Markups and Cost Complementarities in Business Groups

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11 August 2023, NorMac Smögen

Research Area and Question

- Aggregate markup - Is it increasing? If so, why?

  De Loecker and Warzynski (2012); De Loecker and Scott (2016); De Loecker et al. (2020); Gutierrez and Philippon (2017); Foster et al. (2022); Berry et al. (2019); Edmond et al. (2015)

- Firm heterogeneity - Which firms increase their markups? 'All' or 'some'?

- Specifically, can the aggregate trend in markups be (partly) explained by the marginal cost reduction that **business groups** achieve via **economies of scope**?

Definition: Business groups

Figure: Upstream

Figure: Downstream

Business groups ≠ Common Ownership

Figure: Nicolai Tangen, Norwegian Oil Fun, 2023-08-05, Kristiansand

Azar et al. (2018, 2022); Anton et al. (2023); Reynolds and Snapp (1986) focus on anticompetitive effects of common ownership, analogous to M&As.

Definition: Economies of Scope

Two views according to TC = FC + VC.

- Gorman (1985): F = FC of running an orchard, F(a) = additional FC for apple, F(o)= additional fixed cost for orange.
  Combined production FC= F(o)+F+F(a).

- **Weak-cost complementarities**: increasing one output (y_i), weakly decreases the marginal cost of other outputs $\Delta MC_j \leq 0$

Research Question

Can the **aggregate trend in markups** be (partly) explained by the marginal cost reduction that **business groups** achieve via **economies of scope**?

Outline and Contribution

1. Document that the aggregate growth rate of markups of firms in business groups is higher than that of individual firms (**Stylized facts**)

2. Show **theoretically** in a (PE) heterogeneous firm model:
   - How and why productivity improvements/MC reductions to firms 'in groups' increase their markups relative to 'individual' firms?

3. Show evidence for this mechanism using Swedish micro data. **Identification**.

4. Discuss the **potential significance of the mechanism**
   - Are the observed 'cost improvements' in the data large enough to explain a significant share of the aggregate markup trend?
   - How large of a productivity/MC increase/decrease differential across the two types of firms needed to generate the observed increase in markups? Is this supported by the data
   - Horse race between the 'cost complementarity', 'concentration' and 'entry and exit' channels.

Literature

1. Economies of scope: Gorman (1985) and Panzar and Willig (1981)

2. Business groups in emerging markets: **WHY be in groups?**

3. Common Ownership ('concentration channel'), M&A ('concentration and efficiency channels')

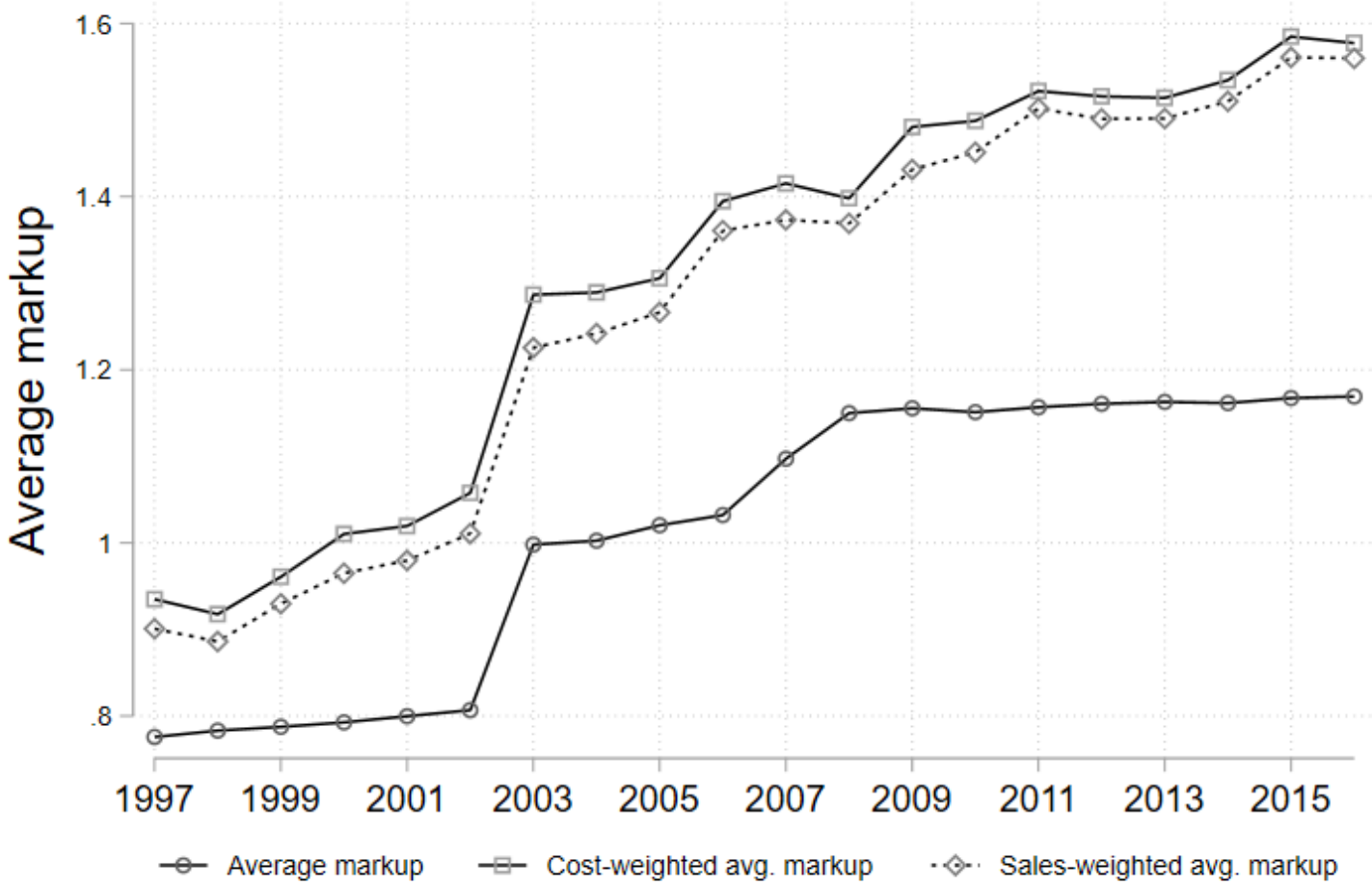
4. Production function estimation and rising markups: De Loecker and Warzynski (2012); De Loecker et al. (2020); De Loecker and Scott (2016)

5. Superstar firms and **'good concentration'**: Gutierrez and Philippon (2017)

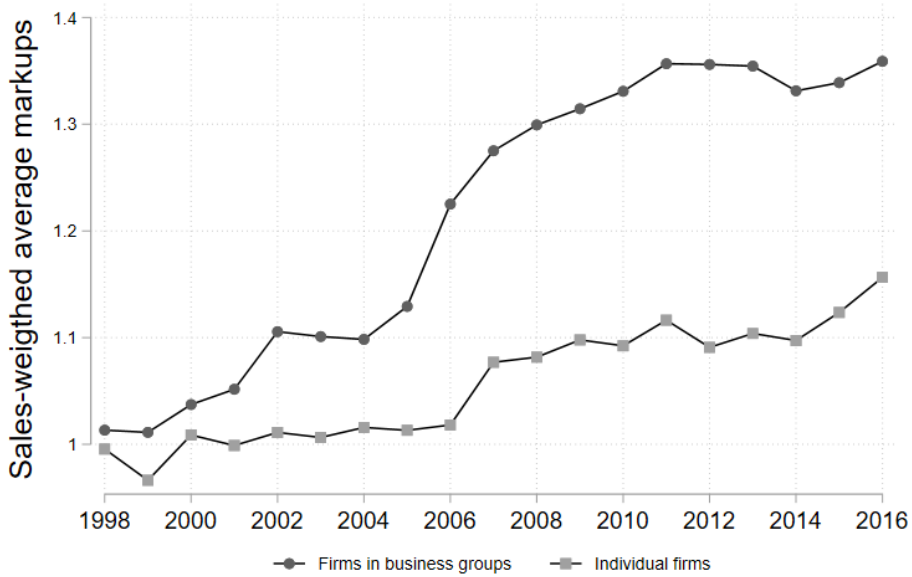
6. Oligopoly macro models: Atkeson and Burstein (2008); Edmond et al. (2015)

7. "Endogenous productivity": Weiss (2021), De Ridder (2021) **Where does the cost efficiency of groups come from? R&D, cheap inputs via trade**

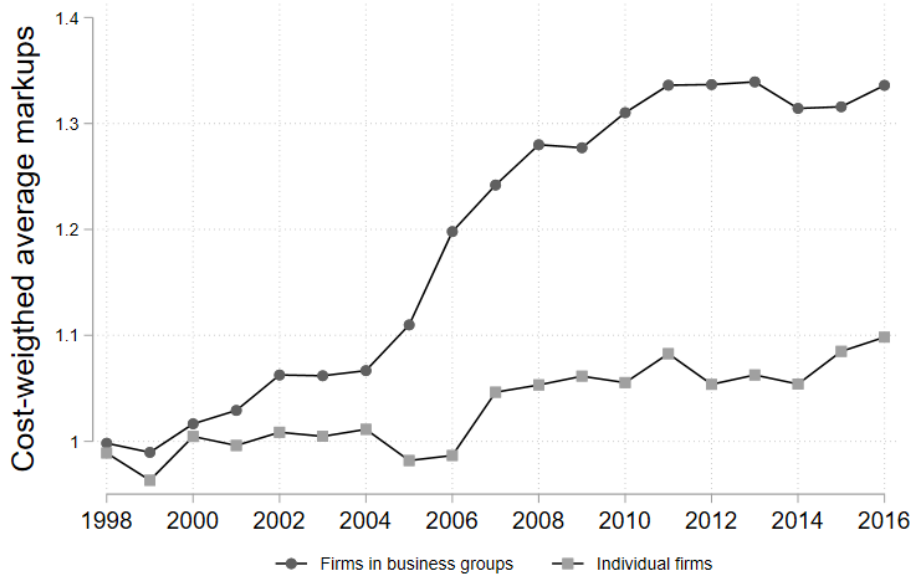
Stylized Fact 1 - Markup overtime



Stylized Fact 2 - Individual vs Group



(a) Sales-weighted average markups



(b) Cost-weighted average markups

A benchmark static PE model: Oligopoly Markets

Features:

1. Oligopolistic competition within and across industries.
2. Firms have market shares.
3. Markups are a function of market shares. (Desired)
4. Market shares are given by marginal cost and productivity.

5. **New**: two types of firms ('in groups' vs 'individual')
   - Productivity is both individual and group specific.

Final good firms

Nested CES: Final good producers and industry good producers.

Final good producers produce Y, each **industry** s **produces** $y(s)$

$$Y = \left(\int_0^1 y(s)^{\frac{\theta-1}{\theta}} ds \right)^{\frac{\theta}{\theta-1}}; \qquad y(s) = \left(\sum_{i=1}^{N(s)} y_i(s)^{\frac{\gamma-1}{\gamma}} \right)^{\frac{\gamma}{\gamma-1}}. \tag{1}$$

where $\theta > 1$ is the elasticity of substitution across industries $s \in [0, 1]$.

Each industry s consists of a finite number $N(s)$ of intermediate producers.

The intermediate good producing firm

Intermediate good producer i in industry s produces output using labor

$$y_i(s) = a_g a_i(s) l_i(s). \tag{2}$$

- where $a_i(s)$ is the firm-specific productivity and $a_{g=1} > 1$ **is the "productivity boost" that firms in groups get**.
- Exogenous for each firm.

The firm's **marginal cost** is

$$\psi_i(s) = \frac{W}{a_g a_i(s)}. \tag{3}$$

- **Economies of scope:** increasing $y_{i=1}$, decreases $MC_{i\neq 1}$ in the group.

Demand and Profit Maximization

The demand function facing the individual firm:

$$y_i(s) = \left(\frac{p_i(s)}{p(s)}\right)^{-\gamma} \left(\frac{p(s)}{P}\right)^{-\theta} Y, \tag{4}$$

where the aggregate and sectoral price indexes are

$$P = \left(\int_0^1 p(s)^{1-\theta} ds\right)^{\frac{1}{1-\theta}}; \qquad p(s) = \left(\sum_{i=1}^{N(s)} p_i(s)^{1-\gamma}\right)^{\frac{1}{1-\gamma}}. \tag{5}$$

Profit maximization:

$$\pi_i(s) \equiv \max_{y_i(s)} \Big[\big(p_i(s) - \psi_i(s)\big) y_i(s)\Big], \tag{6}$$

subject to demand.

Price, Demand Elasticity, Market Share

The solution to the firm's problem is characterized by a **price**

$$p_i(s) = \frac{\epsilon_i(s)}{\epsilon_i(s) - 1}\psi_i(s), \tag{7}$$

where $\epsilon_i(s) > 1$ is the **demand elasticity** facing the firm.

$$\epsilon_{it} = \left(\omega_i(s)\frac{1}{\theta} + (1 - \omega_i(s))\frac{1}{\gamma}\right)^{-1}, \tag{8}$$

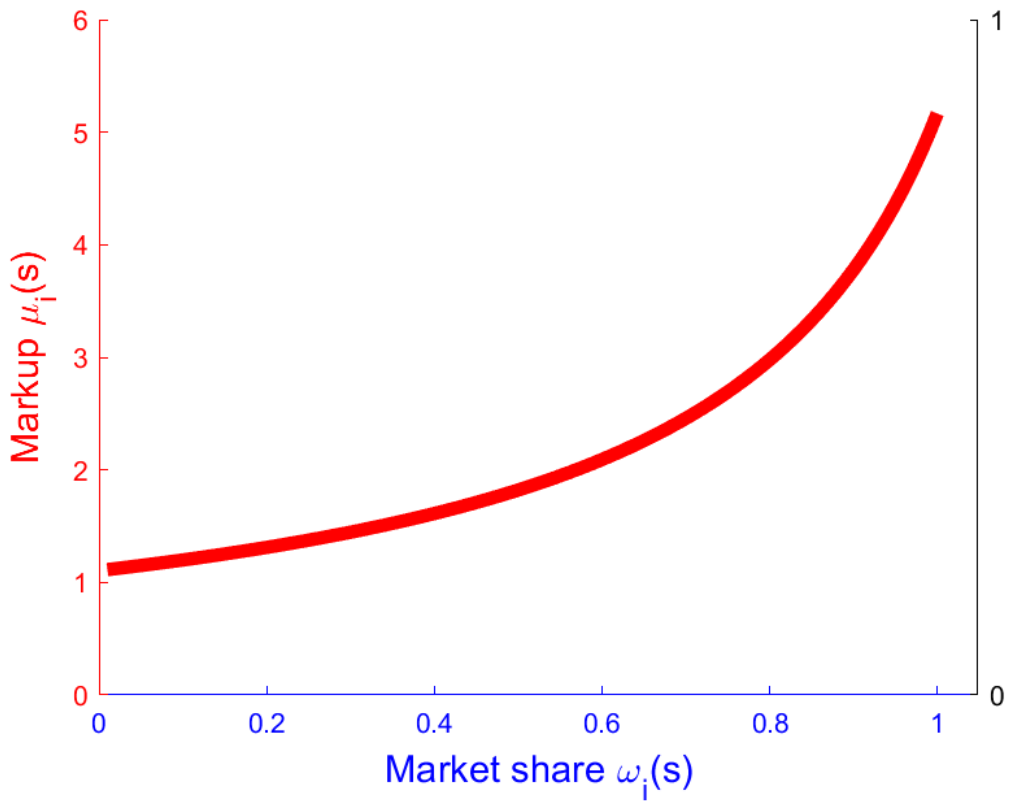
where $\theta < \gamma$ and $\omega_i(s) \in [0, 1]$ is the **firm's share** of its industry's revenue.

$$\omega_i(s) \equiv \frac{p_i(s)y_i(s)}{\sum_{i=1}^{N(s)} p_i(s)y_i(s)}. \tag{9}$$

Price setting

The firm's demand elasticity implies

$$p_i(s) = \underbrace{\left(\frac{\gamma-1}{\gamma} - \left(\frac{1}{\theta} - \frac{1}{\gamma}\right)\omega_i(s)\right)^{-1}}_{=\mu_i} \psi_i(s). \tag{10}$$



Productivity improvements to a firm 'in a group'

Change in the group productivity from a_j^g to $a_j^{g'}$

$$\Delta\mu_i^{g'}(s) = \mu_i^{g'}(s) - \mu_i^g(s)$$

$$= \left(\frac{\gamma-1}{\gamma} - \left(\frac{1}{\theta}-\frac{1}{\gamma}\right)\left(\frac{\frac{\epsilon_i^{g'}(s)}{\epsilon_i^{g'}(s)-1}\frac{W}{a_i \times a_j^{g'}}}{p'(s)}\right)^{1-\gamma}\right)^{-1}$$

$$- \left(\frac{\gamma-1}{\gamma} - \left(\frac{1}{\theta}-\frac{1}{\gamma}\right)\left(\frac{\frac{\epsilon_i^{g}(s)}{\epsilon_i^{g}(s)-1}\frac{W}{a_i \times a_j^{g}}}{p(s)}\right)^{1-\gamma}\right)^{-1} \quad (11)$$

The difference in markup growth between a firm in a group and a firm in other groups, and to an individual firm:

$$\Delta\mathcal{M}^{1,1} = \Delta\mu_{i,j=1}^{1'}(s) - \Delta\mu_{i,j\neq 1}^{1}(s) \quad \propto \quad (a_{i,j=1}^{1'} - a_{i,j\neq 1}^{1}) \quad (12)$$

$$\Delta\mathcal{M}^{1,0} = \Delta\mu_i^{1'}(s) - \Delta\mu_i^{0}(s) \quad \propto \quad (a_{i,j=1}^{1'} - a_i^0).$$

Aggregation

Final output is

$$Y = AL. \tag{13}$$

The aggregate markup is a revenue-weighted harmonic mean of firm-level markups

$$\mathcal{M} = \left(\int_0^1 \left(\sum_{i=1}^{N(s)} \frac{1}{\mu_i(s)} \frac{p_i(s) y_i(s)}{PY} \right) ds \right)^{-1}. \tag{14}$$

Empirical Strategy: Shift-share Instrument

- Identify the effect of being 'in a group' on markups upon cost shocks.
- **Problem**: changes in costs, demand and markups are endogenous.
- **Solution**: Instrument changes in firms' imported input shares (= changes in MC) by allegedly exogenous shift-share "China shock" (Chinese import shares). (Autor et al., 2013, 2016)
- **H0**: Firms in groups set a higher markup for a % decrease in input costs.
- **Identification**: Borusyak, Hull, Jaravel (2022) REStud.

Empirical Strategy: Shift-share Instrument

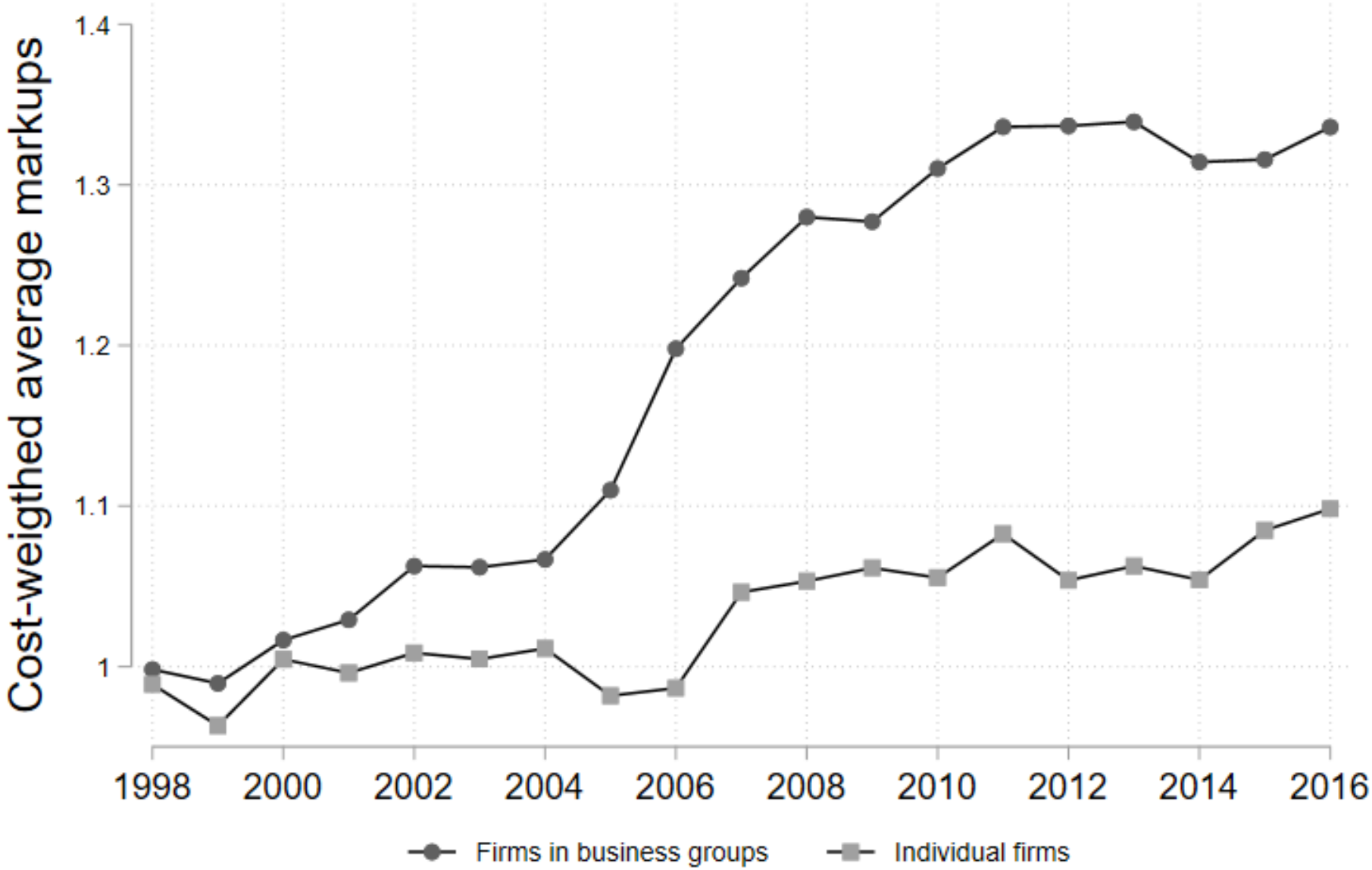
The accession of China to the WTO 11th December 2001,
thus long changes between 2000-2007:

$$\Delta\mu_{it+7} = \alpha+\beta\left(\Delta\frac{M_{it+7}}{TVC_{it+7}}\times I_{t,group=0,1}\right)+\gamma\Delta\frac{M_{it+7}}{TVC_{it+7}}+\xi I_{t,group=0,1}+\nu_s+\epsilon_{it} \tag{15}$$

where import shares are instrumented:

$$\Delta\frac{M_{it+7}}{TVC_{it+7}} = \alpha+\delta\left(\frac{M_{i1998}}{TVC_{i1998}}\times\Delta\frac{Ch_{t+7}}{TVC_{t+7}}\right)+\epsilon_{it}. \tag{16}$$

Parallel trends



Data

Use micro data from Swedish firms:

1. Balance sheets
   - to estimate markups following Ackerberg, Caves and Frazer (2015).
   - to calculate TVC (= salaries, raw and intermediate input costs).
   - group or not indicator.
2. Trade data
   - to calculate Sweden's imported input share from China.
   - to calculate firm-level imported input costs.

IV Regression Results

Table: Instrumental variable regression

	$\Delta\ Markup_{i,t+7}$
group=1$\times\Delta\ M/TVC_{i,t+7}$	0.0574*
	(0.0286)
$\Delta\ M/TVC_{i,t+7}$	-0.0209
	(0.0245)
group=1	0.00471
	(0.0101)
Industry FE	x
Observations	2615

* $p < 0.05$

FS and Reduced form

Table: First-stage regression

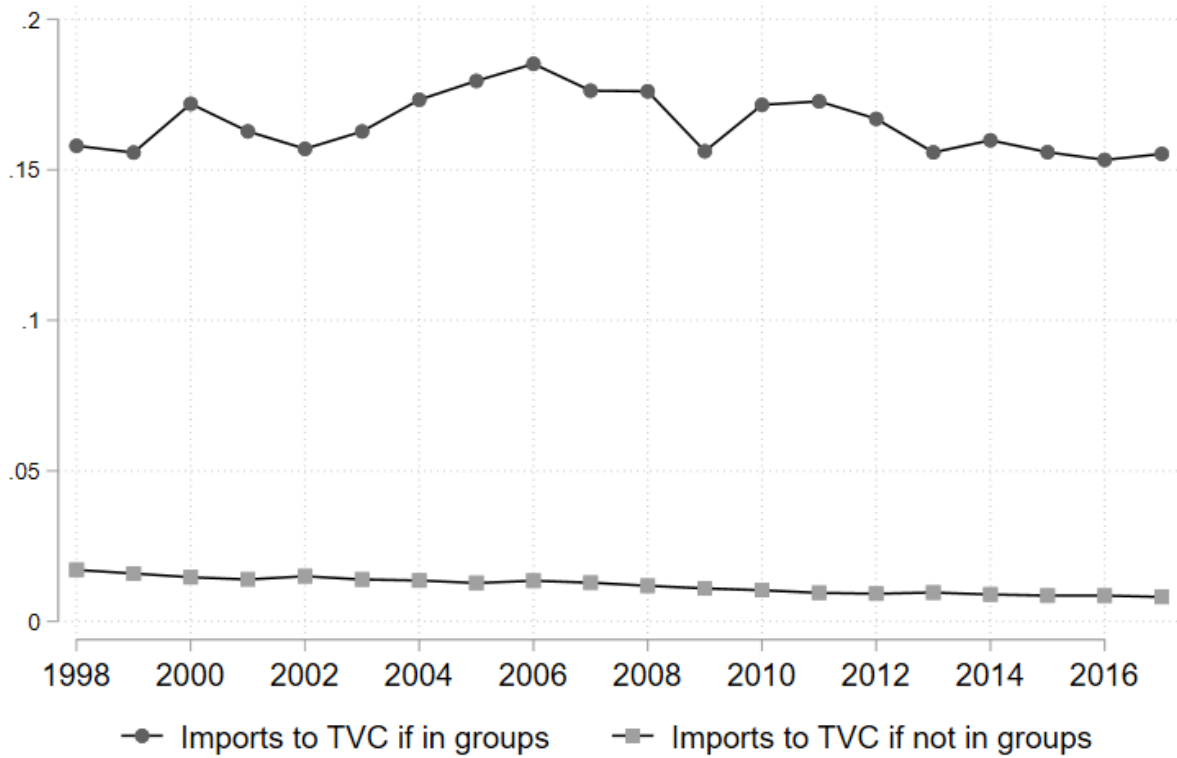
	$\Delta\ M/TVC_{i,t+7}$
$M/TVC_{i,1998} \times \Delta\ Ch/TVC_{t+7}$	-0.447***
	(0.0891)
Observations	2615

Table: Reduced form regression

	$\Delta\ Markup_{i,t+7}$
group=1$\times M/TVC_{i,1998} \times \Delta\ Ch/TVC_{t+7}$	0.0211**
	(0.00734)
group=1	0.0107*
	(0.00450)
$M/TVC_{i,1998}$	-0.0198
	(0.0125)
Observations	81255

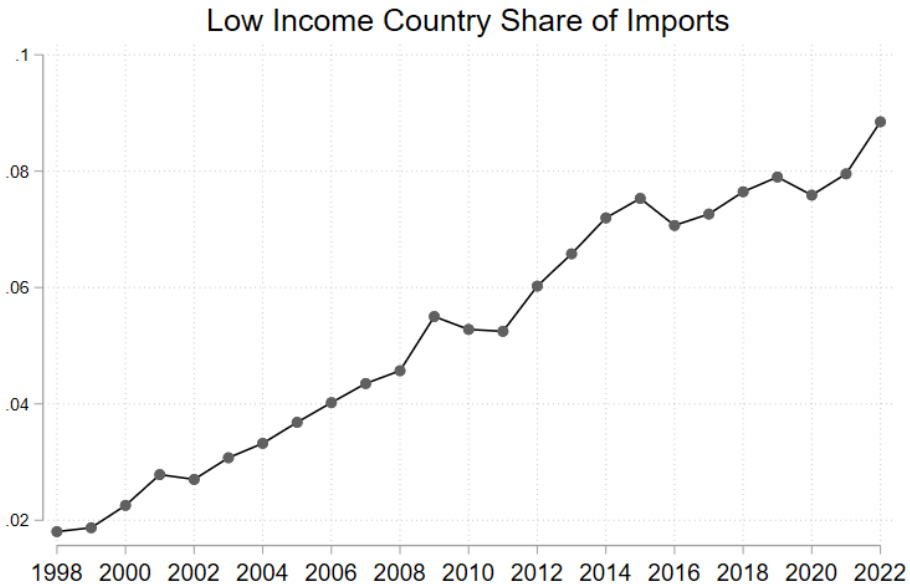
Economic significance of the mechanism: cheaper inputs

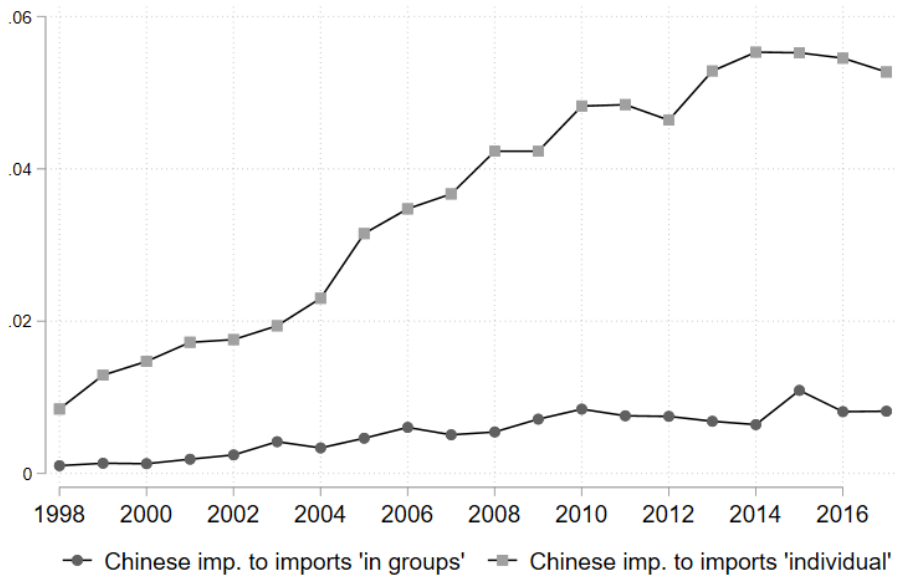
1. The imported input share would have to be non-decreasing.



2. The share of cheaper imported inputs would have to be increasing.
3. The net of these two processes to be large enough to support a potentially significant difference in markups between the two types of firms.

Do cheaper imported inputs increase?





- 5 % relative ↑ in cheaper inputs $\Longrightarrow$ a 29 % relative ↑ in markups
- substantially more than the observed 20 % difference in markups 2016.
- the **cost complementarity channel via cheaper imported inputs** has the **potential to explain the difference in markup growth** across different types of firms.

Numerical Predictions - Calibration

- Simple calibration with 40 firms in 250 industries.
- Individual productivity Pareto distributed.
- Half of the firms in groups.
- Calibrate the group productivity to match the 20% difference in markups.
  - The '**shocks**': Increase and **skew** the group productivities.
- Estimate a **'minimum difference'** by assuming the best firms are in best groups, firms operate across industries.

Numerical Predictions vs Data

1. How large **productivity difference** is needed in the model between the two types of firms to explain the difference in markup growth?
   - **600%**

2. What is the corresponding difference in **marginal costs**?
   - **86%**
   - Data supports a larger MC decline.

3. What are the model implied **GDP shares of the two types of firms**?
   - **>1% and <99%**
   - Data increase from 90% to 96% between 2000 and 2016.

Conclusion

1. The **markups of firms in business groups is rising more** than the markups of firms that operate individually.

2. New data observation.

3. A model with heterogenous **firms** in oligopolistic markets where firms **can take advantage of group productivity improvements and thus economies of scope**.

4. Theoretical and empirical support for the mechanism that the difference can be (partly) explained by cost complementarities between firms in group.

5. In progress: horse race between different mechanisms affecting the markups within a well-calibrated model.

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