The Role of Heterogeneous Markups in Quantifying Misallocation: Evidence for Italy

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Motivation

- Dispersion in firm-level productivity and marginal revenue products of inputs is a well-documented fact.
- It may indicate the existence of frictions that generate misallocation of resources across firms. $\Rightarrow$ Negative effect on the aggregate TFP.
- TFP is the main source of productivity growth in advanced economies. $\Rightarrow$ Undoing misallocation could have first-order welfare effects.
- Recent literature has tried to quantify the degree of misallocation and its welfare implications, but models rely on strong assumptions.

Research Question and Goals

1. How robust are results under change of assumptions on:
   - Demand side
   - Production side
   - Inputs side
2. Focus on heterogeneous markups. Does it affect the results? In which direction?

GOALS:

1. Quantifying the role of misallocation in the Italian manufacturing sector over the last 25 years.
2. Identifying how much this quantification changes when accounting for heterogeneity in markups.
3. Understanding the correlation between markups and distortions.

Why Italy?

- Italy was the best growth performer among major European countries in the 70s and 80s, but in the 90s and 2000s it turned to be the worst performer. Why?
- Progressive slowdown of the TFP growth: 2.6% in the 70s, 1.1% in the 80s, 0.9% in the 90s, -0.4% in the 2000s.
- Over the period 1995-2012, in Italy TFP declined by 0.2% per year, while it rose by 0.1% in Spain, 0.6% in France, 0.8% in Germany. $\Rightarrow$ TFP decline is mainly an Italian phenomenon.

Literature Review

On resource misallocation in manufacturing firms: Restuccia and Rogerson (RED, 2008), **Hsieh and Klenow (QJE, 2009)**, Bartelsman, Haltiwanger and Scarpetta (AER, 2013), Asker, Collard-Wexler, De Loecker (JPE, 2014), Collard-Wexler, De Loecker (AER, 2015).

Applying the HK's procedure to new settings or extending it: Dias et al. (2014), Garcia-Santana et al. (2015), Bellone and Mallen-Pisano (2013), Chen and Irarrazabal (RED, 2014), Brandt et al. (RED, 2013), Ziebarth (RED, 2013), Bollard et al. (RED, 2013), Oberfield (RED, 2013).

On heterogeneous markups: De Loecker (IJIO, 2011), De Loecker and Warzynski (AER, 2012), Peters (2013), Song and Wu (2014).

Theoretical Model

Theoretical model

Extension of the Hsieh and Klenow's (QJE, 2009) framework, **allowing for heterogeneous markups**.

Firm's i in sector s output is produced according to a Cobb-Douglas production technology with constant return to scale:

$$Y_{si} = A_{si} K_{si}^{\alpha_s} L_{si}^{1-\alpha_s}. \tag{1}$$

The firm sells its good in a monopolistic product market, subject to an isoelastic downward-sloping demand curve:

$$Y_{si} = B_{si} P_{si}^{-\sigma_{si}}, \tag{2}$$

where σ_{si} is the firm-specific elasticity of demand. Markups are given by $\frac{\sigma_{si}}{\sigma_{si}-1}$.

Two types of distortions:

- output wedges $\tau_{Y_{si}}$ $\rightarrow$ decrease marginal product of K and L equally;
- capital wedges, $\tau_{K_{si}}$ $\rightarrow$ change the relative MRP of one factor w.r.t. the other one.

Profits of firm i:

$$\pi_{si} = (1 - \tau_{Y_{si}})P_{si}Y_{si} - wL_{si} - (1 + \tau_{K_{si}})RK_{si}. \tag{3}$$

Distortions drive a wedge between firms' marginal revenue products (inefficient factor allocation):

$$MRPL_{si} = \frac{w}{1 - \tau_{Y_{si}}} \quad \text{and} \quad MRPK_{si} = \frac{R(1 + \tau_{K_{si}})}{1 - \tau_{Y_{si}}}. \tag{4}$$

$\Rightarrow$ In case of distortions marginal revenue products of labor and capital are higher than marginal costs.

Introduce TFPQ and TFPR:

$$TFPQ_{si} = A_{si} = \frac{Y_{si}}{K_{si}^{\alpha_s} L_{si}^{1-\alpha_s}}, \tag{5}$$

$$\begin{aligned} TFPR_{si} = P_{si} A_{si} &= \frac{P_{si} Y_{si}}{K_{si}^{\alpha_s} L_{si}^{1-\alpha_s}} = \\ &= \underbrace{\left(\frac{R}{\alpha_s}\right)^{\alpha_s} \left(\frac{w}{1-\alpha_s}\right)^{1-\alpha_s}}_{\text{constant among firms}} \frac{\sigma_{si}}{\sigma_{si}-1} \frac{(1+\tau_{K_{si}})^{\alpha_s}}{1-\tau_{Y_{si}}} \\ &\propto \frac{\sigma_{si}}{\sigma_{si}-1} \cdot \frac{(1+\tau_{K_{si}})^{\alpha_s}}{1-\tau_{Y_{si}}}. \end{aligned} \tag{6}$$

Intuition: *TFPR varies across firms within an industry even if firms do not face output and/or capital distortions.* $\Rightarrow$ *High firm TFPR can be both a sign that the firm faces barriers that adjust its marginal product of capital and labor or that the firm has high markup.*

Data Description

Databases used:

- INVIND survey: panel representative of Italian manufacturing firms with at least 50 employees.
- CB: balance sheets data of around 30,000 Italian firms.

Period considered: 1987–2011.

Firms grouped into six major sectors: textile and leather, paper, chemicals, minerals, metals, machinery (ATECO 2002 classification).

Value Added	Capital	Hours Worked	N. workers	Obs.
31,801	58,626	830,000	511	8,809
(65,405)	(177,000)	(1,720,000)	(1,070)	

Note: Standard deviations in parentheses. Value added and capital are expressed in thousand of 2007 Euros.

Backing out key parameters

Set $(1 - \alpha_s)$ as the industry mean of $\left(\frac{wL_{si}}{P_{si} Y_{si}}\right)$.

The firm-level elasticity of demand σ_{si} is computed exploiting the following question in the survey:

"Consider the following experiment: if your firm increased prices by 10% today, what would be the percentage variation in its nominal sales, provided that competitors did not adjust their pricing and all other things being equal?"

Dropped observations for firms not reporting this piece of information in neither 1996 nor 2007.

Trimmed 1% tails of markup distribution.

Table: **Firm-level elasticity of demand and markups, by sector.**

	σ_{si}		**Markups**	
	Mean	**Median**	**Mean**	**Median**
All	5.537	4.0	1.220	1.333
Textile+leather	4.911	4.0	1.256	1.333
Paper	5.866	5.0	1.206	1.250
Chemicals	5.520	4.0	1.221	1.333
Minerals	5.957	6.0	1.202	1.200
Metals	6.122	5.0	1.195	1.250
Machinery	5.532	4.5	1.221	1.286

Note: Mean and median over the period 1987-2011.

Validation of σ_{si}

- Values perfectly in line with those obtained in literature (De Loecker, 2007; Broda and Weinstein, 2006).
- Pozzi and Schivardi (2015) verify the validity of the estimates obtained from this question of the survey in many ways.
- Checked different trims: no trim, 1%, 5%.
- Checked different ways to attribute markups: interpolation, mean, preferably 1996.
- Comparison with DLW firm-level markups.

How to measure misallocation?

The idea is to **measure misallocation in both the homogeneous and heterogeneous markups case** and compare the results.

But, how to compute misallocation in both cases?

⇒Through the **industry-level variance of distortions**.

Remember that:

$$TFPR_{si} \propto \frac{\sigma_{si}}{\sigma_{si}-1}\frac{(1+\tau_{K_{si}})^{\alpha_s}}{1-\tau_{Y_{si}}} \tag{7}$$

Rename $\ln(TFPR_{si}) = \psi_{si}$, $\ln\left(\frac{\sigma_{si}}{\sigma_{si}-1}\right) = \mu_{si}$, $\ln\left(\frac{(1+\tau_{K_{si}})^{\alpha_s}}{1-\tau_{Y_{si}}}\right) = d_{si}$.

Then,

$$\psi_{si} - \mu_{si} \propto d_{si}. \tag{8}$$

Then, my **measure of misallocation** is:

- If constant markups, i.e., $\sigma_{si} = \sigma$:

$$\mathrm{Var}_s(\psi_{si}) = \mathrm{Var}_s(d_{si}). \tag{9}$$

- If firm-level markups:

$$\mathrm{Var}_s(\psi_{si} - \mu_{si}) = \mathrm{Var}_s(d_{si}). \tag{10}$$

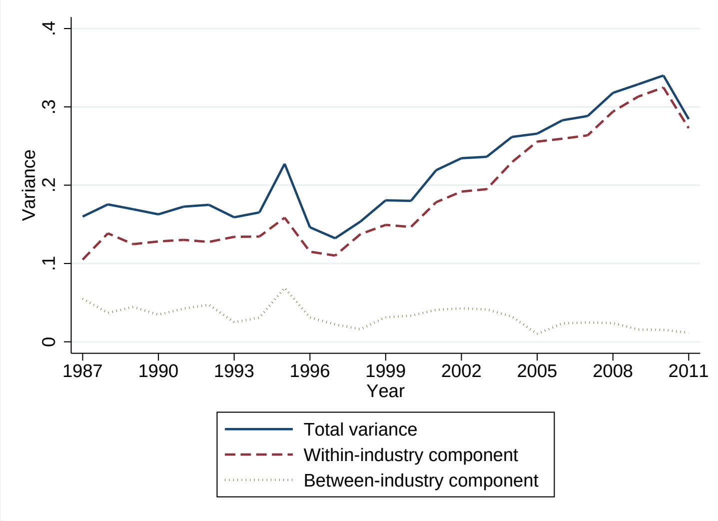
In absence of distortions, both the measures are equal to 0.

To check if they are good measures of misallocation:

$$\mathrm{Var}(X) = \underbrace{\sum_{s=1}^{S} \frac{P_s Y_s}{PY} \sum_{i=1}^{M_s} \frac{P_{si} Y_{si}}{P_s Y_s} (X_{si} - \overline{X}_s)^2}_{\text{within-industry component}} + \underbrace{\sum_{s=1}^{S} \frac{P_s Y_s}{PY} (\overline{X}_s - \overline{X})^2}_{\text{between-industry component}}, \tag{11}$$

where $X_{si} = \{\psi_{si}, (\psi_{si} - \mu_{si})\}$.

Aggregate variance of $(\psi_{si} - \mu_{si})$, within- vs. between-industry component.



Decomposition of misallocation

Subsequently, I decompose my measure of misallocation, in order to figure out which are the main drivers. From (7),

$$\begin{aligned} &\mathrm{Var}_s(\psi_{si}) = \mathrm{Var}_s(\mu_{si}) + \mathrm{Var}_s(d_{si}) + 2\mathrm{Cov}_s(\mu_{si}, d_{si}), \quad \text{i.e.,} \\ &\mathrm{Var}_s(d_{si}) = \mathrm{Var}_s(\psi_{si}) - \mathrm{Var}_s(\mu_{si}) - 2\mathrm{Cov}_s(\mu_{si}, d_{si}) \end{aligned} \tag{12}$$

In addition, from (10),

$$\mathrm{Var}_s(d_{si}) = \mathrm{Var}_s(\psi_{si} - \mu_{si}) \tag{13}$$

I can calculate $\mathrm{Var}_s(\psi_{si})$ and $\mathrm{Var}_s(\mu_{si})$ from the data, as well as $\mathrm{Var}_s(d_{si})$ from (13).

Thus, the covariance term can be computed as:

$$2\mathrm{Cov}_s(\mu_{si}, d_{si}) = \mathrm{Var}_s(\psi_{si}) - \mathrm{Var}_s(\mu_{si}) - \mathrm{Var}_s(d_{si}). \tag{14}$$

Therefore:

- Part of the variance in TFPR can be explained by heterogeneity in markups, and not only by distortions.
- Even in absence of distortions, $\mathrm{Var}_s(\psi_{si})$ is not null, but $\mathrm{Var}_s(\psi_{si}) = \mathrm{Var}_s(\mu_{si})$.
- It means that when not accounting heterogeneity in markups we are mixing up dimensions other than technical efficiency.
- Results are driven by the correlation between distortions and markups.

Correlation between markups and distortions

In case of correlated distortions, it could be:

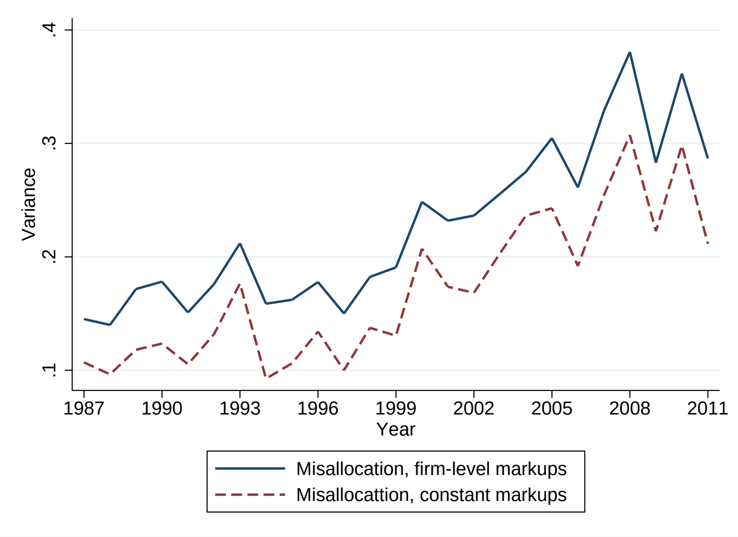
- $\mathrm{Cov}_s(\mu_{si}, d_{si}) > 0$: the higher the covariance term, the lower misallocation.
- $\mathrm{Cov}_s(\mu_{si}, d_{si}) < 0$: the higher the covariance term in absolute values, the higher the overall misallocation.

Moreover, not accounting for heterogeneous markups could underestimate or overestimate misallocation, depending on the sign and the magnitude of $\mathrm{Cov}_s(\mu_{si}, d_{si})$. In particular, it overestimate it if and only if

$$\mathrm{Cov}(\mu_{si}, d_{si}) > -\frac{\mathrm{Var}_s(\mu_{si})}{2}. \quad (15)$$

Intuition: *in case of correlated distortions the covariance between markups and wedges determines if the variance of revenue productivity as measure of misallocation leads to an overestimation or underestimation of it.*

Misallocation, firm-level vs. constant markups case



Therefore, in my case,

$$\mathrm{Cov}_s(\mu_{si}, d_{si}) < -\frac{\mathrm{Var}_s(\mu_{si})}{2} < 0, \tag{16}$$

meaning that:

- The higher the negative correlation between markups and distortions, the greater misallocation of resources. $\Rightarrow$ High taxes on low market power firms are more damaging to aggregate productivity.

- Wedges penalize more firms with lower market power.

These results are robust to various robustness checks on markups and on the sample (weighting, subsamples by different groups etc.).

Conclusions

- In this set up the appropriate measure of misallocation is the within-industry dispersion in the ratio between TFPR and markups.
- This measure results from the combined effect of dispersion in TFPR, markups and covariance between distortions and markups.
- When not accounting for heterogeneity in markups misallocation is underestimated (32% lower on average).
- Results are driven by the negative correlation between distortions and markups. $\Rightarrow$ Wedges penalize more firms with lower market power.
- The higher the negative correlation between wedges and markups, the greater misallocation. $\Rightarrow$ High taxes on low-market power firms are more damaging to the aggregate productivity.