

# Productivity Cost of Distortions in China

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## Questions

How would the predicted total factor productivity (TFP) gains change if we do not use homogeneous demand elasticities and a benchmark economy's production elasticities, but estimate them using firm-level data?

## Literature Background

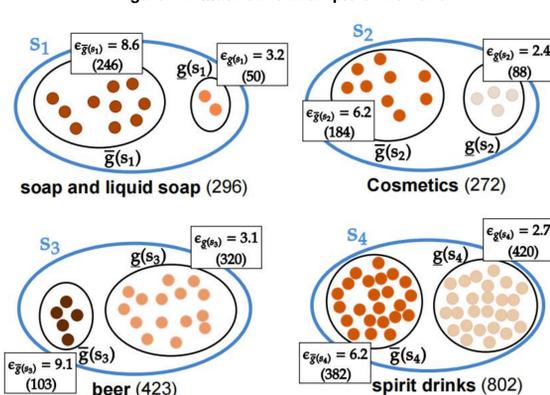
- Hsieh and Klenow (2009) (HK) framework has been widely applied in quantifying misallocation (Italy, China, India, Vietnam, Thailand, Bolivia, etc)
- Calibrating parameters using a benchmark economy and assuming homogeneous demand elasticities are common practice
- Recent papers show the framework's prediction is sensitive to the functional form assumed (Haltiwanger et al. (2018) and Li and Wang (2021)) and measurement errors (Bils et al. (2021)) and that correcting these biases reduces the predicted gains
- This paper shows **even if the functional form is correct, calibrating using a benchmark economy and assuming homogeneous demand elasticities across nests overestimate the predicted gains**

## Model and Estimation

Use Chinese firm-level survey data to estimate a modified HK model:

- **Nested-CES demand with an additional layer of nests within industries and with nest-specific demand elasticities**
- **Cobb-Douglas production functions with firm-specific production distortions and input distortions**
- **Estimate the nest structure, nest-specific demand elasticities, industry-specific production elasticities, and firm-specific distortions**

Figure: An Illustrative Example of Demand



Notes: numbers in parentheses are firm counts in nests.

Table: Average Demand Elasticities at the 2-Digit Industry Level

Industry	$\epsilon$	Firm counts
Oil and gas extraction	3.22	33
Agricultural and Sideline Food Processing	9.59	12275
Tobacco	3.97	102
Textile	11.31	20197
Pharmaceutical	4.82	4233
Rubber products	7.69	2693
General Equipment Manufacturing	7.51	18088
Special-Purpose Equipment Manufacturing	6.48	8923
Recycling and processing of waste resources and materials	14.36	347

## Contributions

- We demonstrate, using Chinese firm-level data, **that the common practice of assuming constant demand elasticities and calibrating production functions using a benchmark economy in estimating TFP gains, as often done in previous literature, introduces biases**
- We propose **a novel method that relaxes these assumptions by estimating both demand and production elasticities**. This approach can potentially alter predicted TFP gains for China

## Main Results

- **20% of the TFP gains in Hsieh and Klenow (2009) are caused by replacing the Chinese production technology with the US technology instead of distortions**
- **Allowing demand elasticities to vary across nests reduces predicted TFP gains by 17%**

## Results in Details

Calibrating production elasticities and assuming homogeneous demand elasticities:

- **Do not bias predicted TFP gains through estimated firm-specific distortions**
- **But through how firms substitute between capital and labor**
- **And through how consumers substitute across different firms and industries**
- **And through the estimated firm-specific TFP**

Figure: Distribution of Production Elasticities of Chinese and US Firms

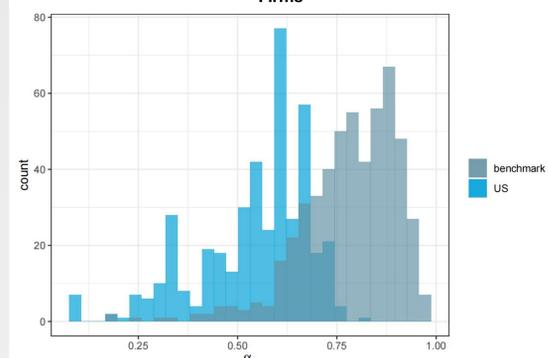


Figure: Distribution of Estimated Distortions

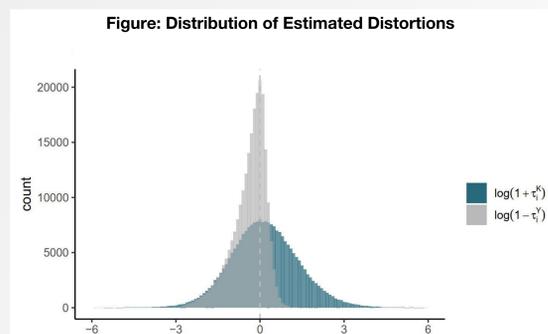


Table: Within-nest TFP gains in China (2005) comparison across specifications

	$\alpha$	$\sigma$	TFP gains (%)
calibrated using US firms (HK)		3	112.8 <sup>1</sup>
calibrated using US firms (HK)		8.5	411.5
calibrated using US firms (HK)	heterogeneous (one-nest industries) <sup>2</sup>		340.9
calibrated using US firms (HK)	heterogeneous (two-nest industries) <sup>3</sup>		351.5
Our estimators		3	92.7
Our estimators		8.5	352.6
Our estimators	heterogeneous (one-nest industries) <sup>2</sup>		287.7
Our estimators	heterogeneous (two-nest industries) <sup>3</sup>		296.8

<sup>1</sup> It is slightly larger than the value reported in HK because we use an updated version of the Chinese Annual Survey Data of Industries.

<sup>2</sup> Each industry contains one nest.

<sup>3</sup> Each industry can contain one or two nests.

## Conclusion

- **Using estimated production elasticities and nest-specific demand elasticities reduces the predicted TFP gains**
- **The predicted TFP gains in our benchmark specification are about 300%**
- **This is likely still an overestimation due to the functional form of production and demand (Bils et al. (2021) and Li and Wang (2021))**

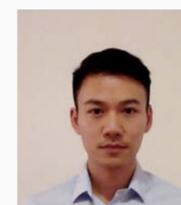
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