Competition and Welfare Gains from Trade: A Quantitative Analysis of China Between 1995 and 2004

Wen-Tai Hsu Yi Lu Guiying Laura Wu

SMU NUS NTU

June 8, 2017 at SMU Trade Workshop

Does Competition Matter in Welfare Gains from Trade?

- Does competition matter in gains from trade?
  - Better productivity (lower costs and hence lower price) – Ricardian effect
  - Lower markups (domestic firms may lower their prices to deter foreign entry and successful foreign entry may also bring lower markup)
  - Higher profits – there are more chances for firms to earn profits from foreign countries
  - Less dispersion of markup distribution – allocative efficiency
- Competition and markups matter in the latter three above-mentioned forces – pro-competitive effects.

Allocative Efficiency

- When some goods are monopolized and others are not, the resource allocation across goods is distorted.
- When mark-ups are the same across all goods, first-best allocative efficiency is attained.
  - The condition that the price ratio equals the marginal cost ratio, for any pair of goods, holds because of constant mark-ups.
- With markup dispersion, firms with low markups may produce/employ more than optimal whereas those with high markups may produce/employ less than optimal.
- Empirical evidence on the reduction in the mean and dispersion of markups in China (Lu and Yu [2015], Brandt et al. [2012]).
- How do pro-competitive effects matter *quantitatively*?

What This Paper Does

- We quantify a model of international trade with **head-to-head competition** that allows for **pro-competitive effects** using Chinese firm level data in 1995 and 2004.

- We evaluate the gains from improved openness from 1995 to 2004 and decompose the gains into a Ricardian effect and two pro-competitive components.

- We extend the model to a multiple sector case, and ask whether China liberalized the right sectors?

China and its Entry to WTO

- During 1995-2004, (weighted) average import tariff drops from 25.5% to 6.3%, whereas average export tariff drops from 6.4% to 3.2%.
- Reforms on State Owned Enterprises (SOE) reduces some entry barriers and make markets more competitive.
- Improvement in infrastructure both within-the-country and across the borders.
- Import share increases from 0.13 to 0.22, and export intensity also grows at a similar rate.

Quantitative Framework

- Our quantitative framework is a variant of the canonical trade model in Bernard, Eaton, Jensen, and Kortum (2003; henceforth BEJK).
  - Productivity (Frechét distribution) differ across firms and countries
  - Firms compete in Bertrand fashion
  - Markups are generated by productivity differences – lowest cost firm charges the price at the second lowest marginal cost
- The distribution of markup is invariant to changes in trade costs....no pro-competitive effect of trade.

Change in the Distribution of Markups (of Firms)

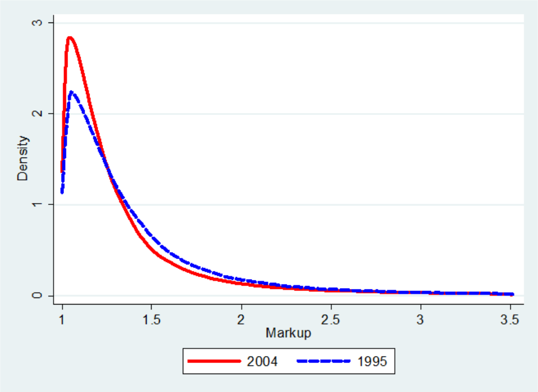

Figure: Markup Distributions (1995 v.s. 2004)

(Unweighted) mean markup decreases from 1.43 to 1.37. All percentiles dropped.

Quantitative Framework

- Holmes, Hsu, and Lee (2014) develop a model that deviate from BEJK in allowing a general distribution of productivity and assuming there are "finite" number of firms per product to draw from the distribution.
- Their result is that pro-competitive effects of trade will emerge when the tail of the productivity distribution is not too fat.
- We adopt the model framework in Holmes, Hsu, and Lee (2014) and assume
  - Productivity draws is from log-normal
  - Number of firms per product is drawn from Poisson
- Log-normal distribution has a kind-of fat-tail, but is less fat than Pareto/Frechét, and it matches the entire distribution better than Pareto, except at the very upper tail (Head, Mayer, and Thoenig 2014).

Trade Flows, Markups, and Gains from Trade

- Arkolakis, Costinot, and Rodriguez-Clare (2012; henceforth ACR): In a class of influential trade model, welfare can be simply determined by domestic consumption share and trade elasticity:

$$\hat{W} = \hat{\lambda}^{1/\epsilon},$$

  where λ is the **share of expenditure on domestic goods**, and ϵ is the **trade elasticity**.

- Hence, λ and ϵ provide **sufficient statistics** for welfare gains from trade.

- This class includes Armington, Krugman (1980), Eaton and Kortum (2002), Melitz (2003) with Pareto, and BEJK.

- No pro-competitive effects in this class.

Trade Flows, Markups, and Gains from Trade

- CES preference, monopolistic competition or perfect competition, plus three macro restrictions:
  - R1: Balanced trade.
  - R2: Aggregate profits as a constant share of revenues.
  - R3: For the partial trade elasticity,

$$\epsilon_j^{ii'} \equiv \frac{\partial \ln (X_{ij}/X_{jj})}{\partial \ln \tau_{i'j}}$$

$$\epsilon_j^{ii'} = \begin{cases} \epsilon & \text{if } i' = i \\ 0 & \text{if } i' \neq i \end{cases}$$

- If R3 doesn't hold, then the *local formula* holds:

$$\frac{d \ln W}{d \ln \tau} = \frac{1}{\epsilon} \frac{d \ln \lambda}{d \ln \tau}. \quad (1)$$

- Unlike BEJK, our model does not feature constant trade elasticity. Whereas the global formula ($\hat{W} = \hat{\lambda}^{1/\epsilon}$) holds in BEJK, one key question is whether (1) holds here.

Recent literature on pro-competitive effects

- Arkolakis, Costinot, Donaldson, and Rodriguez-Clare (2016):
  - developed a framework with general preference under monopolistic competition.
  - No pro-competitive effects under Pareto; Small pro-competitive effects under alternative productivity distributions.
  - If the preference is homothetic, then welfare is captured by the local ACR formula.
- Edmond, Midrigan, and Xu (2015) quantitatively assess pro-compeititve effect using a heterogenous product Cournot competition model in which markups are linked with trade flows.
  - Sizable pro-competitive effects.
  - Total welfare gains are well captured by the ACR formula.
- Feenstra and Weinstein (2016) find that pro-competitive effects account for 50% in a model of translog preference under monopolistic competition. But, again the total gains is captured by the ACR formula.

Preview of Main Results (Total and Decomposition)

- Total gain from the improved openness during 1995-2004 is 9.4%, and the pro-competitive effects account for 25.4% of the total welfare gains.
- The total gains are 17˜24% larger than what would be predicted by the ACR formula, and these are mostly due to the pro-competitive effects.
- This is because in head-to-head competition, changes in markups are not tied with the changes in trade flows.

Preview of Main Results (Multiple Sector)

- Three steps of understanding the 9.4% gain.
  - Large trade cost reduction (from 2.31 to 1.66).
  - Smaller trade elasticity (-2.48 and -3.23) by accounting for Micro data (Similar to Simonovska and Waugh 2014).
  - Pro-competition effects add gains over the ACR formula due to head-to-head competition.
- We extend the model to a multiple sector case, and ask whether China liberalized the right sectors?
  - Answer: Yes, because there is a tendency that when a sector has a higher markup, there is a larger degree of trade liberalization.
  - Welfare improves because the markup dispersion across sectors is reduced.

Contributions in Quantitative Approach

- As the focus is on markups, we use moments on markups and SMM to discipline model parameters.
- We use Chinese firm-level data in 1995 and 2004 and implement an asymmetric-country estimation.
  - Asymmetry is important for China (productivity, competition, wage differential)
  - We separate moments of exporters and non-exporters to help identify the parameters of the ROW (rest of the world).
  - A comparison with symmetric-country implementation shows that the gains from trade are significantly smaller.

Contributions in Quantitative Approach

- Our quantitative approach is applicable to countries of any size.
  - In Edmond et al. (2015), markups are directly linked to **market shares** of firms.
  - Taiwanese data work well for their oligopoly environment because they can go down to very fine product level to look at with a few firms.
  - In large countries, due to numerous firms in a given "industry", market share per firm is typically small, and the market structure looks less concentrated and pro-competitive effects dissipate.
  - This is not to say pro-competitive effects do not exist for large countries. Rather, it may be that there are several markets within a large country, but we simply don't know how to separate them.
  - Our approach allows an oligopoly structure to work even in the presense of hundreds or thousands of firms in an industry, as markups are inferred rather than linked with industrial/product classifications.

Related Literature

- BEJK doesn't allow pro-competitive effects.
- Comparison with Holmes et al. (2014), our work differs in:
    - quantify pro-competitive effects with Chinese data;
    - provide theoretical and quantitative analyses on the link to the ACR formula and how that head-to-head competition adds extra gains
    - we use multi-sector analysis to show how cross-sector markup dispersion matters.
- Markusen (1981) shows that in an environmemnt with *head-to-head Cournot competition* and symmetric countries, trade can reduce markup dispersion and thus enhance welfare without generating trade flows.
- Broadly related to de Blas and Russ (2012), Goldberg, De Loecker, Khandelwal and Pavcnik (2015), Restuccia and Rogerson (2008) and Hsieh and Klenow (2009).......

Model: Consumption

- A continuum of goods, and each good indexed by $\omega \in [0, \gamma]$:
  - γ is exogenous
  - Only $\bar{\omega} \leq \gamma$ measure of goods will be actually produced. (will be explained later)
- Assume CES utility.

$$U = \left(\int_0^{\bar{\omega}} q_\omega^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma}{\sigma-1}}, \text{ for } \sigma > 1.$$

- There are two countries, $i = 1$ (China), 2 (ROW).

Model: Consumption

- The standard CES price index in country j:

$$P_j \equiv \left(\int_0^{\bar{\omega}} p_{j\omega}^{1-\sigma} d\omega \right)^{\frac{1}{1-\sigma}} .$$

- Country j's total consumption expenditure of good ω is given by

$$E_{j\omega} = R_j \left(\frac{p_{j\omega}}{P_j} \right)^{1-\sigma} ,$$

where $\left(\frac{p_{j\omega}}{P_j} \right)^{1-\sigma}$ is expenditure share on good ω, and R_j is the total revenue, as well as total income, of country j.

Number of Firms and Measure of Goods

- The number of firms for each good $\omega \in [0, \gamma]$ in country i is a random realization from Poisson distribution with parameter λ_i:

$$f_i(n) = \frac{e^{-\lambda_i} \lambda_i^n}{n!}.$$

- The actual number of goods produced $\bar{\omega} < \gamma$ is the complement set of the event $(n_1, n_2) = (0, 0)$. Formally,

$$\bar{\omega} = \gamma \left(1 - f_1(0) f_2(0)\right) = \gamma \left[1 - e^{-(\lambda_1 + \lambda_2)}\right]. \quad (2)$$

- In the event $(n_1, n_2) = (0, 1)$ or $(1, 0)$: monopoly.

- If $n_1 + n_2 \geq 2$, then firms engages in **Bertrand competition**.

Productivity, Marginal Cost, and Pricing

- Production features constant returns to scale.
- Labor is the only input.
- Each potential competitor draws a productivity $\varphi_{\omega,ik}$ from a log-normal distribution so that for $k \in \{1, 2, ..., n_{\omega,i}\}$,

$$\ln\left(\varphi_{\omega,ik}\right) \sim N\left(\mu_i, \eta_i\right).$$

- In $n_{\omega,i}$ draws, let $\varphi^{*}_{\omega,i}$ and $\varphi^{**}_{\omega,i}$ be the first and second highest.

Productivity, Marginal Cost, and Pricing

- Shipping domestically is free, but shipping to foreign countries requires an iceberg cost $\tau > 1$.

$$\tau_{ij} = 1 \text{ if } i = j, \text{ and } \tau_{ij} = \tau > 1 \text{ if } i \neq j.$$

- For each ω, the relevant marginal costs to deliver to country j are

$$\left\{ \frac{\tau_{1j} w_1}{\varphi^{*}_{s\omega,1}}, \frac{\tau_{1j} w_1}{\varphi^{**}_{s\omega,1}}, \frac{\tau_{2j} w_2}{\varphi^{*}_{s\omega,2}}, \frac{\tau_{2j} w_2}{\varphi^{**}_{\omega,2}} \right\}.$$

- Let $a^{*}_{j\omega}$ and $a^{**}_{j\omega}$ be the lowest and second lowest elements of this set.

Productivity, Marginal Cost, and Pricing

- Monopoly pricing: $\bar{p}_{j\omega} = \frac{\sigma}{\sigma-1} a^*_{j\omega}$.
- Pricing:

$$p_{j\omega} = \min\left(\bar{p}_{j\omega}, a^{**}_{j\omega}\right) = \min\left\{\frac{\sigma}{\sigma-1} a^*_{j\omega}, a^{**}_{j\omega}\right\}.$$

- The markup of good ω at j is therefore

$$m_{j\omega} = \frac{p_{j\omega}}{a^*_{j\omega}} = \min\left\{\frac{\sigma}{\sigma-1}, \frac{a^{**}_{j\omega}}{a^*_{j\omega}}\right\},$$

General Equilibrium

- There are three conditions that pins down total revenues R_1, R_2, and equilibrium wage ratio $w \equiv w_2/w_1 = w_2$:
  - The labor market clearing condition in both countries.
  - Balanced trade condition, which is implied by the market clearing of commodities.

Aggregate Markups

- From the firms' viewpoint, if it is a nonexporter, then its markup is $m^f_{j\omega} = m_{\omega,j}$.
- For an exporter, constant returns to scale implies that its markup is a revenue-weighted average of markups in both countries.
- Welfare depends on the markups from both consumers' and producers' points of view, but the former is not directly observable.
- What we observe is firms' markups, which are useful for inferring structural parameters.
- **Consumers' aggregate markup** is the revenue-weighted harmonic mean across goods with *destination* at i.

$$M_i^{buy} = \left(\int_0^{\bar{\omega}} m_{\omega,i}^{-1} \phi_{\omega,i} d\omega \right)^{-1}.$$

- **Producers' aggregate markup** M_i^{sell} is defined in a similar way.

Welfare Decomposition

Let A_i be the price index under marginal cost pricing,

$$A_i = \int_0^{\bar{\omega}} a^*_{i\omega} \tilde{q}^m_{i\omega} d\omega,$$

where $\tilde{\mathbf{q}}^m_i = \{\tilde{q}_{\omega,i} : \omega \in [0,1]\}$ is the expenditure-minimizing consumption bundle that delivers one unit of utility. We can then write

$$\begin{aligned} W_i^{Total} &= \frac{R_i}{P_i} = w_i L_i \times M_i^{sell} \times \frac{1}{P_i} && (3) \\ &= w_i L_i \times \frac{1}{A_i} \times \frac{M_i^{sell}}{M_i^{buy}} \times \frac{A_i \times M_i^{buy}}{P_i} \\ &\equiv w_i L_i \times W_i^{Prod} \times \frac{M_i^{sell}}{M_i^{buy}} \times W_i^A, && (4) \end{aligned}$$

where W_i^{Prod} is *productive efficiency* index, and W_i^A is *allocative efficiency* index.

Welfare Decomposition

$$W_i^{Total} = w_i L_i \times \frac{1}{A_i} \times \frac{M_i^{sell}}{M_i^{buy}} \times W_i^A.$$

- We focus on country 1, and we will set $w_1 = 1$. As the labor supply L_i is fixed, the first term can be ignored.
- $W^{Prod} \equiv \frac{1}{A_i}$ is what the welfare index would be with constant mark-up. The index varies with **technological changes** (μ_i, η) or when **trade cost** (τ) changes declines. Terms of trade effects also show up in W^{Prod}, as **wages** also enter the marginal costs.
- It can be shown that this term traces the ACR statistics very closely.

Welfare Decomposition

$$W_i^{Total} = w_i L_i \times \frac{1}{A_i} \times \frac{M_i^{sell}}{M_i^{buy}} \times W_i^A.$$

- When markups are a constant, the third and fourth terms drop out.
- The third term is a "terms of trade" effect on mark-ups.
  - The higher the producers' aggregate markups, or the lower the consumers' aggregate markup, the higher the welfare.
  - This term drops out under autarky.
  - It also drops out under symmetric countries.

Welfare Decomposition

$$W_i^A \equiv \frac{A_i \times M_i^{buy}}{P_i} = \frac{\int_0^{\bar{\omega}} a_{i\omega}^* \tilde{q}_{i\omega}^a d\omega}{\int_0^{\bar{\omega}} a_{i\omega}^* \tilde{q}_{i\omega} d\omega} \leq 1.$$

- Under marginal cost pricing, $\tilde{q}_{\omega,i}^a$ is the optimal bundle, and hence $\int_0^{\bar{\omega}} a_{i\omega}^* \tilde{q}_{i\omega}^a d\omega \leq \int_0^{\bar{\omega}} a_{i\omega}^* \tilde{q}_{i\omega} d\omega$.
- Under constant markups, for any pair of goods, the ratio of actual prices equals the ratio of marginal cost, and hence, $W_i^A = 1$.
- Those with higher markups produce/employ less than optimal, and those with low markups produce/employ more than optimal.

Data

- Economic census from China's NBS (National Bureau of Statistics) data (1995 and 2004).
- From World Bank's WDI (World Development Indicators), obtain world manufacturing GDP and GDP per capita.
- The aggregate Chinese trade data is from UN comtrade.
- Combine data of GDP per capita and labor income share to calculate $w = w_2/w_1$.
- Tariff data from WITS.

Estimation of Markups

- We estimate markups using De Loecker and Warzynski's (2012) approach, which calculate markups as

$$m_\omega^{\mathrm{DLW}} = \frac{\theta_\omega^X}{\alpha_\omega^X},$$

where θ_ω^X is the input elasticity of output of input X, and α_ω^X is the share of expenditure on input X in total sales.

- An alternative is to use CRS assumption and simply calculate markups by

$$m_\omega^{\mathrm{raw}} = \frac{\mathrm{revenue}_\omega}{\mathrm{total\ costs}_\omega},$$

which we call raw markups. We use this measure as a robustness check.

Estimated Markup Distribution

- Table 1.
- The (unweighted) mean markups all decrease between years 1995 and 2004 for all firms, exporters and non-exporters.
- The (unweighted) standard deviation of markups decreases for non-exporters, but it increases for exporters. As there are more non-exporters than exporters, the overall standard deviation decreases.
- For the percentiles, almost all of them decreases between 1995 and 2004. This is consistent with the pattern visually seen in Figure 1-3 that the entire distribution becomes more condensed.

Inference of the Elasticity of Substitution

- The model implies that
$$m \in \left[1, \frac{\sigma}{\sigma - 1}\right].$$
- When the second marginal cost is high, the markup is bounded by the monopoly one because the firm profits is still subject to the substitutibility between products. The higher the substitutibility (σ), the lower the bound.
- Considering the possibility of measurement error and outliers, we equate $\frac{\sigma}{\sigma-1}$ to the 99-percentile of estimated markup distribution.
- Result: $\sigma = 1.4$.
- This $\sigma = 1.4$ is strikingly similar to the estimate of the same parameter (1.37) in Simonovska and Waugh (2014) with optimal weighting matrix in their method of moments procedure.
- Under a constant-markup model and using the harmonic mean of firm markups in 1995, 1.26, this implies $\sigma = 4.86$. In the current model, this value of implies that $m \in [1, 1.26]$, which will cut 50.6% off the estimated markup distribution.

Simulated Method of Moments

- We use SMM to estimate the remaining parameters

τ :	trade cost
γ :	measure of goods
λ_i :	mean number of firms per product
μ_i :	mean parameter of log-normal productivity draw
η_i :	standard deviation parameter of log-normal productivity draw

- For productivity, we normalize $\mu_2 = 0$ (when $\ln \varphi$ is zero, $\varphi = 1$). This is because only the relative magnitude of μ_1 to μ_2 matters. Choosing μ_2 amounts to choosing unit.

- Given data moments of R_1, R_2, w and the inferred σ from markup distribution, we simulate 12 moments for each set of parameter $(\tau, \gamma, \lambda_1, \lambda_2, \mu_1, \eta_1, \eta_2)$.

- Table 2.

Counter-Factual Analysis

- We conduct counter-factuals under 2004 parameter values, and take τ to the 1995 value and to autarky (Table 3).
- The welfare gains from 1995's openness to 2004's level is 9.4%, in which the pro-competitive effect account for 25.4%.
- Allocative efficiency W^A alone accounts for 22.3% of these gains.
- $W^R = \frac{M^{\text{sell}}}{M^{\text{buy}}}$ accounts for 3.1%
  - decreases in both M^{sell} and M^{buy}, but that of M^{buy} is larger.
  - More trade openness benefits Chinese consumers by lowering the markups, but it also hurts Chinese firms' profits.
- Gains from trade from autarky is 33.4%, but the relative contributions of pro-competitive effects are similar (23.3% overall, 22.4% for W^A alone)

Comparison with the ACR formula

- **Proposition** 1: For infinitesimal changes in $\boldsymbol{\tau}$, the change in the productive efficiency W_j^{Prod} can be expressed as

$$d \ln W_j^{Prod} = \frac{1}{\tilde{\epsilon}_j^i} d \ln \tilde{v}_{jj},$$

  where $\tilde{\epsilon}_j^i$ and $\tilde{v}_{jj}$ are trade elasticity and domestic expenditure share under marginal cost pricing. When $\sigma = 1$ (Cobb-Douglas case), $\tilde{v}_{jj} = v_{jj}$, $\tilde{\epsilon}_j^i = \epsilon_j^i$, and $d \ln W_j^{ACR} = d \ln W_j^{Prod}$.
- This above doesn't hold for general $\sigma > 1$, and we need to evalute how close the ACR formula is either the total gains or the W^{Prod}.
- Table 5.

Comparison with the ACR formula

- Extra welfare gains over the ACR formula is around 17˜24%.

	(1, 1)	(1, 2)	(2, 1)	(2, 2)	$(\bar{1})$	$(\bar{2})$
markup	$\frac{\varphi_1^*}{\varphi_1^{**}}$	$\frac{\tau w \varphi_1^*}{\varphi_2^*}$	$\frac{\varphi_2^*}{\tau w \varphi_1^*}$	$\frac{\varphi_2^*}{\varphi_2^{**}}$	$\frac{\sigma}{\sigma-1}$	$\frac{\sigma}{\sigma-1}$
price	$\frac{1}{\varphi_1^{**}}$	$\frac{\tau w}{\varphi_2^*}$	$\frac{1}{\varphi_1^*}$	$\frac{\tau w}{\varphi_2^{**}}$	$\frac{\sigma}{\sigma-1}\frac{1}{\varphi_1^*}$	$\frac{\sigma}{\sigma-1}\frac{\tau w}{\varphi_2^*}$
markup affected by τ	No	Yes	Yes	No	No	No
import affected by τ	No	No	No	Yes	No	Yes

- Trade elasticities at the estimated models in 1995 and 2004 are -2.48 and -3.23, respectively.
- Simonovska and Waugh (2014) obtain a trade elasticity (θ) of -2.74 or -3.21 under the BEJK model.

Symmetric Countries

- For the purpose of comparison, we also estimate a symmetric country case. Tables 6 & 7.
- $W^R = 1$ always in this case, and W^A accounts for 23.7˜31.4% of the total effects.
- The gains from trade, as well as its components, are smaller in symmetric-country case.
    - As productivity draws between the two countries become the same, the Ricardian gains are reduced.
    - When two countries are the same in their productivity draws and entries, not only the distribution of markups becomes more similar, but the dispersion of markups becomes smaller.

Robustness

- The relative contribution of pro-competitive effects remains similar to the following robustness checks
  - Based on 1995 estimates and taking τ to 2004 level or autarky.
  - Using a raw measure of markups:
    $$m = \frac{\text{revenue}}{\text{total costs}}.$$
  - Using 97.5%-tile to infer σ.
  - Trade Imbalance.

Multi-Sector Economy

- For robustness check, we also extend the model to a multiple-sector one to take into account the cross-sector heterogeneity in trade costs, as well as in productivity distribution, entry pressures, and preference parameters.
- The inferred/estimated parameters show a substantial variation across sectors. But, the general pattern of the changes in parameters between 1995 and 2004 still hold true. (Table 9A and 9B)
- The welfare analysis results are similar to the one-sector economy case, although the magnitude is somewhat smaller (Table 10).
  - The total gains reduces from 9.4% to 7.2%, and the relative contribution of the pro-competitive effect reduces from 25.4% to 20.0%.

Did China Trade-Liberalize the Right Sectors?

- If a sector has a higher M_{1s}^{buy} at 1995, do we also actually see a larger degree of trade liberalization between 1995 and 2004?
  - Most pro-competitive gains from trade are due to allocative efficiency.
  - If a sector s has higher M_{1s}^{buy} initially, then allocative efficiency would improve more if the government targets its trade liberalization more in these higher-markup sectors because this reduces the dispersion of markups across sectors.
- Rank the 29 sectors by their values of M_{1s}^{buy} at 1995 and divide them into two groups (15 and 14).
  - Average M_{1s}^{buy} are 1.21 and 1.36. Average changes in trade costs τ_s (i.e, $\Delta\tau_s = \tau_{s,2004} - \tau_{s,1995}$) are -0.446 and -0.856.
  - If we measure trade liberalization by sectoral import tariffs, the corresponding changes are -0.162 and -0.215, respectively.

Did China Trade-Liberalize the Right Sectors?

- Table 11.
- We are not asking a causal question. We don't know how this happened exactly. Perhaps a benevolent government or it could be mechanical because
  - Before entering WTO, there was a large degree of variation in the import tariff in China.
  - The conditions of WTO entry generally requires larger tariff reductions in those industries with higher initial tariffs (see, e.g., Lu and Yu 2015).

Conclusion

- Total gains from such improved openness during 1995-2004 is 9.4%.
- The pro-competitive effects account for 25.4% of the total gains.
- Allocative efficiency plays a much more important role than the relative markup effect.
- Local to the estimated models in 1995 and 2004, we find that total gains from trade is larger than the gains predicted by the ACR formula by $17 \sim 24\%$.
  - These additional gains are mostly from pro-competitive effects.
  - This is a result that is absent in models when a firm monopolizes a variety, such as in EMX or Feenstra and Weinstein (2016) and ACDR with homothetic preference.
  - In head-to-head competition, changes in markups are not necessarily reflected in trade flows.

Conclusion

- Lower trade elasticities in our estimated models also contribute to the larger gains in a similar fashion to Simonovska and Waugh (2014).
- The gains from trade and its components are substantially smaller in the symmetric-country case, indicating the important role played by the differences in productivities and markups.
- Our approach of separating moments from exporters and non-exporters prove to be instrumental in implementing asymmetric-country estimation.
- Exploiting the variations in sectoral markups and trade costs, we find that China on average liberalized the "right" sectors.