Inequality in the Welfare Costs of (Inflation and) Disinflation

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[1]The views are those of the authors and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System

Welfare Costs of (Inflation and) Disinflation

- Welfare costs of inflation
  - Inflation tax
  - Long-run measures
- Inflation tax leads people to prefer an economy with long-run low inflation over one with moderate to high inflation
- But starting from persistently high inflation, how do we get there?
- What are the short-run welfare costs of a *disinflation* period?
  - Usual focus is some version of sacrifice ratio
  - Even absent a sacrifice ratio, we cannot avoid redistributional effects of an unanticipated disinflation

Research Question

- Abstracting from effects on aggregate output vis-a-vis a Phillips curve, what are the welfare costs from disinflation induced by redistribution and porfolio rebalancing?
- The idea
  - To think about meaningful heterogeneity we need to abandon complete markets (i.e., representative agent)
  - Flexible-price incomplete markets monetary economy
    - ⋆ In the long run low inflation dominates high inflation
  - Disinflation is a transition to a new low inflation stationary economy. Compute this sequence of distributions
  - Measure the redistribution and welfare costs along this transition path
  - In general, could measure short-run benefits/costs of any adjustment to an inflation target

Inflation and Welfare Cost Literature

- Long literature on the *long-run* welfare costs of inflation
  - With **complete markets**: Lucas (2000), Lucas and Stokey (1983,1989), Dotsey and Ireland (1996), Aiyagari, Braun, and Eckstein (1998)
  - With **incomplete markets**: Imrohogolu (1992), Chaterjee and Corbae (1992), Erosa and Ventura (2002), Albanesi (2007), Algan and Ragot (2010), Doepke and Schneider (2006)
- Disinflation is a *short-run* transition. Even with long run benefits from low and stable inflation, short run costs to implementing this policy
  - Literature on sacrifice ratios: Okun (1978), Gordon and King (1982), Cecchetti and Rich (2001), Ascari and Ropele (2012)
- Transitional dynamics between stationary incomplete markets equilibria
  - Domeij and Heathcote (2004), Guerrieri and Lorenzoni (2011)

Our Model

- We need a model to consider the counterfactual of no shift or alternative shift in inflation target
- We start with a classical monetary economy and adjust to add the most important features for our question: heterogeneity in income and wealth (inequality), secured borrowing against durable goods (mortgages and housing)
- At "birth" the population is identical, heterogeneity emerges from different realizations of household's earnings over time

Our Model

- In each year, households have some income from their labor earnings and their assets:
  - decide how to allocate it among nondurable consumption, durable goods, liquid assets (money), interest-bearing savings/borrowing
  - may borrow against a fraction of the value of durable goods and limited unsecured borrowing
- Savings invested in productive capital stock and safe government debt
- Aggregate output depends only on the total productive capital stock (no business cycles)

Household Heterogeneity

- Households differ by their accumulated real net worth q, their stock of durable goods d, and their productivity e
- Use a probability distribution ψ_t to keep track of household heterogeneity
- Let $\psi_t\left([-b, q'], [0, d'], e_j\right)$ be the fraction of all households with $-b \leq q_t \leq q'$, $0 \leq d_{t-1} \leq d'$ and $e_t = e_j$

Monetary (and Fiscal) Policy

- Government is a consolidated fiscal and monetary authority
- Commits to inflation target Π_t^* and perfectly manages growth of money stock implement this target
- Seigniorage revenues finance lump sum transfers to households and government spending on purchases and interest expense.

$$G_t + T_t + \frac{B_{t-1} + M_{t-1}}{\Pi_t} = M_t + \frac{B_t}{1 + i_t}$$

- *Monetary policy* is a sequence of inflation rates Π_t^*, real transfers T_t (and possibly debt purchases $\frac{B_t}{1+i_t} - \frac{B_t}{\Pi_t}$) that satisfy the government budget constraint

High Inflation Equilibrium

- Long run equilibrium with constant prices
- Monetary policy is $\Pi^* = \Pi^H$ and seignorage policy, e.g., helicopter drop $T = M\frac{\Pi^H - 1}{\Pi^H}$
- Households and firms optimize
- Distribution is stationary and markets clear

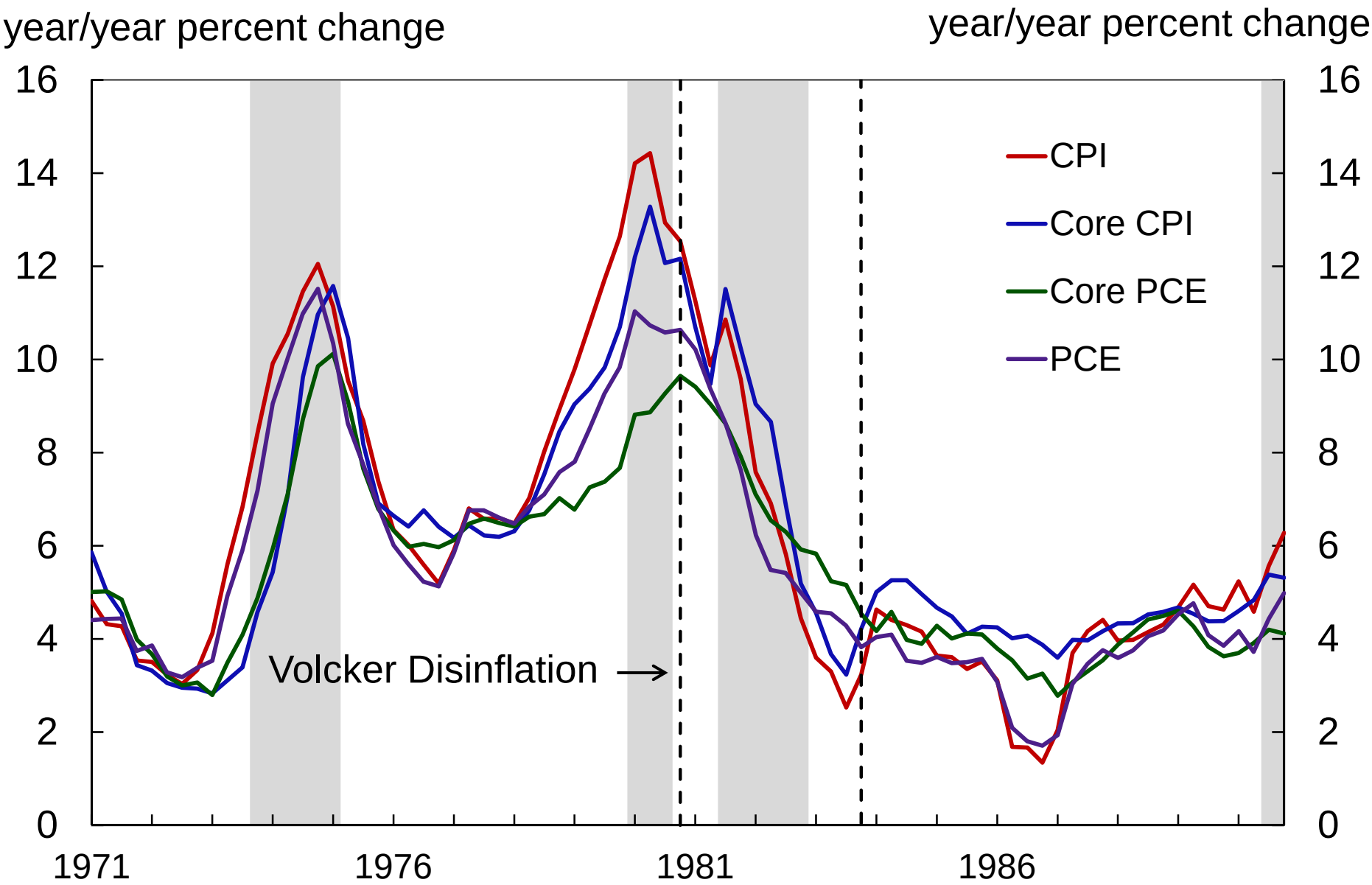
Disinflation Equilibrium Path

- High inflation stationary equilibrium in period $t = 0$
- In period $t = 1$ government announces surprise change in the monetary policy stance
  - Permanently lower inflation target $\Pi^* = \Pi^L$
  - New sequence of transfers T_t that rebate the implied seigniorage revenues to households
- Credibly commits to do whatever it takes to implement new path of inflation
- The announcement is *not anticipated*

Disinflation Equilibrium Path

- The announcement and immediate shift in price level induces a redistribution
  - Nominal borrowing and lending contracts were formed when $\Pi_1 = \Pi^H$
  - With $\Pi_1 < \Pi^H$ the change in inflation redistributes the real value of the nominal wealth from borrowers to lenders
- As households respond to shift in inflation, the distribution of net worth and durables across households ψ_t continues to evolve until it eventually reaches the long-run low inflation distribution ψ^L

Inflation During the Volcker Disinflation



Source: Bureau of Economic Analysis and Bureau of Labor Statistics

High Inflation Economy

- A rough calibration (no housing)
- Nominal rate $i_0 = 14.3$ percent
- Inflation $\Pi^H = 1.1$ and helicopter drop transfers $T/Y = 0.023$
- Capital to Output $K/Y = 3.31$
- 16.0 percent of households borrowers
  - 78.4 percent of low income
  - 9.10 percent of middle income
- 49.4 percent of low-income households borrowing constrained
- Gini 0.81

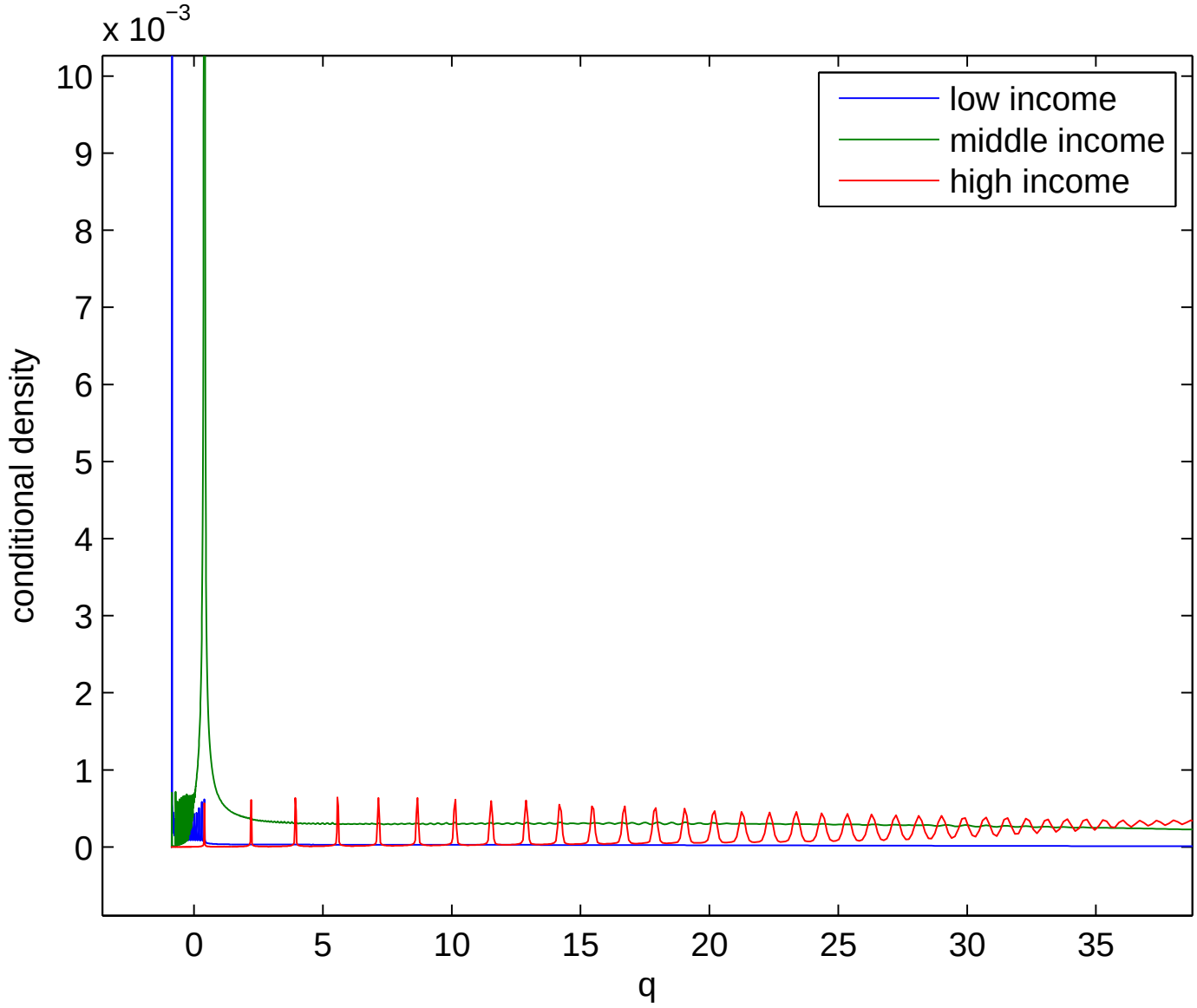


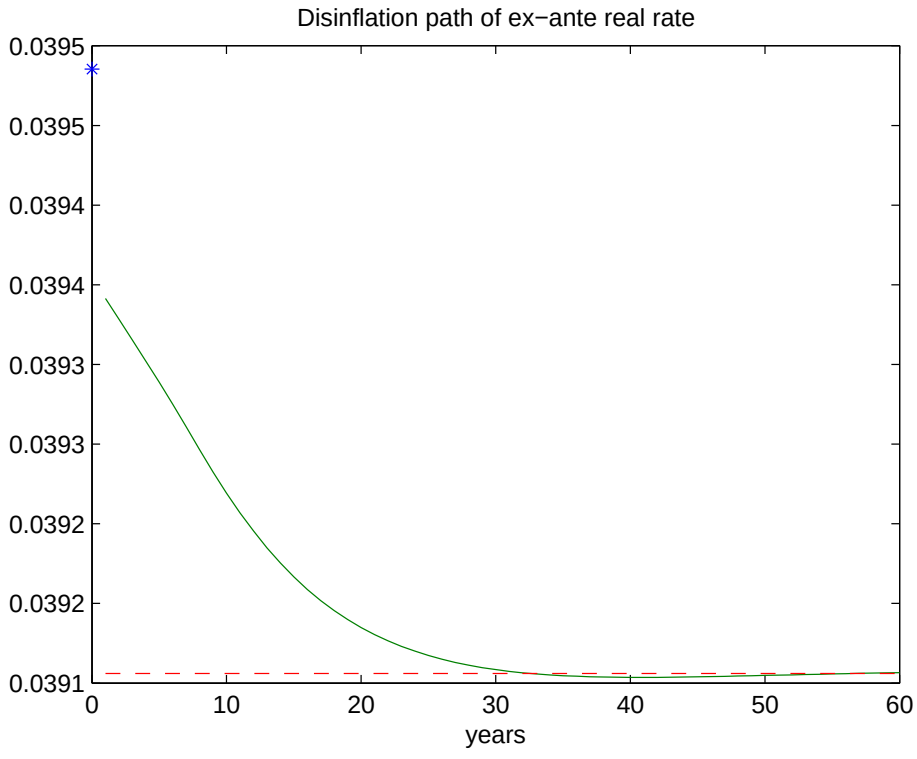
Figure: Conditional densities

Table: Distribution of Wealth Data and Model

	Lowest			Highest			
Share of Total	10%	25%	50%	10%	5%	1%	Gini
1983 SCF							
Net Worth	-0.14	0.12	3.82	66.65	54.56	31.23	0.78
Liquid Assets	0.31	1.07	6.58	50.18	34.80	13.97	0.81
Model							
Net Worth	-0.59	0.46	0.90	62.06	37.20	8.80	0.81
Liquid Assets	0.50	10.59	26.7	33.87	19.30	4.27	0.39

Disinflation Equilibrium Path

- 1 year disinflation from 10 percent to 3 percent announced at the beginning of $t = 1$.
- Households shift back towards liquid assets from interest-bearing savings, pushing up interest rate
- Offset by increased saving as transfers decline
- Sensitive to the use of the seigniorage revenues. With no transfers, portfolio rebalancing effect dominates



Measuring Welfare Changes

- Consumption equivalence in high inflation economy of switching to disinflation equilibrium path
- Counterfactual: stay in high inflation economy
- Conditional short run welfare change $\Delta(q_0, e_1)$

Results

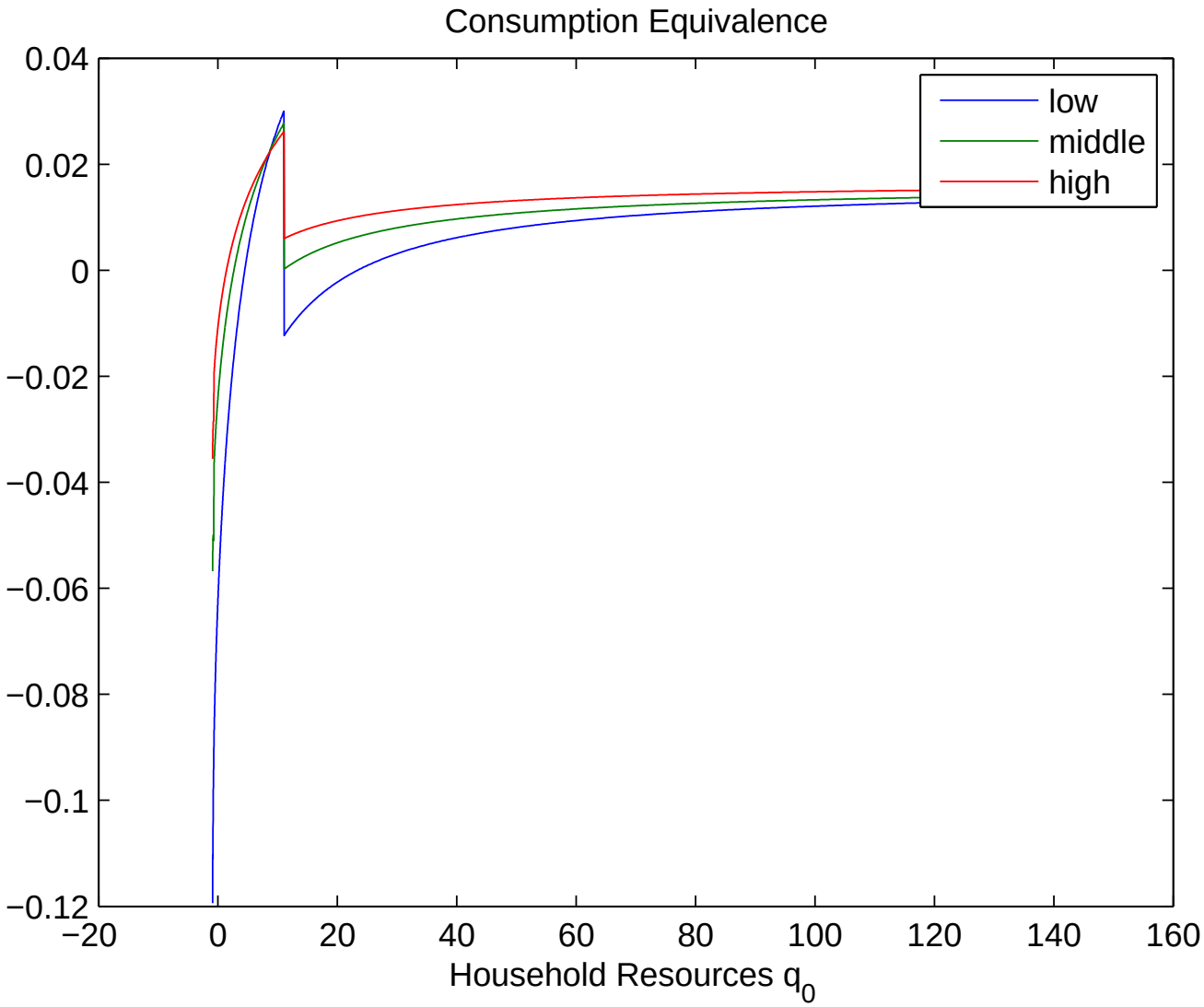


Figure: Consumption equivalence across the state space

Results

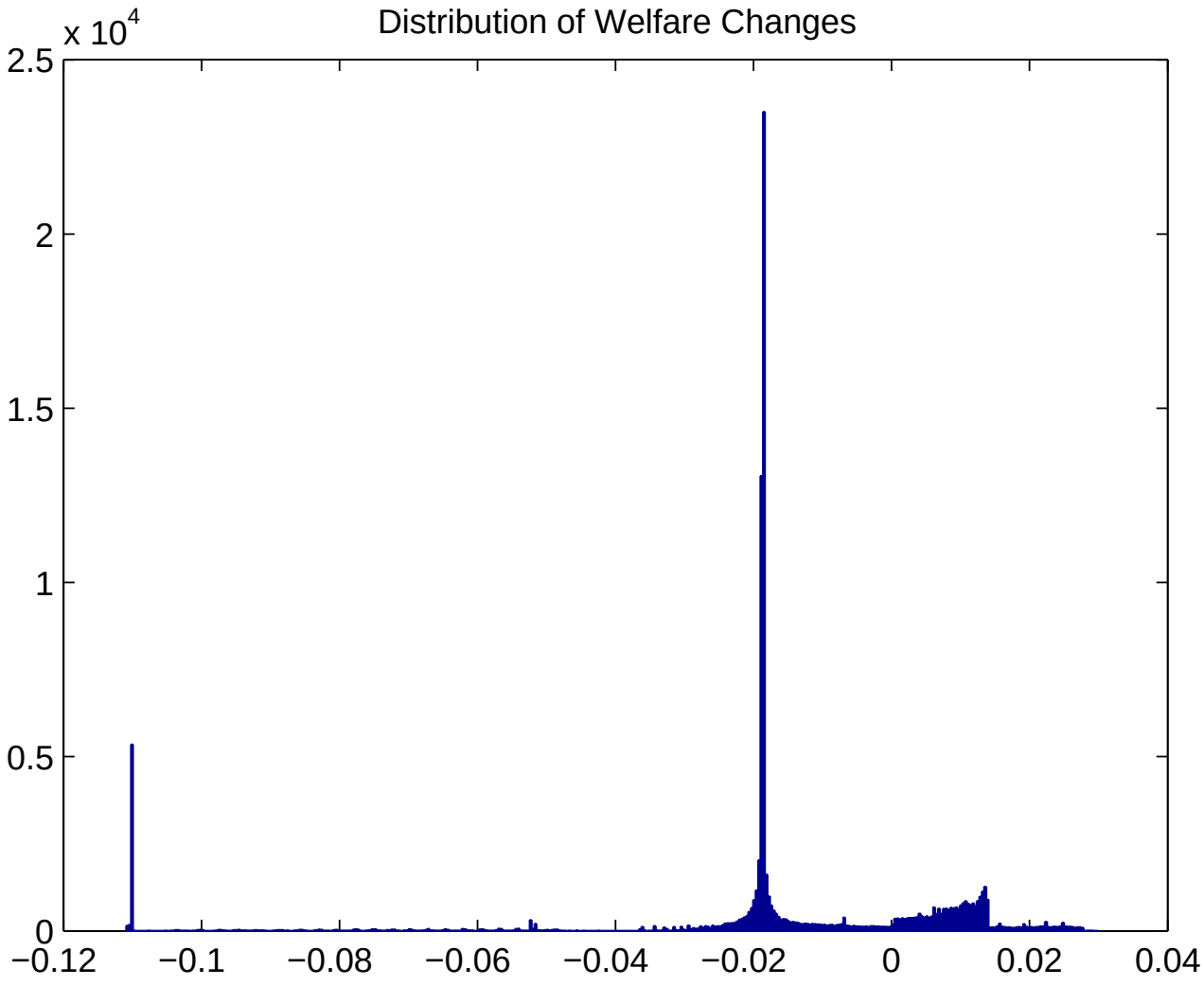


Figure: Overall Distribution of Welfare Changes from Disinflation

Results

Table: Preference for Disinflation Policy

	Percent that Prefer High Inflation		Percent Borrowers	Percent of Population
	Short Run	Long Run		
Total Economy	71.2	11.1	15.98	100
Low Income	93.87	65.77	78.40	11.4
Middle Income	77.72	4.76	9.10	77.2
High Income	1.88	0.00	0.00	11.4

Results

Table: Aggregate Welfare Losses

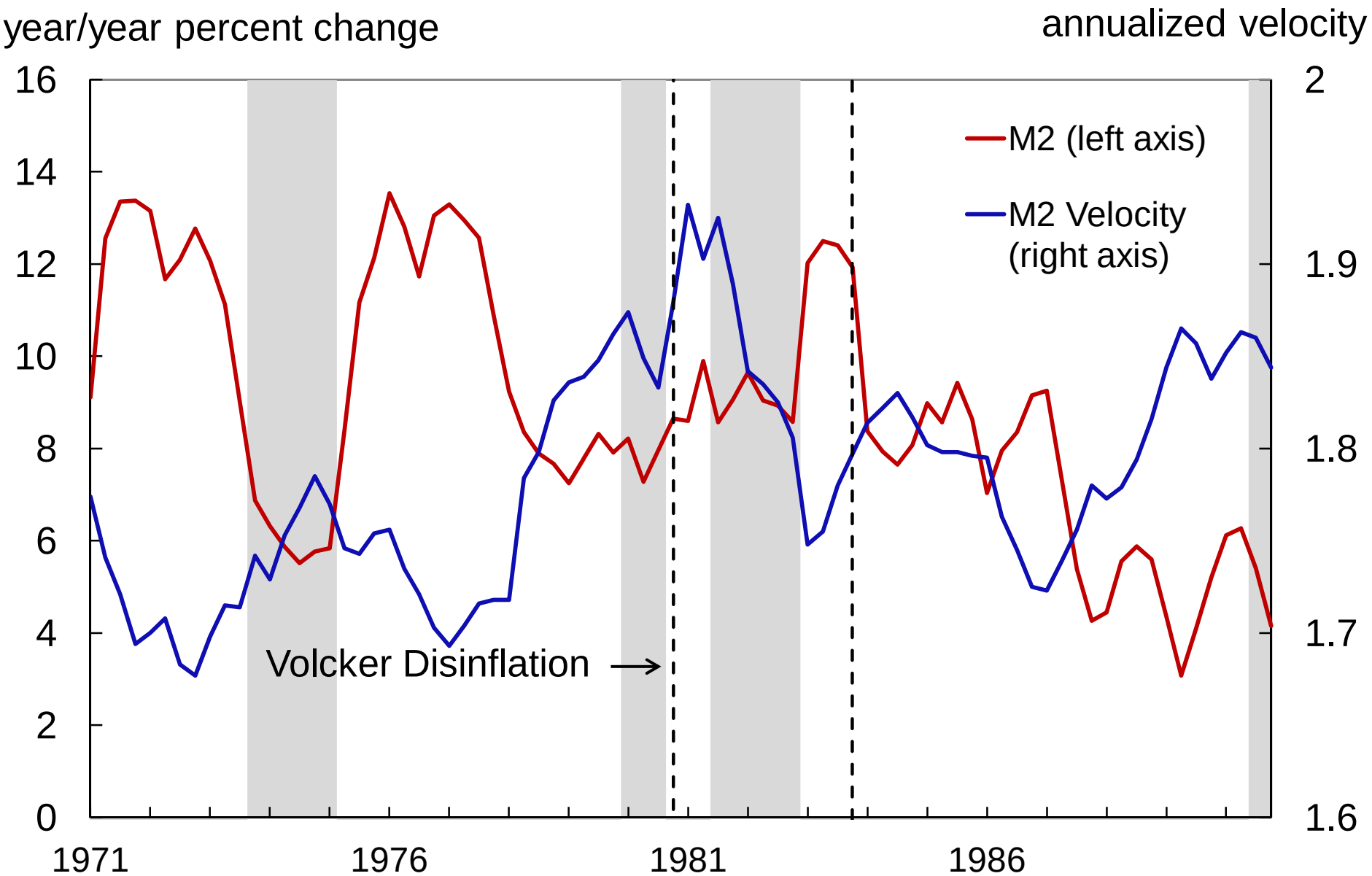
	Percent Welfare Change
Total Economy	-1.73
Aggregate component	+1.09
Redistribution component	-2.80

Summary

- Disinflation imposes a redistribution away from borrowers and towards lenders and increases real borrowing costs
- In the calibrated economy because of these features the majority of households would prefer to remain in the high inflation equilibrium, despite preferring the low inflation equilibrium in the long run
- Determination of long run inequality of total income and net-worth is not straightforward in general equilibrium

- What is next
  - Better match between the initial high inflation equilibrium in the model and the economic environment at the onset of the Volcker disinflation
  - Quantitative measures of the redistributional costs of this episode

Money Supply During the Volcker Disinflation



Source: Federal Reserve Board

Household Behavior

$$V_t(q_{t-1}, e_t) = \max_{c_t \geq 0, m_t \geq 0, a_t \geq -b} \{u(c_t, m_t) + \beta E_t[V_{t+1}(q_t, e_{t+1})]\}$$

such that

$$c_t + \frac{a_t}{1+i_t} + m_t = \frac{q_{t-1}}{\Pi_t} + w_t e_t + T_t$$

and a law of motion for end of period resources q_t

$$q_t = a_t + m_t \ .$$

Capital ownership is not determined, but no arbitrage links the return on capital and the nominal bond

$$1 = \frac{1}{1+i_t} \Pi_{t+1} (1 + v_{t+1} - \delta)$$

No expectation because evidently no uncertainty over future policy or technology

High Inflation Equilibrium

Given a monetary policy with constant inflation target $\Pi^* = \Pi^H$ and spending G and transfers T, a high inflation stationary equilibrium is a constant interest rate i, inflation $\Pi = \Pi^H$, decision rules $c(q,e)$, $m(q,e)$, $a(q,e)$, and an invariant measure $\psi^*(\cdot,e)$ where the policy rules satisfy the household's Bellman equation and

$$1 + i = \Pi^H (1 + v - \delta)$$
$$F_k^{-1}(v,1) = k$$

The capital market clears

$$K = \sum_{i=1}^{N} \int \frac{a(q,e_i)}{1+i} \psi^*(dq,e_i)\,\bar{p}_i$$

and the measure satisfies

$$\psi^*(q,e_j) = \sum_{i=1}^{N} \int_{(a(\tilde{q},e_i)+m(\tilde{q},e_i))\leq q} \psi^*(d\tilde{q},e_i)\,p_{ij} \ .$$

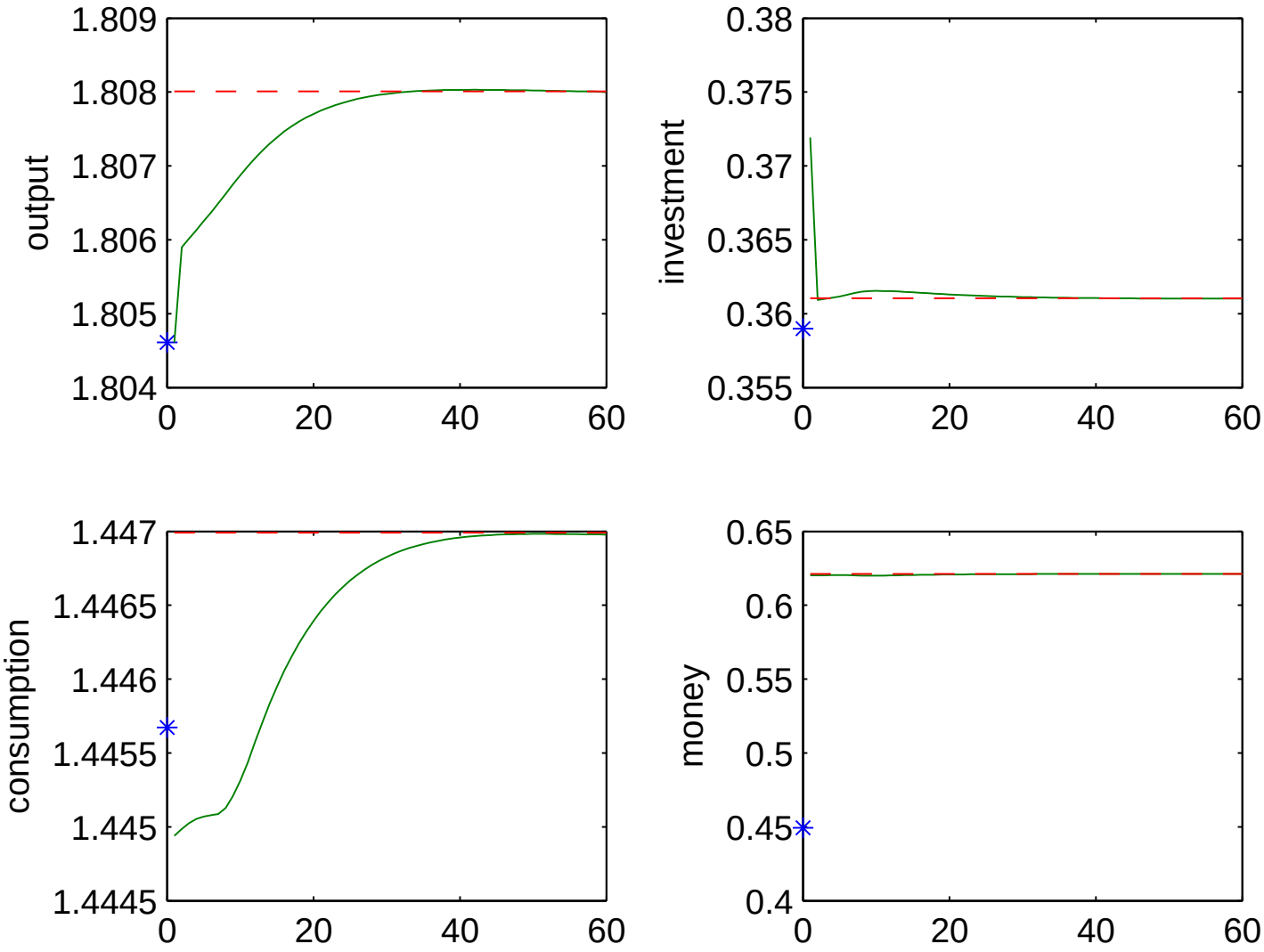


Figure: Disinflation equilibrium path of aggregate variables