

The Effects of Monetary Policy Shocks on Inequality in Japan*

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*The views expressed are those of authors and do not necessarily reflect those of the BOJ/BIS.

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Motivation: growing interest on inequality

Impacts of monetary easing on inequality have attracted increasing attention recently

- Cohan (2014): “Mr. Bernanke’s extraordinary QE program, started in the wake of the financial crisis, has only widened the gulf between haves and have-nots.”
- Krugman (2014): “The belief that QE systematically favors the kinds of assets the wealthy own is wrong or at least overstated.”
- Bernanke (2015): “Monetary policy is a blunt tool which certainly affects the distribution of income and wealth, although whether the net effect is to increase or reduce inequality is not clear.”

Existing empirical studies

Empirical observations are mixed

- Coibion et al. (2017): Income and consumption inequality across U.S. households respond counter-cyclically to monetary policy shocks
- Saiki and Frost (2014): The opposite is true when using Japanese data
- Domanski et al. (2016): Unconventional monetary policy may have widened wealth inequality, in particular through an upsurge in stock prices
- Mummtaz and Theophilopoulou (2016):

Questions raised

Question 1:

- Does a monetary policy *affects* inequalities?
⇒ **YES**

Question 2:

- What *transmission mechanism* works?

What we do

This paper

- Study the distributional effects of monetary policy, using the micro-level data on Japanese households.
- Draw the broad picture of the effects:
 - focusing on inequality measures of income, consumption, and wealth based on the micro-level data
 - using both the theoretical model and the data
 - using a fairly long-span data sample: periods of **conventional** and **unconventional** monetary policy regimes

Potential transmission channels

1. Earnings heterogeneity channel: **Japan**
 - the response of earnings to a monetary policy shock differs
2. Job creation channel
 - job creation/destruction following a MP shock
3. Income composition channel: **US**
 - the income composition of different income types differs
4. Portfolio channel
 - the size and composite of asset portfolio differs
5. Saving redistribution channel: Doepke and Schneider (2006)
 - a transfer from lenders to borrowers by a subsequent rise in inflation caused by monetary easing

I. Data & Estimation

FIES

Family Income and Expenditure Survey (FIES)

- Monthly survey on household income and expenditures
 - January 1981 – December 2008
 - The number of observations: 8,000
 - Panel data: 6 months
 - Two-or-more household members only
- Focus on full-time employees (household head): 25–59
 - Self-employed, retirees and **unemployed** are excluded
- Construct *quarterly series* of variables on economic inequality

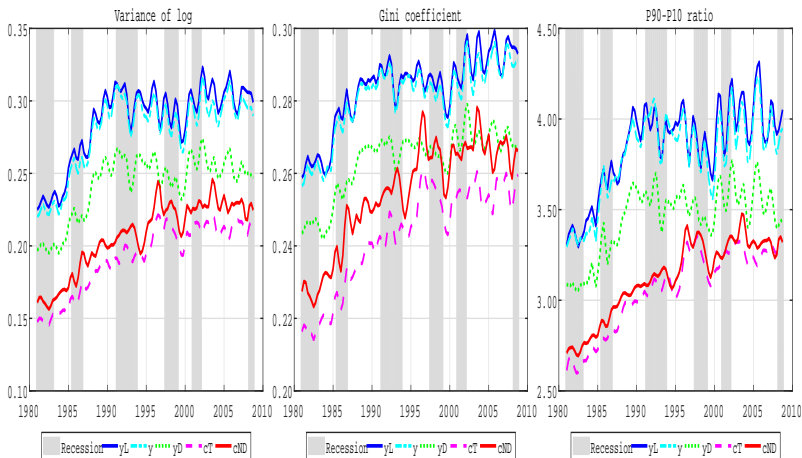
FIES (cont.)

Definition of Variables

1. Earnings y_L
 - Sum of labor income of *all* household members
2. Total income y : y_L + capital income + private transfer
3. Disposable income y_D : y + public transfers - taxes/premiums
4. Nondurable expenditures c_{ND}
 - Housing, purchasing cars and other durables are excluded
5. Total expenditure c_T : c_{ND} + durables (housing excluded)
 - Equivalized by OECD equivalent scale

▶ DETAILS

Time path of inequality measures



Estimation methodology

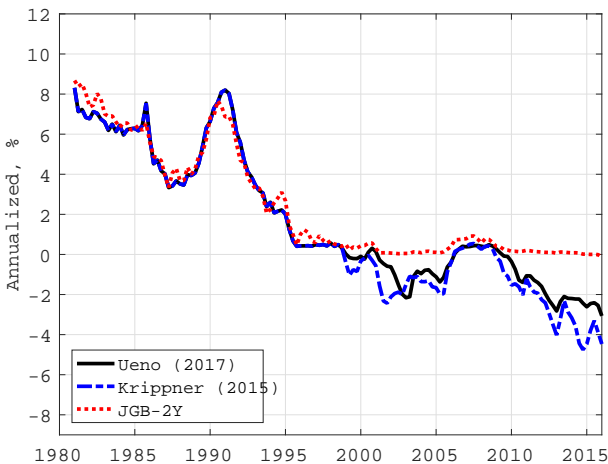
Estimate the impulse responses of inequality measures to a monetary policy shock, using the LLP by Jordà (2005):

$$\underbrace{Y_{t+h}}_{\text{inequality at } t+h} - Y_t = \alpha_h + \Pi_h(L)M_t + \underbrace{\varepsilon_{t+h}}_{\text{innovation}}$$

$$M_t = \begin{bmatrix} \Delta TFP_t \\ Factor_t \\ \Delta R_t \end{bmatrix} \Leftarrow \text{Monetary policy variable}$$

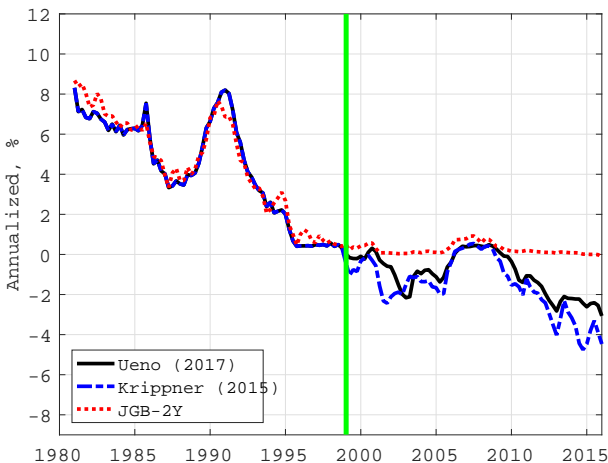
- Advantages of LLP:
 - Robustness to model misspecifications:
 - ⇒ choice of explanatory variables and the number of lags
 - Flexibility of model specifications

Monetary policy instrument



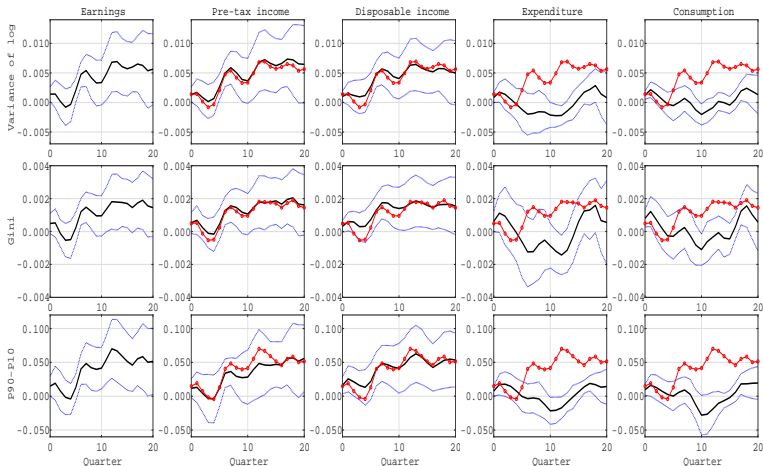
- Baseline: 1981Q1-1998Q4, Shadow rate: after 1999Q1

Monetary policy instrument



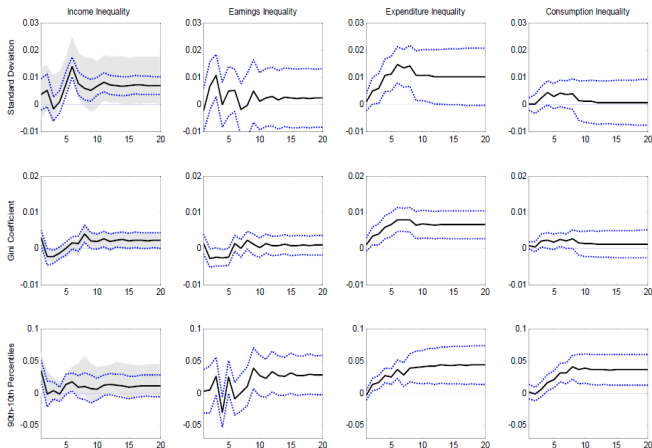
- Baseline: 1981Q1-1998Q4, Shadow rate: after 1999Q1

Responses of inequality measures: Baseline



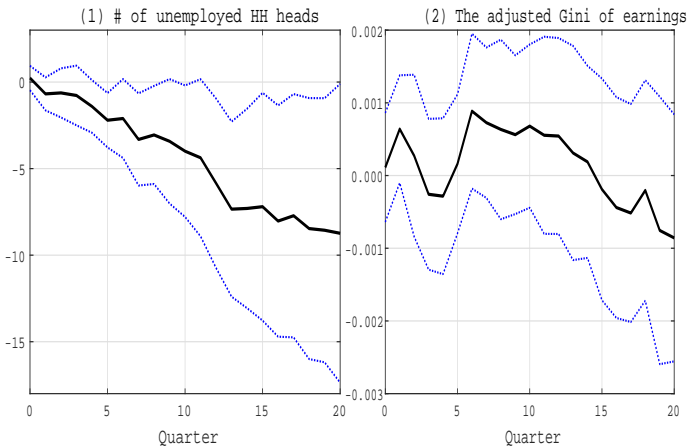
U.S. Economy

FIGURE 4: RESPONSE OF ECONOMIC INEQUALITY TO A CONTRACTIONARY MONETARY POLICY SHOCK



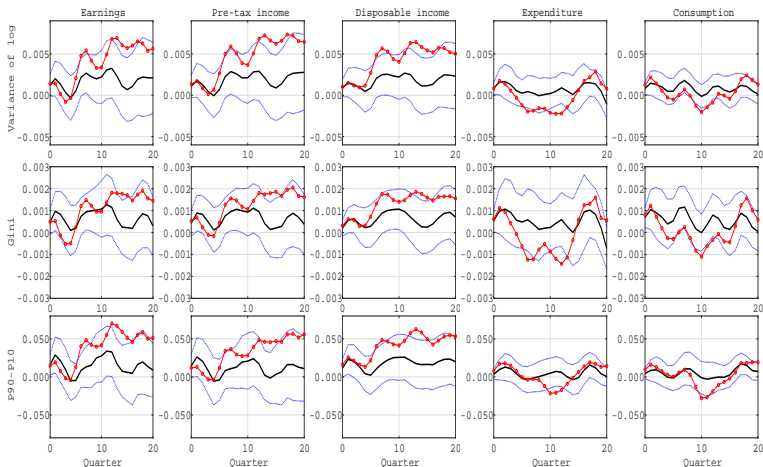
- Figure 4 in Coibion et al. (2017)

Channel through job creation

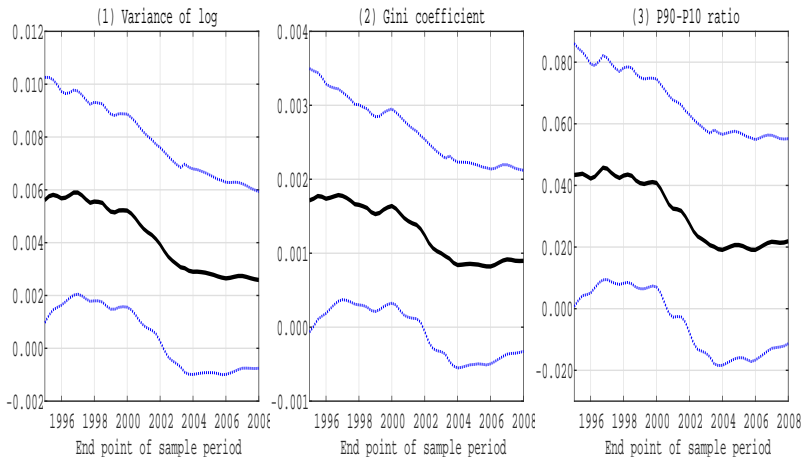


► Adjusted Gini

Responses of inequality: 1981-2008



Changes in responses of earnings inequality over time



Empirical observations

Observation 1:

- Impact of expansionary monetary policy on income inequality is procyclical, arises mainly from procyclical response of earnings inequality. \Rightarrow Earnings heterogeneity channel
- Once-prevailing distributional effects diminish during 2000s
- Possibility that a decline in earnings inequality due to job creation channel counters its rise from earnings heterogeneity channel

Observation 2:

- Transmission of income inequality to consumption inequality is less than one-to-one

Accounting for observations

To address to these observations, we employ three toolkits:

1. Two-sector DSGE model with attached labor inputs
 - illustrate how the distributional effects of monetary policy change with the structure of the economy
2. Industry-level aggregate data sets
3. Micro-level data on households' financial assets and liabilities
 - check whether the model's predictions accord with the data

II. Model

Literature: Theory

Models of inequality:

- Monetary policy shock:
 - Guerrieri and Lorenzoni (2012), Gornemann et al. (2014), Auclert (2015), McKay et al. (2016)
- Fiscal policy:
 - Oh and Reis (2012), McKay and Reis (2015)
- Income inequality and Pareto distribution:
 - Gabaix et al. (2016)
- Business cycle and heterogeneity:
 - Challe, Matheron, Ragot, and Rubio-Ramirez (2015)
- Mechanism behind earnings inequality in HANK
 ⇒ idiosyncratic risks (stochastic, but exogenous)

Our model

- Two production sectors (X and Z)
 - each of which has final goods firms and intermediate goods firms
 - consumption composite consists of goods X and goods Z
- Two households (X and Z)
 - each of which has two types of members: “attached” and “mobile”
 - “Attached” supplies its labor inputs to one of two sectors
 - “Mobile” can supply its labor inputs to both sectors

Objectives of households

- Each type of households (X and Z) maximizes:

$$U_{s,t} = \mathbb{E}_t \left[\sum_{q=0}^{\infty} \beta^q u(C_{s,t+q}, C_{s,t+q-1}, N_{s,t+q}, H_{s,t+q}) \right]$$

$$u(\cdot, \cdot, \cdot, \cdot) = \log(C_{s,t+q} - bC_{s,t+q-1}) - \theta \frac{N_{s,t+q}^{1+\eta}}{1+\eta} - \phi \frac{H_{s,t+q}^{1+\eta}}{1+\eta}$$

- N : attached labor input, H : mobile labor input
- β : discount factor, C : consumption, b : habit

Budget constraint

- For $s = X, Z$, the budget constraint:

$$C_{s,t} + \frac{B_{s,t}}{P_t} \geq \left[\begin{array}{l} \frac{W_{s,t}}{P_t} N_{s,t} + \frac{W_t}{P_t} H_{s,t} \\ + \left(\frac{\Pi_{X,t} + \Pi_{Z,t}}{P_t} \right) \gamma_{\Pi_s} + \left(\frac{R_{X,t} K_X + R_{Z,t} K_Z}{P_t} \right) \gamma_{K_s} \\ + R_{t-1} \frac{B_{s,t-1}}{P_t} + \kappa_B \left(\frac{B_{s,t}}{P_t} \right)^2 \end{array} \right],$$

- γ_{Π_s} : share of dividends, γ_{K_s} : share of capital stock
- κ_B : adjustment costs of bond holding
- Capital stock is fixed at some level

Firm's price setting and gross output

- In sector X , the intermediate firm i choose the prices to solve:

$$\max_{P_{X,t}(i)} \mathbb{E} \left[\sum_{q=0}^{\infty} \beta^{t+q} \frac{\Lambda_{t+q}}{\Lambda_t} \frac{\Pi_{t+q,X}(i)}{P_{t+q}} \right]$$

- subject to

$$\begin{aligned} \Pi_{X,t+q,X}(i) &= P_{X,t+q}(i)x_{t+q}(i) - MC_{X,t+q}(i)x_{t+q}(i) \\ &\quad - \frac{\kappa_X}{2} \left(\frac{P_{X,t+q}(i)}{P_{X,t+q-1}(i)} - 1 \right)^2 P_{X,t+q} X_{t+q}, \\ x_t(i) &= AN_{X,t}(i)^{\alpha\mu} U_{X,t}(i)^{\alpha(1-\mu)} K_{X,t}(i)^{1-\alpha} \end{aligned}$$

Rest of the model

- Production technology of gross output:

$$\bar{X}_t = \left[\int_0^1 x_t(i)^{1-\frac{1}{\varepsilon}} di \right]^{\frac{\varepsilon}{\varepsilon-1}}$$

- The *aggregator* constructs the composite of consumption goods using the aggregate technology

$$C_t = X_t^\rho Z_t^{1-\rho}$$

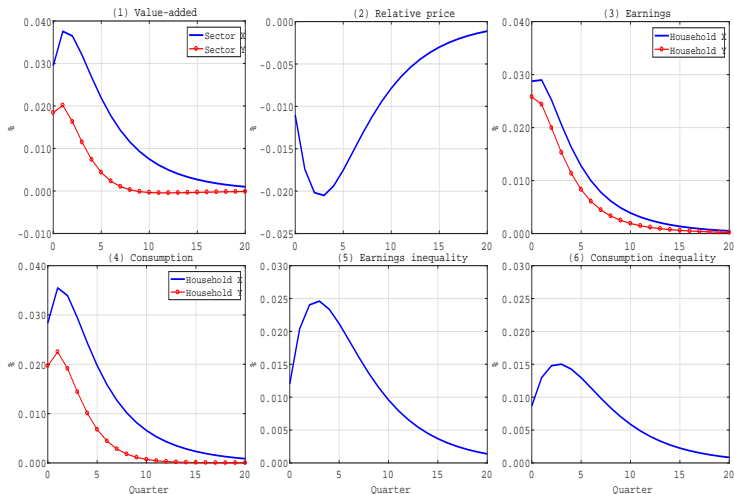
- Monetary policy:

$$\log R_t = \rho_n \log R_{t-1} + (1 - \rho_n) \varphi \log \pi_t + \epsilon_{R,t}$$

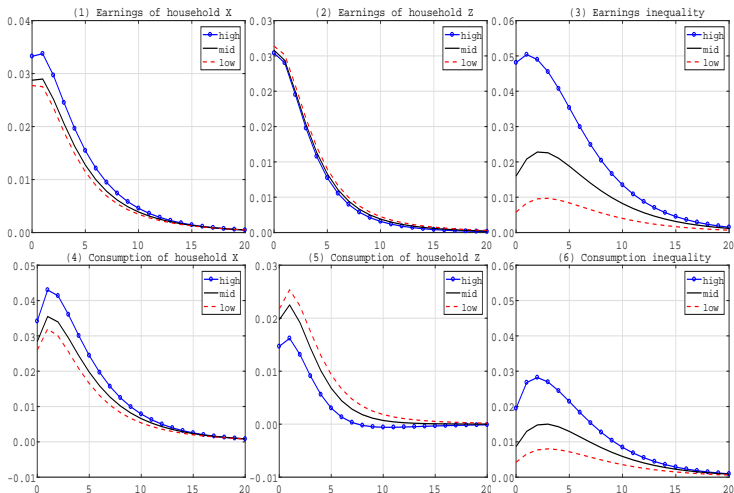
Setup

- Assume that $\rho > 1 - \rho$ and $\kappa_X > \kappa_Z$
- Other parameters are symmetric
- Then,
 - X receives *higher earnings* than Z at steady state
 - Monetary policy affects two sectors *differently* around steady state

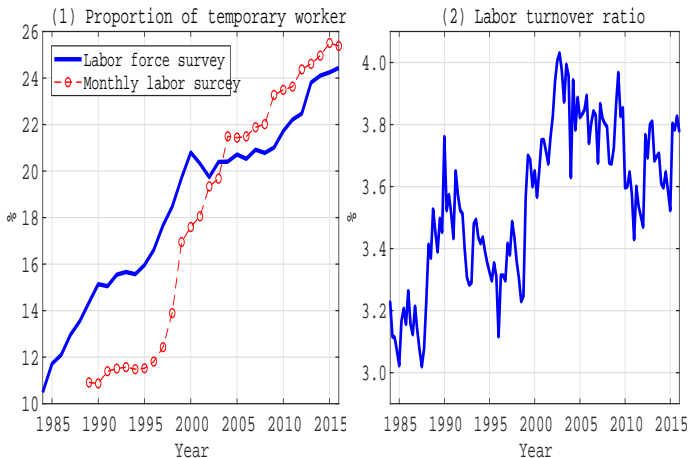
Expansionary monetary policy shock



Labor market flexibility: $\mu \in \{0.4, 0.6, 0.8\}$



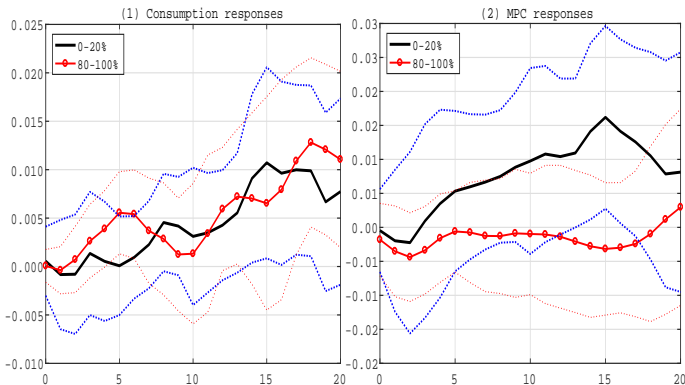
Labor market flexibility in Japan



Transmission to consumption inequality

- Why didn't consumption inequality increase as much as income inequality?
 - Responses of consumption of households are all weak?
 - Or other possible explanations?

Responses of consumption and the MPC

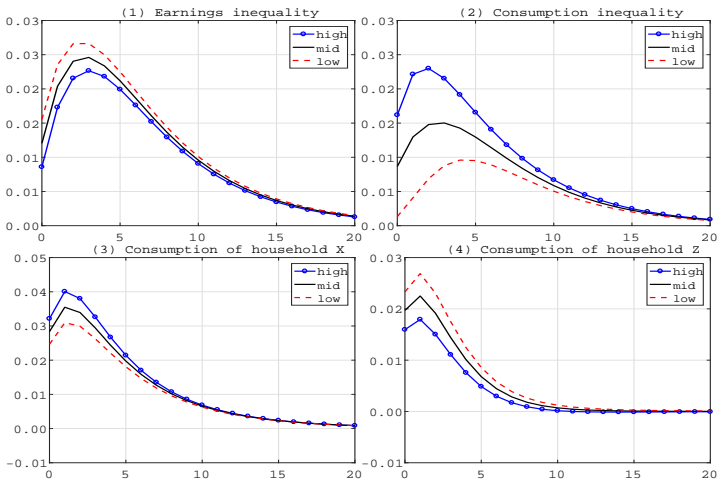


- by income quintiles

Transmission to consumption inequality

- Why is the MPC conditional on monetary policy shocks *higher* in the low income quintile?
 1. Distributional effects via financial asset holdings
 2. Difference in consumption behavior across households

Distribution of financial assets matters



- $\gamma_{K_X} \in \{0.4, 0.5, 0.6\}$

Conclusion

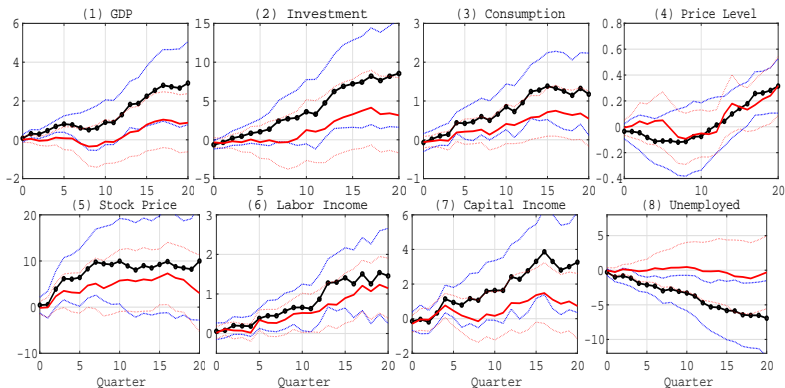
Empirically and theoretically study how monetary policy shocks are transmitted to inequality.

- Findings:
 - Distributional effects of monetary policy were once present, but have become statistically insignificant during the 2000s
 - Transmission of income inequality to consumption inequality is minor
- Takeaways:
 - Labor market flexibility is central to the dynamics of income inequality after the monetary policy shocks
 - Distributions of financial assets and liabilities don't play a significant role

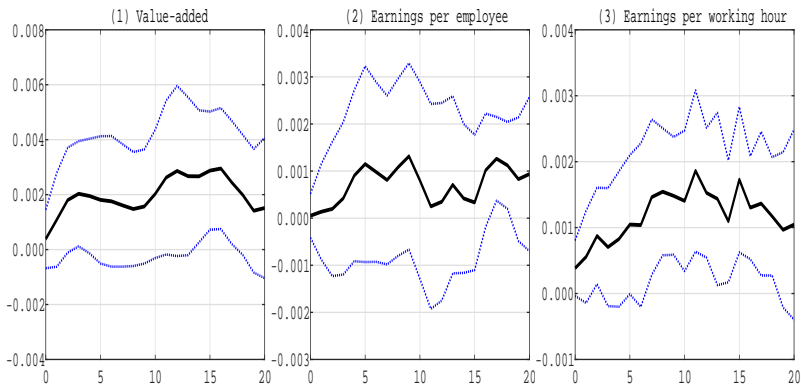
Danke schön!

Appendix Figures

Responses of macro variables



Cross-firm heterogeneity to earnings inequality: baseline



Cross-firm heterogeneity to earnings inequality: 1981-2008



Data Details

Data Details

Definition of Variables

- Labor income y :
 - sum of monthly labor income of household members, which include household head, his/her spouse and other household members
- Nondurable expenditure c :
 - food; repair and maintenance of houses; fuel, light and water charges; domestic utensils, non-durable goods, and services; clothing and footwear; medical care; transportation and communication, excluding purchase of vehicles and bicycles; education; culture and recreation, excluding recreational durable goods; and other consumption expenditure, excluding remittance

Adjusted Gini

Adjusted Gini coefficient

$$G^* \equiv \frac{\sum_{i=1}^{\bar{N}} \sum_{j=1}^{\bar{N}} |x_i - x_j|}{2\bar{N} \sum_{i=1}^{\bar{N}}} = G \frac{N}{\bar{N}} + \frac{\bar{N} - N}{\bar{N}}$$

- Assumption: earnings of unemployed = 0

◀ RETURN