Are Labor or Product Markets to Blame for Recessions?

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[1] Views expressed here are those of the authors and do not necessarily reflect the views of the Federal Reserve System.

Decomposing the Labor Wedge

Hours worked appear to be inefficiently low in recessions.

- "Labor wedge" is large: $\mu \equiv \frac{mpn}{mrs} = \frac{mpn\ u_c}{u_n}$

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Is countercyclical labor wedge due to:

1. Labor Market Wedge: $\mu^w \equiv \frac{w/p}{mrs}$
2. Product Market Wedge: $\mu^p \equiv \frac{mpn}{w/p}$

The Standard Decomposition Approach

Use (aggregate) wage data

- E.g., Gali, Gertler, Lopez-Salido (2007), Karabarbounis (2014)
- Wage Measure: $w/p =$ average wage.
- Key Assumption: all workers employed in spot markets.
- Conclusion: μ^w accounts for nearly all cyclicality of μ.

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- Conclusion: μ^w accounts for nearly all cyclicality of μ.

But, conclusion depends critically on wage measure used.

- Alternative theories emphasize *durable* nature of employment.
- Relevant w/p in some matching models is "user cost of labor".
- With $w/p =$ proxy for user cost, μ^w accounts for essentially none of μ cyclicality.

This Paper

Decompose labor wedge μ without using wage data.

Recall: $\mu^p \equiv \frac{mpn}{w/p} = \frac{p}{w/mpn} \equiv \frac{p}{mc}$.

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   - $mc = (p * mrs)/mpn \quad \Rightarrow \quad \mu^p = \frac{mpn}{mrs} = \mu$

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2. Intermediate Inputs
   - $mc = p_m/mpm$
3. Work-in-process Inventories
   - $mc_t = \mathbb{E}_t \left[\frac{M_{t,t+1}}{\pi_{t+1}} (1 - \delta + mpq_{t+1}) mc_{t+1} \right]$

Preview of Findings

μ^p accounts for at least 75% of cyclical variation in μ:

- Self-Employed: $> 75\%$
- Intermediate Inputs: $> 75\%$
- WIP Inventories: $\approx 100\%$ (manufacturing only)

Thus, countercyclical price markups deserve a central place in business cycle research, alongside labor market frictions.

Outline for Remainder of Talk

Measuring the Labor Wedge

- Representative Agent with Extensive/Intensive Margins
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Representative-Agent Labor Wedge

Preferences:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left\{ \frac{c_t^{1-1/\sigma}}{1-1/\sigma} - \nu \frac{n_t^{1+1/\eta}}{1+1/\eta} \right\}$$

Production:

$$y_t = z_t k_t^{\alpha} n_t^{1-\alpha}$$

Labor Wedge:

$$\begin{aligned} ln(\mu_t) &\equiv ln(mpn_t) - ln(mrs_t) \\ &= ln\left(\frac{y_t}{n_t}\right) - \left[\frac{1}{\sigma} ln(c_t) + \frac{1}{\eta} ln(n_t)\right] \end{aligned}$$

Extensive and Intensive Labor Wedges

- Consider extensive and intensive margins of labor supply
- Why?
  - Can calibrate η to micro estimates at hours margin
  - Self-employed wedge on intensive margin only
  - Product market distortions should impact wedge on both margins

Theory with Both Margins

Preferences:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left\{ \frac{c_t^{1-1/\sigma}}{1-1/\sigma} - \nu \left(\frac{h_t^{1+1/\eta}}{1+1/\eta} + \psi \right) e_t \right\}$$

Production:

$$y_t = z_t k_t^{\alpha} (e_t h_t)^{1-\alpha}$$

Search Frictions

- Matching Technology: $m_t = v_t^{\phi} f(u_t)$
- Vacancy-posting cost: κ_t
- Separation rate: δ

Intensive-Margin Wedge

$$
\begin{aligned}
ln(\mu_t^h) &\equiv ln(mpn_t^h) - ln(mrs_t^h) \\
&= ln\left(\frac{y_t}{h_t}\right) - \left[\frac{1}{\sigma} ln(c_t) + \frac{1}{\eta} ln(h_t) + ln(e_t)\right] \\
&= ln\left(\frac{y_t}{n_t}\right) - \left[\frac{1}{\sigma} ln(c_t) + \frac{1}{\eta} ln(h_t)\right]
\end{aligned}
$$

In comparison to representative-agent wedge, note

- h_t: hours per *worker*
- $\eta = 0.5$ based on micro data

Cyclicality of (Intensive-Margin) Labor Wedge

$$ln(\mu_t) = \alpha + \beta ln(cyc_t) + \epsilon_t$$

	Elasticity wrt	
	GDP	Total Hours
Labor Wedge	-1.91 (0.13)	-1.38 (0.05)
Labor Productivity	-0.10 (0.08)	-0.28 (0.06)
Cons per capita	0.61 (0.03)	0.36 (0.02)
Hours per worker	0.30 (0.07)	0.19 (0.01)

- Quarterly data, 1987-2011 with $\sigma = 0.5$, $\eta = 0.5$

Takeway: Labor wedge strongly countercyclical.

Wedge Decomposition: Alternative Wage Measures

$$\begin{aligned} ln(\mu_t) &= \left[ln\left(\frac{y_t}{n_t}\right) - ln\left(\frac{w_t}{p_t}\right) \right] + \left[ln\left(\frac{w_t}{p_t}\right) - \frac{1}{\sigma} ln(c_t) - \frac{1}{\eta} ln(h_t) \right] \\ &= ln(\mu_t^p) + ln(\mu_t^w) \end{aligned}$$

	Elasticity wrt	
	GDP	Total Hours
μ	-1.91 (0.13)	-1.38 (0.05)
$\mu^p \left(\frac{w}{p} = AHE\right)$	-0.04 (0.13)	-0.07 (0.09)
$\mu^p \left(\frac{w}{p} = NH\right)$	-0.70 (0.16)	-0.53 (0.09)
$\mu^p \left(\frac{w}{p} = UC\right)$	-1.89 (0.21)	-1.37 (0.09)

Takeway: Alternative wages produce very different decompositions!

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Approach 1: Self-Employed

Idea: For self-employed, cyclicality of labor wedge cannot be attributed to labor market distortions.

- $\mu_{se} = \mu_{se}^{p}$

Compare self-employed wedge (μ_{se}) to wedge for all workers (μ).

- Under assumption $\mu_{se}^{p} = \mu^{p}$, comparison yields μ^{p} vs μ.

Focus on intensive (hours) margin

- Extensive movements could reflect costs of starting business
- Concerned about compositional changes

Data

Hours and Earnings: March CPS

- "Self-employed"
  - Primary job is (nonag) self-employment.
  - 95% of earnings from primary job
- Trim sample to deal with top and bottom coding
- Hours: usual weekly hours (also total annual hours)
- Earnings from primary job
- Examine year-to-year changes for "matched" workers

Consumption: Consumer Expenditure Survey

- Construct *relative* consumption of self-employed

Cyclicality of Labor Wedge: All vs Self-Employed

	Labor Wedge			
Elasticity wrt	(1)	(2)	(3)	(4)
Real GDP	-1.87 (0.10)	-2.06 (0.17)	-1.97 (0.25)	-3.23 (1.00)
Total Hours	-1.20 (0.05)	-1.41 (0.10)	-1.29 (0.16)	-1.93 (0.61)
Hours	All	SE	SE	SE
MPN	Agg. y/n	Agg. y/n	SE earn/hr	SE earn/hr
Consumption	NIPA PCE	NIPA PCE	NIPA PCE	NIPA PCE + CE adj.

Self-Employed Conclusions

(Baseline) self-employed wedge is at least as countercyclical as all-worker wedge.

Robustness:

- Use only *unincorporated* self-employed
- Weight CPS observations by industry
- Result: Cyclicality of self-employed wedge always at least 75% of cyclicality of all-worker wedge.

Conclusion: μ^p accounts for at least 75% of cyclical variation in μ.

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Approach 2: Intermediate Inputs

Production function:

$$y = \left[\theta m^{\frac{\varepsilon-1}{\varepsilon}} + (1-\theta)\left[z_v\left[\alpha k^{\frac{\omega-1}{\omega}} + (1-\alpha)(z_n n^{\frac{\omega-1}{\omega}})\right]^{\frac{\omega}{\omega-1}}\right]^{\frac{\varepsilon-1}{\varepsilon}}\right]^{\frac{\varepsilon}{\varepsilon-1}}$$

Marginal Product wrt Intermediates:

$$mpm_t = \theta\left(\frac{y_t}{m_t}\right)^{\frac{1}{\varepsilon}}$$

Product Market Wedge:

$$\mu_t^p = \frac{p_t}{mc_t} = \frac{p_t}{p_{mt}/mpm_t}$$

Constructing μ_i^p

Product Market Wedge

$$\mu_{it}^p = \frac{p_{it}\, y_{it}}{p_{m,it} m_{it}} \left(\frac{y_{it}}{m_{it}} \right)^{\frac{1}{\varepsilon}-1}$$

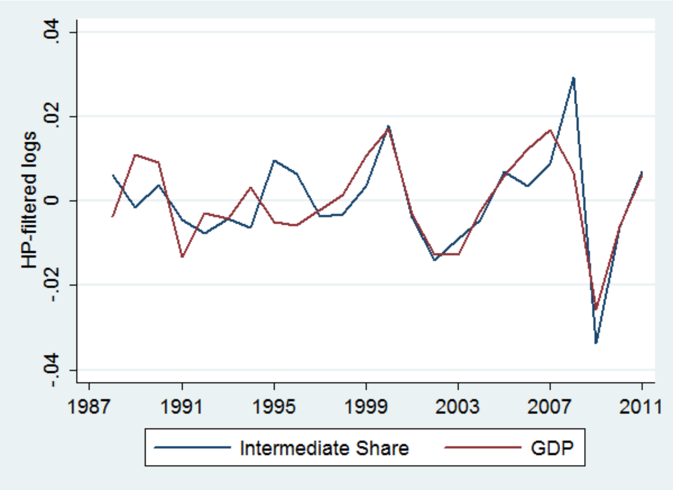
BLS Multifactor Productivity Database

- Annual data, 1987-2011
- 60 industries (18 manufacturing)
- Output and KLEMS inputs, nominal and real

Baseline: $\varepsilon = 1$

- Robustness: $\varepsilon < 1$

Cyclicality of Intermediate Share



Cyclicality of Intermediates-based μ^p

$$ln\left(\mu_{it}^{p}\right) = \alpha_i + \beta^p ln(cyc_t) + \epsilon_{it}$$

	Elasticity wrt GDP
All Industries	-0.86 (0.23)
Manufacturing	-0.80 (0.30)
Non-Manufacturing	-0.88 (0.22)

- Baseline estimates with $\varepsilon = 1$.

Industry-level Total Wedge (μ_i)

Preferences:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left\{ \frac{c_t^{1-1/\sigma}}{1-1/\sigma} - \nu \sum_i \left[\left(\frac{h_{it}^{1+1/\eta}}{1+1/\eta} + \psi \right) e_{it} \right] \right\}$$

Marginal Product wrt Labor (for $\varepsilon = \omega = 1$):

$$mpn_{it} = \frac{y_{it}}{n_{it}}$$

Labor Wedge (intensive-margin):

$$ln\left(\mu_{it}\right) = ln\left(\frac{p_{it}\, mpn_{it}^h}{p_t\, mrs_{it}^h}\right) = ln\left(\frac{p_{it}}{p_t}\frac{y_{it}}{n_{it}}\right) - \left[\frac{1}{\sigma} ln(c_t) + \frac{1}{\eta} ln(h_{it})\right]$$

Cyclicality of *Industry-level* Total Wedge (μ_i)

$$ln(\mu_i) = ln\left(\frac{p_i \frac{v_i}{n_i}}{p \frac{v}{n}}\right) + ln\left(\frac{y_i}{v_i}\right) - \frac{1}{\eta} ln\left(\frac{h_i}{h}\right) + ln\left(\frac{mpn^h}{mrs^h}\right)$$

	Elasticity wrt GDP
All Industries	-1.11 (0.24)
Manufacturing	-0.73 (0.39)
Non-Manufacturing	-1.20 (0.22)

- Baseline estimates with $\varepsilon = 1$.

Role of μ^p in μ, based on Intermediates ($\varepsilon = 1$)

$$\frac{\partial ln\left(\mu^p_{it}\right)}{\partial ln\left(cyc_t\right)} \Big/ \frac{\partial ln\left(\mu_{it}\right)}{\partial ln\left(cyc_t\right)}$$

	μ^p vs μ
All Industries	77%
Manufacturing	109%
Non-Manufacturing	73%

- Baseline estimates with $\varepsilon = 1$.

Role of μ^p in μ, with $\varepsilon < 1$

- $\varepsilon < 1 \Rightarrow \mu_i^p$ *more* countercyclical

$$ln\left(\mu_{it}^p\right) = ln\left(\frac{p_{it}\, y_{it}}{p_{m,it} m_{it}}\right) + \left(\frac{1}{\varepsilon} - 1\right) ln\left(\frac{y_{it}}{m_{it}}\right)$$

- $\varepsilon < 1 \Rightarrow \mu_i$ *less* countercyclical

$$ln\left(\mu_{it}\right) = ln\left(\frac{p_{it}}{p_t}\frac{y_{it}}{n_{it}}\right) + \left(\frac{1}{\varepsilon} - 1\right) ln\left(\frac{y_{it}}{v_{it}}\right) - ln\left(mrs_{it}^h\right)$$

- For $\varepsilon = 0.78$, μ^p accounts for 100% of cyclicality of μ.

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Approach 3: Work-in-Process Inventories

Production Technology:

$$
\begin{aligned}
y_{it} &= g(z_{it}, k_{it}) n_{it}^{1-\alpha} q_{it}^{\phi_{it}} \\
q_{i,t+1} &= (1-\delta) q_{it} + y_{it} - y_{it}^{f}
\end{aligned}
$$

Marginal Product wrt Inventories:

$$
mpq_{it} = \phi_{it} \frac{y_{it}}{q_{it}}
$$

Cost-minimization implies:

$$
\frac{mc_{it}}{p_t} = \mathbb{E}_t \left[\frac{\beta u'(c_{t+1})}{u'(c_t)} \left(1 - \delta + \phi_{i,t+1} \frac{y_{i,t+1}}{q_{i,t+1}} \right) \frac{mc_{i,t+1}}{p_{t+1}} \right]
$$

Constructing Inventory-based μ^p

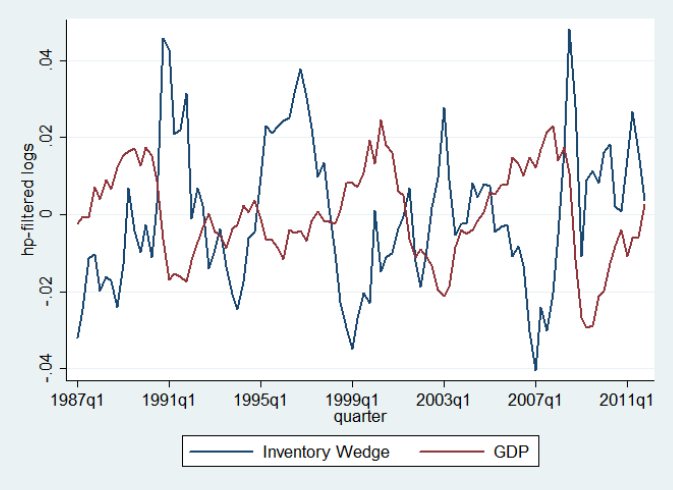
Iterate forward and take logs to get

$$ln\left(\mu_{it}^{p}\right) = -\frac{1}{\sigma} ln(c_t) + ln\left(\frac{p_{it}}{p_t}\right) - \mathbb{E}_t \sum_{s=1}^{\infty} \frac{\phi_{i,t+s}}{1-\delta} \frac{y_{i,t+s}}{q_{i,t+s}}$$

NIPA Underlying Detail Tables

- Quarterly data, 1987-2011
- 22 Manufacturing industries (aggregated to 14)
- q_{it}: Work-in-process inventories
- y_{it}: Sales plus change in (total) inventories
- p_{it}: Sales price deflator

Cyclicality of Inventory-based μ^p



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	Elasticity wrt GDP
μ^p	-0.80 (0.12)
MUC	-1.23 (0.06)
Relative Price	0.67 (0.11)
Output/Inventory Path	0.25 (0.03)

Role of μ^p in μ, based on Inventories

$$\frac{\partial ln\left(\mu_{it}^{p}\right)}{\partial ln\left(cyc_t\right)} \Big/ \frac{\partial ln\left(\mu_{it}\right)}{\partial ln\left(cyc_t\right)}$$

	μ^p vs μ
Manufacturing	109%

Conclusions

μ^p accounts for at least 75% of cyclical variation in μ:

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Thus, countercyclical price markups deserve a central place in business cycle research, alongside labor market frictions.