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
  2. **Shifting out** demand curves

\[ \text{Markups shift input demand between factors} \]
Two-Sector HANK Model

- **Two ways** that workers contribute to aggregate output:
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- **Other model features:**
  - Connect factor income distribution to personal income distribution
  - Pro-cycliclical profits with counter-cycliclical markups
  - Counter-cycliclical labor share with pro-cycliclical real wages

Kaplan and Zoch (2019)
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

Kaplan and Zoch (2019)
1. Representative Agent Model

2. Measurement

3. Heterogeneous Agent Model

4. Conclusion
Households

- **Preferences:** \( \log(C) - \chi \frac{\theta^{1+\varphi}}{1+\varphi} \) where
  \[
  C = \left( N^{-\frac{1}{\sigma}} \int_0^N C_j^{\frac{\sigma-1}{\sigma}} \, dj \right)^{\frac{1}{\sigma-1}} \quad \text{with } \sigma > 1
  \]

- \( N \) 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:**
  \[ PC = WH + \Pi \]

Kaplan and Zoch (2019)
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

\[
\Pi_W = \max_{L_Y, M} P_W M - W_Y L_Y 
\]

subject to

\[
M = Z_Y L_Y^{\theta_Y} 
\]

- $P_W$: wholesale price of intermediate goods
- $\Pi_W$: 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

$$\Pi_R = \max_{L_N, N} \int_0^N \Pi_j dj - W_N L_N$$

subject to

$$N = Z_N L_N^{\theta_N}$$

- $\Pi_j$: gross profits per product line $j$

- $\Pi_R$: net profits of retail sector
Retail Sector: Pricing

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

\[
\Pi_j = \max_{P_j, Y_j, M_j} Y_j P_j - M_j P_W
\]

subject to

\[
Y_j = C \left( \frac{P_j}{\bar{P}} \right)^{-\sigma}
\]

\[
Y_j = M_j
\]

- 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

<table>
<thead>
<tr>
<th>Labor Share $S_L$</th>
<th>Production $S_Y \equiv \frac{W^{NL_Y}}{P^NY} \frac{1}{\mu} \theta_Y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overhead $S_N \equiv \frac{WL_N}{P^NY} \left(1 - \frac{1}{\mu}\right) \theta_N$</td>
<td></td>
</tr>
<tr>
<td>Profit Share $S_\Pi$</td>
<td>Retail $S_R \equiv \frac{n_R}{P^NY} \left(1 - \frac{1}{\mu}\right) \left(1 - \theta_N\right)$</td>
</tr>
<tr>
<td>Wholesale $S_W \equiv \frac{n_W^N}{P^NY} \frac{1}{\mu} \left(1 - \theta_Y\right)$</td>
<td></td>
</tr>
</tbody>
</table>

- 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. $\theta_Y = 1 \implies$ only retail profits (standard one-sector model when $\theta_N = 0$)
  2. $\theta_N = 1 \implies$ only wholesale profits

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Kaplan and Zoch (2019)
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
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

2. Markups redistribute income between labor and profits:
   - Ambiguous effect on labor share $S_L$ relative to profit share $S_\Pi$:
     \[
     \frac{\partial S_L}{\partial \mu} \leq 0 \text{ if and only if } \theta_N \leq \theta_Y
     \]
   - NK models: $\mu$ is counter-cyclical, so cyclicality of labor share informative about $\theta_N \leq \theta_Y$
Four Observations About Markups

3. Markups have ambiguous effect on output:

- Can decompose total output as

\[
\frac{d \log C}{d \mu} = \frac{d \log Y}{d \mu} < 0 + \frac{d \log N}{d \mu} > 0
\]

- 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.
Four Observations About Markups

3. Markups have ambiguous effect on output:

- Can decompose total output as

\[
\frac{d \log C}{d\mu} = \frac{d \log Y}{d\mu} + \frac{d \log N}{d\mu}
\]

- 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.

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 $\Pi_W$ rather than $\Pi_R$
Labor Share Response to a Monetary Shock


- 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 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
Outline

1. Representative Agent Model

2. Measurement

3. Heterogeneous Agent Model

4. Conclusion
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

Kaplan and Zoch (2019)
Occupational Framework

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

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

- Labor market clearing in each occupation $j$

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

- Occupational labor shares are weighted sums of sectoral shares

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

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

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

- For given $\theta_Y$, can recover $(\eta_{jY}, \eta_{jN})$ from $\beta_j$ 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
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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

$$
\rho V(a, b, z, \xi) = \max_{c,h} \log c - \varphi \frac{h^{1+\frac{1}{\nu}}}{1 + \frac{1}{\nu}} + V_b \left[ r^b b + h z w(\xi) - c - d - \chi(d) \right] + V_a [r^a a + d] + \text{terms involving switches in } z
$$
Production, Monetary Policy and Market Clearing

Same in RANK model with following extensions:

1. Both sectors use capital and labor in production

\[ Y = Z_Y \left( K^\alpha_Y \left[ \prod_{j=1}^{J} L_{jY}^{n_jY} \right]^{1-\alpha_Y} \right)^{\theta_Y} \]

\[ N = Z_N \left( K^\alpha_N \left[ \prod_{j=1}^{J} L_{jN}^{n_jN} \right]^{1-\alpha_N} \right)^{\theta_N} \]

2. Separate labor market clearing conditions for each occupation

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

   ⇒ firms discount at \( r^a \) when setting prices.
First Quarter Response to Expansionary Monetary Shock

Total Output $NY$

Output per Variety $Y$

Varieties $N$

Consumption $C$

Profits $\Pi$

Markup $\mu$

Kaplan and Zoch (2019)
First Quarter Response by Occupation: $\theta_N = 1$

Consumption $NY$

Labor Income

- $Y$ intensive occupations
- $N$ intensive occupations
- Aggregate

Kaplan and Zoch (2019)
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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.

Kaplan and Zoch (2019)
### Ranking of Occupations

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

- 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: $\frac{S_N}{S_L} = 0.35$
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 \( \left( \frac{S_{LN}}{S_{LN} + S_{LY}} \right) \)

Occupations

- Assume occupations $\xi_i$ and productivity $z_{it}$ are independent
- Assume $\xi \in [0, 1] \sim F(\xi) = \xi^\phi \Rightarrow E[\xi] = \frac{\phi}{\phi+1}$
- Choose $\phi$ 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.

\( \rightarrow \) back