back toward the untreated path. The decomposition therefore shows that changes in welfare at given household states explain most of the initial gain, while changes in the distribution across asset and employment states also contribute to the dynamics of aggregate welfare.

8 Conclusion

This paper develops a heterogeneous-agent New Keynesian model with search-and-matching frictions in the labor market (HANK–SAM) to compare alternative income-stabilization

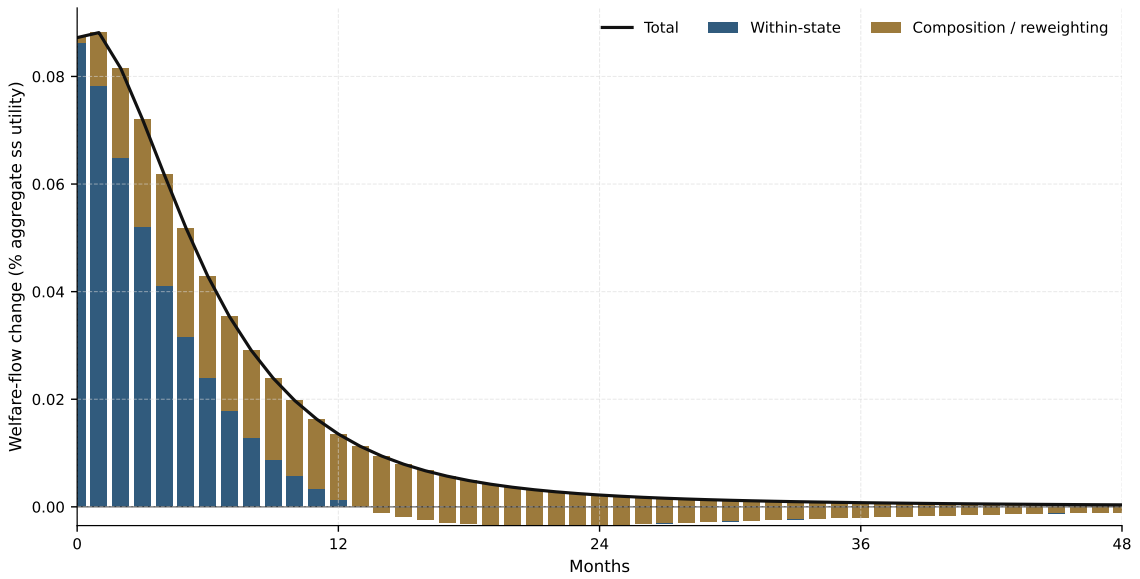


Figure 12: **UI Generosity: Within-State and Compositional Welfare Effects**
Notes: Bars decompose the aggregate welfare-flow difference between the ad hoc UI intervention and the untreated recession into a within-state component and a compositional component. The black line reports the total welfare-flow difference. Welfare includes consumption utility and labor disutility. Source: Authors' calculations.

instruments in a recession under a common fiscal implementation cost. We study three specific policies: an increase in unemployment- insurance generosity, transfers targeted to hand-to-mouth households, and labor-income tax cuts. We evaluate them using a HANK-consistent welfare criterion that aggregates utility across the full cross-section of households along the nonlinear transition path. As a complementary exercise, we compare automatic state-contingent rules with ad hoc exogenous policy paths, conditional on the realization of the unexpected recessionary shock.

Our main result concerns the ranking across policy instruments. Independently of the activation mode, under realized direct fiscal costs, unemployment insurance generates the largest welfare gain at the reference fiscal target, followed closely by the labor-income tax cut, while targeted transfers generate smaller gains. Unemployment insurance combines direct income support to unemployed households with an insurance effect that reduces the income loss associated with unemployment and precautionary saving among employed households. Targeted transfers concentrate resources on liquidity-constrained households with high marginal propensities to consume, but do not provide the same insurance against unemployment risk. Labor-income tax cuts increase disposable labor income and the after-tax return to hours worked, supporting consumption, labor input, employment, and output.

The comparison between unemployment insurance and labor-income tax cuts depends on the treatment of endogenous fiscal feedback. Under realized direct fiscal costs, higher UI generosity reduces unemployment and therefore lowers the benefit caseload, reducing its incremental fiscal cost relative to fixed-exposure pricing. Labor-income tax cuts expand the labor-tax base and recover part of their mechanical revenue loss. At the reference fixed-base policies, the endogenous caseload response reduces the incremental present value of automatic

UI expenditures by approximately 44.6 percent relative to fixed-exposure pricing, while the tax-base response recovers approximately 35.5 percent of the mechanical revenue loss from the automatic labor-income tax cut. When policies are instead evaluated using the fiscal exposure of the untreated recession, the ranking of the first two instruments reverses: the labor-income tax cut ranks first, followed by unemployment insurance and targeted transfers. This ordering remains stable over the fixed-base fiscal-cost range considered in the paper.

As a complementary exercise, we compare automatic state-contingent rules with ad hoc exogenous policy paths for each instrument. Conditional on the downturn having occurred and once direct fiscal resources are equalized, the two policy paths generate very similar welfare gains. This comparison does not incorporate the ex-ante insurance value of an announced contingent policy, since the model does not feature aggregate uncertainty before the shock. Consequently, our results concern the relative performance of alternative policy paths following the downturn, rather than the broader welfare effects of ex-ante policy commitment.

The distributional analysis shows that welfare gains are concentrated among households in the lowest liquid-wealth quartile. At the reference realized fiscal cost under the ad hoc activation mode, unemployment insurance generates the largest average welfare gain for this group and is the only instrument producing a positive average welfare gain in the second quartile. All three instruments generate negative average welfare effects for the upper two liquid-wealth quartiles. These differences reflect heterogeneity in unemployment risk, financial liquidity, and labor-supply responses. For unemployment insurance, the within-state and compositional decomposition further illustrates how changes in utility at given household states and changes in the distribution across asset and employment states contribute to aggregate welfare dynamics.

From a policy perspective, the results indicate that the choice of income-stabilization instrument has quantitatively important welfare consequences and that welfare-per-dollar comparisons depend on how fiscal costs respond to the intervention itself.

Methodologically, in turn, the paper advances a welfare framework for HANK–SAM environments by aggregating node-level utility over the endogenous household distribution along the nonlinear transition. The welfare measure preserves heterogeneity in marginal utility, unemployment risk, and labor supply and allows the policy comparison to account for both consumption and labor effects.

Three limitations of the analysis are worth emphasizing. First, the model abstracts from behavioral search responses to unemployment-benefit generosity and from richer institutional details regarding eligibility and take-up. Incorporating these margins could change the net welfare gains from unemployment insurance and sharpen the policy-design trade-offs. Second, the quantitative exercise is conditional on a one-time demand-driven downturn. The model does not incorporate recurring aggregate uncertainty or the ex-ante behavioral and welfare effects of knowing that a contingent policy response will be available in a future downturn. It therefore does not provide a full comparison between anticipated policy commitment and an intervention introduced only after a shock has materialized. Implementation and legislative delays are also outside the model. Alternative or protracted shocks (Dell'Erba et al., 2018), different envelope definitions, or country-specific institutional settings may alter the quantitative results. Third, the quantitative results are conditional on the calibrated U.S. economy and its maintained labor-market and fiscal institutions. Economies with different

employment structures, unemployment-insurance coverage, tax bases, or transfer systems may exhibit different relative policy effects.

Future research could extend the framework in several directions. One natural extension is to introduce aggregate uncertainty and study how the anticipation of future shocks and contingent policy responses affects household saving behavior and welfare before a downturn occurs. Another is to compare policy performance under alternative shocks, including supply-side disturbances such as productivity shocks or persistent separation shocks associated with technological change (Dabla-Norris et al., forthcoming). Further extensions could introduce endogenous wage setting and richer labor-market responses; or study the same instruments in alternative institutional environments, including with the presence of informality, different unemployment-insurance systems, active labor-market policies (Estevão, 2007), tax schedules, and transfer infrastructures across countries.

References

Alves, F. and G. L. Violante (2025). *Monetary Policy Under Okun's Hypothesis*. NBER Working Paper 33488. National Bureau of Economic Research.

Alves, F. and G. L. Violante (2026). *Inflation vs Inclusion: Stabilization Policy in the Wake of the Pandemic*. NBER Working Paper 34894. National Bureau of Economic Research.

Auclert, A. (2019). "Monetary policy and the redistribution channel". *American Economic Review* 109.6, pp. 2333–2367.

Auclert, A., B. Bardóczy, M. Rognlie, and L. Straub (2021). "Using the sequence-space Jacobian to solve and estimate heterogeneous-agent models". *Econometrica* 89.5, pp. 2375–2408.

Bayer, C., R. Lütticke, L. Pham-Dao, and V. Tjaden (2019). "Precautionary savings, illiquid assets, and the aggregate consequences of shocks to household income risk". *Econometrica* 87.1, pp. 255–290.

Broer, T., J. Druedahl, K. Harmenberg, and E. Öberg (2024). "Stimulus Effects of Common Fiscal Policies". Working Paper.

Broer, T., J. Druedahl, K. Harmenberg, and E. Öberg (2025). "The Unemployment-Risk Channel in Business-Cycle Fluctuations". *International Economic Review* 66.4, pp. 1425–1458. DOI: 10.1111/iere.12773.

Chetty, R. (2006). "A general formula for the optimal level of social insurance". *Journal of Public Economics* 90.10-11, pp. 1879–1901.

Cicek, K., J. Pico-Mejia, M. Poplawski-Ribeiro, and A. Tumino (2026). "Distributional Impacts of Inflation Accounting for Behavioral Effects and Real Assets". *IMF Working Paper* 26/22.

Consolo, A. and M. Hänsel (2024). "HANK faces unemployment". *Available at SSRN 4902309*.

Dabla-Norris, E., D. Garcia Macia, and A. Nguyen (forthcoming). "From Insurance to Reallocation: Labor Market Policy Responses to AI Shocks". *IMF Working Paper*.

Dell'Erba, S., K. Koloskova, and M. Poplawski-Ribeiro (2018). "Medium-Term Fiscal Multipliers during Protracted Economic Contractions". *Journal of Macroeconomics* 56, pp. 35–52.

Estevão, M. (2007). "Labor Policies to Raise Employment". *IMF Staff Papers* 54(1), pp. 113–138.

Furceri, D., P. Loungani, and A. Zdzienicka (2018). "The effects of monetary policy shocks on inequality". *Journal of International Money and Finance* 85, pp. 168–186.

Furceri, D., E. Prifti, and M. Poplawski-Ribeiro (forthcoming). "Divide and Indebt: How Geoeconomic Fragmentation Affects Macro-Fiscal Stability". *IMF Working Paper*.

Gopinath, G. (2022). "How Will the Pandemic and War Shape Future Monetary Policy?" *IMF Speech* August, 8.

Hagedorn, M. and I. Manovskii (2008). "The cyclical behavior of equilibrium unemployment and vacancies revisited". *American Economic Review* 98.4, pp. 1692–1706.

Hagedorn, M., I. Manovskii, and K. Mitman (2015). *The impact of unemployment benefit extensions on employment: the 2014 employment miracle?* Tech. rep. National Bureau of Economic Research.

Hall, R. E. and P. R. Milgrom (2008). "The Limited Influence of Unemployment on the Wage Bargain". *American Economic Review* 98.4, pp. 1653–1674. DOI: 10.1257/aer.98.4.1653.

IMF (2025). *Fiscal Policy Under Uncertainty*. Tech. rep. Fiscal Monitor, Chapter 1, International Monetary Fund, April.

Johnson, D. S., J. A. Parker, and N. S. Souleles (2006). "Household Expenditure and the Income Tax Rebates of 2001". *American Economic Review* 96.5, pp. 1589–1610. DOI: 10.1257/aer.96.5.1589.

Kaplan, G., B. Moll, and G. L. Violante (2018). "Monetary policy according to HANK". *American Economic Review* 108.3, pp. 697–743.

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

Kaplan, G., G. L. Violante, and J. Weidner (2014). "The wealthy hand-to-mouth". *Brookings Papers on Economic Activity* 1, pp. 77–153.

Kroft, K. and M. J. Notowidigdo (2016). "Should unemployment insurance vary with the unemployment rate? Theory and evidence". *The Review of Economic Studies* 83.3, pp. 1092–1124.

Landais, C., P. Michaillat, and E. Saez (2018). "A macroeconomic approach to optimal unemployment insurance: Theory". *American Economic Journal: Economic Policy* 10.2, pp. 152–181.

McKay, A. and R. Reis (2016). "The role of automatic stabilizers in the US business cycle". *Econometrica* 84.1, pp. 141–194.

Michaillat, P. and E. Saez (2015). "Aggregate demand, idle time, and unemployment". *The Quarterly Journal of Economics* 130.2, pp. 507–569.

Mortensen, D. T. and C. A. Pissarides (1994). "Job Creation and Job Destruction in the Theory of Unemployment". *The Review of Economic Studies* 61.3, pp. 397–415. DOI: 10.2307/2297896.

Oh, H. and R. Reis (2012). "Targeted transfers and the fiscal response to the great recession". *Journal of Monetary Economics* 59, S50–S64.

Pallotti, F., G. Paz-Pardo, J. Slacalek, O. Tristani, and G. L. Violante (2024). "Who Bears the Costs of Inflation? Euro Area Households and the 2021–2023 Shock". *Journal of Monetary Economics* 148, 103671. DOI: 10.1016/j.jmoneco.2024.103671.

Pissarides, C. A. (2000). *Equilibrium Unemployment Theory*. MIT Press.

Ravn, M. O. and V. Sterk (2021). "Macroeconomic fluctuations with HANK & SAM: An analytical approach". *Journal of the European Economic Association* 19.2, pp. 1162–1202.

Shimer, R. (2005). "The Cyclical Behavior of Equilibrium Unemployment and Vacancies". *American Economic Review* 95.1, pp. 25–49. DOI: 10.1257/0002828053828572.

Werning, I. (2015). *Incomplete markets and aggregate demand*. Tech. rep. National Bureau of Economic Research.

A Solution Method and Numerical Accuracy

This appendix summarizes the numerical procedure used to solve the model in steady state and along nonlinear transition paths and reports the numerical accuracy of the policy comparisons.

A.1 Household Problem

For each household type i and employment state $e \in \{E, U\}$, the household problem is solved on the liquid-asset grid. Buffer-stock households solve the intertemporal saving problem using the endogenous-grid method. For employed households, hours and consumption are jointly determined using the household budget constraint and the intratemporal labor-supply condition in Equation (5). Unemployed households choose consumption and saving given unemployment-insurance income. The strict hand-to-mouth type is implemented directly by imposing zero next-period liquid assets.

Given paths for prices, taxes, transfers, employment transitions, and realized asset returns, the household block is solved backward to obtain policy functions for consumption, next-period assets, and hours worked. Expectations use the employment-transition probabilities generated by the search-and-matching block. The household distribution is then simulated forward over employment and asset states.

A.2 Steady State and Transition Dynamics

The steady state is obtained by jointly solving the household, labor-market, pricing, monetary, and government blocks together with goods- and asset-market clearing. The search-and-matching block determines steady-state unemployment and matching rates, while the household block determines aggregate asset demand.

Transition dynamics are computed as perfect-foresight nonlinear equilibria. For a given sequence of shocks and policy rules, candidate paths for aggregate prices and quantities are passed to the household block. Household decisions are solved backward and the cross-sectional distribution is simulated forward. The resulting aggregates are returned to the general-equilibrium system, which is solved with a quasi-Newton method until the equilibrium residuals satisfy the numerical tolerance.

Beginning-of-period household assets earn the lagged realized return implied by the government-bond payoff. Welfare is evaluated using the live transition distribution at every date. The main transition horizon is $T = 480$ months, followed by the steady-state continuation described in Section 5.

B Supplementary Automatic and Ad hoc Policy Dynamics

The main text reports a complementary welfare comparison between state-contingent and ad hoc stabilization paths. This appendix provides the instrument-specific policy and macroeconomic paths underlying those results. In every case, the two activation modes start

from the same steady state, face the same downturn, and are independently matched to the same present value of realized direct fiscal cost.

Table 6: Automatic and Ad hoc Welfare at the Reference Realized Fiscal Cost

Instrument	Automatic CEV (%)	Ad hoc CEV (%)	Auto/Ad hoc
Unemployment insurance	0.004034	0.004221	0.9558
Targeted HtM transfers	0.001150	0.001152	0.9981
Labor-income tax cut	0.003950	0.003983	0.9917

Notes: Each policy is independently matched to the same present value of realized direct fiscal cost, $\mathcal{C}^* = 0.0004775949$, equal to 0.15275 percent of monthly steady-state output. CEVs are measured relative to the untreated downturn using the welfare convention in Section 5. Source: Authors' calculations.

Table 6 confirms that differences between activation modes are small at the reference fiscal target. For all three instruments, the larger welfare differences are across instruments rather than between the automatic and ad hoc implementation of a given instrument.

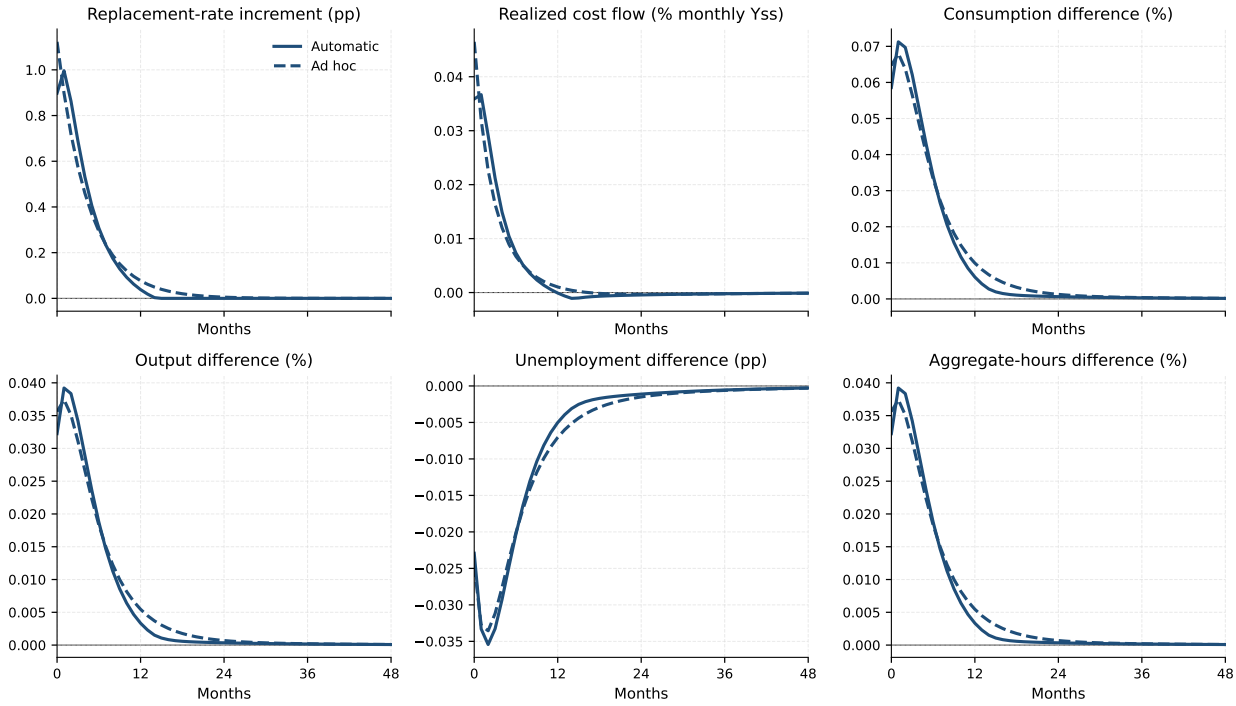


Figure 13: Automatic and Ad hoc Unemployment-Insurance Dynamics

Note: The figure compares the automatic and Ad hoc unemployment-insurance interventions at the reference realized direct fiscal cost. The policy panel reports the increase in the UI replacement rate in percentage points. Fiscal flows are expressed as a percent of monthly steady-state output. Macroeconomic panels report differences relative to the untreated downturn. Source: Authors' calculations.

Figure 13 shows that the automatic UI rule is more tightly linked to the unemployment path, while the ad hoc intervention follows an exogenous decay. The difference in the timing of the replacement-rate paths produces a somewhat larger activation-mode difference for UI

than for the other instruments, but the resulting welfare effects remain close once the present value of realized direct cost is equalized.

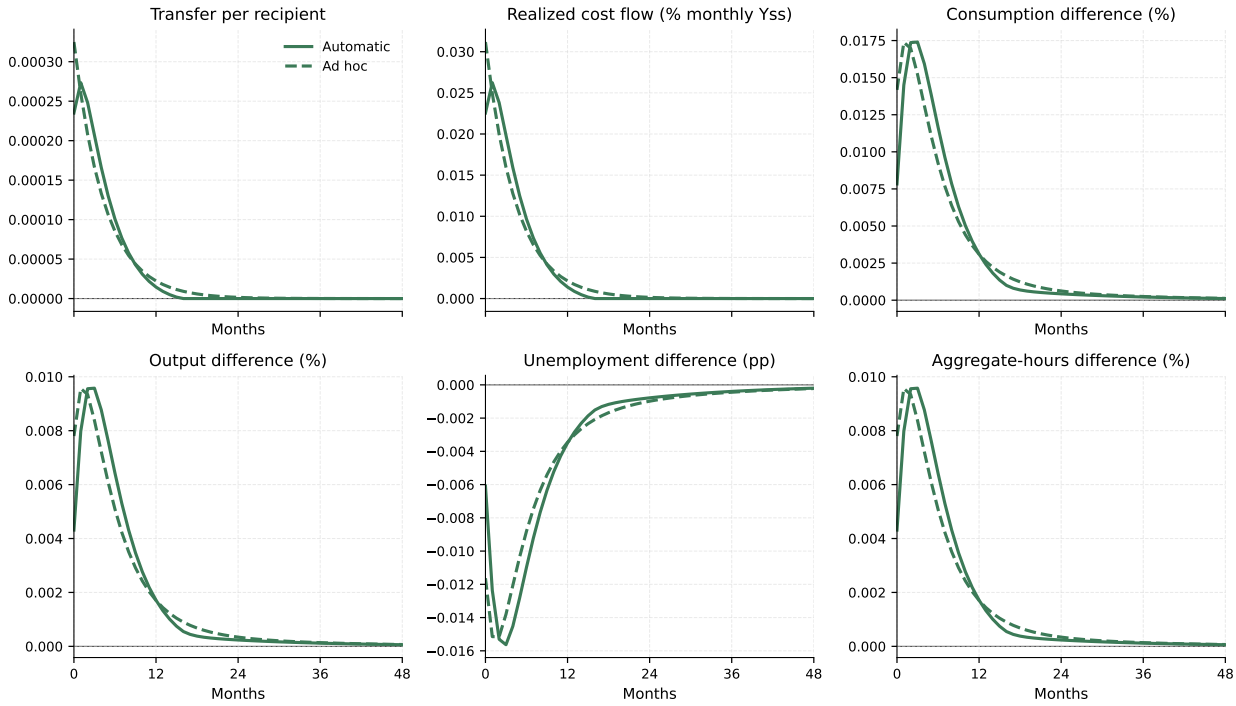


Figure 14: Automatic and Ad hoc Targeted-Transfer Dynamics

Note: The figure compares automatic and ad hoc transfers targeted to hand-to-mouth households at the reference realized direct fiscal cost. The transfer is reported per recipient. Fiscal flows are expressed as a percent of monthly steady-state output, and macroeconomic responses are measured relative to the untreated downturn. Source: Authors' calculations.

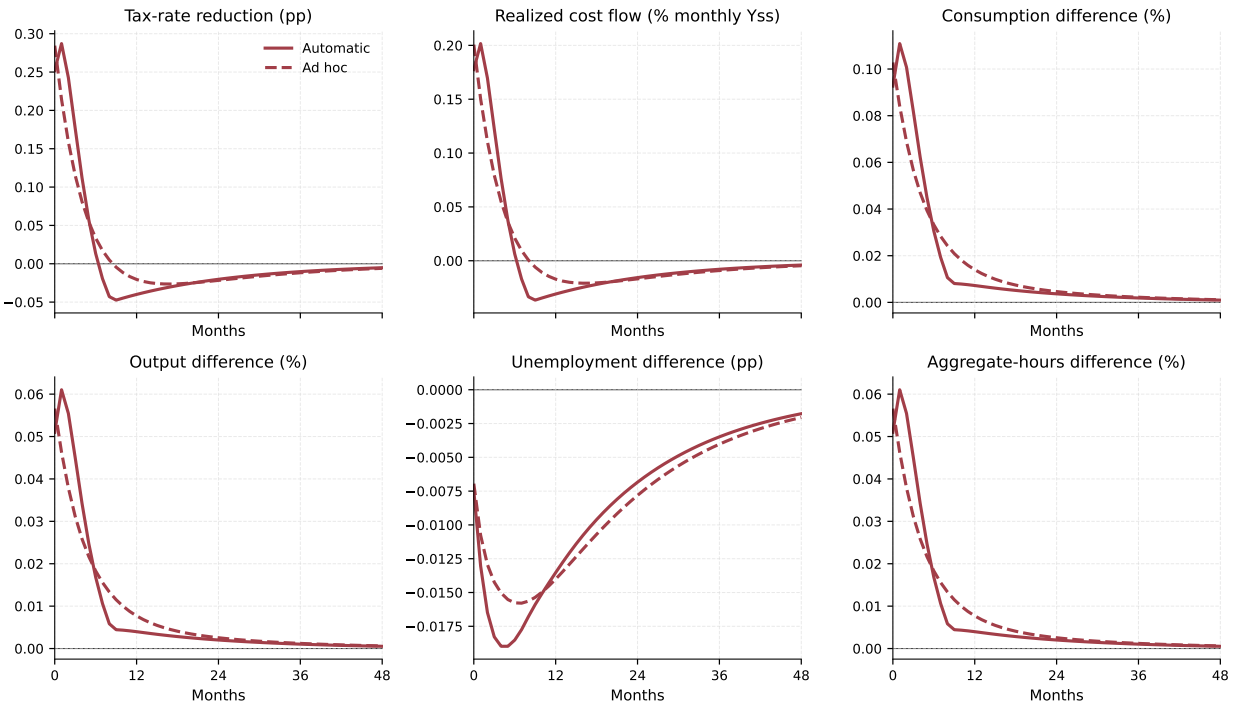


Figure 15: Automatic and Ad hoc Labor-Income Tax-Cut Dynamics

Note: The figure compares the automatic and ad hoc labor-income tax cuts at the reference realized direct fiscal cost. The policy panel reports the reduction in the labor-income tax rate in percentage points. Fiscal flows are expressed as a percent of monthly steady-state output, and macroeconomic responses are measured relative to the untreated downturn. Source: Authors' calculations.

For targeted transfers and labor-income tax cuts, the automatic and ad hoc implementations produce especially similar welfare effects. The targeted-transfer recipient mass is fixed, whereas the tax intervention affects both disposable labor income and the after-tax return to hours worked.

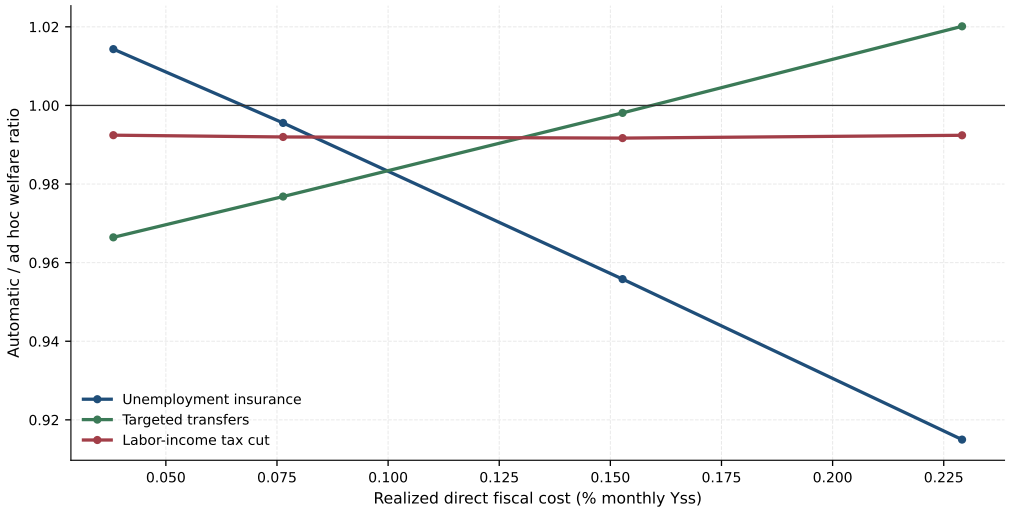


Figure 16: Activation-Mode Welfare Ratios across Realized Fiscal Costs

Note: The vertical axis reports the ratio of automatic to ad hoc CEV for each instrument. Every point is independently matched to the realized direct fiscal-cost target shown on the horizontal axis. Fiscal cost is expressed as a percent of monthly steady-state output. Source: Authors' calculations.

Figure 16 shows that the small welfare difference between activation modes is not specific to the reference fiscal target. At the first three realized-cost points, the automatic ranking is unemployment insurance, the labor-income tax cut, and targeted transfers. At the largest cost point, the automatic labor-income tax cut overtakes automatic UI, while the ad hoc ranking remains unchanged. This upper-end reversal reflects the increasingly self-limiting nature of the one-sided unemployment-gap UI rule as the intervention becomes larger and should therefore be interpreted as a property of the rule at that scale rather than as a general reversal in the relative performance of the two instruments.

C Fiscal-Cost Decompositions

The realized direct fiscal cost of an intervention can differ from the cost obtained by pricing the policy change on a fixed fiscal exposure. This section reports the instrument-specific accounting underlying this distinction.

C.1 Unemployment Insurance

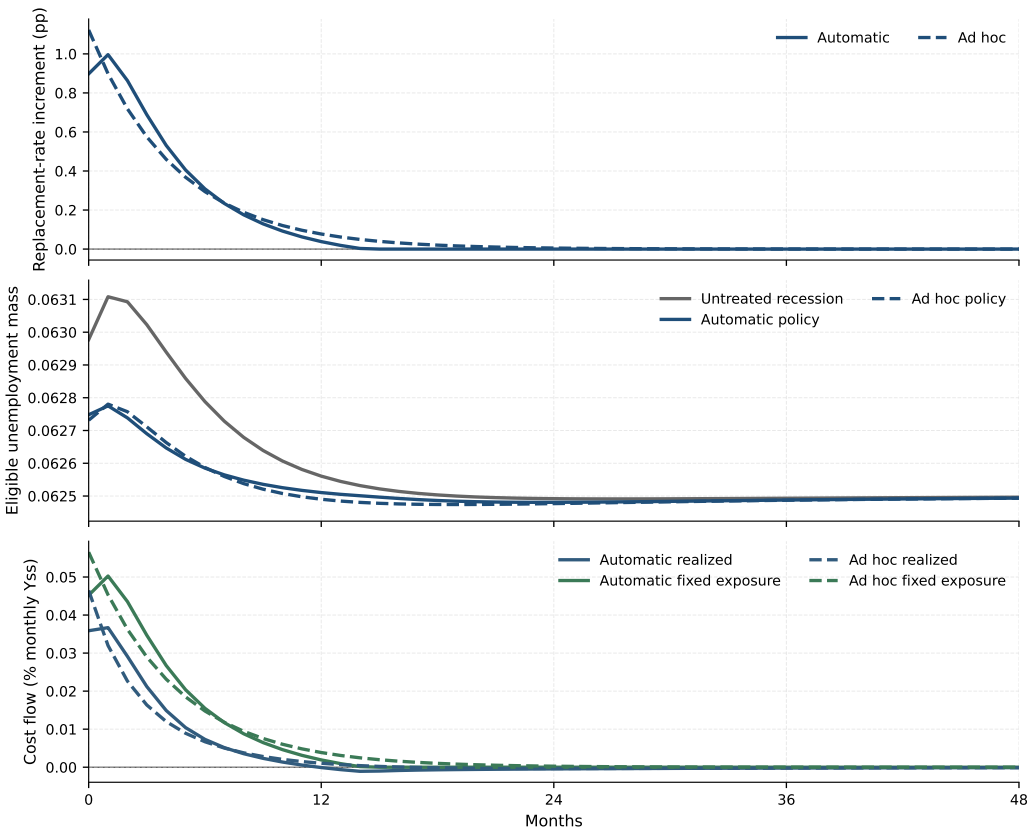


Figure 17: Unemployment-Insurance Cost Decomposition

Note: The first panel reports the replacement-rate increment. The second panel reports the UI-eligible unemployment mass in the untreated and policy paths; with $N_u = 1$, the eligible mass equals total unemployment. The third panel compares realized UI cost with the cost obtained by pricing the same replacement-rate change on the untreated downturn's unemployment exposure. Fiscal flows are expressed as a percent of monthly steady-state output. Source: Authors' calculations.

Higher UI generosity reduces unemployment relative to the untreated downturn and therefore lowers the number of households receiving benefits. The resulting reduction in the eligible caseload offsets a substantial part of the fiscal effect of the increase in the replacement rate. At the reference fixed-base target, realized UI expenditure is approximately 55 percent of its fixed-exposure counterpart.

C.2 Targeted Transfers

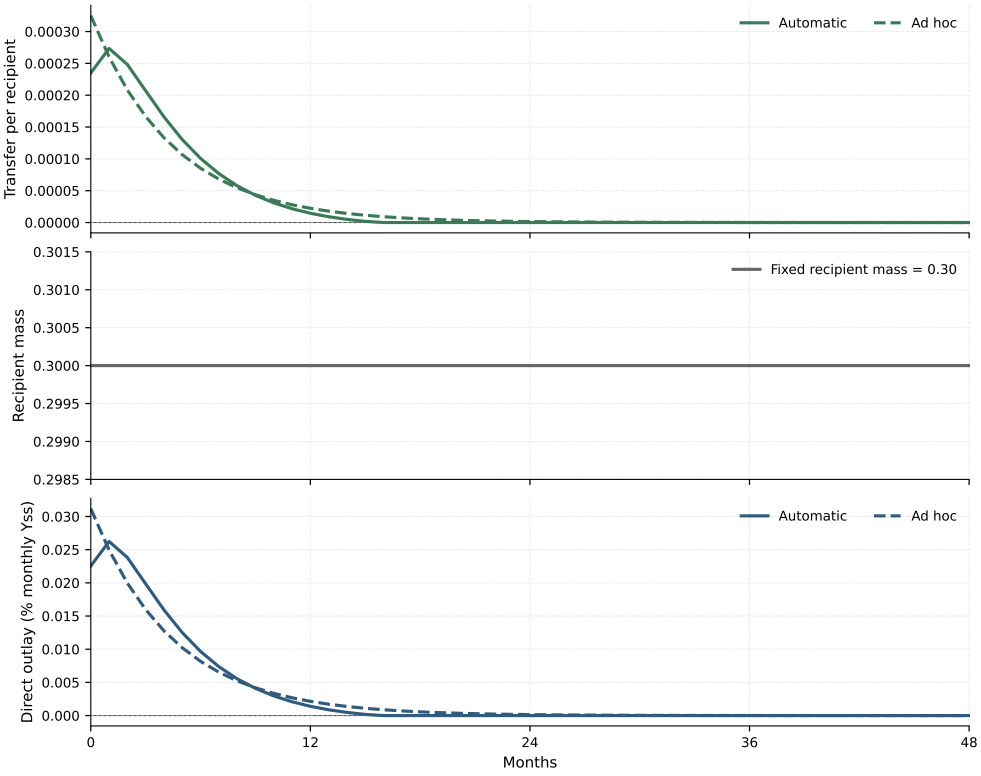


Figure 18: Targeted-Transfer Cost Decomposition

Note: The figure reports the transfer per recipient, the recipient mass, and direct transfer outlays for the automatic and ad hoc interventions. The recipient mass is fixed at 0.30. Fiscal flows are expressed as a percent of monthly steady-state output. Source: Authors' calculations.

For targeted transfers, the recipient mass is fixed by construction. The direct fiscal cost is therefore exactly the recipient mass multiplied by the transfer per recipient. There is no caseload or tax-base channel analogous to those operating for unemployment insurance and the labor-income tax cut.

C.3 Labor-Income Tax Cuts

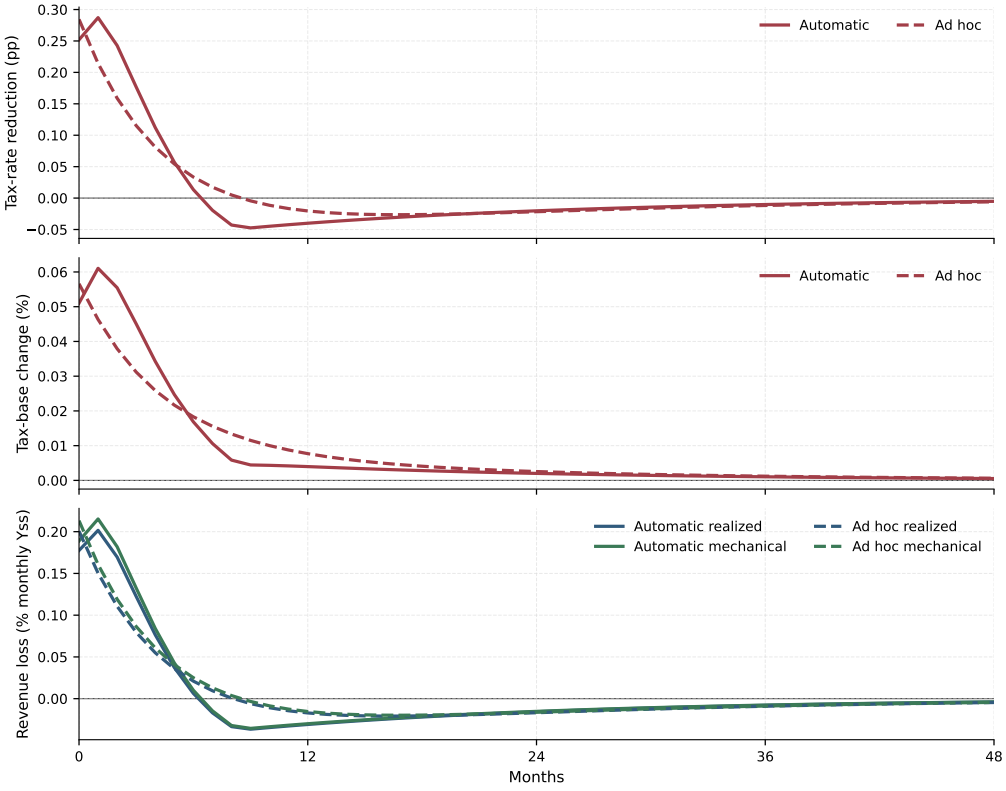


Figure 19: Labor-Income Tax Revenue Decomposition

Note: The figure reports the tax-rate reduction, the endogenous change in the labor-tax base, and the associated revenue loss for automatic and ad hoc tax cuts. Mechanical revenue loss prices the tax-rate change using the untreated tax base, while realized revenue loss uses the endogenous policy tax base. Fiscal flows are expressed as a percent of monthly steady-state output. Source: Authors' calculations.

The labor-income tax cut expands the tax base through higher labor input and economic activity. At the reference realized-cost policies, the tax-base and interaction terms recover approximately 35.53 percent of the mechanical revenue loss under the automatic intervention and 35.73 percent under the ad hoc intervention.

D Alternative Fiscal-Cost Normalizations

D.1 Strict Fixed-Base Cost

The main robustness exercise prices policy changes using the fiscal exposure of the untreated downturn. This removes the policy-induced change in the unemployment-insurance caseload or labor-tax base from the cost used to determine the size of the intervention.

Table 7: Welfare at the Reference Strict Fixed-Base Fiscal Cost

Instrument	Automatic CEV (%)	Ad hoc CEV (%)	Auto/Ad hoc
Labor-income tax cut	0.002544	0.002558	0.9946
Unemployment insurance	0.002345	0.002352	0.9969
Targeted HtM transfers	0.001150	0.001152	0.9981

Notes: Each intervention is independently matched to the same present value of strict fixed-base fiscal cost. UI policy changes are priced using the untreated downturn's unemployment exposure; labor-tax changes are priced using the untreated labor-tax base; targeted-transfer cost is unchanged because recipient mass is fixed. Source: Authors' calculations.

Under the strict fixed-base normalization, the labor-income tax cut ranks first, followed by unemployment insurance and targeted transfers, for both activation modes. This ranking is stable over the four strict-cost points considered in the paper.

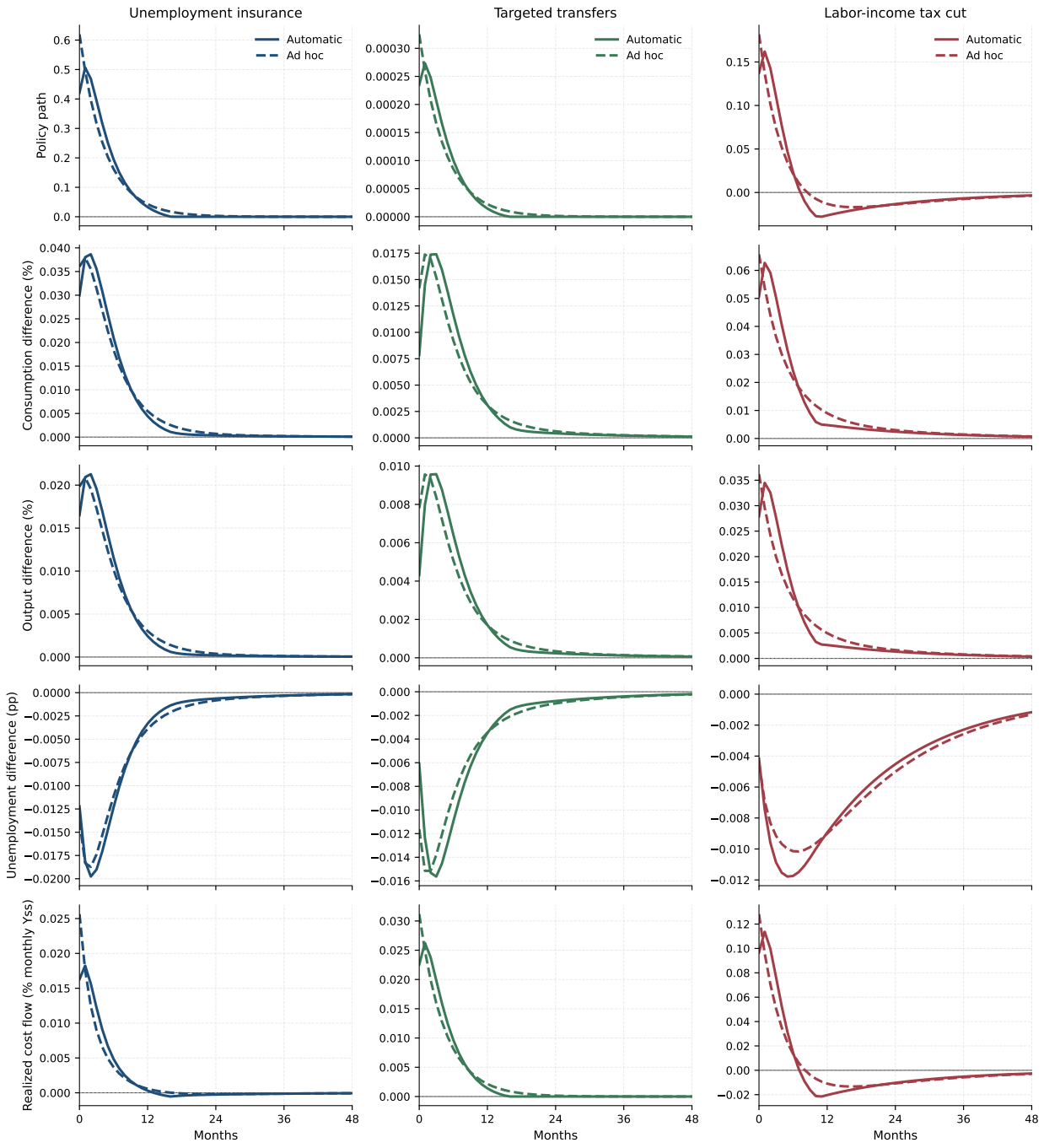


Figure 20: Policy and Macroeconomic Dynamics under Strict Fixed-Base Matching

Note: Columns report unemployment insurance, targeted transfers, and the labor-income tax cut. Solid lines denote automatic interventions and dashed lines ad hoc interventions. Policy amplitudes are matched on the present value of strict fixed-base cost. The bottom row reports the realized cost flow generated by those strict-matched policies, rather than the fixed-base cost flow used for matching. Macroeconomic responses are measured relative to the untreated downturn. Source: Authors' calculations.

D.2 Historical Peak-Debt Normalization

For comparison with the earlier version of the analysis, Figure 21 reports the historical normalization in which ad hoc policy interventions were scaled to generate the same peak increase in face-value government debt relative to steady-state output. This exercise is retained only as an alternative-envelope robustness and is not used for the paper's headline welfare ranking.

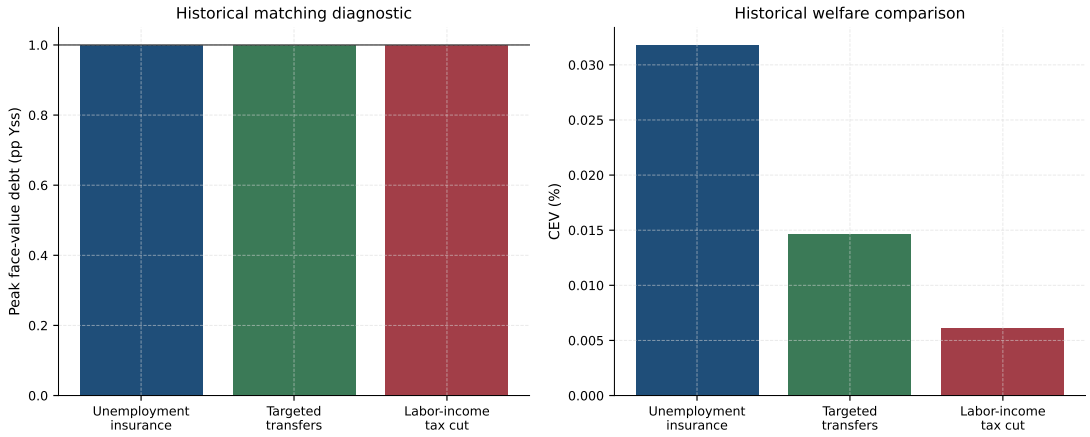


Figure 21: Historical Peak-Debt Normalization

Note: The left panel verifies the historical common peak face-value debt normalization. The right panel reports the associated ad hoc-policy CEVs. These policy sizes are not matched on the present value of direct fiscal cost and their CEV levels are therefore not directly comparable with the headline realized- or fixed-base-cost exercises. Source: Authors' calculations.

Under this historical envelope, ad hoc unemployment insurance has a CEV of approximately 0.031806 percent, targeted transfers 0.014652 percent, and the labor-income tax cut 0.006086 percent. The ordering between targeted transfers and the labor-income tax cut therefore differs from the headline direct-cost ranking. This exercise illustrates why welfare rankings must be interpreted together with the fiscal object held fixed.

E Additional Robustness Checks

E.1 Symmetric Labor-Tax Rule

The main automatic labor-tax rule is one-sided and responds only when unemployment is above steady state. As a robustness exercise, we also consider a symmetric rule that allows the tax adjustment to respond to unemployment gaps of either sign.

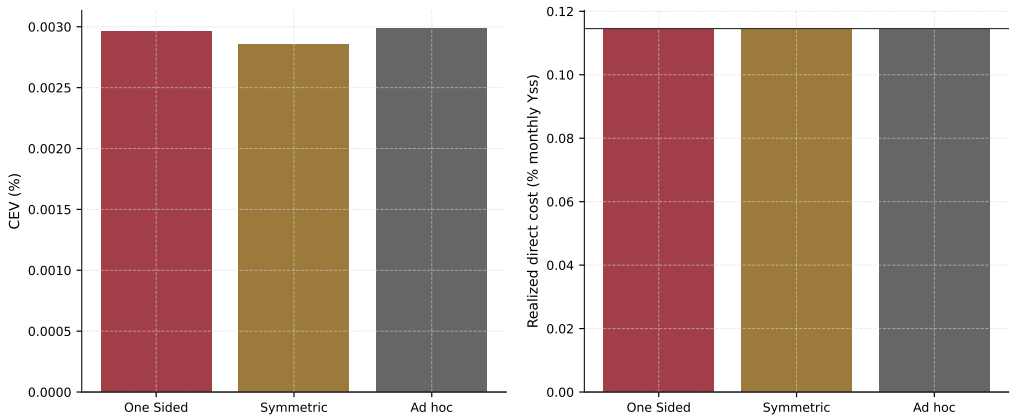


Figure 22: One-Sided and Symmetric Automatic Labor-Tax Rules

Note: The left panel reports CEV and the right panel realized direct fiscal cost. The one-sided automatic rule, symmetric automatic rule, and ad hoc tax cut are evaluated at the same robustness target. Source: Authors' calculations.

At this robustness target, the one-sided automatic rule yields a CEV of 0.002961 percent, the symmetric automatic rule 0.002851 percent, and the matched ad hoc intervention 0.002985 percent. The conclusion that activation-mode welfare differences are small is therefore not specific to the one-sided tax rule.

E.2 Transition-Horizon Robustness

The main welfare calculation uses a 480-month transition followed by a steady-state continuation. Recomputing the welfare comparison using a 240-month transition while retaining the continuation term changes the reported CEVs by at most 1.31×10^{-9} percentage points. The welfare rankings are therefore not driven by the finite transition horizon.

E.3 Alternative Taxable-UI Steady-State Environment

The main specification treats unemployment-insurance benefits as untaxed. We also consider a separate environment in which UI benefits enter the labor-tax base and disposable UI income is taxed. Changing this feature materially changes the steady-state balance sheet and liquidity position. The exercise should therefore not be interpreted as a one-parameter ceteris-paribus transition robustness.

Table 8: Untaxed and Taxable-UI Steady-State Environments

Environment	Auto UI CEV (%)	Ad hoc UI CEV (%)	Auto/Ad hoc	qB/Y^{ss}
Main untaxed UI	0.004034	0.004221	0.9558	0.2198
Taxable UI	0.004702	0.004654	1.0103	0.7331

Notes: qB/Y^{ss} uses monthly steady-state output. Aggregate liquid assets rise from approximately 0.0687 in the untaxed environment to 0.2294 in the taxable-UI environment. Because the steady state and household liquidity position change materially, CEV levels across the two rows should not be interpreted as a one-parameter policy comparison. The automatic-to-ad hoc ratio is calculated within each environment. Source: Authors' calculations.

The automatic-to-ad hoc UI ratio is below one in the main untaxed environment but slightly above one in the taxable-UI environment. Because aggregate liquid assets and public-debt holdings are substantially different across the two steady states, this reversal is best interpreted as an alternative-environment robustness rather than as the causal effect of taxing UI benefits alone.

E.4 Permanent-System UI Robustness

Finally, we retain the permanent-UI exercise as a separate robustness. It asks a different question from the main same-steady-state comparison. The economy with permanently higher UI starts from a different steady-state policy system before the downturn occurs, so the welfare difference contains normal-time steady-state effects as well as stabilization effects.

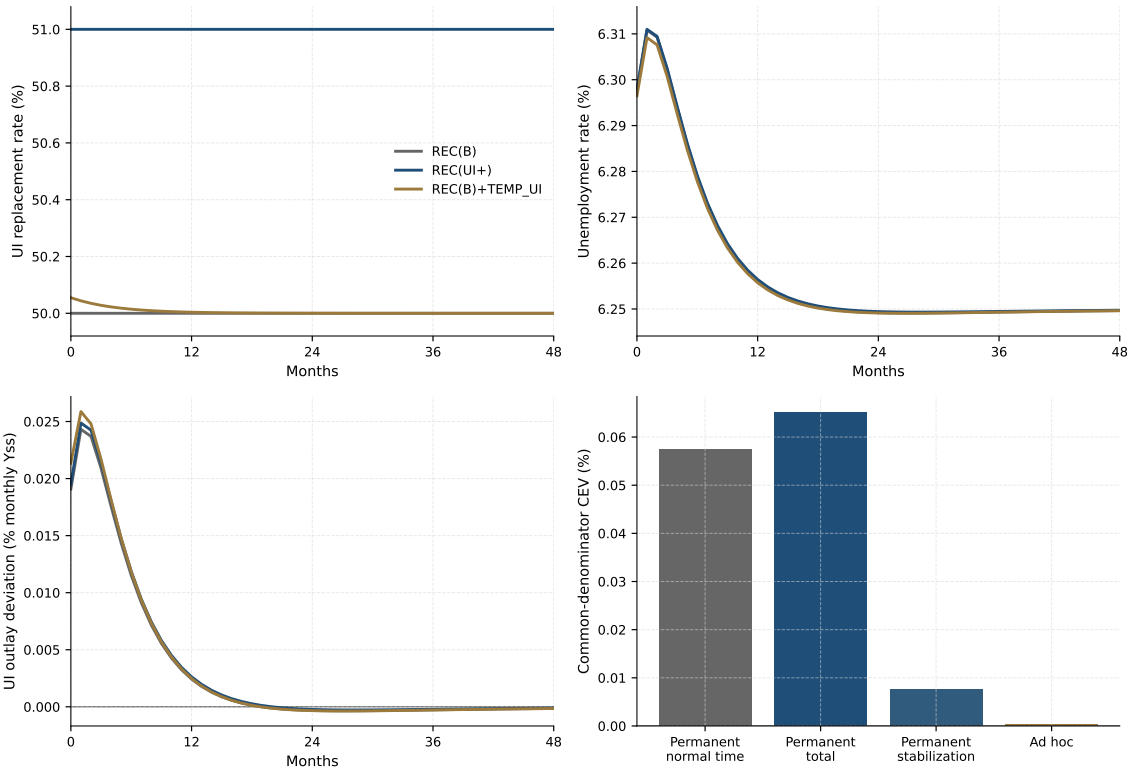


Figure 23: Permanent-System Unemployment-Insurance Robustness

Note: The welfare bars separate the normal-time, total, and stabilization components of the permanent-system comparison. Because the permanent-UI economy starts from a different steady state, these objects are not directly comparable with the same-steady-state automatic-versus-ad-hoc welfare ratios in the main text. Source: Authors' calculations.

The permanent-system comparison is normalization sensitive and is retained only to distinguish the welfare effects of changing the normal-times UI system from the conditional-on-downturn stabilization experiment studied in the main text. It does not alter the main results of the paper, for which all policy experiments start from the same steady state.