Monetary Policy, Markups and Labor Market Inequality

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Overview

Motivation:

- Fundamental determinate of economic inequality is labor income

Existing models:

- Labor income distribution mostly exogenous

Goal:

- Develop framework to understand how labor income distribution is affected by aggregate shocks and policies

Focus: Markups

- Short run: Monetary or demand shocks in NK models
- Long run: Recent attention on trends in competition and technology

Two-Sector HANK Model

- Two ways that workers contribute to aggregate output:

  1. Marginal production of existing goods
  2. Overhead, marketing or production of new goods

- Key distinction: Factors that increase output by

  1. Moving along demand curves

     vs

  2. Shifting out demand curves

  Markups shift input demand between factors

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- Other model features:
  - Connect factor income distribution to personal income distribution
  - Pro-cyclical profits with counter-cyclical markups
  - Counter-cyclical labor share with pro-cyclical real wages

Outline

1. Theory: explain forces in Representative Agent model

2. Measurement: shifts in occupational income shares

3. Quantitative: quantify forces in Heterogeneous Agent model

    - Short-run: Distributional effects of monetary shock in HANK **(TODAY)**

    - Long-run: Distributional effects of changes in market power

Outline

1. Representative Agent Model

2. Measurement

3. Heterogeneous Agent Model

4. Conclusion

Households

- Preferences: $\log\left(C\right) - \chi \frac{H^{1+\varphi}}{1+\varphi}$ where

$$C = \left(N^{-\frac{1}{\sigma}} \int_0^N C_j^{\frac{\sigma-1}{\sigma}} dj \right)^{\frac{\sigma}{\sigma-1}} \quad \text{with } \sigma > 1$$

- N is number of goods in economy. No love of variety.
- Demand function for variety j

$$C_j = \frac{C}{N} \left(\frac{P_j}{P} \right)^{-\sigma} \quad \text{with price index} \quad P = \left(\frac{1}{N} \int_0^N P_j^{1-\sigma} \right)^{\frac{1}{1-\sigma}}$$

- Budget constraint:

$$PC = WH + \Pi$$

Wholesale Sector

- Measure 1 of wholesalers hire production labor in a competitive market
- Produce a homogenous intermediate good M that is sold in a competitive market

$$
\begin{aligned}
\Pi_W &= \max_{L_Y, M} P_W M - W_Y L_Y \\
&\text{subject to} \\
M &= Z_Y L_Y^{\theta_Y}
\end{aligned}
$$

- P_W: wholesale price of intermediate goods
- Π_W: profits of wholesale sector

Retail Sector: Product Creation

- Measure 1 of retailers hire overhead labor to manage product lines.
- Decide measure of product lines N to operate

$$\begin{aligned} \Pi_R &= \max_{L_N, N} \int_0^N \Pi_j \, dj - W_N L_N \\ & \quad \text{subject to} \\ N &= Z_N L_N^{\theta_N} \end{aligned}$$

- Π_j: gross profits per product line j
- Π_R: net profits of retail sector

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Kaplan and Zoch (2019)

Retail Sector: Pricing

- Produce differentiated goods using homogenous goods as only input
- Retailer has monopoly over each variety, takes demand curve as given

$$
\begin{aligned}
\Pi_j &= \max_{P_j, Y_j, M_j} Y_j P_j - M_j P_W \\
& \quad \text{subject to} \\
Y_j &= \frac{C}{N}\left(\frac{P_j}{P}\right)^{-\sigma} \\
Y_j &= M_j
\end{aligned}
$$

- Optimal price is constant markup over marginal cost

$$
\frac{P_j}{P_W} = \frac{\sigma}{\sigma - 1} \equiv \mu^*
$$

- Introduce exogenous markup wedge $\tau_\mu = \mu - \mu^*$ so actual price is $\frac{P_j}{P_W} = \mu$

Equilibrium

- Final goods market clearing, for each variety:

$$C_j = Y_j \quad \forall j$$

- Intermediate goods market clearing:

$$M = \int_0^N M_j dj$$

- Labor market clearing:

$$H = L_N + NL_Y$$

$$W = W_N = W_Y$$

- Symmetric equilibrium: $Y_j = Y \quad \forall j$

- Aggregate market clearing: $C = NY$

- Aggregate profits: $\Pi = \Pi_W + \Pi_R$

Aggregate Constant Returns to Scale

- Recall total output is

$$C = NY$$

and total labor input as

$$H = NL_Y + L_N$$

- In a competitive equilibrium, total output C is homogenous of degree one in total labor input H if and only if $(1 - \theta_Y)(1 - \theta_N) = 0$

- Consider two types of CRS economies:

  1. $\theta_Y = 1$
  2. $\theta_N = 1$

Factor Shares

Labor Share S_L	Production	$S_Y \equiv \frac{WNL_Y}{PNY}$	$\frac{1}{\mu}\theta_Y$
	Overhead	$S_N \equiv \frac{WL_N}{PNY}$	$\left(1-\frac{1}{\mu}\right)\theta_N$
Profit Share S_Π	Retail	$S_R \equiv \frac{\Pi_R}{PNY}$	$\left(1-\frac{1}{\mu}\right)(1-\theta_N)$
	Wholesale	$S_W \equiv \frac{N\Pi_W}{PNY}$	$\frac{1}{\mu}(1-\theta_Y)$

- One-to-one mapping between factor shares (S_Y, S_N, S_W, S_R) and $(\sigma, \theta_N, \theta_Y)$ when $\mu = \mu^*$
- Two CRS cases:
  1. $\theta_Y = 1 \quad \Rightarrow$ only retail profits (standard one-sector model when $\theta_N = 0$)
  2. $\theta_N = 1 \quad \Rightarrow$ only wholesale profits

Four Observations About Markups

1. Markups redistribute income between overhead and production labor:
    - $\mu \uparrow \Rightarrow S_Y \downarrow$: production labor is negatively exposed to markups
    - $\mu \uparrow \Rightarrow S_N \uparrow$: overhead labor is positively exposed to markups

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2. Markups redistribute income between labor and profits:
   - Ambiguous effect on labor share S_L relative to profit share S_Π:

$$\frac{\partial S_L}{\partial \mu} \lesseqgtr 0 \text{ if and only if } \theta_N \lesseqgtr \theta_Y$$

   - NK models: μ is counter-cyclical, so cyclicality of labor share informative about $\theta_N \lesseqgtr \theta_Y$

Four Observations About Markups

3. Markups have ambiguous effect on output:

    - Can decompose total output as

$$\frac{d\log C}{d\mu} = \underbrace{\frac{d\log Y}{d\mu}}_{<0} + \underbrace{\frac{d\log N}{d\mu}}_{>0}$$

    - Case $\theta_Y = 1$: Intensive margin (Y) always dominates
    - Case $\theta_N = 1$: Extensive margin (N) dominates when $\frac{S_N}{S_N+S_Y}$ close to 0 or 1.

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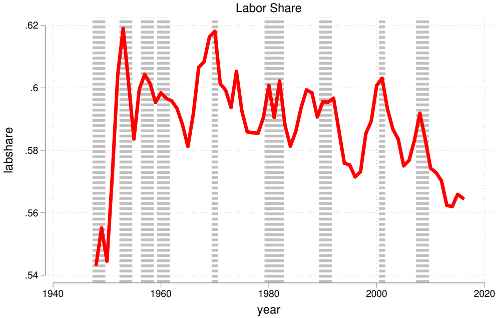
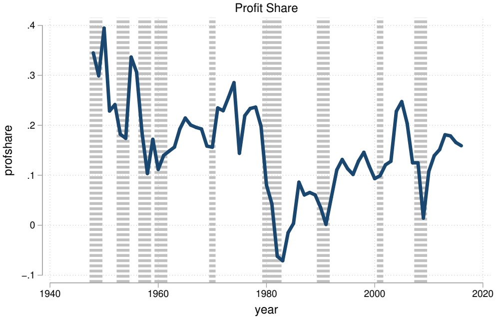
4. Observations about markups extend to monetary and demand shocks in sticky-price New Keynesian versions of the model

Cyclicality of Labor Share and Profit Share

Labor share: counter-cyclical



Profit share: pro-cyclical

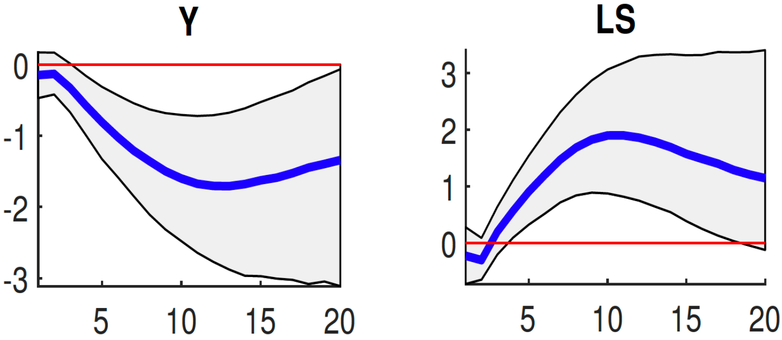


Data from Karabarbounis and Neiman (2018)

- Suggests $\theta_N > \theta_Y$: measured profits reflect Π_W rather than Π_R

Labor Share Response to a Monetary Shock

- Cantore, Ferroni and Leon-Ledesma (2019) estimate impulse response of the labor share to a monetary shock in 5 economies using multiple identification methods
- Strong, robust negative correlation between output and the labor share: $\epsilon_{S_L,Y} \approx -0.5$



- Inconsistent with a broad class of sticky-price NK models

Interpretation

Who captures rents from markups?

- Existing literature: labor moves production up and down demand curves ($\theta_N = 0$)
- Reality: many workers are engaged in activities that shift out demand curves ($\theta_N > 0$)

Set of economies ($\theta_Y, \theta_N, \sigma$) with same overall labor and profit shares

- Nests: (i) standard NK model ($\theta_Y = 1, \theta_N = 0$), (ii) DMP production structure ($\theta_Y = 0, \theta_N = 1$)
- Differ in terms of:
  - Whether economic profits reflect returns to fixed factors vs rents from markups
  - How labor share and profit share respond to respond to shocks
- Data strongly prefers $\theta_N = 1$ over $\theta_Y = 1$, rejecting the conventional setup

Need to know how much of the labor market is like N vs Y?

- Aggregate effects of changes in markups and changes in production structure
- Distributional effects of changes in markups and changes in production structure

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Measurement Through Occupations

- Measurement objectives:
  - Fraction of total labor income going to N and Y? Secular changes?
  - Relative wages and quantities for labor in each sector?
- Challenges:
  - Notion of N is abstract: reflects activities that shift demand curves
  - Firms do not hire directly into N and Y
- Idea:
  - Exploit model implication that $\frac{S_Y}{S_L}$ falls in response to shocks that raise markups
  - Changes in occupational shares: (i) 2008 recession, (ii) monetary shocks

Occupational Framework

- Fixed set of occupations, $j = 1 \dots J$, each used in both sectors

$$Y = Z_Y \left(\prod_{j=1}^{J} L_{jY}^{\eta_{jY}} \right)^{\theta_Y} \qquad N = Z_N \left(\prod_{j=1}^{J} L_{jN}^{\eta_{jN}} \right)^{\theta_N} , \qquad \sum_{j=1}^{J} \eta_{jY} = \sum_{j=1}^{J} \eta_{jN} = 1$$

- Labor market clearing in each occupation j

$$H_j = N L_{jY} + L_{jN} \quad \text{for all } j$$

- Occupational labor shares are weighted sums of sectoral shares

$$S_j = \eta_{jY} S_Y + \eta_{jN} S_N$$

Empirical strategy

- Assume $\theta_N = 1 \quad \Rightarrow$ labor share is counter-cyclical
- Rank $\eta_{jN} - \eta_{jY}$ by sensitivity of relative occupation shares to labor share

$$\Delta\left(\frac{S_j}{S_L}\right) = \underbrace{\left(\eta_{jN} - \eta_{jY}\right)\frac{\theta_Y}{1-\theta_Y}}_{\beta_j}\Delta\left(-\frac{1}{S_L}\right)$$

- For given θ_Y, can recover (η_{jY}, η_{jN}) from β_j and level of relative occupation share $\frac{S_j}{S_L}$
- Strategies to control for differential occupation trends, unrelated to markups:
  1. Cross-state differences in severity of recession
  2. Flexible controls for occupation-specific trends

→ estimates

Outline

Households

- Two-asset HANK model as in Kaplan, Moll and Violante (2018)

- Two dimensions of heterogeneity:
  - Stochastic overall labor productivity z_{it}
  - Fixed occupation $\xi_i \in [0, 1]$, where $\xi \equiv (\eta_{jY}, \eta_{jN})$
  - Productivity independent of occupation **(for now)**

- Household problem

$$
\begin{aligned}
\rho V(a, b, z, \xi) = \max_{c,h} \log c - \varphi \frac{h^{1+\frac{1}{\nu}}}{1+\frac{1}{\nu}} \\
&+ V_b \left[r^b b + hz\omega(\xi) - c - d - \chi(d) \right] \\
&+ V_a \left[r^a a + d \right] \\
&+ \text{terms involving switches in } z
\end{aligned}
$$

Production, Monetary Policy and Market Clearing

Same in RANK model with following extensions:

1. Both sectors use capital and labor in production

$$Y = Z_Y \left(K_Y^{\alpha_Y} \left[\prod_{j=1}^{J} L_{jY}^{\eta_{jY}} \right]^{1-\alpha_Y} \right)^{\theta_Y} \qquad N = Z_N \left(K_N^{\alpha_N} \left[\prod_{j=1}^{J} L_{jN}^{\eta_{jN}} \right]^{1-\alpha_N} \right)^{\theta_N}$$

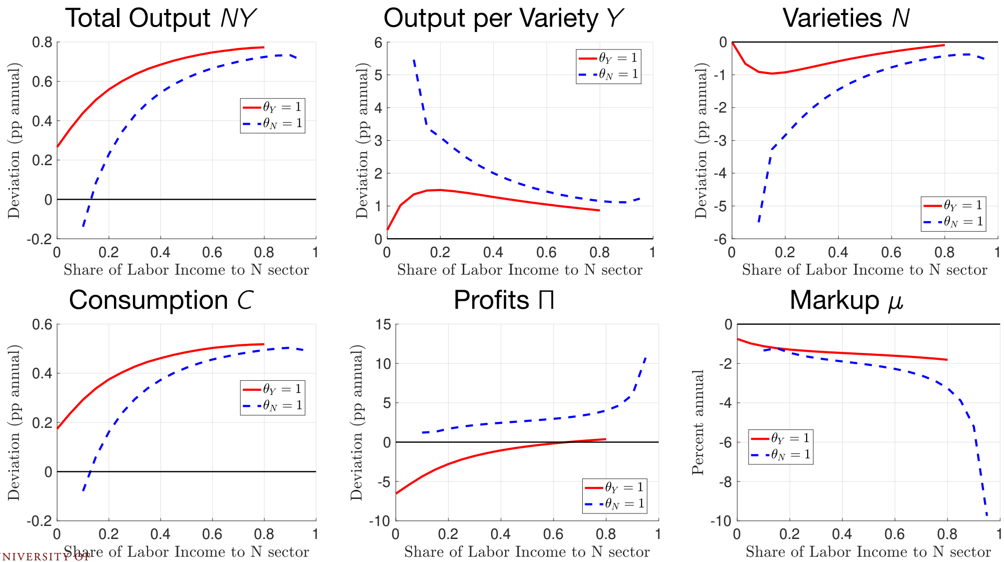
2. Separate labor market clearing conditions for each occupation

3. Illiquid assets consist of claims on:
   - physical capital
   - retail and wholesale profits

   $\Rightarrow$ firms discount at r^a when setting prices.

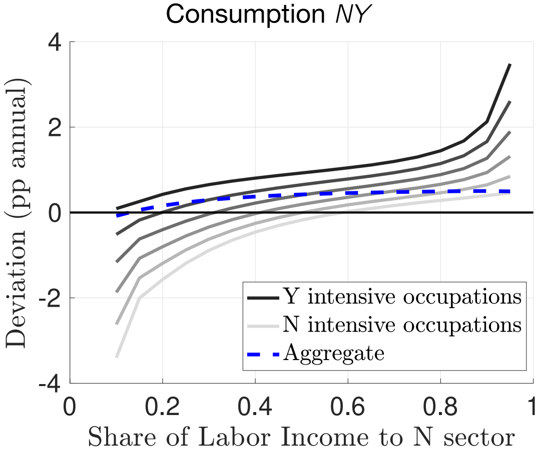
→ calibration

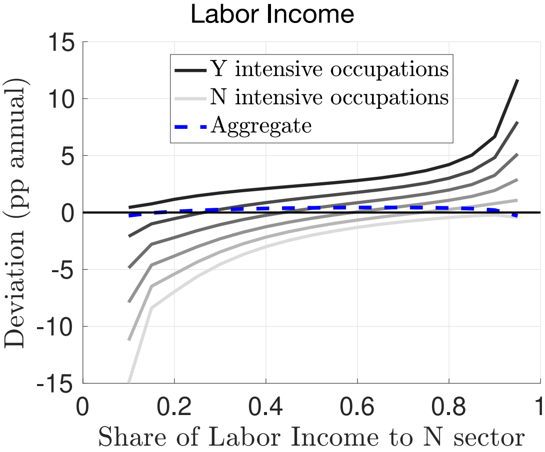
First Quarter Response to Expansionary Monetary Shock



Kaplan and Zoch (2019)

First Quarter Response by Occupation: $\theta_N = 1$





Outline

On the Agenda ...

- Measurement:
  - Identification through monetary shocks
  - Structural estimation
  - Relate wages to occupations
- Theory:
  - Explore non-CES demand structures to get endogenous changes in markups
- Quantitative Model:
  - Systematic investigation of changes in the labor income distribution
  - Transitions after changes in production structure and/or endogenous markup changes.

Ranking of Occupations

Occupation	β_j	$\frac{S_j}{S_L}$	η_{jY}	η_{jN}	$\frac{S_{jN}}{S_{jY}}$
Construction Trades	-0.072	0.07	0.04	0.05	0.71
Transportation and Material Moving	-0.091	0.11	0.07	0.08	0.66
Administrative Support	-0.123	0.21	0.15	0.17	0.62
Professional Specialty occs	-0.222	0.41	0.30	0.34	0.61
Executive, Admin and Managerial	-0.162	0.32	0.24	0.26	0.60
Technicians and Related Support	-0.038	0.09	0.07	0.07	0.59
Retail Sales	-0.042	0.10	0.08	0.09	0.59
Financial Sales and Related	-0.042	0.11	0.09	0.10	0.58
Food Preparation and Service	-0.011	0.04	0.03	0.03	0.57
Mechanics and Repairers	-0.016	0.06	0.05	0.06	0.57
Machine Operators and Assemblers	-0.008	0.07	0.07	0.07	0.55
Management Related	-0.011	0.12	0.11	0.11	0.55
Precision Production	0.006	0.04	0.05	0.04	0.53
Health Service	0.009	0.02	0.03	0.03	0.51
Building and Maintenance	0.012	0.03	0.03	0.03	0.51
Fire Fighting, Police and Correctional	0.018	0.03	0.04	0.04	0.50
Guards	0.047	0.01	0.03	0.03	0.41
Other Agricultural and Related	0.065	0.01	0.04	0.03	0.39
Housekeeping, Cleaning, Laundry	0.051	0.01	0.03	0.02	0.39
Personal Care and Service	0.082	0.01	0.05	0.03	0.38
Extractive	0.105	0.01	0.06	0.04	0.37
Recreation and Hospitality	0.092	0.01	0.05	0.04	0.37
Child Care Workers	0.080	0.00	0.04	0.03	0.37
Personal Appearance	0.100	0.01	0.05	0.04	0.37
Farm Operators and Managers	0.172	0.00	0.09	0.06	0.36

- Assuming $\theta_N = 1$
- Labor share: $S_L = 0.6$
- Capital share: $S_K = 0.3$
- Profit share: $S_\Pi = 0.1$
- Share of N labor: $\frac{S_N}{S_L} = 0.35$

→ back

Calibration

Production

- Labor share = 0.6, capital share = 0.3, profit share = 0.1
- Restrict $\alpha_N = \alpha_Y = \alpha \Rightarrow \alpha = \frac{1}{3}$
- Report values of share of labor in N ($\frac{S_{L_N}}{S_{L_N}+S_{L_Y}}$)

Occupations

- Assume occupations ξ_i and productivity z_{it} are independent
- Assume $\xi \in [0,1] \sim F(\xi) = \xi^{\phi} \quad \Rightarrow E[\xi] = \frac{\phi}{\phi+1}$
- Choose ϕ to match relationship between occupation rank and mean wage $\omega(\xi)$

Monetary Shock

- 50 bp (annual) drop in Taylor rule innovation
- Fiscal policy: debt adjusts in the short run.

→ back