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Inequality, Labour Market Dynamics and the Policy Mix: Insights from a FLANK

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Abstract

This paper investigates whether redistributive fiscal policy can be reconciled with macroeconomic efficiency in a heterogeneous agent economy featuring labour market frictions and monetary policy trade-offs. The paper develops a Finitely-Lived Agent New Keynesian (FLANK) model with search-and-matching frictions and a novel participation margin, where households face a constant probability of permanent exclusion from both labour and financial markets. This structure generates persistent inter-generational and cross-sectional inequality and breaks the Ricardian equivalence through finite lifespans and realistic levels of government debt. The model is used to examine the transitional dynamics following a stylized fiscal expansion in the form of transfers to inactive households. The findings suggest that a dovish monetary stance—characterized by a more muted response to inflation—consistently improves labour market outcomes and mitigates inefficiencies, even when fiscal interventions fail to stimulate aggregate demand. These results imply that accommodative monetary policy can enhance the effectiveness of redistribution in heterogeneous-agent environments.

Key Words: Heterogeneous Agents, Monetary Policy, Fiscal Policy, Inequality, Redistribution, Labour Market Frictions.
JEL Reference Number: E21, E24, E52, E62, D63, D91

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1 Introduction

Over the past decade, macroeconomic research has increasingly focused on the distributional consequences of monetary and fiscal policy. This shift reflects a growing recognition—by both researchers and policymakers—that inequality affects the transmission and effectiveness of stabilization policies. Central bankers such as Yellen (2016), Carney (2016), and Powell (2020) have explicitly called for more research on how monetary policy interacts with inequality, while institutions like the Bank of England have elevated heterogeneity and redistribution as core themes in their research agendas[1]. At the same time, political leaders have underscored the primacy of economic efficiency and growth. The UK Prime Minister Sir Keir Starmer has recently declared that "Growth is our number one priority". Similar rhetoric has been echoed by the Trump administration in the United States, which also adopted a growth-centric approach to fiscal and monetary policy coordination. Although framed in terms of "growth," these positions are best understood as advocating for macroeconomic policies that prioritize efficiency and employment over redistribution. Taken together, this juxtaposition highlights a central and enduring policy tension: how to reconcile inequality-reducing measures with the objective of maximizing macroeconomic efficiency.

This paper takes that tension as its starting point. Specifically, it investigates whether fiscal interventions that reduce inequality—such as temporary increases in government transfers—can be reconciled with a growth-centric approach that emphasizes labour market performance and output stabilization. The analysis also examines how the effectiveness and welfare implications of such interventions vary across different monetary policy regimes (i.e., hawkish versus dovish stances).

To address these questions, this paper develops a tractable heterogeneous agent framework in the tradition of the Blanchard (1985)-Yaari (1965) perpetual youth model, where households face a probabilistic end to their lives and new cohorts enter the economy each period. The consumer side builds on Galí (2021) and Bonchi & Nisticò (2024), introducing an additional layer of heterogeneity: in each period, households also face a constant probability of permanently losing access to the labour and financial markets thus, becoming inactive[2]. At the start of the period, households learn their status before making consumption and saving decisions. Active households work, consume, save, and exit the economy upon death. Inactive households, by contrast, rely solely on government transfers for consumption. This builds on Bonchi & Nisticò (2024), who characterize

[1] See "The monetary toolkit," Bank of England Research Agenda 2024, forwarded by Governor Andrew Bailey.

[2] The model assumes a small but persistent probability that active households transition into permanent inactivity. This can be interpreted as capturing long-term exits from the labour market due to disability, retirement, or discouragement. Motivated by Krueger 2017, the model parameter governing inactivity is calibrated to match a steady-state stock of inactive households of about 35% of the total population (see Appendix A.5 for data motivation) while allowing for significant heterogeneity in consumption behaviour.

inactive households as ”rule-of-thumbers” or ”hand-to-mouth” (HtM) agents. By excluding them from the labour market, the model generates a parametrised ”participation margin”, consistent with empirical evidence. This is relevant because constrained consumers—those at the bottom of the wealth distribution—are both more reliant on transfers and more likely to exit the labour market due to structural economic changes.

Building on this foundation, the paper extends the FLANK framework of Galí (2021) and Angeletos et al. (2024*a*,*b*) to study the distributional effects of monetary and fiscal policy and their interaction with labour market frictions, in a heterogeneous agent economy with a realistic amount of public debt. As in Angeletos et al. (2024*a*,*b*), the model includes finite lives and government debt, which break Ricardian equivalence. This causes households to discount the future differently from their time preference and exhibit larger short-run marginal propensities to consume (MPC). Here, MPC heterogeneity is also introduced through the coexistence of active and inactive agents, capturing a broader range of behaviour and enhancing the model's relevance for more complex HANK environments.

Nominal rigidities are incorporated following Blanchard & Galí (2007, 2010), with both price and wage stickiness included, as both are key features of real economies. The monetary authority follows a simple interest rate rule, while the fiscal authority uses lump-sum taxes levied only on active households to finance government debt service and transfers to unemployed and inactive agents. Fiscal adjustments also follow a simple rule, adjusting taxes when the debt-to-GDP ratio deviates from its steady-state target. However, recent trends—especially in the U.S.—suggest a more passive fiscal stance, with debt rollovers favoured over tax hikes (see Auerbach & Yagan 2025). Accordingly, this paper focuses on scenarios where fiscal authorities respond less than one-to-one to debt deviations. Because taxation is lump-sum and labour supply is inelastic, redistribution does not introduce efficiency losses, isolating the impact of taxation on the wealth distribution from incentive and insurance effects (see Aiyagari & McGrattan 1998). Still, policy adjustments inevitably redistribute wealth and consumption, generating trade-offs.

Labour market frictions are introduced via a standard Search and Matching (SAM) framework, à la Mortensen & Pissarides (1999), enabling frictional unemployment and richer dynamics that better track those in quantitative HANK economies[3]. Wages are determined through Nash bargaining between individual workers and firms. The participation margin modifies the well-known surplus-sharing rule.

To preserve tractability and analytical clarity, the model abstracts from aggregate risk and instead studies the perfect foresight equilibrium path following a one-time, unanticipated, and autocorrelated aggregate shock—an MIT shock in the spirit of Boppart et al. (2018). This modelling choice is consistent with standard practice in both the HANK literature (e.g., Auclert 2019;

[3]See Debortoli & Galí 2018, Cantore et al. 2022, and Komatsu 2023, for detailed discussion

Achdou et al. 2022; Le Grand & Ragot 2023) and in perpetual youth settings (e.g., Leith et al. 2019; Acharya et al. 2023; Karaferis et al. 2024). The shock is interpreted as a temporary increase in transfers to inactive households and serves as a stylized fiscal expansion (i.e. government spending shock).

By assuming logarithmic preferences and omitting aggregate uncertainty, the model admits closed-form solutions for all per capita variables and preserves the property of near-linear aggregation. This analytical tractability is essential for isolating the dynamic effects of fiscal and monetary policy in a heterogeneous-agent setting. While the inclusion of aggregate risk would allow for the study of precautionary behaviour, volatility, and richer asset pricing implications, it would significantly complicate the analysis. In particular, in the presence of aggregate risk, closed-form aggregation is only possible under strong assumptions—specifically, the inclusion of recursive preferences with the coefficient of relative risk aversion equals the inverse of the intertemporal elasticity of substitution (as in log utility). Departures from this knife-edge case, or the introduction of aggregate uncertainty, would require fully numerical methods of the type developed by Krusell & Smith (1998) or Maliar et al. (2010), and would obscure the central mechanisms of interest.

The approach taken here retains micro-foundational rigour while offering a transparent benchmark for understanding the distributional and efficiency trade-offs that arise from fiscal and monetary interactions—even in the absence of aggregate shocks..

Consistent with recent HANK findings (e.g., Auclert et al. 2024), this study shows that following the shock, deviating from strict inflation targeting results in higher equilibrium paths across all (per capita) variables associated with economic efficiency and labour market outcomes—even when transfer shock fails to stimulate the macroeconomy. While the main paper focuses on the transitional dynamics and abstracts from welfare analysis, Appendix A.7 extends the discussion by providing a complete welfare analysis. It first derives a closed-form expression for aggregate welfare by introducing a cohort-specific lump-sum transfer scheme that eliminates intergenerational inequality among active households, thereby allowing preferences to be aggregated into a tractable, micro-founded social welfare function. Importantly, the model retains cross-sectional inequality via the active/inactive margin. Under this setup, Appendix A.7.2 computes the aggregate welfare along the transition path after a government transfer shock, comparing different monetary policy regimes. The study finds that welfare losses are significantly lower under dovish policies—especially when transfers fail to boost real activity—highlighting the efficiency costs of aggressive inflation stabilization in heterogeneous-agent economies.

The remainder of the paper is structured as follows: Section 2 reviews the related literature. Section 3 presents the model, calibration, and solution method. Section 4 discusses the analytical and numerical results. Section 5 concludes.

2 Related Literature

This paper makes contributions to three distinct strands of literature.

First, it advances the macro-labour literature by exploring the interaction between frictional labour markets and policy frameworks. A substantial body of research has examined how monetary policy affects labour market dynamics, including seminal works by Hall (2003), Faia (2008), Christoffel et al. (2009), Blanchard & Galí (2010), Dennis & Kirsanova (2021), Komatsu (2023), and Cantore et al. (2022), among others. While most studies in this area focus on monetary policy, notable exceptions such as Cantore et al. (2014) and Lama & Medina (2019) analyse the impact of fiscal policy on unemployment and job creation. These contributions underscore how introducing search and matching (SAM) frictions in the labour market alters the transmission mechanisms of monetary and fiscal policies in response to aggregate shocks.

Second, the paper also contributes to the Overlapping Generations (OLG) literature built on the Blanchard (1985)-Yaari (1965) perpetual youth framework. This strand examines policy questions in settings that introduce heterogeneity while retaining analytical tractability. Foundational work includes Leith & Wren-Lewis (2000), Kirsanova et al. (2007), Leith & Von Thadden (2008), Rigon & Zanetti (2018), and Leith et al. (2019), who demonstrated that incorporating Non-Ricardian agents alters well-established results from the representative agent literature. More recent studies extend these models by incorporating uninsurable idiosyncratic income risk and/or heterogeneity in marginal propensities to consume (MPC), offering a richer framework that better aligns with empirical dynamics observed in large-scale HANK models.

Prominent examples include the "Finite-Lifespan Agent New Keynesian" (FLANK) framework of Galí (2021), Bonchi & Nisticò (2024), and Angeletos et al. (2024*a*,*b*) as well as the "OLG-HANK" models of Acharya et al. (2023) and Karaferis et al. (2024)-leverage finite lifespans to break Ricardian equivalence, generating higher short-run MPCs. This feature makes these environments particularly useful for deriving policy insights in heterogeneous agent environments. Moreover, these OLG frameworks are also closely related to the seminal work of Nistico (2016), which introduces heterogeneity through stochastic transitions in and out of financial markets. This mechanism generates disparities between savers and HtM consumers, similar to Bilbiie (2008), but also within the saver population itself. By highlighting financial wealth fluctuations as a driver of consumption dynamics, these models reveal policy trade-offs between output stabilization, inflation targeting, and inequality. Notably, they suggest that strict inflation targeting may be suboptimal in heterogeneous agent settings. However, to preserve analytical tractability, many studies in this strand adopt simplifying assumptions, such as degenerate wealth distributions or preferences that facilitate simple aggregation. As a result, these models primarily focus on qualitative differences between heterogeneous agent frameworks and their representative agent counterparts.

Third, the paper contributes to the emerging literature integrating labour market (SAM) frictions into Two-Agent New Keynesian (TANK) and tractable heterogeneous agent New Keynesian (THANK) models to better track the dynamics observed in richer HANK models. Early contributions, including Ravn & Sterk (2017) and Debortoli & Galí (2018), who explore how precautionary saving motives and uninsurable labour income risk influence monetary policy transmission and labour market fluctuations. More recent work by Dolado et al. (2021), Cantore et al. (2022), and Komatsu (2023) incorporates SAM frictions into TANK models, enhancing the analysis of monetary policy transmission and its impact on inequality.

This paper synthesizes insights from these three strands by extending the framework of Galí (2021) to develop a "Two-Agent FLANK" model augmented with SAM frictions in the labour market. This approach enables a detailed exploration of the complex interplay between policy choices, inequality, and labour market frictions in response to one-time unanticipated aggregate shocks.

3 The model

The general framework presented below describes a New Keynesian economy augmented with an overlapping generations structure, following the Blanchard (1985)-Yaari (1965) (BY, henceforth) approach, and Search and Matching frictions in the labour market, in the Diamond-Mortensen-Pissarides tradition. The consumer side is modelled after Galí (2021) and Bonchi & Nisticò (2024), with a constant population size normalized to one. Each individual[4] faces a constant survival probability, γ, and a new cohort of size $(1-\gamma)$ enters the economy in each period. All active individuals participate in the labour and financial markets, but face a constant probability $(1-f)$ of transitioning to inactive status, where they permanently lose market access and rely solely on government transfers. At the beginning of each period all households—including those belonging to newly born cohorts— first discover their status (active or inactive) before making consumption and saving decisions. This creates a coexistence of active and inactive households in each period, with constant population shares of ξ and $(1-\xi)$, respectively. Dividends are equally distributed across active individuals but they are not internalised. Following Acharya et al. (2023) and Karaferis et al. (2024), active households smooth consumption using actuarial bonds, which are exchanged for government bonds through frictionless financial firms.

The model incorporates both price rigidity in the tradition of Rotemberg (1982) and wage rigidity following Hall (2003) and Blanchard & Galí (2007, 2010). The frictional labour market is mod-

[4]The terms 'individual', 'agent', consumer', and 'household' are all used interchangeably. The reason for this is that the model assumes a perfect insurance setup among individuals of the same cohort who also share the same idiosyncratic status (i.e. active or inactive). As such, this system gives us the advantage of examining collective behaviour within each cohort, rather than delving into the intricacies of individual behaviours.

elled after Faia (2008) and Dennis & Kirsanova (2021), allowing for equilibrium unemployment. Fiscal policy raises revenue through lump-sum taxes on active households to service government debt, finance unemployment benefits, and provide transfers to inactive households. Both monetary and fiscal authorities follow simple rules governing the tax and interest rate dynamics.

3.1 Households

3.1.1 The Active Household Type

At any time t, an active or unrestricted individual who belongs to the cohort born at time $s \leq t$ derives utility from real private consumption $c^u_{s|t}$. The paper index agents by $s \in [0,1]$ to refer to the cohort that they belong. Intuitively, s, marks the age of the cohort. The active household s 's optimisation problem is[5]:

$$\max_{\left\{c^u_{s|t}\right\}_{t=0}^{\infty}} \sum_{t=s}^{\infty} (\beta\gamma)^{t-s} u\left(c^u_{s|t}\right)$$

where, the period felicity takes the form

$$u\left(c^u_{s|t}\right) = \log\left(c^u_{s|t}\right)$$

Subject to time t budget constraint

$$P_t c^u_{s|t} + \tilde{P}^M_t \mathscr{A}^M_{s|t+1} + \tilde{P}^S_t \mathscr{A}^S_{s|t+1} = \begin{pmatrix} P_t n_t w_t h^u_{s|t} + P_t(1-n_t)\frac{b}{\xi} + P_t\frac{d_t}{\xi} - P_t\frac{T_t}{\xi} \\ +\left(1+\rho\tilde{P}^M_t\right)\cdot f\cdot \mathscr{A}^M_{s|t} + f\cdot\mathscr{A}^S_{s|t} \end{pmatrix}$$

where, $c^u_{s|t}$ is the period t consumption level of an active consumer who belongs to cohort s. $\tilde{P}^M_t$ and $\mathscr{A}^M_{s|t}$ are the price and the quantity of long-term actuarial bonds, respectively. Similarly, $\tilde{P}^S_t$ and $\mathscr{A}^S_{s|t}$ stands for the price and quantity of short-term actuarial bonds. Newly born individuals enter the market with zero bond holdings, $\mathscr{A}^M_{s|s} = \mathscr{A}^S_{s|s} = 0$ and there is no fiscal transfer to newborns and/or wealth tax on existing households to ensure *ex ante* equality across all households as in Acharya et al. (2023) or Angeletos et al. (2024*a*,*b*). The paper omits this simplification to allow for the presence of both inter-generational wealth inequality as well as cross-sectional consumption/income inequality. All prices are taken as given by the households. As in Galí (2021), the aggregate labour supply is exogenous[6] and uniformly allocated across all cohorts. As such,

[5]The complete derivation of the active household s's optimisation problem can be found in Appendix A.1.

[6]The assumption of exogenous labour supply resolves the well- known of problem of the PY frameworks that the individual labour supply is downward sloping. With, individuals who belong to older generations may exhibit negative labour supply. This issue only occurs when households make endogenous labour/leisure decisions and leisure is considered a normal good (see Ascari & Rankin 2007).

the exogenous labour supply of any individual household is normalised to unity $(h^u_{s|t} = 1, \forall t, s)$. Next, n_t, refers to the real employment rate. Every cohort has the same fraction of employed and unemployed households. As such, the paper does not include any cohort-specific index in the employment rate $(n^s_t \equiv n_t)$. The aggregate dividends, d_t, are also uniformly distributed across all active cohorts but consumers do not internalise them. Consistent with the macro-labour literature, the paper assumes that for each generation, s, there is perfect insurance within type with respect to the idiosyncratic employment shock. This assumption is based on the premise that each household consists of multiple members who may not all (simultaneously) share the same employment status. Household members pool their resources together to ensure that each member consumes an equal amount. The unemployment benefit or replacement rate, b, is parametrised to correspond with the empirical evidence (see Shimer 2005). Finally, T_t stands for the period t level of the lump-sum tax, levied only on active households.

As in Leith et al. (2019) and Karaferis et al. (2024), before recasting the individual household s's budget constraint in real terms, the paper needs to introduce a measure of real assets of cohort s

$$\mathscr{W}^u_{s|t} = \frac{\left(1 + \rho \tilde{P}^M_t\right) a^M_{s|t} + a^S_{s|t}}{(1 + \pi_t)}$$

Where, $a^i_{s|t}$ is the ratio of the number of each type of assets to the price level given as

$$a^i_{s|t} = \frac{\mathscr{A}^{(i)}_{s|t}}{P_{t-1}}, i \in \{M, S\}$$

Intuitively, this measure of real assets of cohort s, $\mathscr{W}^u_{s|t}$, is the portfolio of real actuarial/private bonds held by an individual household belonging to cohort s. Then, the period t budget constraint in real terms takes the form

$$c^u_{s|t} + \frac{\gamma \cdot f}{R_t} \mathscr{W}^u_{s|t+1} = y^u_{s|t} + f \cdot \mathscr{W}^u_{s|t} \tag{1}$$

With the household s's net real non- financial income being denoted as

$$y^u_{s|t} = \frac{w_t n_t \xi}{\xi} + \frac{d_t}{\xi} + (1 - n_t) \frac{b}{\xi} - \frac{T_t}{\xi} \tag{2}$$

As discussed above, solving the profit maximisation of the financial intermediaries yields the *ex-ante* real interest rate R_t ,

$$\frac{\gamma \cdot f}{R_t} = \tilde{P}^S_t (1 + \pi_{t+1}). \tag{3}$$

and the price of the long-term actuarial bonds as

$$\tilde{P}_t^M \frac{R_t}{\gamma \cdot f} = \frac{\left(1+\rho \tilde{P}_{t+1}^M\right)}{\left(1+\pi_{t+1}\right)} \tag{4}$$

With both asset prices being taken as given by any active individual. Now, solving the individual household s's optimisation problem yields the individual consumption Euler equation of a representative active agent who belongs to generation s

$$\Lambda_{s|t}^u = (\beta R_t)\,\Lambda_{s|t+1}^u$$

where,

$$\Lambda_{s|t}^u = \left(c_{s|t}^u\right)^{-1} \tag{5}$$

Thus, allowing us to rewrite the individual Euler equation in the more familiar form as:

$$\left(c_{s|t}^u\right)^{-1} = \beta R_t \left(c_{s|t+1}^u\right)^{-1} \tag{6}$$

Combining the individual household budget constraint, together with the individual Euler equation, and the no-arbitrage condition, yields the individual household s's consumption function

$$c_{s|t} = (1-\beta\gamma)\left(\gamma \cdot f \cdot \mathscr{W}_{s|t} + \zeta_{s|t}\right) \tag{7}$$

where, $\zeta_{s|t}$ represents generation s's human wealth, given as the discounted value of labour income and profits, where the effective discount factor accounts for the probability of survival, γ, as well the probability of becoming inactive, $(1-f)$:

$$\begin{aligned}
\zeta_{s|t} &\equiv y_{s|t} + \sum_{k=1}^{\infty} (\gamma \cdot f)^k \prod_{l=0}^{k-1} \left(\frac{1}{R_{t+l}}\right) y_{s|t+k} \\
&= y_{s|t} + \left(\frac{\gamma \cdot f}{R_t}\right) \zeta_{s|t+1}
\end{aligned} \tag{8}$$

3.1.2 The Inactive Household Type

Similarly, at any time t, there also exist inactive individuals or "Rule-of-Thumbers" who belongs to the generation born at time $s \leq t$. All constrained individuals are identical and hence, any inactive household s derives utility from real private consumption $c_{s|t}^r$.

Although necessary due to their homogeneity, they are also indexed by cohort-specific index $s \in [0,1]$. Thus, the optimisation problem of a representative inactive household who belongs to cohort $s \leq t$ is:

$$\max_{\left\{c^r_{s|t}\right\}_{t=0}^{\infty}} \sum_{t=s}^{\infty} (\beta\gamma)^{t-s} u\left(c^r_{s|t}\right)$$

where, the period felicity takes the form

$$u\left(c^r_{s|t}\right) = \log\left(c^r_{s|t}\right)$$

Subject to the time t real budget constraint

$$c^r_{s|t} = \left(\frac{T^r_t}{1-\xi}\right) \tag{9}$$

As shown by the period t budget constraint, this "Keynesian" household type consumes only out of exogenous wealth transfers. These transfers are made in lump-sum fashion and since "rule-of-thumbers" do not have access to either the labour market or to any saving/borrowing vehicles, there is no consumption, income or wealth dispersion among inactive individuals.

3.2 Financial Intermediaries

As in Acharya et al. (2023) and Karaferis et al. (2024), financial intermediaries operate in a perfectly competitive market. They are just an aggregation device in the sense, that financial firms make no profit and their only purpose is to trade actuarial bonds (households private assets) for government bonds with the same maturity. By definition, the real profit of intermediaries is the difference between total bonds and total amount of actuarial bonds in the economy in $t+1$,

$$\Pi = \left(1+\rho P^M_{t+1}\right) b^M_{t+1} + b^S_{t+1} - \left(1+\rho \tilde{P}^M_{t+1}\right) f\cdot\gamma a^L_{t+1} - f\cdot\gamma a^S_{t+1}, \tag{10}$$

where b^J_{t+1} are total government bonds and $f\cdot\gamma a^J_{t+1}$ are total actuarial bonds at time $t+1$, i.e. $f\cdot\gamma a^J_{t+1} = (1-\gamma)\sum_{s=-\infty}^{t+1}(f\cdot\gamma)^{t+1-s} a^J_{s|t+1}$. The intermediaries maximize (10) subject to the constraint,

$$-\tilde{P}^M_t a^M_{t+1} - \tilde{P}^S_t a^S_{t+1} + P^M_t b^M_{t+1} + P^S_t b^S_{t+1} \leqslant 0. \tag{11}$$

and the optimization yields

$$\frac{1}{\tilde{P}_t^S} = \frac{\left(1+\rho \tilde{P}_{t+1}^M\right)}{\tilde{P}_t^M}, \tag{12}$$

$$\tilde{P}_t^S = f \cdot \gamma \cdot P_t^S, \tag{13}$$

$$\frac{1}{P_t^S} = \frac{\left(1+\rho P_{t+1}^M\right)}{P_t^M}, \tag{14}$$

Notice that the intermediaries' profits are zero and the *ex ante* returns on short and long-bonds are equalized. However, as discussed in Karaferis et al. (2024), one should be careful to note that this does not imply that the *ex post* real interest rates will be equalized in the presence of one-off shocks to the perfect foresight equilibrium path.

The short-term nominal interest rate is denoted as,

$$\frac{1}{1+i_t} = P_t^S, \tag{15}$$

and the real interest rate is,

$$R_t = \frac{\gamma \cdot f}{\tilde{P}_t^S (1+\pi_{t+1})} = \frac{1}{P_t^S (1+\pi_{t+1})} = \frac{1+i_t}{1+\pi_{t+1}}. \tag{16}$$

3.3 Government

The government issues nominal long-term and short-term bonds, for which the maturity matches that of the actuarial bonds used by households. The government budget constraint in nominal terms takes the form

$$P_t^M \mathscr{B}_{t+1}^M + P_t^S \mathscr{B}_{t+1}^S = \left(1+\rho P_t^M\right) \mathscr{B}_t^M + \mathscr{B}_t^S + P_t b\,(1-n_t) + P_t T_t^r - P_t T_t$$

where P_t^M is price of long-term bonds, and P_t^S is price of short-term bonds. Tax revenue is collected using lump-sum taxes, $P_t T_t$. Taxes follow a simple rule specified below (see eq.(58)). The total unemployment subsidy paid by the government across unemployed households is $P_t b\,(1-n_t)$. While, the total wealth transfer paid to non-participating households in each period, t, is denoted by T_t^r. The government budget constraint can be re-written in real terms as,

$$(1+\pi_{t+1}) P_t^S B_{t+1} = B_t + b\,(1-n_t) + T_t^r - T_t \tag{17}$$

where, B_t is a measure of the real value of the government's portfolio

$$B_t = \frac{\left(\left(1+\rho P_t^M\right) b_t^M + b_t^S\right)}{(1+\pi_t)} \tag{18}$$

and

$$b_t^J = \frac{\mathscr{B}_t^J}{P_{t-1}}, J \in \{M, S\}$$

For simplicity, the paper assumes that short-term government bonds are in zero net supply $\left(b_t^S = 0, \forall t\right)$ whilst, due to the inclusion of the tax rule, the equilibrium supply of long-term government bonds is given exogenously to correspond with the average annualised debt-to-GDP ratio observed in the data $\left(b^M = b^{M*}\right)$.

3.4 Aggregation and Market Clearing

Aggregate (per capita) variables are calculated as the weighted sum of individual variables across all cohorts for each type, adjusted by the proportion of that type in the overall population.

$$x_t = (1-\gamma) \sum_{s=-\infty}^{t} (f \cdot \gamma)^{t-s} x_{s|t}^u + \gamma(1-f) \sum_{s=-\infty}^{t} (f \cdot \gamma)^{t-s} x_{s|t}^r \tag{19}$$

$$= \xi \cdot x_t^u + (1-\xi) \cdot x_t^r \tag{20}$$

Aggregation within each type proceeds as follows:

1. **For Active Households:**

$$\xi \cdot x_t^u = (1-\gamma) \sum_{s=-\infty}^{t} (f \cdot \gamma)^{t-s} x_{s|t}^u \tag{21}$$

This represents the contribution from individuals starting from cohort s up current time t, accounting for both the survival probability γ and the likelihood of remaining active f. The term $(1-\gamma)$ accounts for newly born cohorts each period, while $(f \cdot \gamma)^{t-s}$ weights the contribution based on the time cohorts have been active.

2. **For Inactive Households:**

$$(1-\xi) \cdot x_t^r = \gamma(1-f) \sum_{s=-\infty}^{t} (f \cdot \gamma)^{t-s} x_{s|t}^r \tag{22}$$

Inactive households include individuals who have transitioned from being active. The probability of being inactive by time t is captured by $\gamma(1-f)$, while each inactive cohort is weighted by $(f\cdot\gamma)^{t-s}$, reflecting the survival up to time t.

As such, aggregate (per capita) consumption is defined as

$$c_t = \xi \cdot c_t^u + (1-\xi)\cdot c_t^r \tag{23}$$

Similarly, the aggregate labour supply is

$$h_t = (1-\gamma)\sum_{s=-\infty}^{t}(f\cdot\gamma)^{t-s} h_{s|t}^u + \gamma(1-f)\sum_{s=-\infty}^{t}(f\cdot\gamma)^{t-s} h_{s|t}^u$$

For active households, the individual labour supply is exogenously fixed to unity $\left(h_{s|t}^u = 1, \forall t\right)$ whilst inactive households do not have access to the labour market $\left(h_{s|t}^{u^r} = 0, \forall t\right)$. However, for the labour market to clear, the aggregate labour supply must equal the aggregate labour demand, hence

$$h_t = \int_0^1 h_t(j)\,dj = \xi \tag{24}$$

Combining eq.(9) and eq.(2) and applying the aggregation rule (see eq.(19)) delivers the aggregate non- financial income as:

$$\begin{aligned} y_t &= w_t n_t \xi + d_t + (1-n_t)\,b + T_t^r \\ &= \xi\cdot y_t^u + (1-\xi)\cdot y_t^r \end{aligned}$$

Now, since actuarial bonds, $J=\{S,M\}$ are only held by the active household type and hence, the expression for the aggregate actuarial bonds is given as:

$$f\cdot\gamma\cdot a_t^J := (1-\gamma)\sum_{s=-\infty}^{t}(f\cdot\gamma)^{t-s} a_{s|t}^J$$

Furthermore, in order to derive the aggregate budget constraint for the active household type, one needs to first compute $(1-\gamma)\sum_{s=-\infty}^{t}(f\cdot\gamma)^{t-s} a_{s|t+1}^J$. Which takes the form

$$a_{t+1}^J = (1-\gamma)\sum_{s=-\infty}^{t}(f\cdot\gamma)^{t-s} a_{s|t+1}^J$$

Since newly born generations enter the market with zero assets $\left(a_{t+1|t+1}^J = 0\right)$.

It also follows that,

$$
f \cdot \gamma \cdot \mathscr{W}_t^u = (1-\gamma) \sum_{s=-\infty}^{t} (f \cdot \gamma)^{t-s} \mathscr{W}_{s|t}^u
$$
$$
\mathscr{W}_{t+1}^u = (1-\gamma) \sum_{s=-\infty}^{t} (f \cdot \gamma)^{t-s} \mathscr{W}_{s|t+1}^u
$$

And, for the asset market to clear, it follows that the real value of the government portfolio (see eq.(18)) equals the real value of the private portfolio

$$
B_t = f \cdot \gamma \cdot \mathscr{W}_t \tag{25}
$$

Furthermore, the aggregate household budget constraint is derived by combining the budget constraint of each household type and applying the aggregation rule (see eq.(19)).

$$
c_t + \frac{f \cdot \gamma}{R_t} \mathscr{W}_{t+1}^u = y_t + f \cdot \gamma \mathscr{W}_t^u - T_t \tag{26}
$$

and, using the asset market clearing condition, I can re- write eq.(26)) as

$$
c_t + \frac{1}{R_t} B_{t+1} = y_t + B_t - T_t \tag{27}
$$

Now, combing eq.(27) with the government budget constrain eq.(17) yields the product market equilibrium condition. That is

$$
c_t = \xi w_t n_t + d_t
$$

As shown below in the firms' block, aggregate dividends (45) are given as

$$
d_t = \left(1 - \frac{\Phi}{2} \pi_t^2\right) Y_t - \xi w_t n_t - \kappa v_t
$$

So, the aggregate resource constraint takes the familiar form

$$
c_t = \left(1 - \frac{\Phi}{2} \pi_t^2\right) Y_t - \kappa v_t \tag{28}
$$

Finally, the aggregate consumption Euler Equation for the active population is given as

$$
c_t^u = \frac{1}{\beta R_t} \left(c_{t+1}^u + \frac{(1 - f \cdot \gamma)}{f \cdot \gamma} \frac{(1 - \beta \gamma)}{\xi} B_{t+1} \right) \tag{29}
$$

where, the aggregate consumption function of the active types takes the form

$$\xi \cdot c_t^u = (1-\beta\gamma)\left(f \cdot \gamma \cdot \mathscr{W}_t + \xi \cdot \zeta_t\right) \tag{30}$$

while, the aggregate human wealth $(\xi \cdot \zeta_t)$ of the active consumers is

$$\xi \cdot \zeta_t = \xi \cdot y_t^u + \left(\frac{f \cdot \gamma}{R_t}\right) \zeta_{t+1} \tag{31}$$

3.5 The Cross-Sectional Consumption Inequality Index

Following Debortoli & Galí (2018) and Komatsu (2023), the paper defines a simple measure for capturing the cross-sectional consumption inequality (S_t) as

$$S_t = 1 - \frac{c_t^r}{c_t^u} \tag{32}$$

With S_t capturing how the average consumption of inactive households relates to the average consumption of active households, ignoring their respective shares in the total population. If $S_t = 0$ it means that exogenous wealth transfer paid to inactive households is high enough to eliminate the cross-sectional inequality. In this case, the model still features non-trivial inequality but only among active generations. Whereas, if the probability of becoming inactive approaches zero then, the model collapses to the standard perpetual youth environment as described in Kirsanova et al. (2007), Rigon & Zanetti (2018) and Leith et al. (2019).

3.6 The Production Sector

There is a continuum of monopolistic competitive firms $j \in [0,1]$ with each firm producing a differentiated good j. Firms meet workers on a decentralised matching market. The labour relations are determined according to the standard Mortensen & Pissarides (1999) framework. Workers are hired from the unemployment pool whilst the searching process for a firm involves a fixed cost (κ). This means that there is free entry and any firm who is willing to pay this fixed cost can post vacancies. Workers' wages are determined through a Nash bargaining process which takes place on an individual basis. All active individuals have the same (exogenous) labour supply and thus, there is a single market wage regardless of the workers' cohort.

3.6.1 Search & Matching Frictions in the Labour Market

The description of the frictional labour market closely follows Dennis & Kirsanova (2021). The number of workers employed by firm j, with $j \in [0,1]$, is denoted by $n_t(j)$. At the end of each period, the number of workers employed by a specific firm (j) is determined by the number of retained employees from the previous period, adjusted for exogenous separations and new hires. The search for a worker involves a fixed cost, κ, and the probability of finding a worker depends on a **matching function** $(m(\bar{m}_t, u_t, v_t) \equiv m_t)$ that transforms unemployed agents (u_t) and vacancies (v_t) into matches:

$$m_t = \bar{m}_t (v_t)^{1-\omega} (u_t)^{\omega} \tag{33}$$

where, the **matching elasticity** with respect to unemployment is denoted by $\omega \in (0,1)$ and $\bar{m}_t$ is the matching efficiency. The matching efficiency takes the form:

$$\bar{m}_t = \bar{m} \cdot \exp(2 \cdot \mu \cdot (Y_t - Y_{t-1})) \tag{34}$$

where, $\bar{m}$ refers to the standard (exogenous) equilibrium matching efficiency. However, as in Komatsu (2023), the expression includes a cyclical component, $\exp(2 \cdot \mu \cdot (Y_t - Y_{t-1}))$. This component is included since many empirical studies have found that the matching efficiency tends to be quite pro-cyclical[7]. Labour market tightness (ϑ_t), is defined as the ratio of vacancies (v_t) to unemployment (u_t).

$$\vartheta_t = \frac{v_t}{u_t} \tag{35}$$

The variable ϑ_t is crucial as it reflects the health and efficiency of the labour market. Specifically, it determines two key probabilities: the job-filling rate ($q(\vartheta_t) \equiv q_t$), indicating the likelihood of a firm's vacancy being filled, and the job-finding rate ($p(\vartheta_t) \equiv p_t$), representing the probability that an unemployed worker will secure a job. These probabilities are defined as follows:

$$q(\vartheta_t) = \bar{m}_t(\vartheta_t)^{-\omega} \tag{36}$$

$$p(\vartheta_t) = \vartheta_t \cdot q(\vartheta_t) \tag{37}$$

Firms base their decisions on these rates, posting vacancies until the expected payoff from hiring equals the marginal costs. As such, the aggregate employment in the economy evolves over time as:

$$n_t = (1-\rho)\, n_{t-1} + q(\vartheta_t) \cdot v_t \tag{38}$$

While, the unemployment rate adjusts according to

$$u_t = 1 - (1-\rho)\, n_{t-1} \tag{39}$$

[7] See Elsby et al. 2015 for a recent discussion on the relevant literature.

The transition dynamics in the labour market depends mainly on the **exogenous job separation rate** (ρ). As specified above, the labour market is homogeneous, as all active households have the same skills and supply the same hours regardless of their cohort. As a result, there is no need for cohort specific indexing and thus, $n_{s|t} \equiv n_t$ and $u_{s|t} \equiv u_t$. These relationships capture the dynamics of hiring, separations, and matching efficiency, which together define the evolution of employment and unemployment in the model.

3.6.2 Firms

If the search process is successful then, the monopolistic firm operates following the production function

$$Y_t(j) = z_t \cdot n_t(j) \cdot h_t(j) \tag{40}$$

where, z_t is the aggregate level of productivity and $n_t(j) \cdot h_t(j)$ denotes the labour demand of firm j. With $n_t(j)$ being the number of the workers and $h_t(j)$ being the working hours demanded by firm j. Firms face quadratic adjustment costs $R(\cdot) = \frac{\Phi}{2} Y_t \left(\frac{P_t(j)}{P_{t-1}(j)} - 1\right)^2$ every time they wish to adjust their prices, as proposed by Rotemberg (1982).

Each intermediate firm j solves the following optimization problem:

$$\max_{\{P_t(j), n_t(j), v_t(j)\}} \Pi_t(j) = \sum_{t=0}^{\infty} (\beta)^t \frac{\Lambda^u_{s|t}}{\Lambda^u_0} \left(\left(\frac{P_t(j)}{P_t} Y_t(j) - w_t n_t(j) h_t(j) \right) - \frac{\Phi}{2} \left(\frac{P_t(j)}{P_{t-1}(j)} - 1 \right)^2 Y_t - \kappa v_t(j) \right)$$

where, $\Lambda^u_{s|t}$ the firms' discount factor comes from the solution of household s's optimisation problem (see eq.(5))).

Subject to

1. The monopolistic demand for its product,

$$Y_t(j) = Y_t \left(\frac{P_t(j)}{P_t} \right)^{-\varepsilon_t} \tag{41}$$

   Where, ε_t is the elasticity of substitution between intermediate varieties.

2. The law of motions of employment of firm (j) is given by:

$$n_t(j) = (1-\rho) \cdot n_{t-1}(j) + q_t(j) \cdot v_t(j) \tag{42}$$

where, mc_t captures the marginal cost of production, κ the real cost real cost of opening a new vacancy and μ_t captures the marginal cost of filling a vacancy.

Solving the firms' optimisation problem yield the following optimality conditions[8]:

1. The New Keynesian Phillips Curve (NKPC)

$$\Phi\left(1+\pi_t\right)\pi_t Y_t = \left(\left(1-\varepsilon_t\right)+\varepsilon_t\cdot mc_t\right)Y_t+\beta\Phi\left(\frac{\Lambda^u_{s|t+1}}{\Lambda^u_{s|t}}\left(1+\pi_{t+1}\right)\pi_{t+1}Y_{t+1}\right) \tag{43}$$

2. The aggregate hiring condition :

$$\frac{\kappa}{q\left(\vartheta_t\right)} = \left(mc_t\cdot z_t - w_t\right)\cdot h_t+\beta\left(1-\rho\right)\left(\frac{\Lambda^u_{s|t+1}}{\Lambda^u_{s|t}}\frac{\kappa}{q\left(\vartheta_{t+1}\right)}\right) \tag{44}$$

The hiring condition sets the expected cost of posting a vacancy equal to the expected benefits.

Finally, the profits of firm j, $\Pi_t(j)$ specified above, are uniformly distributed as dividends across active cohorts ($d^u_{s|t}=\frac{d_t}{\xi}$). Aggregate dividends, are given as

$$d_t = \int_0^1 \Pi_t\left(j\right)dj = \Pi_t$$

However, in anticipation of symmetric equilibrium, the subscript j is removed, so the aggregate dividends are

$$d_t = Y_t - \xi w_t n_t - \kappa v_t - \frac{\Phi}{2}\pi^2 Y_t \tag{45}$$

With, the aggregate output being:

$$Y_t = \xi\cdot z_t\cdot n_t \tag{46}$$

3.7 Bellman Equations and Nash Bargaining Over Wages

In each period, the real wage rate is determined through Nash bargaining between an individual worker and a firm. In period t, the value of a household with a member employed, belonging to cohort $s\leq t$, is represented by $V^E_{s|t}$. Conversely, the value of a household belonging to generation $s\leq t$, with a member unemployed is denoted by $V^U_{s|t}$.

[8]The complete derivation of firm j's optimisation problem as well as the resulting optimality conditions can be found in Appendix A.2.

$$V^E_{s|t} = w_t h^u_{s|t} + \beta \left(\frac{\Lambda^u_{s|t+1}}{\Lambda^u_{s|t}} \Big(\rho \left(1 - p(\vartheta_{t+1})\right) V^U_{s|t+1} + \left(1 - \rho \left(1 - p(\vartheta_{t+1})\right)\right) V^E_{s|t+1} \Big) \right) \tag{47}$$

Here, ρ represents the exogenous job separation rate, and $p_t = \bar{m}_t(\theta_t)^{1-\omega}$ is the probability of finding a job. As noted by Faia (2008), the first term on the right-hand side of the equation represents the real benefit of the worker's real labour income. The second term reflects the discounted benefit for a household in cohort s that is employed in period t, considering the potential change in status to unemployment in period $t+1$.

On the other hand, the value of a household in cohort s with a member unemployed, denoted $V^U_{s|t}$, is given by:

$$V^U_{s|t} = \frac{b}{\xi} + \beta \left(\frac{\Lambda^u_{s|t+1}}{\Lambda^u_{s|t}} \Big(\left(1 - p(\vartheta_{t+1})\right) V^U_{s|t+1} + p(\vartheta_{t+1}) V^E_{s|t+1} \Big) \right) \tag{48}$$

The first term, $\frac{b}{\xi}$, represents the immediate real benefit of being unemployed. The second term reflects the discounted payoff for a household in cohort s that remains unemployed in period $t+1$, including the weighted change in value from potentially becoming employed in $t+1$.

The individual surplus of household s from the bargaining process, denoted $S^H_{s|t}$, is calculated as the difference between having an additional household member employed and having one unemployed:

$$\begin{aligned} S^H_{s|t} &= V^E_{s|t} - V^U_{s|t} \\ &= w_t h^u_{s|t} - \frac{b}{\xi} + \beta \frac{\Lambda^u_{s|t+1}}{\Lambda^u_{s|t}} \Big((1-\rho)\left(1 - p(\vartheta_{t+1})\right) S^H_{s|t+1} \Big) \end{aligned} \tag{49}$$

Now turning to the firm side, due to the symmetry in the firms' problem, the study assumes the existence of a representative firm and omits the firm-specific index. The value of an unallocated vacancy, V^V_t, is zero, while the value of an allocated vacancy, V^J_t, is given by:

$$V^J_t = (mc_t \cdot z_t - w_t) \cdot \xi + (1-\rho)\beta \left(\frac{\Lambda^u_{s|t+1}}{\Lambda^u_{s|t}} V^J_{t+1} \right) \tag{50}$$

In equilibrium, the value of posting a vacancy must be zero. Thus, using the aggregate hiring condition, the value of an allocated vacancy can be expressed as:

$$\frac{\kappa}{q_t} = (mc_t \cdot z_t - w_t) \cdot \xi + (1-\rho)\beta \left(\frac{\Lambda^u_{s|t+1}}{\Lambda^u_{s|t}} \frac{\kappa}{q_{t+1}} \right) \tag{51}$$

The firm's surplus from wage bargaining is:

$$S^F_t \equiv \frac{\kappa}{q_t} = (mc_t \cdot z_t - w_t) \cdot \xi + (1-\rho)\beta \left(\frac{\Lambda^u_{s|t+1}}{\Lambda^u_{s|t}} \frac{\kappa}{q_{t+1}} \right) \tag{52}$$

The first term represents the real profits from goods produced by hiring an additional worker. The second term reflects the payoff from not needing to fill a vacancy in the next period.

The wage bargaining problem is formulated as:

$$\max_{w_t} \left(\varsigma \log\{S^H_{s|t}\} + (1-\varsigma) \log\{S^F_t\} \right) \tag{53}$$

where ς is the worker's share of the joint surplus. Solving for the real wage yields:

1. The surplus sharing rule from Nash bargaining:

$$S^F_t = \frac{1-\varsigma}{\varsigma} \cdot \xi \cdot S^H_{s|t} \tag{54}$$

As the probability of becoming inactive approaches zero, eq.(54) simplifies to the standard surplus sharing rule.

2. The real wage per worker, w_t, is a weighted average of the marginal revenue product of the worker, the cost of replacing the worker, and the worker's outside option:

$$w_t = \varsigma \cdot \left[mc_t \cdot z_t + \frac{\kappa}{\xi} \frac{1-\rho}{R_t} \vartheta_{t+1} \right] + (1-\varsigma) \cdot \frac{b}{\xi} \tag{55}$$

3.8 Wage Rigidity

As in Faia (2008), the paper follows the seminal approach of Hall (2003) and Blanchard & Galí (2007, 2010) to introduce wage rigidity in a parsimonious way. Namely, the prevailing wage rate for any period, t, is

$$w_t = \lambda \cdot w_t + (1-\lambda) \cdot w_{stst}$$

with $\lambda \in [0,1]$. That is, the current wage rate is calculated as a weighted sum of the wage that comes from the Nash bargaining between an individual worker and a firm and the steady-state wage rate. Hence, the current period, t, market wage can be re-written as:

$$w_t = \lambda \cdot \left[\varsigma \cdot \left[mc_t \cdot z_t + \frac{\kappa}{\xi} (1-\rho) \beta \left(\left(\frac{\Lambda^u_{s|t+1}}{\Lambda^u_{s|t}} \right) \vartheta_{t+1} \right) \right] + (1-\varsigma) \frac{b}{\xi} \right] + (1-\lambda) \cdot w_{stst} \tag{56}$$

3.9 Monetary Policy

Following Faia (2008) and Komatsu (2023), the paper assumes that the monetary authority follows a real interest rate reaction function of the form

$$\log\left(\frac{R_t}{R}\right) = \phi_\pi \log\left(\frac{1+\pi_t}{1+\bar{\pi}^*}\right) + \phi_y \log\left(\frac{Y_t}{Y}\right) \tag{57}$$

In line with the literature, interest rate adjusts in response to a targeted variable deviation from the either the steady-state or the exogenous equilibrium target. Contrary to Faia (2008), this monetary rule omits both an explicit unemployment component and interest rate smoothing. Now, while it is true that including interest rate smoothing leads to higher welfare along the equilibrium path (see Schmitt-Grohé & Uribe 2007), it is often used as an apparatus to mimic optimal discretionary monetary policy and this is not the aim of this paper.

3.10 Fiscal Rule

Consistent with Leith & Von Thadden (2008) and Rigon & Zanetti (2018), the government adjusts lump-sum taxes following a simple rule[9]

$$T_t = \bar{T} + \phi_b\left(\frac{(1+\pi_{t+1})\,P_t^S B_{t+1}}{4Y_t} - \frac{(1+\pi^*)\,P^S B^*}{4Y}\right) \tag{58}$$

where $\bar{T}$ stands for the steady-state level of taxes, and $\phi_b > 0$ captures the reaction of taxation to outstanding debt. Fiscal policy described by eq.(58) implies that the government responds only to deviations of the annualised debt-to-GDP ratio from the exogenous steady-state target.

3.11 Competitive Equilibrium

The private sector equilibrium consists of sequences of prices $(\pi_t, P_t^M, w_t, mc_t)_{t=0}^{\infty}$, aggregate quantities $(c_t, c_t^u, c_t^r, S_t, Y_t, B_t^S, B_t^M, n_t, \vartheta_t, q_t, p_t, v_t, u_t)_{t=0}^{\infty}$ and policy instruments $(R_t, T_t, T_t^r)_{t=0}^{\infty}$ that satisfy the household's and firm's optimality conditions, the Nash bargaining, the government's budget constraint, the monetary and fiscal policy rules, the deterministic process for government transfers, aggregate technology, matching efficiency, and elasticity of substitution between intermediate varieties. Additionally, they also satisfy the aggregate hiring condition, aggregate employment, the job-finding and job-filling rates, the labour market tightness, the asset, labour and goods market clearing conditions—the asset pricing condition, the New Keynesian Phillips curve, the Euler and consumption equations and the transversality conditions.

[9]Unlike Leith & Von Thadden (2008) and Rigon & Zanetti (2018), the tax rule in this model responds to deviations of the annualised debt-to-GDP ratio from its exogenous target, rather than to deviations in the level of debt itself.

3.12 Calibration and Simulations

The model is calibrated at a quarterly frequency for the U.S. economy, covering the period from 1985 to the end of the Great Moderation. The key parameter values are presented in Table 1, while a detailed discussion of the calibration process is available in Appendix A.5.

Table 1: Calibration of the baseline FLANK model

Description	Parameter	Value	Source
Household discount rate	β	$(1.02)^{-1/4}$	Data
Elasticity of substitution among goods	ε	11	Chari et al. (2000)
Price adjustment cost	Φ	59.11	Gavin et al. (2015)
Wage rigidity parameter	λ	0.6	Blanchard & Galí (2007, 2010)
Survival probability	γ	0.996	SSA data
Probability of becoming inactive	$1-f$	0.216%	See text
Active population share	ξ	65%	BLS data
Separation rate	ρ	0.12	Dennis & Kirsanova (2021)
Elasticity of the matching function	ω	0.72	Shimer (2005)
Bargaining power	ς	0.72	Shimer (2005)
Matching efficiency	$\bar{\mu}$	0.66	Dennis & Kirsanova (2021)
Replacement rate	$\frac{b}{h \cdot w}$	0.47	Nickell & Nunziata (2001), Shimer (2005)
Cost of posting a vacancy	$\frac{\kappa}{w \cdot h}$	0.2	Ljungqvist (2002)
Government transfers to inactive households	T^r	0.4819	Karabarbounis & Chodorow-Reich (2014)
Cyclicality of matching efficiency	μ	0;1	See text
Persistence of Total Productivity Shock	ρ_z	0.95	Bayer et al. (2020)
Persistence of Government Spending Shock	ρ_{tr}	0.97	See text
Steady-State Inflation target (p.a)	$\pi^\star$	0;2%	See text
Inflation reaction coefficient (Hawkish policy)	ϕ_π	1.5	Komatsu (2023), Taylor (1993)
Inflation reaction coefficient (Dovish policy)	ϕ_π	0.9	See text
Persistence of monetary policy states	π_{11}, π_{22}	1	See text
Fiscal response coefficient	ϕ_b	0.04	See text
Debt maturity (quarters)	m	20	Atlanta FED
Equilibrium Debt-to-GDP ratio (p.a.)	$\frac{P^M b^M}{4Y}$	46%	Atlanta FED, Leeper & Zhou (2021)
Alternative Debt-to-GDP ratio (p.a.)	$\frac{P^M b^M}{4Y}$	Up to 200%	See text

All computations in this study were conducted using the RISE toolbox (Maih 2015). The model is first solved non-linearly to determine the perfect-foresight steady-state, followed by first-order perturbations to analyse its dynamics. As noted earlier, the model abstracts from aggregate risk, considering only a single unanticipated and autocorrelated aggregate shock to the perfect-foresight equilibrium path—commonly referred to as the MIT shock. After the initial impact, households regain perfect foresight. Due to structural similarities between the FLANK model and the nested representative-agent framework, these MIT shocks are introduced following the approach of Boppart et al. (2018).

4 Discussion

This section first examines analytically the diverse effects of monetary and fiscal policy on consumption and inequality, followed by a detailed numerical analysis.

Initially, the paper explores how changes in monetary policy affect individual consumption, emphasizing its impact on both inter-generational inequality among active individuals and cross-sectional inequality between active and inactive households. The discussion then shifts to the aggregate consumption dynamics influenced by monetary policy.

The study further demonstrates that in this heterogeneous agent OLG economy, fiscal policy can reduce inequality between active and inactive populations by increasing wealth transfers to inactive households. While this result aligns with expectations due to the coexistence of active and rule-of-thumb consumers, the overall reduction in cross-sectional inequality also depends on the OLG channel and the active population size.

Next, the numerical results are presented. The study compares the steady-state allocation of the benchmark FLANK model, incorporating stochastic inactivity transitions, with both the nested representative agent model and the standard FLANK model focusing only on active consumers. This comparison examines how the long-run equilibrium is affected by various factors such as the inflation target, the debt-to-GDP ratio, and sources of inequality, summarized in Tables 2 and 3.

The discussion then turns to the short-run dynamics, abstracting from aggregate risk and focusing on the perfect foresight equilibrium path after a one-off autocorrelated aggregate shock. Following this shock, households regain perfect foresight. The paper primarily discusses the model dynamics in response to a one-off increase in wealth transfers to inactive individuals, referred to as a government spending shock[10].

The main paper intentionally abstracts from welfare analysis. Including a consumption-weighted utility loss function would necessitate eliminating inter-generational inequality among active consumers or lose our ability to retain analytical expressions for the key per capita variables (see Appendix A.7). However, the social welfare function is derived in Appendix A.7.1 while Appendix A.7.2, presents the welfare analysis along the equilibrium path, following a one-off increase in the transfers to the inactive, under varying degrees of inflation targeting. The results of the welfare analysis verify the insight obtained from the evaluation of the short-run dynamics.

Finally, the paper also examines the impact of cyclical variations in matching efficiency and the influence of monetary policy stances (Hawkish vs. Dovish) on aggregate dynamics.

[10]The study also considers the effects of a positive shock to the aggregate technology (i.e. TFP shock), a reduction in the elasticity of substitution between differentiated goods as well as a shock to the equilibrium matching efficiency. Appendix A.6 discusses the models dynamics in response to the TFP shock. The dynamic responses of the other two shocks are available upon request.

4.1 Policy Trade-offs and Inequality

This section analytically explores how changes in monetary and fiscal policy affect intra- and inter-generational inequality within the FLANK framework. To retain maximal tractability, the focus remains on the direct effects of policy changes, abstracting from feedback loops, to build intuition before turning to the insights of the numerical investigation. Since both monetary and fiscal authorities follow simple, rule-based policies, this setting allows for a transparent assessment of the distributional channels at play.

The model departs from Ricardian equivalence due to three key features: finite lifespans, government bonds in non-zero net supply, and the coexistence of two distinct household types (active and inactive) with different consumption behaviours. These features generate heterogeneity in the marginal propensities to consume (MPC) and highlight trade-offs in the transmission of policy.

In the absence of distortionary taxation and/or endogenous labour supply, fiscal policy redistributes resources across households through bond issuance and targeted transfers. While such redistribution does not directly affect aggregate efficiency, it can shift inequality across and within generations. The study examines these mechanisms by first focusing on monetary policy and then turning to fiscal redistribution.

4.1.1 Monetary Policy and Inequality

Monetary policy affects inequality through three well-known channels (Auclert 2019, Auclert et al. 2024): earnings heterogeneity, the Fisher channel, and interest rate exposure. Active households, who participate in labour and financial markets, experience direct effects through all three channels. In contrast, inactive households—permanently excluded from both markets—are only affected indirectly, primarily through inflation.

The earnings channel operates via changes in employment and wages. Lower real interest rates stimulate aggregate demand and reduce discount rates, encouraging hiring and raising the marginal product of labour. This boosts the non-financial income of active households, while inactive households remain unaffected due to their fixed transfers.

The interest rate exposure channel further distinguishes households by age. Older active cohorts hold more financial wealth and are therefore more sensitive to changes in bond valuations. This is result is easily observable when comparing the effect of an interest rate change on the consumption of a newly born household compared to the effect of on the consumption of any other generation. Proposition 1 formalizes this heterogeneity in sensitivity across generations:

Proposition 1 *Even among active households, a change in the real interest rate has heterogeneous* *effects due to generational differences:*

$$\frac{\partial}{\partial R_t} c^u_{s|t} \neq \frac{\partial}{\partial R_t} c^u_{t|t} \quad \textit{for } s \neq t$$

Newborn agents—entering the market with no financial wealth—adjust their consumption in response to shifts in expected income and borrowing costs. In contrast, older cohorts revalue existing assets, creating asymmetric consumption responses across generations.

Inactive households, by contrast, consume entirely out of fixed transfers and do not hold assets. As such, they are unaffected directly by interest rate changes:

Proposition 2 *A change in the real interest rate does not directly impact the consumption of inactive agents:*

$$\frac{\partial}{\partial R_t} c^r_{s|t} = \frac{\partial}{\partial R_t} T^r_t = 0, \quad \forall t$$

4.1.2 Aggregate Consumption Effects of Monetary Policy

At the aggregate level, the direct effects of monetary policy are concentrated among active households. Since these agents face no exogenous binding credit constraints and share a common elasticity of inter-temporal substitution, they respond like permanent income consumers:

Proposition 3 *A change in the real interest rate affects aggregate consumption of active households proportionally:*

$$\frac{\partial c^u_t}{c^u_t} = -\frac{\partial R_t}{R_t}$$

Inactive households' consumption remains unaffected:

$$\frac{\partial}{\partial R_t} c^r_t = 0$$

Hence, the per capita effect on total consumption is simply the active agents' response scaled by their population share. Proposition 4 below formalises this result.

Proposition 4 *The direct effect of an interest rate change on per capita (total) consumption depends on how it impacts the consumption of the active agents scaled by the share of this household type* (ξ) *in the total population.*

$$\frac{\partial}{\partial R_t} c_t = \xi \cdot \frac{\partial}{\partial R_t} c^u_t$$

4.1.3 Fiscal Policy and Redistribution

Fiscal policy redistributes income through government debt issuance and transfers to inactive and unemployed households. Under the fiscal rule, lump-sum taxes on active agents adjust residually to maintain debt sustainability. This structure creates offsetting forces: bond issuance raises active households' wealth, but this is partially undone by higher taxes.

Inactive households, by contrast, respond one-for-one to changes in transfers due to their hand-to-mouth nature. This creates a clear lever for reducing cross-sectional consumption inequality:

Proposition 5 *An increase in transfers to inactive households reduces cross-sectional inequality:*

$$\frac{\partial}{\partial T_t^r} S_t = -\frac{1}{c_t^u}\left(\frac{1}{(1-\xi)} + \Omega_t\right) < 0 \tag{59}$$

where,

$$\Omega_t = (1-S_t)\left[\frac{(1-\beta\gamma)}{\xi}\left(\frac{\phi_b}{\phi_b + 4Y_t}\right)\right]$$

The magnitude of this inequality reduction depends on the size of the OLG channel, the share of active agents, and the responsiveness of taxes to debt dynamics. With greater MPC dispersion amplifying these effects.

In summary, monetary policy operates primarily through the active population, with heterogeneous responses by age and asset position. Fiscal policy, especially via transfers to the inactive, offers a direct tool for managing cross-sectional inequality without distorting labour supply. These trade-offs—between inter-temporal smoothing, redistribution, and generational equity—will be further explored in the numerical results that follow.

The complete proofs of Propositions 1 through 5 are provided in Appendix A.3.

4.2 Steady-State Allocations and Labour Market Equilibrium

This section examines the model's steady-state allocations, comparing the RANK, the traditional FLANK (BY model), and the main FLANK (with stochastic transitions into inactivity) environments. Both monetary and fiscal policies use rule-based approaches, so the steady-state values for inflation and the debt-to-GDP ratio are set exogenously. Additionally, due to the presence of labour market frictions, the separation rate (ρ) and matching efficiency ($\bar{m}$) are also fixed.

Table 2 presents the steady-state outcomes for inflation targets of $\pi^* = 0\%$ and $\pi^* = 2\%$ per annum across three model variants: RANK (columns I–II), FLANK without inactivity (III–IV), and the main FLANK with stochastic inactivity (V–VI), under a common calibration for labour market and public debt.

Table 2: Steady-State: RANK vs. FLANK

Model Specification						
Parameter	**RANK**		**FLANK**			
	I	**II**	**III**	**IV**	**V**	**VI**
Prob. of Survival (γ)	1	1	0.996	0.996	0.996	0.996
Prob. of Inactivity ($1-f$)	0	0	0	0	0.0022	0.0022
Share Active (ξ)	1	1	1	1	0.65	0.65
Steady-State Variables						
Inflation Target (%, p.a.)	0	2	0	2	0	2
Debt-to-GDP (%, p.a.)	46	46	46	46	46	46
Lump-sum Tax (T)	0.0328	0.0328	0.0329	0.0329	0.1903	0.1903
Aggregate Output (Y)	0.9408	0.9408	0.9408	0.9408	0.6115	0.6115
Aggregate Consumption (C)	0.9113	0.9106	0.9113	0.9106	0.5924	0.592
Real Interest Rate (R)	2.0151	2.0151	2.0557	2.0557	2.0963	2.0963
Nominal Rate (I)	2.0151	4.0604	2.0557	4.1016	2.0963	4.1428
Asset Prices (P^M)	19.9	18.1031	19.8726	18.0803	19.8412	18.0541
Employment Rate (n)	0.9408	0.9408	0.9408	0.9408	0.9403	0.9403
Searching (u)	0.1721	0.1721	0.1721	0.1721	0.1725	0.1725
Vacancy Rate (v)	0.1683	0.1683	0.1683	0.1683	0.1671	0.1671
Job-Filling Rate (p)	0.6559	0.6559	0.6558	0.6559	0.6541	0.6542
Job-Finding Rate (q)	0.6708	0.6706	0.6708	0.6707	0.6754	0.6753
Tightness (θ)	0.9778	0.9781	0.9777	0.978	0.9684	0.9687
Real Wage Rate (w)	0.8766	0.8767	0.8766	0.8767	0.8768	0.8769
Cross-Sectional Inequality (S)	–	–	–	–	0.2607	0.2599

Table 3: Steady-State: FLANK under Increasing Debt-to-GDP Ratios

FLANK with Stochastic Inactivity Transitions						
Debt-to-GDP (%, p.a.)	0	46	60	100	123	200
Lump-sum Tax (T)	0.1845	0.1903	0.1922	0.1976	0.2008	0.2123
Aggregate Output (Y)	0.6115	0.6115	0.6115	0.6115	0.6115	0.6114
Aggregate Consumption (C)	0.5924	0.5924	0.5924	0.5924	0.5924	0.5924
Nominal Rate (I)	2.0151	2.0963	2.0963	2.1369	2.1776	2.2996
Asset Prices (P^M)	19.9	19.8412	19.8233	19.7725	19.7435	19.6467
Employment Rate (n)	0.9403	0.9403	0.9403	0.9403	0.9403	0.9403
Searching (u)	0.1725	0.1725	0.1725	0.1725	0.1725	0.1725
Vacancy Rate (v)	0.1671	0.1671	0.1670	0.1671	0.1670	0.1670
Job-Filling Rate (p)	0.6541	0.6541	0.6541	0.6541	0.6541	0.6540
Job-Finding Rate (q)	0.6754	0.6754	0.6754	0.6755	0.6755	0.6756
Tightness (θ)	0.9686	0.9684	0.9684	0.9683	0.9682	0.9680
Real Wage Rate (w)	0.8768	0.8768	0.8768	0.8768	0.8767	0.8767
Cross-Sectional Inequality (S)	0.2607	0.2607	0.2607	0.2607	0.2607	0.2607

As expected, without the stochastic transition to inactivity ($f = \xi = 1$), the differences across the traditional BY model and the nested RANK are quantitatively small. Still, the assumption of finite-lived agents ($\gamma < 1$) coupled with positive steady-state government debt breaks the Ricardian equivalence and causes the equilibrium real interest rate to be higher than the rate of time preference ($R > \frac{1}{\beta}$). The differences across the two frameworks become more pronounced as the size of the active population decreases.

Across all specifications, labour market allocations align with empirical US averages. For the benchmark FLANK model, the steady-state unemployment rate is approximately 5.97%, matching the historical quarterly average of 5.8% (BLS series LNS14000000). The model predicts around 17% of the labour force is actively searching. This variable refers to workers that are actively looking for jobs at the start of the period. And, given that the FLANK model results in higher equilibrium unemployment, it naturally reports a higher steady-state of job searching.

The steady-state production technology is always normalised to one. As a result, the steady-state output is determined by the equilibrium employment (see eq.(46)) and the share of the active population (ξ). Thus, both the traditional BY model and the standard RANK specification always delivers higher aggregate output due to their higher equilibrium employment and higher share of households participating in the labour market.

The choice of the inflation target affects inequality by differentially impacting savers and borrowers. Higher steady-state inflation reduces the purchasing power of inactive households but benefits younger active agents by decreasing their real debt burden. On the other, older active households are typically saver and thus, the opposite effect is found. Since older cohorts dominate the population, the net effect reduces cross-sectional inequality.

Increasing the debt-to-GDP target has no measurable impact on cross-sectional inequality because inactive agents receive fixed transfers, unaffected by interest rate or tax changes, while active agents can smooth consumption through financial markets.

Overall, the FLANK model introduces realistic trade-offs in macroeconomic allocations and distributional outcomes, setting the stage for evaluating policy shocks in the following dynamic simulations.

4.3 Dynamic Responses

This section analyses the perfect foresight equilibrium path following a one-time, positive, and autocorrelated shock to government spending, modelled as a direct transfer to inactive households. The framework abstracts from aggregate risk and follows the standard MIT shock approach (see Blanchard 1985; Yaari 1965; Angeletos et al. 2024*a*,*b*; Leith et al. 2019; among others), with agents regaining full information immediately after impact.

Figure 1 shows the responses under four different levels of persistence of the transfer shock: fully transitory ($\rho_{tr} = 0$), low (0.1), medium (0.5), and high (0.97). The fiscal response coefficient ϕ_b is deliberately kept below one in all cases, allowing government debt to evolve almost like a random-walk, consistent with empirical fiscal behaviour even in the post-Covid era (see Ramey

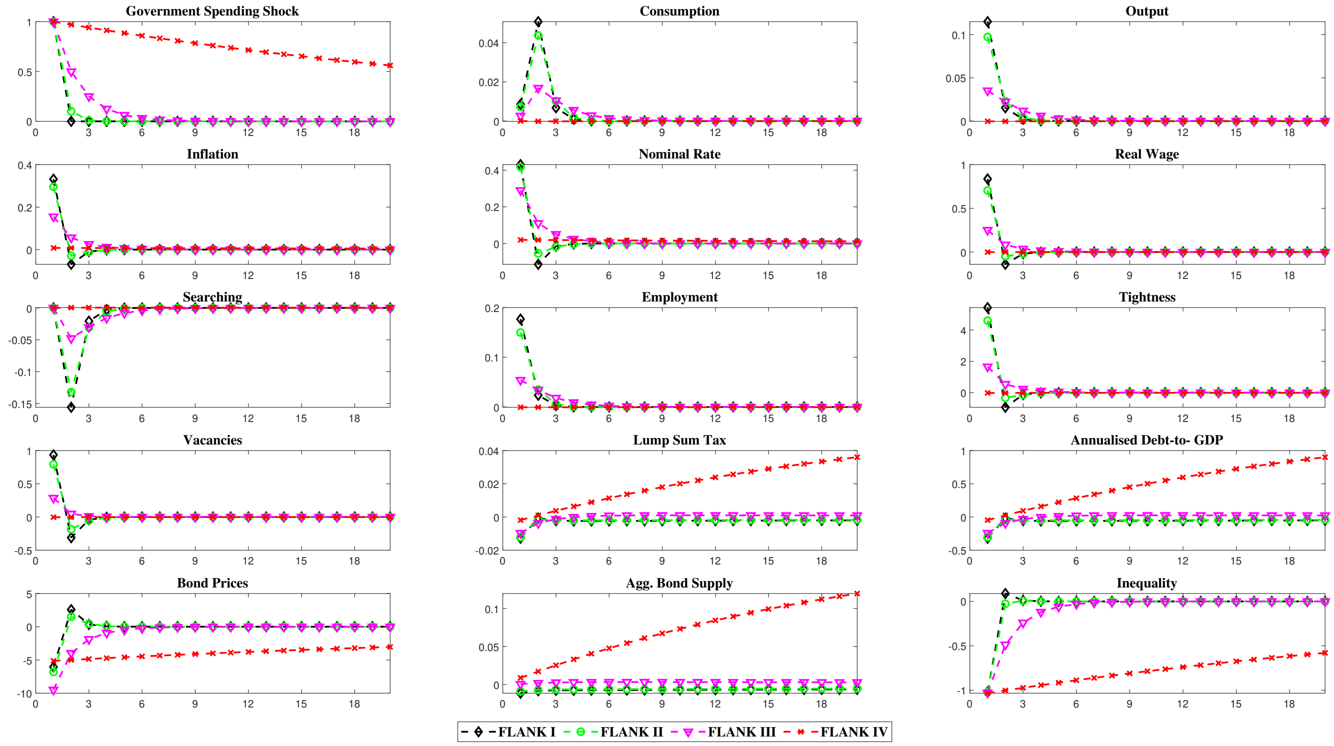

Figure 1: Dynamic responses to a one-time positive government spending shock. FLANK I refers to the case with a fully transitory government spending shock ($\rho_{tr} = 0$). FLANK II allows for low persistence in the shock ($\rho_{tr} = 0.1$). FLANK III introduces mild shock persistence ($\rho_{tr} = 0.5$). FLANK IV refers to the benchmark case with high persistence in the government spending shock ($\rho_{tr} = 0.97$).

2025) and theoretical findings in Leith et al. (2019).

Figure 1 shows that the initial impact of the transfer uniformly reduces cross-sectional inequality, as inactive households receive a proportional increase in their income. However, as the persistence of the government spending shock increases, its ability to stimulate the macroeconomy gradually diminishes.. When the transfer is transitory or mildly persistent, aggregate consumption increases: the rise in debt is temporary, and taxes remain low, enabling active consumers to smooth consumption. When the shock is highly persistent, the sustained increase in government debt eventually leads to higher path for taxes—even though they are lump-sum—which depresses active households' consumption and offsets the initial stimulus. This reflects a key feature of the FLANK structure: despite inelastic labour supply and non-Ricardian households, rising taxes reduce human wealth and dampen demand.

Importantly, the consumption dynamics diverge from standard HANK models. In OLG environments, consumption is increasing in financial wealth, but fiscal expansions financed by debt create tensions. More specifically, higher government debt raises private wealth via the market clearing condition, yet this is offset by future taxes that lower human wealth. Thus, for active consumers, the net effect is ambiguous and depends on fiscal responsiveness. In contrast, inactive households benefit unambiguously, as transfers increase their permanent income regardless of age. These effects are magnified when the fiscal adjustment is slow, confirming that the macroeconomic efficiency of fiscal stimulus depends jointly on the shock persistence and the stance of monetary and fiscal policy.

Consistent with the empirical literature (e.g., Elsby et al. 2015; Hall & Schulhofer-Wohl 2018), a positive government spending shock that successfully stimulates aggregate demand leads firms to increase hiring efforts. This results in more vacancies, a higher matching rate, and a rising employment rate. As unemployed workers find jobs more quickly, the pool of job seekers declines. Conversely, when the fiscal stimulus fails to raise output—typically under high persistence and/or hawkish monetary policy—firms scale back vacancy postings, matches fall, and unemployment rises.

Real wages also respond cyclically. In line with findings from Mortensen & Pissarides (1999), the model produces pro-cyclical wage dynamics: wages rise when the economy expands and fall during downturns. However, due to the presence of wage rigidity embedded, wages return to their steady state more slowly than output. Inflation does not directly feed into wage-setting as in the standard New Keynesian model; instead, its impact is mediated through firm marginal costs and the bargaining power of workers.

Finally, the inflation response depends crucially on the persistence of the fiscal shock. Low-persistence transfers create a sharp but temporary boost to output, leading to a quick rise in prices. Since the monetary authority follows an active inflation targeting rule, interest rates increase more aggressively in these cases to stabilize inflation. In contrast, when fiscal transfers are highly persistent, the gradual nature of the stimulus leads to a more muted and delayed inflationary response, with correspondingly smaller interest rate movements.

Cyclicality of the Equilibrium Matching Efficiency

Empirical evidence suggests that matching efficiency varies with the business cycle. Using JOLTS data (2001–2013), Elsby et al. (2015) document strong pro-cyclicality in matching efficiency across 17 U.S. industrial sectors, with a sharp rebound following the Great Recession. Hall & Schulhofer-Wohl (2018) report similar patterns. Motivated by this evidence, this subsection examines the role of pro-cyclical matching within the FLANK framework.

The analysis begins with a nearly transitory government spending shock, modelled as a one-time increase in transfers to inactive households with low persistence ($\rho_{tr} = 0.1$). Figure 2 compares two scenarios: one with a-cyclical matching efficiency ($\mu = 0$), and another with pro-cyclical matching ($\mu = 1$).

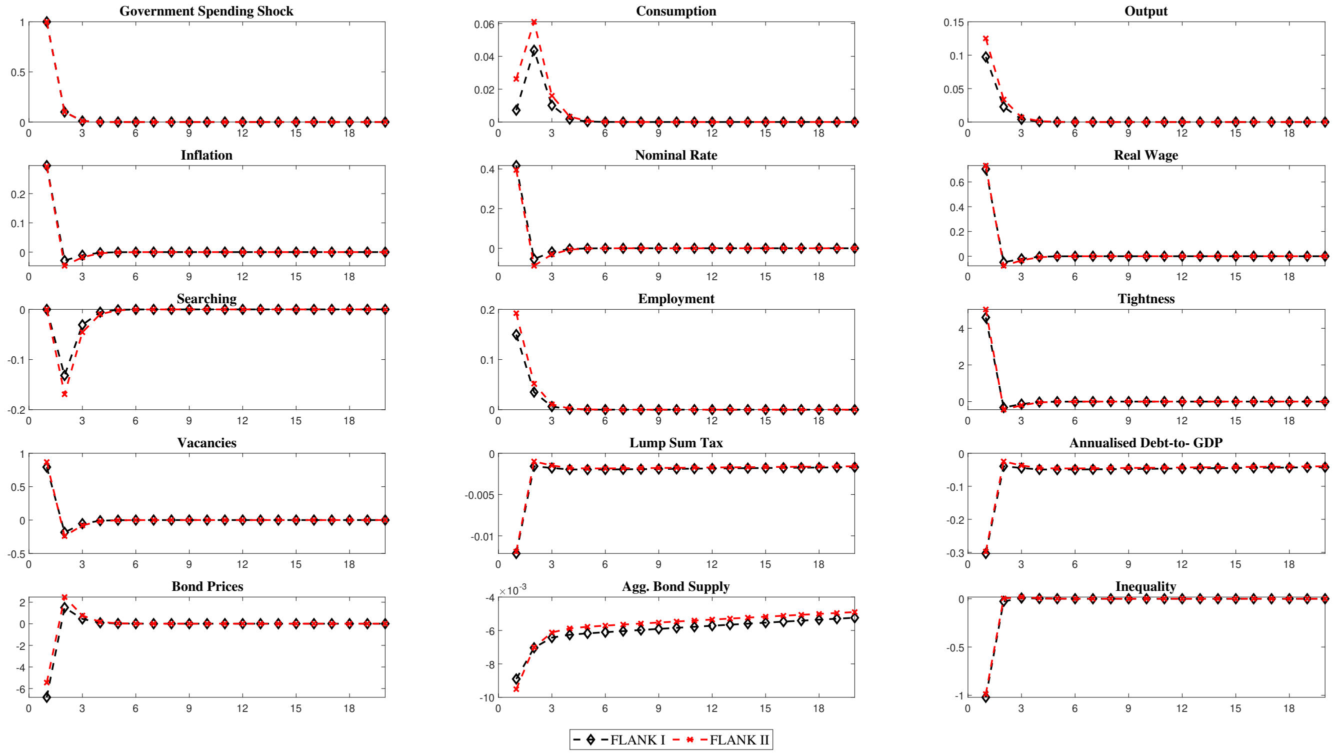

Figure 2: Response to a one-time government spending shock. FLANK I: low persistence ($\rho_{tr} = 0.1$) and a-cyclical matching ($\mu = 0$); FLANK II: pro-cyclical matching ($\mu = 1$).

When matching efficiency is pro-cyclical, the labour market adjusts more elastically: even at unchanged vacancy and unemployment levels, more matches are formed, leading to a sharper rise in employment. Output increases by approximately 25% more than in the a-cyclical case, and labour market tightness rises faster. Search activity also declines more quickly and remains subdued for longer, driven by faster job-finding and higher employment retention. Amplified consumption demand leads to stronger inflation and a more pronounced real interest rate response.

Despite this real-side amplification, inequality remains largely unaffected. Inactive (Keynesian) households consume fixed transfers and are insulated from interest rate or price fluctuations, rendering short-run cross-sectional inequality dynamics insensitive to labour market frictions.

The analysis then turns to a highly persistent shock ($\rho_{tr} = 0.97$), shown in Figure 3. The same two matching regimes are compared.

Under high persistence, the government spending shock becomes contractionary, especially when matching is pro-cyclical. With higher government debt and an active monetary response ($\phi_\pi > 1$), interest rates rise, and private demand is crowded out. Output, consumption, and employment decline. This aligns with findings in Ramey (2025), who argue that fiscal transfers may reduce activity when persistent deficits raise debt service costs.

While inequality initially declines due to the direct transfer, the effect is short-lived. With pro-

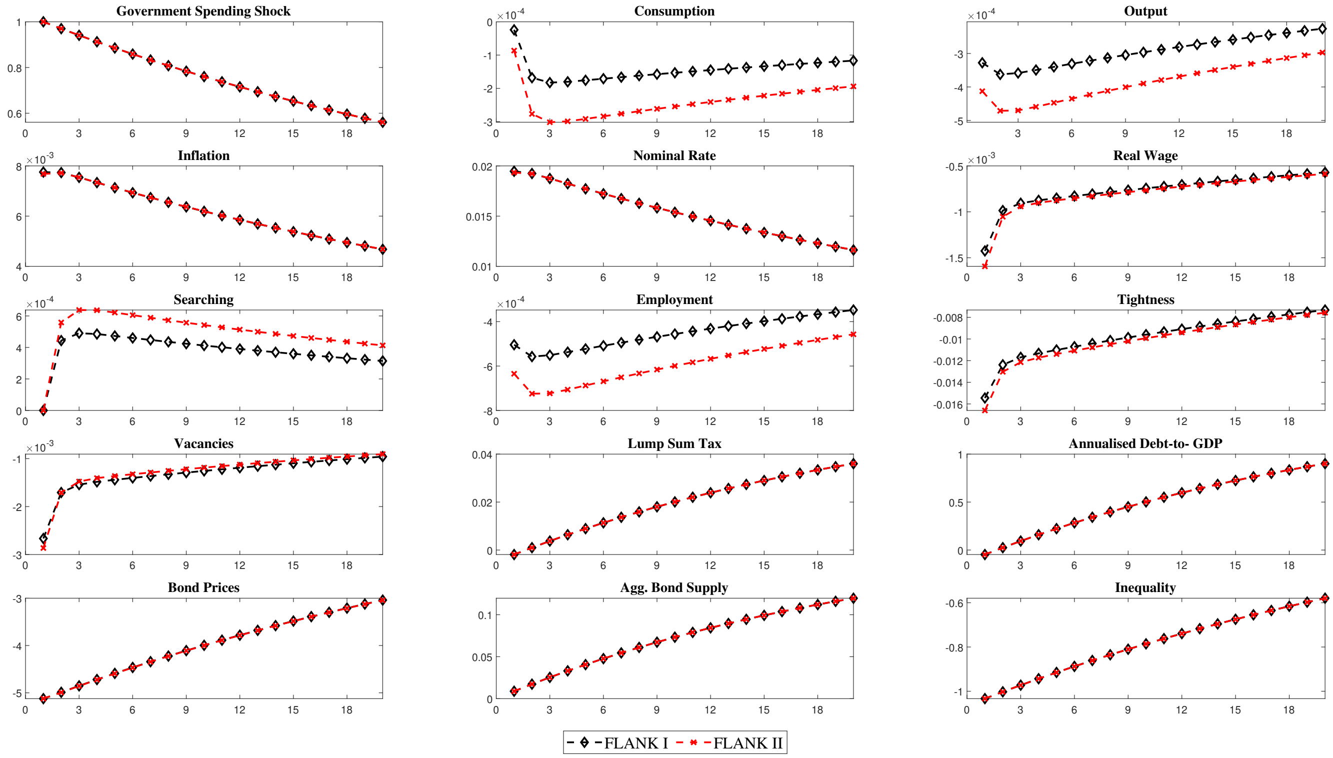

Figure 3: Response to a one-time government spending shock. FLANK I: high persistence ($\rho_{tr} = 0.97$) and a-cyclical matching ($\mu = 0$); FLANK II: pro-cyclical matching ($\mu = 1$).

cyclical matching, deteriorating labour market conditions dominate: vacancy postings fall, successful matches decline, and unemployment rises. Wages fall alongside inflation and the interest rate, though less sharply than in the transitory case.

All in all, the cyclicality of matching efficiency significantly shapes the transmission of fiscal policy. When the shock is transitory, pro-cyclical matching amplifies the stimulus—raising employment, output, and labour market tightness. When the shock is persistent, those same mechanisms reinforce the contractionary dynamics triggered by tighter fiscal and monetary conditions. In both cases, the effects on inequality remain muted, as hand-to-mouth consumers are unaffected by interest rate dynamics and asset price movements.

Hawkish vs Dovish Monetary Policy

Recent advances in the HANK literature emphasize that strict inflation targeting may be suboptimal in the presence of household heterogeneity and financial market incompleteness. Building on this insight, this section compares the effects of fiscal transfers under two alternative monetary policy stances: a "hawkish" regime ($\phi_\pi = 1.5$) and a "dovish" regime ($\phi_\pi = 0.9$). The policy regime follows a fully persistent two-state Markov process, which is known to all agents and incorporated into their decision-making under perfect foresight.

Although the inflation coefficient ϕ_π does not alter the model's steady state, it has first-order implications for the transitional dynamics. Following an unanticipated government spending shock at time $t = 0$, all households condition expectations on the observed regime and forecast accordingly. Monetary policy is conducted via a standard Taylor-type rule, and fiscal policy adjusts slowly (with $\phi_b < 1$), allowing debt to follow an approximate random walk.

Figures 4 and 5 display dynamic responses to a low-persistence fiscal shock ($\rho_{tr} = 0.1$) and a high-persistence shock ($\rho_{tr} = 0.97$) under both monetary regimes.

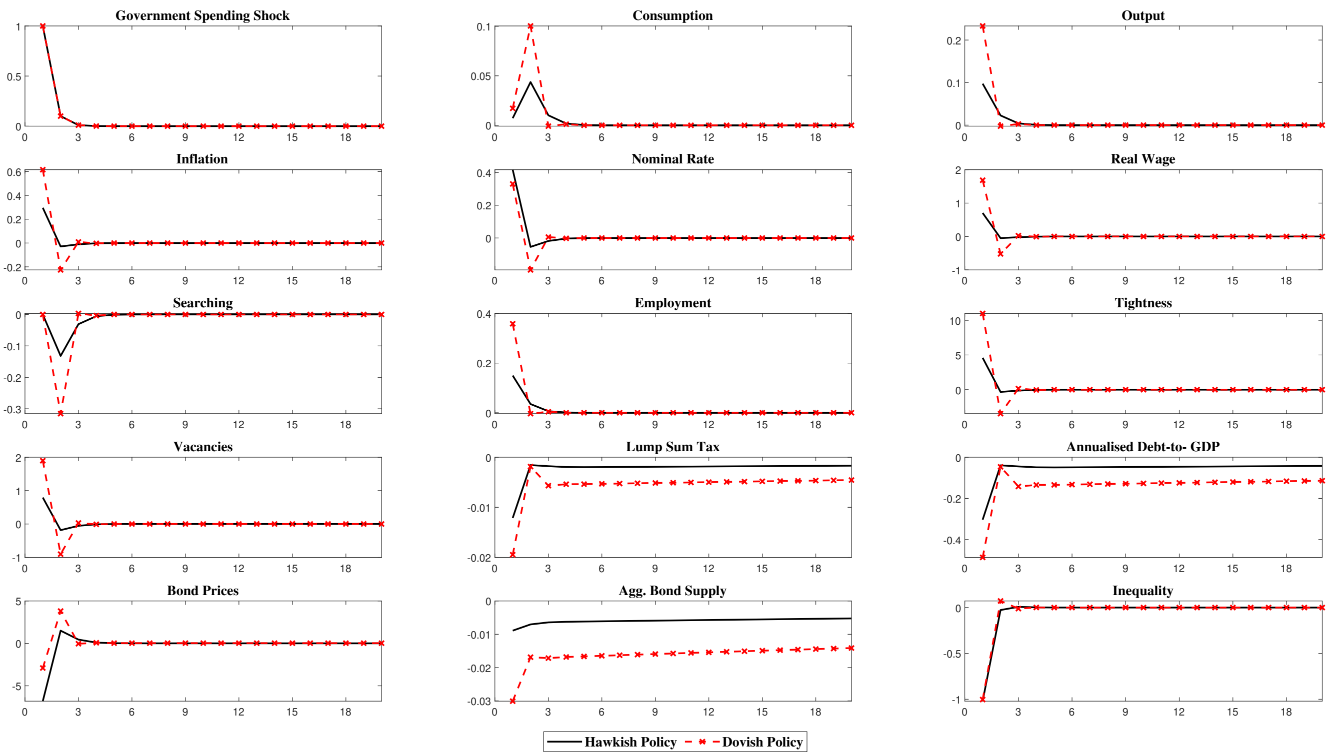

Figure 4: Dynamic responses to a one-off government spending shock with low persistence ($\rho_{tr} = 0.1$). Hawkish ($\phi_\pi = 1.5$) vs. Dovish ($\phi_\pi = 0.9$) monetary policy.

Across both scenarios, the stance of monetary policy has limited impact on inequality dynamics but significant consequences for the output, employment, and consumption path. In the case of a transitory fiscal shock, both regimes produce short-run output gains, but the dovish policy stance yields significantly stronger macroeconomic performance. The real interest rate rises by less, reducing the inter-temporal distortion faced by active consumers. Aggregate demand expands more robustly, encouraging vacancy creation, employment gains, and higher consumption. Since taxation is lump-sum and labour is inelastic, the policy does not distort labour supply directly, but it does affect lifetime wealth and, hence, consumption-savings decisions.

As the persistence of the spending shock increases, so does the fiscal burden—via greater issuance of government debt and higher taxes required for solvency. Since the fiscal authority issues bonds with longer maturities, the rise in interest rates induces valuation effects, as emphasized by Leeper & Leith (2016). Even though taxation is lump-sum and labour supply is inelastic, the fiscal drag leads to a demand-driven contraction. Figure 5 shows that under both regimes, output and employment fall relative to the transitory case, but the contraction is notably milder under the dovish policy.

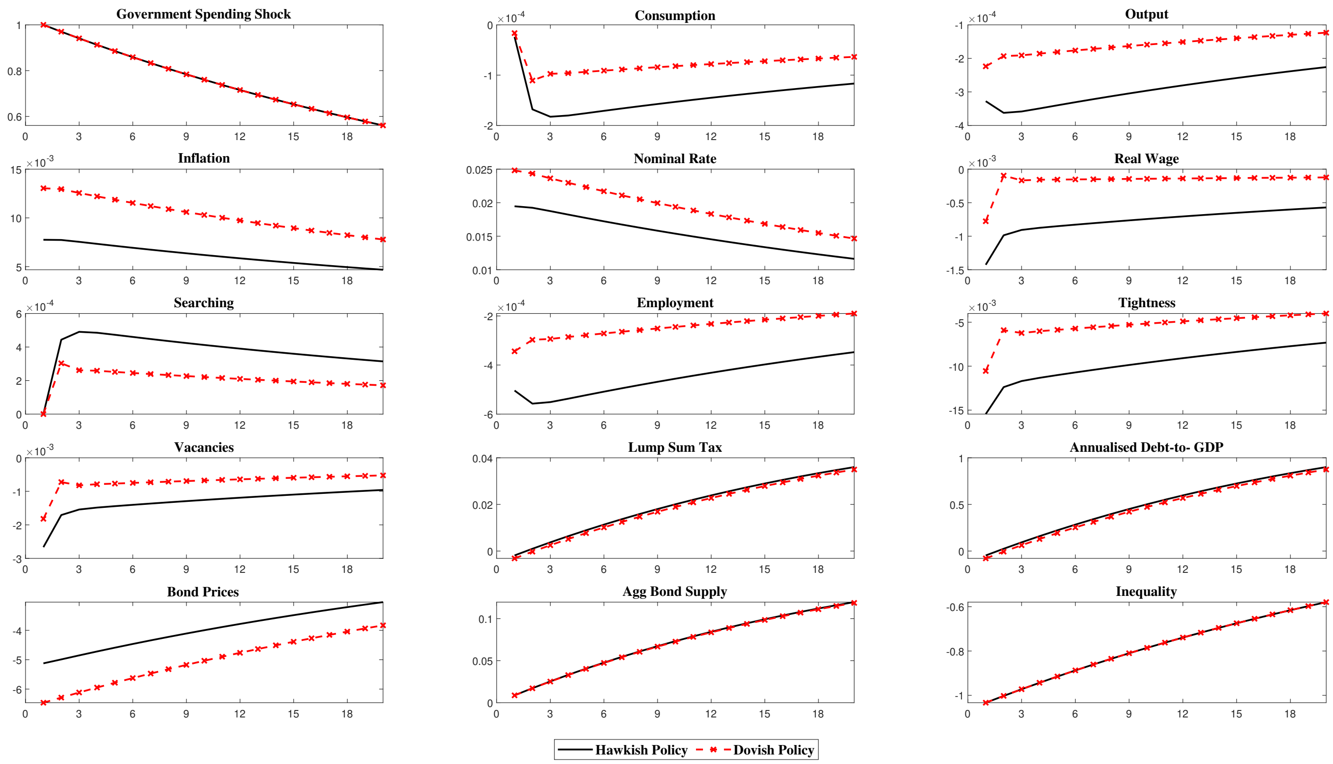

Figure 5: Dynamic responses to a one-off government spending shock with high persistence ($\rho_{tr} = 0.97$). Hawkish ($\phi_\pi = 1.5$) vs. Dovish ($\phi_\pi = 0.9$) monetary policy.

The labour market adjusts more elastically under dovish policy: vacancy posting is stronger, matching rates improve, and unemployment falls more quickly. Market tightness rises faster, and the search pool shrinks accordingly. Nonetheless, the presence of nominal rigidities implies that real wages return to steady state only gradually, amplifying differences across monetary regimes. Importantly, these dynamics occur despite the absence of distortionary taxation or endogenous labour supply responses.

The effect on inequality remains minimal in both regimes. Inactive agents—by design—do not participate in asset or labour markets and are thus insulated from interest rate and inflation fluctuations. Their consumption tracks the transfer path closely. Consequently, the implications of alternative monetary stances are driven almost entirely by macroeconomic efficiency: higher output path, smoother transitions, and lower consumption volatility for active consumers.

While monetary policy does not affect the steady state, it critically shapes the economy's dynamics in response to the government spending shock. A dovish stance consistently improves short-run macroeconomic outcomes by mitigating the contractionary effects of fiscal drag and smoothing consumption dynamics. These findings reinforce results in the recent HANK literature (e.g., Auclert et al. 2024), suggesting that deviating from strict inflation targeting enhances macroeconomic efficiency even when fiscal transfers are only partially effective.

5 Conclusion

The paper develops a flexible heterogeneous-agent framework that incorporates overlapping generations, stochastic inactivity transitions, and frictional labour markets. This model provides a structured yet analytically transparent approach to studying inequality, macroeconomic dynamics, and the joint roles of fiscal and monetary policy. A central innovation is the inclusion of inactive, permanently hand-to-mouth households who do not participate in asset or labour markets. This generates a realistic participation margin and amplifies cross-sectional consumption heterogeneity—even in the absence of aggregate uncertainty.

The analysis mainly focuses on the short-run transitional dynamics following a one-off, unanticipated, and autocorrelated increase in government transfers to inactive households, interpreted as a stylized government spending shock. Under lump-sum taxation and inelastic labour supply, such transfers can reduce inequality without generating direct efficiency losses. However, their macroeconomic effectiveness depends critically on the monetary stance and the persistence of the shock. A dovish monetary regime consistently improves labour market outcomes and raises aggregate efficiency by mitigating the contractionary effects of future tax expectations and nominal rigidities. These results highlight the limitations of strict inflation targeting in heterogeneous-agent economies.

While the main study focuses on transitional dynamics, the paper also presents welfare analysis along the equilibrium path, under different monetary regimes, in Appendix A.7. The welfare analysis reinforces key insights from the dynamic responses. Namely, even when inequality paths are invariant across regimes, macroeconomic efficiency can diverge sharply, leading to welfare gains under dovish policy.

A key strength of the framework lies in its tractability. By abstracting from aggregate risk and assuming log utility, the model delivers closed-form expressions for all per capita variables and preserves near-linear aggregation. Including aggregate uncertainty would require strong assumptions—such as either the inclusion of recursive preferences with the coefficient of relative risk aversion and the inter-temporal elasticity of substitution equal to unity —or a fully numerical solution approach, such as that of Krusell & Smith (1998) or Maliar et al. (2010). Both would obscure the transparent policy mechanisms the paper aims to highlight.

Future research could extend this framework to incorporate aggregate risk, endogenous labour supply, and richer asset market structures, or apply it to the analysis of optimal policy design. However, the central contribution of this paper is to show that even in the absence of aggregate shocks, monetary-fiscal interactions generate meaningful trade-offs in heterogeneous-agent economies. The findings reinforce recent results in the HANK literature: strict inflation targeting may be inefficient, while dovish monetary policy can improve macroeconomic outcomes through smoother transitions and more effective fiscal transmission.

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Appendix A Online Appendix

Appendix A.1 Solving the Individual Household s's Optimisation Problem

Setting up the Lagrangian of a household belonging to cohort s

$$\mathscr{L} = \max_{\{c_t^s, \mathscr{W}_t^s\}_{t=0}^{\infty}} \sum_{t=s}^{\infty} (\beta\gamma)^{t-s} \left(u\left(c_t^s\right) + \lambda_t^s \left(y_t^s + \mathscr{W}_t^s - c_t^s - \frac{\gamma}{R_t} \mathscr{W}_{t+1}^s - T_t \right) \right)$$

FOCs

$$\frac{\partial \mathscr{L}}{\partial c_t^s} = \quad 0 : (\beta\gamma)^{t-s} u^{'}\left(c_t^s\right) + (\beta\gamma)^{t-s} \lambda_t^s (-1) = 0$$

$$a : \quad \lambda_t^s = u^{'}\left(c_t^s\right) = \left(c_t^s\right)^{-1}$$

$$\frac{\partial \mathscr{L}}{\partial \mathscr{W}_{t+1}^s} = 0 : (\beta\gamma)^{t-s} \lambda_t^s \left(-\frac{\gamma}{R_t} \right) + (\beta\gamma)^{t+1-s} \left(\lambda_{t+1}^s\right) = 0$$

$$\lambda_t^s \left(\frac{\gamma}{R_t} \right) = (\beta\gamma)\, \lambda_{t+1}^s$$

$$\lambda_t^s = (\beta R_t)\, \lambda_{t+1}^s$$

Substituting in eq.(a)

$$\left(c_t^s\right)^{-1} = (\beta R_t) \left(c_{t+1}^s\right)^{-1}$$

Or rather,

$$b : c_{t+1}^s = \beta R_t c_t^s$$

$$\frac{\partial \mathscr{L}}{\partial \lambda_t^s} = 0 : \frac{\gamma}{R_t} \mathscr{W}_t^s = y_t^s - T_t + \mathscr{W}_{t-1}^s - c_t^s$$

Appendix A.2 Firms

If the search process is successful then, the monopolistic firm operates following the production function. For convention, I initially include the expectation operator ($\mathbb{E}_t(\cdot)$) when setting up the firms' problem. However, due to the lack of aggregate risk, I can drop them at any point.

$$Y_t(j) = z_t n_t(j) h_t(j)$$

where, (z_t) is the total factor productivity.Firms face quadratic adjustment costs $R(\cdot) = \frac{\Phi}{2} Y_t \left(\frac{P_t(j)}{P_{t-1}(j)} - 1 \right)^2$ as proposed by Rotemberg (1982) . The firm j solves the following optimization problem

$$\max_{\{P_t(j), n_t(j), v_t(j)\}} \Pi_t(j) = \mathbb{E}_t \sum_{t=0}^{\infty} (\beta)^t \frac{\Lambda_t^s}{\Lambda_0^s} \left(\left(\frac{P_t(j)}{P_t} Y_t(j) - w_t n_t(j) h_t(j) \right) - \frac{\Phi}{2} \left(\frac{P_t(j)}{P_{t-1}(j)} - 1 \right)^2 Y_t - \kappa v_t(j) \right)$$

Subject to

1. monopolistic demand for its product,

$$Y_t(j) = Y_t \left(\frac{P_t(j)}{P_t} \right)^{-\varepsilon_t}$$

Where, ε_t stands for the elasticity of substitution between intermediate varieties.

2. The law of motions of employment o in firm (j) is- the Beveridge curve is given by:

$$n_t(j) = (1-\rho) \cdot n_{t-1}(j) + q_t(j) \cdot v_t(j)$$

Where,

The probability of filling a vacancy $(q_t(j))$**:** $\quad q_t(j) = \bar{m}_t (\vartheta_t)^{-\omega} = \bar{m}_t \left(\frac{u_t}{v_t} \right)^{\omega}$

The labour market tightness (θ_t) : $\quad \vartheta_t = \frac{v_t}{u_t}$

The Lagrangian for this decision problem is

$$\mathscr{L} = \mathbb{E}_t \sum_{t=0}^{\infty} (\beta)^t \frac{\Lambda_t^s}{\Lambda_0^s} \left(\begin{array}{c} \left(\left(\left(\frac{P_t(j)}{P_t} \right)^{1-\varepsilon_t} - \frac{w_t n_t(j) h_t(j)}{Y_t} \right) Y_t - \frac{\Phi}{2} \left(\frac{P_t(j)}{P_{t-1}(j)} - 1 \right)^2 Y_t - \kappa v_t(j) \right) \\ -mc_t \left(Y_t \left(\frac{P_t(j)}{P_t} \right)^{-\varepsilon_t} - z_t n_t(j) h_t(j) \right) \\ -\mu_t \left(n_t(j) - (1-\rho) \cdot n_{t-1}(j) - q_t(j) \cdot v_t(j) \right) \end{array} \right)$$

where, mc_t captures the marginal cost of production and μ_t captures the marginal cost of filling a vacancy.

$$FOCs$$

$$\frac{\partial \mathscr{L}}{\partial P_t(j)} = 0 : \left[\begin{array}{c} (\beta)^t \frac{\Lambda_t^s}{\Lambda_0^s} \left(\begin{array}{c} \left(\frac{(1-\varepsilon_t)}{P_t(j)} \left(\frac{P_t(j)}{P_t} \right)^{1-\varepsilon_t} - \frac{\Phi}{P_{t-1}(j)} \left(\frac{P_t(j)}{P_{t-1}(j)} - 1 \right) \right) \\ -mc_t \left(-\frac{\varepsilon_t}{P_t} \left(\frac{P_t(j)}{P_t} \right)^{-\varepsilon_t - 1} \right) \end{array} \right) Y_t \\ +\mathbb{E}_t \left((\beta)^{t+1} \frac{\Lambda_{t+1}^s}{\Lambda_0^s} \left(\frac{\Phi}{P_t(j)} \frac{P_{t+1}(j)}{P_t(j)} \left(\frac{P_{t+1}(j)}{P_t(j)} - 1 \right) Y_{t+1} \right) \right) \end{array} \right] = 0$$

In anticipation of a symmetric equilibrium, I drop the j subscript $(P_t(j) = P_t)$.

$$\frac{\partial \mathscr{L}}{\partial P_t(j)} = 0 : \left[\begin{array}{c} \mathbb{E}_t (\beta)^t \frac{\Lambda_t^s}{\Lambda_0^s} \left(\left((1-\varepsilon_t) - \Phi \frac{P_t}{P_{t-1}} \left(\frac{P_t}{P_{t-1}} - 1 \right) \right) + mc_t \varepsilon_t \right) \frac{Y_t}{P_t} \\ +\frac{\Phi}{P_t} \mathbb{E}_t (\beta)^{t+1} \frac{\Lambda_{t+1}^s}{\Lambda_0^s} \left(\left(\frac{P_{t+1}}{P_t} \left(\frac{P_{t+1}}{P_t} - 1 \right) Y_{t+1} \right) \right) \end{array} \right] = 0$$

Multiplying across $(\beta)^{-t} P_t \frac{\Lambda_0^s}{\Lambda_t^s}$

$$\frac{\partial \mathscr{L}}{\partial P_t(j)} = 0 : \left[\begin{array}{c} \left(\left((1-\varepsilon_t) - \Phi \frac{P_t}{P_{t-1}} \left(\frac{P_t}{P_{t-1}} - 1 \right) \right) + \mu_t^Y \varepsilon_t \right) Y_t \\ +\Phi \beta \mathbb{E}_t \left(\frac{\Lambda_{t+1}^s}{\Lambda_t^s} \frac{P_{t+1}}{P_t} \left(\frac{P_{t+1}}{P_t} - 1 \right) Y_{t+1} \right) \end{array} \right] = 0$$

By definition inflation takes the form $(1+\pi_t) = \frac{P_t}{P_{t-1}}$.

$$\frac{\partial \mathscr{L}}{\partial P_t(j)} = 0 : \left[\begin{array}{c} ((1-\varepsilon_t) + mc_t \cdot \varepsilon_t - \Phi (1+\pi_t) \pi_t) Y_t \\ +\Phi \beta \mathbb{E}_t \left(\frac{\Lambda_{t+1}^s}{\Lambda_t^s} (1+\pi_{t+1}) \pi_{t+1} Y_{t+1} \right) \end{array} \right] = 0$$

The NKPC takes the form:

$$\Phi (1+\pi_t) \pi_t Y_t = ((1-\varepsilon_t) + \varepsilon_t \cdot mc_t) Y_t + \Phi \beta \mathbb{E}_t \left(\frac{\Lambda_{t+1}^s}{\Lambda_t^s} (1+\pi_{t+1}) \pi_{t+1} Y_{t+1} \right) \tag{NKPC}$$

$$\begin{aligned} \frac{\partial \mathscr{L}}{\partial n_t(j)} &= 0 : (\beta)^t \frac{\Lambda_t^s}{\Lambda_0^s} (-w_t h_t(j) + mc_t z_t h_t(j) - \mu_t) + \mathbb{E}_t (\beta)^{t+1} \left(\frac{\Lambda_{t+1}^s}{\Lambda_0^s} (1-\rho) \mu_{t+1} \right) = 0 \\ &: \text{ Multiplying across by } (\beta)^{-t} \frac{\Lambda_0^s}{\Lambda_t^s} \text{and re-arranging} \\ &: \mu_t = (mc_t z_t - w_t) h_t(j) + (\beta (1-\rho)) \mathbb{E}_t \left(\frac{\Lambda_t^s}{\Lambda_0^s} \mu_{t+1} \right) \end{aligned}$$

Aggregating across the j firms yields:

$$\text{MC of filling a vacancy} \quad : \quad \mu_t = (mc_t z_t - w_t)\, h_t + \left(\frac{(1-\rho)}{R_t}\right)\mathbb{E}_t\left(\mu_{t+1}\right)$$
$$= \quad (mc_t z_t - w_t)\xi + \left(\frac{(1-\rho)}{R_t}\right)\mathbb{E}_t\left(\mu_{t+1}\right)$$

$$\frac{\partial \mathscr{L}}{\partial v_t(j)} \quad = \quad 0 : (\beta)^t \frac{\Lambda_t^s}{\Lambda_0^s}\left(-\kappa - \mu_t\left(-q_t(j)\right)\right) = 0$$
$$: \quad \mu_t = \frac{\kappa}{q_t(j)}$$

Appendix A.3 Proof of Propositions (1) to (5)

To show the heterogenous effect of monetary policy on individual household dynamics, start from the individual household s's, period t, consumption function (see eq.(7))

$$c_{s|t}^u = (1-\beta\gamma)\left(f \cdot \gamma \mathscr{W}_{s|t}^u + \zeta_{s|t}^u\right)$$

Where, the human wealth of an active individual belonging to generation s is

$$\begin{aligned}
\zeta_{s|t}^u &\equiv y_{s|t}^u + \sum_{k=1}^{\infty}(f\cdot\gamma)^k \prod_{l=0}^{k-1}\left(\frac{1}{R_{t+l}}\right) y_{s|t+k}^u \\
&= y_{s|t}^u + \left(\frac{f\cdot\gamma}{R_t}\right)\zeta_{s|t+1}^u \\
&= \frac{\xi w_t n_t}{\xi} + \frac{d_t}{\xi} + (1-n_t)\frac{b}{\xi} - \frac{T_t}{\xi} + \left(\frac{f\cdot\gamma}{R_t}\right)\zeta_{s|t+1}^u
\end{aligned}$$

and, the dividends are given as

$$d_t = \left(1 - \frac{\Phi}{2}\pi_t^2\right) Y_t - \xi w_t n_t - \kappa v_t$$

Whilst, the real financial income of active generation s is

$$\mathscr{W}_{s|t}^u = \frac{\left(1+\rho \tilde{P}_t^M\right) a_{s|t}^L + a_{s|t}^S}{(1+\pi_t)}$$

with the price of the long-term actuarial bonds is

$$\tilde{P}_t^M = \frac{f \cdot \gamma}{R_t} \frac{\left(1 + \rho \tilde{P}_{t+1}^M\right)}{\left(1 + \pi_{t+1}\right)}$$

However, since newly born agents enter the market with zero wealth, $\mathscr{W}_{t|t}^u = 0$, the period t consumption of a newly born active individual takes the form

$$\begin{aligned} c_{t|t}^u &= (1 - \beta\gamma)\left(f \cdot \gamma \mathscr{W}_{t|t}^u + \zeta_{t|t}^u\right) \\ &= (1 - \beta\gamma)\, \zeta_{t|t}^u \end{aligned}$$

For any active household that belongs to a cohort $s \leqslant t$, the direct effect of an interest rate change equals the combined effect from the household's financial and non- financial income

$$\begin{aligned} \frac{\partial}{\partial R_t} c_{s|t}^u &= (1 - \beta\gamma)\frac{\partial}{\partial R_t}\left(f \cdot \gamma \mathscr{W}_{s|t}^u + \zeta_{s|t}^u\right) \\ &= (1 - \beta\gamma)\left(f \cdot \gamma \frac{\partial}{\partial R_t} \mathscr{W}_{s|t}^u + \frac{\partial}{\partial R_t} \zeta_{s|t}^u\right) \end{aligned}$$

However, since newly born agents enter the market with zero wealth, $\mathscr{W}_{t|t}^u = 0$, an interest rate change affects the period t consumption of a newly born active individual only to the degree that it affects their the human wealth

$$\begin{aligned} \frac{\partial}{\partial R_t} c_{t|t}^u &= (1 - \beta\gamma)\frac{\partial}{\partial R_t}\left(f \cdot \gamma \mathscr{W}_{t|t}^u + \zeta_{t|t}^u\right) \\ &= (1 - \beta\gamma)\left(\frac{\partial}{\partial R_t} \zeta_{t|t}^u\right) \end{aligned}$$

As such,

$$\frac{\partial}{\partial R_t} c_{s|t}^u \neq \frac{\partial}{\partial R_t} c_{t|t}^u$$

As shown above, a change in the interest rate has a heterogeneous effect on active households depending on the age of their generation. So, this result is formalised by proposition 1 below.

Proposition 1. Even among active households, a change in the real interest rate has heterogeneous effects due to generational differences. This result becomes evident when comparing the impact of a current-period real interest rate change on the consumption of a newly born cohort, t, with that of any older cohort that entered the economy in a prior period (i.e., $s < t$).

$$\frac{\partial}{\partial R_t} c^u_{s|t} \neq \frac{\partial}{\partial R_t} c^u_{t|t} \text{ With } s < t$$

Next, let us examine the effects of a change in monetary policy on the consumption of the "rule- of- thumbers". This mass of constrained households do not have access to either labour or financial markets and consume only out of lump-sum government subsidies. As such, there is no heterogeneity among inactive individuals and thus, there is no direct effect on their consumption from an interest rate change. That is

$$\frac{\partial}{\partial R_t} c^r_{s|t} = \frac{\partial}{\partial R_t} T^r_t = 0, \forall t$$

This result is formally presented as **proposition 2**.

So far I have show that there is a heterogeneous age-dependent effect from a change in monetary policy amongst active households. So, before moving on with the effects of monetary policy on aggregate consumption, let's us first understand how an interest rate change impacts the consumption of an active household that belongs to generation $s \leqslant t$ is:

$$\begin{aligned}
\frac{\partial}{\partial R_t} c^u_{s|t} &= (1-\beta\gamma)\frac{\partial}{\partial R_t}\left(f\cdot\gamma\mathscr{W}^u_{s|t} + \zeta^u_{s|t}\right) && (60)\\
&= (1-\beta\gamma)\left(\begin{array}{c} f\cdot\gamma\cdot\frac{\partial}{\partial R_t}\mathscr{W}^u_{s|t} \\ +\frac{\partial}{\partial R_t}\left[w_t n_t - \frac{T_t}{\xi} + \frac{d_t}{\xi} + (1-n_t)\frac{b}{\xi} + \left(\frac{f\cdot\gamma}{R_t}\right)\zeta^u_{s|t+1}\right]\end{array}\right) && (61)\\
&= (1-\beta\gamma)\left(\begin{array}{c} f\cdot\gamma\cdot\frac{\partial}{\partial R_t}\mathscr{W}^u_{s|t} \\ +\left[n_t\frac{\partial}{\partial R_t}w_t - \frac{1}{\xi}\frac{\partial}{\partial R_t}T_t + \frac{1}{\xi}\frac{\partial}{\partial R_t}d_t - \frac{1}{R_t}\left(\frac{f\cdot\gamma}{R_t}\right)\zeta^u_{s|t+1}\right]\end{array}\right) && (62)
\end{aligned}$$

However, since households do not internalise the effects of dividend income, the paper ignore the effects of an interest rate change on them $\left(\frac{\partial}{\partial R_t}d_t = 0\right)$. As such, eq.(62) can be re-written as

$$\frac{\partial}{\partial R_t} c^u_{s|t} = (1-\beta\gamma)\left(\begin{array}{c} f\cdot\gamma\cdot\frac{\partial}{\partial R_t}\mathscr{W}^u_{s|t} \\ +\left[n_t\frac{\partial}{\partial R_t}w_t - \frac{1}{\xi}\frac{\partial}{\partial R_t}T_t - \frac{1}{R_t}\left(\frac{f\cdot\gamma}{R_t}\right)\zeta^u_{s|t+1}\right]\end{array}\right) \quad (64)$$

To find the direct effect of an interest rate change on the consumption of an active household s, at period t, first I need to calculate the following derivatives:

$$
\begin{aligned}
f\cdot\gamma\cdot\frac{\partial \mathscr{W}^{u}_{s|t}}{\partial R_t} &= f\cdot\gamma\frac{\partial}{\partial R_t}\left[\frac{a^L_{s|t}}{(1+\pi_t)}\left(1+\rho\tilde{P}^M_t\right)+\frac{a^S_{s|t}}{(1+\pi_t)}\right] \\
&= \left[\frac{a^L_{s|t}}{(1+\pi_t)}f\cdot\gamma\frac{\partial}{\partial R_t}\left(1+\rho\tilde{P}^M_t\right)+f\cdot\gamma\frac{\partial}{\partial R_t}\frac{a^S_{s|t}}{(1+\pi_t)}\right] \\
&= \left[\frac{a^L_{s|t}}{(1+\pi_t)}f\cdot\gamma\cdot\rho\cdot\frac{\partial}{\partial R_t}\left(\tilde{P}^M_t\right)\right] \\
&= \left[\frac{a^L_{s|t}}{(1+\pi_t)}f\cdot\gamma\cdot\rho\cdot\frac{\partial}{\partial R_t}\left(\frac{f\cdot\gamma}{R_t}\frac{\left(1+\rho\tilde{P}^M_{t+1}\right)}{(1+\pi_{t+1})}\right)\right] \\
&= \left[\frac{a^L_{s|t}}{(1+\pi_t)}f\cdot\gamma\cdot\rho\cdot\left(-\frac{f\cdot\gamma}{(R_t)^2}\frac{\left(1+\rho\tilde{P}^M_{t+1}\right)}{(1+\pi_{t+1})}\right)\right] \\
&= -f\cdot\gamma\cdot\left[\frac{a^L_{s|t}}{(1+\pi_t)}\cdot\rho\cdot\left(\frac{\tilde{P}^M_t}{R_t}\right)\right]
\end{aligned}
$$

Interestingly, the (direct) effect of a change in monetary policy on household s's financial wealth is comprised of the direct effect shown in the discounted value of their asset position (i.e. ”pure balance sheet” effect) as well as the indirect effect linked to the maturity of the assets included in the household s's portfolio(i.e. ”portfolio composition effect”).

and,

$$
\frac{\partial}{\partial R_t}\zeta^u_{s|t}=\frac{\partial}{\partial R_t}\left[w_t n_t - T_t+\frac{d_t}{\xi}+(1-n_t)\frac{b}{\xi}+\left(\frac{f\cdot\gamma}{R_t}\right)\zeta^u_{s|t+1}\right]
$$

Where, the effect of an interest rate change on the wage equation (eq.(56)) is

$$
\begin{aligned}
\frac{\partial w_t}{\partial R_t} &= \frac{\partial}{\partial R_t}\begin{pmatrix} \lambda\cdot\left[\varsigma\cdot\left[mc_t\cdot z_t+\frac{\kappa}{\xi}\frac{(1-\rho)}{R_t}\vartheta_{t+1}\right]+(1-\varsigma)\frac{b}{\xi}\right] \\ +(1-\lambda)\cdot w_{t-1}\end{pmatrix} \\
&= \frac{\partial}{\partial R_t}\left(\lambda\cdot\left[\varsigma\cdot\left[mc_t\cdot z_t+\frac{\kappa}{\xi}\frac{(1-\rho)}{R_t}\vartheta_{t+1}\right]\right]\right)
\end{aligned}
$$

I can substitute out the expression of the mc_t, from the NKPC, in the above expression which allows us to re-write as

$$
\begin{aligned}
\frac{\partial w_t}{\partial R_t} &= \frac{\partial}{\partial R_t}\left(\lambda\cdot\varsigma\cdot\left[z_t\cdot\left(\begin{array}{c}\left(\frac{\varepsilon_t-1}{\varepsilon_t}\right)+\frac{\Phi}{\varepsilon_t}\left(1+\pi_t\right)\pi_t\\ -\frac{\Phi}{\varepsilon_t R_t}\left(\left(1+\pi_{t+1}\right)\pi_{t+1}\frac{Y_{t+1}}{Y_t}\right)\\ +\frac{\kappa}{\xi}\frac{(1-\rho)}{R_t}\vartheta_{t+1}\end{array}\right)\right]\right)\\
&= \left(\lambda\cdot\varsigma\cdot\left[z_t\cdot\left(\frac{\Phi}{\varepsilon_t\left(R_t\right)^2}\left(\left(1+\pi_{t+1}\right)\pi_{t+1}\frac{Y_{t+1}}{Y_t}\right)\right)-\frac{\kappa}{\xi}\frac{(1-\rho)}{\left(R_t\right)^2}\vartheta_{t+1}\right]\right)\\
&= \left(\frac{\lambda\cdot\varsigma}{R_t}\cdot\left[z_t\cdot\left(\frac{\Phi}{\varepsilon_t R_t}\left(\left(1+\pi_{t+1}\right)\pi_{t+1}\frac{Y_{t+1}}{Y_t}\right)\right)-\frac{\kappa}{\xi}\frac{(1-\rho)}{R_t}\vartheta_{t+1}\right]\right)
\end{aligned}
$$

Finally, from the fiscal rule I know that

$$T_t = \bar{T} + \phi_b\left(\frac{B_{t+1}}{4Y_t} - \frac{B^*}{4Y}\right)$$

where

$$B_t = \frac{\left(\left(1+\rho P_t^M\right)b_t^M + b_t^S\right)}{\left(1+\pi_t\right)}$$

Given that short-term government bonds are in zero net supply $\left(b_t^S = 0, \forall t\right)$ the expression reduces to

$$T_t = \bar{T} + \phi_b\left(\frac{\left(1+\rho P_{t+1}^M\right)b_{t+1}^M}{4Y_t\left(1+\pi_{t+1}\right)} - \frac{B^*}{4Y}\right) \tag{63}$$

However, using the bond pricing equation (see eq.(14), eq.(63)) can be written more compactly as

$$T_t = \bar{T} + \phi_b\left(\frac{R_t P_t^M b_{t+1}^M}{4Y_t} - \frac{B^*}{4Y}\right)$$

So, the effect of an interest rate change on taxes is

$$
\begin{aligned}
\frac{\partial T_t}{\partial R_t} &= \frac{\phi_b}{4Y_t}P_t^M b_{t+1}^M\\
&= \frac{\phi_b}{R_t}\frac{B_{t+1}}{4Y_t}
\end{aligned}
\tag{64}
$$

Interestingly, $\frac{\partial T_t}{\partial R_t} > 0$ due to the revaluation effects that stem from the fact that the government issues bonds of maturity longer than 1 period.

By substituting the expressions for $\frac{\partial}{\partial R_t}\mathscr{W}^u_{s|t}$, $\frac{\partial T_t}{\partial R_t} > 0$ and $\frac{w_t}{R_t}$ back into eq.(63) yields

$$\frac{\partial}{\partial R_t} c^u_{s|t} = -\frac{(1-\beta\gamma)}{R_t} \left(\begin{array}{c} f \cdot \gamma \cdot \left[\frac{a^L_{s|t}}{(1+\pi_t)} \cdot \rho \cdot \tilde{P}^M_t \right] + \left(\frac{f \cdot \gamma}{R_t} \right) \zeta^u_{s|t+1} + \frac{1}{\xi} \frac{\phi_b}{4Y_t} R_t P^M_t b^M_{t+1} \\ -n_t \left(\lambda \cdot \varsigma \cdot \left[\begin{array}{c} z_t \cdot \left(\frac{\Phi}{\varepsilon_t R_t} \left((1+\pi_{t+1}) \pi_{t+1} \frac{Y_{t+1}}{Y_t} \right) \right) \\ -\frac{\kappa}{\xi} \frac{(1-\rho)}{R_t} \vartheta_{t+1} \end{array} \right] \right) \end{array} \right)$$

Consistent with the results of Auclert et al. (2024), Auclert (2019) and Leeper & Leith (2016), the composition of the asset portfolios matters as the value of any asset with maturity longer than one period is more volatile to an interest rate change. Additionally, households who belong to younger generations rely more on their non- financial income for consumption and hence, a decrease in the real interest rate allows them to use assets and smooth their consumption more easily- due to the lower borrowing cost. On the other hand, the same interest rate drop reduces the financial income older cohorts. Thus, reducing the consumption and wealth dispersion amongst active individuals. These are the effects of the so- called ”earnings heterogeneity” and ”interest rate exposure” channels of monetary policy.

However, the is also indirect affects attributed to a change in monetary policy. If for example the central bank reduces the real interest rate, this will allow inflation to rise and reduce the real value of the households financial wealth. Now, for consumers who belong to younger cohorts and thus, tend to be borrowers, a rise in inflation will reduce the real value of their debt. Whereas, for older households I observe the opposite result. This is the effect of the so- called Fisher channel of monetary policy.

Now, let us turn our attention to the aggregate effect of an interest rate change on aggregate consumption dynamics. This result is easily observable from the per capita consumption Euler equation for the active population. As shown below, since active consumers have unconstrained access to the asset market and are not subject to any exogenous binding borrowing constraint then,

$$
\begin{aligned}
\frac{\partial}{\partial R_t} c_t^u &= \frac{\partial}{\partial R_t}\left(\frac{1}{\beta R_t} c_{t+1}^u\right) + \frac{(1-f\cdot\gamma)}{f\cdot\gamma}\frac{(1-\beta\gamma)}{\xi\cdot\beta}\frac{\partial}{\partial R_t}\left(P_t^M b_{t+1}^L\right) \\
&= -\frac{1}{R_t}\left(\frac{1}{\beta R_t} c_{t+1}^u\right) + \frac{(1-f\cdot\gamma)}{f\cdot\gamma}\frac{(1-\beta\gamma)}{\xi\cdot\beta} b_{t+1}^L \frac{\partial}{\partial R_t}\left(\frac{f\cdot\gamma}{R_t}\frac{\left(1+\rho P_{t+1}^M\right)}{(1+\pi_{t+1})}\right) \\
&= -\frac{1}{R_t}\left[\frac{1}{\beta R_t} c_{t+1}^u + \frac{(1-f\cdot\gamma)}{f\cdot\gamma}\frac{(1-\beta\gamma)}{\xi\cdot\beta}\left(P_t^M b_{t+1}^L\right)\right] \\
&= -\frac{c_t^u}{R_t}
\end{aligned}
$$

or rather,

$$
\frac{dc_t^u}{c_t^u} = -\frac{dR_t}{R_t}
$$

Meaning that we obtain the familiar result consistent with perfect insurance. This result is formalised below as:

Proposition 3. Active individuals have the same elasticity of inter-temporal substitution and are also able to freely adjusts their portfolios in each period. Hence, a change in the real interest rate affects them in the same manor as a permanent income consumer.

$$
\frac{\partial c_t^u}{c_t^u} = -\frac{\partial R_t}{R_t}
$$

Whereas, inactive households are a mass of Keynesian consumers. Therefore, there is no direct effect on their aggregate consumption due to an a change in the real interest rate.

$$
\frac{\partial}{\partial R_t} c_t^r = 0
$$

Finally, the overall effect of an interest rate change on aggregate consumption is

$$
\begin{aligned}
\frac{\partial}{\partial R_t} c_t &= \xi\cdot\frac{\partial}{\partial R_t} c_t^u + (1-\xi)\cdot\frac{\partial}{\partial R_t} c_t^r \\
&= \xi\cdot\frac{\partial}{\partial R_t} c_t^u \\
&= -\xi\cdot\frac{c_t^u}{R_t}
\end{aligned}
$$

equal to the direct effect on the consumption of active agents as well as the share of this household type ξ in the total population. This result is formally presented as proposition 4.

Proof of Proposition 5

Decrease in cross-sectional inequality due to an increase in the transfers made to inactive households.

To show that an increase in direct redistribution reduces consumption inequality, I start by examining its effect on the active and inactive population. Let's begin with the consumption equation for an active individual from cohort s:

$$c^u_{s|t} = (1-\beta\gamma)\left(f\cdot\gamma\mathscr{W}^u_{s|t} + \zeta^u_{s|t}\right) \tag{65}$$

This equation simplifies to:

$$c^u_{s|t} = (1-\beta\gamma)\left(f\cdot\gamma\mathscr{W}^u_{s|t} + (1-\tau_t)\,w_t n_t h^u_{s|t} + \frac{d_t}{\xi} + (1-n_t)\,\frac{b_t}{\xi} - \frac{T_t}{\xi} + \left(\frac{f\cdot\gamma}{R_t}\right)\zeta^u_{s|t+1}\right) \tag{66}$$

I make use of the financial market clearing condition, $B_t = f\cdot\gamma\cdot\mathscr{W}_t$, to derive the aggregate consumption function of the active population.

$$\tilde{c}^u_t = \xi\cdot c^u_t = (1-\beta\gamma)\,(B_t + \xi\cdot\zeta_t) \tag{67}$$

I note that an increase in taxation will negatively affect $\tilde{c}^u_t$, likewise an increase in the next period's financial wealth will yield a positive impact on $\tilde{c}^u_t$:

$$\frac{\partial\tilde{c}^u_t}{\partial T_t} = -\,(1-\beta\gamma) < 0 \tag{68}$$

$$\frac{\partial\tilde{c}^u_t}{\partial B_{t+1}} = \frac{(1-\beta\gamma)}{\beta}\left(\frac{1}{R_t} + \frac{(1-f\cdot\gamma)}{f\cdot\gamma}\right) > 0 \tag{69}$$

I then examine the overall impacts of changing wealth transfers on the active and inactive populations. An increase in wealth transfers to the inactive population T^r_t leads to a proportional increase in their aggregate consumption, while for the active population there are competing effects caused by the change in outstanding government debt and the tax mechanism. As presented through the following results:

$$\frac{\partial B_{t+1}}{\partial T^r_t} = R_t\left(\frac{4Y_t}{\phi_b + 4Y_t}\right) > 0 \tag{70}$$

$$\frac{\partial T_t}{\partial B_{t+1}} = \frac{\phi_b}{4Y_t R_t} > 0 \tag{71}$$

$$\frac{\partial \tilde{c}_t^u}{\partial T_t^r} = -\left(1-\beta\gamma\right)\left(\frac{\phi_b}{\phi_b+4Y_t}\right) \leqslant 0 \tag{72}$$

$$\frac{\partial \tilde{c}_t^r}{\partial T_t^r} = \frac{1}{(1-\xi)} \tag{73}$$

Finally, I analyse the effect on overall consumption inequality. The formula showing the effect of an increase in transfers to the inactive population on the inequality index S_t is derived as follows:

$$\begin{aligned}
\frac{\partial}{\partial T_t^r} S_t &= \frac{\partial}{\partial T_t^r}\left(1-\frac{c_t^r}{c_t^u}\right) \\
&= -\frac{\partial}{\partial T_t^r}\left(\frac{c_t^r}{c_t^u}\right) \\
&= -\left(\frac{c_t^u \frac{\partial}{\partial T_t^r} c_t^r - c_t^r \frac{\partial c_t^u}{\partial T_t^r}}{\left(c_t^u\right)^2}\right)
\end{aligned}$$

$$\frac{\partial}{\partial T_t^r} S_t = -\frac{1}{c_t^u}\left(\frac{1}{(1-\xi)} + \Omega_t\right) < 0 \tag{74}$$

where $\Omega_t = \left(1-S_t\right)\left[\frac{(1-\beta\gamma)}{\xi}\left(\frac{\phi_b}{\phi_b+4Y_t}\right)\right]$. Thus, I conclude that a rise in transfers to the inactive population decreases cross-sectional consumption inequality.

Appendix A.4 Bellman Equations and Nash Bargaining Over Wages

This section closely follows Faia (2008) and Dennis & Kirsanova (2021). For convention, I include the expectation operator $\mathbb{E}_t(\cdot)$ when setting up the firms' problem. However, due to the absence of aggregate risk, expectations can be dropped at any point.

The real wage rate is determined through Nash bargaining between an individual worker and a firm. In period t, the value to a household[11] belonging to cohort s of having a member employed is denoted $V_{s|t}^E$. The value of having a member unemployed is denoted $V_{s|t}^U$. The Bellman equation for employment is:

$$V_{s|t}^E = w_t h_{s|t}^u + \beta \mathbb{E}_t\left(\frac{\Lambda_{s|t+1}^u}{\Lambda_{s|t}^u}\left[\rho\left(1-p\left(\vartheta_{t+1}\right)\right)V_{s|t+1}^U + \left(1-\rho\left(1-p\left(\vartheta_{t+1}\right)\right)\right)V_{s|t+1}^E\right]\right),$$

where ρ is the job separation rate, and the job-finding probability is defined as:

[11] In this section, ”household(s)” refers to active household(s), as only this type has access to financial markets.

$$p(\vartheta_t) \equiv p_t = \bar{m}_t \vartheta_t^{1-\omega}.$$

The value of unemployment is:

$$V^U_{s|t} = \frac{b}{\xi} + \beta \mathbb{E}_t \left(\frac{\Lambda^u_{s|t+1}}{\Lambda^u_{s|t}} \left[(1 - p(\vartheta_{t+1})) V^U_{s|t+1} + p(\vartheta_{t+1}) V^E_{s|t+1} \right] \right).$$

The surplus from employment for a household in cohort s is:

$$\begin{aligned} S^H_{s|t} &\equiv V^E_{s|t} - V^U_{s|t} \\ &= w_t h^u_{s|t} - \frac{b}{\xi} + \beta \mathbb{E}_t \left(\frac{\Lambda^u_{s|t+1}}{\Lambda^u_{s|t}} (1-\rho)(1 - p(\vartheta_{t+1})) S^H_{s|t+1} \right) \\ &\approx w_t - \frac{b}{\xi} + \underbrace{\beta \mathbb{E}_t \left(\frac{\Lambda^u_{s|t+1}}{\Lambda^u_{s|t}} (1 - \rho - p_{t+1}) S^H_{s|t+1} \right)}_{\text{Discounted future surplus for an active cohort-}s\text{ household}} . \end{aligned}$$

Now consider the representative firm. The value of an unallocated vacancy is $V^V_t = 0$, and the value of a filled vacancy is:

$$V^J_t = (mc_t \cdot z_t - w_t) \cdot \xi + (1-\rho) \beta \mathbb{E}_t \left(\frac{\Lambda^u_{s|t+1}}{\Lambda^u_{s|t}} V^J_{t+1} \right).$$

From the zero-profit condition and the aggregate hiring condition (eq. (44)):

$$\frac{\kappa}{q_t} = (mc_t \cdot z_t - w_t) \cdot \xi + (1-\rho) \beta \mathbb{E}_t \left(\frac{\Lambda^u_{s|t+1}}{\Lambda^u_{s|t}} \frac{\kappa}{q_{t+1}} \right).$$

Define firm surplus:

$$S^F_t \equiv \frac{\kappa}{q_t}.$$

The Nash wage bargaining problem is:

$$\max_{w_t} \left(\varsigma \log S^H_{s|t} + (1-\varsigma) \log S^F_t \right),$$

with $\varsigma \in (0,1)$ denoting the worker's share of surplus.

First-order condition:

$$\frac{\varsigma}{S^H_{s|t}} - \frac{(1-\varsigma)\cdot\xi}{S^F_t} = 0 \quad \Rightarrow \quad S^F_t = \xi\cdot\frac{1-\varsigma}{\varsigma}S^H_{s|t}. \tag{Nash Sharing Rule}$$

Given $S^F_t = \kappa/q(\vartheta_t)$, this implies:

$$S^H_{s|t} = \frac{1}{\xi}\cdot\frac{\varsigma}{1-\varsigma}\cdot\frac{\kappa}{q(\vartheta_t)}, \quad S^H_{s|t+1} = \frac{1}{\xi}\cdot\frac{\varsigma}{1-\varsigma}\cdot\frac{\kappa}{q(\vartheta_{t+1})}.$$

Now substitute into the expanded wage rule and assume perfect foresight (so $\mathbb{E}_t(\cdot)\to\cdot$ and $\beta\frac{\Lambda^u_{s|t+1}}{\Lambda^u_{s|t}} = \frac{1}{R_t}$):

$$\begin{aligned}\xi\cdot\left(\frac{1}{\varsigma}\right)w_t = mc_t\cdot z_t\cdot\xi + \frac{1-\rho}{R_t}\cdot\frac{\kappa}{q(\vartheta_{t+1})}\\ +\xi\cdot\frac{1-\varsigma}{\varsigma}\left(\frac{b}{\xi} - \frac{1-\rho}{R_t}\cdot(1-p(\vartheta_{t+1}))\cdot\frac{1}{\xi}\cdot\frac{\varsigma}{1-\varsigma}\cdot\frac{\kappa}{q(\vartheta_{t+1})}\right),\end{aligned}$$

which simplifies to:

$$\xi\cdot\left(\frac{1}{\varsigma}\right)w_t = mc_t\cdot z_t\cdot\xi + \frac{1-\varsigma}{\varsigma}b + \frac{1-\rho}{R_t}\cdot p(\vartheta_{t+1})\cdot\frac{\kappa}{q(\vartheta_{t+1})}.$$

Using $p(\vartheta_{t+1}) = \vartheta_{t+1}q(\vartheta_{t+1})$, we get:

$$\xi\cdot\left(\frac{1}{\varsigma}\right)w_t = mc_t\cdot z_t\cdot\xi + \frac{1-\varsigma}{\varsigma}b + \kappa\cdot\frac{1-\rho}{R_t}\cdot\vartheta_{t+1}.$$

Finally, solve for w_t:

$$w_t = \varsigma\left[mc_t\cdot z_t + \frac{\kappa}{\xi}\cdot\frac{1-\rho}{R_t}\cdot\vartheta_{t+1}\right] + (1-\varsigma)\cdot\frac{b}{\xi}.$$

This determines the real wage per worker, w_t, as a weighted average of the marginal product of labour (including the cost of replacing a worker) and the worker's outside option.

Appendix A.5 Calibration and Simulations

The model is calibrated to a quarterly frequency for the US economy. Most parameter calibrations are standard and generally follow those in Dennis & Kirsanova (2021). I calibrate the household discount rate to $\beta = (1.02)^{-1/4}$, aligning it with a real interest rate of 2% per annum, which is close to the average US real rate over the 1984-2024. The elasticity of substitution among goods, ε, is set to 11 based on evidence in Chari et al. (2000), corresponding to a markup of 10%.

The model includes price rigidity in the tradition of Rotemberg (1982). In line with the recent literature who calibrates their frameworks for the US economy, the study assumes that prices change approximately every 10 months (see Klenow & Kryvtsov 2008, Nakamura & Steinsson 2008 and Klenow & Malin 2010). Since the Rotemberg (1982) and Calvo (1983) models generate isomorphic linearized New Keynesian Phillips curves, the equivalent Rotemberg model parameter is approximately $\Phi = 60$. This implied value for the price adjustment cost, Φ, is also consistent with the empirical estimates of Gavin et al. (2015). The model also features wage rigidity similar to Hall (2003) and Blanchard & Galí (2007, 2010). Following Faia (2008), the parameter λ that controls the size of the wage rigidity is set to 0.6. Next, the survival rate is chosen to be consistent with an average lifespan of 80 years, as reported by SSA data.[12]. I assume that a Newly born cohort enters the market at the age of 18 and remains alive for approximately another 62 years. As such, the survival probability is set to $\gamma = 0.996$ which is consistent with an average life of 62.5 years, from the moment a new cohort enters the economy.

Following Galí (2021) and Bonchi & Nisticò (2024) all "living" households also face a constant probability of becoming inactive. As in Bonchi & Nisticò (2024) all inactive consumer have permanently lost access to the labour and asset markets. The probability of an active household becoming inactive is set to $(1 - f) = 0.216\%$ resulting in the steady-state stock of the active households of $\xi = 65\%$. This value is consistent with both 0verage participation margin as shown by the data from the US Bureau of Labor Statistics (BLS) data[13] for the 1985 -2021.

The parametrisation of the labour market closely follows Dennis & Kirsanova (2021). As in Dennis & Kirsanova (2021),the exogenous (quarterly) separation rate, ρ, is set to 0.12. This value lies between the empirical estimates of Merz (1995) and Andolfatto (1996). The choice is also consistent with recent theoretical studies (e.g. Faia 2008; Blanchard & Galí 2010; Debortoli & Galí 2018; Komatsu 2023) who tend to choose a value for the separation rate between 0.07 and 0.15. This parameter value delivers a steady-state unemployment rate which is very close to the observed US quarterly average of 5.8%, as reported by the BLS[14].

Following, Shimer (2005) the elasticity of the matching function, ω, is set to 0.72. Now, by utilizing the Hosios condition (see Hosios 1990) which states that an economy is constrained efficient when the bargaining power, ς, is equal to the elasticity of the matching function with respect to vacancies, the bargaining power is set equal to the elasticity of the matching function ($\varsigma = \omega = 0.72$).

As in Dennis & Kirsanova (2021), the average matching efficiency ($\bar{\mu}$), in the matching function, is set to 0.66 which yields an equilibrium job-filling rate of approximately $q = 0.67$ and the

[12]See Period Life Table at www.ssa.gov.

[13]The data on the participation rate was the LNS11300000 and it taken from the BLS database (https://www.bls.gov/).

[14]I refer to the "LNS14000000" series which comes from the 'Current Population Survey (Household Survey)' for the period 1984- 2024.

average labour market tightness, θ, equal to about 0.97.

Next, the exogenous replacement rate, $\frac{b}{h \cdot w}$ equals 0.47, which is close to the observed (average) values for advanced economies (see Nickell & Nunziata 2001 and Shimer 2005). In line with Ljungqvist (2002) , the cost of posting a vacancy equals 20 percent of a workers quarterly wage-income, i.e. $\frac{\kappa}{w \cdot h}$ = 0.2. Since, inactive households are a mass of "Keynesian" consumers, the equilibrium exogenous government transfers made to inactive (T^r) are chosen to be approximately equal to 55% of the equilibrium pre-tax wage so that the model delivers a steady-state value for the cross-sectional inequality of about 0.26, in line with the estimates of Karabarbounis & Chodorow-Reich (2014).

Furthermore, the coefficient that controls the cyclicality of the matching efficiency is set to zero ($\mu = 0$) in the benchmark calibration. However, following the empirical evidence of Elsby et al. (2015) and Hall & Schulhofer-Wohl (2018), the paper also considers an alternative parametrisation with pro- cyclical matching efficiency, in which case $\mu = 1$.

The persistence of deterministic processes for productivity and the elasticity of substitution are set to 0.95 and 0.9, respectively. These parameter values follow Acharya et al. (2023) and Karaferis et al. (2024), who adopt the empirical estimates of Bayer et al. (2020). Following Dennis & Kirsanova (2021) the persistence of the deterministic process for the matching efficiency is set to 0.8. Whilst, the persistence of deterministic processes for government transfers to inactive households is set 0.97. In our framework, an "MIT" shock to the transfers made to the inactive population (T_t^r) is equivalent to a shock in government expenditure. In general such changes involve parliamentary procedures for most advanced economics and hence, are very persistent. Recent studies like Leith et al. (2019) and Le Grand & Ragot (2023) allow the persistence of of government expenditure to take values between 0.1 and 0.99. However, much of the focus lies in the short- run dynamics when persistent is high.

Moreover, the parametrisation of both the interest rate reaction function and the tax rule are kept simple. In the benchmark case, the monetary authority has only a price stabilisation objective. Since, as shown by Faia (2008), when the monetary rule reacts to output deviations is always welfare detrimental. As in Komatsu (2023), the paper follow the parametrisation of Taylor (1993) for the inflation coefficient ans set it to $\phi_\pi = 1.5$. Since interest rate adjusts more than 1-to-1 to a change inflation, the Taylor principle is met. As such, the baseline calibration represents the scenario of "hawkish" monetary policy. Similarly, if the central bank is pursuing "dovish" policy $(\phi_\pi < 1)$, then the inflation reaction coefficient is changed to $\phi_\pi = 0.9$. However, since the model abstracts from aggregate risk, the policy states are assumed to be fully-persistent ($\pi_{11} = \pi_{22} = 1$). As such, households can observe the current state (i.e. "hawkish" or "dovish") and have perfect foresight regarding how monetary policy is going to react in response to a so-called MIT shock.

The coefficient ϕ_b in the fiscal rule governs the speed at which taxes adjust to restore the annualized debt-to-GDP ratio to its exogenous equilibrium level. Across all specifications, ϕ_b is set to 0.04—the smallest value that ensures determinacy. This choice aligns with the findings of Leith et al. (2019), who show that even in models with finite-lived agents, it is optimal for aggregate debt to behave almost like a random walk. Moreover, as emphasized by Blanchard (2019) and Auerbach & Yagan (2025), fiscal policy has become increasingly passive, particularly in the U.S., where policymakers tend to favour rolling over debt rather than adjusting taxes. Therefore, a coefficient close to zero is an appropriate choice.

The rest of the fiscal parameters are calibrated based on empirical evidence. Following Leeper & Zhou (2021), who calibrate their model for the approximately same period, the parameter ρ is set to match the maturity of the outstanding debt $m = 20$ quarters since the average maturity of the US government debt is found to be about 5.4 years whilst the annualised debt to GDP ratio is found to be $+46\%$ [15]. However, in the aftermath of the Covid-19 pandemic, the outstanding government debt has been considerably higher thus, the paper also considers alternative parametrisations where the debt-to-GDP ratio takes values up to $+200\%$.

All computations presented in this paper were implemented using the RISE toolbox (see Maih 2015). More specifically, the code first solves (non-linearly) for the perfect foresight steady-state and then employs first-order perturbations around it to calculate the model dynamics. As discussed above, the paper abstracts from aggregate risk and only allows for a one-time autocorrelated unanticipated aggregate shock to the perfect foresight equilibrium path. This is the so-called MIT shock approach. Immediately, after impact, the households regain perfect foresight. Due to the similarities of the FLANK and the nested representative agent model, these MIT shocks are modelled in the same way, following Boppart et al. (2018).

[15] This calculation is done using data from the Federal Reserve Bank of Atlanta (https://www.atlantafed.org/) and is available in the the appendix of Leeper & Zhou (2021).

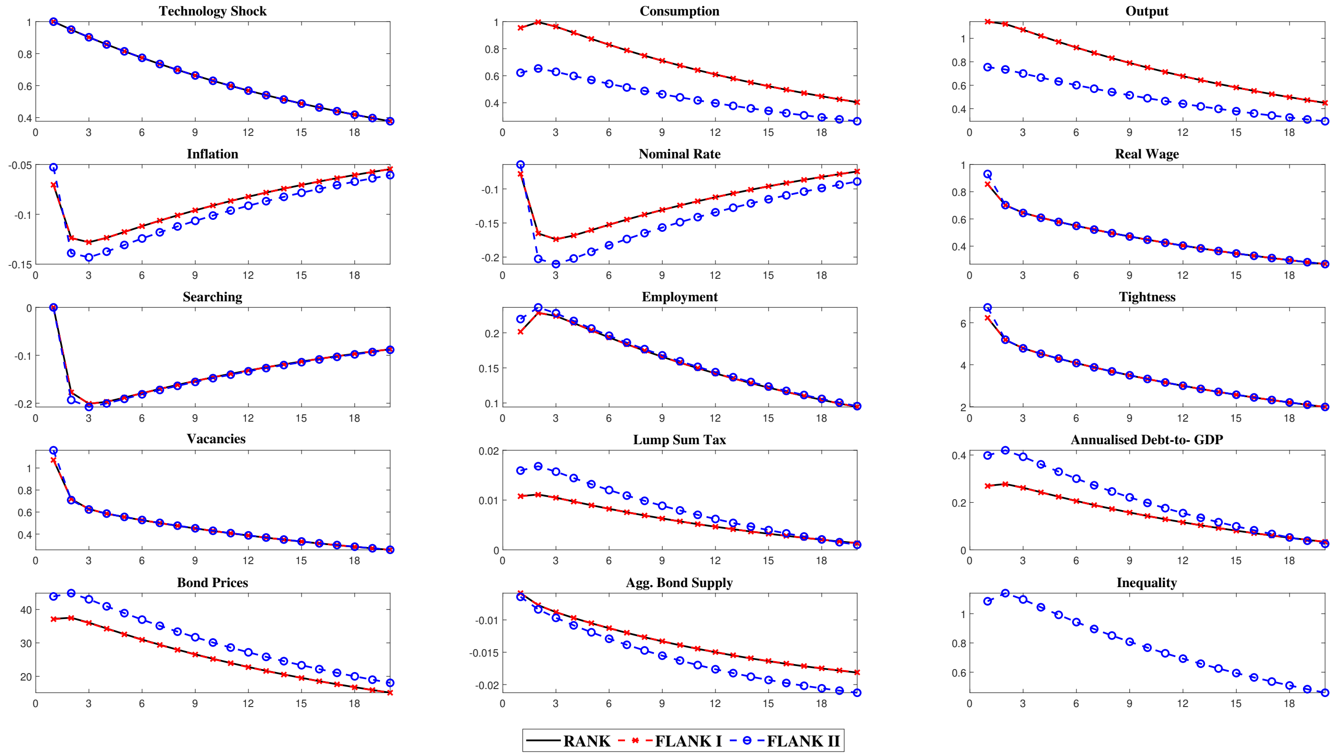

Figure 6: Dynamic responses to a positive technology shock. FLANK I refers to the standard FLANK model with only active consumers. FLANK II allows for stochastic transition to "inactivity".

Appendix A.6 Dynamic Responses to a TFP Shock

In this section, the paper explores the dynamic effects of a one-time positive total factor productivity (TFP) shock within the FLANK model. As in the main paper, the analysis abstracts from aggregate risk and focuses on the perfect foresight equilibrium path following an unanticipated autocorrelated aggregate shock.

This section first considers the effect of a one-off increase in aggregate productivity, comparing the dynamic responses across three model variants: the nested RANK, the standard FLANK with only active households (FLANK I), and the main FLANK model with stochastic transitions into inactivity (FLANK II). To avoid confusion, the study refers to FLANK II as the "baseline FLANK" environment.

Figure 6 compares the responses across models. While all specifications yield qualitatively similar directional responses, key quantitative differences emerge. In particular, the coexistence of active and inactive agents in FLANK II amplifies marginal propensity to consume (MPC) heterogeneity, leading to more sluggish aggregate responses.

The $+1\%$ TFP shock raises output proportionally, scaled by the employment rate and the share of active participants. Because FLANK II has a lower participation margin and consistently higher

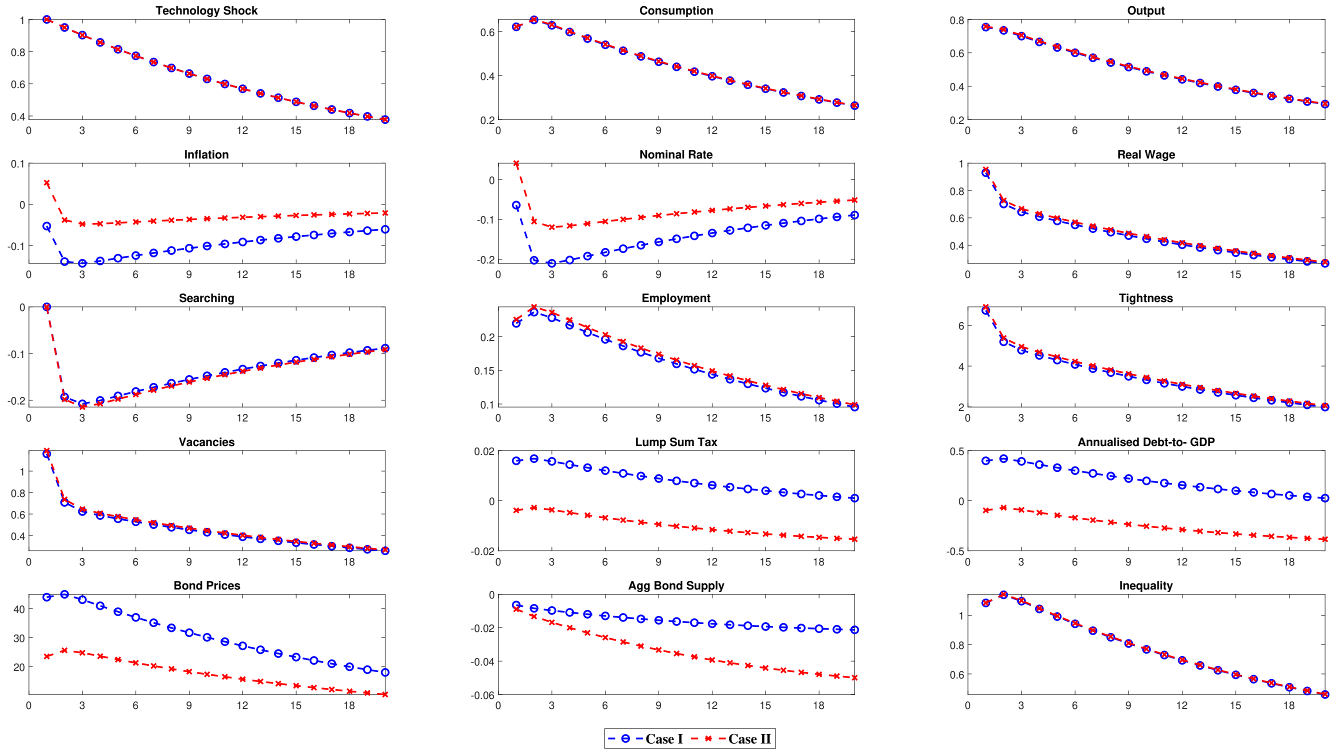

Figure 7: Dynamic responses to a positive technology shock. Case I refers to the benchmark case where the monetary authority targets both price and output stabilization. Case II removes the output gap from the interest rate rule.

unemployment, leading to a smaller initial output response than that of FLANK I or the RANK model. Moreover, the shock is highly persistent, and none of the specifications fully converge back to steady state within the 20-period (5-year) horizon.

In line with the empirical evidence of Elsby et al. (2015) and Hall & Schulhofer-Wohl (2018), the shock stimulates hiring with vacancies, wages, and employment rising, while search effort declines as more matches are made. These responses are dampened in FLANK II, where higher discounting reduces the value of employment, weakening household and firm surpluses and flattening the hiring condition.

Figure 7 presents monetary policy comparisons under two Taylor-type rules in the benchmark FLANK model. In Case I, the central bank targets both inflation and output ($\phi_\pi = 1.5, \phi_y = 0.125$). Output rises and inflation initially falls, prompting a modest increase in the real interest rate. In Case II, the central bank prioritizes inflation alone($\phi_\pi = 1.5, \phi_y = 0$). Here, inflation rises and the nominal interest rate responds more aggressively. These contrasting responses affect real interest rate dynamics and, consequently, the paths of asset prices and consumption.

Wage responses are consistent with Mortensen & Pissarides (1999): wages are pro-cyclical but lag behind output due to wage rigidities and Nash bargaining. Inflation affects wages indirectly—via marginal cost—rather than through standard New Keynesian Phillips curve dynamics. The path for aggregate consumption closely follows output, moderated by price-induced efficiency losses.

Inequality dynamics also differ across regimes. In Case II, a larger nominal interest rate response reduces bond prices, triggering valuation losses and a fall in financial wealth for active households. Since inactive agents consume fixed transfers, they are insulated. As shown in Proposition 4, only active agents' consumption responds to real interest rate changes, scaled by their population share. As a result, cross-sectional inequality rises initially.

Furthermore, interest rate shifts benefit younger/poorer active households through reduced borrowing costs, while older/richer cohorts see declines in asset income. However, strong revaluation effects from long-duration bonds amplify inequality. With persistent shocks and rigidities, convergence toward steady-state inequality is slow, and disparities among active households remain elevated over time.

Cyclicality of the Average Matching efficiency

In this section, the paper discusses the implications of allowing the (equilibrium) matching efficiency to be pro-cyclical instead of a-cyclical when the economy is experiencing an one-off autocorrelated aggregate shock. More specifically, the paper considers the dynamic responses to a one-off autocorrelated positive technology shock.

Figure 8 shows the effects of $+1\%$ unanticipated TFP shock. Under a pro-cyclical matching efficiency, the effects of the TFP shock on output and aggregate employment are amplified. Even for the same level of unemployed workers and/or vacancies, successful matching increases as output jumps above its equilibrium level.

Employment is experiencing more than double the increase in response to the positive TFP shock, compared to the benchmark FLANK model. As a result, aggregate output increases more than one- to- one with technology. Furthermore, the labour market itself becomes more resilient, which is evident from the fact that the tightness of the labour market initially jumps higher by more than 2%.

Furthermore, despite the fact that searching start from the same point in response to the aggregate shock, under pro-cyclical matching efficiency, searching drops further and remains below the equilibrium value for longer. This is hardly surprising since by definition searching is driven by the lagged value of employment, scaled by retention rate.

As anticipated, the positive technology shock leads to a more pronounced initial increase in output and aggregate consumption, driven by the pro-cyclical matching efficiency. This causes both inflation and the real interest rate to initially rise significantly higher compared to the benchmark case. As a result, inequality experiences a sharper initial surge and remains elevated compared to

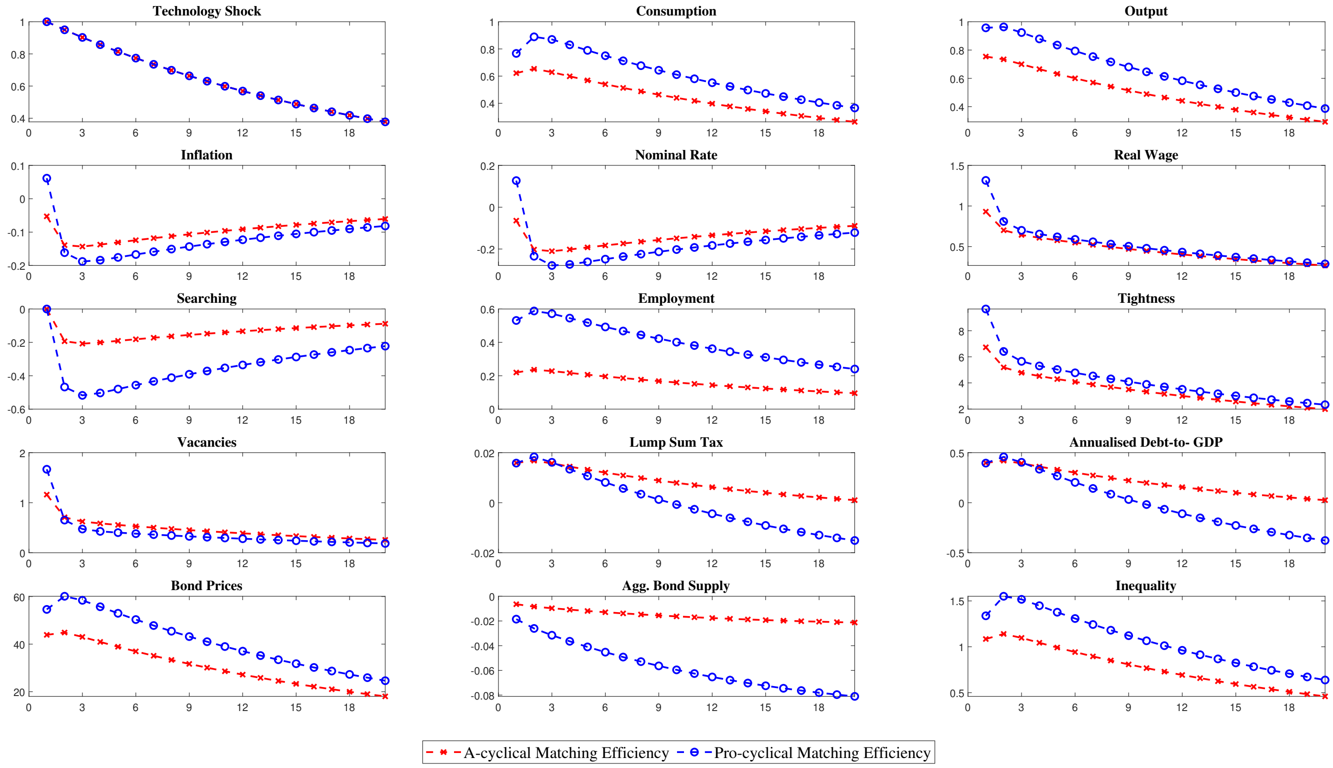

Figure 8: Policy response to an one-time unanticipated TFP shock. A-cyclical vs. Pro-cyclical matching efficiency.

the benchmark scenario until the economy returns back to its steady-state.

Once again, searching and employment move in opposite directions. As the number of successful matches increase, in response to the positive technology shock, both the unemployment pool and the number of people searching decreases. As a result, the benefit of being employed, as measured by the real wage rate and aggregate consumption, increases by more compared to the baseline scenario. Finally, in line with the empirical evidence, vacancies are increasing in response to the unanticipated positive technology shock as firms increase their hiring intensity- since the economy is booming. Overall, the benefits from an unexpected positive aggregate shock show significantly higher gains under pro-cyclical matching efficiency, in terms of economic efficiency and labour market dynamics but, at the cost of higher cross-sectional lineality along the perfect foresight equilibrium path. This is a direct result of assuming the presence of a ”Keynesian” population.

Hawkish vs. Dovish Monetary Policy

This subsection investigates how alternative monetary policy stances affect the dynamic adjustment of the FLANK model following a one-time autocorrelated technology shock. As in previous

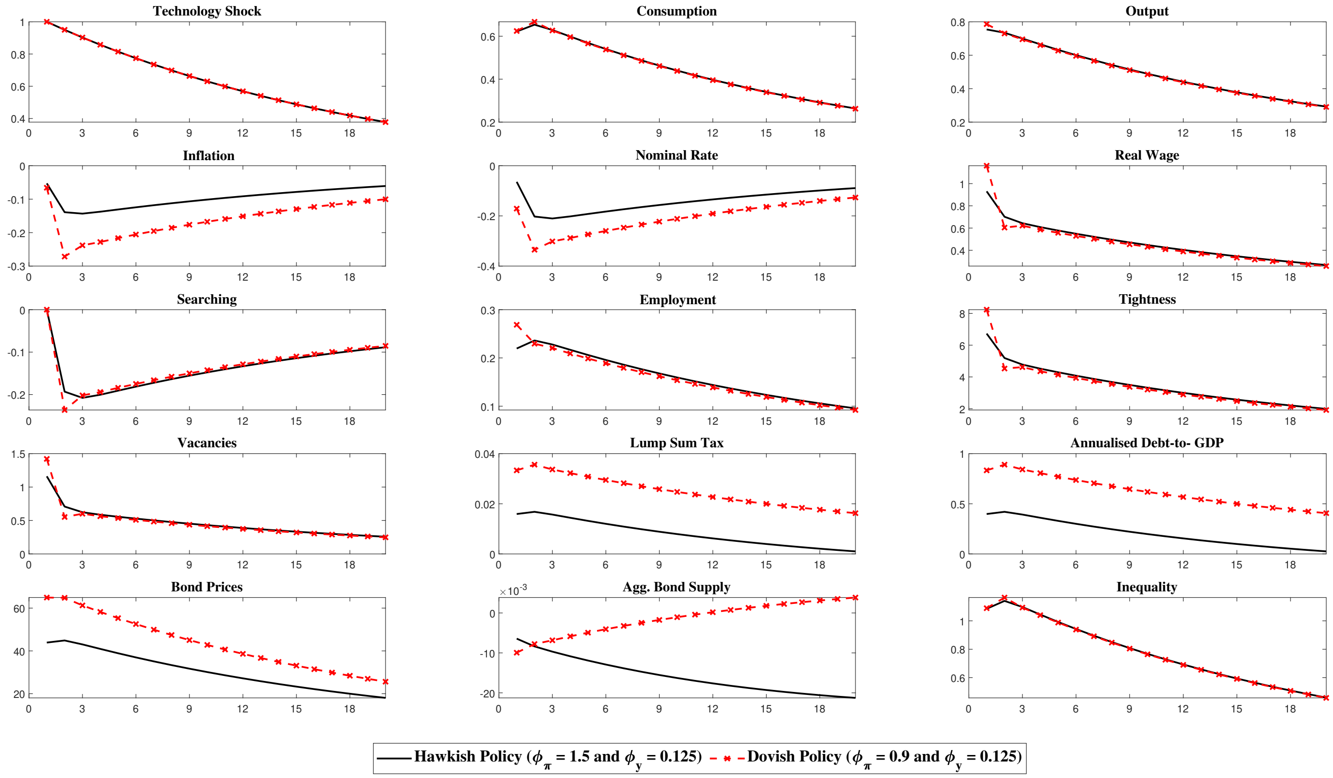

Figure 9: Dynamic responses to a one-off autocorrelated technology shock. Hawkish ($\phi_\pi = 1.5$) vs. Dovish ($\phi_\pi = 0.9$) monetary policy.

analyses, the study is concerned with the perfect foresight equilibrium path following the unanticipated TFP shock. The shock is realized in period 0, after which households fully anticipate the path of the economy and policy.

While the choice of monetary policy reaction coefficients does not influence the long-run equilibrium allocation, it plays a critical role in shaping the transitional dynamics. Figure 9 compares the responses under a hawkish regime ($\phi_\pi = 1.5$) and a dovish regime ($\phi_\pi = 0.9$).

Under the dovish regime, the central bank allows inflation to fall more sharply and recover more slowly in response to the positive TFP shock. Despite assigning lower priority to price stability, real interest rates still track inflation movements but less than one-for-one. The resulting fall in nominal rates induces large revaluation effects on financial portfolios. While aggregate real purchasing power rises across all consumers, the capital gains experienced by older, asset-rich active households outweigh borrowing gains for younger agents. As a result, initial inequality increases more under the dovish policy.

In contrast, the real economy—particularly the labour market—benefits more visibly from monetary accommodation. The larger decline in nominal interest rates under the dovish stance leads to a stronger expansion in output, vacancies, and employment. Wage growth and labour market tightness respond more forcefully as well, driven by heightened hiring incentives and a higher marginal value of job creation.

These differences in real activity are short-lived. After several periods, labour market variables—such as employment and vacancies—converge to a common trajectory, regardless of the monetary policy stance. However, in the early phases of adjustment, a dovish policy clearly accelerates labour market recovery and amplifies the benefits of the positive supply shock.

In summary, while both regimes deliver similar long-run outcomes, the dovish stance provides meaningful short-term gains by boosting output and employment more rapidly. These findings reinforce the view that, although monetary policy does not affect steady-state allocations, it plays a decisive role in managing the transition to full employment and stabilizing macroeconomic dynamics in the presence of aggregate shocks.

Appendix A.7 Welfare Analysis

Appendix A.7.1 The Social Welfare Function

To derive a closed-form expression for the social welfare metric, it is first necessary to eliminate all inter-generational inequality among active households. The literature offers two primary approaches to address this. The first, developed by Leith et al. (2019) and grounded in the seminal work of Calvo & Obstfeld (1988), separates the inter-temporal and distributional components of welfare to facilitate aggregation. This paper adopts an alternative strategy, following Acharya et al. (2023) and Angeletos et al. (2024*a*,*b*), the study introduces a cohort-specific lump-sum tax/transfer system. Specifically, each cohort of active households receives a differentiated lump-sum transfer $G^u_{s|t}$ such that $(1-\gamma)\sum_{s=-\infty}^{t}(f\cdot\gamma)^{t-s}G^u_{s|t}=0$, $\mathscr{W}^u_{s|t}=\mathscr{W}^u_{s+1|t}=...=\mathscr{W}^u_{t|t}=\mathscr{W}_t^u$ and thus, $c^u_{s|t}=c^u_{s+1|t}=...=c^u_{t|t}=c^u_t,\forall t$. This mechanism equalizes wealth across all active individuals within each period, ensuring identical consumption and saving choices. By eliminating inter-generational heterogeneity among active households, this approach simplifies the aggregation of preferences and allows the analysis to clearly focus on the trade-off between efficiency and cross-sectional equity. In particular, all heterogeneity in consumption is attributed to institutional or life-cycle transitions—namely, the transition of a fraction of active households to inactivity-rather than differences within the active population itself.

The social welfare metric is defined as the weighted sum of the lifetime utility of all generations both current and future. Formally:

$$W_0=\sum_{s=-\infty}^{\infty}\omega_s W_s$$

where the lifetime utility of a cohort born at time s is:

$$W_s = f \cdot W_s^u + (1-f) \cdot W_s^r$$

Here, W_s^u and W_s^r are the lifetime utilities of an active and inactive household born at time s, respectively, and f is the probability of remaining active. These utilities are given by:

$$W_s^u = \sum_{t=s}^{\infty} (\beta\gamma)^{t-s} \log(c_t^u)$$
$$W_s^r = \sum_{t=s}^{\infty} (\beta\gamma)^{t-s} \log(c_t^r)$$

And, the weights ω_s account for both the demographic structure and inter-temporal aggregation, following the perpetual youth tradition. More specifically,

$$\omega_s = \begin{cases} (1-\gamma)\gamma^{-s}, & s \leq 0 \\ \gamma^s, & s > 0 \end{cases}$$

For $s \leq 0$, the weight reflects the mass of individuals from each past cohort who are still alive today, accounting for both mortality and the declining size of past generations. For $s > 0$, the weight represents the planner's valuation of unborn cohorts, combining time discounting and survival probability.

Substituting into the social welfare definition gives:

$$\begin{aligned} W_0 = (1-\gamma) \sum_{s=-\infty}^{0} \gamma^{-s} \left[f \sum_{t=s}^{\infty} (\beta\gamma)^{t-s} \log(c_t^u) + (1-f) \sum_{t=s}^{\infty} (\beta\gamma)^{t-s} \log(c_t^r) \right] \\ + \sum_{s=1}^{\infty} \gamma^s \left[f \sum_{t=s}^{\infty} (\beta\gamma)^{t-s} \log(c_t^u) + (1-f) \sum_{t=s}^{\infty} (\beta\gamma)^{t-s} \log(c_t^r) \right] \end{aligned}$$

To ensure maximal tractability, the study swaps the order of summation. Thus, summing over calendar time t instead of cohort birth time s. This change exploits the law of large numbers: in each period, the cross-sectional distribution of household types converges to the population shares of active (ξ) and inactive ($1-\xi$) households, given constant probabilities for mortality and activity transitions. As a result, the period t social welfare metric can be expressed, as a deterministic weighted sum of the felicity functions of the two groups[16].

[16] As in the THANK literature (e.g. Bilbiie & Ragot 2021, Chien & Wen 2021) this result is motivated from the

The active utility terms become:

$$\sum_{s=-\infty}^{\infty} \omega_s \sum_{t=s}^{\infty} (\beta\gamma)^{t-s} \log(c_t^u) = \sum_{t=0}^{\infty} \beta^t \log(c_t^u) \cdot \underbrace{\sum_{s=-\infty}^{t} \omega_s \gamma^{t-s}}_{=\xi}$$
$$= \sum_{t=0}^{\infty} \beta^t \xi \cdot \log(c_t^u)$$

Similarly, the inactive terms are:

$$\sum_{s=-\infty}^{\infty} \omega_s \sum_{t=s}^{\infty} (\beta\gamma)^{t-s} \log(c_t^r) = \sum_{t=0}^{\infty} \beta^t \log(c_t^r) \cdot \underbrace{\sum_{s=-\infty}^{t} \omega_s \gamma^{t-s}}_{=1-\xi}$$
$$= \sum_{t=0}^{\infty} \beta^t (1-\xi) \cdot \log(c_t^r)$$

Putting it together, we obtain:

$$W_0 = \sum_{t=0}^{\infty} \beta^t \left[\xi \cdot \log(c_t^u) + (1-\xi) \cdot \log(c_t^r)\right] \tag{75}$$

Reformulating the Social Welfare Function via Inequality

Interestingly, the welfare function can also be expressed in terms of the cross-sectional consumption inequality index (see eq.(32)). The cross-sectional consumption inequality takes the form

$$S_t = 1 - \frac{c_t^r}{c_t^u}$$

And, since both sides are strictly positive as long as $(1-f) > 0$ then, a logarithmic transformation can be applied. Hence,

$$\log(c_t^r) = \log(c_t^u) + \log(1 - S_t) \tag{76}$$

Substituting this into eq.(75) gives:

existence of perfect insurance within type.

$$
\begin{aligned}
W_0 &= \sum_{t=0}^{\infty} \beta^t \left[\xi \cdot \log(c_t^u) + (1-\xi) \cdot (\log(c_t^u) + \log(1-S_t))\right] \\
&= \sum_{t=0}^{\infty} \beta^t \left[\log(c_t^u) + (1-\xi) \cdot \log(1-S_t)\right]
\end{aligned} \tag{77}
$$

This expression highlights the planner's trade-off: welfare is increasing in average (active) consumption c_t^u, but decreasing in cross-sectional inequality S_t, with the strength of the inequality penalty scaled by the stationary share of inactive households, $(1-\xi)$.

Appendix A.7.2 Welfare Analysis along the Equilibrium Path

In models without aggregate uncertainty, expected social welfare coincides with its deterministic counterpart along the perfect-foresight transition path. This modelling choice enhances transparency while retaining tractability. While introducing aggregate risk would allow for richer precautionary behaviour and endogenous volatility, it would also preclude closed-form aggregation. Achieving analytical solutions under aggregate risk typically requires strong assumptions on preferences—such as recursive utility forms, with the coefficient of relative risk aversion and the intertemporal elasticity of substitution both equal to unity. Absent these assumptions, one must resort to fully numerical methods (e.g., Krusell & Smith 1998, Maliar et al. 2010), which risk obscuring the underlying macro-distributional channels this paper aims to highlight. As such, the full-information, deterministic approach is widely used in the Blanchard (1985)–Yaari (1965) tradition and adopted in more recent heterogeneous-agent applications (e.g., Benhabib et al. 2016, Leith et al. 2019).

To evaluate the welfare consequences of alternative monetary stances, the paper simulates the FLANK model's transition path in response to a one-time increase in government transfers targeted at inactive households. This temporary shock reduces cross-sectional inequality by redistributing income toward agents without access to market earnings. However, the macroeconomic efficiency of the transition path—reflected in aggregate output, employment, and consumption—does depend on the degree of inflation targeting. This is particularly true when the government spending shock is highly persistent and, as a result, fails to stimulate aggregate demand due to the higher paths for government debt and taxes.

To quantify the associated welfare implications, the study computes the discounted sum of aggregate utility (see (77)) along the equilibrium transition path over 100,000 periods, ensuring full convergence to steady state. The inflation coefficient ϕ_π is varied across a grid from 0.9 (dovish) to 1.5 (hawkish), holding all other parameters fixed. Figure 10 reports the resulting level

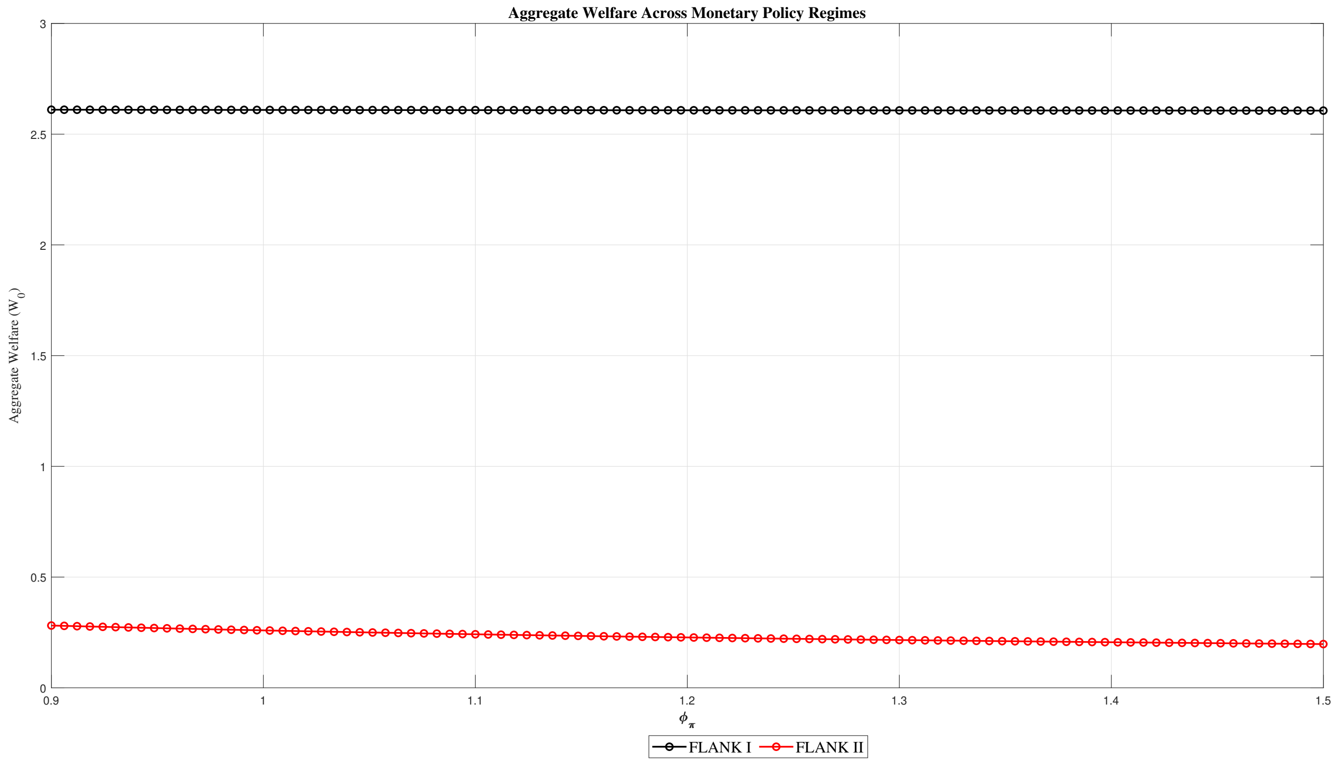

Figure 10: Aggregate welfare along the transition path following a one-time transfer to inactive households, under varying degrees of inflation targeting. FLANK I: Low persistence shock ($\rho_{tr} = 0.1$). FLANK II: High persistence shock ($\rho_{tr} = 0.97$).

of aggregate welfare under each regime, while Figure 11 depicts welfare losses relative to the dovish benchmark. The results reveal that more aggressive inflation targeting reduces aggregate welfare, despite identical distributional effects across regimes. This is because higher values of ϕ_π induce larger short-run contractions in output and employment, worsening the real economic cost of stabilizing inflation.

It is important to emphasize that while the transfer shock reduces inequality in all regimes, the distributional effects are invariant to monetary policy—at least in the short run. Instead, the welfare differences stem from heterogeneous general equilibrium responses in macroeconomic aggregates. In particular, dovish regimes deliver stronger recoveries in output, employment, and consumption, thus improving overall social welfare.

All in all, even though monetary policy does not alter the short-run distributional impact of the fiscal shock, it significantly shapes macroeconomic dynamics along the transition path. A more accommodative (dovish) stance—characterized by a lower ϕ_π—mitigates the contractionary effects of inflation stabilization and delivers higher social welfare. These findings reinforce the core message of the paper: in heterogeneous-agent economies, nominal stabilization policy entails real trade-offs that are crucial for welfare evaluation.

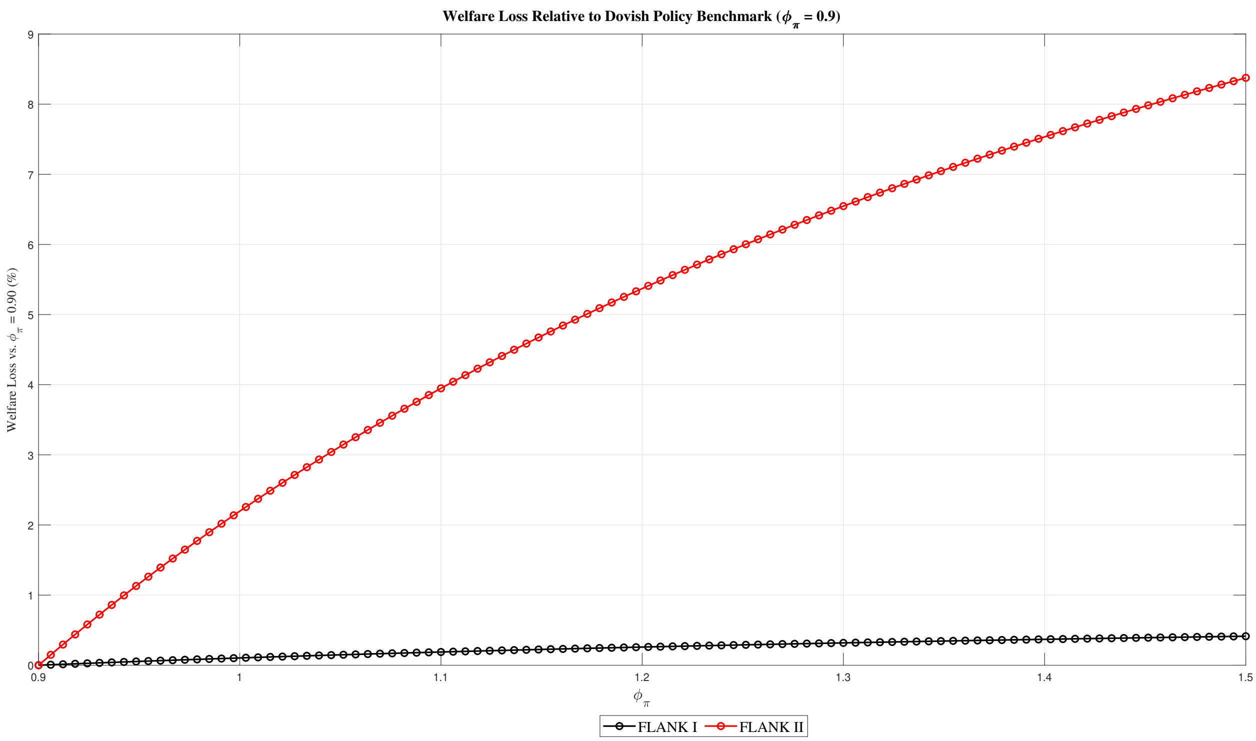

Figure 11: Welfare loss relative to the dovish benchmark ($\phi_\pi = 0.9$) following a one-time transfer shock, under varying degrees of inflation targeting. FLANK I: Low persistence shock ($\rho_{tr} = 0.1$). FLANK II: High persistence shock ($\rho_{tr} = 0.97$).