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

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Welfare Analysis 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 contrast increases in unemployment insurance generosity, with targeted transfers to hand-to-mouth households, and universal transfers. Policy effectiveness is assessed through the aggregate consumers' welfare, measured in consumption-equivalent variation units. In an economy calibrated to U.S. data, unemployment insurance yields the largest welfare gain per percentage point of fiscal cost, followed by targeted transfers, while universal transfers are the least effective. A temporary increase in unemployment insurance generates the highest welfare, as it combines immediate cash-flow support with insurance effects, disproportionally benefiting households with high marginal propensities to consume.

JEL Classification Numbers:	Income stabilization; Heterogeneous-agent New Keynesian (HANK); Search-and-matching; Unemployment insurance; Targeted transfers; Consumption-equivalent variation; Public debt envelope
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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 economic volatility and geoeconomic fragmentation (Furceri, Prifti, et al., forthcoming). In this environment, governments can no longer rely on blunt policy tools such as untargeted fiscal stimulus to cushion economic downturns. 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 addresses two central questions for the design of income support policies aimed at mitigating the effects of large economic shocks—both those recently experienced and those likely to recur in the future—while preserving fiscal sustainability. *First, how can governments provide timely, targeted, and temporary income support to households and workers during severe downturns? Second, what are the distributional consequences of alternative policy instruments, and to what extent do they effectively reach households most in need?* These questions are particularly challenging because distributional effects feed back into aggregate demand and broader macroeconomic dynamics.

In answering these questions, the paper contributes to the literature in three main ways. It first provides an economic comparison of three income-stabilization policies—unemployment insurance, targeted transfers to liquidity-constrained households, and universal transfers to all households—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). This is done by ranking those instruments by the welfare gain generated per policy unit under a common fiscal implementation cost equivalent to a one-percentage-point increase in the debt-to-GDP ratio. Second, the paper computes household welfare directly from the cross-section of households along the full transition path returning to the equilibrium with the implemented income-stabilization policy, rather than using aggregate utility or local approximations. 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—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 elements. 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 policy instruments within a common fiscal envelope, designing each intervention to generate the same increase in the public debt-to-GDP ratio.[1]

Our analysis is conducted using a HANK–SAM model calibrated to the United States, featuring sticky prices, a Diamond–Mortensen–Pissarides (DMP) labor market with firms' free entry, and an explicit government budget that incorporates long-bond pricing and tax smoothing similar to Broer, Druedahl, Harmenberg, and Oberg, 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, providing a universal lump-sum transfer, or targeting transfers to HtM households only. 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 induces higher precautionary saving. The contractionary demand shock raises unemployment and lowers output. In response, policy interventions are also introduced as one-time, transitory, and unanticipated increases in government outlays. We evaluate each income-stabilization tool under a common implementation cost, measured by the peak debt-to-GDP deviation from the steady-state. Total fiscal cost of each instrument can vary, reflecting differences in macroeconomic effects of their implementation. This setup is closely related to the concept of semi-automatic stabilizers (e.g., McKay and Reis, 2016, Blanchard and Summers, 2020, and IMF, 2022), which are measures that activate under specific economic conditions and provide timely support without requiring permanent policy changes.

Our welfare computation is HANK-consistent and aggregates utility across 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 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 an annualized discount factor. We map welfare changes into a path-based consumption-equivalent variation (CEV) relative to the solved no-policy-intervention baseline.

To offset the welfare loss from the benchmark demand-driven recession, our calibration implies a fiscal intervention of 0.378 percentage points of GDP when expanding unemployment insurance, 0.584 policy units for transfers targeted to hand-to-mouth households, and 1.505 policy units for universal transfers. These differences reflect the general-equilibrium mechanisms through which each instrument operates and underpin our welfare ranking: a temporary increase in unemployment insurance yields the largest welfare gain per unit of fiscal

[1] Equalizing the debt response to the policies implementation in our model does not imply that contemporaneous outlays (or the timing of outlays) are identical across instruments. In our implementation, each policy shock is scaled so that $\max_t \Delta(B_t/Y^{ss}) = 0.01$, and we then allow general-equilibrium feedbacks—through unemployment, output, and the tax base—to determine the implied ex-post fiscal dynamics under each instrument.

cost, followed by transfers targeted to hand-to-mouth households, while universal transfers deliver the lowest welfare gain per unit. Specifically, unemployment insurance operates through multiple channels: a cash-flow channel that supports unemployed households; an insurance channel that lowers perceived job-loss risk for employed households and reduces precautionary saving; and a labor-market feedback loop whereby stronger demand raises profits, vacancies, and market tightness, gradually improving job-finding rates and reducing unemployment. Targeted transfers concentrate resources on households with the highest marginal propensities to consume, generating a strong but shorter-lived demand response in the absence of job insurance. Universal transfers, by contrast, spread resources broadly, and payments to households with low marginal propensity to consume (MPC) dilute their impact, resulting in the smallest welfare gain.

The main policy implications of these findings are twofold. First, in demand-driven downturns in which fiscal space is limited, expanding unemployment insurance (UI) should be prioritized. Second, when administrative capacity allows for reliable targeting, unemployment insurance could be effectively complemented with transfers to liquidity-constrained households to accelerate the demand response while limiting fiscal leakages. To preserve debt sustainability and maintain policy space for future shocks, these income-stabilization measures should be embedded within a credible fiscal framework, potentially through semi-automatic stabilizers.

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 transfers. A rich and growing literature demonstrates that household heterogeneity significantly reshapes the effects of fiscal and monetary interventions (Kaplan and Violante, 2014, McKay and Reis, 2016, Kaplan, Moll, 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, our study provides a direct comparison of the three policy instruments under a common fiscal envelope, which facilitates transparent welfare-per-dollar comparisons across 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; and Michaillat and Saez, 2015). Integrating this framework into HANK models, Broer, Druedahl, Harmenberg, and Öberg, 2021 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, Druedahl, Harmenberg, and Oberg, 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. Besides analyzing the three income-stabilization policies, our work extends this literature by ranking these instruments on a welfare basis, decomposing gains into within-group effects and composition (reweighting) effects to identify which household types drive the policy gains. This comparative approach yields novel insights into the relative effectiveness of targeted versus broad-based fiscal stimulus in heterogeneous-agent economies.

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—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, Manovskii, and Mitman, 2015), yet, crucially, these benefits also helped sustain consumption among affected households, potentially stabilizing demand in severely impacted regions. To mediate these effects, some scholars advocate for UI policies that respond to local economic conditions; for example, Kroft and Notowidigdo, 2016 propose more generous UI during periods or in areas of high unemployment—when job availability is limited and the moral hazard costs are correspondingly reduced—and scaling back benefits when labor markets strengthen. Extending this literature, again, our analysis embeds UI and alternative transfer instruments within a unified fiscal cost framework and evaluates their full 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 details of the recession experiment, fiscal envelope and impulse responses. Section 5 presents the welfare computation and results with decompositions. Section 6 analyzes the distributional effects of the policy instruments investigated. At last, Section 7 concludes the paper.

2 Model

This section describes our HANK–SAM model in discrete time ($t = 0, 1, 2, \ldots$) with 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 $i \in \{1, \dots, I\}$ 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)[2] 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.[3]

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, which is $e_t \in \{E, U\}$. In the model unemployment duration is assumed to be equal to one—i.e., Nu = 1.[4]

We assume a standard Constant Relative Risk Aversion (CRRA) utility function for the agent's consumption, $u(c) = \frac{c^{1-\sigma}}{1-\sigma}$. Hence, given the household type i, the Bellman problems for the expected, $\mathbb{E}_t$, net present welfare value as a function of a, $V^E_{i,t}(a)$, depend on whether the household is employed or not. They can be written as

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

$$\text{s.t.} \quad c + a' = (1 + r_t)\, a + (1 - \tau_t)\, w_t \; + \; \text{div}_t \; + \; \text{tr}_t, \tag{2}$$

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

$$\text{s.t.} \quad c + a' = (1 + r_t)\, a + y^{\text{UI}}_t \; + \; \text{div}_t \; + \; \text{tr}_t, \tag{4}$$

where $a' \geq 0$ is the borrowing constraint; r_t is the real interest rate; τ_t is the labor tax; w_t is the real wage rate; div_t denotes firm dividends (profits) rebated lump-sum to households; and tr_t denotes lump-sum transfers/taxes from the government.

The unemployment insurance income per unemployed, y^{UI}_t, can then be written as

$$y^{\text{UI}}_t = \phi^o \, w_t \, U^{\text{UI}}_t + \phi^u \, w_t \, (u_t - U^{\text{UI}}_t),$$

where ϕ^o corresponds to the (high) replacement rate for the subset U^{UI}_t of unemployed households that are insured; and ϕ^u is the replacement rate for non-insured unemployed households, given the unemployment rate, u_t.

The tax base for this unemployment insurance equals

$$\text{tax base}_t \; = \; w_t(1 - u_t) \; + \; \chi^{\text{UI}}_{\text{tax}} \cdot \Phi_t, \qquad \chi^{\text{UI}}_{\text{tax}} \in \{0, 1\},$$

in which, $\chi^{\text{UI}}_{\text{tax}}$ denotes UI tax-treatment parameter: it governs whether (and how much) unemployment-insurance payments enter the tax base; and Φ_t represents the total public

[2] 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.

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

[4] 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.

outlays with unemployment insurance (see Subsection 2.6 below). Notice that labor taxes apply to labor income only; and 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 interest factor is at last described by $R_t \equiv 1 + r_t = \frac{1+i_t}{1+\pi_{t+1}}$, where i_t is the nominal interest rate set by monetary policy and π_{t+1} is next period inflation.

2.2 Employment Risk and Aggregation

Let $N_t = 1 - u_t$ denote the level of employment given the labor force being normalized to one. Employment transitions follow the search block that we will describe in the next subsection, whereas aggregate consumption C_t^{hh}, and assets A_t^{hh}, 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 $\text{TFP}_t \equiv 1$. In turn, the real wage rate is exogenous and proportional to the intermediate-good price, p_t^x, being described by $w_t = \bar{\omega}\, p_t^x$ with the constant share $\bar{\omega}$. Hence, a filled job position, J_t, has a financial value equal to

$$J_t \;=\; (p_t^x - w_t) \;+\; \beta_f\,(1-\delta_{t+1})\,J_{t+1}, \tag{5}$$

where β_f is the firm discount factor and δ_t is the separation rate. The assumption of free entry of firms yields a vacancy posting cost, κ, that equals the filled job value times the search friction to fill a job, λ_t^v—i.e., $\kappa = \lambda_t^v J_t$. This way, vacancy posting costs do not show up in profits in equilibrium. The search frictions, in turn, are defined as

$$\lambda_t^u = A\,\theta_t^{1-\alpha}, \qquad \lambda_t^v = A\,\theta_t^{-\alpha}, \qquad \theta_t = \frac{v_t}{S_t}, \tag{6}$$

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; at last α represents the labor market matching elasticity.

The mass of searchers unemployment evolves as

$$u_t \;=\; u_{t-1} \;-\; S_t\,\lambda_t^u \;+\; \delta_t\,(1-u_{t-1}). \tag{7}$$

Output, Y_t, is supply-determined by the levels of TFP_t and employment:

$$Y_t \;=\; \text{TFP}_t(1-u_t). \tag{8}$$

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

$$\text{div}_t \;=\; Y_t - w_t(1-u_t), \tag{9}$$

which are rebated lump-sum to households.

2.4 Price Setting (Rotemberg) and Inflation

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

$$\underbrace{(1-\varepsilon)+\varepsilon\, p_t^x}_{\text{desired markup}} \;=\; \varphi_p\, \pi_t(1+\pi_t) \;-\; \beta_f\, \varphi_p\, \pi_{t+1}(1+\pi_{t+1})\, \frac{Y_{t+1}}{Y_t}, \tag{10}$$

with demand elasticity $\varepsilon > 1$ and inflation $\pi_t \equiv P_t/P_{t-1} - 1$. Equation (10) pins down π_t given (p_t^x, Y_t).

2.5 Monetary Policy

The central bank follows a pure inflation-gap Taylor rule

$$1 + i_t \;=\; (1+i^{ss})\Big(\frac{1+\pi_t}{1+\pi^{ss}}\Big)^{\delta_\pi}, \qquad \delta_\pi > 1, \tag{11}$$

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):

$$\Phi_t \;=\; \phi^o\, w_t\, U_t^{\mathrm{UI}} \;+\; \phi^u\, w_t\,(u_t - U_t^{\mathrm{UI}}), \tag{12}$$

where U_t^{UI} is the share of unemployed receiving the high replacement rate, $U_t^{\mathrm{UI}} = u_t$, in the form of a high first-month insurance.

Lump-sum transfers, tr_t, are defined as

$$\mathrm{tr}_t \;=\; \mathrm{tr}^{ss} \;+\; T_t, \tag{13}$$

where tr^{ss} corresponds to the transfers level in steady state; and T_t is an exogenous transfer shock.[5]

Let q_t be the price of a perpetual (consol) real government bond B_t, that pays coupon $\delta_q q_{t+1}$ in the next period, and where δ_q is coupon-rate parameter of the government bond (which is equal to zero in the baseline). The government's one-period flow budget constraint is then

$$(1+\delta_q q_t)B_{t-1} \;+\; \underbrace{\big(\Phi_t + G_t + \mathrm{tr}_t\big)}_{X_t} \;=\; \tau_t\, \underbrace{\big[w_t(1-u_t) + \chi_{\mathrm{tax}}^{\mathrm{UI}}\Phi_t\big]}_{\text{tax base}} \;+ q_t B_t, \tag{14}$$

[5]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.

where G_t correspond to other government outlays.

Taxes apply to labor income and, when $\chi_{\text{tax}}^{\text{UI}} = 1$, also to UI benefits. Hence, the tax base is $w_t(1 - u_t) + \chi_{\text{tax}}^{\text{UI}} \Phi_t$. The tax rate blends a debt-stabilising target with the steady-state rate:

$$\tau_t = \omega\,\hat{\tau}_t + (1 - \omega)\,\tau^{ss}, \qquad \omega \in [0, 1], \tag{15}$$

$$\hat{\tau}_t = \frac{(1 + \delta_q q_t)B_{t-1} + X_t - q^{ss}B^{ss}}{w_t(1 - u_t) + \chi_{\text{tax}}^{\text{UI}} \Phi_t}, \tag{16}$$

where τ^{ss}, q^{ss}, and B^{ss} are the steady state levels of labor taxes, the price of the real government bond, and the public debt, respectively. Equation (16) targets the steady-state debt level (rather than balanced budget each period). Its denominator corresponds to the pre-tax base, with $\omega = 0$ implying a full tax smoothing (pure debt finance) while $\omega = 1$ would imply immediate tax finance.

Hence, given our solution for τ_t, coming from Equation (16), and the households' flow budget constraint, coming from Equation (14), the law of motion for debt can be written as

$$B_t \;=\; \frac{(1 + \delta_q q_t)B_{t-1} + X_t - \tau_t\big[w_t(1 - u_t) + \chi_{\text{tax}}^{\text{UI}} \Phi_t\big]}{q_t}. \tag{17}$$

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

$$q_t \;=\; \frac{1 + \delta_q q_{t+1}}{R_t}. \tag{18}$$

2.7 Market Clearing

With the vacancy costs canceled by free entry in the labor market, the goods market clearing condition is given by:

$$Y_t \;=\; C_t^{hh} \;+\; G_t. \tag{19}$$

In turn, the asset market clearing condition can be written as:

$$q_t B_t \;=\; A_t^{hh}. \tag{20}$$

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, Druedahl, Harmenberg, and Oberg, 2024, and Ravn and Sterk, 2021).[6]

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

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 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 $\phi = 600$, ensuring realistic price stickiness.

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 is modeled as a consol bond with maturity parameter $\delta_q = 0$. Tax adjustment is smoothed via

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

implying a slow adjustment of taxes to debt deviations.[7] Outside the transfer experiments, lump-sum transfers remain at their steady-state level (which offsets steady-state dividends in the baseline). In the transfer experiments, T_t is the exogenous policy shock.

3.5 Monetary Policy

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

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

[7] In the benchmark specification, unemployment-insurance benefits are not taxed, so $\chi^{\text{UI}}_{\text{tax}} = 0$. The robustness exercises additionally consider $\chi^{\text{UI}}_{\text{tax}} = 1$.

with no direct response to the output gap or unemployment. The steady-state real interest rate is set to $r^{ss} = 0.02$ annually, with zero steady-state inflation.

3.6 Calibration Assessment

The calibration yields a steady-state unemployment rate of approximately 6 percent, a real interest rate of 2 percent annually, and a government tax rate of 30 percent (see Table 4). The share of hand-to-mouth households is set to 30 percent, ensuring strong heterogeneity in consumption responses, following the literature. The average MPC is equal to 0.40, also following empirical estimates for the United States.

Table 1: Household (HA) Parameters — Monthly

Symbol	Description	Value	Source
σ	CRRA coefficient	2.00	Standard macro; paper baseline
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 targets average quarterly MPC (Johnson et al., 2006). β_{BS} chosen to clear assets at r^{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	Unemployment duration tiers	1	Baseline (single tier)

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}.

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	Rotemberg price-adjustment cost	600	Paper baseline
φ_π	Taylor-rule inflation coeff.	1.5	Taylor (1993, 1999)
τ	Average labor(-income) tax rate	0.30	NIPA/OECD Taxing Wages
ω	Tax-smoothing weight	0.05	Paper/slides baseline
δ_q	Debt maturity parameter	0.00	Consol benchmark
$\phi_{\overline{u}}$	UI replacement (upper tier)	0.50	U.S. DoL/CBO; Kekre (2023)
$\phi_{\underline{u}}$	UI replacement (lower tier)	0.50	U.S. DoL/CBO; Kekre (2023)
w_{share}	Wage-share parameter ($w = 0.9\,p_x$)	0.75	Model choice[a]
$\rho_T, \rho_{\varphi^{UI}}$	Persistence of transfer and UI shocks	0.80	Baseline persistence

Source: Authors' calculations.

[a] Model wage-share parameter pins w to p_x; empirical U.S. labor income share is $\approx$ 0.60–0.65 (BEA).

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
δ_{ss}	0.020	Separation (monthly)	BLS JOLTS
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	Matches MPC evidence	Johnson–Parker–Souleles (2006)

Source: Authors' calculations.

4 Results: Macroeconomic Effects of the Instruments

With the baseline model calibrated to the United States, this section analyzes the macroeconomic effects of a contractionary demand shock and examines how these effects change when different income-stabilization policy instruments are introduced. In particular, we assess the response under three policy options: (i) an increase in unemployment insurance benefits, (ii) the adoption of a universal transfer scheme, and (iii) the implementation of a targeted transfer program directed at hand-to-mouth households.

Figure 1 reports the impulse responses to the demand shock in the baseline calibration, with no additional policy response. The shock depresses household spending on impact. Firms, in turn, cut production because of price stickiness, causing them to adjust quantities rather than prices at business-cycle frequencies. Consumption falls immediately as liquidity-constrained households reduce purchases and households with access to a bond market raise

Table 5: Shock Calibration Used in the Policy Experiments

Object	Value	Interpretation
Demand shock persistence, ρ_β	0.8	AR(1) persistence of the demand shock
UI-generosity shock persistence, $\rho_{\varphi^{UI}}$	0.8	AR(1) persistence of the UI shock
Transfer shock persistence, ρ_T	0.8	AR(1) persistence of both transfer instruments
Benchmark financing weight, ω	0.05	Low contemporaneous tax adjustment
Alternative financing weight, ω	0.20	Higher contemporaneous tax adjustment
UI tax treatment, χ^{tax}_{UI}	0 or 1	0 = UI benefits untaxed; 1 = UI benefits taxed

Notes: The benchmark case uses $\omega = 0.05$ and $\chi^{tax}_{\text{UI}} = 0$. Robustness cases vary $\omega \in \{0.05, 0.20\}$ and $\chi^{tax}_{\text{UI}} \in \{0, 1\}$. Source: Authors' calculations.

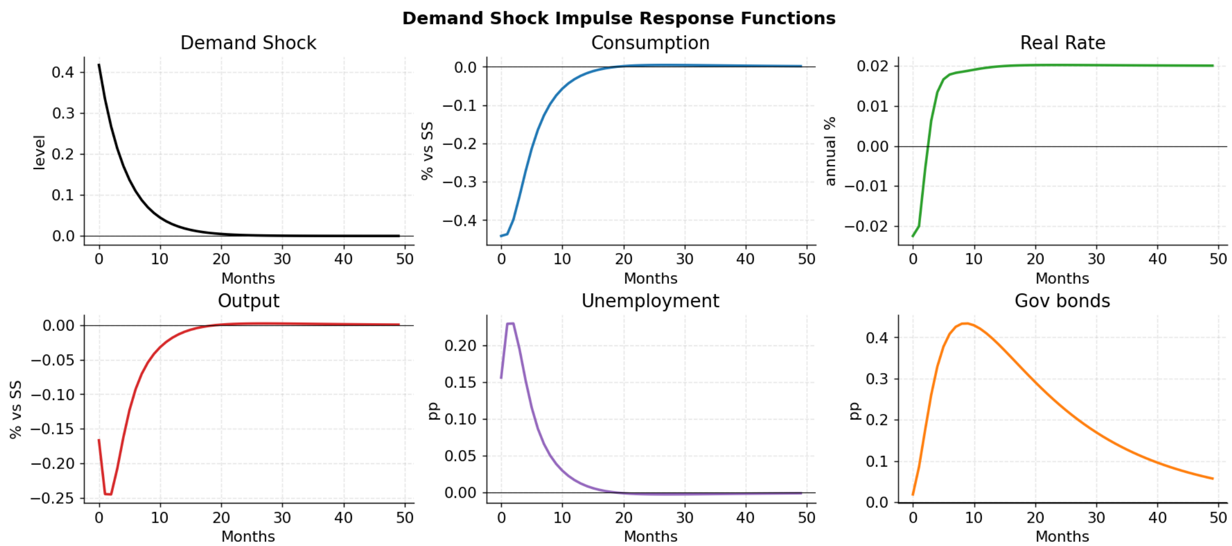

Figure 1: Monthly Macroeconomic Effects of a Negative Demand Shock

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

savings. The real interest rate drops, reflecting an accommodative but not fully offsetting monetary stance. As a result, demand does not return quickly but in a gradual recovery.

The labor market responds with a lag. Lower sales reduce vacancy posting, market tightness falls, and the job-finding rate declines. Hence, unemployment rises more slowly than output falls, peaking after the real side of the economy has already begun to stabilize. This timing pattern is a hallmark of search frictions: flows into and out of employment transmit demand shortfalls into the stock of unemployed over several months. The deterioration in job-finding reinforces precautionary saving by employed households concerned about job loss, which keeps consumption subdued even after the initial shock dissipates.

Fiscal dynamics are driven by the tax-smoothing rule. With a weaker tax base and higher cyclical outlays, the government allows debt to absorb the on-impact financing need. The debt-to-GDP ratio jumps at the onset of the recession and then declines only gradually as the economy recovers and taxes adjust back toward the steady state. By shifting financing intertemporally, the tax-smoothing rule avoids extracting resources from high-MPC households precisely when their spending is most fragile, but it implies a persistent elevation in public debt for some time after the shock.

Distributional forces amplify the downturn. As unemployment risk rises and more households approach their borrowing limits, the effective share of hand-to-mouth agents increases. Average MPC in the economy rises, so any reduction in disposable income translates more directly into lower consumption. This compositional shift helps explain why the decline in spending is front-loaded and why the recovery is slow even as the shock fades. All in all, a negative demand shock lowers spending and hiring in our setup.

To counteract these forces, we evaluate three income-stabilization policy instruments. The first is a boost to unemployment insurance, which increases replacement rates for job losers and provides both cash-flow support to high-MPC households and insurance against job-loss risk. The second is a targeted transfer that pays a lump sum only to hand-to-mouth households. The third is a universal transfer that pays the same lump sum to all households. Throughout, we adopt the fiscal normalization defined in the introduction: each instrument is designed so that its implementation implies a one-percentage-point increase in debt-to-GDP ratio along the transition, while allowing ex-post fiscal dynamics to differ through general-equilibrium feedbacks.

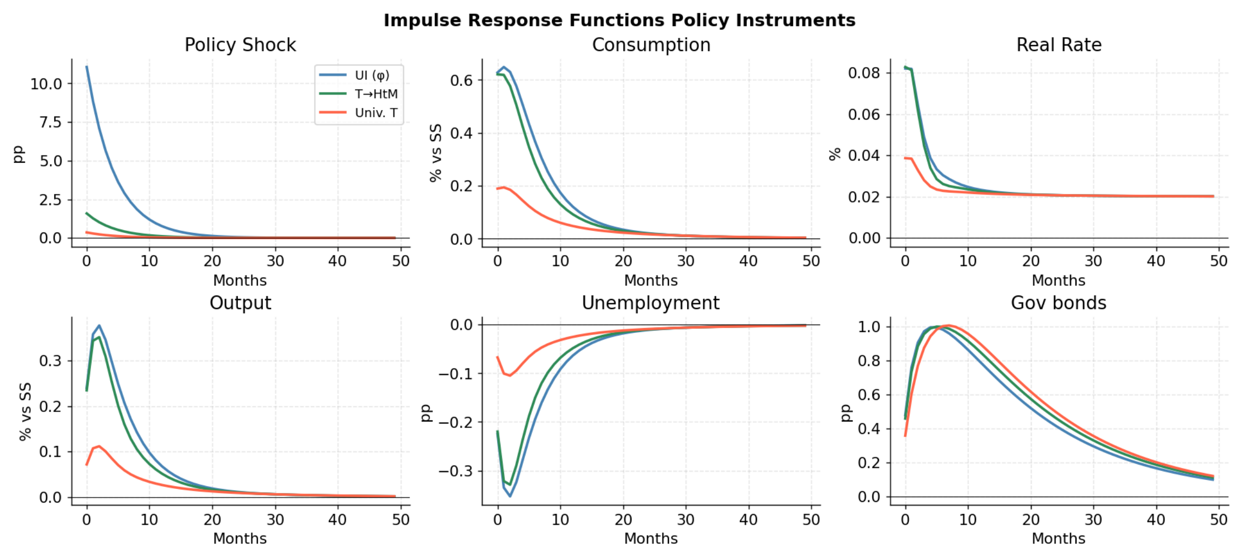

Figure 2: Macroeconomic Effects of Income-Stabilization Policies Under a Common Fiscal Envelope.

Note: Each panel compares the responses induced by the three policy instruments, each scaled to produce an approximately one-percentage-point peak increase in the debt-to-GDP ratio. Source: Authors' calculations.

Figure 2 compares the dynamic effects of the three instruments in isolation, without the demand shock, by plotting impulse response functions of aggregate variables as deviations from their steady-state levels. Unemployment insurance (blue lines in the figure) generates the strongest and most persistent output stabilization. Consumption increases above the baseline on impact because unemployed households have very high propensities to spend the income obtained through the benefit increase. Meanwhile, the insurance value of more generous benefits reduces the precautionary savings by the employed households, which widens the spending response to other households that are not unemployed. The rise in demand improves firm revenues, vacancy posting increases, market tightness recovers, and the job-finding rate rises. Unemployment peaks earlier and at a lower level than in the baseline and then declines faster, reflecting a more supportive hiring environment. Output tracks consumption upward, and the real interest rate moves in a manner consistent with stronger activity and a gradual normalization of monetary conditions. Public debt rises by design to the same peak as for the other instruments, but because unemployment insurance supports demand for longer, the recovery in the tax base is faster and the path back toward steady debt is smoother.

Targeted transfers to hand-to-mouth households (green lines in Figure 2) deliver the largest immediate lift in consumption among the three tools. Because the payment is concentrated on liquidity-constrained households, the impact MPC is very high and spending jumps quickly. The labor market responds through the same vacancy-tightness mechanism: higher sales raise job openings, improve job-finding, and curb the rise in unemployment. However, the absence of an insurance effect means that the support fades sooner than under unemployment insurance. As the one-off cash support is spent and risk perceptions among the employed are unchanged, the consumption path gradually converges back toward the baseline. Output mirrors this pattern, with a strong short-run improvement and more limited persistence. The real interest rate response is modestly stronger on impact than under a universal transfer because the initial demand surge is larger, but the difference narrows as the effect fades. Debt follows the same envelope by construction, peaking at one percentage point above baseline before drifting down faster as revenues recover.

Universal transfers (orange lines in Figure 2) produce the broadest coverage among households, but the weakest macroeconomic response per unit of fiscal space utilized. A sizable share of the payment goes to households with low marginal propensities to consume. The aggregate consumption response is therefore smaller on impact than under the targeted transfer. Without an insurance channel, the effect on risk perceptions and precautionary saving is limited. Vacancy posting and market tightness improve only modestly, job-finding rises less, and unemployment remains closer to its baseline path throughout the episode. Output gains are correspondingly muted, and the real interest rate shows the smallest deviation from the baseline among the three instruments. Debt again peaks at one percentage point of GDP by construction, but the recovery of the tax base is slower than under unemployment insurance, with a less favorable path back toward the steady debt. Appendix B reports how financing timing (the tax-smoothing parameter ω) and the tax treatment of UI benefits affect magnitudes. These variations change levels but do not overturn the qualitative 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 one to compare the three income-stabilization instruments proposed via this key dimension. In the next subsection, we explain the methodology used to perform the welfare calculation; and, in the subsequent subsection, the results of this welfare analysis.

5.1 Methodology: HANK Welfare Measurement

Standard representative-agent models measure welfare using the utility of a representative consumption path $U_t = u(C_t)$, where C_t is aggregate consumption. This procedure is inadequate in HANK settings because it ignores heterogeneity across households in assets, labor market states, and MPCs.

In our proposed welfare calculation, the household problem is solved by the endogenous grid method. For each household of type i (defined by discount factor β_i, asset grid point a, and employment state z), we record the per-period consumption $c_{i,t}$ along the transition path computing the node-level utility $u(c_{i,t})$ through a CRRA utility function:

$$u(c) = \begin{cases} \log(c), & \sigma = 1, \\ \frac{c^{1-\sigma}}{1-\sigma}, & \sigma \neq 1, \end{cases}$$

where σ denotes the coefficient of relative risk aversion.

The mass of households of each type is denoted by $D_{i,t}$, evolving according to labor market transitions (employment vs. unemployment duration), separation shocks, and the distribution of assets. This ensures that both, household heterogeneity (coming from the asset distribution) and unemployment risk heterogeneity (coming from the z-states), are incorporated. In the steady-state this distribution is stationary by definition, but it can evolve along the transition path, indicated by the subscript t.

We aggregate utilities at each period:

$$U_t \equiv \mathbb{E}[u(c_t)] = \sum_i D_{i,t}\, u(c_{i,t}). \tag{21}$$

This is the HANK-specific welfare object, which is distinct from the approximation used in representative-agent models ($u(C_t)$). To our knowledge, this is the first paper that computes HANK welfare values consistently along non-linear transitions of a HANK–SAM model.

We discount these flow utilities with an annual discount factor $\beta_y = (\beta_m)^{12}$, where β_m is the model's monthly discount factor:

$$W = \sum_{t=0}^{T} \beta_y^t\, U_t.$$

We then compute the *consumption equivalent variation (CEV)* between a baseline path (U_t^0) and a counterfactual path (U_t^1):

$$g = \begin{cases} \exp\left(\frac{W^1 - W^0}{\sum_t \beta_y^t}\right) - 1, & \sigma = 1, \\ \left(\frac{W^1}{W^0}\right)^{\frac{1}{1-\sigma}} - 1, & \sigma \neq 1. \end{cases}$$

The CEV, denoted as g, is reported in percent. So, $g = 0.2$ means that households would be willing to permanently scale their entire consumption path up by 0.2 percent to be indifferent between the baseline and the counterfactual of a particular policy instrument being implemented.

To make welfare gains comparable across policies, we normalize the size of each policy shock so that the peak debt-to-GDP ratio, $\Delta B_t/Y^{ss}$, reaches 1 percentage point.[8] This makes the "one unit of policy" equivalent across income-stabilization instruments. We also compute the number of such units required to offset a negative demand shock (a contraction in β) and use this as the benchmark shock to be offset.[9]

5.2 Results: Welfare Effect and Fiscal Cost of Each Income-Stabilization Policy

Table 6 reports the welfare gains for one percentage-point increase in the debt-to-GDP ratio caused by each of the three income-stabilization policy instruments analyzed. It also reports the implied fiscal costs of implementing each of those policy instruments. All policies are evaluated with HANK welfare $U_t = \mathbb{E}[u(c_t)]$ under the same fiscal cost of implementation (1 percentage point of GDP).

Table 6: Welfare Effect and Fiscal Cost of Each Income-Stabilization Policy Instrument

Policy	**CEV gain**[1] (percent per fiscal implementation cost)	**Overall fiscal cost**[2] (percentage points of GDP)
Unemployment insurance ($\boldsymbol{\varphi^{UI}}$)	0.36	0.378
Targeted transfer to HtM[3] (T_{HtM})	0.23	0.584
Universal transfer (T)	0.09	1.505

Notes: [1] CEV gain is the annual consumption-equivalent welfare gain, expressed in percent, from an income-stabilization policy whose fiscal implementation cost is equal to one percent of GDP. [2] Overall fiscal cost is the total cost caused by the policy instrument offsetting the welfare loss from the benchmark demand shock, i.e. |CEV loss|/(CEV gain per unit). Lower values indicate a more efficient policy. [3] HtM = hand-to-mouth households. Source: Authors' calculations.

Unemployment insurance emerges as the most efficient income stabilizer in our benchmark experiments. It requires only 0.378 policy units to offset the welfare loss from the recession. This performance reflects two reinforcing facts emphasized in both the theory and the data. First, UI transfers are directed to households with very high marginal propensities to consume and high marginal utility of consumption—the recently unemployed workers. Hence, the cash-flow channel is powerful on impact. That is corroborated by the micro evidence in the literature (e.g., Kolsrud et al., 2018 and Ganong and Noel, 2019, which shows sharp spending responses from its beneficiaries to UI income and sizable drops of that spending at the exhaustion of UI.

[8] Unless otherwise stated, the benchmark specification uses low tax smoothing, $\omega = 0.05$, and no tax on unemployment-insurance benefits, $\chi_{UI}^{tax} = 0$.

[9] But why not using $u(C_t)$? That is because $u(\cdot)$ is concave, and so evaluating welfare at the aggregate, $u(C_t)$, would understate the marginal utility of consumption for low-consumption states and overstates high-consumption states. In recessions, the mass of households shifts toward low-income, high-MPC households, (and unemployment rises). So $\mathbb{E}[u(c_t)] \neq u(C_t)$ in economically meaningful ways. Our welfare object $U_t = \sum_i D_{i,t}\, u(c_{i,t})$ captures these distributional shifts, the unemployment-risk channel, and the insurance value of policy.

Second, UI also operates through an insurance channel: by softening the consequences of job loss, it reduces precautionary saving among the employed, supporting aggregate demand more broadly. This macro insurance value is central in work on optimal cyclical UI and on the amplification role of unemployment risk in heterogeneous-agent models (Chetty, 2006, Landais et al., 2018 and Broer, Druedahl, Harmenberg, and Öberg, 2021). In our HANK–SAM setting, these cash-flow and insurance effects propagate through vacancies, market tightness, and job-finding, generating a persistent improvement in employment that outlasts the immediate fiscal impulse.

Transfers targeted to hand-to-mouth households are the next best option. By concentrating resources on liquidity-constrained households—including some employed workers with little liquid wealth—they deliver a large impact increase in consumption consistent with the "wealthy hand-to-mouth" hypothesis and with high measured MPCs to rebate checks and stimulus payments (Kaplan, Violante, and Weidner, 2014). However, unlike UI, targeted transfers do not insure against unemployment risk and, therefore, do not reduce precautionary saving among those workers who keep their jobs. Absent this insurance margin, general-equilibrium gains fade faster even though the initial boost is strong—an outcome aligned with recent HANK studies in which the persistence of stabilization depends on both who receives funds and how policy alters risk (Auclert, 2019, Consolo and Hänsel, 2024).

Universal transfers are the least efficient of the three policy options. Their broad coverage directs substantial fiscal resources (about 1.5 percent of GDP in our model) to unconstrained households with low MPCs, who tend to save a large share or pay down debt. Empirically, aggregate MPCs out of universal payments are lower and highly dispersed across the distribution of households, diluting the macro effect of a given fiscal envelope. In our model, the absence of an insurance effect and the dispersion of payments across low-MPC households produce the weakest improvements in consumption, hiring, and unemployment per unit of fiscal cost.

Methodologically, our evaluation differs from much of the representative-agent (RA) and two-agent (TANK) literature that ranks income-stabilization policy instruments by using output-based metrics, or by aggregating utility from average consumption. We compute welfare directly from the full HANK distributional path, aggregating node-level utilities $U_t = \mathbb{E}[u(c_t)]$ along the nonlinear transition. This approach respects concavity, captures changing composition in liquidity and risk exposure, and quantifies insurance benefits that are invisible in RA models (Auclert, 2019, Kaplan, Moll, et al., 2018, Ravn and Sterk, 2021). It is precisely this distributional accounting—combined with a common policy-unit normalization—that reveals the welfare advantage of UI over equally initially costly targeted or universal transfers. These new elements of our model further align its mechanisms with the empirical evidence on MPC heterogeneity and the insurance value of UI.

Figure 3 plots the annual welfare gain on the vertical axis against the number of policy units on the horizontal axis. Each policy is represented by a straight ray through the origin, whose slope equals the policy's annual CEV gain per unit. The dashed horizontal line marks the welfare loss generated by the benchmark demand shock. The intersection between that line and each policy ray determines the number of policy units needed to offset the recession. In the benchmark, UI has the steepest slope and therefore reaches the demand-shock line with the lowest fiscal cost, requiring 0.378 units. It is followed by transfers targeted to hand-to-mouth households, which require 0.584 units, and finally by universal transfers,

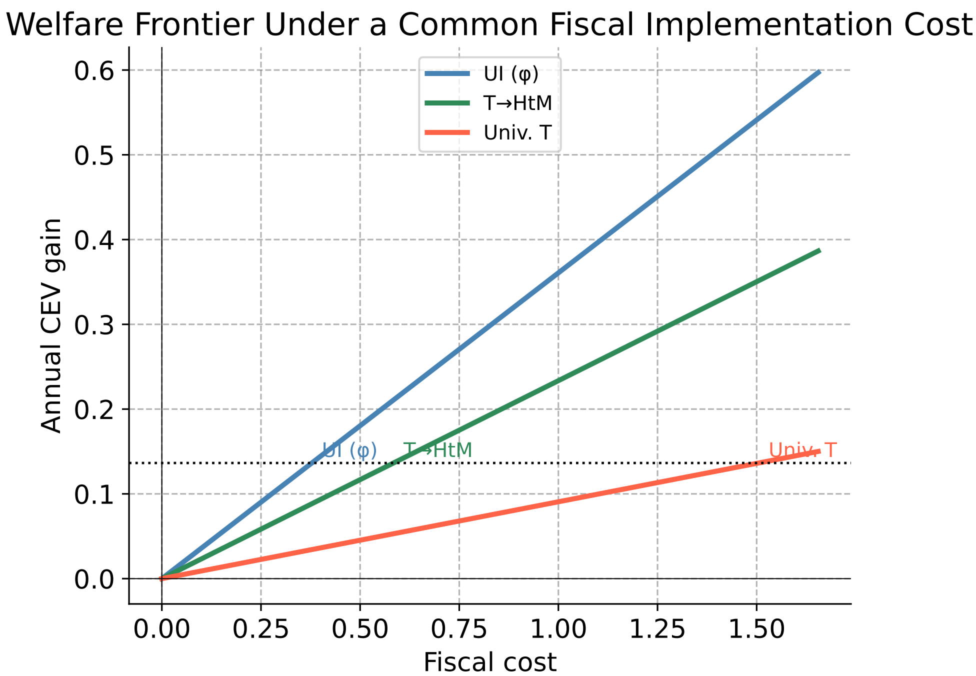

Figure 3: Welfare Frontier Under a Common Fiscal Implementation Cost

Notes: Each ray plots the annual consumption-equivalent welfare gain (CEV) generated by a given number of policy units. One policy unit is defined as the policy intervention that generates an approximately 1 percentage point peak increase in the debt-to-GDP ratio.

which require 1.505 units. Because all rays start at the origin and share the same policy-unit normalization, the comparison across instruments is scale-free and transparent.

As a final exercise in this section, we assess whether the welfare and fiscal rankings are robust to alternative public-financing arrangements. We consider three dimensions of financing: (i) higher initial taxation, captured by a higher value of the tax-smoothing parameter ω in Equation 15; (ii) higher initial financing through public debt, captured by a lower value of ω; and (iii) the taxation of unemployment-insurance benefits, which in the model is equivalent to taxing them as labor income.

The results, reported in Appendix B (Table 7), show that the qualitative ranking remains unchanged across all specifications. Unemployment insurance continues to deliver the highest welfare gain per unit and the lowest implementation cost, targeted transfers remain second, and universal transfers remain the least efficient instrument. Quantitatively, implementation costs vary across financing arrangements. For UI and targeted transfers, stronger front-loaded taxation lowers costs in the untaxed cases, whereas taxing UI benefits raises costs, especially when ω is low. For universal transfers, however, the financing pattern is less favorable and costs need not fall with a higher value of ω. Thus, the main result of the paper is robust: changing the financing arrangement affects magnitudes, but not the ranking of the three policy instruments.

6 Distributional Effects of the Policy Instruments

This section studies how stabilization gains are distributed across households with different liquid-wealth positions.[10] The per-period welfare can be measured as the sum of households' utility functions from the HANK model defined in Section 5, see Equation (21), as follows:

$$U_t \equiv \mathbb{E}[u(c_t(j))] = \sum_i D_{i,t}\, u(c_{i,t})\,, \tag{22}$$

where i indexes nodes in the $(\beta, \text{employment}, a)$ grid, $D_{i,t}$ is the cross-sectional mass at node i, and $u(\cdot)$ is CRRA utility.

For the distributional analysis, households are grouped into wealth quartiles based on the pre-shock wealth distribution across all household types. Meanwhile, the welfare impulse responses are reported as the difference (ΔU_t^{tot}) between the total welfare in each period t under a particular policy (U_t) and the total welfare in the steady state (U^{ss}):

$$\Delta U_t^{\text{tot}} \equiv 100 \times \frac{U_t - U^{\text{ss}}}{|U^{\text{ss}}|},$$

where this difference is measured in percent of $|U^{\text{ss}}|$, so magnitudes are directly comparable across subgroups and policies.[11]

6.1 Cross-Policy Distributional Comparison

Figure 4 compares impact welfare gains by wealth quartile across the three instruments under a common fiscal implementation cost. The comparison is computed at the steady state, that is, without an additional β demand shock, so that the bars isolate the cross-sectional incidence of each instrument at a fixed aggregate state.[12] The figure shows that households in the second wealth quartile benefit the most from a temporary increase in unemployment insurance. The intuition is that higher unemployment insurance improves insurance against job-loss risk for buffer-stock households that are close to being hand-to-mouth but still retain an intertemporal margin. As a result, their precautionary saving falls and their consumption rises immediately, even when they remain employed. The effect of higher unemployment insurance is slightly negative for the richest quartile, consistent with the fact that these households benefit less from the insurance margin while contributing relatively more to finance the policy through taxation.

As expected, targeted transfers, represented by the orange bars in Figure 4, benefit most strongly households in the poorest wealth quartile. That quartile is dominated by hand-to-mouth households whose employed members have little or no intertemporal margin,

[10] 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., 2023, and Cicek et al., 2026, for inflation; and Furceri, Loungani, et al., 2018 for monetary policy).

[11] For subgroup g, we define $\Delta U_t^g \equiv 100 \times \left(U_t^g - U_{\text{ss}}^g\right)/|U^{\text{ss}}|$ with $U_t^g \equiv {m_t^g}^{-1}\int_{j\in g} u(c_t(j))\, d\mu_t(j)$, where m_t^g is the mass of g. Using $|U^{\text{ss}}|$ in the denominator keeps scales common across groups.

[12] As the initial fiscal envelope used to implement the three policy instruments is the same, one policy unit, corresponding to an approximately 1 percentage point peak increase in the debt-to-GDP ratio, the bars in Figure 4 are directly comparable.

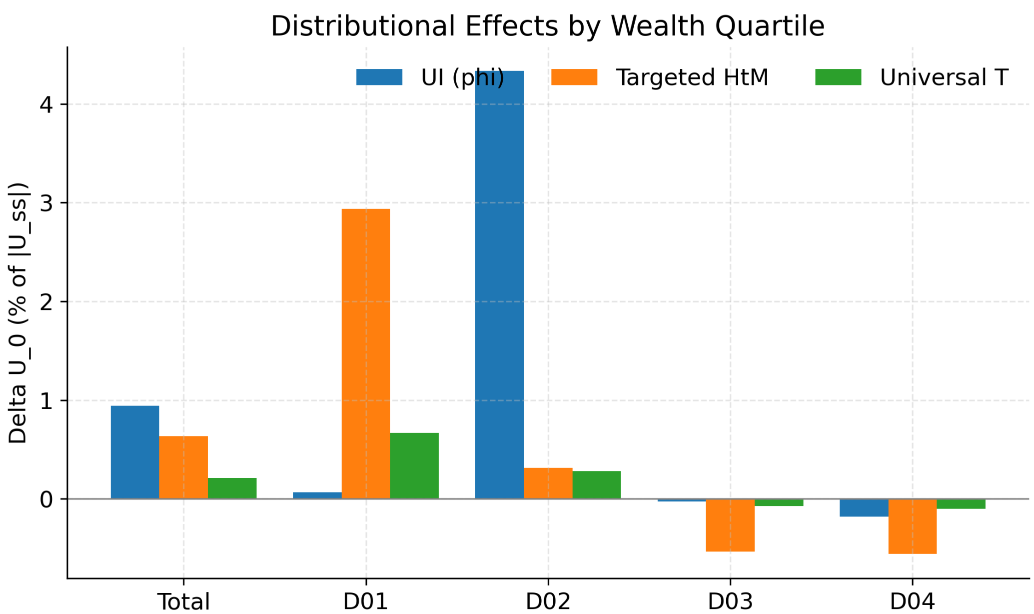

Figure 4: **Distributional Effects of Income-Stabilization Instruments by Wealth Quartile**

Notes: Grouped bars report the impact welfare change (ΔU_0) for the aggregate economy (Total) and for each wealth quartile, expressed in percent of aggregate steady-state welfare, $|U^{ss}|$. The comparison is computed in the policy-only benchmark, that is, without an additional β demand shock. ϕ denotes unemployment-benefit generosity, T_{HtM} denotes transfers targeted to hand-to-mouth households, and T denotes universal transfers. D01, D02, D03, and D04 correspond to the first (poorest), second, third, and fourth (richest) wealth quartiles, respectively. Source: Authors' calculations.

and whose unemployed members are more likely to be close to the replacement-rate cap, so they benefit the most from targeted transfers. The gains are much smaller already in the second quartile, which contains relatively fewer hand-to-mouth households, and become negative for the richer quartiles, which help finance the program but receive little direct benefit from it. Universal transfers spread resources more broadly across households and therefore generate the smallest impact effect for a given fiscal cost. Their gains are positive for the poorer quartiles and close to zero or slightly negative for the richest households.

6.2 UI Generosity: Dynamics by Wealth Quartile

We next consider the full time path following the baseline increase in unemployment insurance generosity. Figure 5 shows the welfare responses for each wealth quartile together with the aggregate response. Aggregate welfare is positive on impact and then declines gradually toward zero over time. Distributionally, the second wealth quartile experiences by far the largest initial improvement, whereas the first quartile records only modest gains, the third quartile remains close to zero, and the top quartile experiences a mild impact loss. These responses also display interesting dynamics. The first quartile turns slightly negative after the initial months, the second quartile crosses below zero after roughly one year and then gradually converges back toward zero, the third quartile remains mildly negative for much

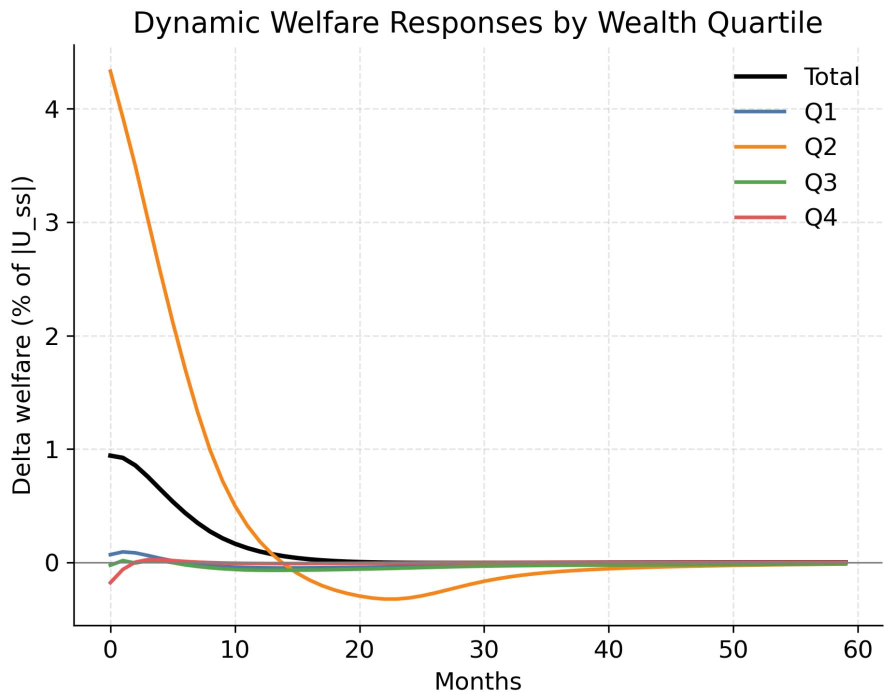

Figure 5: **Dynamic Welfare Responses by Wealth Quartile to Higher UI Generosity**
Notes: Solid colored lines plot the welfare change (ΔU_t^g) for each wealth quartile, expressed in percent of aggregate steady-state welfare, $|U^{ss}|$. The black line reports the aggregate welfare response, ΔU_t^{tot}. Q1, Q2, Q3, and Q4 denote the first (poorest), second, third, and fourth (richest) wealth quartiles, respectively.
Source: Authors' calculations.

of the transition, and the top quartile reverts quickly from its initial loss toward values close to zero. Overall, as labor-market conditions improve and unemployment risk recedes, cross-quartile differences narrow and the welfare responses of all groups converge back toward their steady-state levels.

6.3 UI Generosity: Within-Group and Compositional Welfare Effects

To understand more clearly the mechanisms behind the aggregate welfare response, we decompose the change in aggregate welfare into a "within-group" component and a compositional component. The within-group effect is computed by holding fixed the steady-state mass of each household type, D_i^{ss}, and isolating the effect of the policy on utility at given states. The compositional effect captures instead the contribution of changes in the cross-sectional distribution of households along the transition. Using Equations (21) and (22), the decomposition can be written as

$$\underbrace{U_t - U^{ss}}_{\text{total}} = \underbrace{\sum_i \left[u(c_{i,t}) - u(c_i^{ss})\right] D_i^{ss}}_{\text{within-group effect, at } D^{ss}} + \underbrace{\sum_i u(c_{i,t})\big(D_{i,t} - D_i^{ss}\big)}_{\text{compositional effect (reweighting)}} .$$

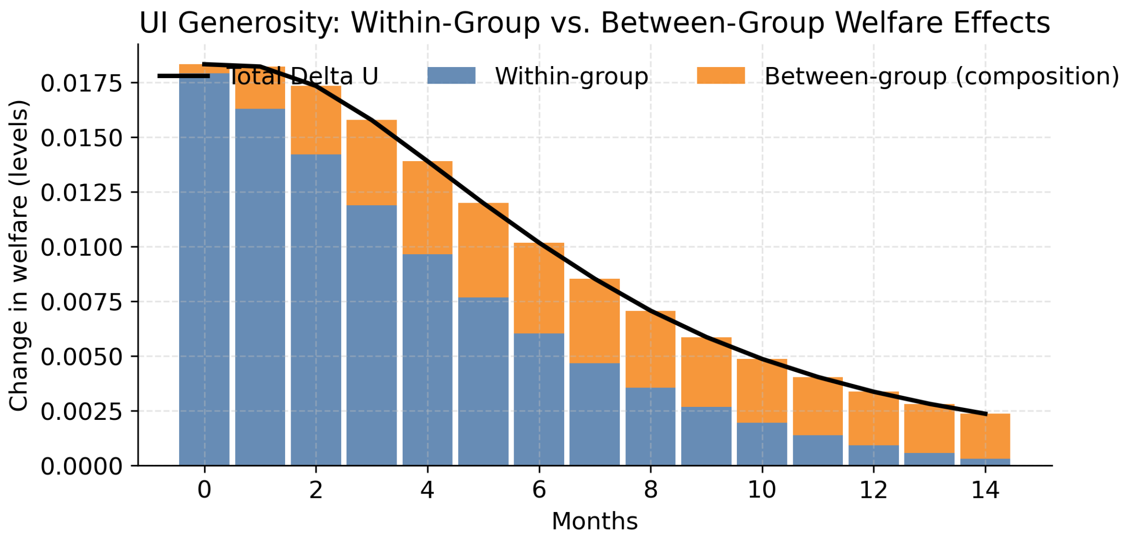

Figure 6: **UI Generosity: Within-Group and Compositional Welfare Effects**
Notes: Bars decompose the aggregate change in welfare, $U_t - U^{\text{ss}}$, into a within-group component (holding D_i fixed at D_i^{ss}) and a compositional component (the reweighting term). The solid line reports the total welfare change. The decomposition is shown in utility levels, not in percent. Source: Authors' calculations.

Figure 6 reports this decomposition for the unemployment-insurance experiment. On impact, the within-group component accounts for most of the total welfare gain, reflecting the direct cash-flow effect of higher unemployment benefits for unemployed households together with the immediate reduction in precautionary saving among near-hand-to-mouth buffer-stock households. Over time, the within-group effect declines, while the compositional effect remains positive and becomes relatively more important, indicating that part of the persistence in aggregate welfare comes from changes in the distribution of households across employment and asset states during the transition. This decomposition is consistent with the broader mechanism emphasized in Section 5: income stabilization operates both by improving utility at given household states and by altering households' exposure to job-loss risk over time.

7 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 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 universal transfers—and evaluate them using a HANK-consistent welfare criterion that aggregates utility across the full cross-section of households along the nonlinear transition path. Policy comparisons are conducted under a common fiscal implementation cost equivalent to a one-percentage-point increase in the debt-to-GDP ratio.

Our main result indicates that in response to a recessionary demand shock, increasing unemployment-insurance generosity delivers the largest welfare gain per percentage point of GDP of the fiscal implementation cost. Transfers targeted to hand-to-mouth households deliver the second-highest welfare value, while universal transfers yield the lowest welfare value. This ranking is robust across the financing arrangements considered in the paper and to the tax treatment of unemployment-insurance benefits, even though the quantitative magnitudes of welfare gains and implementation costs vary across specifications.

The intuition for these findings follows from the interaction of the households' income distribution, availability of unemployment insurance, and the characteristics of the labor market. Unemployment insurance (UI) provides resources to households with high marginal utility of consumption and high marginal propensities to consume (MPC), namely the unemployed, generating a powerful cash-flow effect on impact. At the same time, it improves insurance against job loss for employed workers, reducing precautionary saving and supporting aggregate demand more broadly. In our HANK–SAM environment, these two channels propagate through vacancies, market tightness, and job finding, so the effects of higher UI generosity on employment and welfare persist beyond the initial fiscal impulse. Targeted transfers share the first channel, because they concentrate resources on liquidity-constrained households with high MPCs, but they do not provide the same insurance margin against unemployment risk. Universal transfers, in turn, spread resources too broadly, directing a larger share of spending to lower-MPC households and, therefore, generating the least effective policy in terms of welfare.

The paper also shows that the welfare effects of these instruments differ sharply across households and over time. Under the common implementation fiscal envelope, unemployment insurance primarily benefits households in the lower-middle (second wealth quartile) of the wealth distribution—those close to being hand-to-mouth, but with remaining intertemporal smoothing capacity—reflecting their high valuation of insurance and a reduction in precautionary saving even during employment. By contrast, targeted transfers benefit the poorest households the most, while universal transfers generate smaller and more diffuse gains. Over time, the welfare gains from unemployment insurance are initially driven mainly by within-group improvements in consumption and insurance, while compositional changes in the household distribution help sustain the aggregate welfare response during the transition.

From a policy perspective, these findings imply that when downturns are driven by weak demand, expanding unemployment insurance should be the best income-stabilization policy. Targeted transfers remain a useful second-best tool when the objective is to support liquidity-constrained households quickly, especially where targeting is feasible and administrative systems are reliable. Universal transfers are less efficient from a welfare perspective because they allocate more resources to households with low marginal propensities to consume. More generally, our results suggest that the design of income-stabilizing policies should consider who receives the support, how policy changes risk exposure, and how those distributional shifts feed back into labor-market dynamics. To preserve debt sustainability and maintain policy space for future shocks, such income-stabilization measures should also be embedded within credible fiscal frameworks (Beetsma et al., forthcoming), potentially through semi-automatic stabilizers (see, for example, McKay and Reis, 2016, Blanchard and Summers, 2020, and IMF, 2022).

Methodologically, the paper advances a welfare framework for HANK–SAM environments by departing from representative-agent shortcuts that evaluate utility at aggregate consumption. By aggregating node-level utilities over the endogenous household distribution, our approach preserves concavity, captures changes in liquidity and unemployment risk over time, and uncovers insurance gains absent from representative-agent settings. As a result, the model can sharply differentiate among policies that appear similar when judged solely by output or aggregate consumption.

Two 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 would likely reduce the net gains from unemployment insurance and sharpen the policy design trade-offs. Second, our quantitative exercise focuses on a particular demand-driven recession under a common fiscal implementation envelope. Alternative or protracted shocks (Dell'Erba et al., 2018), different envelope definitions, or country-specific institutional settings may alter quantitative magnitudes even if the qualitative ranking survives.

Future research could extend the framework in several directions. One natural extension is to move beyond demand shocks and compare policy performance under supply-side disturbances, such as productivity shocks or persistent separation shocks associated with technological change (Dabla-Norris et al., forthcoming). Another is to incorporate endogenous wage setting and richer labor-supply responses, allowing a finer decomposition of the interaction between income stabilization, labor-market adjustment, and inflation dynamics. A third extension would be to study how these instruments perform under alternative institutional environments, including different unemployment-insurance systems and other types of active labor market policies (Estevão, 2007), tax schedules, and transfer infrastructures across countries.

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A Appendix—Solution Method

This appendix briefly summarizes the numerical procedure used to solve the model in the steady state and along transition paths.

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 using the endogenous grid method. Given a path for aggregate prices, taxes, transfers, employment transitions, and returns, the Euler equation is used to recover optimal consumption and savings on an endogenous grid, which is then interpolated back to the fixed asset grid while imposing the borrowing constraint $a' \geq 0$. Expectations are formed using the transition probabilities between employment and unemployment implied by the search-and-matching block. This delivers policy functions for consumption and next-period assets at each date and state.

A.2 Steady State and Transition Dynamics

The steady state is computed by jointly solving the household block, the labor-market block, and the government block until all equilibrium conditions are satisfied. In particular, the labor market pins down steady-state unemployment and matching rates, while the household block implies aggregate asset demand. The steady state is then closed by imposing asset-market clearing and the government budget constraint.

Transition dynamics are computed as a perfect-foresight equilibrium. For a given sequence of shocks, the model stacks the paths of the endogenous aggregate variables and solves for them jointly so that all equilibrium conditions hold at every date. At each iteration, the current candidate paths for prices, quantities, taxes, and labor-market variables are passed to the household block, which is solved backward to obtain policy functions and then simulated forward to update the distribution of households and the resulting aggregate quantities. The equilibrium system is solved numerically with a quasi-Newton method of the Broyden type until the residuals of all equilibrium conditions are sufficiently small.

This procedure preserves the two key channels emphasized in the paper. First, unemployment risk generates state-dependent consumption responses through the household block. Second, the fiscal rule governs how policy interventions are financed over time, thereby affecting disposable income, aggregate demand, and labor-market dynamics along the transition.

B Appendix—Robustness Checks to Alternative Types of Fiscal Financing of the Policy Instruments

This appendix examines whether the welfare ranking of the three policy instruments depends on the type and calibration of public finance that supports them. Two alternatives to the way the policy instruments are financed and calibrated in the baseline model are considered. First, we investigate whether the timing of fiscal financing—that is, whether the instruments are financed more through taxation or debt—matters for the welfare ranking of the instruments.. Second, we analyze whether the tax treatment of the unemployment-insurance benefits also affect that welfare ranking.

For that, we compute the welfare loss generated by the contractionary demand shock in *consumption equivalent variation (CEV)*[13] and the size of the different income-stabilization policy instruments under each alternative specification of fiscal financing that would be needed to offset such welfare loss. As in the main text, for each type of fiscal financing analyzed, the income-stabilization policy instrument is normalized to initially cost one percent of the debt-to-GDP ratio to be implemented.

Hence, the fiscal cost of the required income-stabilization needed to offset the welfare loss from the demand shock can be written as:

$$\text{Fiscal cost of the needed intervention} = \frac{|\text{CEV loss}|}{\text{CEV gain under the common fiscal implementation cost}}.$$

Table 7 reports those fiscal costs—in percentage points of GDP (pp of GDP)—for the different types of public financing and income-stabilization policies analyzed.[14]

B.1 Changes to the Tax-Smoothing Parameter

For this type of fiscal financing, we consider two values of the tax-smoothing parameter, $\omega \in \{0.05, 0.20\}$, when unemployment benefits are not taxed—i.e., $\chi^{\text{UI}}_{\text{tax}} = 0$. A higher ω represents a higher initial financing of the income-stabilization policy through taxation instead of through public borrowing (see Equation (16)).

The results in the first two columns of Table 7 show that the qualitative ranking of instruments is unchanged across the calibration of the tax-smoothing parameter. Unemployment insurance remains the most effective instrument in welfare terms, followed by targeted transfers to hand-to-mouth households, while universal transfers remain the least effective.

Quantitatively, a higher value of ω lowers the implementation cost of unemployment insurance and targeted transfers in the untaxed cases: for example, the fiscal cost of increasing unemployment benefits falls from 0.378 percentage points of GDP when $\omega = 0.05$ to 0.346 when $\omega = 0.20$. For universal transfers, however, the opposite occurs, with the required cost rising from 1.505 to 1.630 policy units.

B.2 Taxing the Unemployment Benefits

A second set of robustness checks for the type of fiscal financing considers the same tax-smoothing parameter calibrations from above, but now assuming that unemployment benefits are also taxed—i.e., $\chi^{\text{UI}}_{\text{tax}} = 1$.

[13]The CEV represents again how much households would be willing to permanently scale their entire consumption path up (in percent) to be indifferent between a baseline utility path (U^0_t) and a counterfactual path (U^1_t).

[14]Because the binding cap on the demand shock differs across tax regimes, the achieved impact decline in output is −0.17% in the untaxed cases in Table 7 and −0.12% in the taxed cases. Again, for each case, the calculation uses the welfare loss associated with the achieved recession path.

Table 7: Fiscal Cost to Offset the Welfare Loss from the Demand Shock under Alternative Types of Policies and Public Financing

(percentage points of GDP; lower values are better)

	UI untaxed		**UI taxed**	
	$\omega = \mathbf{0.05}$	$\omega = \mathbf{0.20}$	$\omega = \mathbf{0.20}$	$\omega = \mathbf{0.05}$
UI generosity (φ^{UI})	0.378	0.346	0.443	0.618
Targeted transfer (T_{HtM})	0.584	0.514	0.883	1.114
Universal transfer (T)	1.505	1.630	2.775	2.485

Notes: Entries report the number of policy units needed to offset the welfare loss from the demand shock under each financing/UI-tax specification. One policy unit is defined as the policy intervention that generates an approximately 1 percentage point peak increase in the debt-to-GDP ratio. Lower values indicate lower fiscal cost. Units are computed as |CEV loss|/(CEV gain per unit), using the achieved welfare loss in each specification. Source: Authors' calculations.

The results in the last two columns of Table 7 show that the qualitative ranking of instruments remains again unchanged. Still, when taxing the unemployment benefits, the fiscal cost of the policy intervention is higher. That is because the new taxation makes the worker's insurance cost in the model more expensive for any type of policy intervention. The higher taxation of UI benefits weakens the insurance value of the intervention and therefore requires a larger fiscal effort to stabilize household income after the demand shock.

Overall, the results in this appendix show that the policy ranking remains unchanged across different types of fiscal financing. The intuition is straightforward. Unemployment insurance combines direct support to households with high marginal propensities to consume and an insurance effect that reduces precautionary saving among employed households exposed to job-loss risk. Targeted transfers retain the first channel but not the second, while universal transfers dilute resources across households with lower marginal propensities to consume. Altering the timing of tax finance or taxing UI benefits changes the strength of these channels, but not the basic mechanism that gives unemployment insurance the strongest welfare effect under the common fiscal envelope used in the paper. Quantitatively, higher contemporaneous taxation lowers implementation costs for unemployment insurance and targeted transfers in the untaxed cases, but not for universal transfers.

PUBLICATIONS

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