Chinese Exports and US Import Prices

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Motivation

- One of the most remarkable recent changes in the composition of US international trade has been the increase in imports from China.
  - 6 percent of US imports in 1995, 18 percent in 2011.
  - Over the 2002-6 period, China exported to the US in 76 percent of the 15,980 HS10 categories, an increase of roughly 2,000 categories relative to 1997-2001.
  - China's market share increased in the vast majority of those product categories.

Motivation

- China's burgeoning exports have stimulated great interest in identifying its effects on competing producers and US consumers.
  - Under imperfect competition, exports from China may lead US producers and other exporting countries to diminish their markups (*pro-competitive effect*).
  - The extent of China's impact on a given industry will be a function of how substitutable Chinese exports are for other varieties (*quality differentiation*).

Objectives

- Jointly estimate the distribution of markups and marginal cost in an industry (incl. the scope for quality differentiation).

- Use the estimator as a laboratory to measure the effect of increasing Chinese import competition on markups and MC charged by other countries exporting to the United States.

Findings

- In industries which China entered or substantially increased market share:
  - Other exporters sharply reduced their markups.
  - Other exporters increased their marginal costs, suggesting a shift in composition towards higher quality varieties.

Related Literature

- Measurement of producer markups in an international trade context.
  - Feenstra and Weinstein (2010), De Loecker and Warzynski (2012), De Loecker, Goldberg, Khandelwal and Pavcnik (2012).

- In this paper:
  - I focus on the role of other exporters rather than domestic import-competing producers.
  - The method only relies on detailed price data.

Related Literature

- Measurement of trade quality.
  - Hallak and Schott (2010), Khandelwal (2010), Gervais (2011): quality = price conditional on trade balance, market share, or output quantity.
  - Feenstra and Romalis (2012): quality = price divided by productivity-adjusted wages.
  - Verhoogen (2008), Kugler and Verhoogen (2011), Manova and Zhang (2011): export prices relate to input prices via choice of product quality.

- In this paper:
  - I estimate the influence of product quality specifically on the marginal cost component of price.

Related Literature

- Gauging the effect of Chinese competition on:
  - Import prices: Kamin, Marazzi & Schindler (2006)
  - Producer prices: Auer and Fischer (2010)
  - R&D, patenting, IT and TFP: Bloom, Draca & van Reenen (2011)
  - Manufacturing employment: Autor, Dorn & Hanson (2013)

- In this paper:
  - Relate post-WTO change in Chinese exports to components of US import price.
  - Less focus on identification of exogenous component of Chinese exports.

Outline

1. China's place in the US import price distribution.

2. Decomposition of price into markup and MC.

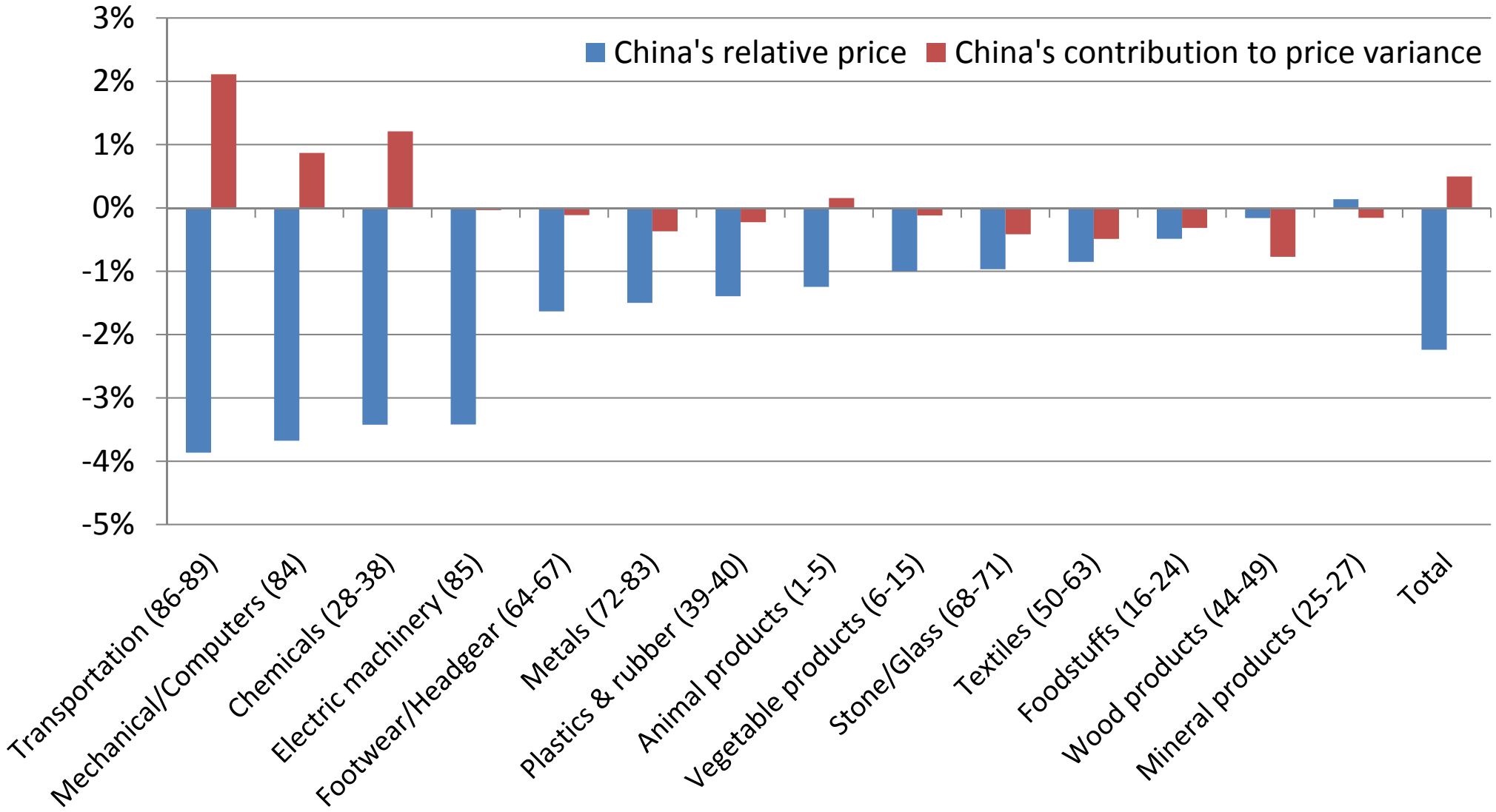
3. Estimates of markup and MC dynamics for US imports from China/RoW.

US Import Prices

$$p_i^j = \frac{\sum_{t=2002}^{2006} M_{it}^j}{\sum_{t=2002}^{2006} Q_{it}^j}$$

- Define import price from *i* to *j* as the corresponding HS10 unit value.
- Numerator and denominator each average over 5 years of customs data.

China's Contribution to US Import Price Statistics

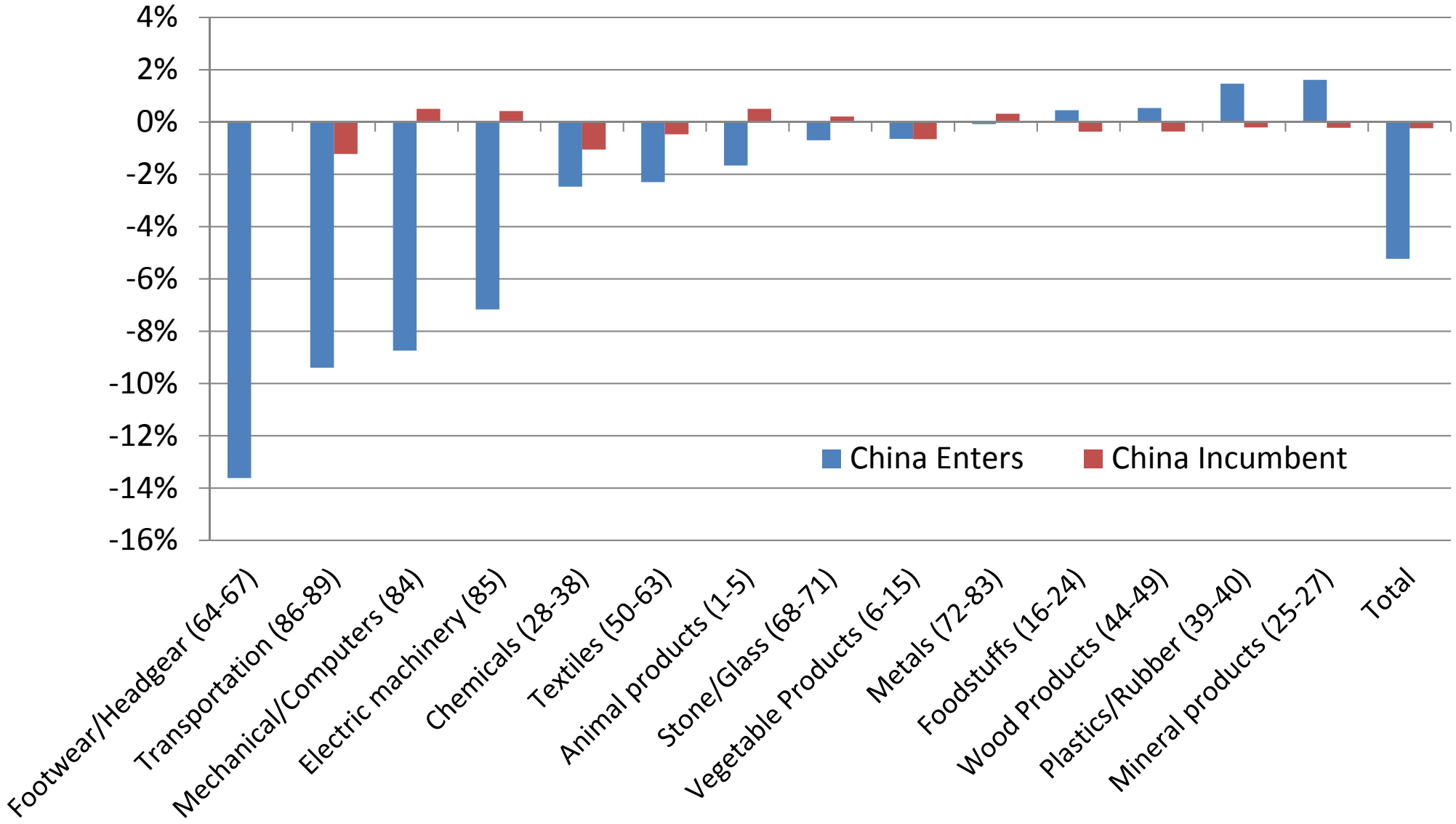


- Chinese prices, while generally lower, only increase the variance of prices in a subset of manufacturing industries.

China's Contribution to US Import Price Statistics

- In many instances, China exerts a substantial influence on the product price distribution.

China's Contribution to US Import Price Changes



- Over time, Chinese prices contributed decreases to product-level unit values; particularly products in which China entered.

Import Price Decomposition

- Prices of a given source country are composed of a markup (ρ) and marginal cost (MC) component.

$$\ln p_i = \ln \rho_i + \ln MC_i$$

- Marginal cost is determined by an exporter's productivity (φ) and the degree of quality differentiation (β).

$$\ln MC_i = \beta \ln \varphi_i$$

Import Price Decomposition (cont.)

- The first three moments of the price distribution can be expressed generically as:

1. Mean:

$$E[\ln p_i] = E[\ln \rho_i] + \beta E[\ln \varphi_i]$$

2. Variance:

$$Var[\ln p_i] = Var[\ln \rho_i] + \beta^2 Var[\ln \varphi_i] + 2\beta cov[\ln \rho_i, \ln \varphi_i]$$

Import Price Decomposition (cont.)

3. Skewness:

$$\frac{Skew[\ln p_i]}{Var[\ln p_i]^{-\frac{3}{2}}} \approx \frac{Skew[\ln \rho_i]}{Var[\ln \rho_i]^{-\frac{3}{2}}} + \beta^3 \frac{Skew[\ln \varphi_i]}{Var[\ln \varphi_i]^{-\frac{3}{2}}}$$
$$- 3\beta cov[\ln \rho_i, \ln \varphi_i] + \frac{3}{2} Var[(\ln p_i)]^2$$
$$- \frac{3}{2} Var[\ln \rho_i]^2 - \frac{3}{2} Var[\beta \ln \varphi_i]^2$$

- For this system to be identified, enough restrictions on the markup and productivity distributions are needed to reduce the number of unknowns on the right-hand side to 3.

Import Price Decomposition (cont.)

- The choice of the productivity distribution borrows from the fact that the intra-industry firm size distribution tends to be fat-tailed.

$$\varphi \sim pareto(1, \lambda)$$

implies: $\ln \varphi \sim \exp(\lambda)$

- The choice of the markup distribution depends on market structure and the form of demand.

Case I: CES Demand

- Under CES demand, the markup distribution collapses to a point:
  - $\ln\rho_i = \ln\rho$, any i; $Var[\ln\rho_i]=0$; $Skew[\ln\rho_i]=0$; Cov[…]=0
- The moments of price can be expressed:

$$E[\ln p_i] = \ln\rho + \frac{\beta}{\lambda}$$

$$Med[\ln p_i] = \ln\rho + \ln 2\frac{\beta}{\lambda}$$

$$\frac{Skew[\ln p_i]}{Var[\ln p_i]^{-\frac{3}{2}}} = 2\left(\frac{\beta}{\lambda}\right)^3$$

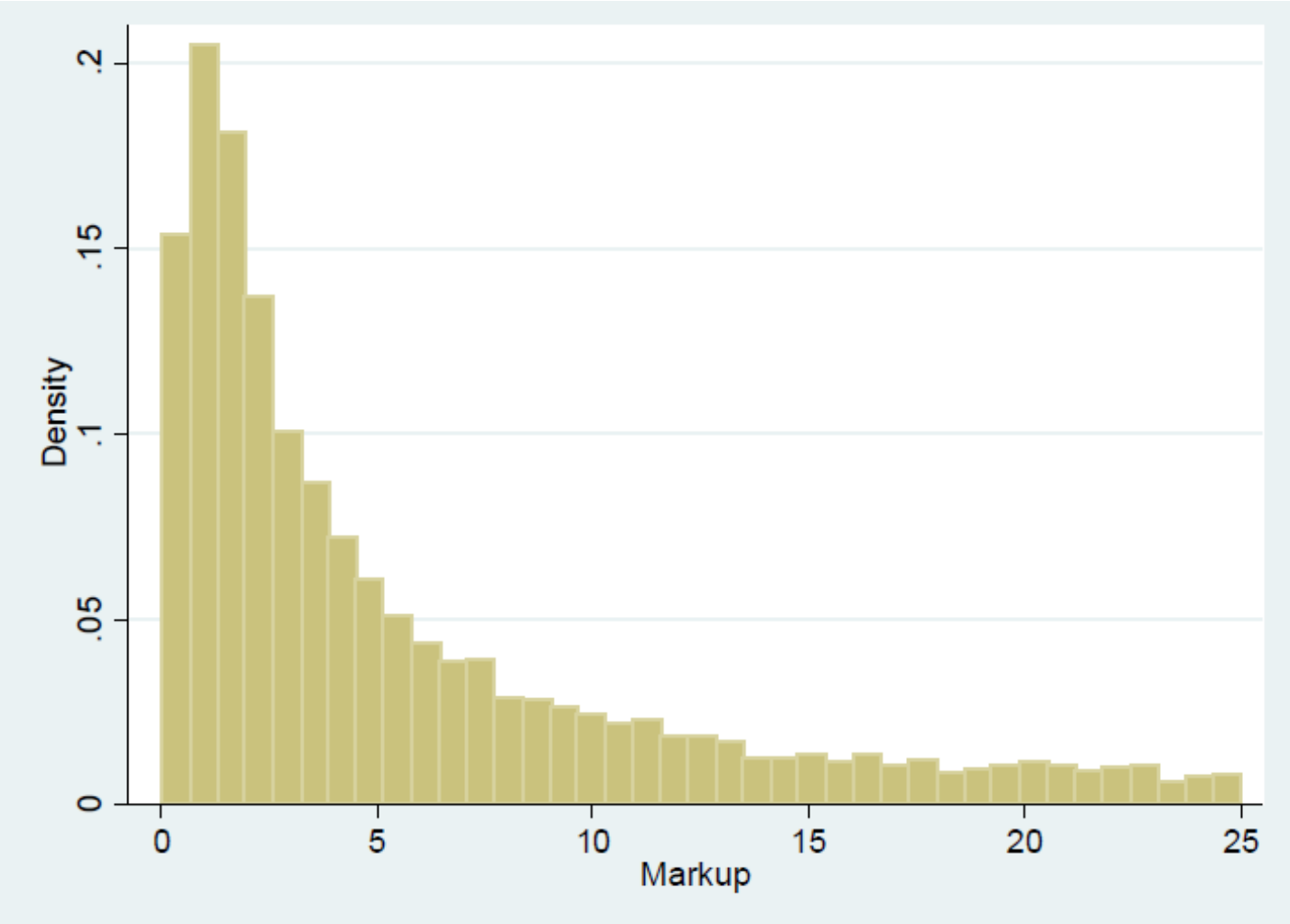
Case I: CES Demand

- These expressions allow one to solve for the parameters of the productivity and markup distributions in terms of the observed moments of prices.

$$\frac{\widehat{\beta}}{\lambda} = \frac{E[\ln p_i] - Med[\ln p_i]}{(1 - \ln 2)}$$

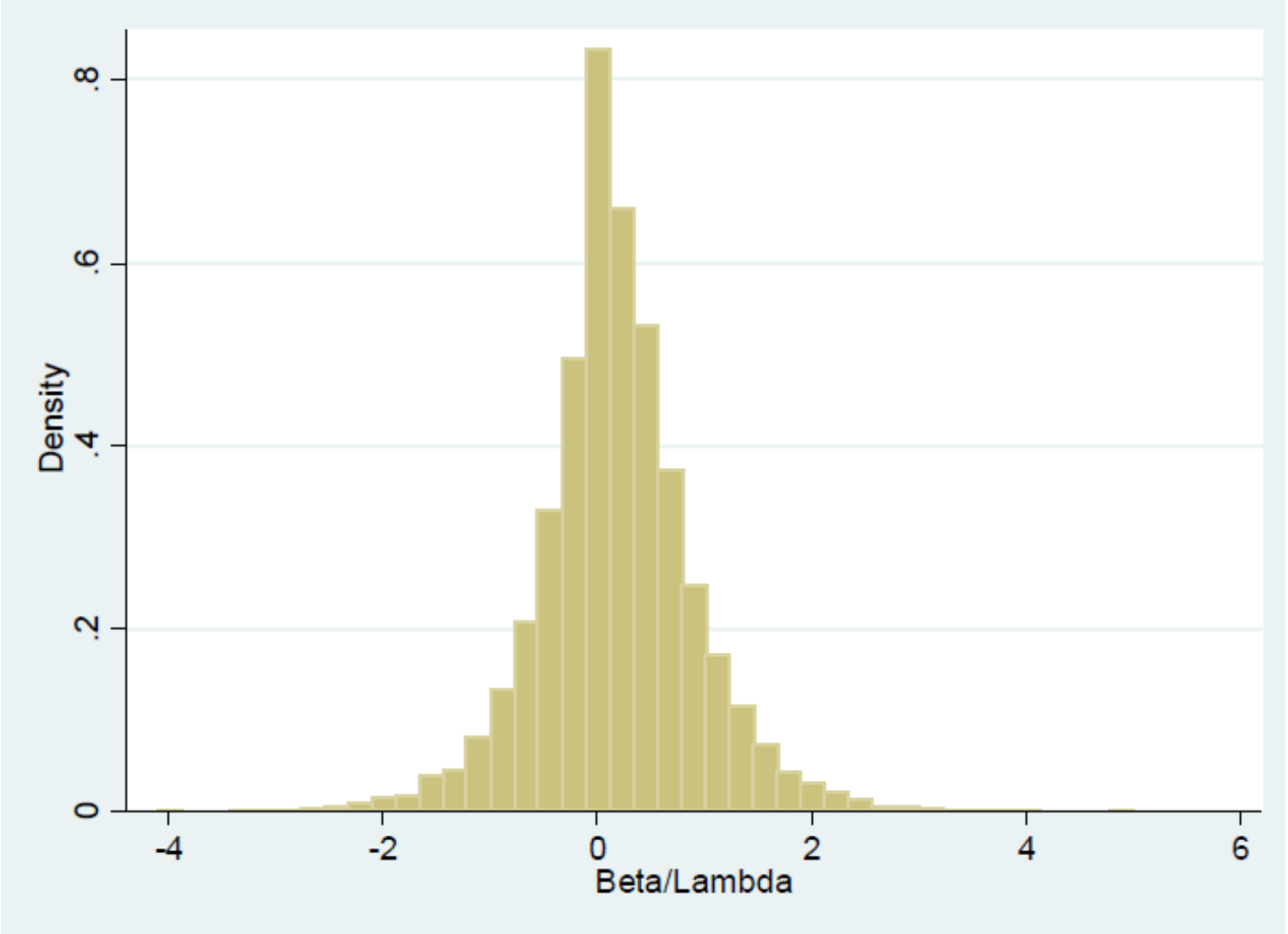
$$\widehat{\ln \rho} = Med[\ln p_i] - \frac{(\ln 2)}{(1 - \ln 2)} E[\ln p_i]$$

Evaluation of the Estimator: Case I



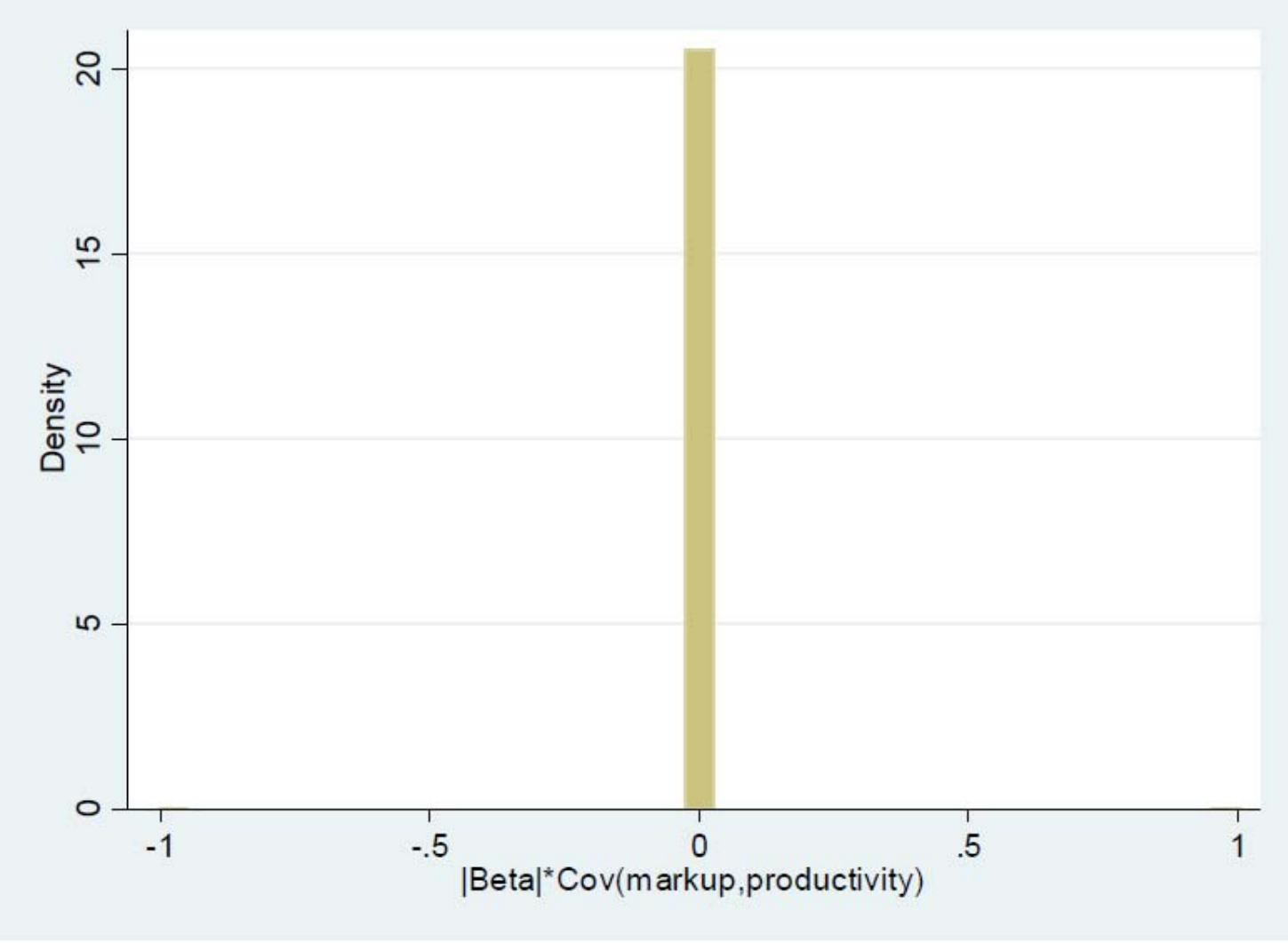
- CES-based estimator is readily computed for all industries, but gives rise to implausibly high levels of markups.

Evaluation of the Estimator: Case I



- Consistent with other studies, the majority of industries have long quality ladders (i.e., $\beta>0$)

Evaluation of the Estimator: Case I



- Finally, CES demand implies zero covariance between productivity and markups.

Case II/III: Pareto-distributed Markups

- As an alternative to CES, assume markups to be:

$$\ln \rho \sim \exp(\lambda_\rho),\ \lambda_\rho > 0.$$

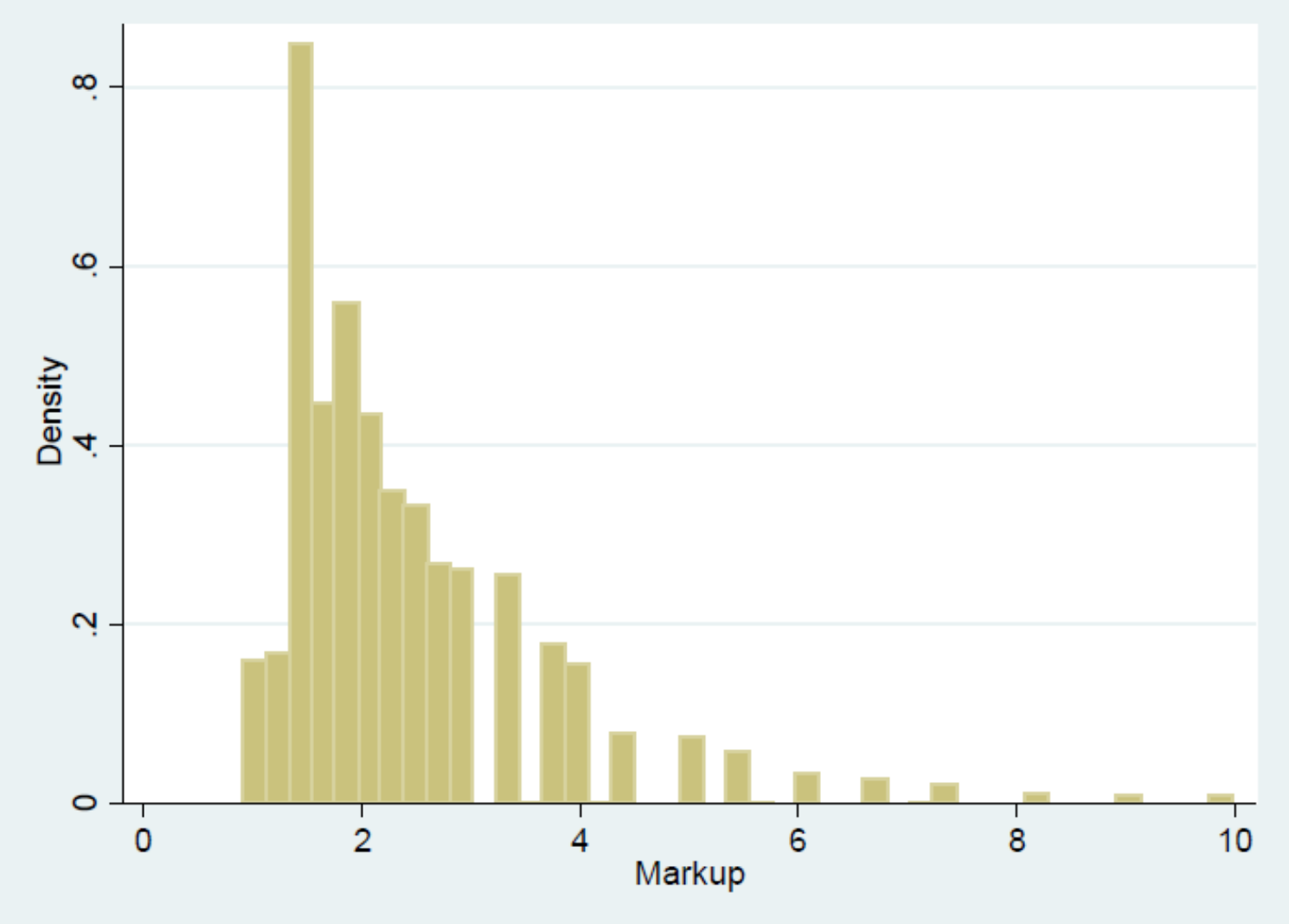
- The moments of price can be expressed:

$$\begin{aligned}
E[\ln p_i] &= \frac{1}{\lambda_\rho} + \frac{\beta}{\lambda_\varphi} \\
Var[\ln p_i] &= \left(\frac{1}{\lambda_\rho}\right)^2 + \left(\frac{\beta}{\lambda_\varphi}\right)^2 + 2\beta cov[\ln \rho_i, \ln \varphi_i] \\
\frac{Skew[\ln p_i]}{Var[\ln p_i]^{-\frac{3}{2}}} &\approx 2\left(\frac{1}{\lambda_\rho}\right)^3 + 2\left(\frac{\beta}{\lambda_\varphi}\right)^3 - 3\beta cov[\ln \rho_i, \ln \varphi_i] - \frac{3}{2} Var[\ln p_i] \\
&\quad + \frac{3}{2}\left(\frac{1}{\lambda_\rho}\right)^2 + \frac{3}{2}\left(\frac{\beta}{\lambda_\varphi}\right)^2
\end{aligned}$$

Case II/III: Pareto-distributed Markups

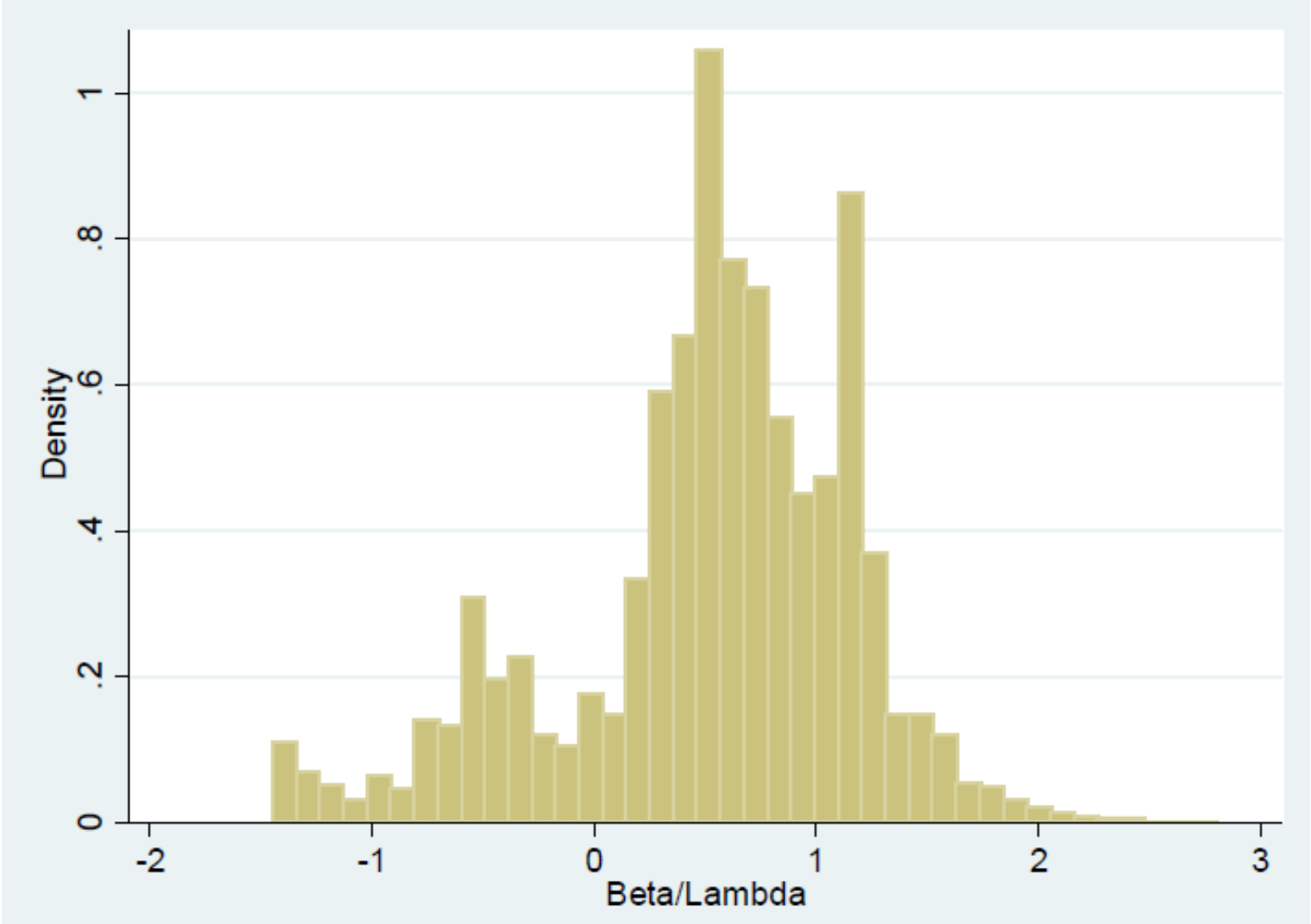
- I try two solution algorithms:
  - Case II: Solve for exact solutions.
  - Case III: Grid search over the range of plausible parameter values, minimizing the difference between implied and observed moments of price.

Evaluation of the Estimator: Case III



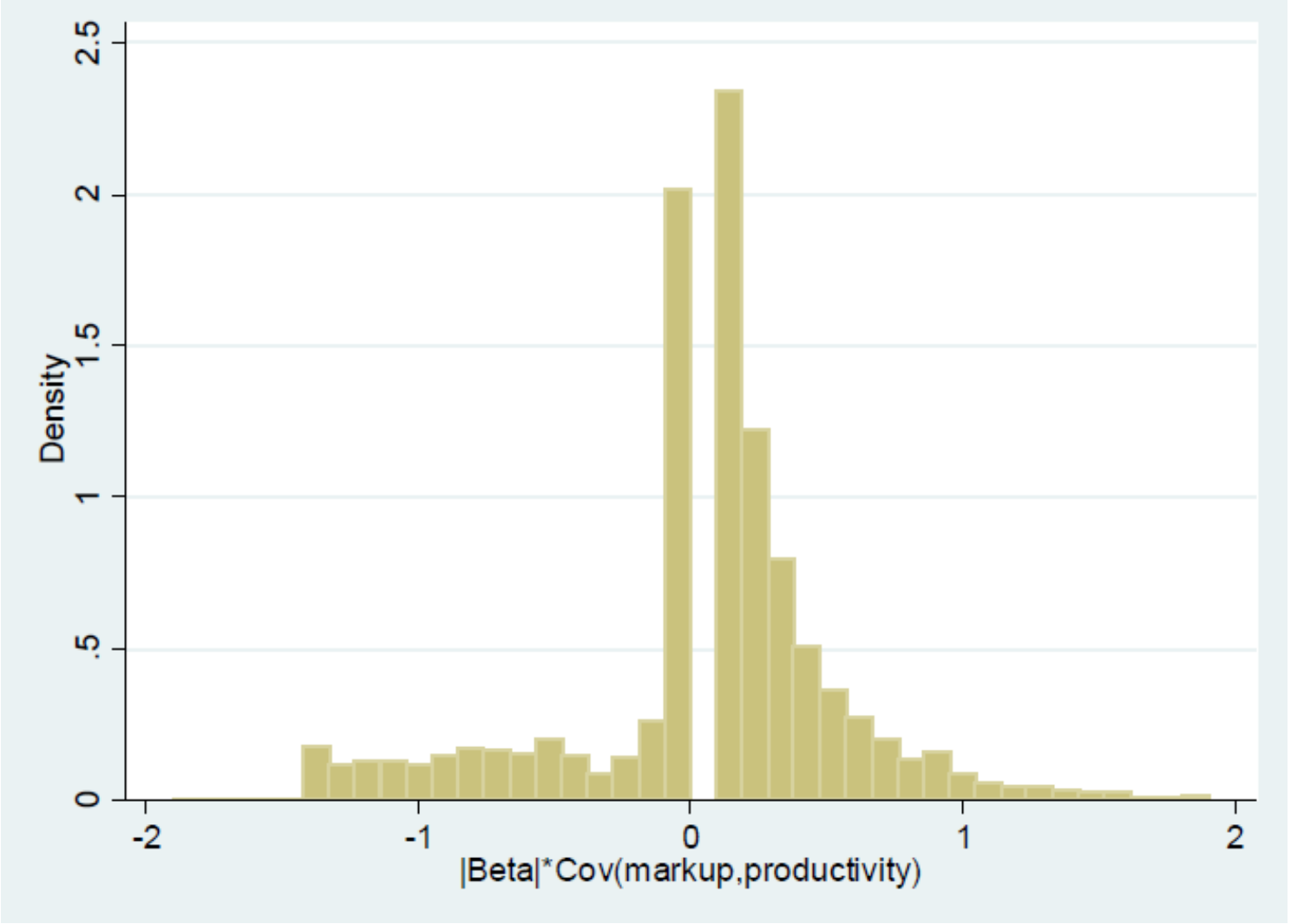
- The Pareto-distributed markup specification (w/ grid-search) gives rise to more plausible markup levels.

Evaluation of the Estimator: Case III



- On balance, industries have $\beta>0$.

Evaluation of the Estimator: Case III



- The bulk of industries have a positive covariance between markups and productivity.

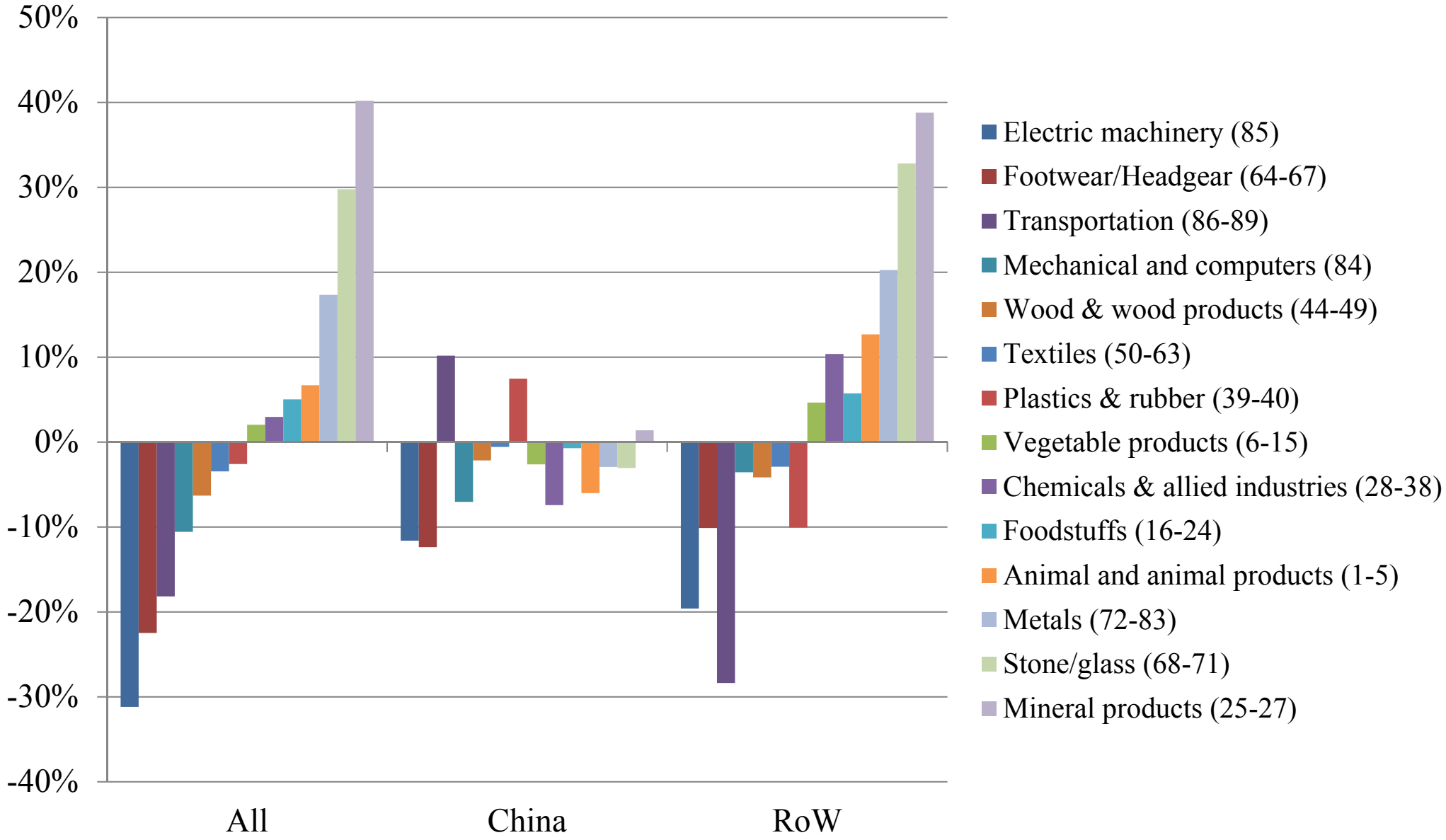
China vs. RoW

$$\left(\widehat{\frac{1}{\lambda_\rho}}\right)_{i=China} = \left(\widehat{\frac{1}{\lambda_\rho}}\right)_{i=all} - \left(\widehat{\frac{1}{\lambda_\rho}}\right)_{i\neq China}$$

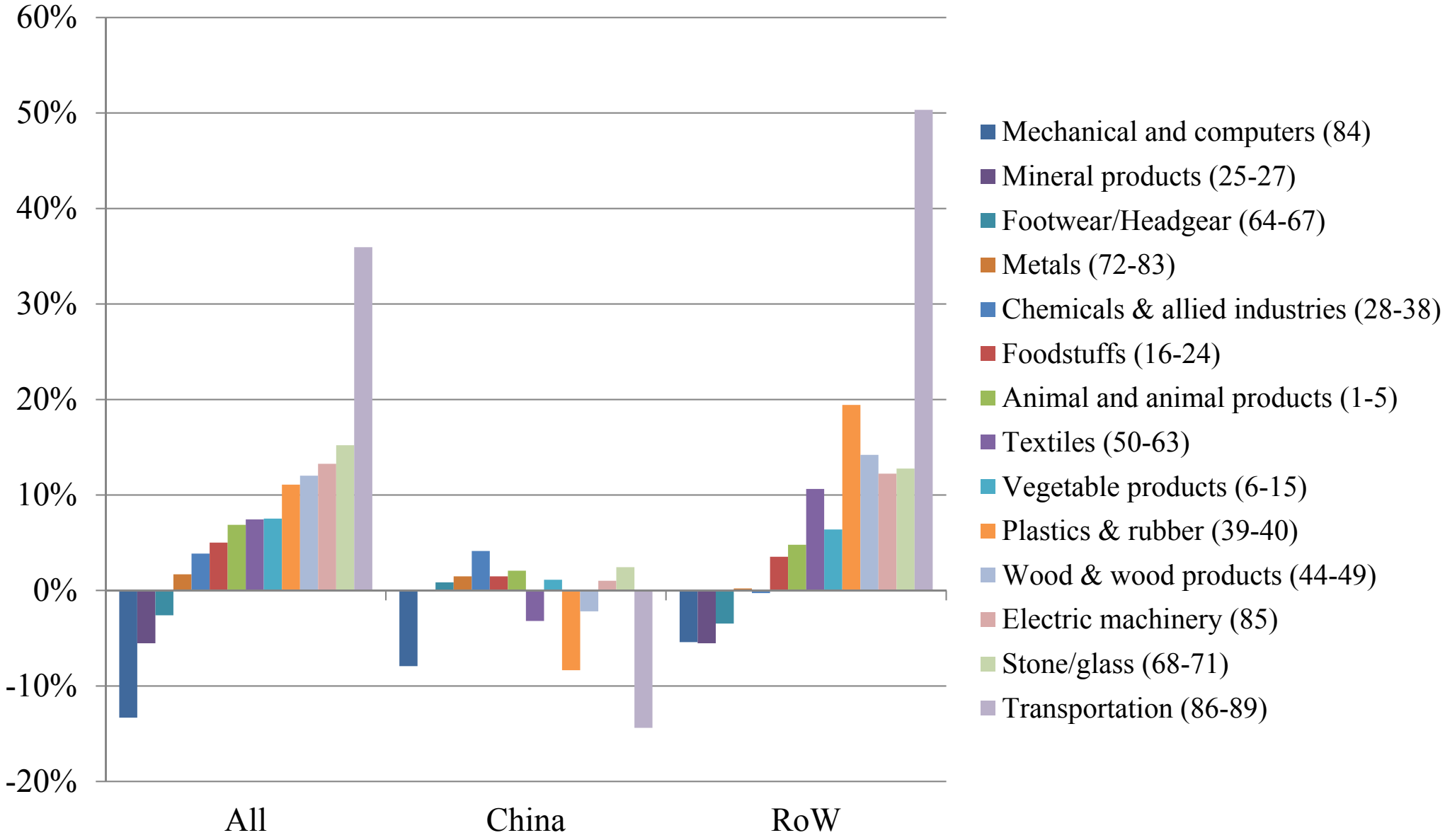
$$\left(\widehat{\frac{\beta}{\lambda_\varphi}}\right)_{i=China} = \left(\widehat{\frac{\beta}{\lambda_\varphi}}\right)_{i=all} - \left(\widehat{\frac{\beta}{\lambda_\varphi}}\right)_{i\neq China}$$

- China's contribution to industry markups and marginal cost is the difference between the estimates w/ and w/o China.
- Each estimate is computed for the 1997-01 period as well as the 2002-06 period.
- I examine the estimates against the backdrop of two proxies for increasing Chinese competition: (i) entry into an industry, and (ii) increasing market share.

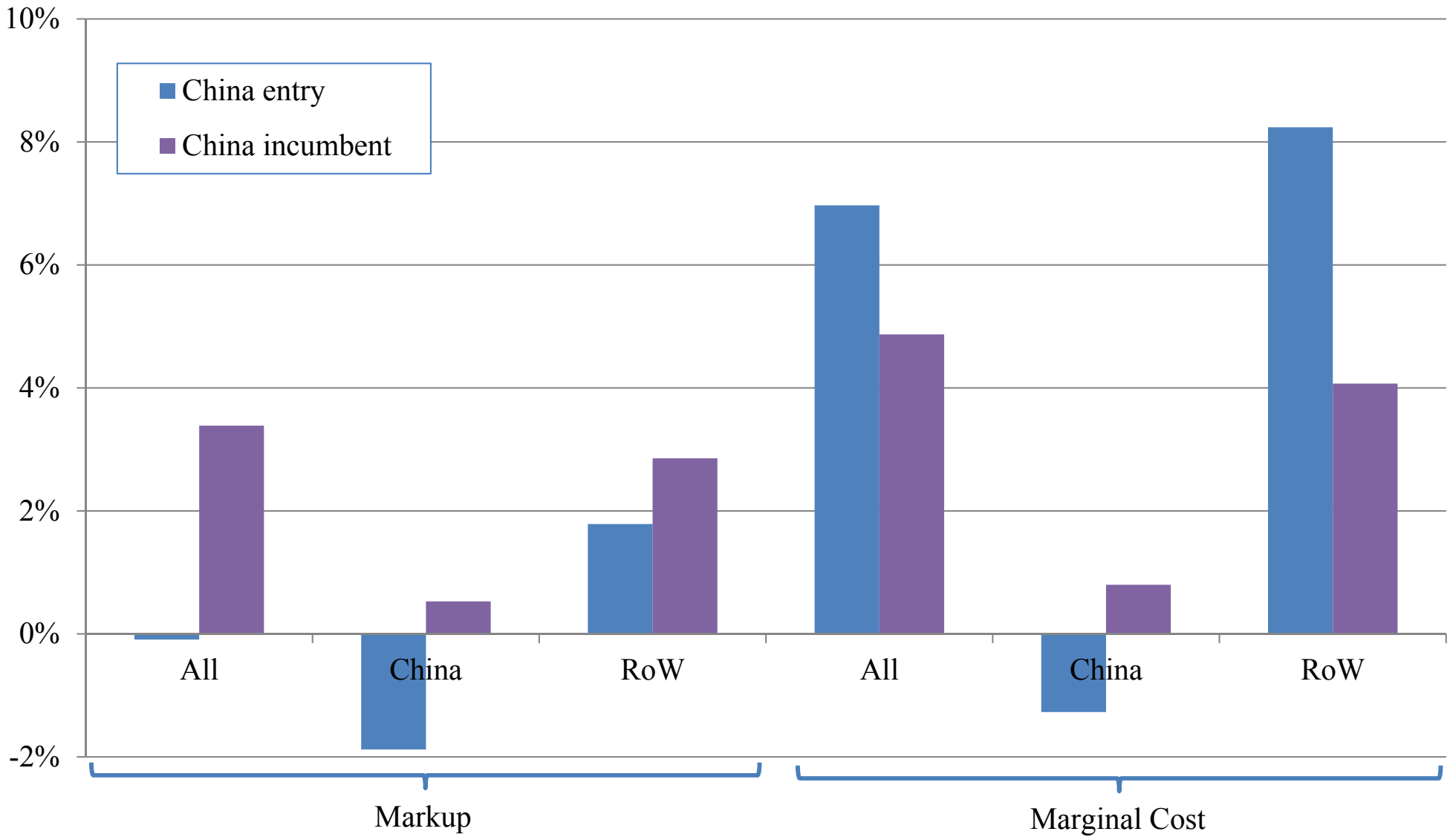
Changes in Markups (China Entry)



Changes in Marginal Cost (China Entry)

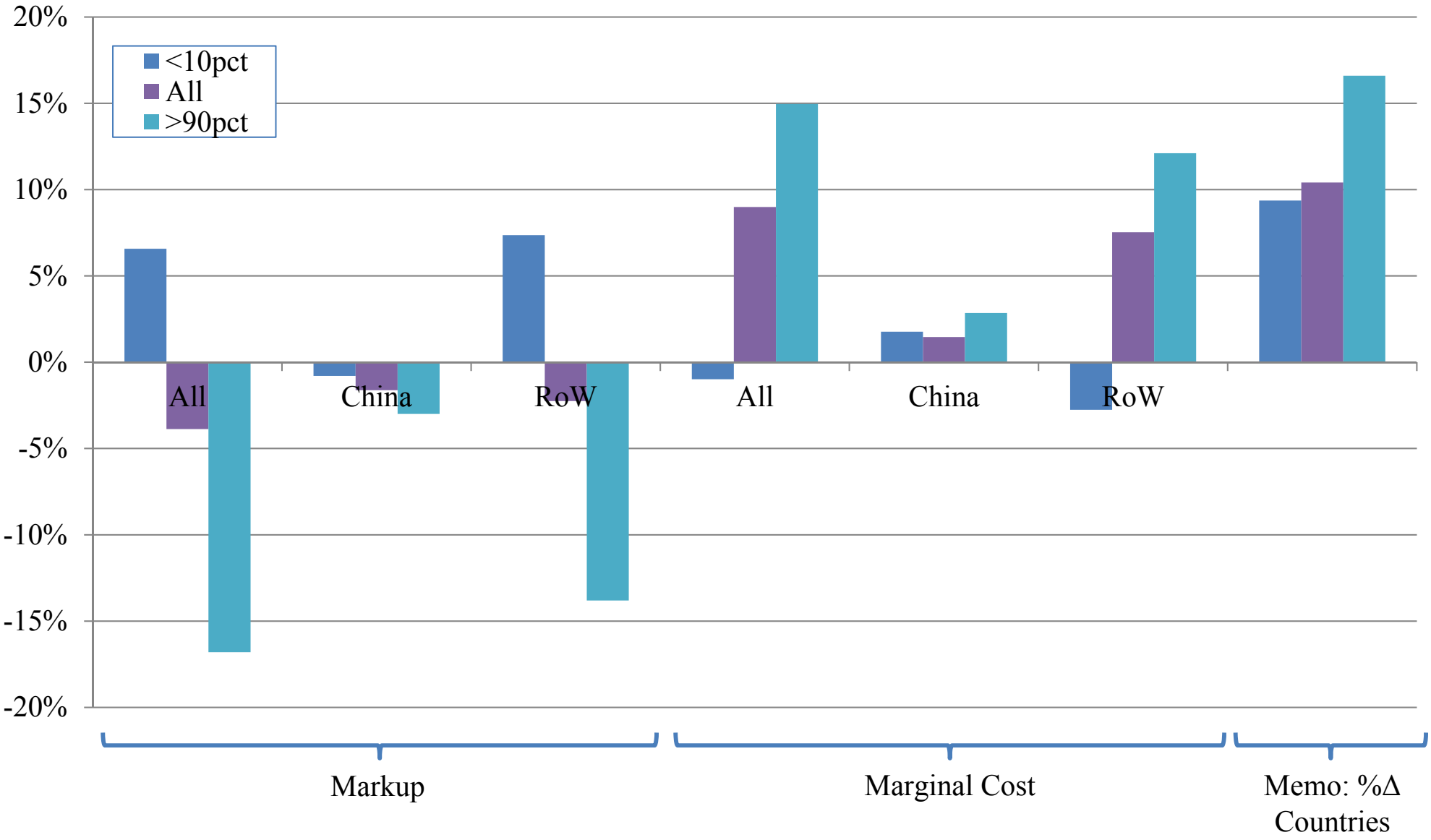


Changes in Markups and Marginal Cost
(by China entry)



Changes in Markups and Marginal Cost

(by change in Chinese market share)



Concluding Remarks

- New estimator of producer markups and marginal cost, inferred from the higher moments of prices.

- Estimates suggest two simultaneous pro-competitive effects of increasing Chinese trade:
  - Falling markups *and* increasing quality of exports from the rest of the world.