

# Cyclicalities of Markup and Markdown : Evidence from Korean Firm Data

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# 1. Motivation

The countercyclical movement in the price markup play a key role in the transmission of monetary and fiscal policy shocks.

In the sticky price models, a demand shock raises output and marginal cost, but since prices are sticky, the markup of price over marginal cost falls.

## 2. Previous empirical studies

(1) Time series studies : use labor share as a proxy for the markup

(2) Firm data studies : measure markup from cost minimization

- procyclical : Domowitz et al (86), Haskel et al (95),

  - Chirinko and Fazari (94)

- no clear patten : Marchetti (02)

- countercyclical : Anderson et al (18), Morrison (94)

- All previous study measuring markup assume that the labor market is competitive, so do not distinguish markup from markdown.

- This paper distinguishes and identifies markup and markdown, and examines the cyclicalities of markup.
- This paper identifies markup and markdown using the production function approach
  - Some other studies : Yeh, Macaluso, and Hershbein (2019), Kim (2017), Morlaco (2019), Hong (2021)
- Results
  - The markup is strongly countercyclical
  - The estimation on the cyclicalities of markup could (downward) be biased if the impact of markdown is not taken into account.

### 3.1. Markup and Markdown from Cost Minimization

- Profit maximization:  $\frac{\partial R}{\partial L} = \left( \frac{\partial W}{\partial L} \frac{L}{W} + 1 \right) \equiv (\epsilon_L^{-1} + 1) W$

note  $\frac{\partial R/\partial L}{W} \equiv v^L = \epsilon_L^{-1} + 1$  : **labor market markdown**

Cost minimization:  $W \left( \frac{\partial W}{\partial L} \frac{L}{W} + 1 \right) = \lambda \frac{\partial Q}{\partial L}$

let  $\mu \equiv P/\lambda$  be **the markup**,  $\theta^L \equiv \partial \ln Q / \partial \ln L$  (elasticity of output)

- Then, we have  $\mu \cdot v^L = \theta^L \frac{PQ}{WL}$ 
  - Previous studies implicitly assume  $v^L = 1$
  - When  $v^L > 1$  (monopsony power) , being measured so far is the product of markup and markdown.  
(define market power  $\psi \equiv \mu \cdot v^L$ )
  - Markup and markdown is not separately identified.
  - Labor share may not be a good proxy when elasticities of product is not constant over time.

## 3.2. Identification of markdown

- Let  $C$  be the factor has no monopsony power,  $v^C = 1$ .
- This paper : 'other manufacturing expenses' such as electricity costs, water and light and heat costs, and tax, because the government fully controls the price of other manufacturing expenses in Korea.

- Then markdown is identified. 
$$v^L = \frac{\theta^L}{\theta^C} \frac{P^C C}{WL}$$

### 3.3. Estimation of output elasticity

- log production function

$$y_{it} = \theta_0 + \theta_{it}^L l_{it} + \theta_{it}^k k_{it} + \theta_{it}^M m_{it} + \theta_{it}^C c_{it} + w_i + \epsilon_{it}$$

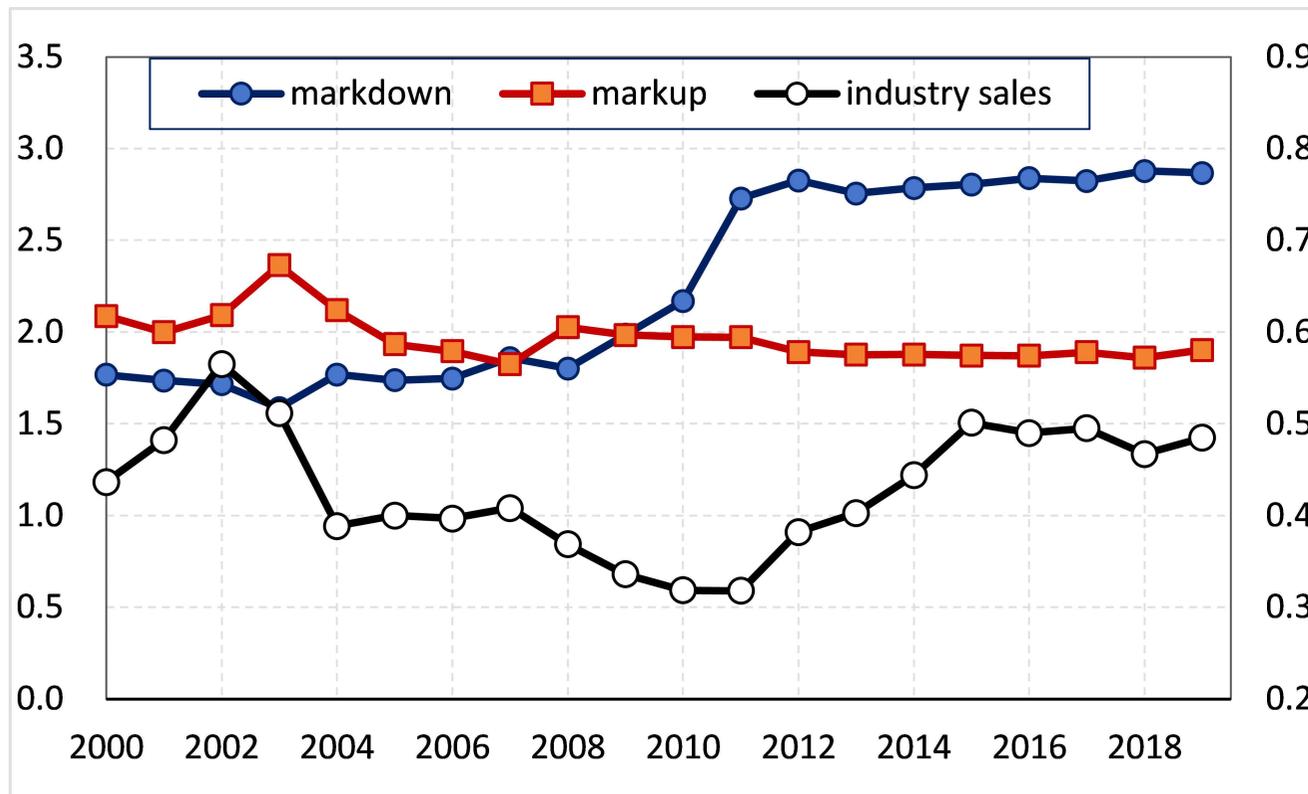
- estimation by the method of Akerberg, Caves, and Frazer (2015)
  - sets  $w_i$  as a nonparametric function of the variable input
  - and estimates the coefficient value using the moments that the lagged value of variable inputs are not correlated with  $w_i$  and  $\epsilon_{it}$ .

## 4. Data and Sample

- Korean firm accounting data. From 2000 to 2019.
- Manufacturing industry, the sample size 3,324,819.
  - accounts for 54.4% companies in the whole firm data
- Business cycle indicator : Sectoral cycles  
(deviations of industry sales from its long-term trend)
  - Indicator from previous studies: detrended real GDP, aggregate unemployment and capacity utilisation, sectoral unemployment, cyclical financial market value.

## 5. Aggregate Elasticity

- Aggregate Markup, Markdown(left axis), and Industry Sales (right axis)



■ Elasticity of Aggregate Markup and Markdown

	Industry Sales	GDP	Firm Sales
Markup	0.040	0.133	-0.033
Markdown	0.110	-0.021	0.159

(note) 'GDP' is the cyclical component of log real GDP using Christiano-Fitzerald filter.

- the markup is close to acyclical
- the markdown is weakly procyclical.

## 6. Cyclicalities of Markups and Markdowns: Main results

- Panel (Firm) Fixed Effect Model Regression

	Markup		Markdown	
	(1)	(2)	(3)	(4)
Industry Sales	-0.119 (0.002)	-0.458 (0.002)	0.483 (0.003)	0.358 (0.004)
Productivity		0.638 (0.002)		0.431 (0.003)
Sample	2502662	1949299	2502662	1949299

(Notes) All variables are in log forms. Clustered SE. All significant at 1%.

- Unconditional cyclicalities: (1), (3)

- Markup is weakly countercyclical. Markdown is strongly procyclical.

- [Main Results] Conditional cyclicalities: (2), (4)

- Productivity : supply shock, Industry sales : demand shock

- **Markup is strongly countercyclical. Markdown is strongly procyclical.**

- Mechanism of procyclical markdown
  - Demand shock → Firm's employment and working hours increase
  - Elasticity of labor supply decreases (markdown is procyclical)

Or Markdown= Marginal Wage / Average Wage

	Market Power		Labor Share	
	(5)	(6)	(7)	(8)
Industry Sales	0.364 (0.002)	-0.099 (0.002)	-0.063 (0.002)	0.239 (0.002)
Productivity		1.070 (0.001)		-0.465 (0.002)
Sample	2502662	1949299	2427633	1891107

- When do not distinguish markup from markdown : (5), (6)  
Markup seems to be weakly countercyclical (or procyclical).  
In fact, it is the mixture of markup (countercyclical) and markdown (procyclical). Two forces counteract.  
It is important to distinguish markdown when trying to understand the cyclicity of the markup.

- When use labor share as a proxy for the markup: (7), (8)
  - Results are very different from (1) and (2)
  - questioned whether labor share is a proper proxy for markup.

## 6.2. Estimation results accounting the overhead labor

$$\mu \cdot v^L = \theta^L \frac{PQ}{WL} \left( \frac{H}{H - \bar{H}} \right)$$

- Estimation results : Including direct labor cost ratio

	Markup	Markdown	Market Power	Labor Share
Industry Sales	-0.460 (0.002)	0.364 (0.003)	-0.096 (0.001)	0.228 (0.002)
Productivity	0.825 (0.002)	-0.081 (0.002)	0.744 (0.001)	-0.367 (0.002)
Direct Labor Cost Ratio	0.618 (0.002)	-1.697 (0.002)	-1.079 (0.001)	0.265 (0.002)

- As predicted by the theory, considering the overhead cost, the volatility of the markup increases.
- The effect of the demand shock on the markup has little change.

■ Estimation Results with alternative indicators for business cycle

	Markup	Markdown	Market Power	Markup	Markdown	Market Power
	(1)	(2)	(3)	(4)	(5)	(6)
GDP	-3.871 (0.036)	4.977 (0.051)	1.106 (0.025)			
Firm Sales				-0.153 (0.001)	0.388 (0.001)	0.235 (0.0004)
Productivity	0.740 (0.002)	-0.023 (0.002)	0.717 (0.001)	0.877 (0.002)	-0.394 (0.002)	0.483 (0.001)
Direct Labor Ratio	0.612 (0.002)	-1.69 (0.002)	-1.078 (0.001)	0.649 (0.002)	-1.776 (0.002)	-1.128 (0.001)
N	1949299	1949299	1949299	1949299	1949299	1949299

- the results remain unchanged, with markup being countercyclical and markdown being procyclical.

## Conclusion

- It is important to distinguish markdown when trying to understand the cyclical nature of the markup.
- The estimation on the cyclical nature of markup could (downward) be biased if the impact of markdown is not taken into account.
- The markup is strongly countercyclical and markdown is procyclical. Market power's cyclical nature appears in a mixture of market power and market down's cyclical nature.