

The Uneven Welfare Costs of the Volcker Disinflation*

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Abstract

We use a Heterogeneous Agent New Keynesian (HANK) model to quantify the distribution of welfare gains and losses of the US Volcker disinflation. In the long run households prefer low inflation, but the Volcker disinflation requires a transition period characterized by a sharp increase in the real interest rate and unemployment, as well as a redistribution from net nominal borrowers to net nominal savers. We calibrate the model to match the micro and macro moments of the late 1970s high-inflation environment and examine the actual changes in the nominal interest rate and inflation over the Volcker disinflation. While aggregate welfare gains are positive, the effects are highly skewed across households; almost 50 percent would prefer to avoid the disinflation. This share depends negatively on the liquidity value of money, positively on the average duration of nominal borrowing, and positively on the short-run increase in the real interest rate.

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1 Introduction

In most environments, households would prefer an economy with low and stable inflation over one with persistently high inflation. Even putting aside costs from relative price dispersion and inflation uncertainty, high inflation imposes resource costs as consumers alter their savings and consumption behavior in order to economize on nominal liquid assets subject to an inflation tax. In recent years, the welfare costs of high inflation have been especially salient. After averaging 8 percent in 2022, CPI inflation has declined but remains above the Federal Reserve’s 2 percent target. The last time US households faced a comparable inflation episode was almost 50 years ago. In the late 1970s, inflation was in excess of 10 percent. Paul Volcker, Chair of the Federal Reserve from 1979 to 1987, publicly committed to reducing inflation and largely succeeded by the mid-1980s. The period of tight monetary policy designed to tame high inflation became known as the Volcker disinflation, and it has been influential for modern practitioners of monetary policy.

In this paper, we revisit the welfare costs and benefits of the Volcker disinflation. The debate over the costs of disinflation typically centers on an aggregate sacrifice ratio, or the short-run loss in output or employment necessary to reduce the rate of price inflation. But the focus on aggregates necessarily abstracts from the underlying heterogeneous effects. By developing a framework to study the distributional effects, we quantify the redistributive costs and benefits of the Volcker disinflation.

The heterogeneous effects are potentially significant for several reasons. First, the Volcker period encompassed a sharp increase in the real interest rate and unemployment; the incidence of which is felt unevenly across the income and wealth distribution. Next, disinflation lowers the burden of the inflation tax whose incidence varies across households with heterogeneous money demand. Furthermore, households typically borrow in nominal contracts with long durations and hold a mix of real and nominal assets. A sudden decrease in inflation and inflation expectations accompanying an increase in the real interest rate increases the real burden of net nominal borrowers and redistributes resources towards net nominal savers ([Doepke and Schneider, 2006a](#)).

To isolate the welfare costs imposed by a sudden disinflation, we build a heterogeneous agent New Keynesian (HANK) monetary economy ([Kaplan et al., 2018](#)). We extend a Bewley-Imrohoroglu-Huggett-Aiyagari economy to include money, valued for its liquidity services, a durable good, and long-term secured loans. Households face idiosyncratic earnings shocks as in a standard income fluctuation problem but now also face a portfolio choice problem. They must allocate resources between money, a long-term interest-bearing nominal asset, and investment in durable goods. They also have access to secured borrowing against their durable stock in the form of a long-term nominal contract. Nominal borrowing is the first source of nominal rigidities and allows us to capture a common feature of household balance sheets: a fixed-rate mortgage secured by a house or other secured loans, such as those for automobiles. The second source of nominal rigidity arises from sticky wages, which creates a short-run tradeoff between inflation and unemployment embodied in a wage Phillips curve ([Erceg et al., 2000](#); [Auclert et al., 2018](#)). The nominal interest rate and inflation rate are jointly determined by the fiscal and monetary authorities.

We calibrate the model to match key features of the US economy just before the Volcker disinflation. We do not argue that the economy was in a high-inflation steady state in 1980 prior to the Volcker disinflation. Instead, the economy had undergone a sequence of inflationary shocks and several false starts by the Federal Reserve in attempting to reduce inflation. The high-inflation equilibrium should therefore be understood as the relevant policy benchmark facing the Federal Reserve at the time: accommodate the elevated inflation of the late 1970s or disinflate.

From that starting point, we construct a *disinflation equilibrium path* as the economy's dynamic response to a sudden shift in monetary and fiscal policy. We calibrate monetary and fiscal policy to match the exact sequence of nominal interest rates and inflation observed during the Volcker disinflation. This path includes a short-run increase in the real interest rate before nominal interest rates and inflation fall to their permanently lower level.¹ Because of sticky wages and the resulting wage Phillips curve, there is a decline in output and an increase in unemployment along the disinflation path, consistent with the recession generated by the Volcker disinflation. We calibrate shocks to the wage Phillips curve to match the observed decrease and recovery of employment during the period. In implementing the Volcker disinflation, we therefore take the paths of nominal interest rates, inflation, and employment from the data. While the model provides a general-equilibrium framework that can rationalize these aggregate dynamics, we primarily view it as a measurement device. It allows us to quantify the welfare effects of the disinflation and to examine the impact of the four main channels that shape those effects: redistribution, the inflation tax, the real interest rate, and unemployment.

The unanticipated policy shift endogenously redistributes resources away from borrowers and towards savers. Borrowers also experience a sudden increase in their continued borrowing costs due to the rise in the real interest rate. Borrowers deleverage in response to their unexpectedly large real debt burden, while savers further increase their savings to smoothly consume the real value of their windfall over future periods. At the same time, all households are hurt by the rise in unemployment, and all households rebalance their portfolios as a reduced inflation tax lowers the cost of holding real balances.

The full welfare effects of the disinflation will be determined jointly by the benefit of the lower inflation tax, the cost of the redistribution, and the changes in the real interest rate and unemployment. For both borrowers and savers, the immediate impact of the transition is ambiguous. Savers receive a windfall from the redistribution while also benefiting from the lower inflation tax and the higher real interest rate. However, they face costs from the increase in unemployment. For borrowers, the welfare benefit depends on whether the lower inflation tax is enough to compensate them for both the wealth lost in the redistribution and the short-run increase in the real interest rate and unemployment. In our baseline calibration, the aggregate gains from the Volcker disinflation are positive; on average, households need to be compensated between 2 and 3 percent of their consumption in order to be willing to stay in the high-inflation steady state. However,

¹Hagedorn (2011) shows that this temporary increase in nominal rates may not have been an optimal strategy depending on the level of credibility of the central bank.

the costs and benefits are unevenly distributed across households; almost 50 percent of households prefer to remain in the high inflation steady state rather than face the costs of the redistribution and the temporary increase in real borrowing costs and unemployment. This suggests that the long-run benefit of the lower inflation tax is not enough to compensate many borrowers for their losses during the transition.

The costs and benefits of the Volcker disinflation are borne unequally across the income distribution. In an up or down vote, 38 percent of low income households, 72 percent of middle income households, and no high-income households would choose to live with high inflation despite the high inflation tax. In the long run, if they could skip the redistribution and disinflation period, all of these households would prefer the low-inflation equilibrium.

We decompose the overall welfare costs into separate efficiency, redistribution, and insurance components, applying the methodology of [Bhandari et al. \(2023\)](#). In the baseline model, the 2 to 3 percent average consumption-equivalent welfare gain follows from positive contributions from the efficiency and insurance benefits of the disinflation, which are partially offset by negative contributions from the redistribution component.

We then explore the sensitivity of the welfare results to four alternative experiments. First, we ask how these welfare results depend quantitatively on the burden of the inflation tax, which is determined by the liquidity value of money. We compare our baseline welfare results to a calibration of an economy with no money. Without any offsetting welfare gains from the reduction of the inflation tax, the average welfare gain from the disinflation falls by half.

Second, we compare the welfare results from the baseline calibration to a version where households can only borrow in 1-period real debt, as opposed to the 4.5 year duration nominal-debt in the baseline calibration. In this case, there is no longer a revaluation of nominal debt. The shorter duration real debt substantially decreases the size of the redistribution—in the decomposition, the redistribution component falls by about 20%. Because the redistribution is smaller, borrowers are more willing to face the burden of the redistribution in exchange for the benefit of the lower inflation tax. However, the borrowers are still hurt by the short-run increase in the real interest rate. In this economy, although the welfare costs for most households are substantially smaller than the baseline model, 47% still prefer to stay in the high inflation steady state because of the changes in the real interest rate during the disinflation.

Third, we compare our results to a version in which there is no change in the real interest rate along the disinflation path. Although borrowers no longer face a temporary increase in their borrowing cost, they are still hurt by the redistribution, and most borrowers still prefer to remain in the high-inflation steady state. Still, because the rise in the real rate hurts borrowers and helps savers, the size of the redistribution channel falls by half relative to the baseline transition.

Finally, we consider an experiment in which there is no short-run increase in unemployment. This case could be considered a best-case-scenario for the Federal Reserve if they were able to disinflate without invoking a shift along the wage Phillips curve. Removing the increase in the unemployment rate changes the welfare results only modestly. In the model, the decline in labor

income associated with higher unemployment is partly offset by the utility value of additional leisure. The differences between the baseline calibration and the alternative experiments highlight the importance of capturing all four channels—the redistribution, the decrease in the inflation tax, and the changes in the real interest rate and unemployment—when considering the welfare costs of the Volcker disinflation.

After discussing the previous literature, in Section 2 we describe our model and in Section 3 we describe the data and model calibration. In Section 4 we describe the transition period for our baseline experiment: a surprise disinflation calibrated to match the paths of nominal interest rates, inflation, and employment during the Volcker disinflation, and discuss the welfare effects of the disinflation. Section 5 compares the results from our baseline calibration to a cashless economy, an economy with only one-period borrowing, and a transition with no change in the real interest rate and unemployment. Section 6 concludes.

Contribution to the literature

Our analysis of the Volcker disinflation highlights the importance of considering four channels to understand the welfare costs of a disinflationary period: the revaluation of nominal assets, the change in the inflation tax, and the changes in the real interest rate and unemployment. We discuss the literature on each of these channels below. A key contribution of our work is that we are the first to consider this question in a HANK model with a rich enough portfolio choice problem on the household side to jointly consider all four channels.

We include money explicitly to allow for long-run benefits of reducing steady-state inflation. With money, inflation serves as a tax, which directly affects households’ demand for real balances and consumption. The idea of inflation as a consumption tax is well established, and the effects can be significant for welfare.² Allais, Algan, Challe, and Ragot (2020) and Cao, Meh, Ríos-Rull, and Terajima (2018) consider the welfare consequences of an inflation tax in models with incomplete markets, but they do not examine the redistribution consequences of a change in inflation along the transition path. The long-run equilibrium effects of inflation on the real interest rate are developed in Dotsey and Ireland (1996) and Aiyagari et al. (1998). They introduce a channel where inflation draws resources away from production and into credit services to avoid an inflation tax, inducing a general equilibrium effect on the real interest rate.

The redistribution or Fisher channel has been most recently studied in work by Auclert (2019) and Doepke and Schneider (2006a). They show that an unexpected shock to the inflation rate will revalue nominal assets, causing a redistribution between borrowers and savers. Doepke and Schneider (2006a) reinvigorated an early literature on inflation and redistribution (see for example Bach and Stephenson, 1974) by documenting the economically significant net nominal exposure of

²While Lucas (2000) and Bailey (1956) find small estimates of the welfare costs of inflation from integrating under an estimated money demand curve in a representative agent economy. Chatterjee and Corbae (1992) and Imrohoroglu (1992) find that incomplete market arrangements can significantly amplify welfare costs of an inflation tax over the earlier complete markets estimates. Attanasio et al. (2002) and Erosa and Ventura (2002) also show that transaction costs from inflation vary considerably across households.

various cohorts and sectors in the US economy and conducting a reduced form calculation of the redistribution from a surprise inflation episode. [Adam and Zhu \(2016\)](#) perform a similar analysis for Euro Area households, and they further consider redistributive effects across countries within the currency union.

Several papers have also examined the effect of the Fisher channel quantitatively in a heterogeneous agent model with incomplete markets, but they exclude the long-run benefits of lower inflation. [Doepke and Schneider \(2006b\)](#) and [Meh, Ríos-Rull, and Terajima \(2010\)](#) do this by treating a surprise inflation as an exogenous redistribution of wealth and examine the resulting transition path back to the stationary equilibrium. Instead, we model inflation directly and consider the portfolio choice problem by households that captures the long-run welfare effects of the lower inflation tax. Without the inflation tax, changing the steady-state rate of inflation amounts to a simple redistribution of wealth with no long-run benefits.

Recent work considers the transmission of monetary policy in an incomplete markets framework.³ However, the goal of this literature is distinct from our own. These papers are interested in characterizing how heterogeneity will affect the central bank’s ability to use monetary policy as a tool to counteract short-term business cycle fluctuations. In contrast, we are interested in characterizing the redistribution effects of a long-run change in monetary and fiscal policy. [Kaplan, Moll, and Violante \(2018\)](#), [Gornemann, Kuester, and Nakajima \(2016\)](#) and [Mitman, Manovskii, and Hagedorn \(2017\)](#) extend these models to include a New Keynesian block on the production side. Their focus is also on the transmission of monetary policy rather than the distributional consequences of a large permanent shock to steady-state inflation. An interesting exception is [Sterk and Tenreyro \(2018\)](#) who use an incomplete markets model with money to consider the effect of a redistribution between households and government on the pass-through of monetary policy. Building on this work, [Auclert et al. \(2018\)](#) embed the sticky-wage framework from [Erceg et al. \(2000\)](#) into a HANK model giving rise to a wage Phillips curve and examine the implications for the fiscal multiplier.

Finally, we build on the work of [Hagedorn \(2016\)](#) and [Hagedorn \(2018\)](#) who prove price-level determinacy under incomplete markets. They show that when the government issues nominal debt, even for an arbitrary interest rate rule, price-level determinacy is assured by equating the real value of government debt with household net asset demand to clear the asset, or equivalently the goods, market—a demand theory of the price level. This is feasible since precautionary motives under incomplete markets break Ricardian equivalence and make net asset demand a well-defined increasing function of the real interest rate. The demand theory is particularly well-suited for our analysis since it allows us to jointly characterize the fiscal and monetary policies that implement the actual path of inflation and nominal interest rates during the Volcker disinflation.

³For example, [Wong \(2015\)](#), [Cloyne, Ferreira, and Surico \(2020\)](#), [Garriga, Kydland, and Šustek \(2017\)](#), [Bhandari et al. \(2021\)](#), and [Ozkan, Mitman, Karahan, and Hedlund \(2017\)](#) show that part of the consumption response to a monetary policy or inflation shock will take place through the refinancing of household debt or the effects of interest-rate and inflation changes on households’ nominal assets and liabilities.

2 Monetary economy with heterogeneity

We start by extending a Bewley-Imrohoroglu-Huggett-Aiyagari economy to include money, durable goods, long-term secured nominal lending contracts, and nominal wage rigidities.⁴ As in the standard model, households cannot perfectly insure idiosyncratic shocks to their labor productivity, but may trade in cash, interest-bearing nominal assets, and durable goods, of which the latter may also serve as collateral. We first consider a stationary environment with high inflation. To study the welfare effects of a disinflation, we quantify the response of this high-inflation economy to an unanticipated tightening of the monetary policy stance intended to permanently reduce inflation. We then measure both the short-run and long-run benefits and costs of inflation across the evolving distribution of households along the equilibrium path.

2.1 Preliminaries

Time is discrete. The economy consists of a large number of dynastic households indexed by i and represented by the unit interval $i \in [0, 1]$. Each supplies labor to a labor union that negotiates over wages and labor supply with a labor packer; a government implements fiscal and monetary policy.

This is a monetary economy where money, $\tilde{m}$, is together a numeraire, a store of value and a source of liquidity services to the households. As numeraire we define the money price of period t output as P_t and denote the real value of money balances as $m \equiv \tilde{m}/P$. Throughout, we use the $\tilde{\cdot}$ notation to indicate a nominal variable. We capture the liquidity value of money by including real balances m directly in the household's preferences, although the economy would be little changed if demand for real balances were instead determined by shopping time or cash-in-advance constraints.⁵

Preferences and endowments. Households have identical preferences over sequences of non-durable consumption, c_t , real balances, m_t , and the service flow from durables, d_{t-1} , ordered by

$$E_0 \left[\sum_{t=0}^{\infty} \beta^t (u(c_t, m_t, d_{t-1}) - v_t(n_t)) \right], \quad (1)$$

with discount factor β and standard assumptions on u . The expectation is over only the household's idiosyncratic labor efficiency; there is no aggregate uncertainty. Each household supplies n_t units of labor to a production sector, with n_t negotiated by the labor union. Labor efficiency $z_t \in \{z_1, \dots, z_{N_z}\}$ follows a Markov chain with constant transition matrix $P = [p_{lk}]$ initialized from its stationary distribution $\bar{p} \in \mathbb{R}^{N_z}$. Since draws are independent across households, a law of large numbers implies that the aggregate quantity of efficiency units of labor $\bar{N}$ is constant and equal to

⁴Money is included solely to incorporate the welfare costs of economizing on the liquidity it provides under high inflation. Price level determinacy is ensured under incomplete markets through the demand theory of the price level (Hagedorn, 2016) as we describe in Section 2.5.

⁵With some small alterations to the timing assumptions our model would be equivalent to cash-credit or shopping time microfoundations of money demand. We would expect similar results in any model where inflation generates utility or resource costs to economizing on liquid assets.

$E[z_t]$. The employment rate, i.e., the share of this labor used in production, $N_t/\bar{N}$, is negotiated by a myopic labor union that trades off higher wages for a lower employment rate.

Production The production sector consists of a representative firm that uses capital and labor to produce. They rent capital from the mutual fund, but face costs denominated in the final good, $\zeta(K_t, K_{t-1})$, to adjusting their installed capital. They choose labor, taking wages as negotiated by the labor union. Given an initial installed capital stock, K_{-1} , firms choose the stream of capital and labor to maximize profits:

$$\max_{\{K_t, N_t\}} \sum_{t=0}^{\infty} \frac{1}{R_{0,t}^K} (P_t A K_{t-1}^\alpha N_t^{1-\alpha} - P_t V_t K_{t-1} - P_t W_t N_t - P_t \zeta(K_t, K_{t-1}) K_{t-1}). \quad (2)$$

Throughout, we use capital letters to denote aggregate quantities. Aggregate output, $Y_t = A K_{t-1}^\alpha N_t^{1-\alpha}$, may be consumed by households, C_t , invested, either in the capital stock, I_t^K , or durables, I_t^D , or purchased by the government, G_t , so that the aggregate resource constraint is:

$$Y_t = C_t + I_t^K + I_t^D + G_t. \quad (3)$$

Given aggregate investment, I_t^K , the capital stock depreciates at rate δ^K and follows the law of motion:

$$I_t^K = K_t - (1 - \delta^K) K_{t-1} + \zeta(K_t, K_{t-1}) K_{t-1}. \quad (4)$$

Durable investment may vary across households. Given aggregate durable investment, $I_t^D = \int_0^1 i_{it}^D di$, the aggregate durable stock follows the law of motion:

$$I_t^D = D_t - (1 - \delta^D) D_{t-1} + \int_0^1 \Psi_i di, \quad (5)$$

The last term sums the household-level durable adjustment cost, $\Psi(d_{it}, d_{it-1})$, across households so the aggregate adjustment cost will depend on the underlying distribution of durable investment across households.

Nominal wage-setting union Following [Erceg et al. \(2000\)](#) and [Auclert et al. \(2018\)](#), we incorporate sticky wages through the use of a labor union. Workers provide labor services to a continuum of labor unions, indexed by k , who provide differentiated labor services to a labor packer. The packer is a CES aggregator of all the labor varieties in the economy,

$$N_t = \left(\int_k N_{kt}^{\frac{\varepsilon_w - 1}{\varepsilon_w}} dk \right)^{\frac{\varepsilon_w}{\varepsilon_w - 1}}.$$

Let W_t denote the real wage per efficiency unit of labor and $\tilde{W}_t = P_t W_t$ the nominal wage. The union k chooses the sequence of nominal wages to maximize the average utility of its members

subject to a log-quadratic adjustment cost on nominal wages

$$\max_{\{\tilde{W}_{kt}\}} \sum_{t=0}^{\infty} \beta^t \left(\int_0^1 [u(c_{it}, m_{it}, d_{i,t-1}) - v_t(n_{it})] di - \frac{\psi}{2} \log \left(\frac{\tilde{W}_{kt}}{\tilde{W}_{kt-1}} / \Pi^* \right)^2 \right)$$

and subject to labor demand $N_{kt} = N_t \left(\frac{\tilde{W}_{kt}}{\tilde{W}_t} \right)^{-\varepsilon_w}$.

This gives rise to a wage Phillips curve:

$$\log(\Pi_t^w) = (1 - \beta) \log(\Pi^*) + \beta \log(\Pi_{t+1}^w) + \frac{\varepsilon_w}{\psi} \left[\int_0^1 \gamma n_{it}^{1+\frac{1}{\varepsilon}} di - \frac{\varepsilon_w - 1}{\varepsilon_w} (1 - \tau) \lambda \int_0^1 (W_t z_{it} n_{it})^{1-\tau} \frac{\partial u(\cdot)}{\partial c_{it}} di, \right] \quad (6)$$

where gross nominal wage inflation is

$$\Pi_t^w \equiv \frac{\tilde{W}_t}{\tilde{W}_{t-1}} = \Pi_t \frac{W_t}{W_{t-1}}.$$

2.2 Market arrangements

There are competitive capital rental markets with price $P_t V_t$. Financial intermediation is through a representative mutual fund, which owns the capital stock and makes secured long-term *nominal* lending contracts to households and the government.

Household borrowing and saving. Households may borrow in nominal secured loans from the mutual fund for durable purchases. There is no unsecured borrowing. To match the higher duration borrowing observed for US households, we build on [Hatchondo and Martinez \(2009\)](#) and [Auclert \(2019\)](#) and allow the mutual fund to offer long-term nominal debt contracts with a duration that depends on parameter ρ . A household who borrows $\tilde{l}_t \geq 0$ towards a purchase of durable goods agrees to a perpetual stream of payments $\tilde{l}_t / P_t^{\tilde{L}}$, $\rho \tilde{l}_t / P_t^{\tilde{L}}$, $\rho^2 \tilde{l}_t / P_t^{\tilde{L}}$, $\dots$ that decay at rate ρ , where $P_t^{\tilde{L}}$ is the price of the loan. With $\rho = 0$ this is a one-period loan, but increasing ρ stretches the duration of the loan, mimicking longer-term borrowing such as mortgages. A secured nominal lending constraint,

$$\frac{\tilde{l}}{P_t^{\tilde{L}}} \left(1 + \rho P_{t+1}^{\tilde{L}} \right) \leq \mu (1 - \delta^D) d_t P_{t+1}, \quad (7)$$

ensures that the value of the security can be used to repay the loan. The left-hand side is the nominal value of the household's borrowing in period $t+1$, and the right-hand side is some fraction $\mu \leq 1$ times the nominal value of the household's remaining durables in period $t+1$.⁶

Households may save by holding equity, $\tilde{e}_t$, in the mutual fund, but they may not simultaneously borrow or save, i.e., $\tilde{l}_t \tilde{e}_t = 0$. It will be useful to distinguish borrower and saver households by

⁶Since the borrowing constraint (7) depends on future prices, an unexpected disinflation may push constrained households beyond their secured borrowing limits ex post. For this reason, we set μ low enough so the value of the loan will never exceed the full value of the remaining durables.

their nominal financial net worth, $\tilde{a} = \tilde{e}_t - \tilde{l}_t$. However, it will not be sufficient to simply track net financial assets. While expected rates of return on household borrowing and saving are equivalent, as we explain below, an unanticipated disinflation would affect the ex post return on borrowing and saving differently.

Government. We treat the government symmetrically to households. The government has a stock of nominal government debt $\tilde{B}_t$. When $\tilde{B}_t > 0$, the government borrows $\tilde{B}_t = \tilde{L}_t^G$ from the financial intermediary with the same perpetual coupon structure. Unlike household borrowing, government debt is not subject to a collateral constraint since it is backed by future tax revenues. In case the government is a saver, $\tilde{B}_t \leq 0$, (like households) it holds its savings as equity, $\tilde{E}_t^G$, in the mutual fund so that, in general, $-\tilde{B}_t = \tilde{E}_t^G - \tilde{L}_t^G$ with $\tilde{E}_t^G \tilde{L}_t^G = 0$.

Mutual fund. Financial intermediation is through a mutual fund. The fund is financed entirely through its equity, $\tilde{E}_t = \int \tilde{e}_{it} di + \tilde{E}_t^G$, which is invested in capital, $P_t K_t$, and in lending, $\tilde{L}_t = \int \tilde{l}_{it} di + \tilde{L}_t^G$, to households and the government. Capital purchased at price P_t is rented to firms the following period at rate $P_{t+1} V_{t+1}$. Including the value of the undepreciated capital, the gross nominal return on capital investment is:

$$R_{t+1}^{PK} = \frac{V_{t+1} P_{t+1} + (1 - \delta) P_{t+1}}{P_t} = \Pi_{t+1} (V_{t+1} + 1 - \delta), \quad (8)$$

where $\Pi_{t+1} = P_{t+1}/P_t$ is the gross inflation rate, which converts the real return on capital to a nominal return. Given the geometric decay structure of the long-term debt contract, the gross nominal return on the fund's investment in lending is:

$$R_{t+1}^{\tilde{L}} = \frac{1 + \rho P_{t+1}^{\tilde{L}}}{P_t^{\tilde{L}}}. \quad (9)$$

Increases in ρ increase the duration of the loan portfolio and thus the sensitivity of its value to the nominal interest rate.⁷

Since the mutual fund is financed entirely by equity, total equity, $\tilde{E}_t$, equals total assets, $\tilde{L}_t + P_t K_t$. We let $\phi_t \equiv \frac{\tilde{L}_t}{\tilde{L}_t + P_t K_t}$ denote the share of the fund's assets (and equity) held in loans.⁸ Then, the gross nominal return on mutual fund equity can be written as the share-weighted average:

$$R_{t+1}^{\tilde{E}} = \phi_t R_{t+1}^{\tilde{L}} + (1 - \phi_t) R_{t+1}^{PK}. \quad (10)$$

⁷For example, with a constant gross nominal return R , in equilibrium $P_t^{\tilde{L}} = \frac{1}{R - \rho}$ and the duration of the lending portfolio would be $\frac{R}{R - \rho}$. To see this, note that the Macaulay duration is defined as the horizon weighted average of discounted future cash flows relative to the price. In this case:

$$D \equiv \sum_{k=1}^{\infty} k \left(\frac{1}{R} \right)^k \rho^{k-1} / P_t^{\tilde{L}} = \frac{R - \rho}{\rho} \sum_{k=1}^{\infty} k \left(\frac{\rho}{R} \right)^k = \frac{R}{R - \rho}.$$

The third equality follows from the convergent power series $\sum_{k=1}^{\infty} k z^k = z / (1 - z)^2$.

⁸Because capital is a real asset and lending is a nominal asset, the loan share ϕ_t is also the nominal share of assets.

We consider an equilibrium where the mutual fund holds both capital and loans in its portfolio, $\phi_t \in (0, 1)$, thus a no-arbitrage condition ensures the expected return on bank equity must equal the expected return on its loan and capital investments:

$$E_t \left[R_{t+1}^{\tilde{E}} \right] = E_t \left[R_{t+1}^{\tilde{L}} \right] = E_t \left[R_{t+1}^{PK} \right]. \quad (11)$$

Under perfect foresight, the expectation operator over returns may appear unnecessary. However, if realized prices were to differ from their expected values, e.g. because of an unanticipated disinflation, the ex post return on equity in (10) would be different than its expected return in (11).

The modeling choice of equity over debt financing for the intermediary is important in this case. A lower-than-expected realization of inflation reduces the nominal return on capital but not the nominal return on lending. And if $\rho > 0$, the nominal return on lending actually increases. In this event, the ex-post return on mutual fund equity simply adjusts according to (10). If the intermediary were instead financed by nominal debt, such as a bank deposits the increases in the nominal return on long-term lending might not offset the reduction in the nominal return on capital, and the intermediary would not be able to pay the interest owed on deposits. If the return paid on deposits matched the return on lending, the intermediary would be insolvent.

2.3 Household behavior

Given these arrangements, the timing is as follows. In each period t , a household begins the period with nominal asset positions, denoted by $\tilde{\cdot}$, given by $\tilde{m}_{t-1} + \tilde{e}_{t-1} - \tilde{l}_{t-1}$, and with remaining durables $(1 - \delta^D)d_{t-1}$. After the current price level P_t is realized, the real value of these nominal positions is pinned down. Households earn a nominal wage $P_t W_t$ per efficiency unit of labor. Taxes are progressive, following [Heathcote et al. \(2010\)](#). They may purchase consumption, c_t , and invest in durable goods, i_t^D , both at price P_t . They can also adjust their money holdings, $\tilde{m}_t$, and borrow $\tilde{l}_t$ in loans subject to borrowing constraint (7) or save through the purchase of equity $\tilde{e}_t$ (but not both, with $\tilde{l}_t \tilde{e}_t = 0$). Using (5) to substitute for i_t^D and dividing by P_t to express in terms of output, the household is subject to a sequence of real budget constraints:

$$c_t + m_t + e_t - l_t + d_t + \Psi(d_t, d_{t-1}) = \lambda(W_t n_t z_t)^{1-\tau} + \frac{e_{t-1} R_t^{\tilde{E}} - l_{t-1} R_t^{\tilde{L}} + m_{t-1}}{\Pi_t} + (1 - \delta^D) d_{t-1} \quad (12)$$

where $e_t = \tilde{e}_t / P_t$ and $l_t = \tilde{l}_t / P_t$ are the real values of the nominal saving and borrowing. Given initial real savings $e_{-1} - l_{-1} + m_{-1}$ and durable stock d_{-1} , each household maximizes (1) subject to sequences of borrowing (7) and budget constraints (12) for $t \geq 0$.

To characterize household behavior, it is helpful to rewrite its sequence problem recursively. We first define the household's real net worth in period t after inflation, Π_t is realized:

$$q_t \equiv \frac{m_{t-1} + e_{t-1} R_t^{\tilde{E}} - l_{t-1} R_t^{\tilde{L}}}{\Pi_t} + (1 - \delta^D) d_{t-1}. \quad (13)$$

For all $t \geq 0$, given real net worth q_t , accumulated durables d_{t-1} , and labor efficiency z_t , we let $\mathcal{V}_t(q_t, d_{t-1}, z_t)$ denote the value of a household in period t . Then for all $t \geq 0$, $\mathcal{V}_t$ satisfies a sequence of Bellman equations:

$$\mathcal{V}_t(q_t, d_{t-1}, z_t) = \max_{c_t, m_t, d_t, e_t, l_t} \{u(c_t, m_t, d_{t-1}) - \nu_t(n_t) + \beta E[\mathcal{V}_{t+1}(q_{t+1}, d_t, z_{t+1}) | z_t]\}, \quad (14)$$

each subject to a real budget constraint,

$$c_t + e_t - l_t + d_t + \Psi(d_t, d_{t-1}) + m_t = q_t + \lambda(W_t n_t z_t)^{1-\tau},$$

a real borrowing constraint from (7),

$$l_t R_{t+1}^{\bar{L}} \leq \Pi_{t+1} \mu (1 - \delta^D) d_t,$$

which incorporates definition of the gross nominal return on lending, (9), and the requirement that the household is either a saver or borrower, but not both, i.e., $e_t l_t = 0$. Next period q_{t+1} is determined according to (13). The value functions depend on t through interest rates, i_t , wages, W_t and fiscal and monetary policy, which may vary over time. We abuse notation slightly and label the policy functions that satisfy the Bellman equation as $c_t(q_t, d_{t-1}, z_t)$, $m_t(q_t, d_{t-1}, z_t)$, $d_t(q_t, d_{t-1}, z_t)$, $e_t(q_t, d_{t-1}, z_t)$, and $l_t(q_t, d_{t-1}, z_t)$.

2.4 Aggregating over heterogeneous households

Before characterizing an equilibrium, we first define a measure to keep track of the distribution of households. Let $\psi_t(q, d, z)$ be the measure of households that *begin* period t with $q_t \leq q$, $d_{t-1} \leq d$ and efficiency $z_t = z$. For $t \geq 0$, given household policy rules a_t , m_t , and d_t , this measure must satisfy the law of motion:

$$\begin{aligned} \psi_t(q', d', z_j) = \sum_{k=1}^{N_z} \left[\iint \mathbf{1} \left\{ \left(\frac{e_{t-1}(q, d, z_k) R_t^{\bar{E}} - l_{t-1}(q, d, z_k) R_t^{\bar{L}} + m_{t-1}(q, d, z_k)}{\Pi_t} \right. \right. \right. \\ \left. \left. \left. + (1 - \delta_D) d_{t-1}(q, d, z_k) \right) \leq q' \cap d_{t-1}(q, d, z_k) \leq d' \right\} \psi_{t-1}(\partial q, \partial d, z_k) \right] p_{kj}. \quad (15) \end{aligned}$$

This captures the evolution of real net worth and durables given each household's choices and the realization of the Markov state z . The dependence on t is through the household policy rules, which are themselves functions of equilibrium prices.

Using ψ_t , we can define aggregate quantities for consumption

$$C_t \equiv \sum_{k=1}^{N_z} \left[\iint c_t(q, d, z_k) \psi_t(\partial q, \partial d, z_k) \right],$$

demand for real balances,

$$M_t^d \equiv \sum_{k=1}^{N_z} \left[\iint m_t(q, d, z_k) \psi_t(\partial q, \partial d, z_k) \right],$$

durables,

$$D_t \equiv \sum_{k=1}^{N_z} \left[\iint d_t(q, d, z_k) \psi_t(\partial q, \partial d, z_k) \right],$$

and aggregate household savings,

$$S_t \equiv \sum_{k=1}^{N_z} \left[\iint (e_t(q, d, z_k) - l_t(q, d, z_k)) \psi_t(\partial q, \partial d, z_k) \right].$$

The outer sum in each definition is over the distribution of z , which is stationary.⁹

2.5 Government

The government is a consolidated fiscal and monetary authority. It sets the nominal rate of return, $R_t^{\tilde{L}}$, and nominal borrowing, $\tilde{B}_t$, and provides a perfectly elastic supply of money, $\tilde{M}_t$, to satisfy household demand for real balances at the realized price level. Rather than through money market clearing, the price level is determined by equating the real value of government debt, with the net real asset demand from households.¹⁰ The government achieves its desired path of inflation through its choice of the nominal stock of government debt (Hagedorn, 2016).

Specifically, given initial nominal liabilities $\tilde{M}_{-1}$ and $\tilde{B}_{-1}$, and an inflation target Π^* , a *fiscal and monetary policy* is a sequence for $t \geq 0$ of labor income taxes, $\{\tilde{\tau}_t\}$, nominal interest rates, $\{R_t^{\tilde{L}}\}$, and nominal government debt, $\{\tilde{B}_t\}$. In each period, for a given realization of the price level, P_t , the nominal money stock, $\tilde{M}_t$, is determined endogenously by demand for real balances,

$$\tilde{M}_t = P_t M_t^d, \quad (16)$$

and nominal government expenditures, $P_t G_t$, are determined endogenously by the government's budget constraint,

$$P_t G_t = \tilde{M}_t - \tilde{M}_{t-1} + \tilde{B}_t - R_t^{\tilde{L}} \tilde{B}_{t-1} + P_t \int \left(z_{ti} n_t W_t - \lambda (z_{ti} n_t W_t)^{1-\tau} \right) di + P_t \text{div}_t, \quad (17)$$

given the path of its borrowing along with its seigniorage and tax revenue.¹¹ The price level, P_t ,

⁹Recall that the transition matrix of the Markov chain for labor efficiency z is defined $P = [p_{ij}]$ and the chain is initialized from its unique ergodic distribution $\bar{p} \in \mathbb{R}^{N_z}$.

¹⁰Under incomplete markets, precautionary motives ensure this net asset demand is well defined and increasing in the real interest rates.

¹¹Alternatively, government expenditures could be specified exogenously, and a lump sum transfer would adjust (passively) to maintain budget balance. However, lump sum transfers provide partial insurance to households, and any changes would have direct effects on welfare. We abstract from these effects by allowing government expenditures,

will be determined in equilibrium to clear the asset market:

$$\frac{\tilde{B}}{P_t} = S_t - K_t. \quad (18)$$

In the long run, the government can ensure it implements its inflation target, Π^* , by choosing a path of nominal bonds that grows at the same rate as desired inflation.

2.6 Stationary high-inflation equilibrium

We define the stationary *high-inflation equilibrium* as follows. Given a fiscal and monetary policy with constant nominal interest rate, $R^{\tilde{L}}$, nominal debt, $\tilde{B}_{t+1} = \Pi^H \tilde{B}_t$, growing at the target rate of inflation, and constant labor income tax, τ , a stationary equilibrium consists of prices $\{P_t, P_t^{\tilde{L}}, V_t, W_t\}$, aggregates $\{N_t, K_t, C_t, S_t, M_t, G_t\}$ and nominal wage inflation Π^w such that:

1. The price level, P_t , grows at the constant inflation rate $\Pi = \Pi^H$, while the loan price $P_t^{\tilde{L}}$, real wage W_t , and rental rate V_t are constant together satisfy the loan-pricing condition (9), the no arbitrage condition (11), and profit maximization (2).
2. Nominal wage inflation equals Π and together with N_t satisfy the wage-Phillips curve (6).
3. A stationary value function $\mathcal{V}(q, d, z)$ that solves the Bellman equation (14) with decision rules $c(q, d, z)$, $m(q, d, z)$, $d(q, d, z)$, and $a(q, d, z)$.
4. A stationary measure ψ^H that satisfies (15) given household decision rules.
5. Aggregate capital demand from (2) and aggregate savings satisfy asset market clearing (18).

2.7 Disinflation equilibrium path

We use the stationary high inflation equilibrium in $t = 0$ as the starting point. Then we ask, what if, in the following period $t = 1$, the monetary and fiscal authorities coordinate to abruptly change their fiscal and monetary policy stance? We consider a scenario where the government abandons its original inflation target Π^H and makes a credible commitment to a lower inflation target $\Pi^L < \Pi^H$ achieved through a sequence of nominal interest rates $\{R_t^{\tilde{L}}\}$ and nominal government debt $\{\tilde{B}_t\}$ for $t \geq 1$. The announcement takes households by surprise as they have already made their portfolio choices in period $t = 0$ in the high-inflation equilibrium.

Redistribution. Any change in the realized level of inflation Π_1 from its previously anticipated value Π^H alters the real value of household net worth across the distribution of households. Moreover, any change in the path of nominal rates changes the realized price $P_1^{\tilde{L}}$ of long-term loans.

which are separable from household preferences, to adjust instead. For this reason, we also rebate firm profits, div_t , to the government.

With the aggregate real value of assets unchanged, the effect is pure redistribution (Fisher effect). The redistribution sets each household's real net worth according to:

$$q_1 = \begin{cases} \frac{m_0}{\Pi_1} + a_0 \frac{1+P_1^{\tilde{L}}\rho}{P_0^{\tilde{L}}\Pi_1} + (1-\delta^D) d_0 & \text{if } a_0 < 0 \\ \frac{m_0}{\Pi_1} + \left((1-\phi_0)(1+V_1-\delta) + \phi_0 \frac{1+P_1^{\tilde{L}}\rho}{P_0^{\tilde{L}}\Pi_1} \right) a_0 + (1-\delta^D) d_0 & \text{if } a_0 \geq 0 \end{cases}. \quad (19)$$

For households with debt, $a_0 < 0$, the redistribution increases the real value of their nominal liabilities. They had anticipated a real borrowing cost of $R_0^{\tilde{L}}/\Pi^H$ and find instead the realized borrowing cost between period 0 and 1 is $(1+\rho P_1^{\tilde{L}})/(P_0^{\tilde{L}}\Pi_1)$. For households with savings, $a_0 \geq 0$, the redistribution increases the real value of their mutual fund equity, but only for the nominal share of mutual fund assets, ϕ_0 . The surprise disinflation has no effect on the real value of the fraction $1-\phi_0$ of the fund's assets invested in the capital stock. The expression $\left((1-\phi_0)\Pi_1(1+V_1-\delta) + \phi_0 \frac{1+P_1^{\tilde{L}}\rho}{P_0^{\tilde{L}}\Pi_1} \right)$ adjusts the face value of the household's claim on fund equity to reflect the gain in the real value of the fund's nominal assets. Rather than the expected real return $1+V_1-\delta$ on equity, the household instead earns the realized real return of $\phi_0 \frac{(1+P_1^{\tilde{L}}\rho)}{P_0^{\tilde{L}}\Pi_1} + (1-\phi_0)(1+V_1-\delta)$.

Given this immediate redistribution, we consider the welfare effects along the exact equilibrium path that converges in finite time to a low inflation stationary equilibrium. The experiment is similar in spirit to [Domeij and Heathcote \(2004\)](#) who popularized this methodology to consider the welfare costs of a one-time change in the capital gains tax rate under imperfect insurance.

Transition path. Given an initial high inflation stationary equilibrium as described in Section 2.6 and its stationary measure ψ^H , we characterize the disinflation transition equilibrium as follows. For $t \geq 1$, given a monetary and fiscal policy with inflation target Π^L consisting of a sequence of nominal interest rates $\{R_t^{\tilde{L}}\}$, nominal government debt $\{\tilde{B}_t\}$, and constant labor income tax, τ , a *disinflation transition equilibrium* is for $t \geq 1$

1. An initial redistribution described by equation (19), which, together with the productivity transition, induces the period-1 measure ψ_1 from the initial stationary distribution, ψ^H .
2. A sequence of measures ψ_{t+1} that satisfy (15).
3. Sequence of prices $P_t^{\tilde{L}}$, W_t , V_t , and inflation Π_t that satisfy the loan-pricing condition (9), the no-arbitrage condition (11), and profit maximization (2).
4. Decision rules $c_t(q, d, z)$, $m_t(q, d, z)$, $a_t(q, d, z)$, $e_t(q, d, z)$ and $d_t(q, d, z)$ that solve the sequence of Bellman equations (14),
5. a sequence of nominal wage inflation, $\{\Pi_t^w\}$, given by

$$\Pi_t^w = \Pi_t \frac{W_t}{W_{t-1}},$$

and a sequence of wage Phillips curve shocks that rationalize the observed employment path $\{N_t\}$ through the wage Phillips curve (equation 6), and

6. Aggregate capital demand in (2) and aggregate savings satisfy asset market clearing (18).

2.8 Model solution

For the stationary economy, we use an extended version of the endogenous grid method developed by [Hintermaier and Koeniger \(2010\)](#) to solve for the household decision rules under constant inflation and real prices. For the transition we use an approach similar to [Domeij and Heathcote \(2004\)](#). We work backwards from a stationary low inflation equilibrium. The disinflation equilibrium will converge to the low inflation equilibrium in finite time. We use 200 periods. For a given sequence of nominal interest rates, inflation, and employment rates, we can solve backwards from the low inflation equilibrium (using the endogenous grid method to find the sequences of optimal decision rules). Then starting from the distribution of households in the initial high inflation economy, we solve the distribution forwards using the law of motion (15) and the disinflation sequences of policy rules. We find the sequence of nominal government debt, $\{B_t\}$, that clears the asset market, government expenditures $\{G_t\}$ that satisfies the government budget constraint, and wage Phillips curve shocks that rationalizes the observed sequence of employment rates $\{N_t\}$.

3 Initial high-inflation equilibrium

The starting point for our experiment is the high inflation period in the early 1980s during which Paul Volcker became Chairman of the Federal Reserve. We calibrate our model economy to mimic this macro environment and to match moments of the wealth distribution measured in microdata on household finances around that period.

It is important to note that the US economy prior to the Volcker disinflation was not in a deterministic steady state. Inflation and nominal interest rates were highly volatile throughout the 1970s. For this reason, we interpret the Volcker Fed as facing a choice between accommodating the policy mistakes of the 1970s and allowing inflation to remain persistently high, or instead implementing a disinflation. The high-inflation steady state to which we compare the disinflation should therefore be understood as a counterfactual benchmark rather than an outcome directly observed in the data.

Our calibration proceeds in two steps. First, we set some parameters externally to standard values in the literature. Second, we internally calibrate the parameters of the income process, the discount rate, the coefficient of relative risk aversion, the CES weight on non-durables, and the durable goods adjustment cost parameter to match moments on the wealth distribution, the share of households with nominal debt, the marginal propensities to consume durable and non-durable goods, and the nominal wealth share of net worth. After a brief summary of the household balance sheet data in Section 3.1, we discuss the calibration in Section 3.2, and the model fit in Section 3.3.

3.1 Household finance data

To measure household balance sheets in the pre-Volcker high-inflation period, our primary data source is the 1977 historical Survey of Consumer Finances (SCF), as harmonized by [Kuhn et al. \(2020\)](#). The modern SCF begins in 1983. [Kuhn et al. \(2020\)](#) reconstruct and harmonize archival historical SCF waves from 1949 to 1977 so that the pre-1983 surveys are broadly comparable to the post-1983 SCF in their coverage of household income, assets, debt, and wealth. The 1977 survey is the last available cross section prior to 1983.

Using the 1977 SCF+, we measure the components of household wealth. The survey contains information on a broad set of asset and debt categories, including liquid assets, bonds, equity, housing, other real estate, business assets, consumer debt, and housing debt. We map these categories into our measures of nominal, real, and liquid wealth; see Appendix A. Household balance sheets in 1977, especially portfolio positions, reflect the asset allocation decisions made during the high-inflation period of the mid- to late 1970s. An important limitation of the 1977 SCF+ is that mortgage balances are not observed directly in the same way as in later surveys and must instead be proxied from origination information. Because mortgages are a central component of nominal household debt, we repeat the main exercises using the 1983 SCF in Appendix F.5.

With one exception, this measurement is similar to [Doepke and Schneider \(2006a\)](#) for a different time period. We differ by only identifying direct nominal positions at the household level. [Doepke and Schneider \(2006a\)](#) use the Flow of Funds data from the Federal Reserve Board to correct for the indirect nominal positions of households, where indirect nominal wealth includes the nominal positions of the businesses on which the household has claims. They determine the indirect position using the nominal leverage ratio of the US business sector which they define as the nominal debt position per dollar of equity. This correction is well suited to their goal of characterizing the aggregate nominal position of the household sector and cohorts of the household sector, but it will be substantially less accurate for characterizing the distribution of the nominal wealth among households. We do not make an adjustment, because we believe that any bias from indirect nominal positions at the household level will be small. In the 1977 SCF+, only 21% of households have any claims to public or private equity, and of those, the median equity share of net worth was only 8.1%.

3.2 Calibration of high-inflation equilibrium

Interest rates, inflation, and labor. To calibrate nominal interest rates and inflation for the initial high inflation steady state, we use the CPI-Urban inflation rate and the 30-year mortgage rate for 1981.¹² Gross inflation reached a high of 10.4%. In our baseline calibration, we set the nominal interest rate to $i = 15.6\%$ so that the real interest rate, 4.7%, equals the average real interest rate during the Greenspan period after the Volcker disinflation. This assumption removes the welfare costs of a permanent decline in the real interest rate. We relax this assumption in

¹²The Volcker disinflation begins in the second half of 1981 with inflation finally achieving a sustained fall starting in September.

appendix F.1.¹³ Both the CPI-Urban and the 30-year mortgage rate are downloaded from FRED. We use the 30-year mortgage rate rather than the Federal Funds Rate since the 30-year mortgage rate is a better indicator of the rates at which households would have been able to borrow during this period. As in the demand theory of the price level described in Section 2, we assume that the central bank sets the nominal interest rates and that inflation is determined by outstanding government bonds.

We also calibrate the model to match the observed path of employment rates observed during the Volcker disinflation by solving for the disutility of labor scaling parameter, γ , in the high-inflation steady-state to clear the wage Phillips curve. As with the nominal rate, we assume that the employment rate returns to its initial level in the low-inflation steady state. We relax this assumption in Appendix F.1. The implied path of employment can be rationalized as arising from shocks to the wage Phillips curve.¹⁴ We take the value for n_t from the data, using the complement to the unemployment rate from FRED (UNRATE). In the high-inflation steady-state, the employment rate is 92.4%.

Period length and debt duration. The period length is one year. To capture the longer duration of household debt contracts we use the perpetual coupon structure with a constant decay rate governed by ρ . If ρ is equal to zero, then debt is equivalent to a one-period bond that is typical in this literature. In our baseline calibration we set $\rho = 0.89$, implying a duration of approximately 4.5 years, to match the average duration of household nominal liabilities in the US for this period as documented by Doepke and Schneider (2006a).

Preferences. We specify household preferences with relative risk aversion σ over a CES aggregate of consumption, real balances and durables so that:

$$u(c_t, m_t, d_{t-1}, n_t) \equiv \frac{1}{1-\sigma} \left(\left(\omega c_t^{\frac{\eta-1}{\eta}} + (1-\omega) m_t^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta-1}{\eta} \theta} d_{t-1}^{1-\theta} \right)^{(1-\sigma)} - \gamma \frac{n_t^{1+\frac{1}{\varepsilon}}}{1+\frac{1}{\varepsilon}} \quad (20)$$

With these preferences, the elasticity of substitution between consumption and real balances η will turn out to be the interest elasticity of money demand, since unconstrained households would choose:

$$m_t = \left(\frac{1+i_t}{i_t} \frac{1-\omega}{\omega} \right)^{\eta} c_t. \quad (21)$$

We follow Lucas (2000), who finds $\eta = 0.5$ to be a reasonable approximation for the aggregate interest elasticity of demand for M1 when computing the welfare costs of inflation. The parameter $\omega \in [0, 1]$ scales the liquidity value of real balances, with $\omega = 1$ implying no liquidity value of money and thus zero demand for real balances. With η fixed, we calibrate ω to target the ratio of real balances to output of roughly 17% in the high inflation stationary distribution. We internally

¹³The actual nominal interest rate on a 30-year mortgage in 1981 was 16.4%.

¹⁴These shocks can either be to an additive cost-push shock or to wage markup directly.

calibrate θ to target the household marginal propensity to consume on durables, and σ to target the household marginal propensity to consume on non-durables. We set the Frisch elasticity, ε , to the standard literature value of 1, and we calibrate the value of γ to satisfy the wage Phillips Curve in the high steady-state. Finally, we internally calibrate the discount factor β to match the share of households that are nominal borrowers (see Appendix B.1). In the 1977 SCF+, approximately 49% of households have negative net nominal positions.

Durable goods. We follow [Hintermaier and Koeniger \(2010\)](#) and set quadratic adjustment costs for durables:

$$\Psi(d_t, d_{t-1}) = \frac{\kappa}{2} \left(\frac{d_t - (1 - \delta_d)d_{t-1}}{d_{t-1}} \right)^2 d_{t-1} \quad (22)$$

The parameter κ represents the cost of adjusting durable holdings and δ_d the depreciation rate on durable goods. We set δ_d to 0.2 following [Auclert et al. \(2018\)](#) who in turn cite the average depreciation of durables estimated by [Fraumeni \(1997\)](#), and we jointly calibrate κ with other internally calibrated parameters to match the 1977 SCF+ estimate of the average ratio of liquid wealth to net worth. Further details on the calibration procedure are in Appendix B.1. We set the securitization rate on durable goods, μ , to be 0.8 as in [Kaplan et al. \(2020\)](#).

Production. For production, we use a Cobb-Douglas production function

$$F(K, N) = AK^\alpha N^{1-\alpha}$$

with capital share $\alpha = 0.33$, which is roughly in line with the long-run average of capital income to output. We set A to unity (Appendix B.1). We follow [Auclert et al. \(2018\)](#) and assume that capital is subject to quadratic adjustment costs. Specifically, adjustment costs are given by

$$\zeta(K_t, K_{t-1}) = \frac{1}{2\delta^K \epsilon_I} \left(\frac{K_t}{K_{t-1}} - 1 \right)^2$$

As in [Auclert et al. \(2018\)](#), we set ϵ_I to 4.0 and the depreciation rate, δ^K , to 0.08.

Government taxation. We calibrate the tax progressivity parameter τ to help match the distribution of wealth in the high-inflation steady-state. We solve for λ such that the average tax rate is 20%. Government spending, G , adjusts with the change in seigniorage revenue as discussed in Section 2.5. In practice, the change in seigniorage revenue results in a small change in government spending as a share of output since most government spending is financed by tax revenue. The resulting government spending to output ratio in steady-state is approximately 19%.

3.3 Model fit in the high-inflation equilibrium

We calibrate the parameters of the Markov chain governing idiosyncratic labor efficiency to match moments on the distribution of wealth in the data. We follow [Castaneda et al. \(2003\)](#) and choose

a 4-state Markov chain with a relatively high productivity state with less persistence. We choose the values of the productivity states and the probability transition matrix to match moments on the wealth distribution. Appendix B.1 provides further details on the calibration of this process.

In Table 1, we compare the wealth distribution of households in the 1977 SCF+ with our calibrated high-inflation economy. For net worth and real assets, instead of expressing the distribution in dollars, we instead describe points along the Lorenz curve. For example, in the 1977 SCF+, the top 10 percent of households ordered by their net worth, owned 59.3 percent of total net worth, and the bottom 50 percent of households owned only 5.9 percent of total net worth. We hold the ordering by net worth fixed across all variables.

In 1977, as in other years, the distribution of net worth is skewed, with the top one percent of households owning 21.0 percent of total net worth. The precautionary savings motive in our model and the use of a superstar state (as in Castaneda et al., 2003) is able to generate this extreme wealth inequality. We miss some of the debt accumulation for the poorest 10% of the households whose share of net worth in the data is negative.¹⁵

Net-worth percentile group	Bottom of net-worth distribution		Top of net-worth distribution		
	10%	50%	10%	5%	1%
Net worth: share of total wealth (Lorenz curve)					
Data	-0.50	5.92	59.28	46.99	20.96
Model	0.18	3.05	57.67	45.99	30.97
Real wealth: share of total wealth (Lorenz curve)					
Data	0.41	9.11	55.51	44.01	19.92
Model	0.34	6.54	56.06	44.85	30.32
Nominal wealth: average share of own net worth					
Data	-129.60	-20.30	3.80	4.70	0.20
Model	-129.88	-5.98	8.16	8.08	6.43

Table 1: Distribution of Wealth: Data and Model for 1977 SCF+

Note: We keep the ordering by net worth constant for all asset classes. Data on the wealth distribution and the share of households with net negative nominal wealth is from the 1977 SCF+. Adjusted net worth is total net worth less the value of any durable assets or secured borrowing against these assets (Appendix A).

For nominal wealth, rather than targeting the Lorenz curve, we use an alternative set of moments: the average nominal share of net worth for households at selected percentiles of the net worth distribution.¹⁶ In the 1977 data, households at the 10th percentile of net worth have an average nominal wealth equal to -129.6% of their net worth, reflecting significant nominal debt accumulation. The model matches this moment closely, generating -129.9% at the 10th percentile of the wealth distribution.

¹⁵With no unsecured borrowing, the model is unable to generate negative net worth positions.

¹⁶In 1977, aggregate nominal wealth was negative for US households, whereas it was positive in the post-1983 surveys. This makes the Lorenz-curve moments for 1977 unstable and difficult for the model to match. The alternative moments are more stable across survey years.

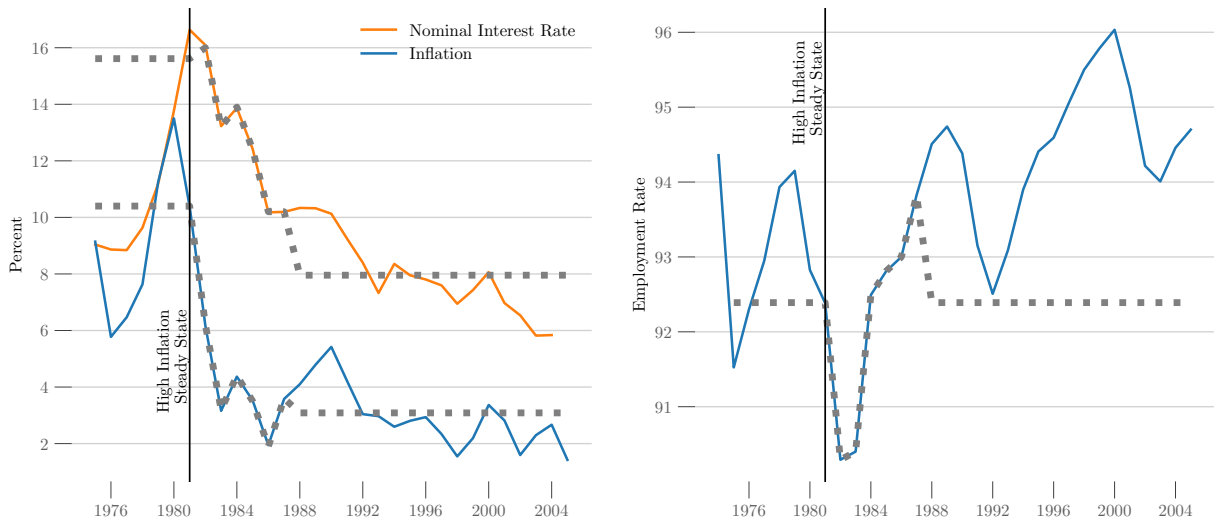


Figure 1: Interest rates, inflation, and employment during the Volcker disinflation

Note: The left panel shows the path of interest rates and inflation in the data (solid lines) and the path that is fed into the perfect foresight shock in the model (dotted lines). For interest rates we use the 30-year mortgage rate and for inflation we use CPI-U. The initial steady state is calibrated to the rate of inflation and interest rate in 1981 right before the Volcker disinflation and the final steady state averages inflation and interest rates during Alan Greenspan’s tenure as Chairman. The right panel shows the path of the employment rate in the data (solid line) and model (dotted line). The initial and final steady states are calibrated to the employment rate in 1981.

In the data, net nominal positions are negative for 49 percent of the population versus 49.6 percent in the high-inflation steady state in our model. This reflects secured borrowing in the form of mortgages, which is captured in our model by secured borrowing against durables. This is important when thinking about welfare, since households with nominal debt contracts stand to lose in a sudden disinflation. In a model that incorporates secured nominal borrowing against durable real assets, this means welfare losses occur across the income distribution, not just among the poor.

3.4 The Volcker disinflation

To quantify its welfare costs, we treat the Volcker disinflation as a perfect foresight shock. The model starts in a high-inflation equilibrium, which we calibrate to match the average inflation rate in 1981 described in Section 3.¹⁷ While slightly different from the actual nominal interest rate in 1981, we set the initial value of the nominal rate to be 15.6% so that the real rate is equal to the average real rate in the Greenspan period. Then, at the beginning of 1982, the government announces a new path of nominal interest rates and government bonds to achieve a new, lower inflation target of 3.1 percent. The left panel of Figure 1 plots the path implied by the Volcker

¹⁷The exact timing of when the Volcker disinflation begins is up for debate. In the summer of 1981 the central bank re-raised the federal funds rate to a high of 19.1 percent after several unsuccessful attempts to tame inflation throughout the 70s and in 1980. As a result of these previous failed attempts, inflation increased in 1981 before finally starting a sustained fall that September. Thus, we choose to calibrate the initial steady state to 1981 and start the perfect foresight shock in 1982. Goodfriend and King (2005) recount the course of events and policy commitments leading up to and through the “incredible Volcker disinflation.” See also Lindsey et al. (2005).

disinflation shock (broken line) for the nominal interest rate and inflation against the data (solid line). We calibrate the announced monetary and fiscal policy sequence of nominal interest rates $\{\tilde{R}_t^L\}$ and nominal debt $\{\tilde{B}_t\}$ to match the exact path of nominal interest rates and inflation rates during Volcker’s remaining seven years of his term as Chairman. Thereafter, we assume monetary and fiscal policy maintains a constant nominal rate and inflation rate, which we set to match the average over Chairman Alan Greenspan’s terms (August 1987 to January 2006).

In addition, we take the employment rate from the data as given, as shown in the right panel of Figure 1. In 1981, the employment rate was 92.4%. As with the real rate, we impose a return to the same employment rate once inflation reaches its new steady state. This approach eliminates welfare impacts from the long-run increase in the employment rate, which may or may not be attributable to the disinflation, to isolate only the impact of the recession created by the Volcker disinflation. In section 5, we relax this assumption and allow the low-inflation steady state employment rate to increase. In appendix F.1, we also allow heterogeneous labor supply by productivity level.

Figure 1 highlights that the high-inflation steady state in our analysis is a counterfactual benchmark rather than an observed outcome. The 1970s were instead characterized by substantial volatility in inflation, nominal interest rates, and employment. We interpret the experiment as comparing the Volcker disinflation to a policy of accommodating the mistakes of the 1970s and allowing inflation to remain persistently high.

In implementing the Volcker disinflation, we take the paths of the nominal interest rate, the inflation rate, and the employment rate from the data.¹⁸ While we provide a general-equilibrium framework that can rationalize these aggregate paths, we primarily view the model as a measurement device. It allows us to quantify the welfare effects of the disinflation and to examine the impact of the four main channels that shape those effects: the revaluation of nominal assets, the inflation tax, the real interest rate, and employment.

3.5 Model Validation

We provide two validations that the model generates sensible dynamics in response to the Volcker disinflation. First, we compare the model-implied paths of key aggregate variables to the corresponding aggregate time series during the Volcker period. Second, we show that the model can reproduce changes in the cross section of households’ nominal saving behavior.

Fit to the aggregate data. We compare the model’s time series for key aggregate variables against their data counterparts over the Volcker disinflation. While we match the series in Figure 1 by construction, Figure 2 shows the dynamics of other (non-targeted) aggregate variables over the disinflation are broadly consistent with the data. In the absence of high-quality household-level time series to compare with the model’s household-level predictions, we compare the observed aggregate

¹⁸In the model, the nominal interest rate is set directly by the monetary authority, while the path of inflation must be rationalized by a corresponding sequence of government bonds and the path of employment by a sequence of shocks to the wage Phillips curve.

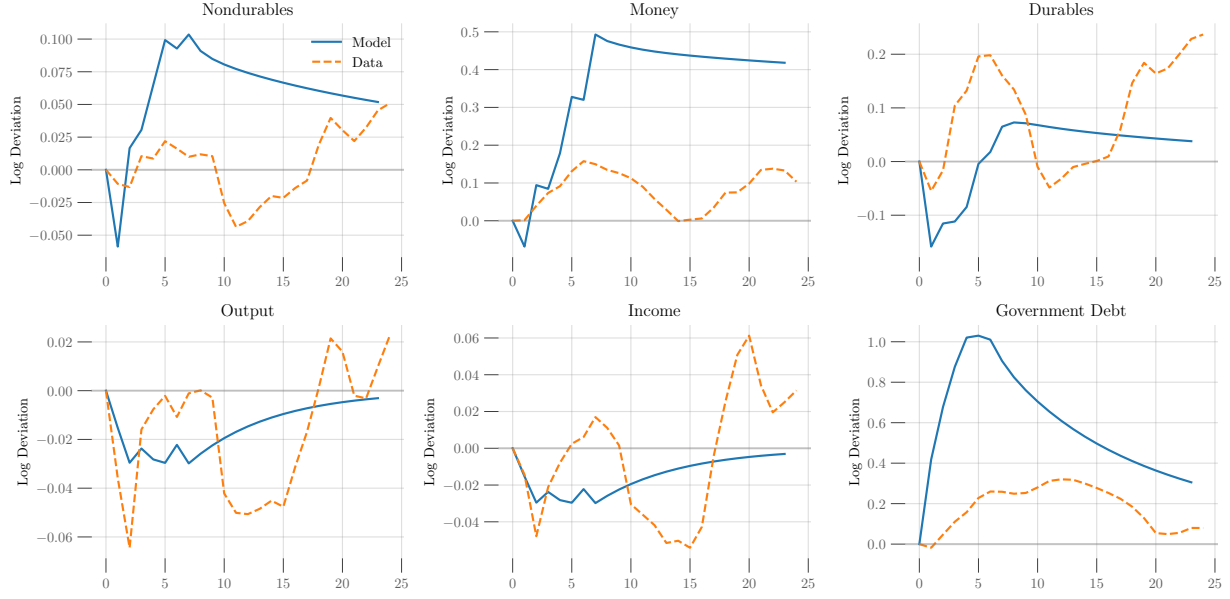


Figure 2: Path of aggregate variables

Note: Figure shows time series path of consumption, money, durables, output, wages and government debt in the data and the model. For consumption we use Personal Consumption Expenditures Non-Durables (PCEND), money is the M2 Money Stock (M2SL), durables is Personal Consumption Expenditures Durables (PCEDG), output is GDP (GDPC1), compensation is “National Income: compensation of employees” (A033RC1A027NBEA), and government bonds is outstanding government debt. The FRED series IDs are given in parentheses with the exception of outstanding debt which is downloaded from the Treasury (<https://fiscaldata.treasury.gov/datasets/historical-debt-outstanding/historical-debt-outstanding>). PCE and M2 are deflated by the PCE Price Index (PCEPI) and Consumption of Fixed Capital is deflated by the PCE Durables Price Index (DDURRG3M086SBEA). Series are passed through a Christiano and Fitzgerald two-sided band-pass filter to remove periodicities under 4 years and greater than 16 years.

data from this period with the model’s aggregates. This exercise is especially useful since these aggregates are not used as calibration targets. However, we emphasize that one should not expect a perfect fit, as there are many other events happening during this period that are not captured in our model. Because the model is not designed to capture high-frequency aggregate fluctuations or long-run trends, we apply a two-sided band-pass filter as in [Christiano and Fitzgerald \(2003\)](#) to the data to isolate medium-run fluctuations. We keep fluctuations with periodicities between 4 and 16 years, but the results are very similar if we also include shorter-run fluctuations by including periodicities between 2 and 16 years.

In the first row of Figure 2, we compare the dynamics of non-durable consumption, real balances, and durable consumption when aggregated in the model (solid blue line) versus the data (dashed orange line) over the Volcker disinflation period. The model predicts a long-run aggregate increase in non-durable consumption and real money balances as the inflation tax declines. In the data, we remove this variation since we cannot say what portion of the aggregate increase in consumption and money balances are due to the Volcker disinflation as opposed to other aggregate trends. However, the model does a good job of matching the initial decline and subsequent rise in non-durable and durable consumption.

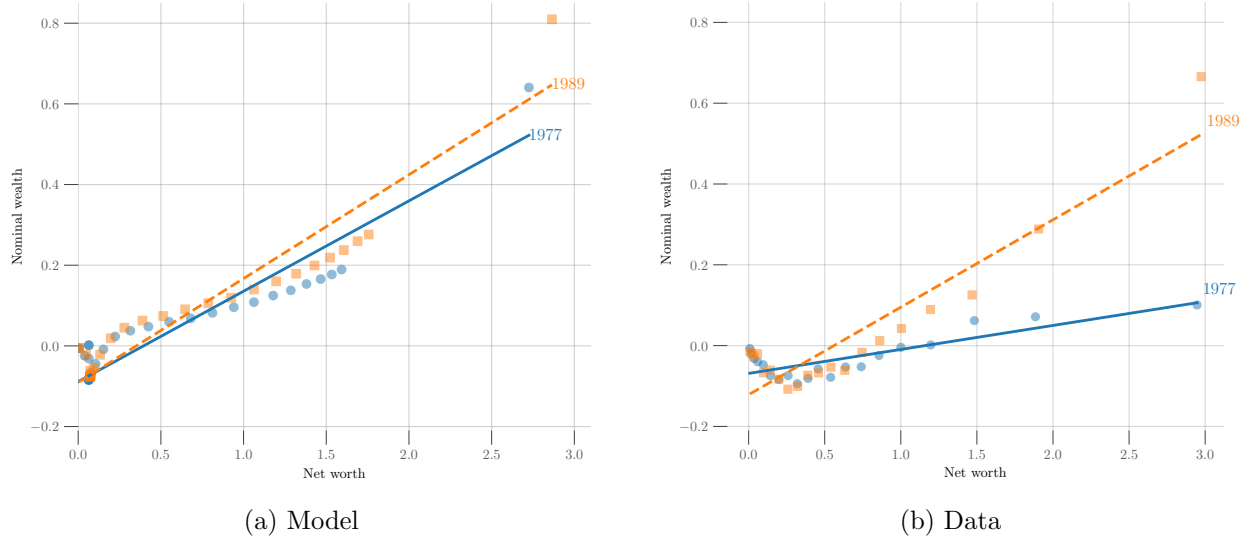


Figure 3: Transition of household nominal worth compared to net worth

Note: Panel (a) shows the model transition of household nominal worth to net worth through the transition path, starting in the high-inflation steady state and transitioning through 1989. Panel (b) shows this same transition in the SCF+ data from 1977 to 1989. We take the hyperbolic arcsin as nominal wealth can be negative.

The second row of Figure 2 shows the aggregate path of output and income. Both series match their data counterparts well. In particular, the model generates a decline in output of about 3%, half of the 6% decline in the data. For income, the 3% decline in the model is close to the 4% decline seen during the Volcker disinflation. Finally, the last figure shows the path of government debt in the model versus the data. The model is successful at matching the qualitative pattern—a sustained increase in government debt, but the model overshoots the increase, as the government faces a long-run loss in seigniorage revenue and a short-run drop in tax revenue during the recession.

Cross-sectional changes in nominal wealth. Figure 2 provides a check on the aggregate transition dynamics generated by the model. To assess the transition at the household level, we examine households' nominal wealth positions relative to their net worth in 1977 (the high-inflation state) and 1989. Figure 3 reports the model in panel (a) and the SCF+ data in panel (b). In both panels, net worth and nominal wealth are transformed using the hyperbolic arcsine, since nominal wealth can be negative.

For savers, the transition involves a nontrivial portfolio reallocation problem across money, equity, and durables. Borrowers, by contrast, finance durables with nominal loans, and as they deleverage their nominal positions fall mechanically. Because borrowers in the model cannot simultaneously hold equity and nominal debt, their transition abstracts from the richer portfolio reallocation margin that is central for savers.

In both the data and the model, the cross-sectional relationship between nominal wealth and net worth steepens over the disinflation period. Intuitively, as inflation falls, the inflation tax on nominal assets declines, making nominal claims more attractive because they preserve real value

more effectively. We view this as evidence that the model captures an important adjustment in household portfolios during the Volcker disinflation.

Furthermore, the model does reasonably well at matching the cross-sectional pattern of money holdings before the Volcker disinflation. Appendix E shows money as a share of net worth plotted against household net worth in the data and the model. Even though we use a money-in-utility framework, which implies some proportionality between money and nondurable consumption for unconstrained households (see Equation 21), there is still a rich enough portfolio choice problem through the choice of durables, the adjustment costs, and the borrowing constraints to match the relationship between money and net worth. At the same time, the model does not match the cross-sectional changes in money holdings after the disinflation. In particular, the model predicts that all households increase their money holdings as a share of net worth after the disinflation, whereas in the data high-net-worth households increase money holdings more than low-net-worth households. Capturing this pattern would likely require a richer framework for money demand, such as one with fixed costs of credit use (Erosa and Ventura, 2002) or non-homothetic money demand (Allais et al., 2020). We therefore view the model as capturing the broad cross-sectional shift toward nominal assets after the disinflation, while missing some heterogeneity in how money holdings adjust across the wealth distribution. This limitation likely causes the model to understate the long-run welfare gains from lower inflation for high-net-worth households.

4 The welfare costs of the Volcker disinflation

In this section, we examine the welfare costs of the Volcker disinflation. Throughout, we use two methods to measure its distributional and welfare impacts. We begin by directly examining the distribution of consumption-equivalent welfare costs across households. We then decompose the aggregate welfare effect into efficiency, redistribution, and insurance components, following Bhandari et al. (2023).

For each household, the welfare costs of the disinflation will depend on whether the benefit of the lower inflation tax is enough to compensate them for the rise in unemployment, the effects of the redistribution, and the changes in the path of real interest rates. In Section 5, we consider the role of each of these channels separately.

4.1 Short-run conditional welfare

We compute a conditional welfare measure that asks on the eve of the inflation reform what consumption equivalent each household would require to be indifferent between the economy with the disinflation and a counterfactual economy which remains in the high inflation equilibrium permanently.

Since the unanticipated disinflation begins in period $t = 1$, let $\{c_t, m_t, d_{t-1}, n_t\}_{t=1}^{\infty}$ denote the household's allocation under the disinflation path. Let $\{c_t^H, m_t^H, d_{t-1}^H, n_t^H\}_{t=1}^{\infty}$ denote the counterfactual allocation if inflation had remained high. We define the consumption-equivalent welfare

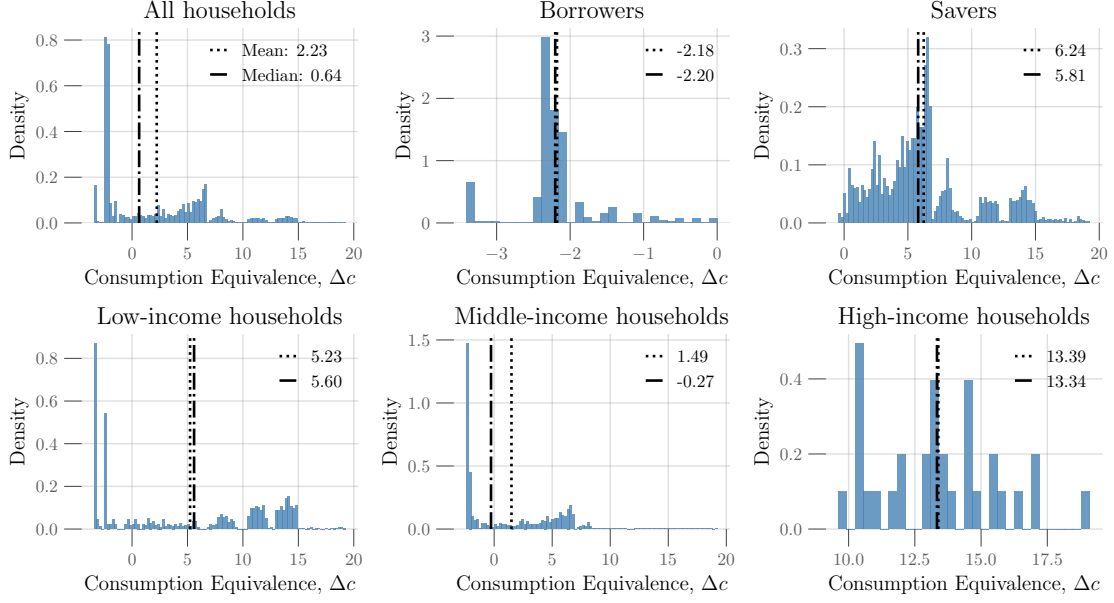


Figure 4: Consumption equivalent measure of welfare of Volcker disinflation as percent

Note: Figure shows the consumption equivalent needed to make households indifferent between the disinflation and the high inflation steady state relative to their initial nominal wealth position (see equation 23). A negative value means households would sacrifice a permanent fraction $|\Delta_c|$ of their consumption bundle in the high-inflation steady state to avoid the disinflation.

change, Δ_c , as the permanent proportional adjustment to consumption, money, and durables in the high-inflation counterfactual that makes the household indifferent between that counterfactual and the transition to the new low-inflation steady state. Specifically, Δ_c sets the expected streams of utility equal,

$$E_i \left[\sum_{t=1}^{\infty} \beta^{t-1} (u((1 + \Delta_c)c_t^H, (1 + \Delta_c)m_t^H, (1 + \Delta_c)d_{t-1}^H) - v(n_t^H)) \right] = E_i \left[\sum_{t=1}^{\infty} \beta^{t-1} (u(c_t, m_t, d_{t-1}) - v(n_t)) \right] \quad (23)$$

When $\Delta_c < 0$, this implies that they would be willing to sacrifice fraction $|\Delta_c|$ of their consumption bundle every period in order to avoid going through the transition. When $\Delta_c > 0$ the household would need to be compensated with an additional fraction Δ_c of the consumption bundle each period to remain in the high inflation steady state. Figure 4 plots the distribution of consumption equivalents from a simulation of the model with 10,000 households. The overall average welfare gain is approximately 2.2 percent in consumption equivalent terms.

The gains from the Volcker disinflation are not distributed evenly across households. Figure 4 shows that nominal borrowers bear the costs of the disinflation, with low- and middle-income nominal borrowers experiencing the largest losses – up to 3.5 percent of consumption for the poorest households. The bunching in the histograms of the welfare costs reflects the fact that many low-

	Percent that prefer high inflation		Percent borrowers	Percent of Population
	Short run	Long run		
Total economy	47.8	0.0	47.7	100.00
Borrowers	99.8	0.0	100.0	47.7
Savers	0.48	0.0	0.00	52.3
Low income	37.6	0.0	36.2	18.6
Middle income	72.2	0.0	72.4	56.5
High income	0.0	0.0	0.00	24.5
Very high income	0.0	0.0	0.00	0.32

Table 2: Preference for Disinflation Policy

and middle-income borrower households are clustered near the borrowing constraint.

Overall, in this baseline disinflation 48 percent of households prefer to remain in the high-inflation steady state rather than undergo the disinflation. In Table, 2 we tally who would vote for the Volcker disinflation. Since 48 percent of households are borrowers, many households stand to lose from the redistribution and from the short-run increase in the real interest rate. The decline in the inflation tax partly offsets these losses, but not enough for most borrowers: 99.8 percent of borrowers prefer to remain in the high-inflation steady state.

At first glance, the prevalence of households who prefer to avoid the disinflation may appear at odds with contemporaneous news coverage that indicated inflation was a major concern (Goodfriend and King, 2005). However, the harm from high inflation does not imply that households would unanimously accept the costs of a disinflation. In Appendix C, we use the Michigan Survey of Consumers to assess consumer sentiments during this historical period. While we cannot directly observe welfare costs, we do find evidence supportive of the model’s predictions, namely that the benefits of the Volcker disinflation are concentrated among higher-income households. As we discuss in Appendix C, over the disinflation period, the share of high-income households who report being *better* off from prices rises significantly, whereas the share of low-income and middle-income households who report the same is little changed. Reciprocally, the decline in the share who report being *worse* off from prices during the disinflation is significantly larger for high-income than for low- and middle-income households. Similarly, Michelacci and Paciello (2022) use the Bank of England Inflation Attitudes Survey to show that wealthy households are 20 percentage points more likely to dislike inflation than debtor households.

Given the disagreement about the benefits of the disinflation, why did it happen? While few liked the high inflation of the 1970s, there were repeated attempts to bring inflation down that were ultimately abandoned because the “cure” was viewed as too costly. Even within the Federal Reserve, there was substantial concern about the recessionary costs of disinflation, and some favored a more gradual reduction in inflation in order to limit those transition costs (Lindsey et al., 2005; Goodfriend and King, 2005). Goodfriend and King (2005) quote Governor Partee as saying, “I would hate to have somebody ask me what I was doing during the crash and have to remark that

I was defending our credibility.” The political economy that led to the disinflation is beyond the scope of this paper. But, the historical debate is consistent with the idea that the policy created both winners and losers, and had substantial short-run costs.

4.2 Long-run measures

We then ask whether households would choose differently if they could move immediately to the low-inflation equilibrium. To answer this question, we examine the same households in the high- and low-inflation economies long after the disinflation has ended and the economy has reached its low-inflation stationary equilibrium. Table 2 shows that *all* households now prefer the low-inflation equilibrium.

The key assumption driving the unanimous vote for low inflation in the long run is that the real interest rate and the unemployment rate remain unchanged between the high- and low-inflation steady states. As we discuss in Section 3.4, in our baseline calibration, we keep these rates constant to isolate the impact of the transitional costs, and because it is difficult to determine what was the result of the Volcker disinflation versus other long-run economic trends. However, it is possible that the Volcker disinflation could drive long-run changes in the unemployment rate and the real interest rate (Algan and Ragot, 2010; Algan et al., 2011). The average real interest rate was lower during the Greenspan era than during the period leading up to the Volcker disinflation, and the average employment rate increased. In Appendix F.1, we show that if we allow the real interest rate to fall or the employment rate to increase to the Greenspan level in the long-run steady state, then 13 and 48 percent of households, respectively, would prefer to avoid the disinflation through the full transition.

Table F.2 reports the average and median *long-run* consumption-equivalent gains by group. In the baseline model, the average long-run gain is 1.78% of consumption for all households, and is similar across income groups. The limited variation is because the homothetic money-in-utility specification imposes a degree of proportionality between money and nondurable consumption. Although the model captures the relationship between money holdings and net worth, as shown in Figure E.1, it is the money to non-durable consumption ratio that determines the welfare effect. Richer specifications that allow money holdings to vary more flexibly relative to consumption, as in Erosa and Ventura (2002) and Allais et al. (2020), could generate greater heterogeneity in the welfare effects of the inflation tax. Thus, the long-run effects should be interpreted with respect to this modeling assumption.

One additional long-run channel that we do not capture is the effect of the Volcker disinflation on inflation and output volatility through increased policy credibility. A more credible monetary regime could increase the long-run welfare gains of the disinflation by lowering macroeconomic volatility. At the same time, incorporating this channel would require a substantially richer stochastic environment with aggregate risk, asset-price responses to volatility, and endogenous portfolio reallocation. It would also raise identification questions relating to the impact of the disinflation on volatility. Goodfriend and King (2005) argue that volatility may have increased during the

	As a Percent of Δ Welfare			Δ Welfare
	Efficiency	Redistribution	Insurance	
Full transition	301.33	-308.93	107.60	0.162
By phase of the transition				
Recession phase	49.83	48.63	1.54	-0.175
Post-recession phase	170.81	-123.37	52.56	0.337

Table 3: Welfare Decomposition (in % of welfare change)

Note: The NBER Business Cycle Dating Committee indicates the recession from the Volcker disinflation started in July 1981 and ended in November 1982. This recession phase corresponds to the first two years of our transition path. The post-recession phase refers to year three onward.

transition itself because the Federal Reserve initially lacked credibility. Thus, this omitted channel likely increases the long-run benefits of the disinflation while also increasing its short-run costs.

4.3 Contributions to welfare costs

Next, we decompose the welfare effects of the disinflation into efficiency, redistribution, and insurance components using the methodology of [Bhandari et al. \(2023\)](#). Appendix D describes how we implement this decomposition in our setting. The decomposition is useful because it helps clarify how the disinflation can generate positive average welfare gains even though many households are hurt by the policy.

The efficiency component captures the welfare effect of changes in aggregates—aggregate consumption, money balances, durables, and labor—holding each household’s share of those aggregates fixed. In this sense, it is the closest object in our framework to the welfare effect for a representative agent.¹⁹ The redistribution component captures the welfare effect of changes in households’ shares of aggregate resources. Finally, the insurance component captures the welfare effect of changes in the variances and covariances of household consumption, money, durables, and leisure.

Table 3 reports the percent contribution of each component to the total welfare change, along with the total welfare change in the right-most column. By construction, the three components sum to 100%. In the baseline model, the aggregate welfare gain of 0.16 reflects positive contributions from efficiency and insurance, partially offset by a negative contribution from redistribution. This is consistent with the view that disinflation has important redistributive effects, as emphasized by [Doepke and Schneider \(2006a\)](#). In our model, borrowers are hurt by the unexpected increase in the real burden of nominal liabilities and the increase in the real interest rate, while savers benefit. The redistribution component is therefore negative even though aggregate welfare rises.

Table 3 further decomposes the transition into two phases: the first two years, when the economy is in recession, and the post-recession phase. If the calculation were truncated after the first two years, the aggregate welfare effect would be negative at -0.18 , with the efficiency component

¹⁹We cannot directly implement a representative agent version of our model because the demand theory of the price level relies on a downward-sloping demand for bonds generated by households’ insuring against idiosyncratic income risk.

accounting for 50% of that decline. After the recession ends, however, the welfare effect turns positive, and the efficiency component becomes the dominant force. Once the short-run contraction has passed, the lower inflation tax raises money balances and nondurable consumption. From the perspective of aggregate efficiency alone, the disinflation therefore appears beneficial.

The efficiency component isolates the welfare effects on aggregate allocations that would be felt by a representative agent, helping to connect our results to the earlier literature on the Volcker disinflation. Much of the previous work on the cost of the Volcker disinflation focuses on the sacrifice ratio, defined as the amount of lost output per percentage point reduction in inflation. Ball (1994) estimates a sacrifice ratio of 1.9 for the Volcker disinflation, while summarizing earlier estimates ranging from 1.4 to 4.2. In our model, the sacrifice ratio over the transition period is 2.44. We therefore view our findings as consistent with the existing literature on the aggregate costs of the Volcker disinflation, while also providing a framework to quantify the welfare implications.

Finally, the decomposition implies small welfare gains from insurance. In our model, this mainly reflects the fact that the real interest rate rises during the disinflation, which improves consumption smoothing for the majority of households, who are savers.

5 Sensitivity of welfare to alternative calibrations

The baseline welfare results depend on the trade-off between the benefit from lowering the inflation tax, the size of the revaluation of nominal assets, and the time paths of the real interest rate and unemployment. In this section, we explore the sensitivity of our results to shutting down or mitigating each of these channels.

No inflation tax. The more money held by households, the greater the burden of the inflation tax. To generate demand for money, we include it directly in the household’s utility function. When unconstrained, a household’s money demand is proportional to their consumption (as shown in equation (21)). We interpret the demand for money as demand for liquidity: households need money in order to consume and pay bills. The amount of money held will be determined by ω . When $\omega = 1$, households hold no money and are unaffected by the inflation tax.²⁰ We compare our baseline welfare results from Section 4 to the same calibration with no liquidity value of money, $\omega = 1$. In this calibration, the results are solely driven by the effect of the redistribution and changes in the real interest rate and unemployment. Households get no benefit from the lower inflation tax.

Without money, there is no reduction in the inflation tax. The only effects of the disinflation are to redistribute wealth from borrowers to savers and to raise the real interest rate and unemployment in the short run. Without the lower inflation tax, borrowers receive no offsetting benefit for these redistributive losses and higher short-run borrowing costs. Panel (a) of Table 4 shows how the share of households voting for the disinflation changes across the different experiments. Without

²⁰Since the price level is determined independently of money market clearing, this need not be the cashless limit, $\omega \rightarrow 1$.

the decline in the inflation tax, 52 percent of households would prefer to remain in the high-inflation steady state, compared with 48 percent in the baseline calibration.

While the change in the share voting for the disinflation is small, the welfare consequences are quite different. Panel (b) of Table 4 shows moments from the distribution of the welfare costs. In the baseline, the median household gains 0.6 percent in consumption equivalent terms from the disinflation. Without the inflation tax, this turns negative falling to -0.5% of consumption. Figure F.2 in Appendix F.4 shows the histograms of the consumption-equivalent welfare changes in the no-inflation-tax case. While the overall shapes of the histograms are similar to the baseline, they are shifted to the left, reflecting that households are worse off without the benefit of the lower inflation tax. The largest differences are for borrower and low-income households who hold more money as a share of their net worth (see Figure E.1).

Panel (c) of Table 4 shows the welfare decomposition under the no-inflation-tax calibration. For ease of interpretation, we report the efficiency, redistribution, and insurance components relative to their values in the baseline experiment. Without the inflation tax, the efficiency gain is smaller—60% of its baseline level. This is because part of the efficiency gain in the baseline arises from the reduction in the inflation tax, which allows households to hold more money, which they value directly, and to consume more, for which they need money. Without the inflation tax, the high-inflation steady state and the transition are more efficient, but there is no corresponding efficiency *gain* from lowering the inflation tax. The redistribution and insurance components are largely unchanged.

One-period real loans. The size of the revaluation from the surprise inflation shock is determined by the duration of households’ nominal debt. In this exercise, we reduce the duration of household debt to 1-period and denominate all debt in real terms so that there is no Fisher revaluation of household borrowing. Borrower households are still hurt by unexpected increases in the real rate as their debt rolls over and they must slowly deleverage, but they are not surprised with a larger debt burden than expected. The share of equity that is invested in loans to households will also be denominated in real 1-period debt, so the size of the revaluation effect for savers is also reduced.²¹

Table 4 reports the welfare results from the 1-period real debt calibration versus the baseline. For borrowers, the welfare cost of the disinflation falls substantially, though this is partly offset by a decline in the welfare gains for savers. On net, the average welfare gain rises to 2.8 percent of consumption, while the lower tail of the welfare distribution improves markedly, with the cost at the bottom of the distribution falling from -2.3 to -0.75 . This reduction in welfare losses is driven primarily by borrowers at the bottom of the welfare distribution. The effects on savers, who lie in the right tail of the welfare distribution, are smaller. Figure F.3 of Appendix F.4 shows the histograms of the consumption equivalents in the 1-period real debt case. The median consumption

²¹While no Fisher revaluation of household borrowing occurs, money is still nominal. Household wealth changes after the surprise disinflation, moving households on the net worth grid.

Table 4: Welfare under Alternative Experiments

Panel (a): Preference for disinflation

	Percent that prefer high inflation				
	baseline	no π tax	1 per. real loans	const. r	const. U
Total economy	47.8	51.8	46.7	45.0	48.0
Borrowers	99.8	99.9	98.0	94.4	100.0
Savers	0.48	7.71	0.49	0.00	0.59
Low income	37.6	41.1	37.2	35.7	37.6
Middle income	72.2	78.1	70.4	67.9	72.5
High income	0.00	0.00	0.00	0.00	0.00
Very high income	0.00	0.00	0.00	0.00	0.00

Panel (b): Distributional impacts

	p10	p50	p90	Mean
baseline	-2.31	0.64	8.40	2.23
no π tax	-3.13	-0.51	7.13	1.12
1-per. real loans	-0.75	0.68	8.35	2.84
constant r	-1.42	1.56	3.32	0.79
no change U	-2.30	0.63	8.34	2.18

Panel (c): Decomposition

	Efficiency	Redistribution	Insurance	Δ Welfare
Baseline: as % of Δ Welfare (percent)				
baseline	301.33	-308.93	107.60	0.162
Counterfactuals: as % of baseline				
no π tax	59.68	93.62	96.15	-5.91
1-per. real loans	103.76	83.87	116.17	178.57
constant r	56.22	45.66	2.77	31.35
no change U	97.82	99.50	102.52	97.67

equivalent loss for borrowers falls from -2.2 to -0.66 and for savers the gain falls from 5.8 to 5.6 consistent with the smaller redistribution between the two groups.

Panel (c) of Table 4 reports the efficiency, redistribution, and insurance components in the one-period-loan experiment relative to the baseline. The redistribution component falls to 84% of its baseline level, consistent with the smaller size of the redistribution. The insurance component rises to 116% of its baseline level, suggesting that shorter-duration debt modestly improves households' ability to smooth idiosyncratic shocks during the transition.

Constant real interest rate. We compare the baseline results to a calibration in which there is no change in the real interest rate. During the Volcker disinflation, the real interest rate rises sharply as the monetary and fiscal authority increase nominal interest rates and decrease the supply of government bonds in order to decrease inflation. We ask what the effects of the disinflation would have been if the central bank set nominal interest rates to keep real rates constant at 4.7 percent while the fiscal authority adjusts the path of bonds to lower inflation. This allows us to isolate the welfare effect of the Volcker disinflation that was generated by the change in real rates rather than the redistribution or the decrease in the inflation tax. It is important to emphasize that even when the government maintains a constant 4.7 percent real interest rate throughout the disinflation, there is still a revaluation effect. The real interest rate is the cost of borrowing between the current and future periods. The realized real borrowing cost and return on equity still diverge from the expected 4.7 percent because of the unanticipated change in inflation to Π_1 and unexpected change in the price of loans to $P_1^{\tilde{L}}$.

In this case, the share of households that would vote to remain in the high-inflation steady state falls. Holding the real interest rate constant has heterogeneous effects on borrowers and savers. The largest change is among low- and middle-income borrower households, which are hurt in the baseline by the short-run increase in real interest rates. The welfare costs are smaller for borrowers, who no longer face a temporary increase in borrowing costs. Conversely, the welfare gains are substantially smaller for savers, who no longer receive a temporary increase in the return on their savings. On net, both average welfare gains and losses decline substantially: the average welfare gain falls from 2.2 to 0.79. The histograms of the consumption equivalents are shown in Figure F.4. The biggest difference is in the distribution for savers whose gains are much smaller without the increase in the real rate.

With no change in the real interest rate, the efficiency, redistribution, and insurance components all fall substantially. The change in the real interest rate redistributes resources from borrowers to savers and raises the wealth of the 52% of households, who are savers. Without this channel, the efficiency gain and the redistribution cost fall to 56 and 46 percent of their baseline levels, respectively. The decomposition also shows a smaller insurance effect, which falls almost to zero. This is because the increase in the real interest rate helps the majority-saver households smooth consumption.

No rise in unemployment Finally, we consider the welfare results if there had been no increase in unemployment along the transition path. This is akin to asking what the welfare results would have been if the monetary authority could avoid the rise in unemployment from movements along the wage-Phillips curve; a best-case scenario for a perfectly credible monetary authority that wishes to implement disinflation.

The effect of higher unemployment is ambiguous. On the one hand, workers lose wage income. On the other hand, they gain utility from increased leisure. In our model, there is perfect insurance against unemployment risk within productivity types, so households share the ex ante risk of unemployment. As a result, the model does not capture the full welfare losses experienced ex-post by those households that actually become unemployed.

Overall, these two forces largely offset one another, leaving the average consumption-equivalent welfare change essentially unchanged. Welfare losses are smaller at the 10th percentile of the consumption-equivalent distribution and the gains are slightly smaller at the 90th percentile. The effect on the extensive margin—the share of households that would vote for the disinflation—is minimal. The magnitudes of the efficiency, redistribution, and insurance components are similar. Figure F.5 shows that the histograms of the consumption-equivalent welfare changes are largely unchanged, reflecting the offsetting effects of the decline in labor income and the increase in leisure.

One assumption we make in the baseline calibration is that all skill groups are equally impacted by the increase in unemployment. In the data this is not true; when aggregate unemployment rises, it rises more for low-skill groups than high-skill groups (Hoynes et al., 2012). In Appendix F.1, we relax this assumption by assuming that when unemployment rises, it rises more for the low-skill group than the high-skill group. Under this alternative specification, the aggregate welfare gain in the decomposition is about 91% of its baseline value. Much of this decline comes through the insurance component, since heterogeneous exposure to unemployment increases income risk during the transition. This makes the median consumption-equivalent welfare gain from the disinflation fall from 0.64% of consumption to 0.59% of consumption and at the 10th percentile, the cost of the disinflation increases from -2.31 to -2.38%.

Summing up. Collectively, the differences between the baseline calibration and the alternative experiments highlight the importance of capturing all four channels (the revaluation of nominal positions, the decrease in the inflation tax, and the increase in the real interest rate and unemployment) when considering the welfare costs of the Volcker disinflation. This suggests that an accounting exercise focused only on the revaluation of nominal assets and liabilities, as in Doepke and Schneider (2006a), while crucial for understanding the size of the revaluation channel, is not sufficient by itself to fully understand the welfare consequences of the Volcker disinflation.

Across our alternative experiments, the largest change in average welfare comes from shutting down the real interest rate channel, which lowers the average welfare gain from 2.2 to 0.8. The next largest effect comes from removing the inflation tax channel, which lowers the average gain to 1.1. The revaluation channel is also quantitatively important: removing it raises the average gain

to 2.8. Finally, changes in employment matter though they are quantitatively less important in our baseline calibration. Taken together, these results show that the welfare consequences of the Volcker disinflation cannot be understood from the revaluation channel alone.

6 Conclusion

We examine the welfare effects of a permanent and unexpected change in the monetary and fiscal policies of the government to reduce inflation. The unexpected change in the inflation rate redistributes wealth from nominal borrowers towards savers, but it also lowers the burden of the inflation tax for all households. In the case of the Volcker disinflation, the combined effect of the monetary and fiscal policies also entailed a short-run increase in the real interest rate and unemployment. We quantify the welfare effects stemming from each of these channels.

Our analysis relies on a HANK model extended to include a consumer portfolio choice between nominal savings or debt, real durable goods, and money. Nominal borrowing is secured against real durable goods, meaning that even wealthy households can have negative nominal wealth positions, as is often the case for US households with a nominal fixed rate mortgage. The change in the inflation rate redistributes wealth from households with net nominal liabilities towards those with positive net nominal assets.

We calibrate the model to consider the Volcker disinflation of the early 1980s. We compare the welfare results from several calibrations. In the baseline, we calibrate the duration of nominal debt and the liquidity value of money to match characteristics of the US wealth distribution in 1977. The disinflation redistributes wealth from borrowers to savers and also increases the unemployment rate and the short-run borrowing costs for debtors. As a result, even though they are compensated by the lower inflation tax, almost all debtor households, 48 percent of the population, prefer to remain in the high inflation steady state rather than go through the disinflation. Middle income households, who have large nominal debt positions secured against their durables, are most likely to prefer the high inflation steady state (72 percent of middle income households) rather than face the disinflation. On the other hand, saver households generally prefer to go through the disinflation path, as overall efficiency and insurance against variation in consumption, real money holdings, and durables improve household welfare.

We then consider four alternative versions of our baseline model: no money and therefore no benefit from a lower inflation tax, household borrowing in real 1-period debt in which there is no revaluation effect, a constant real interest rate throughout the Volcker disinflation, and a constant unemployment rate. In all of the experiments, the percent of households who prefer to stay in the high inflation steady state remains high ($\sim 50\%$). The redistribution component of the aggregate welfare change continues to hit borrowers through higher real rates and higher unemployment. Undoing either of these channels will decrease the welfare costs of the disinflation for borrower households, but not undo them. In the cashless version of the economy, the lack of inflation tax relief leads to more households preferring to remain in the high-inflation steady state.

Our results suggest that it is crucial to capture the duration of assets, the change in the real interest rate, the change in the inflation tax, and the change in unemployment when considering the welfare consequences of changing the inflation rate.

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A Data appendix

Table A.1 reports the real and nominal categorization of assets and liabilities measured in the SCF.

Assets	Liabilities
<i>A. Nominal assets and liabilities</i>	
Liquid:	Secured borrowing:
Cash in checking accounts	Home mortgages
Cash in savings or share accounts	Amount owed against land
Money market and call accounts	contract notes
IRA or Keogh accounts	Amount outstanding on
Certificates of Deposit	other property mortgages
US Savings Bonds	
Non liquid:	Unsecured borrowing:
Face value of bonds	Amount outstanding on loans
Loans owed to household and	other than mortgages ¹
gas leases	Credit card debt
Aggregate gross value of land	Amount owed on lines of credit
contracts and notes	
Thrift type pension account assets	
<i>B. Real assets</i>	
Durables:	
Home	
Other properties	
Vehicles	
Financial:	
Stocks and mutual funds	
Trust accounts	
Business:	
Net value of business with	
management interests	

Table A.1: Categorization of SCF household assets and liabilities

Note: classification of assets and liabilities variables in 1977 Survey of Consumer Finances+ as harmonized by [Kuhn et al. \(2020\)](#).

¹ Also subtracts loans against life insurance policies.

B Model Appendix

B.1 Internal Calibration

We calibrate the Markov process and several key parameters that govern the wealth distribution and the marginal propensities to consume durable and non-durable goods. The calibration of the Markov process follows [Castaneda et al. \(2003\)](#). We choose the parameters of the probability transition matrix, the income states, aggregate productivity, the discount factor, the weight on money in the utility function and the adjustment cost for durables to match moments on the

wealth distribution, money holdings, and the MPCs. Specifically, we choose the parameters to minimize a pseudo-Huber loss over normalized differences between moments in the model and the data:

$$\min_{\mathbb{P}} \sum_j \left[\sqrt{1 + \left(\frac{X_{\text{model},j}(\mathbb{P}) - X_{\text{data},j}}{s_j} \right)^2} - 1 \right], \quad (\text{B.1})$$

where $\mathbb{P}$ is the vector of parameters, X is the vector of moments, and s_j is the normalization applied to moment j . All moments enter the objective in percentage points. The moment vector consists of the fifteen wealth-distribution moments reported in Table 1 and the five additional moments reported in Table B.1.

We normalize most moments by five percentage points. We use tighter normalizations for the share of nominal borrowers and aggregate money demand, because these moments discipline the prevalence of nominal liabilities and households' demand for money, both of which are central to the welfare effects of disinflation. We also use a tighter normalization for the nominal wealth to net worth ratio at the 90th percentile. This moment disciplines the nominal exposure to the disinflation for savers without the sensitivity that comes from being in the extreme tails of the wealth distribution.

We use looser normalizations for the top 1 percent wealth moments, because they are sensitive to the extreme tail of the wealth distribution, and for the average liquid wealth to net worth ratio, because it is sensitive to households with net worth close to zero. The pseudo-Huber loss is approximately quadratic for small discrepancies but approximately linear for large discrepancies, making the calibration less sensitive than squared-error loss to moments that the model cannot fit closely. The targeted moments and model fit are summarized in Table 1 and Table B.1.

Equation (B.2) gives the income states for our productivity process. There are four income groups with an average income using the stationary probability distribution of approximately 1.11.

$$z \in [0.0381; 0.6768; 2.3490; 48.7972] \quad (\text{B.2})$$

Equation (B.3) gives the transition matrix describing how households transition between states. An element of the matrix π_{ij} describes the probability that the household transitions from state i to state j .

	z_1	z_2	z_3	z_4
z_1	0.9723	0.0190	0.0087	0.0000
z_2	0.0031	0.9838	0.0131	0.0000
z_3	0.0132	0.0215	0.9641	0.0012
z_4	0.0093	0.0966	0.0090	0.8851

(B.3)

Given the transition matrix, in steady state, 18.3 percent of the population will be low income, 56.4 percent will be middle income, 25.1 percent high income, and 0.3 percent will be very high income. As described in Table 1, the process does a good job of replicating the distribution of income and wealth across households.

The values of the discount factor β , the CRRA parameter σ , the utility weight on durables θ , the adjustment cost for durables κ , and the utility weight on liquid holdings ω are given in Table B.1. We target moments on the share of households that are nominal borrowers from the SCF and empirical estimates of the marginal propensities to consume durable and non-durables from Lewis et al. (2019).

Parameter	Value	Moment	Data	Model
β	0.9145	Share of Nominal Borrowers	0.490	0.496
σ	1.4754	MPC non-durables	0.190	0.110
θ	0.6116	MPC durables	0.260	0.203
κ	0.1092	Average Liquid Ratio	0.200	0.262
ω	0.9752	Money to Output	0.169	0.174

Table B.1: Internal Calibration for 1977 SCF+

In addition, we include the tax progressivity parameter τ in the calibration algorithm. This parameter impacts the shape of the wealth distribution, allowing us to more closely match the targeted wealth moments. We solve for λ , the scale parameter on the income tax function, that delivers an average tax rate of 20%. τ is calibrated at 0.052, delivering the following tax rates for each productivity level:

$$\begin{array}{ccccc} & z_1 & z_2 & z_3 & z_4 \\ \text{tax rate} & 0.016 & 0.153 & 0.209 & 0.322 \end{array} \quad (\text{B.4})$$

C Consumer Sentiments during the Volcker Disinflation

In this section, we compare data from the Michigan Survey of Consumers with the welfare costs measured within the model. While the data cannot measure the actual welfare costs of a disinflation, we find evidence supportive of the model’s predictions.

For this analysis, we focus on the responses to two specific questions. The survey asks respondents about whether they are better or worse off than a year ago and the reason they are better or worse off. Amongst the answers, respondents can say they are worse off due to “higher prices”, or inflation. We tabulate for each calendar quarter the fraction of households who report being better or worse off by income quartile. Figure C.1 plots these shares of respondents who say they are better or worse off because of prices by income over time.

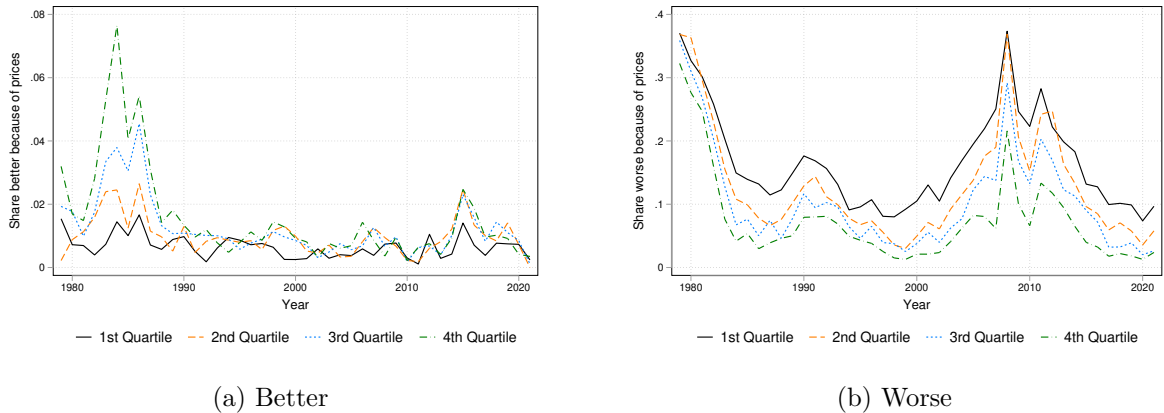


Figure C.1: Share of households better or worse because of prices by income quartile

First, in accordance with the presence of a substantial inflation tax in the model, very few if any households in the Michigan Survey say they are better off because of prices before the Volcker Disinflation, and roughly one-third say they are worse off due to prices. Moreover, as in the model, a consistently larger share of low- and middle-income households report being worse off from prices than of high-income households. In the model, these households pay the inflation tax on a larger share of their assets.

However, disliking inflation in steady state is *not* the same as being willing to go through the disinflation. While we do not have data on how households viewed the disinflation directly, we examine the share who say they are better or worse off due to price changes over time. After the Volcker Disinflation begins in 1982, there is a significant increase in the share of high-income households who say they are better off due to inflation, while the share of low- and middle-income households who say they are better off remains negligible.

Turning to the shares who report being worse off, the declines during the Volcker disinflation were uneven across the income distribution. By 1987, the share of high-income households who say they are hurt by inflation falls almost to zero, while for low-income households it only falls by two-thirds. Together, these patterns align with the model's predictions that the benefits of the disinflation policy are concentrated among the higher income households who are net nominal savers, while low- and middle-income households bear the costs.

D Welfare Decomposition

In this appendix section, we describe how we implement the method from [Bhandari et al. \(2023\)](#) in our model. The goal is to decompose the change in aggregate welfare caused by the Volcker disinflation into a component arising from aggregate efficiency, redistribution, and insurance.

For ease of notation, let ι collect the state variables of the household in the high-inflation economy into a vector: $\iota = \{q^H, d^H, z^H\}$. In our economy, the aggregate welfare is $\mathbb{E}[\alpha_\iota V^H(\iota)]$, the average value of a household in the high-inflation economy weighted by their Pareto weights α_ι . Since we employ utilitarian Pareto weighting, the expectation averages over households according to their states in the high-inflation equilibrium. Similarly, the aggregate welfare for households going through the transition is $\mathbb{E}[\alpha_\iota V^T(\iota)]$, where $V^T(\iota)$ gives the value of a household during the transition, with ι referencing their state variables in the high-inflation steady state before the redistribution.

[Bhandari et al. \(2023\)](#) show that the change in welfare can be written as

$$\begin{aligned} \Delta W &= \mathbb{E}[\alpha_\iota V^T(\iota)] - \mathbb{E}[\alpha_\iota V^H(\iota)] \\ &\approx \underbrace{\mathbb{E}\left[\sum_t \sum_k \phi_{k,t}(\iota) \Gamma_{k,t}\right]}_{\text{Aggregate efficiency}} + \underbrace{\mathbb{E}\left[\sum_t \sum_k \phi_{k,t}(\iota) \Delta_{k,t}(\iota)\right]}_{\text{Redistribution}} + \underbrace{\mathbb{E}\left[\sum_t \sum_k \sum_g \phi_{k,t}(\iota) \gamma_{kg,t}(\iota) \Lambda_{kg,t}(\iota)\right]}_{\text{Insurance}}. \end{aligned}$$

Here k and g index over different good types, consumption, money, durables, and labor, $k, g \in \{c, m, d, n\}$. Let $j \in \{T, H\}$ index the aggregate policies of transition or high-inflation steady state, respectively. Then define:

$$\begin{aligned}
\Gamma_{k,t} &= \ln X_{kt}^T - \ln X_{kt}^H, \\
\Delta_{k,t}(\iota) &= \ln(w_{k,t}^T(\iota)) - \ln(w_{k,t}^H(\iota)), \\
\Lambda_{kg,t}(\iota) &= -\frac{1}{2} [\text{cov}(\ln(x_{kt}^T), \ln(x_{gt}^T) \mid \iota) - \text{cov}(\ln(x_{kt}^H), \ln(x_{gt}^H) \mid \iota)], \\
w_{k,t}^j(\iota) &= \frac{\mathbb{E}_\iota[x_{kt}^j \mid \iota]}{\mathbb{E}[\mathbb{E}_\iota[x_{kt}^j \mid \iota]]}.
\end{aligned}$$

The weights and marginal utility terms are:

$$\begin{aligned}
\phi_{k,t}(\iota) &= \alpha_\iota \beta^{t-t_0} U_{k,t}(\iota) x_{k,t}^Z(\iota), \\
\gamma_{kg,t}(\iota) &= \frac{-U_{kg,t}(\iota) x_{g,t}^Z(\iota)}{U_{k,t}(\iota)}, \\
x_{kt}^Z(\iota) &= \sqrt{x_{kt}^T x_{kt}^H},
\end{aligned}$$

where t_0 refers to the first transition period, $U_{k,t}$ refers to the flow marginal utility with respect to good k at time t and $U_{kg,t}$ refers to the second derivative.

E Liquid Wealth as a Share of Net Worth

This appendix provides additional detail on the comparison between money holdings and net worth discussed in Section 3.5. Figure E.1 plots liquid wealth as a share of net worth against household net worth in the model and in the SCF+ data. In both the model and the data, lower-net-worth households hold a larger share of their net worth in liquid assets before the Volcker disinflation. This is the cross-sectional pattern that matters for the incidence of the inflation tax, and the model captures this initial relationship reasonably well.

At the same time, the model does not fully match the changes in money holdings over the transition. In the model, the decline in inflation lowers the opportunity cost of holding money balances, so money holdings as a share of net worth increase broadly across the distribution. In the data, the increase is more concentrated among higher-net-worth households. Capturing this pattern would likely require a richer framework for money demand, such as one with fixed costs of credit use (Erosa and Ventura, 2002) or non-homothetic money demand (Allais et al., 2020). We therefore view the model as capturing the broad shift toward nominal assets after the disinflation, while missing some of the heterogeneity in how money holdings adjust across the wealth distribution.

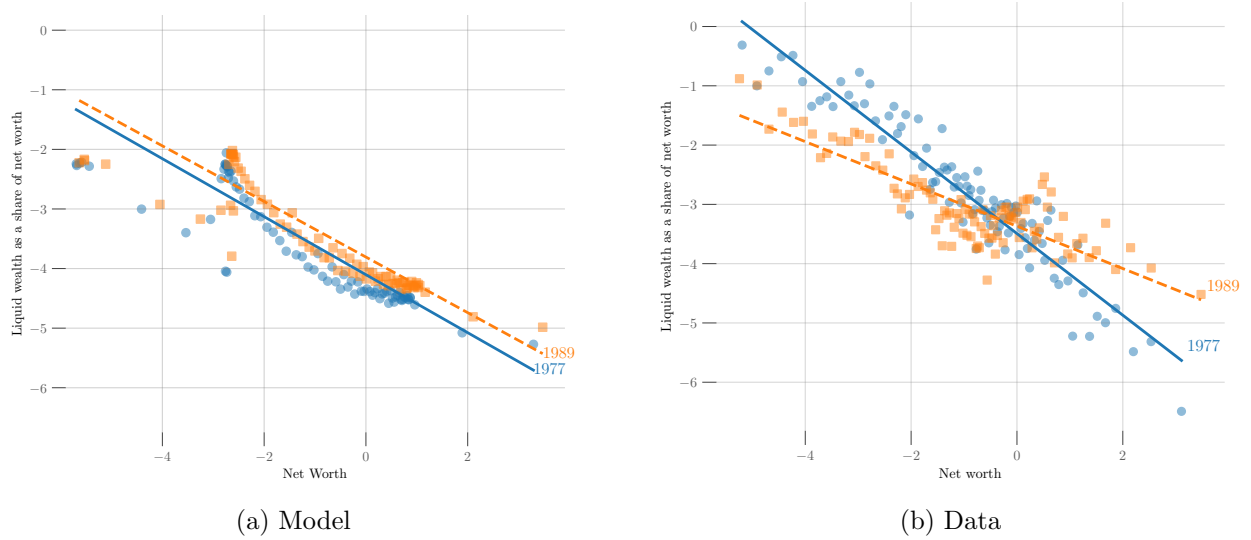


Figure E.1: Transition of household liquid wealth as a share of net worth compared to net worth

Note: Panel (a) shows the model transition of household liquid wealth as a share of net worth to net worth through the transition path, starting in the high-inflation steady state and transitioning through 1989. Panel (b) shows this same transition in the SCF+ data from 1977 to 1989. We take the log transform of both axes.

F Robustness Exercises and Additional Results

F.1 Varying the Employment Rate and the Real Rate

In our benchmark model, we made three strong assumptions that we relax in this Appendix. First, we assumed that the employment rate is the same across the high- and low-inflation steady states. Second, we assumed that the real rate remains unchanged between steady states. By 1989, though, the employment rate had risen from 92.4% to 94.5% and the real rate decreased from 5.6% to an average of 4.7% during the Greenspan era. In this section, we relax each assumption separately, recompute both high and low steady states, and recalculate the transition path.

Third, we allow households to differ in their exposure to changes in the unemployment rate. Following the empirical results on the heterogeneous exposure to changes in the unemployment rate by education from [Hoyne et al. \(2012\)](#), we scale the change in the aggregate unemployment rate by skill. For a one percentage point increase in aggregate unemployment, low productivity households experience a 1.74 percentage point increase in unemployment. Medium productivity households experience a 1.21 percentage point increase. High skilled households experience a 0.80 percentage point increase. Very high skilled households experience a 0.37 percentage point increase. We normalize these unemployment rates so that their population-weighted average matches the change in aggregate unemployment. While productivity may not correspond one-to-one with educational attainment, this alternative specification provides a way to check if allowing heterogeneous exposure to unemployment materially changes the baseline welfare results.

Table F.1 compares the results of the policy vote and welfare implications to the baseline and alternative specifications in the body of the paper. When allowing the steady state employment rate to change, slightly more households would vote to go through the disinflation as their labor income is higher in the long-run. At the tail of the distribution, the welfare costs fall from -2.31 to -2.23. Some of the gains are offset from the disutility of work. In the long run, roughly 2% of the population would prefer to stay in the high-inflation steady-state.

When we allow the real rate to vary between steady-states, nearly 70 percent of the borrowers would vote to go through the disinflation. Despite the short-run increase in the borrowing cost, they vote for the disinflation because borrowing costs decrease in the long-run. When considering the disinflationary period, no savers vote to stay in the high-inflation equilibrium. In the long-run though, roughly 13% of the population, all savers, would prefer that the real rate have remained high as in the high inflation equilibrium. These savers do not like the long-run fall in the real rate. When the real rate is allowed to fall, the efficiency channel increases by 32% relative to the baseline model, and the negative redistribution force is mitigated as less wealth is reallocated to savers. The overall welfare increase is double that of the baseline.

With heterogeneous labor supply, low-skilled households bear a larger share of the recessionary burden. As such, a larger share of those households would vote to stay in the high inflation equilibrium. The bottom 10 percent are relatively worse off due to the amplified unemployment rate, while the top 10 percent are relatively better off.

Table F.2 displays the mean and median consumption equivalencies in percents for the long-run across the various groups of households. We compare the baseline model to the models where we allow the long-run employment rate and the long-run real rate to change relative to the high inflation steady state. In the baseline model, median households in all groups are better off. The only long-run change in the baseline model is the lower inflation rate. Since money is proportional to non-durable consumption in our baseline specification, this benefits households across the income distribution similarly.

In the specification with a varying steady-state labor supply, median borrower welfare improves while savers are worse off relative to the baseline. The increased employment rate provides borrower households, concentrated in the low and medium income brackets, needed income to alleviate tight borrowing constraints. Saver households still favor the disinflation on average, but are relatively harmed by higher labor hours. This effect is seen especially strongly in very high income households. These households, being far from their borrowing constraint, consume enough durable and non-durable goods and hold enough money that the disutility of labor outweighs marginal consumption gains from the extra income and the lower inflation tax.

With a varying steady-state real rate median welfare rises, driven primarily by medium income borrowers. Because the real rate falls in the long-run, borrowers – especially borrowers that borrow a lot relative to net worth – are much better off. Savers, especially those that save a lot, are hurt.

Table F.1: Welfare under Alternative Experiments

Panel (a): Preference for disinflation

	Percent that prefer high inflation			
	baseline	varying n_{ss}	varying r_{ss}	het. n
Total economy	47.8	47.5	12.6	48.3
Borrowers	99.8	99.7	31.0	100.0
Savers	0.48	0.00	0.00	1.17
Low income	37.6	36.1	26.7	38.5
Middle income	72.2	72.2	13.4	72.7
High income	0.00	0.00	0.00	0.00
Very high income	0.00	0.00	0.00	0.00

Panel (b): Distributional impacts

	p10	p50	p90	Mean
baseline	-2.31	0.64	8.40	2.23
varying n_{ss}	-2.23	0.72	8.22	1.96
vary r_{ss}	-0.11	2.89	8.05	2.99
het. n	-2.38	0.59	8.40	2.13

Panel (c): Decomposition

	Efficiency	Redistribution	Insurance	Δ Welfare
Baseline: as % of Δ Welfare				
baseline	301.33	-308.93	107.60	0.162
Counterfactuals: as % of baseline				
vary n_{ss}	92.08	95.53	88.87	77.96
vary r_{ss}	131.83	63.15	16.93	220.36
het. n	103.38	104.63	95.54	91.09

	Baseline		Vary n_{ss}		Vary r_{ss}	
	Mean	Median	Mean	Median	Mean	Median
All Households	1.78	1.79	1.50	1.93	2.75	3.71
Borrowers	1.77	1.79	2.21	2.08	5.08	5.09
Savers	1.80	1.80	0.85	0.84	1.17	1.14
Low	1.75	1.78	2.02	2.16	1.12	0.66
Medium	1.79	1.79	1.79	2.08	4.12	5.06
High	1.80	1.80	0.52	0.41	0.92	0.80
Very High	1.80	1.80	-5.02	-5.15	-3.47	-3.76

Table F.2: Long-run consumption equivalent welfare

Note: We calculate long-run welfare using $\Delta_c^{ss}(\iota) = \left(\frac{U_{ss}^L(\iota) + D_{ss}^H(\iota) - D_{ss}^L(\iota)}{U_{ss}^H(\iota)} \right)^{\frac{1}{1-\sigma}} - 1$, where ι denotes the household state, L denotes the low-inflation steady-state after the disinflation, and H denotes the high-inflation steady-state just prior to the disinflation. U denotes discounted expected lifetime utility from the consumption bundle. D denotes discounted expected lifetime disutility from labor.

F.2 Non-Indexed Tax Rates

This section adds two exercises that consider the fiscal implications of disinflation through nominally denominated taxes. First, we consider a nominal tax basis for capital depreciation, under which inflation erodes the real value of depreciation allowances and raises the effective tax wedge on capital. Second, we consider imperfect indexation of household income taxes, under which higher inflation raises average tax rates through bracket creep and disinflation lowers the household tax burden.

Feldstein and Summers (1983) note that inflation distorts capital tax rates by changing the value of a firm's capital basis. To explore the welfare benefits of the Volcker disinflation from this angle, we develop a simplified model in the spirit of Edge and Rudd (2011). The mutual fund, which produces capital in our model, now pays taxes on the income from its capital stock, but can deduct a portion, δ^T of the previous year's nominal tax basis, $P_{t-1}s_{t-1}$. The real tax bill for the mutual fund in period t is then:

$$\tau^k \left(v_t K_{t-1} - \delta^T \frac{s_{t-1}}{\Pi_t} \right)$$

The tax basis includes the amount of investment the mutual fund puts into capital plus the basis that has not depreciated from the preceding period, yielding law of motion $s_t = K_t - (1 - \delta)K_{t-1} + (1 - \delta^T) \frac{s_{t-1}}{\Pi_t}$.

Inflation impacts the value of the tax deduction each period for the mutual fund. When inflation rises, the tax deduction is smaller. When inflation falls, the tax deduction is larger. Therefore, as inflation falls through the 1980s, the tax burden on the mutual fund falls. In the long run, this decreases the market rate for capital, v_t , and increases the amount of investment.

Quantitatively we set $\delta^T = \delta$, a simplifying assumption that implements geometric depreciation, and $\tau^k = 46\%$, the federal corporate tax rate for corporations earning over \$100,000 from 1979-1981. We keep the rest of the calibration the same and recalculate the transition path. While the initial recession is largely the same as under the baseline calculation, long-run output increases

due to the long-run fall in the price of capital. Wages increase, leading to welfare that improves throughout the distribution relative to baseline.

We conduct a similar exercise with personal income taxes. Our income function follows [Heathcote et al. \(2010\)](#):

$$\lambda(W_t n_t z_t)^{1-\tau}$$

where λ governs the average marginal tax rate and τ governs the curvature, or progressivity, of the tax schedule. In the baseline model, we hold λ constant across time. If tax brackets are not perfectly indexed to inflation though, average tax rates will increase as inflation increases. Indeed, Congress began indexing tax rates to inflation in 1984 ([Burman and Maag, 2001](#)). We implement a reduced-form indexation in our model by allowing λ to be partially indexed to the steady-state inflation rate after the Volcker disinflation:

$$\lambda_t = \lambda_{ss} \left(\frac{\Pi_t}{\Pi^*} \right)^{-\delta^\lambda}$$

If inflation rises, then λ_t will fall relative to λ_{ss} , decreasing the amount of pay taken home by workers and increasing the tax revenue collected by the government. Similarly, if inflation falls below Π^* , the amount of pay taken home will increase and the amount of tax revenue will decrease. We calibrate δ^λ such that the average tax rate is roughly one percentage point higher in our high inflation steady-state than in the low inflation steady-state ([Barro and Sahasakul, 1986](#)). Through the Volcker disinflation, the income tax rate thus falls, leading to an increase in take-home wages and improving welfare through the wealth distribution.

Quantitatively, the nominal capital tax basis has the larger effect, raising average welfare by nearly two percentage points in consumption-equivalent terms. The gains from non-indexed income tax brackets are also meaningful, increasing average welfare by nearly one percentage point. [Table F.3](#) reports the full welfare results.

F.3 Calibration Sensitivity

Our baseline model is calibrated to match wealth moments derived from the 1977 SCF+. To determine how sensitive the model is to the aggregate parameters we calibrate, we perturb each parameter, recalculate the high and low inflation steady-states, solve the transition path, and calculate the mean consumption equivalent welfare results. [Figure F.1](#) displays the results.

Table F.3: Welfare Results for Taxation Experiments

Panel (a): Preference for disinflation

	Percent that prefer high inflation		
	baseline	nom. capital tax basis	non-indexed income tax
Total economy	47.8	43.6	45.7
Borrowers	99.8	91.5	96.0
Savers	0.48	0.00	0.00
Low income	37.6	36.1	35.8
Middle income	72.2	65.2	69.0
High income	0.00	0.00	0.00
Very high income	0.00	0.00	0.00

Panel (b): Distributional impacts

	p10	p50	p90	Mean
baseline	-2.31	0.64	8.40	2.23
nom. cap. tax basis	-0.75	2.44	11.56	4.22
non-indexed income tax	-1.32	1.58	8.95	3.06

Panel (c): Decomposition

	Efficiency	Redistribution	Insurance	Δ Welfare
Baseline: as % of Δ Welfare				
baseline	301.33	-308.93	107.60	0.162
Counterfactuals: as % of baseline				
nom. cap. tax basis	188.27	121.82	100.45	299.05
non-indexed income tax	125.22	95.25	94.40	184.65

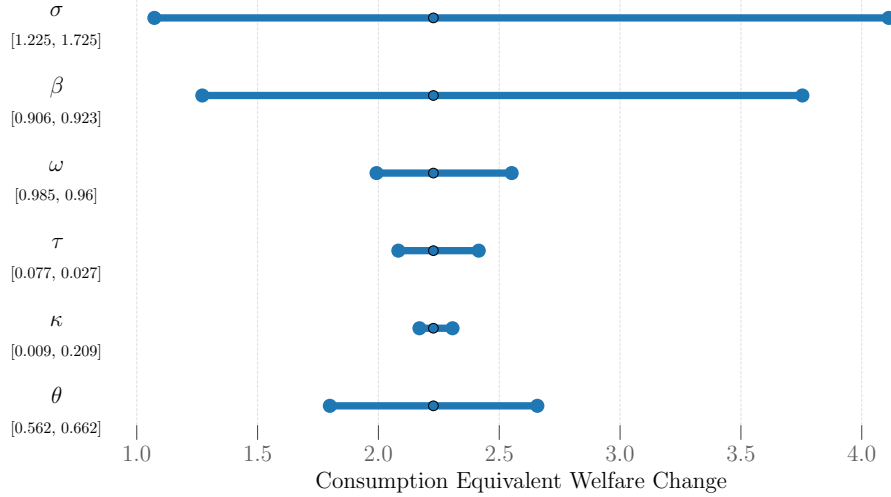


Figure F.1: Sensitivity of welfare results to parameter calibration.

Note: The blue bar denotes the mean consumption equivalent welfare change. Numbers underneath each parameter denote the values for that parameter. The left number denotes the value used for the low welfare result; the right number denotes the value used for the high welfare result. The point outlined in black denotes the baseline welfare result.

The household discount factor, β , is important for welfare results, governing how much households value the future. If households are impatient (β is low), then households weight the recession period of the Volcker disinflation more and benefit less from the disinflation. If households are patient (β is high), then they care more about the long-term results from the disinflation and benefit more.

σ , the consumption composite coefficient of relative risk aversion, changes how households value their nondurable, liquid holdings, and durable consumption. A higher σ increases the welfare returns to consuming for low-consumption households—the utility function becomes steeper. Because nondurable consumption and liquid holdings both increase in the long-run, a higher σ raises overall welfare relative to baseline.

ω , the CES weight on nondurable consumption, governs the value households place on liquid holdings. The higher ω , the less the reduction in the inflation tax matters for households. As such, welfare gains are lower than baseline. The lower ω , the more households gain from the reduction in the inflation tax.

θ is the utility weight between the CES aggregate, of nondurable consumption and liquid holdings, and durable consumption. A higher θ shifts weight away from durable goods and towards the CES aggregate. Because the CES aggregate increases more than durables in the long-run, a higher θ improves welfare.

τ is the tax progressivity parameter. A more progressive tax system decreases the welfare gains from the disinflation. In the baseline results, almost all savers experience welfare gains. All high-income households are savers. By increasing the tax rate on high-income households, some of the saving households are unable to consume as much through the transition as before. As such, higher progressivity dampens the welfare gain.

κ is the durables adjustment cost parameter. A higher κ increases the cost of changing the stock of durables. Because the disinflation leads to a decline in durables, a higher adjustment cost parameter prevents the stock of durables from falling as much as in the baseline. As such, welfare actually improves relative to baseline, though the absolute welfare change relative to baseline is

small.

F.4 Consumption Equivalence Plots for Alternative Experiments

This section presents the histograms of the consumption equivalent welfare measures for each of the alternative experiments discussed in Section 5.

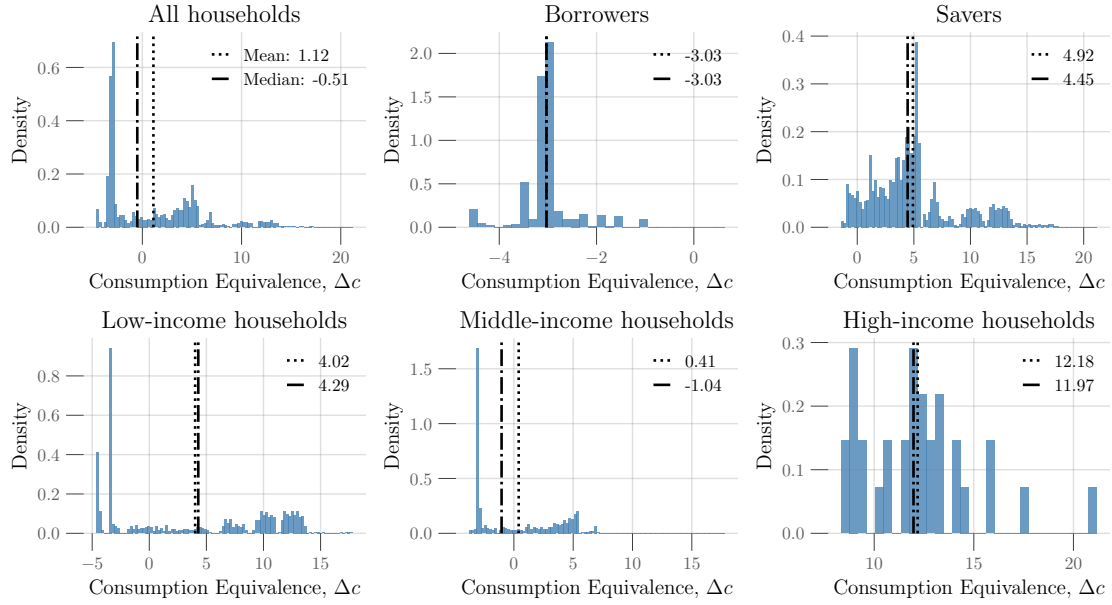


Figure F.2: Consumption equivalent welfare – cashless specification

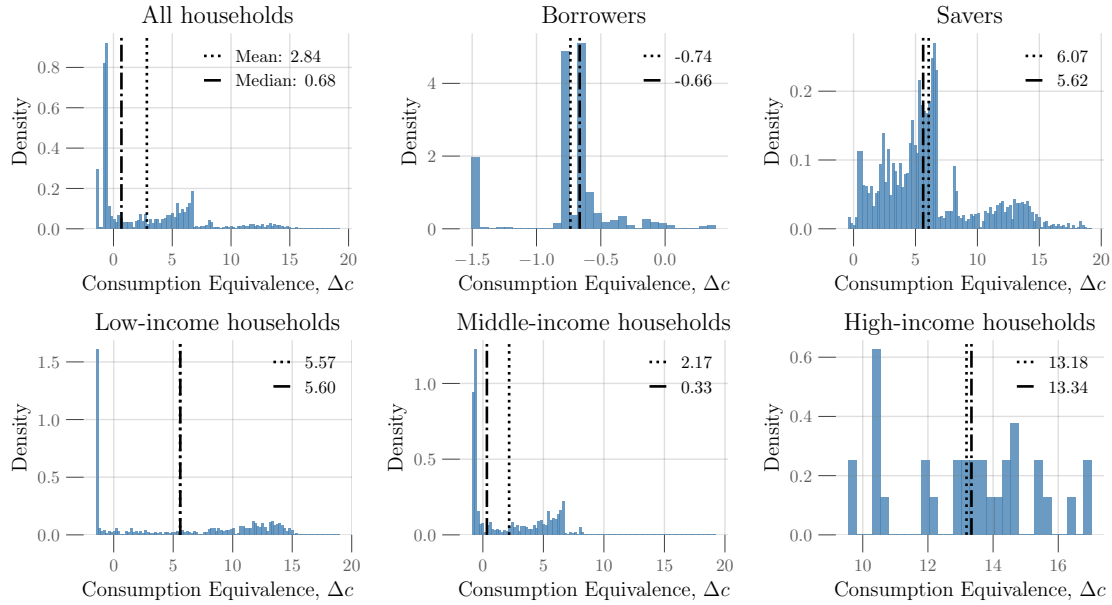


Figure F.3: Consumption equivalent welfare – one-period real assets specification

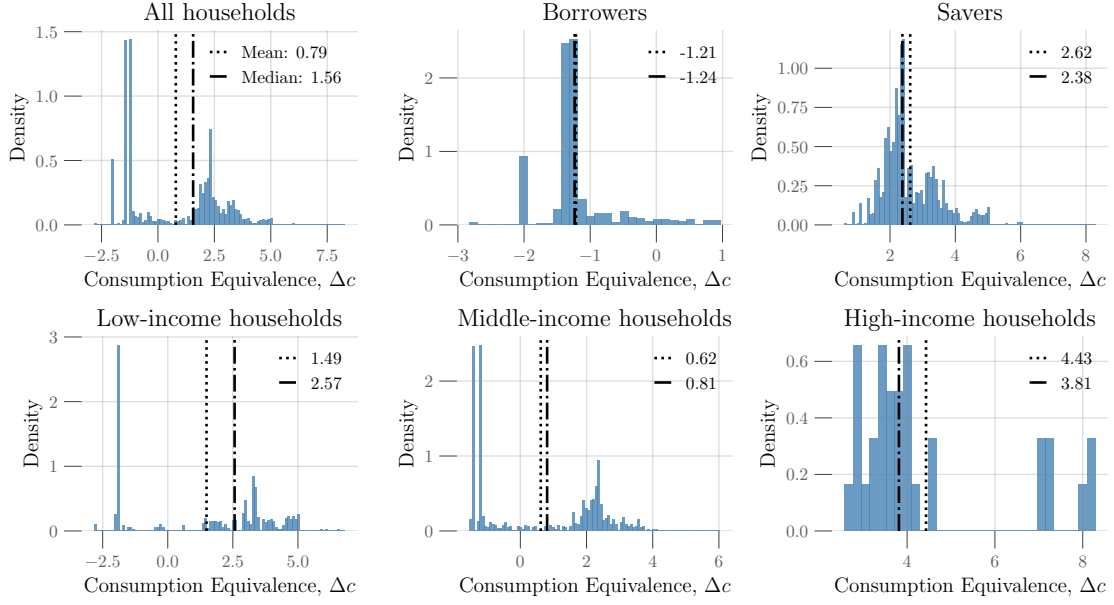


Figure F.4: Consumption equivalent welfare – constant real rate specification

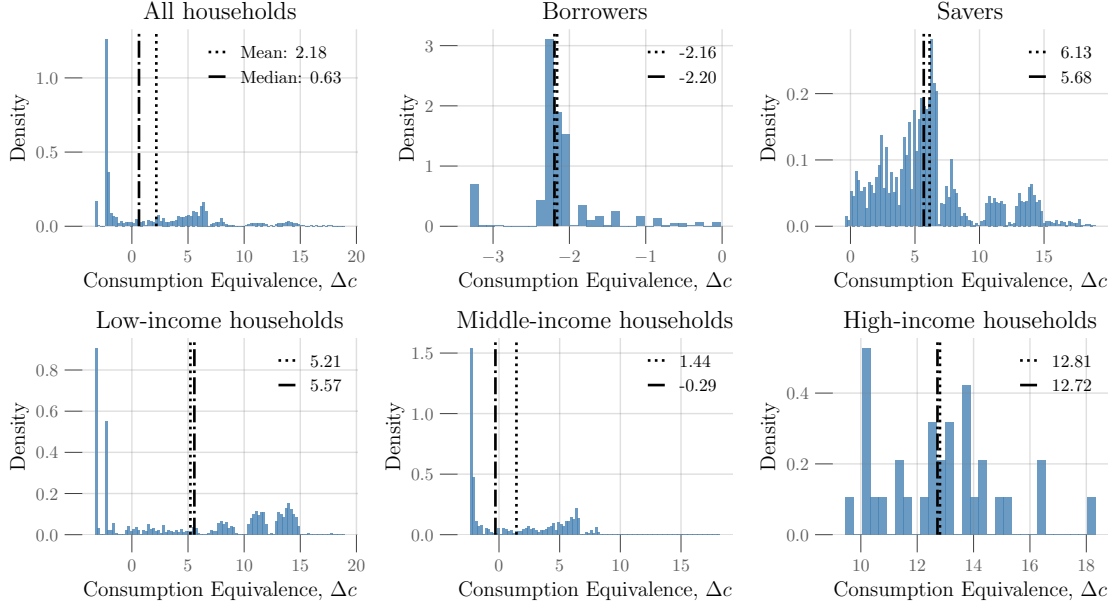


Figure F.5: Consumption equivalent welfare – constant employment specification

F.5 1983 SCF Calibration

In our main calibration, we use data from the 1977 SCF+ as harmonized by [Kuhn et al. \(2020\)](#). One drawback to this data is that, in 1977, mortgage debt was imputed based on origination information. Mortgage debt makes up a key part of households' nominal debt holdings. As such, in this section, we show that the results are robust to using the 1983 SCF instead. For the most part, the moments we use to calibrate the model—namely the moments along the Lorenz curve for

net worth and real assets and the average nominal share of net worth for various points in the net worth distribution—are relatively stable between surveys. An exception is that in 1983, wealthy households hold a larger share of their net worth in nominal assets compared to 1977 when the top 1% of households held only 0.2% of their wealth in nominal assets. As we show in Section 3.5, this shift is something that the model will predict as the inflation tax on nominal assets fall.

Table F.4 details the model fit when calibrating the model to match the 1983 SCF. The model continues to match the targeted moments well. Table F.5 details the results of the voting experiment. The main results are largely unchanged.

Borrowers continue to prefer avoiding the disinflation, while savers, in general, prefer a lower inflation environment. The lowest 10th percentile of the economy loses 2.28 percent of consumption, similar to the baseline, while the median household gains 0.77 and the top 10th percentile gains 10.32 percent of consumption-equivalent utility, both higher than the baseline calibration. The average household gains by 2.38 percent of consumption-equivalence units, higher than the 2.23 average gain in the baseline economy. This difference stems from the nominal assets—when the wealthy households hold a larger share of their net worth in nominal assets, they have more to gain from the disinflation.

Total welfare is slightly lower in the 1983 version, at about 91% of the 1977 SCF+ calibration. While the efficiency gain is larger by 20%, the redistribution loss is also larger by 21%. The insurance component of welfare falls by 3.4 percentage points.

Net-worth percentile group	Bottom of net-worth distribution		Top of net-worth distribution		
	10%	50%	10%	5%	1%
Net worth: share of total wealth (Lorenz curve)					
Data	-0.13	3.88	66.48	54.29	31.15
Model	0.13	2.38	66.25	55.98	33.39
Real wealth: share of total wealth (Lorenz curve)					
Data	0.17	6.30	62.33	50.70	29.33
Model	0.23	5.33	64.81	54.97	32.83
Nominal wealth: average share of own net worth					
Data	-126.50	-16.20	6.30	13.30	10.70
Model	-129.03	-10.47	8.99	8.79	6.62

Table F.4: Distribution of Wealth: Data and Model for 1983 SCF

Note: We keep the ordering by net worth constant for all asset classes. Data on the wealth distribution and the share of households with net negative nominal wealth is from the 1983 SCF. Adjusted net worth is total net worth less the value of any durable assets or secured borrowing against these assets (Appendix A).

	Percent that prefer high inflation		Percent borrowers	Percent of Population
	Short run	Long run		
Total economy	48.2	0.0	48.4	100.00
Borrowers	98.9	0.0	100.0	48.4
Savers	0.50	0.0	0.00	51.6
Low income	38.6	0.0	37.4	18.6
Middle income	72.2	0.0	72.2	56.8
High income	0.0	0.0	1.91	24.0
Very high income	0.0	0.0	0.00	0.60

Table F.5: Preference for Disinflation Policy in 1983 SCF Calibration