Monetary Policy, Labor Mobility and the Inflation-Inequality Trade-off*

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Abstract

We study the inflation-inequality trade-off and the distributional consequences of monetary policy in a model where wage inequality and wealth inequality are endogenous. To this purpose, we build an heterogenous agent model that combines incomplete markets, stemming from uninsurable risk and occasionally binding borrowing constraints, with a dynamic discrete occupational choice, and price and wage rigidity. In this model both uninsurable risk and inflation affect labor reallocation and participation, which in turn determines wage inequality and affects the distributional consequences of monetary policy. We show that labor mobility acts as a *cost push shock*: its decline raises the costs of recoveries and wage inequality, thereby worsening the output-inflation trade-off. We show that the model can replicate business cycle moments of macro and inequality variables and we validate that its monetary transmission mechanism, along the income distribution, through local projection methods and using CPS data and high frequency identified monetary policy shocks.

Keywords: *Occupational mobility, Incomplete Markets, Wage Inequality.*

JEL classification: *E5, J22, J23, J31, J62, E21, D31.*

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1. Introduction

The question of the distributional consequences of monetary policy and how inequality interacts with the policy trade-offs is at the center stage in the policy and academic debate. The recent spikes in inflation has further worsened the policy trade-offs, also since it affects labor demand and supply across occupations, and hence inequality. Such novel dimensions of the monetary policy trade-offs can be studied only through a model in which wage inequality is endogenously determined by the forces of labor demand and supply across occupational islands.

Models with exogenous processes for uninsurable risk, or employment states, allow researchers to study the distributional consequences of monetary policy for wealth inequality through the consumption-saving channel, but lack an endogenous response of labor earning inequality. Models of the Roy (1951) tradition instead study how occupational choices determine wage inequality, but the efficient allocation that emerges therein, and the lack of incomplete markets, leaves no scope for monetary policy analysis. We study the above mentioned question with a model merging occupational mobility, which renders the labor earning distribution endogenous, incomplete markets (see Bewley (1980)) and nominal rigidities, with the last two justifying a role for monetary policy. In this model both incomplete markets and inflation can affect occupational reallocation, or else labor demand and supply across occupational islands. We show that the core mechanism lies in labor mobility acting as a cost push shock, hence creating an additional inflation-inequality trade-off. A decline in labor reallocation, which may stem from an increase in risk or an increase in inflation, raises inequality and impairs recoveries, thereby flattening the Phillips curve and steepening the severity of the policy trade-offs. Given the novel policy transmission channels that we examine, we validate our model against macro and micro evidence. We show that it can replicate business cycle statistics of macro variables and can endogenously generate countercyclical inequality. Furthermore, we estimate, using CPS data and panel time series methodologies, impulse responses, along the income distribution, of occupational reallocation and wage growth to high frequency identified monetary policy shocks and show that they are in line with those implied by the model.

The model is a dynamic general equilibrium with incomplete markets, both uninsurable risk (see Bewley (1980)-Aiyagari (1994)) and borrowing constraints, where households, heterogenous also in skills, make consumption and portfolio decisions as well as occupational decisions through a Rust (1987) dynamic discrete occupational choice.[1] The production sector is made of monopolistic competitive firms, choosing labor demand for each occupation and facing nominal rigidities. In this model the dynamic of inequality is endogenous to shocks and policy and depends on the equilibrium between heterogenous demand and supply in each occupation. The occupational choice is determined by the terms of comparative advantage,[2] and by the value functions, which in turn are affected by uninsurable risk. This also implies that in our model households self-insure not only through the consumption-saving margin, but also through the labor participation and mobility margin. Finally, we extend the model to include wage rigidities, as they allow for labor demand frictions and deviations from the divine coincidence (see Blanchard and Galí (2010)).

First, we show analytically that the core mechanism of the model lies in the fact that labor mobility acts as a cost push shock. Its decline, which can come from an increase in income risk or an increase in inflation, increases wage inequality and dampens the recovery, thereby flattening the Phillips curve and worsening the output-inflation trade off. Numerically we confirm that the sacrifice ratio worsens when inequality rises, that is when labor mobility declines, and even more so under wage rigidity.

To understand the channels behind the core result, we examine the model's transmission mechanism through impulse responses to a monetary policy shock. On impact a monetary contraction leads to a stronger decline in labor demand and in wages for bottom earners, since firms layoff the least productive first. For bottom earners wages decline even below the outside options, hence those move out of the labor force: this forces firms to increases wages again in subsequent periods to regain those workers. The others, who face the potential losses in disposable income and the risk of becoming liquidity constraints, increase their labor

1 Households choose occupations comparing the optimized, with respect to consumption, dynamic value functions across occupations. The solution method involves an endogenous grid point, extended with a value function iteration for the discrete choice along the lines of Iskhakov et al. (2017).

2 To improve the model fit we calibrate the comparative advantage matrix by clustering ONET skill requirements.

mobility seeking to move to higher paying jobs. Overall mobility increases in response to a monetary contraction.

We make sure that the model is fit for policy analysis we also validate it against macro and micro empirical evidence. First, we show that it can replicate the business cycle moments of macro variables and can generate endogenously counter-cyclical inequality. Furthermore, the indivisible nature of labor supply, induced by the discrete choice, allows us to reconcile the low micro elasticities of labor supply with the high macro fluctuations of employment, and the low volatility of wages. At last, through panel local projection methods (see Jordà (2005)) we estimate the impact of high frequency identified monetary policy shocks on monthly CPS data for separations (our measure for labor demand), occupational reallocation (our measure of mobility), and real earnings, along the income distribution. Likewise in the model, separations increase more for bottom earners, occupational reallocation increases and real wage growth for employed workers is positive for bottom earners. Results are valid also with a Heckman (1974) correction and with Mincer earnings.

Related Literature. Several recent studies have assessed the role of monetary policy shocks for either earning inequality (see Coibion et al. (2017) or Amberg et al. (2021)) or for the heterogenous response of job flows and reallocation (see Engbom and Moser (2017) for evidence on Brasil or Broer et al. (2021) for evidence on Germany). Our own evidence, and the model's transmission mechanism, relates to both.[3] Many of the studies examine overall earning inequality, including the income of unemployed agents; our focus is on wage inequality of employed workers, since the main mechanism of our model goes through labor mobility.

There is a growing, and by now very large, literature that studies the monetary policy transmission mechanism in models with incomplete markets and nominal rigidities. Those models usually study the distributional consequences of policies for wealth inequality focusing on the consumption-saving channel. The modeling frameworks closer to ours, in discrete time and with non-degenerate risk distribution, are those presented in Auclert (2019). We augment those incomplete market economies with occupation choice, a feature which makes

3 Since our focus is on the heterogeous responses, for our empirical analysis we rely on a cross-sectional time series specification with pseudo panel like Cloyne et al. (2020).

the dynamic of the labor earning inequality endogenous to shocks and policies. As such it allows us to study the monetary transmission mechanism through the labor market. Other studies examine the role of labor supply or demand for policy in incomplete market models. Ferriere and Navarro (2025) and Chang and Schorfheide (2013) introduce a discrete participation choice in a model with incomplete markets, while Gornemann et al. (2016) provides an incomplete market models with labor demand frictions. Faia and Shabalina (2022) apply the multi-sector and flexible price version of our model with incomplete markets and Roy (1951) mobility to study the impact of technological shifts on reallocation on inequality. Graves et al. (2023) studies the monetary transmission distinguishing labor supply and demand.

We introduce a dynamic discrete optimal choice across occupations along the lines of Boskin (1974), Rust (1987), Keane and Wolpin (1997). Those frameworks did not include uninsurable risk and liquidity constraints, which have been documented to impact labor supply and mobility (see evidence in Card et al. (2007) or Chetty et al. (2011)). We obtain a tractable form for the occupational shift probabilities through type I amenity shocks, which capture the concept of comparative advantage a' la Rosen (1986). Solving a model with uninsurable risk and a discrete choice involves a new numerical routine, which includes a fixed point iteration on the value function. The method we employ builds on Iskhakov et al. (2017).

2. Incomplete Market Macro Model with Occupational Mobility

We build an incomplete market dynamic general equilibrium model, featuring uninsurable risk a' la Bewley (1980)-Aiyagari (1994) and borrowing constraints, and where in each period households-workers, featuring ex ante heterogeneity in skills, make consumption-saving, portfolio and occupation decisions. The probabilities of moving across occupations are not exogenous nor do they depend on some aggregate states, but are the result of an optimizing decision, formalized through a dynamic discrete choice optimization a' la Rust (1987). A

fixed point iteration, between the two optimization stages and between the value functions and the occupational shift probabilities, characterizes the equilibrium. The production sector is composed of monopolistic competitive producers, which employ workers through a menu of partially substitutable occupations, use capital and face adjustment costs on prices and capital. The labor market therefore features heterogenous demand and supply. Nominal rigidities are introduced to study monetary policy. Adjustment costs on capital improve the fit of the investment dynamic. We examine also a model variant with wage rigidity, hence also with a friction on labor demand, which calls for deviations from price stability.

2.1. Consumption-Saving and Occupational Choice

Households can be employed in one of many different occupations indexed by $o \in \{1, ..., O\}$ or non-employed, with $O+1$ being the out of employment state. Households differ in their skills and, hence, efficiency units of labor that they can provide in each occupation. The household's skill-type (hereafter, type) is indexed by $j \in \{1, ..., J\}$. The mass of each type j is denoted by m_j. Each type j is characterized by vector $\boldsymbol{\gamma_j}$, which describes the efficiency units that the type j can provide in each occupation $o \in \{1, ..., O\}$. $\mathbf{\Gamma}$ is the $J \times O$ matrix that stacks the vectors for all J types. The matrix captures the household's comparative advantage for each occupation. At the beginning of each period t, employed and non-employed households experience an idiosyncratic productivity shock e_t. The shock follows an n_e-state Markov process with transition matrix $P(e_{t+1}|e_t)$ and stationary distribution $\pi(e)$ and is independent of the household's skill type, or the current occupation. Real after-tax labor income $\xi^o_{j,t}$ of individual of type j at time t in occupation o is a function of efficiency units of type j in occupation o, γ^o_j, the idiosyncratic productivity state e_t, the real wage in occupation o, w^o_t, the labor hours n_t, and the tax rate τ_t: $\xi^o_{j,t} = (1-\tau_t)e_t w^o_t \gamma^o_j n_t$. We denote by $\boldsymbol{\xi_{j,t}}$ the $(O+1)$-dimensional vector of the real after-tax labor income of type j individuals in time t in all possible occupations and in the non-employment state, whose value we denote by h. Furthermore, in each period households draw an idiosyncratic occupational-preference shock ϕ^o_t for all $o \in O+1$, in terms of utility, which is i.i.d. across workers and occupations and follows a type 1 extreme value distribution, with density $f(\phi)$ and cumulative distribution

function $F(\phi)$. Those capture the compensating differentials across occupations (see Rosen (1986)). In the consumption-saving stage households also make portfolio decisions: those allow us to introduce in the model a realistic dynamic for wealth inequality, and its components.

In each period a household of type j chooses an occupation $o \in \{1, ..., O, O+1\}$, as well as consumption and savings. Hours are equal across occupations $n^o = n$ for all o and are chosen by a representative household head. The state in period t is $(e_t, a_{t-1}, b_{t-1}, \boldsymbol{\phi_t})$ where e_t is the idiosyncratic productivity shock, a_t are the illiquid assets, b_t are the liquid assets, and $\boldsymbol{\phi_t}$ is the $(O+1)$-vector of the taste shocks across all occupations and the non-employment state. A household of type j maximizes the following value function, given the state space:

$$\begin{aligned} V_j(e_t, a_{t-1}, b_{t-1}, \boldsymbol{\phi_t}) &= \max_{o_t, c_t, a_t, b_t} u(c_t, n_t^o) + \phi_t^o + \beta E_t \bar{V}_j(e_{t+1}, a_t, b_t, \boldsymbol{\phi_{t+1}}) \\ \text{s.t.} \quad & c_t + a_t + b_t = \xi_{j,t}^o + (1 + r_t^a) a_{t-1} + (1 + r_t^b) b_{t-1} - \Phi(a_t, a_{t-1}) \\ & a_t \geq 0, \quad b_t \geq \underline{b} \end{aligned} \tag{1}$$

where E_t denotes the joint expectation operator with respect to the earning shock, the taste shock and the aggregate shocks. Furthermore r_t^a and r_t^b are the interest rates on illiquid and liquid assets, respectively, $\Phi(.)$ is the convex portfolio adjustment costs defined below, and β is the time discount factor. The instantaneous utility takes the standard separable form $u(c, n) = \frac{c^{1-\sigma}}{1-\sigma} - \frac{n^{1+\rho}}{1+\rho}$. Equations $a_t \geq \underline{a}$ and $b_t \geq \underline{b}$ are borrowing constraints on illiquid and liquid assets respectively.

We solve the consumption-saving and occupational decisions in two stages. Conditional on an occupational choice o, each household of type j in period t chooses consumption, c_t, savings in liquid, b_t, and illiquid, a_t, assets to maximize the following value function:

$$\begin{aligned} V_j^o(e_t, a_{t-1}, b_{t-1}) &= \max_{c_t, a_t, b_t} u(c_t, n_t) + \beta E_t V_j(e_{t+1}, a_t, b_t, \boldsymbol{\phi_{t+1}}) \\ \text{s.t.} \quad & c_t + a_t + b_t = \xi_{j,t}^o + (1 + r_t^a) a_{t-1} + (1 + r_t^b) b_{t-1} - \Phi(a_t, a_{t-1}) \\ & a_t \geq 0, \quad b_t \geq \underline{b} \end{aligned} \tag{2}$$

where $V_j^o(e_t, a_{t-1}, b_{t-1})$ is the value function in time t of type j conditional on occupation o and ϕ_t^o evaluated at 0. The portfolio adjustment costs take the functional form: $\Phi(a_t, a_{t-1}) =$

$\frac{\chi_1}{\chi_2}\left|\frac{a_t-(1-r_t^a)a_{t-1}}{(1+r_t^a)a_{t-1}+\chi_0}\right|^{\chi_2}[(1+r_t^a)a_{t-1}+\chi_0]$, with $\chi_0>0$, $\chi_1>0$ and $\chi_2>1$.[4] The Euler conditions with respect to liquid and non-liquid assets read as follows:

$$u_c(c_t|o)=\lambda_t+\beta E_e\partial_b\overline{V}_j(e_{t+1},a_t^o,b_t^o) \tag{3}$$

$$u_c(c_t|o)[1+\Phi_1(a_t,a_{t-1})]=\mu_t+\beta E_e\partial_a\overline{V}_j(e_{t+1},a_t^o,b_t^o) \tag{4}$$

where by envelope condition: $\partial_b\overline{V}_t(e_t,a_{t-1},b_{t-1})=\frac{\sum_{o_t}exp(\tilde{V}_t^o(e_t,b_{t-1},a_{t-1}))u'(c_t^*|o_t)(1+r_t^b)}{exp(\overline{V}_t(e_t,a_{t-1},b_{t-1}))}$ and $\partial_a\overline{V}_t(w_t,a_{t-1},b_{t-1})=\frac{\sum_{o_t}exp(\tilde{V}_t^o(e_t,b_{t-1},a_{t-1}))u'(c_t^*|o_t)(1+r_t^a-\Phi_2(a_t^*,a_{t-1}))}{exp(\overline{V}_t(e_t,a_{t-1},b_{t-1}))}$ and where $u_c(c_t|o)$ is the marginal utility of consumption in occupation o. Labor hours are chosen for the family as a whole and are determined through the intra-temporal first order condition:

$$\varphi n_t^\rho=\sum_{o=1}^{O}\sum_{j=1}^{J}m_j\int u_c(e_t,a_{t-1},b_{t-1},o_t)\theta_j(o|e_t,a_{t-1},b_{t-1})\frac{\partial\xi_{j,t}^o}{\partial n_t^o}dD_j(e_t,a_{t-1},b_{t-1}) \tag{5}$$

where $\theta_j(o|e_t,a_{t-1},b_{t-1})$ are optimal probabilities for each occupation, derived further below. The solution to the optimization problem is a collection of type- and occupation-specific policy functions, $c_j^o(e_t,a_{t-1},b_{t-1})$, $a_j^o(e_t,a_{t-1},b_{t-1})$ and $b_j^o(e_t,a_{t-1},b_{t-1})$, that depend on the path $\left\{r_s^a,r_s^b,\tau_s\right\}_{s>t}$, taken as given by households.

Given the choice of savings, a household of type j chooses occupation o by comparing value functions from each choice, evaluated at the optimal consumption-saving policies:

$$o=\text{argmax}_{[1,.....,O,O+1]}[\tilde{V}_j^o+\phi_t^o] \tag{6}$$

where $\tilde{V}_j^o$ is the value function $V_j^o(e_t,a_{t-1},b_{t-1})$, evaluated at the optimal consumption-saving policy $c_j^o(e_t,a_{t-1},b_{t-1})$, $a_j^o(e_t,a_{t-1},b_{t-1})$ and $b_j^o(e_t,a_{t-1},b_{t-1})$.[5] The solution o to the occupational choice problem (6) satisfies: $F(\tilde{V}_j^o+\phi_t^o\geq\tilde{V}_j^{o'}+\phi_t^{o'})\forall o'\neq o\in O+1$, where $F(.)$ is the cumulative density of the taste shock. Taking expectations with respect to the

4 $\Phi(a_t,a_{t-1})$ is bounded, differentiable, and convex in both arguments.

5 We skip the dependence of the value function on the state for notational convenience. Also note that the taste shock, ϕ_t^o, only affects preferences for occupation and does not influence the consumption-saving decision.

current period taste shocks of the household value function in (1), and evaluating them at the optimal consumption-saving choice yields:

$$E_{\boldsymbol{\phi}}\tilde{V}_j(e_{t+1}, a_t, b_t, \boldsymbol{\phi_{t+1}}) = E_{\boldsymbol{\phi}} \max_{o_t} \left[\tilde{V}_j^o(e_t, a_{t-1}, b_{t-1}) + \phi_t^o\right] = \ln\Big(\sum_{o_t} \exp(\tilde{V}_j^o(e_t, a_{t-1}, b_{t-1}))\Big) \tag{7}$$

where the last equality follows from the properties of the Gumbel distribution. Combining (6) and (7) yields the following closed-form solution for the occupational choice probabilities:

$$\theta_j(o|e_t, a_{t-1}, b_{t-1}) = \frac{\exp(\tilde{V}_j^o(e_t, a_{t-1}, b_{t-1}))}{\sum_o \exp(\tilde{V}_j^o(e_t, a_{t-1}, b_{t-1}))}. \tag{8}$$

Equation 8 shows that the probabilities of moving across occupations and the non-work state depend on the households' value functions, hence on earning shocks, e, on wealth and the wages that clear the markets in each occupational island.

We obtain the aggregate policy functions for consumption and asset holdings by integrating individual and occupation specific policy functions through the distribution $D(e_t, A_-, B_-,) = Pr(e = e_t, a_{t-1} \in A_-, b_{t-1} \in B_-)$, and aggregating across all occupations $o \in O+1$ and across all household types $j \in J$. The aggregate policy functions for every period $i \geq t$ are: $\mathcal{A}_t(r_i^a, r_i^b, \tau_i, N_i) = \sum_{j=1}^J m_j \sum_{o=1}^{O+1} \Big(\int a_j^o(e_t, a_{t-1}, b_{t-1})\theta_j(o|e_t, a_{t-1}, b_{t-1})dD_j(e_t, a_{t-1}, b_{t-1})\Big)$, $\mathcal{B}_t(r_i^a, r_i^b, \tau_i, N_i) = \sum_{j=1}^J m_j \sum_{o=1}^{O+1} \Big(\int b_j^o(e_t, a_{t-1}, b_{t-1})\theta_j(o|e_t, a_{t-1}, b_{t-1})dD_j(e_t, a_{t-1}, b_{t-1})\Big)$ and $\mathcal{C}_t(r_i^a, r_i^b, \tau_i, N_i) = \sum_{j=1}^J m_j \sum_{o=1}^{O+1} \Big(\int c_j^o(e_t, a_{t-1}, b_{t-1})\theta_j(o|e_t, a_{t-1}, b_{t-1})dD_j(e_t, a_{t-1}, b_{t-1})\Big)$, where N_i is total hours and is given by: $N_t = n_t \sum_{j=1}^J m_j \int \theta_j(o|e_t, a_{t-1}, b_{t-1})dD_j(e_t, a_{t-1}, b_{t-1})$. The total effective labor supply in occupation o is aggregated across efficiency units of labor and idiosyncratic shocks:

$$L_t^{o,Supply} = n_t \sum_{j=1}^J m_j \gamma_j^o \int e_t \theta_j(o|e_t, a_{t-1}, b_{t-1})dD_j(e_t, a_{t-1}, b_{t-1}) \tag{9}$$

2.2. Monopolistic Production Sector

Monopolistic competitive firms produce output by combining total labor input and capital using the production function: $y_t = z_t k_{t-1}^{\nu} L_t^{1-\nu}$, where y_t is the variety, z_t is the total factor

productivity and ν is the capital share, k is capital and L is labor input. The optimal demand for each variety is given by $p_t = \left(\frac{Y_t}{y_t}\right)^{\frac{1}{\eta}} P_t$, where P_t is the aggregate price index. Each firm employs a menu of occupations, in terms of occupation-specific effective labor hours $l_{o,t}$, with different shares α_o and elasticity of substitution σ. The labor aggregator is: $L_t = \left(\sum_{o=1}^{O} \alpha_o l_{o,t}^{\sigma}\right)^{\frac{1}{\sigma}}$. The elasticity of substitution across occupations, $\frac{1}{\sigma}$, determines the extent of reallocation across occupations. Firms choose labor demand, $l_{o,t}$, for each occupation $o \in O$, capital demand, k_t, and investment, I_t, to maximize the sum of future discounted real profits, which recursively reads as follows:

$$
\begin{aligned}
J_t\left(k_{t-1}\right) = \max_{p_t, k_t, I_t, l_{o,t}} \quad & \left\{ \frac{p_t}{P_t} y_t - \sum_{o=1}^{O} w_t^o l_{o,t} - I_t - \frac{1}{2\varepsilon_I} \left(\frac{k_t - k_{t-1}}{k_{t-1}}\right)^2 k_{t-1} \right. \\
& \left. - \frac{\eta}{2\kappa} \ln(1+\pi_t)^2 Y_t + \frac{J_{t+1}(k_t)}{1+r_{t+1}} \right\} && (10) \\
\text{s.t.} \quad & k_t = (1-\delta) k_{t-1} + I_t - k_t^{adj} && (11) \\
& p_t = \left(\frac{Y_t}{y_t}\right)^{\frac{1}{\eta}} p_t && (12) \\
& y_t = z_t k_{t-1}^{\nu} L_t^{1-\nu} && (13)
\end{aligned}
$$

where equation (11) is the capital accumulation equation, δ is the depreciation rate of capital, and $\frac{\eta}{2\kappa} \ln(1+\pi_t)^2 Y_t$ is the quadratic price adjustment cost. Firms also face quadratic adjustment costs on physical capital, $k_t^{adj} = \frac{1}{2\varepsilon_I} \left(\frac{k_t - k_{t-1}}{k_{t-1}}\right)^2 k_{t-1}$, which lead to a variable price of capital.[6] The first order condition for labor demand is:

$$
l_{o,t} = \left(\frac{mc_t (1-\nu)\alpha_o}{w_t^o}\right)^{\frac{1}{1-\sigma}} \left(z_t k_{t-1}^{\nu}\right)^{\frac{\sigma}{(1-\nu)(1-\sigma)}} y_t^{\frac{\sigma-1+\nu}{(1-\nu)(\sigma-1)}}, \tag{14}
$$

Defining q_t as the Lagrange multiplier on the capital accumulation and, hence, as the shadow price of capital, the firm's first order condition for the capital stock is:

$$
\begin{aligned}
(1+r_{t+1}) q_t = \nu z_{t+1} \left(\frac{L_{t+1}}{k_t}\right)^{1-\nu} mc_{t+1} - & \\
- \left[\frac{k_{t+1}}{k_t} - (1-\delta) + \frac{1}{2\varepsilon_I} \left(\frac{k_{t+1} - k_t}{k_t}\right)^2\right] + \frac{k_{t+1}}{k_t} q_{t+1} & && (15)
\end{aligned}
$$

6 Including those costs improves the empirical performance of investment and allows us to compare results to the literature, in which those costs are commonly used.

where mc_{t+1} is the Lagrange multiplier on the production constraint and represents real marginal cost. The first order condition with respect to investment leads to the price of capital: $q_t = 1 + \frac{1}{\varepsilon_I}\left(\frac{k_t - k_{t-1}}{k_{t-1}}\right)$. Finally, the first order condition with respect to prices leads to the Phillips curve:

$$\log(1+\pi_t) = \kappa\left(\frac{p_t}{P_t}\right)^{-\eta}(mc_t - \frac{1}{\mu_p}\frac{p_t}{P_t}) + \frac{Y_{t+1}}{Y_t}\log(1+\pi_{t+1})\frac{1}{1+r_{t+1}} \tag{16}$$

where $\mu_p = \frac{\eta}{\eta-1}$.

2.3. Equilibrium Conditions and Policy

A competitive financial intermediary collects the funds from heterogenous households and invests them either in firms' equities or in government bonds. Let r_t denote the ex-post return on government bonds. Let v_t be the ex-dividend price of equities and d_{t+1} be the firm dividend. The real return on equity is $\frac{d_{t+1}+v_{t+1}}{v_t}$. The no-arbitrage condition, between equity and bond returns, implies that: $v_t = \frac{E_t(d_{t+1}+v_{t+1})}{1+E_t r_{t+1}}$. Given this, the combined return on illiquid assets is:

$$(1+r_t^a) = \left(\frac{v_t}{\mathcal{A}_t}\right)\frac{d_t + v_t}{v_{t-1}} + \left(1 - \frac{v_t}{\mathcal{A}_t}\right)(1+r_t) \tag{17}$$

The government pays interest on the constant level of government debt B^g. The return on liquid assets is set by a representative competitive financial intermediary, which transforms illiquid into liquid assets through a technology that operates at a proportional cost ψ. Arbitrage between the two assets, coupled with a zero profit condition on the intermediary, leads to the following return on liquid assets: $r_t^b = r_t - \psi$.

Fiscal policy follows a balanced-budget policy: $\tau_t \sum_{o=1}^{O} w_t^o l_{o,t} = r_t B^g + G_t$, where G_t is government expenditures. Monetary policy follows a classical Taylor-type rule, which endogenously responds to macroeconomic conditions as follows: $i_t = r_t^* + \phi_\pi \pi_t + \phi_y(Y_t - Y_{ss})$, where i_t is the monetary policy rate, ϕ_π is the weight on inflation π_t, ϕ_y is the weight on output gap, $(Y_t - Y_{ss})$, i_t is the nominal interest rate, r_t^* is the natural interest rate, which is equal to the real interest rate in the steady state, and the Fischer relation holds $1 + r_t = \frac{1+i_{t-1}}{1+\pi_t}$.

Finally, market clearing conditions hold. Wages are determined in equilibrium by equating labor supply and demand for each occupation, hence:

$$\underbrace{L_t^{o,Demand} = l_{o,t}}_{Demand} = \underbrace{n_t \sum_{j=1}^{J} m_j \gamma_j^o \int e_t \theta_j(o|e_t, a_{t-1}, b_{t-1}) dD_j(e_t, a_{t-1}, b_{t-1}) = L_t^{o,Supply}}_{Supply} \tag{18}$$

Asset market clearing is given by: $\mathcal{A}_t + \mathcal{B}_t = v_t + B^g$. Aggregate supply of goods is equal to aggregate demand of goods, hence: $Y_t + hL_t^{O+1} = \mathcal{C}_t + G_t + I_t + \psi\mathcal{B}_t + \Phi_t,$, where $\psi\mathcal{B}_t$ is the resource cost from liquidating assets, L_t^{O+1} is the number of individuals in the non-employment state, Φ_t is the resource costs of adjusting prices and where all variables are aggregated through the joint distribution, D_j, defined above.

Definition 1: Competitive Equilibrium A Competitive Equilibrium of the economy satisfies the following definition: the sequence $[c_t, a_t, b_t]_{t=0}^{\infty}$ solves households' consumption-saving decision in 2 for each occupation, given the distribution of idiosyncratic shocks, $P(e_{t+1}|e_t)$ and the sequence of prices $r_t^a, r_t^b, r_t, \boldsymbol{w_t}$. The sequence of probabilities $[\theta_t]_{t=0}^{\infty}$ solves households' occupational choice problem in (6). The policy functions resulting from the consumption-saving and the occupational problem are solved through fixed point iteration. Aggregate assets holdings and consumption of the households are equal to the product of the individual optimal policy functions and the distribution of households across occupations, income states and assets. Firms choose labor demand for each occupation, $l_{o,t}$, and capital inputs, k_t to solve discounted profit optimization, given in 13. Market clearing and the aggregate resource constraints are satisfied. Monetary policy follow a Taylor rule and fiscal policy follows a balanced budget rule.

3. Monetary Policy Trade-offs and The Monetary Transmission Channels

We start by providing analytical derivations that can guide the economic intuition on the channels. First, we show that the slope of the Phillips curve, hence the severity of the

monetary trade-offs, is shaped by the changes in labor mobility. Second, we derive the elasticities of wage inequality and job transitions with respect to an interest rate shock, decomposing them into direct and indirect, or general equilibrium, effects.

Labor Reallocation as a Cost Push Shock. Occupational mobility has an impact on the output-inflation trade-off faced by the monetary authority to the extent that it affects the slope of the Phillips curve and the business cycle fluctuations in marginal costs. We therefore derive their log-linear expression.

Proposition 1. *Upon imposing a labor market equilibrium the model's log linear Phillips curve reads as follows*

$$\hat{\pi}_t = \kappa(mc)(\hat{mc}_t) + \Psi\hat{\pi}_{t+1} \tag{19}$$

where:

$$\hat{mc}_t = (1-\sigma)\hat{l}_{o,t}(e_t, a_{t-1}, b_{t-1}) - \frac{\sigma}{1-\nu}[\hat{z}_t + \nu\hat{k}_{t-1}] + \frac{\sigma+\nu-1}{1-\nu}\hat{y}_t + \hat{w}_t^o \tag{20}$$

and:

$$\hat{l}_{o,t} = \sum_{j=1}^{J} \frac{m_j \gamma_j^o n I(\theta_j)}{l^o} \left(\hat{n}_t(e_t, a_{t-1}, b_{t-1}) + \hat{I}_t(\theta_j)\right) \tag{21}$$

and where $I_t(\theta_j) = \int e_t \theta_j(o|e_t, a_{t-1}, b_{t-1}) dD_j(e_t, a_{t-1}, b_{t-1})$, is evaluated at the stochastic steady state.

Labor mobility affects the Phillips curve in several ways. First, since it enters the steady state marginal cost, it affects its slope and hence the costs of dis-inflation. Second, changes in labor hours, which depend both on the shift probabilities and the labor hours determine the evolution of the marginal cost. In equations 20 and 21 we emphasize the dependence of the labor hours and wages on the idiosyncratic shocks, e, and on past wealth. In absence of uninsurable risk the Roy (1951) allocation process is efficient, as each worker is employed based on comparative advantage. With incomplete markets workers insure against shocks also through the labor margin. The gap in the shift probabilities and labor hours between the complete and the incomplete market case acts as a cost push shock, which affects the dynamic of firms' marginal cost. To quantify this in Section 4.2 we provide a numerical

simulation of the changes in the ratio of output-inflation costs in response to changes in parameters that affects labor mobility.

The Elasticity of Job Transitions and Earnings Inequality: Direct and Indirect Effects. In models with incomplete markets changes in the policy rate affect the equilibrium through a direct impact on individual policy functions and through indirect general equilibrium effects, or else changes in prices triggered by market clearing adjustment. In our model the latter include the adjustment in the wage distribution that clears the markets across occupational islands. We now decompose the elasticities of wage inequality and job transitions into direct and indirect effects.

We measure wage inequality with the Gini index, $G_t = f(\{\xi^o_{j,t}\}, \{\theta^o_{j,t}\})$, where $\{\xi^o_{j,t}\}$ is a vector of labor income levels in the economy at time t ($o \in \{1, ...O+1\}$, $j \in \{1, ...J\}$) and $\{\theta^o_{j,t}\}$ is a vector of shares of households that receive the corresponding levels of income. The derivative of the Gini index with respect to the interest rate is: $\frac{\partial G_t}{\partial r_t} = \frac{G_t}{r_t}\left(\sum_{o,j} \varepsilon_{\xi^o_{j,t}, r_t} \cdot \varepsilon_{f, \xi^o_{j,t}} + \sum_o \varepsilon_{\theta^o_{j,t}, r_t} \cdot \varepsilon_{f, \theta^o_{j,t}}\right)$, where $\varepsilon_{i,j}$ indicates the elasticity of variable i to changes in variable j and $\varepsilon_{f,\cdot}$ are the elasticities for a function f. The elasticity of the Gini index to interest rate depends on the elasticity of labor income and the employment shares in each occupation, which we derive in the next two propositions.

Proposition 1. *The elasticity of labor income to interest rate changes*:

$$\varepsilon_{\xi^o_t, r_t} = \underbrace{-\frac{\tau_t}{1-\tau_t}\varepsilon_{\tau_t, r_t} + \sigma\varepsilon_{n_t, r_t} + (1-\sigma)\frac{r_t}{r_t+\delta} + \sigma\left(\sum_{o''=1}^{O} \alpha_{o''}^{\frac{1}{1-\sigma}} w_{o'',t}^{\frac{-\sigma}{1-\sigma}} \cdot \varepsilon_{w_{o'',t}, r_t}\right)\left(\sum_{o''=1}^{O} \alpha_{o''}^{\frac{1}{1-\sigma}} w_{o'',t}^{\frac{-\sigma}{1-\sigma}}\right)^{-1}}_{\text{aggregate GE effects}} -$$

$$\underbrace{-(1-\sigma)\frac{n_t}{l_{o,t}} \sum_{j=1}^{J} m_j \gamma^o_j \int e_t \theta^o_j(e_t, a_{t-1}, b_{t-1}) \cdot \varepsilon_{\theta^o_{j,t}, r_t} \cdot dD_j(e_t, a_{t-1}, b_{t-1})}_{\text{occupation-specific effect}} \tag{22}$$

Proof. See Appendix A.

The first term on the right-hand side of Equation (22) is the change in labor earnings needed to maintain balanced fiscal budget: since the increase in the interest rate raises the cost of debt, future taxes are expected to increase. The next terms is the change in the policy functions for labor hours and consumption induced by changes in capital income. The next

term is the change in the wages that clear the market, following changes in labor demand. The last term is the changes in the shift probabilities: those depend on the elasticity $\varepsilon_{\theta_j^o, r_t}$, which we derive next.

Proposition 2. *The elasticity of the shift probability across occupations for each household j with respect to interest rate shocks is:*

$$\varepsilon_{\theta_j^o, r_t} = \underbrace{r_t\left(\sum_{j=t}^{\infty} \beta^j u_{c^{o,*},t+j} \frac{\partial c_{t+j}^{o,*}}{\partial r_{t+j}}\right)}_{\text{within occupation-specific effect}} - \underbrace{r_t \frac{\sum_{o''=1}^{O+1} exp(\tilde{V}_j^{o''}(e_t, a_{t-1}))\left(\sum_{j=t}^{\infty} \beta^j u_{c^{o,*},t+j} \frac{\partial c_{t+j}^{o,*}}{\partial r_{t+j}}\right)}{\sum_{o''=1}^{O+1} exp(V_j^{o''}(e_t, a_{t-1}))}}_{\text{granularity effect}} \tag{23}$$

where: $\frac{\partial c_t^{o,*}}{\partial r_t} = \frac{\partial \xi_j^o}{\partial r_t} - \frac{\partial a_t^{o,*}}{\partial r_t} + \frac{\partial r_t^a}{\partial r_t} a_{t-1}$.

Proof. See Appendix A.

The first term in Equation (23) is an income effect. Changes in the interest rate induce changes in labor and capital income, $\frac{\partial c_t^{o,*}}{\partial r_t} = \frac{\partial \xi_j^o}{\partial r_t} - \frac{\partial a_t^{o,*}}{\partial r_t} + \frac{\partial r_t^a}{\partial r_t} a_{t-1}$, which in turn affect future optimal consumption. The second term is the changes in the probabilities of being in each occupation due to changes in the value functions. We dub this the *granularity effect* since a change in the share of workers in each occupation implicitly modifies the degree of labor market concentration.

4. Quantitative Results

We solve the model quantitatively to compare its mechanism to the data. We start by describing the solution method and the calibration. Next, we examine impulse responses to monetary shocks and business cycle moments, both compared to the data evidence.

Solution Method and Calibration. The solution to the stochastic steady state involves a fixed point iteration between the individual asset demand and the interest rate that clears the market and between the heterogenous labor supply and the wage distribution that clears the market in each occupational island. Furthermore, the participation and occupational shift probabilities depend on the expected value functions across states, that we guess and verify. Our procedure follows the endogenous grid method (see Carroll (2006)), augmented

with discrete choices. Our solution builds on the method proposed by Iskhakov et al. (2017), which consists in guessing value functions with polynomials and iterating until convergence. Details are in Appendix B.

The dynamic response to shocks is obtained through the sequence space Jacobian method (see Boppart et al. (2020) and Auclert et al. (2019)), an approximation method which computes the solution to the individual policy functions through a Jacobian approximation, evaluated at each point of the grid, and in response to a path for the aggregate shock. The sequences of policy functions are then aggregated, so that the shares characterizing the evolution of the distribution, solve the set of equilibrium macro conditions.

Calibration follows past literature or relies on micro data. Reallocation in the model is driven by the skill distribution matrix Γ, whose elements, γ_j^o, measure the comparative advantage, in terms of efficiency units of labor, of each household j for occupation o. We calibrate the entries using ONET data on occupational skills. We first cluster, through a k-means algorithm, the ONET occupations into 8 categories and then compute Euclidean distances of the skill requirements across occupations to fill the matrix entries relatively to the diagonal. Details are in Appendix B.

The values of the other parameters are summarized in Table 1. Time is in quarters. The steady state interest rate on government bonds is calibrated to 1.25%, close to the 5-year average of the Effective Federal Funds Rate. The time discount factor, β, is obtained from the asset market clearing condition. The portfolio adjustment cost parameter χ_1 is set to 6.4 to match the quarterly interest rate of 1.25% and the liquid assets to output ratio of 1.04. Following Auclert et al. (2019) the portfolio adjustment costs parameters are chosen to be $\chi_0 = 0.25$ and $\chi_2 = 2$, and the steady state mark-up is set to 1.015 in order to match the steady state sum of liquid and non-liquid assets, which in our model is 16.26. The steady state level of government spending is set to 0.2 of GDP, a widely used "great ratio" from the literature. The value of taxes is then obtained from the fiscal policy rule and is equal to 0.4. Monetary policy follows Taylor-type rule with a 1.5 response to inflation. The slope of the Phillips curve, the capital depreciation rate and the capital adjustment costs are calibrated to 0.1, 0.02, and 4, respectively, following Auclert et al. (2019). We calibrate the flow value

of non-employment, h_t, using estimates of the opportunity cost of employment reported by Chodorow-Reich and Karabarbounis (2016).[7]

The parameter ν in the production function is consistent with a capital share of 0.40, the average capital share across sectors in the EU-KLEMS data. The baseline σ is set to 0.2, but is varied in experiments. The α shares are calibrated as follows. Production, $y_t = Z_t K_t^{\nu} L_t^{1-\nu}$, and aggregate labor demand, $L_t = \left(\sum_{o=1}^{O} \alpha_o l_{o,t}^{\sigma}\right)^{\frac{1}{\sigma}}$, are substituted in the firms' first order conditions for labor to deliver: $(1-\nu)K_t^{\nu} L_t^{-\nu} \alpha_o \frac{1}{\sigma} \left(\sum_{o=1}^{O} \alpha_o l_{o,t}^{\sigma}\right)^{\frac{1}{\sigma}-1} \sigma l_{o,t}^{\sigma-1} = w_o$. We then take the ratios $\frac{\alpha_o}{\alpha_{o'}} = \left(\frac{l_{o,t}}{l_{o',t}}\right)^{1-\sigma} \frac{w_o}{w_o'}$ and sum them up to obtain: $\frac{1}{\alpha_{o'}} = \sum_{o=1}^{O} \left(\frac{l_{o,t}}{l_{o',t}}\right)^{1-\sigma} \frac{w_o}{w_o'}$. We take data on wages for each of the occupational clusters from the BLS Occupational Employment Statistics (OES) for the period 2014-2019. Those, weighted by the employment shares in each occupation, are used to calibrate the steady state real wages in the 8 occupational clusters of the model. Given wages we use the expressions derived above to calibrate the α_o, which are: 0.078, 0.254, 0.092, 0.280, 0.035, 0.085, 0.070, 0.106. The wage distribution, $w_o \, \forall o$, is: 14.1, 40.8, 16.7, 46.3, 6.2, 14.9, 12.8, 18.9.

Measuring Job Flows in the Data and the Model. To assess the transmission mechanism onto job transitions, we compute the conditional shift probabilities. Analytical derivations are reported in appendix A. We calculate overall mobility, $\mathcal{M}_t$, by using the formula below, where a transition is counted if the household was employed in one of the O occupations (not including non-employment state, $O+1$) in periods t and $t+1$, but $o_t \neq o_{t+1}$:

$$\mathcal{M}_t = \sum_{j=1}^{J} m_j \sum_{o=1}^{O} \Theta_{j,t}^{o} \cdot (1 - \Theta_{j,t+1}^{o} - \Theta_{j,t+1}^{O+1}) \tag{24}$$

where $\Theta_{j,t}^{o}$ is aggregated probability across idiosyncratic income and asset states.[8] The expressions are equivalent to the ones that we compute in the data and use for the time series evidence reported in 4.4.

Steady State Results. First, we assess whether the model reproduces facts on job

7 They use a variety of data sources that cover unemployment insurance, other benefits like Medicaid as well as foregone value of non-working time expressed in units of consumption. Under separable preferences, which is the case considered in our model, Chodorow-Reich and Karabarbounis (2016) report a ratio of opportunity cost of employment to the marginal product of employment of 47%. We then multiply this value with the average steady state income for all employed households. This delivers a value of 0.16.

8 The solution method does not allow us to aggregate after calculating the product of probabilities.

Table 1: Parameter Values, Description and Source

Parameter	Description	Value and source
O	No. occupations	8, clustered by k-means
J	No. skill types	8, clustered from O*NET
m_j	Distribution skill types	$1/J$ (uniform across J)
P_t	Aggregate Price	1 in the steady state.
σ	Elasticity of substitution	0.2 (baseline)
ν	Capital share	0.4, KLEMS
w^o	steady state wage in o (per Eff. units)	OES-BLS
δ	Capital depreciation	0.02
ε_I	Capital adj. parameter	4
β	Time discount factor	0.980, Target $r = 0.0125$
χ_0	Portfolio adj. cost pivot	0.25
χ_1	Portfolio adj. cost scale	6.4 (target $\mathcal{B}_h = 1.04Y$)
χ_2	Portfolio adj. cost curvature	2
σ	EIS	0.5
ρ	Inverse Frisch elasticity	1
ρ_z	Autocorrelation of earnings	0.966
σ_z	Cross-sectional std of log earnings	0.92
h_t	Flow value non-employment	47% of average income
φ	Dis-utility parameter	1.28 (target $n = 1$)
r	Real interest rate	0.0125
ψ	Liquidity premium	0.005
μ_p	steady state markup	1.015
ϕ	Taylor rule inflation coeff.	1.5
ϕ_y	Taylor rule output gap coeff.	0
τ	Tax rate	0.401
$\mathcal{B}_g$	Bond supply	2.8
κ	Slope Phillips curve	0.1

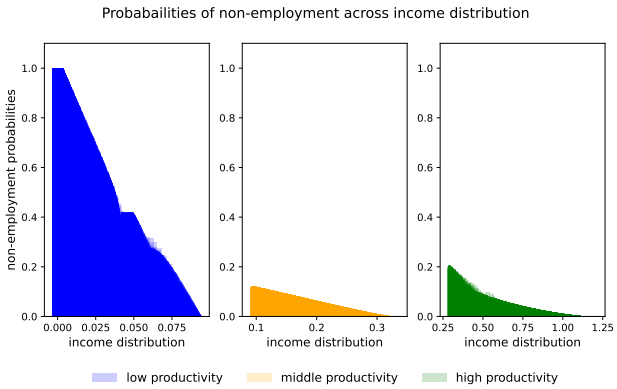


Figure 1: Non-employment Duration. The figure shows probabilities of choosing non-employment for three different realizations of the idiosyncratic shock process, e, in the steady state. X-axis shows households' incomes and Y-axis shows the non-employment probabilities. The value of 1 corresponds to staying out of the labor force indefinitely.

transitions, and their relations to income and wealth, which we gather from Survey of Income and Program Participation (SIPP in short), as well as the long run wealth statistics, which we obtain from the Survey of Consumer Finance (SCF in short). Figure 1 shows the non-employment probabilities for three different realizations of the idiosyncratic income shock, e. Households with the low income realization are more likely to enter non-employment and tend to remain there for longer. This relation is in line with duration dependence, a well established labor market fact.[9] Next, we examine the relation between wealth and employment shares using data from SIPP, a survey run by the US Census Bureau, which provides data on both job flows and wealth over the period 1984-2021.[10] Figure 2 shows the transitions from employment to non-employment in the SIPP data (left panel) and in the model (right panel). Both exhibit a convex declining relation. Separations are higher for low wealth individuals.

The focus of our study is on wage inequality, but we examine also the model's implications for wealth inequality. We compute statistics for wealth and its component, liquid and non-liquid assets, and compare them to those from the Survey of Consumer Finance (SCF), averaged over the period 1989-2019 across different wealth and income percentiles.[11] Table 2

9 see early work by Sider (1985), Baker (1992), Dynarski and Sheffrin (1990) among others and the review by Machin and Manning (1999).

10 The wealth data are available at a lower frequency than the labor variables, typically once a year for a particular panel. Therefore we harmonize the frequencies by taking the mean transition probabilities within a ventile of wealth at an annual level, and by using the survey weights to match with wealth at an annual frequency.

11 Liquid assets consist of the following categories: transactions accounts, directly held bonds, directly held stocks, and credit card balances. Non-liquid assets consist of certificate of deposits, savings bonds, cash

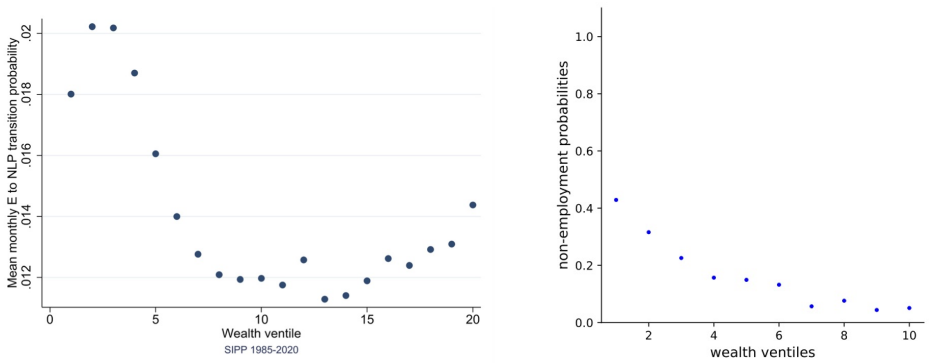


Figure 2: Wealth and Employment in SIPP data and the Model. The figure plots employment-to-non-participation transition probability (separations in short) across percentiles of total household net wealth. The left panel shows the relation using data are from Survey of Income and Program Participation for wealth and labor flows from 1985 (wave 2 of the 1984 survey) through 2020 (the reference year of the 2021 survey). The right panel shows the model equivalent, where X-axis is households' wealth as a sum of liquid and illiquid assets and Y-axis is the non-employment probabilities. The value of 1 corresponds to staying out of the labor force indefinitely.

compares the model and the data statistics. The model matches well the average holdings of liquid and illiquid assets from the SCF (the first two rows in Table 2) and the Gini coefficients reported in the World Inequality Database. The model's wealth distribution, not reported for brevity, is skewed and exhibits a peak at zero, like in the data. The matching, which is fairly good for all statistics, except for illiquid asset holdings of the top 10%, is in line with previous studies. The SCF data also contains information on income and assets by broad occupational groups. We compare the SCF group "Managers" to our occupations 2 and 4, and the SCF group "Technical, Sales, Services" to our occupations 5, 6 and 7. The ratios of mean income to liquid assets in the model matches well the data counterparts.

4.1. Impulse Response Analysis and Business Cycle Statistics

We study the monetary transmission mechanism in the short run with impulse response analysis and business cycle statistics, both of which we later compare to the data. We start by computing impulse responses to a 25 basis point contractionary monetary policy shock. Figure 3 displays results for a set of selected variables. To appreciate the role of occupational reallocation we compare the impulse responses of our model (blue lines) to those implied by a model without mobility, hence with fixed occupational shares (orange lines). Figure 4 shows

value of insurance, other managed assets, retirement accounts, stock holdings, and primary residence net of mortgage home loans.

Table 2: Income and Asset Distributions. Model's Steady State Values and Data. Data on income, liquid and non-liquid assets are from the Survey of Consumer Finance, averages over 1989-2019. The deciles for illiquid assets holdings are based only on the value of primary residence. The data on Gini coefficients are from the World Inequality Database.

Statistics	Data	Model
Mean Liquid Assets/GDP	0.26	0.17
Median Illiquid/GDP	2.92	3.89
Income Gini	0.52	0.41
Liquid assets Gini	0.98	0.82
Illiquid assets Gini	0.81	0.47
Shares of liquid assets per income percentile		
less than 20th percent.	0.05	0.03
20th-40th percent.	0.10	0.19
40th-60th percent.	0.08	0.04
60th-80th percent.	0.13	0.40
80th-100th percent.	0.63	0.31
Shares of illiquid assets per income percentile		
less than 20th percent.	0.07	0.07
20th-40th percent.	0.09	0.09
40th-60th percent.	0.11	0.14
60th-80th percent.	0.15	0.28
80th-100th percent.	0.57	0.28
Income/Liquid Assets, by Occupation		
Managers and Professionals	1.80	2.04
Technical, Sales and Services	2.74	2.81

the dynamic of wages in all occupations in the model with mobility. First, like in any model with incomplete markets risk and borrowing constraints heighten precautionary savings and exacerbate the decline in consumption and assets, more so in the model with mobility due to the endogenous movements in the wage distribution. Precautionary saving is also responsible for the shift from non-liquid to liquid assets. We now turn to the labor market adjustment, which is the focus of this paper. Separations (third panel, second row) increase due to the decline in labor demand, more so for bottom earners since labor demand falls more for the least productive workers.[12] Second, the loss in disposable income and the increase in the likelihood of being liquidity constrained increase the incentives of low wage workers to move to higher paying jobs, hence mobility (last panel, third row) increases. In turn, the forces of wage equalization intrinsic to the Roy (1951) mechanism induce an increase in wages for all low wage occupations (first panel, last row). Figure 4 shows that wages in all wage occupations rise already one period after the shock. The compression in the dispersion of

12 Part of the increase in separations is also due to workers, whose wages decline below the non-employment value. Ellieroth and Michaud (2024), using CPS data, also report that during recessions quits into non participation increase also among those laid-off. The decline in labor demand is however larger.

wage growth induces a decline in the wage Gini (first panel to the bottom of Figure 3). Let us remark that we examine the trends of wage inequality of employed workers: it may well be that the loss in income of the displaced workers may increase overall inequality.

We inspect the transmission mechanism further by plotting impulse responses for different values of the substitution elasticity across occupations, σ, and of the skill distribution matrix, Γ, the primitives that affect labor mobility. Higher σ reduces mobility, which in turn delays the recoveries and increases wage inequality. Higher skill dispersion instead increases mobility and hence has the opposite effect on the economy. See Appendix C for results.

Business Cycle Statistics in the Model and the Data. We provide a general validation of the model by comparing the business cycle statistics of several macro variables in response to TFP shocks to the ones for the U.S. economy during the period 1966-present and to the ones of an incomplete market model without occupations and mobility. Table 3 shows results. The statistics in our model are closer to the data. First, the indivisible nature of labor, induced by the discrete choice, increases the employment volatilities, while dampening that of wages. The additional amplification induced by the labor market adjustment also increases the volatility of inflation and interest rates, bringing them closer to the data. Those are two variables which are crucial for the monetary transmission mechanism. At last, in our model wage inequality is endogenous. Table 4 compares the volatility and persistence of the 90-50 ratio of earnings percentiles and the 50-10 ratio in the data and in the two models. In the new Keynesian model with an exogenous income distribution the volatility of wage inequality is zero, in our model it is positive and very close to the data. Note an important point, on which we will return in section 4.4: while wage inequality is counter-cyclical with respect to business cycle fluctuations in output, its conditional response to shocks may vary across them. The first of those measures is indeed a correlation and the second is a causal estimate.

4.2. Monetary Policy Trade-offs

A key novel aspect of our model lies in the role of labor mobility for the slope of the Phillips curve, and hence the monetary trade-offs, as shown in proposition 1. We now examine it

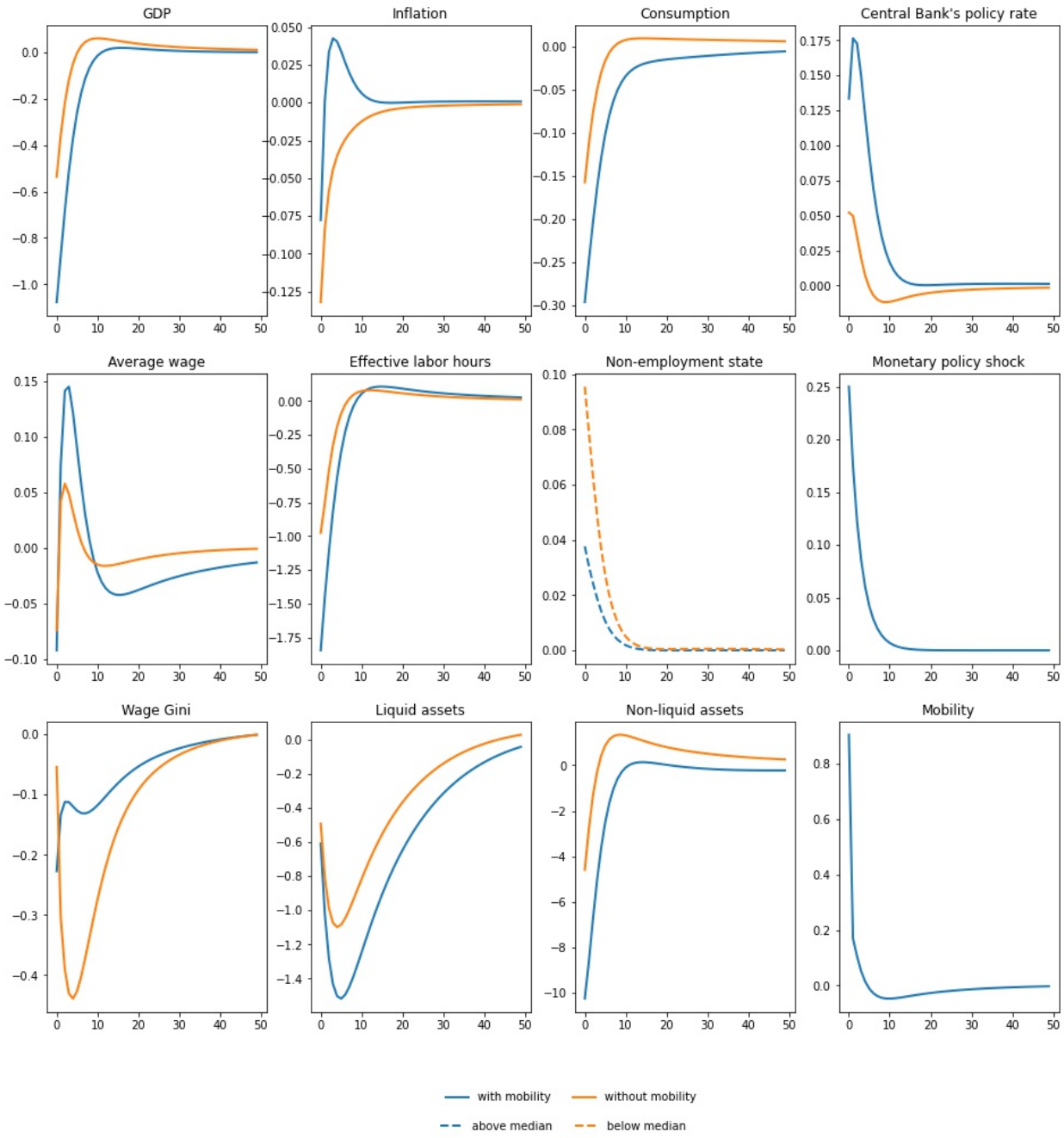


Figure 3: Impulse Responses to a Monetary Policy Shock. Impulse responses are percentage deviations from the steady state in response to a 25 b.p. increase in the Central Bank's interest rate, with persistence of 0.7. Impulse responses for the model with the occupational mobility are in blue and for the model without are in orange. The average wage is the sum of wages in each occupation, weighted by the employment shares in terms of efficiency units. Mobility is reallocation across occupations aggregated across households and occupations (total occupation-to-occupation flows). X-axis shows the time in quarters.

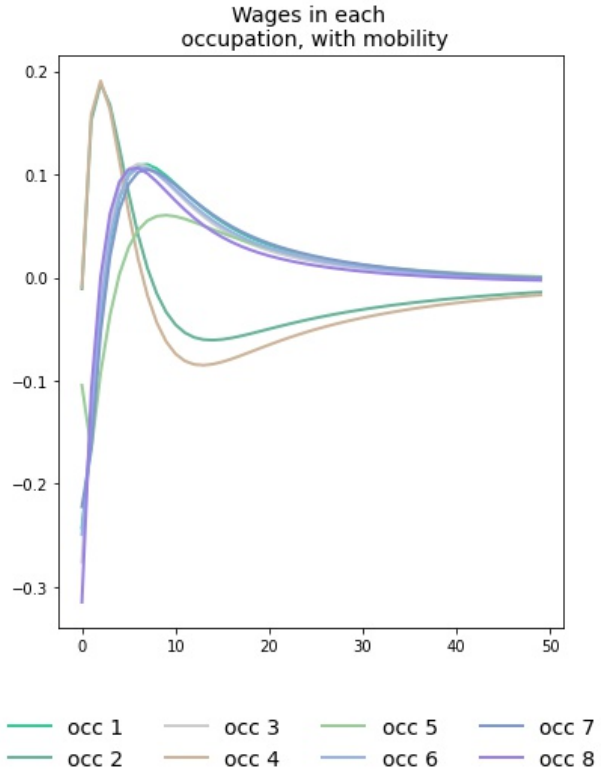


Figure 4: Impulse Responses to a Monetary Policy Shock: Wage Heterogeneity. Impulse responses are percentage deviations from the steady state in response to a 25 b.p. increase in the Central Bank's interest rate, with persistence of 0.7. Occupations 2 and 4 are high-wage occupations, other occupations are low-wage occupations. X-axis shows the time in quarters.

Variable	U.S.	std HA, two assets	std HA two assets, occupational choice
Consumption	0.80	0.96	0.73
Investments	2.81	2.34	2.47
Interest rate, nominal	0.54	0.14	0.40
Wages	0.61	1.27	1.08
Labor hours	0.91	0.42	0.66/0.77
Inflation	0.73	0.09	0.27

Table 3: Second Moments: Two Assets HANK and Heterogenous Agent Model with Occupational Mobility. All standard deviations are relative to the Output's standard deviation. The moments are computed given productivity shock. The hours in the model with occupational choice are shown for the intensive margin before the "/" sign, and for efficient hours after the "/" sign (includes probabilities and productivity). Statistics in the U.S. economy are for the sample period 1966-present and are Hodrick Prescott filtered.

quantitatively. Note that labor mobility by affecting inequality interacts with the policy trade-offs. To show the role of labor mobility for the trade-offs, we compute the sacrifice ratio, the output cost needed to stabilize inflation, for different values of skill's dispersion matrix. This is shown in Figure 5. The output cost needed to stabilize inflation declines with

Statistic	Data	Model with Labor Mobility	Model with Incomplete Markets
		p9010	
std	0.03	0.03	0.00
persistence	0.92	0.88	1.00
		p5010	
std	0.03	0.01	0.00
persistence	0.92	0.88	1.00

Table 4: Standard deviation and persistence of income inequality. The table shows standard deviations and persistence of the ratios 90-50 (income level at the 90th percentile to income level at the 50th percentile) and 50-10 (income level at the 50th percentile to income level at the 10th percentile) calculated in the model using simulated series of monetary policy shocks and in the data using data from GRID database for the log incomes from 1998 to 2019 (similar ratios for residual log incomes).

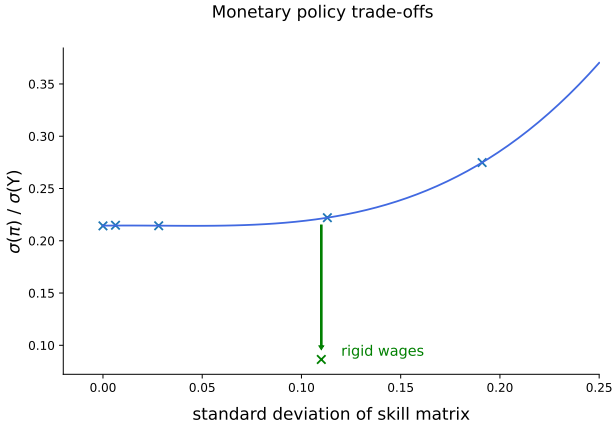


Figure 5: Monetary Policy Frontier depending on Inequality. The figure shows the inflation/output trade-off for different standard deviations of the Γ matrix. The baseline x-value is 0.11. Second moments are computed as standard deviations of the simulated inflation and output over 300 quarters. Simulated paths were obtained in response to randomly sampled monetary policy shocks with 0.15 persistence and 0.2449 standard deviation (as in Smets and Wouters (2007)). The green dot corresponds to the case with occupation-specific wage rigidity.

higher skills' dispersion, that is when mobility is larger and wage inequality is lower following contractionary shocks. Higher labor mobility facilitates recovery, since firms can more easily satisfy their labor demand. This in turn reduces the output costs. Higher mobility also lowers the marginal costs, as shown in proposition 1, hence it steepens the Phillips curve and reduces the severity of the output-inflation trade-off.

4.3. Adding Wage Rigidity

So far we abstracted from frictions on labor demand and equilibrium unemployment. We now examine if the transmission mechanism described so far remains valid when we introduce wage

rigidity, a friction to labor demand that breaks the "divine coincidence"[13] (see Blanchard and Galí (2007) or Schmitt-Grohé and Uribe (2017), or Michaillat and Saez (2024)). We introduce wage rigidity through labor unions that face quadratic adjustment costs in wage setting. Each occupation-specific union maximizes the discounted sum of future utilities of all households working in the given occupation, subject to adjustment costs: $\frac{\epsilon_w}{2\kappa_w} log(\frac{w_{o,t}}{w_{o,t-1}\Pi_w})^2$.

$$\sum_{s=0}^{\infty} \beta^s \{ \sum_i \left\{ \frac{c_{i,o,t+1}^{1-\sigma}}{1-\sigma} - \varphi \frac{n_{i,o,t+s}^{1+\rho}}{1+\rho} \right\} dD_i - \frac{\epsilon_w}{2\kappa_w} log \left(\frac{w_{o,t}}{w_{o,t-1}\Pi_w} \right)^2 \} \tag{25}$$

Imposing symmetry across unions j in each occupation and, given the demand function from competitive labor packers, $n_{j,o,t} = (\frac{w_{j,o,t}}{w_{o_t}})^{-\frac{1}{\sigma}} n_{o,t}$, the resulting occupation-specific wage Phillips curve reads as follows:

$$log\left(1+\pi_{w,o,t}\right) = \kappa_w \left(\varphi N_t^{\rho} - w_{o,t} \sum_j m_j \int (1-\tau_t) \gamma_j^o e_{j,t} u_{c,o,j,t} dD_j \right) N_t + \beta log\left(1+\pi_{w,o,t+1}\right) \tag{26}$$

Figure 6 compares the impulse responses, to a contractionary monetary policy shock, of the macro variables in the model with (orange line) and without (blue line) wage rigidity. The transmission mechanisms are qualitatively similar between the two models, except that the dynamic of wages is now dampened as one may expect. This also dampens the dynamic of job transitions. As per our proposition 1 this then impairs the recovery and increases inequality, steepening the severity of the policy trade-offs. Figure 5 depicts the output-inflation volatility ratio in this model for a specific skill dispersion. The output costs needed to dis-inflate the economy are larger in this case. In sum, adding a labor demand friction leaves the transmission mechanism qualitatively unaltered, but worsens the policy trade-offs.

4.4. Time Series Evidence

We now validate the impulse response analysis to monetary policy shocks by estimating, with CPS data over the period 1989-2019, the impact of high frequency identified monetary

13 This term refers to the ability of the price stability policy to close the inflation gaps in absence of real frictions.

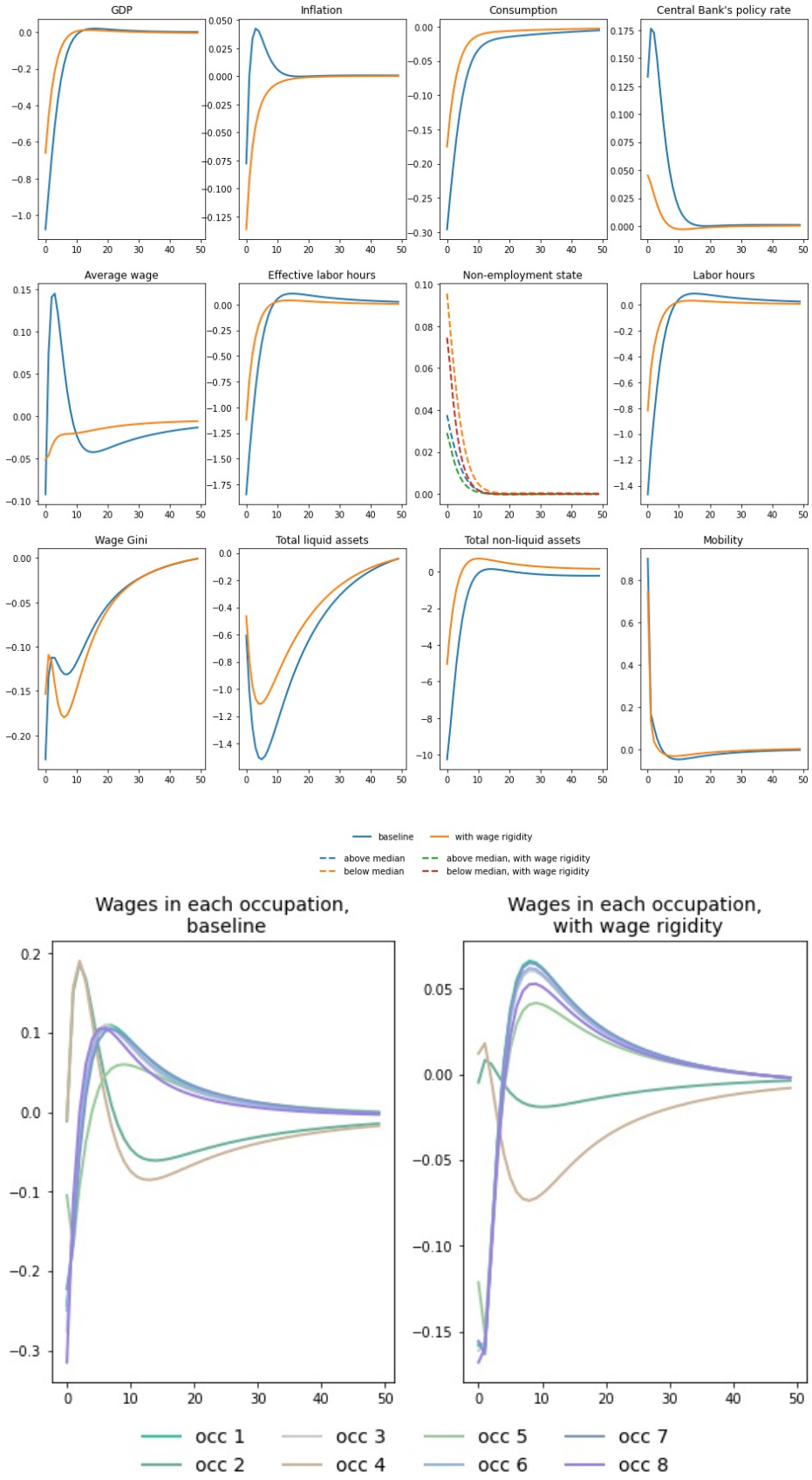


Figure 6: Impulse Responses to a Monetary Policy Shock. Model with Wage Rigidity. Impulse responses are percentage deviations from the steady state in response to a 25 b.p. increase in the interest rate, with persistence of 0.7. Impulse responses from the model with the occupational mobility are in blue and those from the model without it are in orange. The average wage is the one weighted by the employment shares in terms of efficiency units. Mobility panel shows wages across occupations. X-axis shows the time in quarters.

policy shocks onto occupational reallocation,[14], separations and real labor earnings, which we gather also along the income distribution. We employ data from US Current Population Survey (CPS-IPUMS in short)[15] and estimate, through panel local projections (Jordà (2005)), the response to high frequency identified monetary policy shocks. CPS is best suited for our analysis, since contrary to other datasets such as the National Longitudinal Survey of Youth (NYLS) or the Survey of Income Programs and Participation (SIPP), it is monthly and includes information on occupations and occupational mobility.[16] Earnings are measured weekly to reflect wage levels, rather than extensive margin fluctuations in the working time. For workers paid on an hourly basis, earnings are given by the product of the hourly wage and the hours worked, while for salaried workers they are given by their per-week salary. All earnings are not netted out by taxes and other deductions and are deflated by CPI. Our final earning measure is a Mincer residual estimated by conditioning on age, sex, race and a dummy for whether a worker is paid hourly. This purges the wage dynamic by life-time and demographic trends. Using the responses of individuals that report their weekly hours/earnings in the 4th and 8th interview, we construct a year-over-year change in earnings for each individual: $\Delta w_{i,t} = \frac{w_{i,t+12}-w_{i,t}}{\frac{1}{2}(w_{i,t+12}+w_{i,t})}$.[17] We measure the dynamic of wage inequality as changes in wage growth along the income distribution (see Amberg et al. (2021)). To track changes in the wage distribution for similar workers we create a pseudo panel, by grouping individuals on their earnings in CPS' sample month 4, that is the first time the worker is in the outgoing rotation group and reports earnings. We assign to workers their earnings-rank pooling at all periods[18] and bin them into groups based on their earnings-ranks and observation dates.

We estimate the impact in response to high frequency identified monetary policy shocks, constructed by interest rate changes around the Federal Reserve's Open Market Committee

14 We construct occupational transitions comparing the 3-digit level occupation of a worker in two different survey responses at two different points in time, linked together using the panel dimension of the dataset.

15 The CPS is a monthly rotating panel of 60,000 individuals, in which households are sampled for four consecutive months, not surveyed for the following 8 months, then sampled again for the following four months.

16 Occupational transitions are reported annually also in the March survey. We employ the monthly survey to capture short run changes.

17 This formulation implies that earnings are 0 for one of the periods.

18 As a robustness check we control for the trend of the mean wage. The coefficient in front of the mean wage is significant for the separation and earnings regressions. The magnitude of the coefficient is, however, small, and hence it does not affect the results.

(FOMC) announcements. We employ the ones constructed by Swanson (2021). Those are based on more frequent announcement events, hence do not suffer from the attenuation bias noted in Ramey (2016). We employ the orthogonalized variant, which projects out any correlation with recent macroeconomic and financial news. Our econometric methodology is a panel local projection specification (see Jordà (2005)), whose regressors include the monetary surprise, interacted with the income percentiles and the percentile fixed effects. The dependent variables are either separations, reallocation or log deviation of earnings growth in each income ventile:

$$y_{i,t+j} = \alpha_i + \Gamma_{i,j} x'_{i,t} \Delta m_t + \Theta Z_{i,t} + \epsilon_{i,t+j} \tag{27}$$

where $y_{i,t+1}$ is either the percentage change in real wages or in the transition probabilities, each of them measured for each income percentile, $x_{i,t}$ is the prior income percentile, α_i are percentile fixed effects. The coefficients of interest for our analysis are the $\Gamma_{i,j}$, or the semi-elasticity of the dependent variable to monetary shocks, along the income distribution.

Threats to Identification. Our specification captures causal responses to shocks. Two types of threats to identification may arise. The dynamic may be driven by trends unrelated to business cycle responses to the monetary shocks. To address this we use Mincer for the earnings. Second, the response of wages may be driven by some composition effects: following the monetary contraction, only a selected pool of workers remains employed and this may bias the estimates. We address this second concern by including in the regression a Heckman (1974) correction: we compute a Mills ratio from a first stage probit model that regresses the probability of being employed, or not, onto a set of demographics. We then include the Mills ratio as a control in the local projection specification.

Figure 7 presents the impulse responses in the first period[19] for all income ventiles. Specifically, it shows the estimated coefficient on monetary policy shocks interacted with income ventiles in one single graph. We verified the same cross sectional responses also for next periods and they are similar. Occupational reallocation and separations significantly increase like in the model and more so for bottom earners, who are most likely be liquidity

19 We verified if impulse responses at later periods confirm the results and they do.

Figure 7: Semi-elasticity of separation rates (transitions from employment to unemployment), occupational reallocations and earnings for each ventile of the earning distribution. Empirical estimates of the impact coefficient of the exogenous monetary policy shock interacted with income ventiles. Estimation time period 1989-2019. The figure plots the coefficients Γ_j for each income ventile and its 5% confidence intervals.



Occupational Reallocation Separations Earnings Growth

constrained or short of disposable income. Like in the model real labor earnings increase significantly only for bottom earners. Since our estimates control for sample selection, the wage response is likely due to the need to retain low wage workers, since the recession increased their incentives to reallocate to higher paying jobs. Quantitatively the response of wages is also very similar to the one in the model; the response of reallocation is somewhat larger.

At last, another useful observation arises. Wage inequality tends to be counter-cyclical with respect to output fluctuations over the business cycle, a fact reproduced also by our model and reported in 4.1. This is however a correlation. The response to monetary policy shocks is instead causal identification: for that we observe that wage inequality decreases in face of contractionary shocks.

5. Conclusions

The response of wage inequality to monetary policy shocks depends on the heterogenous response of labor demand and supply. Macro models with incomplete markets, hence uninsurable risk and borrowing constraints, focus on studying the monetary transmission mechanism onto wealth inequality, but maintain an orthogonal process for the earnings distribution. In Roy (1951) type models wage inequality is determined by the occupational shifts, but those are made in absence of any risk. We construct a model merging incomplete

markets, with Bewley (1980) shocks and borrowing constraints, and occupational mobility. We show that the model can match well both long run and short run evidence, and provides a novel perspective on the trade-offs faced by monetary authorities and how those interact with wage inequality.

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A. Analytical Derivations

Proof of Proposition 1. Labor income in the model reads as follows: $\xi_t^o = (1-\tau_t)e_t\gamma_j^o w_t^o n_t$. The derivative of the labor income with respect to the interest rate could be rewritten as:

$$\varepsilon_{\xi_t^o, r_t} = \frac{\partial \xi_t^o}{\partial r_t}\frac{r_t}{\xi_t^o} = -\frac{\partial \tau_t}{\partial r_t}\frac{\xi_t^o}{1-\tau_t}\frac{r_t}{\xi_t^o} + \frac{\partial n_t}{\partial r_t}\frac{\xi_t^o}{n_t}\frac{r_t}{\xi_t^o} + \frac{\partial w_t^o}{\partial r_t}\frac{\xi_t^o}{w_t^o}\frac{r_t}{\xi_t^o} = -\frac{\tau_t}{1-\tau_t}\varepsilon_{\tau_t, r_t} + \varepsilon_{n_t, r_t} + \varepsilon_{w_t^o, r_t} \tag{A.1}$$

The next step is to obtain expressions for all the elasticities in A.1. The derivative of taxes with respect to interest rates is determined through the fiscal balance budget constraint.

The elasticity of wages with respect to the interest rate is obtained from the labor market clearing condition. We proceed as follows. First, we derive the equilibrium aggregate labor demand and compute the elasticity of wages implied by changes in the labor demand with respect to the interest rate. Next, from the market clearing condition we derive how labor demand in each occupation changes in response to a change in labor supply induced by a change in interest rate. This two step procedure allows us to obtain the elasticity of wages in response to an interest rate shock taking into account overall changes in market clearing. Labor demand equation in each occupation is:$l_{o,t} = \left(\frac{mc_t(1-\nu)\alpha_o}{w_t^o}\right)^{\frac{1}{1-\sigma}} y_t^{\frac{1}{1-\sigma}} L_t^{\frac{-\sigma}{1-\sigma}}$. Aggregate labor demand is:

$$L_t = \left(\sum_{o=1}^{O} \alpha_o l_{o,t}^{\sigma}\right)^{\frac{1}{\sigma}} = mc_t(1-\nu)y_t \left(\sum_{o=1}^{O} \alpha_o^{\frac{1}{1-\sigma}} (w_t^o)^{\frac{-\sigma}{1-\sigma}}\right)^{\frac{1-\sigma}{\sigma}} \tag{A.2}$$

A fixed point delivers the equilibrium labor demand in each occupation. Specifically firms guess that all other firms adopt the same policy function for labor demand: this allows us to substitute the individual labor demand in A.2, and the latter back in individual demands, to obtain the equilibrium labor demand in each occupation. This delivers:

$$l_{o,t} = \left(\frac{mc_t(1-\nu)\alpha_o}{w_t^o}\right)^{\frac{1}{1-\sigma}} y_t^{\frac{1}{1-\sigma}} (mc_t(1-\nu)y_t)^{\frac{-\sigma}{1-\sigma}} \left(\sum_{o=1}^{O} \alpha_o^{\frac{1}{1-\sigma}} (w_t^o)^{\frac{-\sigma}{1-\sigma}}\right)^{-1} \tag{A.3}$$

We can use A.3 to obtain an expression for wages. The derivative of the wages with respect to the interest rate then reads as follows:

$$\begin{aligned}\varepsilon_{w_t^o, r_t} = (1-\sigma)\frac{\partial mc_t}{\partial r_t}\frac{r_t}{mc_t} + (1-\sigma)\frac{\partial y_t}{\partial r_t}\frac{r_t}{y_t} - (1-\sigma)\varepsilon_{l_t^o, r_t} + \\ \sigma \left(\sum_{o''=1}^{O} \alpha_{o''}^{\frac{1}{1-\sigma}} (w_t^{o''})^{\frac{-1}{1-\sigma}} \frac{\partial w_t^{o''}}{\partial r_t}\right) \left(\sum_{o''=1}^{O} \alpha_{o''}^{\frac{1}{1-\sigma}} (w_t^{o''})^{\frac{-\sigma}{1-\sigma}}\right)^{-1}\end{aligned} \tag{A.4}$$

Equation A.4 depends upon general equilibrium changes in labor demand and the latter are determined by the market clearing condition. Hence we proceed to take the derivative of l_t^o with respect to r_t that could be obtained from the labor market clearing condition:

$$\varepsilon_{l_t^o,r_t} = \varepsilon_{n_t,r_t} + \frac{n_t r_t}{l_{o,t}} \sum_{j=1}^{J} m_j \gamma_j^o \int e_t \frac{\partial \theta_j^o(e_t, a_{t-1}, b_{t-1})}{\partial r_t} dD_j(e_t, a_{t-1}, b_{t-1}) \tag{A.5}$$

The elasticity $\varepsilon_{w_t^o,r_t}$ also depends upon the derivatives of mc_t and y_t with respect to the interest rate. The latter are obtained from the demand for capital (assuming no capital adjustment costs to simplify):$r_t + \delta = \nu mc_t \frac{y_t}{k_{t-1}}$, which implies: $1 = \frac{\partial mc_t}{\partial r_t} \frac{r_t+\delta}{mc_t} + \frac{\partial y_t}{\partial r_t} \frac{r_t+\delta}{y_t}$. The final result of proposition 1 is obtained upon substitution of all derived elasticities into equation A.1.

Proof of Proposition 3. To simplify the calculations we derive the elasticity in the economy where households can invest only in one asset. This is without loss of generality as the additional asset enriches the dynamic of wealth, but has not first order impact on the occupational choice. Starting from the expression for the probability of choosing occupation o by household of type j:$\theta_j^o(e_t, a_{t-1}) = \frac{exp(\tilde{V}_j^o(e_t, a_{t-1}))}{\sum_{o''=1}^{O+1} exp(\tilde{V}_j^{o''}(e_t, a_{t-1}))}$, where $\tilde{V}_j^o(e_t, a_{t-1})$ is the value function evaluated at the optimum. The elasticity of probability with respect to the interest rate could be written as:

$$\varepsilon_{\theta_j^o,r_t} = r_t \frac{\partial \tilde{V}_j^o(e_t, a_{t-1})}{\partial r_t} - r_t \frac{\sum_{o''=1}^{O+1} exp(\tilde{V}_j^{o''}(e_t, a_{t-1})) \frac{\partial V_j^{o''}}{\partial r_t}}{\sum_{o''=1}^{O+1} exp(V_j^{o''}(e_t, a_{t-1}))} \tag{A.6}$$

Using the definition of the value function for each occupation at the optimum:

$$\tilde{V}_j^o(e_t, a_{t-1}) = u(c_t^{o,*}, n_t^*) + \beta E_e E_\phi \tilde{V}_j^o(e_{t+1}, a_t^{o,*}) \tag{A.7}$$

The derivative of the value function with respect to the interest rate could be expressed as:

$$\frac{\partial \tilde{V}_j^o(e_t, a_{t-1})}{\partial r_t} = u_{c^{o,*},t} \frac{\partial c_t^{o,*}}{\partial r_t} + u_{n^*,t} \frac{\partial n_t^*}{\partial r_t} + \beta E_e E_\phi \frac{\partial \tilde{V}_j^o(e_{t+1}, a_{t1})}{\partial r_t} \tag{A.8}$$

where $u_{c^{o,*},t}$ and $u_{n^*,t}$ are the marginal utilities of consumption and labor. Using recursivity we can re-write the above expression as:

$$\frac{\partial \tilde{V}_j^o(e_t, a_{t-1})}{\partial r_t} = \sum_{j=t}^{\infty} \beta^j u_{c^{o,*},t+j} \frac{\partial c_{t+j}^{o,*}}{\partial r_{t+j}} + u_{n^*,t+j} \frac{\partial n_{t+j}^*}{\partial r_{t+j}} \tag{A.9}$$

The final step is to compute the derivative of the policy function for consumption with respect to the interest rate. Consumption changes occur through three channels. First, changes in the interest rate affect household income, and through this consumption. Second, changes in the interest rate affect the household saving decision, and hence its wealth accumulation. This in turn affect the consumption policy function. Third, each household takes into account that changes in the interest rate affect the policy functions of other households in the economy, and through the market clearing those eventually affect the return on assets. Hence the derivative of the optimal consumption at any period t is given by:$\frac{\partial c_t^{o,*}}{\partial r_t} = \frac{\partial \xi_j^o}{\partial r_t} - \frac{\partial a_t^{o,*}}{\partial r_t} + \frac{\partial r_t^a}{\partial r_t} a_{t-1}$, where $\frac{\partial r_t^a}{\partial r_t} a_{t-1}$ subsumes the impact that changes in the policy function of other agents, and in their asset distribution, affect the return to asset through the market clearing condition. To simplify calculations we derive the elasticity under the case in which the interest rate induces no changes in labor hours. This is without loss of generality for what concerns the effects of changes in occupational value functions on the elasticity. The elasticity of job flows to interest rates can be summarized as follows:

$$\varepsilon_{\theta_j^o, r_t} = r_t \left(\sum_{j=t}^{\infty} \beta^j u_{c^{o,*},t+j} \frac{\partial c_{t+j}^{o,*}}{\partial r_{t+j}}\right) - r_t \frac{\sum_{o''=1}^{O+1} exp(\tilde{V}_j^{o''}(e_t, a_{t-1}))(\sum_{j=t}^{\infty} \beta^j u_{c^{o,*},t+j} \frac{\partial c_{t+j}^{o,*}}{\partial r_{t+j}})}{\sum_{o''=1}^{O+1} exp(V_j^{o''}(e_t, a_{t-1}))} \tag{A.10}$$

Derivations of Job Flows in the Model. Occupational choice in period t is described by $\theta_j(o|e_t, a_{t-1}, b_{t-1})$ and in period $t+1$ by $\theta_j(o'|e_{t+1}, a_t, b_t)$. There is a change in occupation (flow) between t and $t+1$ if $o' \neq o$. Let $\tilde{V}_j^o$ be the value function $V_j^o(e_t, a_{t-1}, b_{t-1})$ evaluated at the optimal consumption-saving policy $c_j^o(e_t, a_{t-1}, b_{t-1})$, $a_j^o(e_t, a_{t-1}, b_{t-1})$ and $b_j^o(e_t, a_{t-1}, b_{t-1})$. Write $V_j^o(e_t, a_{t-1}, b_{t-1})$ for the value function in t and $V_j^o(e_{t+1}, a_t, b_t)$ for the value function at $t+1$. There is a change in occupation o between period t and $t+1$ if in period t, $V_j^o(e_t, a_{t-1}, b_{t-1}) + \phi_t^o \geq V_j^{o'}(e_t, a_{t-1}, b_{t-1}) + \phi_t^{o'}$ and $\forall o' \neq o \in O+1$ and in period $t+1$ there exist at least one $o' \in O+1$ such that:$V_j^o(e_{t+1}, a_t, b_t) + \phi_{t+1}^o \leq V_j^{o'}(e_{t+1}, a_t, b_t) + \phi_{t+1}^{o'}$.

The probability of the change of occupation o between t and $t+1$ is the product of the probabilities of the events described so far:

$$\theta_j(o|e_t, a_{t-1}, b_{t-1}) * (1 - \theta_j(o|e_{t+1}, a_t, b_t)) \tag{A.11}$$

Gross flow between t and $t+1$ for workers of type j, conditional on state (e_t, a_{t-1}, b_{t-1}), is

$$\sum_o \theta_j(o|e_t, a_{t-1}, b_{t-1}) * E_{e,t}(1 - \theta_j(o|e_{t+1}, a_t, b_t)), \tag{A.12}$$

where $E_{e,t}$ is the expectations operator with respect to idiosyncratic income shocks conditional on information at time t. Integrating gross flows between t and $t+1$ over state (e_t, a_{t-1}, b_{t-1}) and summing over worker types j, yields gross flow between t and $t+1$

$$\sum_{j=1}^{J} m_j \sum_o \int_{e_t, a_{t-1}, b_{t-1}} \theta_j(o|e_t, a_{t-1}, b_{t-1}) * \sum_{e_{t+1}} (1 - \theta_j(o|e_{t+1}, a_t, b_t)) P(e_{t+1}|e_t) dD_j(e_t, a_{t-1}, b_{t-1}) \tag{A.13}$$

where $a_t = a(e_t, a_{t-1}, b_{t-1})$, $b_t = b(e_t, a_{t-1}, b_{t-1})$ and $P(e_{t+1}|e_t)$ is an element of the transition matrix (the matrix has a property $\sum_{e_{t+1}} P(e_{t+1}|e_t) = 1$).

B. Computation Method

The model stochastic steady state is solved through an endogenous grid method extended to include discrete choice (see Iskhakov et al. (2017)) and the short run dynamic is solved using the sequence space Jacobian method by Auclert et al. (2019). Numerically this has been implemented through a guess and verify procedure with the following steps. First, we guess future value functions, $W_a(\mathbf{z}_{j,t}, a_t, b_t, \phi_{o,t+1})$ and $W_b((\mathbf{z}_{j,t}, a_t, b_t, \phi_{o,t+1})$ where $W(\mathbf{z}_{j,t}, a_t, b_t, \phi_{o,t+1}) = \sum_{o=1}^{O} V(\mathbf{z}_{j,t}, a_t, b_t, \phi_{o,t+1}) p(o_{t+1}|a_t, b_t, \mathbf{z}_{j,t})$. For each occupation we compute policy functions, i.e. calculate $a(\mathbf{z}_{j,t}, b_{t-1}, a_{t-1})$ and $b(\mathbf{z}_{j,t}, b_{t-1}, a_{t-1})$ $\forall o$ (using F.O.C. s from the optimization problem in Equation 2). We then feed policy functions into the value and update: $V^o(\mathbf{z}_{j,t}, a_{t-1}, b_{t-1})$. Furthermore, we compute occupation choice

probabilities: $\delta(o_t|\mathbf{z}_{j,t}, b_{t-1}, a_{t-1}) = \frac{exp(V^o(\mathbf{z}_{j,t}, b_{t-1}, a_{t-1})}{\sum_{o'_t} exp(V^o(\mathbf{z}_{j,t}, b_{t-1}, a_{t-1})}$. Next, we update the guesses of $W_a(\mathbf{z}_{j,t}, a_t, b_t, \phi_{o,t+1})$, $W_b(\mathbf{z}_{j,t}, a_t, b_t, \phi_{o,t+1})$ using envelope conditions and probabilities from step 4. Aggregation is done using steady state distribution of the idiosyncratic income shocks, liquid and illiquid assets and the probabilities of being in each occupation which we assume we can handle as masses of our population. Mathematically the guess is used for the value function that reads as:

$$\overline{V}_j(e_t, a_{t-1}, b_{t-1}) = log[\sum_{o_t} exp(\max_{a_t^o, b_t^o} u(\xi_{j,t}^o + (1 + r_t^a)a_{t-1} + (1 + r_t^b)b_{t-1} - \Phi(a_t^o, a_{t-1}) - a_t^o - b_t^o) + \lambda_t(b_t^o - \underline{b}) + \mu_t a_t^o + \beta E_{e_{t+1}} \overline{V}_j(e_t, a_t^o, b_t^o))] \quad \text{(B.1)}$$

where $\overline{V}_j(e_t, a_{t-1}, b_{t-1}) = E_\phi V_j(e_t, a_{t-1}, b_{t-1}, \boldsymbol{\phi}_t)$. Using the above we compute the F.O.C.s with respect to liquid and illiquid assets as following:

$$u_{c_t,o} = \lambda_t + \beta E_e \partial_b \overline{V}_j(e_{t+1}, a_t^o, b_t^o) \quad \text{(B.2)}$$

$$u_{c_t,o}[1 + \Phi_1(a_t, a_{t-1})] = \mu_t + \beta E_e \partial_a \overline{V}_j(e_{t+1}, a_t^o, b_t^o) \quad \text{(B.3)}$$

where $u_{c_t,o}$ is the marginal utility of consumption in occupation o. Envelope conditions:

$$\partial_b \overline{V}_t(e_t, a_{t-1}, b_{t-1}) = \frac{\sum_{o_t} exp(\tilde{V}_t^o(e_t, b_{t-1}, a_{t-1})) u_{c_t^*,o}(1 + r_t^b)}{exp(\overline{V}_t(e_t, a_{t-1}, b_{t-1}))} \quad \text{(B.4)}$$

$$\partial_a \overline{V}_t(w_t, a_{t-1}, b_{t-1}) = \frac{\sum_{o_t} exp(\tilde{V}_t^o(e_t, b_{t-1}, a_{t-1})) u_{c_t^*,o}(1 + r_t^a - \Phi_2(a_t^*, a_{t-1}))}{exp(\overline{V}_t(e_t, a_{t-1}, b_{t-1}))} \quad \text{(B.5)}$$

The above operators are inserted in the computational method for heterogeneous agents by Auclert et al. (2019).

Calibrating the Skill-Matrix through k-means Clustering of the ONET Occupations. We calibrate the households skill-matrix in two steps. First, we clustering the thousands of occupations in ONET, and their skill-requirements, into few. Next, we construct

the vectors of skills for each households in terms of Euclidean distance from the occupations for which he does not have absolute comparative advantage. The O-NET dataset contains up to a thousand occupational categories. To map those into the model and reduce the curse of dimensionality, the 3-digit or 968 occupations in the dataset are grouped into 8 categories with similar job requirements using k-means clustering. The entries of the matrix Γ are then filled using the skill-requirements vectors provided in O-NET.[20]

First, a k-means clustering algorithm is used to identify clusters of 3-digit occupations with similar requirements. Mathematically, let M be distinct elements in the vector of job requirements reported by O-Net and let G denote a set of detailed occupations in O-Net, each characterized by the M-dimensional vector of requirements $\mathbf{h}_g$. Given the set of observations ($\mathbf{h}_1$,$\mathbf{h}_2$, ..., $\mathbf{h}_G$), the k-means clustering partitions the G observations into k ($\leq G$) sets $\mathbf{O} = (O_1, O_2, ..., O_k)$ by minimizing the within-cluster sum of squares (i.e. variance):

$$\arg\min_{\mathbf{O}} \sum_{i=1}^{k} \sum_{\mathbf{h} \in O_i} \|\mathbf{h} - \mathbf{m}_i\|^2 \tag{B.6}$$

where $\mathbf{m}_i$ is the mean of points in O_i. k is set to 8. The resulting 8 occupational clusters are summarised based on the following labels: (1) Manual trade occupations, (2) Management and supervisory occupations, (3) Machine operators, (4) Engineering occupations, (5) Healthcare and community occupations, (6) Personal services, (7) Technical-support occupations, and (8) Office and administrative support. The entries of the Γ matrix are then filled with a comparative advantage index constructed from O-NET skill-requirements.

Next, we calibrate the skill-distribution matrix in the model based on the skill-requirements for the 8 clusters. Each household j holds an absolute advantage for the occupation along the diagonal. A measure of skill-transferability is then constructed as the Euclidean distance between skill that household j possesses for occupation $j = o$ and that required in occupation o'. In the data the skill distance between occupational clusters o and o' is the sum of the

20 Each detailed requirement is ranked by its importance on a scale from 0 to 7. For example, O-Net contains information on 52 different elements within abilities - such as "Problem Sensitivity", "Mathematical Reasoning" or "Manual Dexterity". Skill requirements are "Management of Financial Resources", "Social Perceptiveness" or "Complex Problem Solving" etc.

weighted (by the employment shares in 2019) absolute difference between the elements of H_o and $H_{o'}$:

$$\gamma_j^o = \sum_m^M \text{abs}\left|h_m^j - h_m^o\right|, \tag{B.7}$$

This implies that the diagonal entries are the smallest.[21] To translate the Euclidean distance into a comparative advantage, we re-normalize every row so that the diagonal entries become all ones. This implies that in the final matrix higher values correspond to higher comparative advantage in the specific occupation. The characterization described so far captures the concept of horizontal or core-task specialization. In the data however occupations are also hierarchical. To capture also vertical specialization, each entry is multiplied by the share of occupations in cluster o with the same or higher educational attainment. The latter is computed as the mode of educational attainment for all occupations in the cluster using the 2018 BLS data and considering three levels: (1) less than college, (2) college, and (3) more than college. At last, in the baseline parametrization, the shares of households with skill j is distributed uniformly, hence $\mu_j = 1/J = 1/8$ for all $j \in J$.

C. Other Quantitative Results

Figure 8 compares impulse responses of selected variables to the same monetary policy shock in the model with the baseline calibration for the skill distribution matrix to one characterized by a lower dispersion. Larger variance may also capture fat-tailed distributions. Higher dispersion amplifies the dynamic of the flows out of employment and across jobs. This in turn acts as an equalizing force on wages. Noteworthy is that, with higher dispersion, more of the bottom and mid earners drop out of the labor force. In sum, and likewise in our empirical analysis, the selection channel becomes stronger when higher skill dispersion interacts with lower earnings.

21 Note that the entries are never zeros: since those are grouped occupations the set of skills is an average across all the occupations in the cluster.

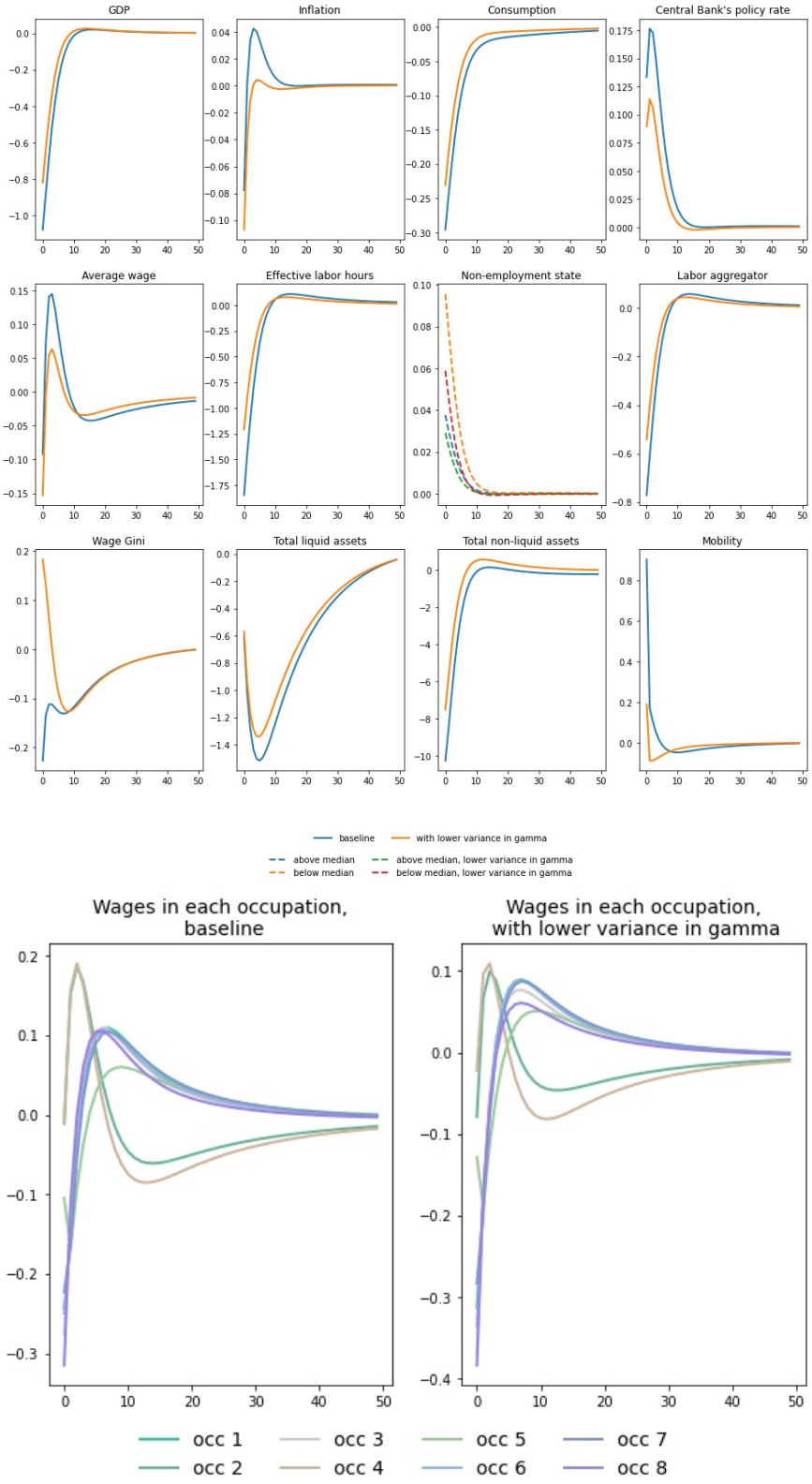


Figure 8: Impulse Responses to a Monetary Policy Shock. Lower Variance of Skill Distribution. Impulse responses are percentage deviations from the steady state in response to a 25 b.p. increase in the Central Bank's interest rate, with persistence of 0.7. The plots compared impulse responses from the model with the occupational mobility (in blue) and from the model without it (in orange). The average wage is the weighted average wage across occupations where the weights are occupational employment shares in terms of efficiency units. Mobility panel shows reallocation across occupations aggregated across households and occupations (total occupation-to-occupation flows). Probabilities of non-employment are shown for different types of households and are presented in deviations from the steady state. X-axis shows the time in quarters.

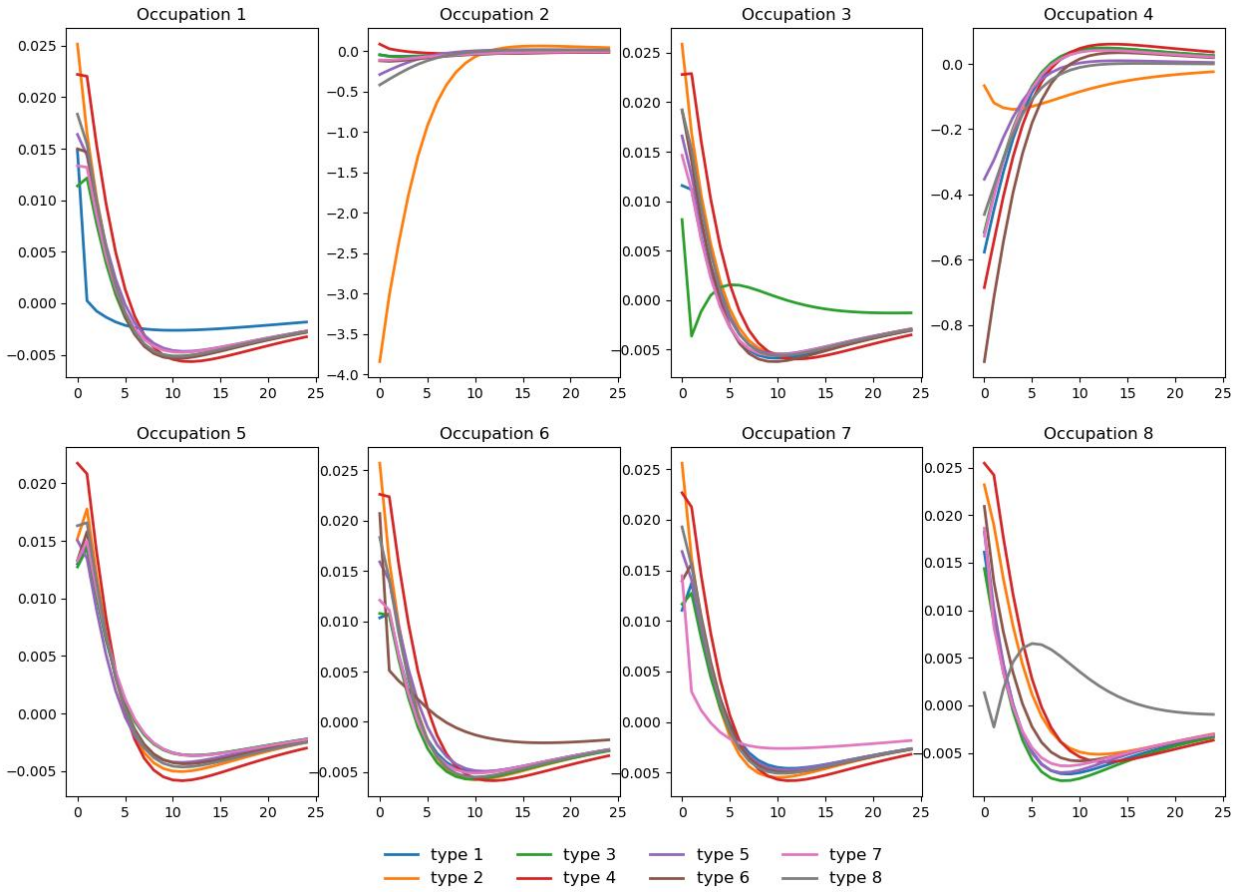


Figure 9: Reallocation Across Occupations in Response to a Contractionary Monetary Policy Shock. The figure shows percentage deviations of the occupational probabilities from the steady state in response to a 25 bp contractionary monetary policy shock. It shows responses aggregated across household types and for each occupation.