Taking Stock of Trade Policy Uncertainty: Evidence from China’s Pre-WTO Accession

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Two Main Questions about Trade & Trade Policy

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Explore these inter-related questions with US renewal of China’s MFN Status
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Explore these inter-related questions with US renewal of China’s MFN Status

Innovation: use within-year variation in future tariff risk from political process.
1. Show imports rise with TPU in monthly trade flows (anticipatory stockpiling).
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2. Quantify role of expected tariffs vs uncertainty in sS inventory model.
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2. Quantify role of expected tariffs vs uncertainty in sS inventory model.

3. Estimate annual non-renewal probability (6 percent).
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2. Quantify role of expected tariffs vs uncertainty in sS inventory model.

3. Estimate annual non-renewal probability ( 6 percent).

4. Show stockpiling behaviour accounts for 30 percent of TPU effects in annual data.
Main idea: Anticipated Risk of a 10% Tariff Hike
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- sS inventory model with many firms importing & reselling a foreign input.
- Assume tariffs expected to rise by 10 percent in 12 months with probability, $\pi$
  - But, tariff $\Delta$ not realized.
- Firms will shift timing of imports to avoid importing when tariffs are high.
- Strength of shifting rises in tariffs.
- Only affects imports in narrow window around possible tariff $\Delta$. 
Main idea: Anticipated Effect of Risky 10% Tariff Hike
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Imports, log

News

Shock

- 0% Prob
- 20% Prob
- 50% Prob
Main idea: Anticipated Effect of Risky 10% Tariff Hike
Literature

- **Trade Policy Uncertainty**
  - New mechanism: *Incumbents ordering decisions.*
Literature

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- **Anticipation to Policy Changes**
  Coglianese et al. (2017), Agarwal et al. (2017), Baker et al. (2018), Fajgelbaum et al. (2019), Khan & Khederlarian (2019)
  - *Evidence of stockpiling in anticipation of TPU*
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  - *Evidence of stockpiling in anticipation of TPU*

- **Inventories & Trade**
  - *First moment drives majority of the uncertainty effect*
Outline

Empirical Evidence

Model

Model Implied Probability of MFN Status Reversal

Uncertainty vs Expected Tariff Change

Effect on Annual Trade Flows
Outline

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Effect on Annual Trade Flows
Background US Tariff Treatment of China

- Non Normal Trade Relation (NNTR) rates to communist countries.

- 1974 onward: MFN status conditional on annual renewal by President.
  - For China, temporary MFN status expired annually every 3rd of July.

- 1980: EU grants China MFN unconditionally.

- 1990 onward: Congress considers disapproving renewal within 60 days.
  - Ex-post, MFN status was always renewed.

- 10/2000: Congress grants Permanent NTR upon joining WTO.

- 12/2001: China enters the WTO.
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TPU before WTO Accession

Features of China MFN renewal helpful to answer our two questions
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- **When?** Every year after Presidential renewal and Congress vote.
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- **How much?** NNTR Rate - MFN Rate.
  - NNTR rates set in 1930, time-invariant
Features of China MFN renewal helpful to answer our two questions

- **When?** Every year after Presidential renewal and Congress vote.

- **How much?** NNTR Rate - MFN Rate.
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- **How likely?** Use anticipatory dynamics to study likelihood.
Empirical Approach

- Consider trade dynamics around MFN renewal decisions
- Use differences in growth of US imports from China relative to other countries
- In the background we have a nested CES aggregator determining purchases of goods by firms from specific countries.
Empirical Approach

- Within-year trade growth rates \( \ln \left( \frac{v_{i,j,z}^{t,m-2:m}}{v_{i,j,z}^{t,m-7:m-5}} \right) \)
  - \( v_{i,j,z}^{t} \) monthly averages of imports (CIF consumption value) from i to j of good z.
  - Cancels out year FE.

- Tariff risk, \( X_{z,t} \equiv \ln \left( \frac{1 + \tau_{NNTR,z,t}}{1 + \tau_{MFN,z,t}} \right) \).


- Product \( z \) at HS 6-digit level, balanced panel of 1812 products.
Empirical Approach

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- Product $z$ at HS 6-digit level, balanced panel of 1812 products
Cross-sectional Distribution

Fraction

NNTR Gap (NNTR-MFN)
Identification Challenges

1. Lumpiness
   - Aggregate across time and products

2. Product specific seasonalities.
   - Sector-Month FE.

   - Reference exporter $j$, RoW (135 countries): Unconditional MFN rates.
   - Reference importer $i$, EU-12: Unconditional MFN rates to both exporters.
   - Importer-Month-Year FE & Exporter-Month-Year FE
Identification Challenges

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Estimation Equation

\[
\ln\left( \frac{v_{i,j,z,t}^{m-2:m}}{v_{i,j,z,t}^{m-7:m-5}} \right) = \sum_{m'} \beta_{m'}^{TPU} \mathbb{1}\{i=US, j=China\} \mathbb{1}\{m=m'\} X_{z,t} \\
+ \sum_{m'} \beta_{m} X_{z,t} \\
+ \gamma_{i,t,m} + \gamma_{j,t,m} + \gamma_{s,m} + \varepsilon_{i,j,z,t,m}
\]

- Anticipation: \( \beta_{m}^{TPU} > 0 \) for months before uncertainty resolution
Baseline Result

See $\hat{\beta}_m$
Magnitude: Certain vs Uncertain Changes

- For median uncertain tariff increase, 31% relative to monthly average
  - Before uncertainty resolution, imports rise 10% (anticipatory elasticity = 0.35)
  - After resolution imports fall 5% (resolution elasticity = -0.2)

- For median certain tariff cut of 3% from NAFTA's phase-outs Khan & Khederlian (19)
  - Before resolution, imports fall 15% (anticipatory elasticity = 5)
  - After resolution imports rise 22.5% (resolution elasticity = -7.5)
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Robustness

- Fixed Effects.

- Growth windows: base window, size of window.

- Prices vs Quantities.

- Alternative dependent variables.
Post-WTO comparison

- Previously, sample limited to 1991-2000, now expand until 2005.

- Compare US-China trade flows previous to WTO Accession vs. all others.

\[
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+ \sum_{m'} \beta_{m'}^{Post} \mathbb{1}\{i=US, j=China\} \mathbb{1}\{m=m'\} X_{z,t} \\
+ \sum_{m'} \beta_{m'} \mathbb{1}\{m=m'\} X_{z,t} \\
+ \gamma_{i,m} + \gamma_{j,m} + \gamma_{s,m} + \varepsilon_{i,j,z,t,m}
\]
Pre-relative to Post-WTO

See $\beta_{Post}$
Anticipation & Storability

- Anticipatory effects will be larger for goods that are more storable. Of course, all traded goods are storable to some extent.
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- Use trade lumpiness of US imports from RoW over 1991-2000 at HS-6 level.

\[
HH_{z,i,t} = \sum_{m=1}^{12} \left( \frac{v_{i,z,t,m}}{\sum v_{i,z,t,m}} \right)^2 \in \left[ \frac{1}{12}, 1 \right]
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- Estimate \( HH_z \) by washing out country-year fixed effects.
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- Estimate \( HH_z \) by washing out country-year fixed effects.

- Consider \( 1/HH_z \) - the effective number of months w/ shipments

- Lower \( 1/HH_z \) \( \implies \) more storability
\[ \ln(\frac{v_{i,j,z,t}^{m-2:m}}{v_{i,j,z,t}^{m-7:m-5}}) = \sum_{m'} \beta_{m'}^{HH} \mathbb{1}\{i=US, j=China\}\mathbb{1}\{m=m'\}[1/HH_z] \times X_{z,t} \\
+ \sum_{m'} \beta_{m'}^{TPU} \mathbb{1}\{i=US, j=China\}\mathbb{1}\{m=m'\} X_{z,t} \\
+ \sum_{m'} \beta_{m'} \mathbb{1}\{m=m'\} X_{s,t} \\
+ \gamma_{i,m} + \gamma_{j,m} + \gamma_{s,m} + \varepsilon_{i,j,z,t,m} \]
Anticipation & Storability
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Empirical Evidence

Model

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Uncertainty vs Expected Tariff Change

Effect on Annual Trade Flows
Model

- Consider (s,S) inventory model (Alessandria, Kaboski, & Midrigan, 2010)

- Continuum of monopolistic importers differentiating and reselling foreign intermediate with stock (s)
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- Continuum of monopolistic importers differentiating and reselling foreign intermediate with stock \((s)\)

- Fixed import cost \((f)\), demand uncertainty \((\sigma_\nu)\) & one-month delivery lag

- Per unit price \(\tau > 1\) possibly stochastic.
Model

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▶ Holding costs: Interest \((\beta)\) and depreciation \((\delta)\)
Model

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- Demand faced by the importer is

\[
q_j = e^{\nu_j} p_j^{-\sigma}, \text{ where } \nu_j \sim N(0, \sigma_\nu)
\]
Model: No Trade Policy Shocks

- Importer decides between importing or not importing

\[ V(s, \nu; \tau) = \max[V^a(s, \nu; \tau), V^n(s, \nu; \tau)] \]

\[ V^a(s, \nu; \tau) = \max_{p, i > 0} q(p, s, \nu)p - \tau i - f + \beta EV(s', \nu'; \tau) \]

\[ V^n(s, \nu; \tau) = \max_{p > 0} q(p, s, \nu)p + \beta EV(s', \nu'; \tau) \]

subject to

\[ q(p, s, \nu) = \min(e^{\nu} p^{-\sigma}, s) \]

\[ s' = \begin{cases} (1 - \delta)[s - q(p, s, \nu) + i] & \text{if import} \\ (1 - \delta)[s - q(p, s, \nu)] & \text{o/w} \end{cases} \]
Stationary Decisions Rules (constant tariff)

Order ←→ Do not order

Demand Shock ($\nu$)

Inventory / Sales$_{ss}$

Pricing	 Calibration
Model: Trade Policy Shocks

- Importer decides between Importing or not importing

\[ V_t(s, \nu, \tau) = \max[V^a_t(s, \nu, \tau), V^n_t(s, \nu, \tau)] \]

\[ V^a_t(s, \nu, \tau) = \max_{p, i > 0} q(p, s, \nu) p - \tau i - f + \beta E V^i_{t'}(s', \nu', \tau') \]

\[ V^n_t(s, \nu, \tau) = \max_{p > 0} q(p, s, \nu) p + \beta E V^i_{t'}(s', \nu', \tau') \]

- Where \( \tau \in \{1, 1 + X_z\} \)

- Let \( \Pi^\tau \) be the transition matrix for \( \tau \)
Model: Trade Policy Uncertainty Shock

- All firms start with $\tau = 1$

- Make transition matrix time specific, $\Pi^\tau_t$

- Firms anticipate a change in $\tau$ in period $m_{res} + 1$ when the uncertainty resolves

\[
\Pi^\tau_t = \begin{cases} 
I_{|T|} & \text{if } t \neq m_{res} \\
\tilde{\Pi}^\tau & \text{if } t = m_{res}
\end{cases}, \quad \tilde{\Pi}^\tau = \begin{bmatrix} (1 - \pi) & \pi \\ 0 & 1 \end{bmatrix}
\]
Decisions Rule - Ordering Cutoffs
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![Graph showing the relationship between Demand Shock (\(\nu\)) and Inventory / Sales (\(\text{SS}_{\text{SS}}\)). The graph compares Initial SS and 12 Months before.](image-url)
Decisions Rule - Ordering Cutoffs

![Graph showing demand shock (v) vs. inventory/sales (ss) for different time periods: Initial SS, 12 Months before, and 3 Months before. The graph illustrates the cutoff points for decision making.](image-url)
Decisions Rule - Ordering Cutoffs

![Graph showing demand shock vs. inventory/sales ratio with different time periods: Initial SS, 12 Months before, 3 Months before, and 1 Month before.]
Path of Imports by NTR gap - 10% probability
Path of Inventories by NTR gap - 10% probability
Outline

Empirical Evidence

Model

Model Implied Probability of MFN Status Reversal

Uncertainty vs Expected Tariff Change

Effect on Annual Trade Flows
Measuring Likelihood of MFN Reversal

- Estimate average and time-varying probability of non-renewal, $\pi_t$
- Need to match product-level variation in tariff gaps and trade flows
- But, the seasonal is related to industry structure, tariff gap and industry characteristics (storability)
Calibration

- Balanced data panel consists of 1812 products

- Classify products into bins (h) of 4 products by NNTR gap
Measuring Likelihood of MFN Reversal

1. Generate 453 simulations facing tariff hike of $X_h$ with probability $\pi$. Calibrate $\delta_h$ to match monthly concentration of annual imports in product $h$. 

2. Estimate:

$$\ln\left(\frac{v_{h_m}^{\text{res}} - 2}{v_{h_m}^{\text{res}} - 5}\right) = \beta_{\text{sim}1} X_h + \beta_{\text{sim}2} \delta_h + \epsilon_h$$

3. Iterate over $\pi$ until $\beta_{\text{sim}1} = \hat{\beta}_{\text{US, CHN}} = 0$.

Average model-implied expected likelihood of reversal: $\hat{\pi} = 6\%$
Measuring Likelihood of MFN Reversal

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2. Estimate:

$$\ln\left(\frac{v_{m_{res}-2:m_{res}}^h}{v_{m_{res}-5:m_{res}-7}^h}\right) = \beta_{1}^{sim} X_h + \beta_{2}^{sim} \delta_h + \epsilon_h$$
Measuring Likelihood of MFN Reversal

1. Generate 453 simulations facing tariff hike of $X_h$ with probability $\pi$. Plot
   - Calibrate $\delta_h$ to match monthly concentration of annual imports in product $h$.

2. Estimate:
   \[
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   \]

3. Iterate over $\pi$ until $\beta_1^{sim} = \hat{\beta}^{US,CHN} = 0.35$
Measuring Likelihood of MFN Reversal

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Measuring Likelihood of MFN Reversal: Annual Probabilities

- Redo previous exercise year-by-year to construct annual probability
Measuring Likelihood of MFN Reversal: Annual Probabilities

- Redo previous exercise year-by-year to construct annual probability

  ⇒ Between 1990-2001: \( \hat{p} \in [2.4\%, 11\%] \)

- Compare annual probability to news-based measures of non-renewal
Annual Probabilities of Revoked Access to MFN Rates

![Graph showing annual probabilities of revoked access to MFN rates over years from 1991 to 2000. The graph includes two lines: one for the implied probability of revocation (\( \pi \)) and one for the percentage of news articles (PS, 2016).](image)
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Effect on Annual Trade Flows
Role of Uncertainty vs. First Moment Shock: Model I

Reconsider uncertainty vs. expected tariff $\Delta$: separate 1st & 2nd moment in model.

1. Generate $h$ simulations facing tariff hike of $\hat{\pi}_X$ with probability $\pi$.
2. Estimate:
   $$\ln(v_{hmres} - 2: mres/v_{hmres} - 5: mres - 7) = \beta_{sim1} X_h + \beta_{sim2} \delta_h + \epsilon_h \Rightarrow$$
   Anticipatory response under certainty: $\hat{\beta}_{sim1} = 0$.

$\Rightarrow$ Uncertainty dampens anticipation - “wait and see”.

$\Rightarrow$ Expected trade costs explains around 3/4 of trade response.
Role of Uncertainty vs. First Moment Shock: Model I

Reconsider uncertainty vs. expected tariff $\Delta$: separate 1st & 2nd moment in model.

1. Generate $h$ simulations facing tariff hike of $\hat{\pi}X_h$ with probability $\pi = 1$.

2. Estimate:

$$\ln\left(\frac{v^h_{m_{res}-2:m_{res}}}{v^h_{m_{res}-5:m_{res}-7}}\right) = \beta_1^{sim}X_h + \beta_2^{sim}\delta_h + \varepsilon_h$$

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Uncertainty vs Expected Tariff Change

Effect on Annual Trade Flows
Effect of Stockpiling on Annual Flows

- Reconsider source of trade dampening effects of TPU (Handley & Limao, 14)

\[
\ln(v_{i,j,z,t}) = \beta \mathbb{1}_{(i,j)=(US,Chn)} \mathbb{1}_{\{t\in Pre\}} X^{HL}_{z,t} + \delta_{i,s,t} + \delta_{j,z,t} + \delta_{i,j,t} + \varepsilon_{i,j,z,t}
\]

- But, stockpiling \Longrightarrow higher holding costs \Longrightarrow lower annual trade

\[
\ln(v_{i,j,z,t}) = \beta \mathbb{1}_{(i,j)=(US,Chn)} \mathbb{1}_{\{t\in Pre\}} X^{HL}_{z,t} + \gamma \ln(HH_{i,j,z,t}) + \delta_{i,s,t} + \delta_{j,z,t} + \delta_{i,j,t} + \varepsilon_{i,j,z,t}
\]

Where

\[
X^{HL}_{z,t} = \left( \frac{1 + \tau^{NNTR}_{z,t}}{1 + \tau^{MFN}_{z,t}} \right)^{-\sigma}
\]
Controlling for Lumpiness

<table>
<thead>
<tr>
<th>Dep Variable $\ln(v_{i,j,z,t})$</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1{(i,j)=(US,China)}1{t\in Pre} \times X_{z,t}^{HL}$</td>
<td>0.41***</td>
<td>0.72***</td>
<td>0.20***</td>
<td>0.23***</td>
</tr>
<tr>
<td></td>
<td>(0.13)</td>
<td>(0.06)</td>
<td>(0.07)</td>
<td>(0.07)</td>
</tr>
<tr>
<td>Adj $R^2$</td>
<td>0.76</td>
<td>0.76</td>
<td>0.76</td>
<td>0.49</td>
</tr>
</tbody>
</table>

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Model
Controlling for Lumpiness

<table>
<thead>
<tr>
<th>Dep Variable $\ln(v_{i,j,z,t})$</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1{(i,j)={(US,China)}}1{t\in Pre} \times X_{z,t}^{HL}$</td>
<td>0.41***</td>
<td>0.72***</td>
<td>0.20***</td>
<td>0.23***</td>
</tr>
<tr>
<td></td>
<td>(0.13)</td>
<td>(0.06)</td>
<td>(0.07)</td>
<td>(0.07)</td>
</tr>
</tbody>
</table>

| Adj $R^2$                        | 0.76 | 0.76 | 0.76 | 0.49 |

| $1\{(i,j)={(US,China)}\}1\{t\in Pre\} \times X_{z,t}^{HL}$ | 0.31*** | 0.48*** | 0.16*** | 0.13*** |
|                                                             | (0.05) | (0.02) | (0.03) | (0.03) |

| $\ln(HH_{i,j,z,t})$                             | -1.94*** | -1.95*** | -1.94** | -2.65*** |
|                                                 | (0.01) | (0.01) | (0.01) | (0.01) |

| Adj $R^2$                        | 0.86 | 0.86 | 0.86 | 0.75 |

| Reduction                      | 24% | 33% | 20% | 43% |

| Observations                    | 234294 | 234294 | 234294 | 252582 |

*Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Model
Mechanism at work: US and UK

- Trade policy uncertain since Brexit & US election
- Tariffs have been rising in US and China but with more on the horizon
- Observed rising stocks and robust economic growth
Mechanism at work: Brexit
Mechanism at work: UK & Euro Area

UK & Euro Area Inventory to Production

- UK
- EURO Area

Time periods: 2014m1 to 2020m1
Mechanism at work: UK

UK Trade and Output

- Trade
- Mfr IP

Time:
- 2016m1
- 2017m1
- 2018m1
- 2019m1
- 2020m1

Last date: 02/20; Relative to 18Q4; Source: OECD MEI
Mechanism at work: UK

UK Trade and Output

Trade
Mfr IP

Last date: 02/20; Relative to 18Q4; Source: OECD MEI
Mechanism at work: Covid-19

- An uncertain future demand shock will generate similar stockpiling.

\[
q_t = p_t^{-\sigma} e^{\nu_t}
\]

\[
\nu_t = \rho \nu_{t-1} + \alpha_0 \varepsilon_t + \alpha_1 \varepsilon_{t-1}
\]

- Use storability of goods used for infectious diseases (Ventilators, PPE, etc) to estimate country-specific expectations of Covid-spread \((\rho, \alpha_0, \alpha_1)\)

- Alternative real-time monitor of global health & policy response.
Mechanism at Work: Covid-19

Graph showing the growth in product share for Ventilators and Surgical Gloves over a bimonthly period starting in 2019.
Conclusion

- New approach to quantifying TPU leveraging *near-term* TPU using *monthly* data.
  - Bundling with other decisions to get full path of expected tariffs.

- Robust evidence of anticipation to TPU for this episode.

- Model implies low and decreasing probability of revoking MFN status.

- Expected tariff more important than uncertainty in ordering decisions.

- Important for the recent world - aggregate effects?
<table>
<thead>
<tr>
<th>Year</th>
<th>Disapproval Res.</th>
<th>Final Status</th>
<th>Alternate bills</th>
<th>Final Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>None</td>
<td>—</td>
<td>None</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Vetoed by President 3/2</td>
<td>House override vote 3/11 (357-61)</td>
<td>Senate override vote 3/18 (60-38) - veto sustained</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S. 2808</td>
<td>Senate amended with text of S. 2808, passed by voice vote, 9/14</td>
<td>H.R. 5318 vetoed by President, 9/28</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S. 1367</td>
<td>Passed H.R. 2212 in lieu 7/18 (55-44)</td>
<td>House override vote 9/30 (345-74)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>H.R. 3584</td>
<td>Senate override vote 10/1 (59-40) - veto sustained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1993</td>
<td>H.J.Res. 208</td>
<td>House rejected 6/8 (103-318)</td>
<td>H.R. 1835</td>
<td>No action</td>
</tr>
<tr>
<td></td>
<td>S. 806</td>
<td></td>
<td>S. 806</td>
<td></td>
</tr>
<tr>
<td>1994</td>
<td>H.J.Res. 373</td>
<td>House rejected 8/9 (75-356)</td>
<td>H.R. 4590</td>
<td>Amended to impose no conditions, then passed House 6/8 (280-152)</td>
</tr>
<tr>
<td></td>
<td>S.J.Res. 37</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S.J.Res. 56</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td>H.J.Res. 79</td>
<td>House rejected 6/24 (173-259)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>S.J.Res. 31</td>
<td>—</td>
<td></td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>S.Amdt. 890*</td>
<td>—</td>
<td></td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Senate rejected 7/16 (22-77)</td>
<td>*(S.Amdt. 890 expressed the sense of the Senate that China’s MFN status should be revoked. It was offered as non-binding language to S. 955, the FY1998 Foreign Operations Appropriations bill.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>H.J.Res. 121</td>
<td>House rejected 7/22 (166-264)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1999</td>
<td>H.J.Res. 57</td>
<td>House rejected 7/27 (170-260)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>S.J.Res. 27</td>
<td>Senate rejected motion to discharge committee 7/20 (12-87)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>2000</td>
<td>H.J.Res. 103</td>
<td>House rejected 7/18 (147-281)</td>
<td>H.R. 4444</td>
<td>House passed 5/24 (237-197)</td>
</tr>
<tr>
<td></td>
<td>S. 2277</td>
<td>Senate passed H.R. 4444 on 9/19 (85-13)</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>
Note: Spread percentiles are calculated each year over NAICS Industries. Gaps are means over HS-8 Product lines from Pierce & Schott (2016).
Note: NNTR Gaps are means over HS-8 Product lines from Pierce & Schott (2016). The HH indexes are calculated as the mean HH index of the US imports from China in the second year a product line appears in the sample.
Note: The HH indexes are calculated as the mean HH index of the US imports from China in the second year a product line appears in the sample.
Stationary Pricing Decision

Figure 3: Optimal Price Functions

- Import
- Do not import
- Excess inventories

(price vs. beginning-of-period inventories (relative to mean sales))
<table>
<thead>
<tr>
<th><strong>Parameter</strong></th>
<th><strong>Value</strong></th>
<th><strong>Source</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta$</td>
<td>0.97</td>
<td>St. Louis Fed</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>4</td>
<td>Literature</td>
</tr>
<tr>
<td>$f$</td>
<td>0.095</td>
<td>Match HH index</td>
</tr>
<tr>
<td>$\mu$</td>
<td>1 pd</td>
<td>AKM</td>
</tr>
<tr>
<td>$\sigma_\nu$</td>
<td>0.8</td>
<td>AKM</td>
</tr>
<tr>
<td>$\delta$</td>
<td>30%</td>
<td>AKM</td>
</tr>
</tbody>
</table>

**Moments**

| **HH Index**                  | 0.32      | 75<sup>th</sup> pctile in data |
| Median Inventory-Sales        | 3.64 months |                            |
| Mean(Fixed Cost/Revenue)      | 6.8%      |                            |
Note: Crosses are point estimates from the baseline estimating equation. Blue are estimates for $\hat{\beta}_TPU$, red are estimates $\hat{\beta}_m$. Lines is the applied locally weighted scatterplot smoother. Dashed lines are the 90% confidence interval. Standard errors are clustered at HS-6 product level.
Note: Crosses are point estimates from the baseline estimating equation. Blue are estimates for $\hat{\beta}_m^{TPU}$, red are estimates $\hat{\beta}_m^{Post}$. Lines is the applied locally weighted scatterplot smoother. Dashed lines are the 90% confidence interval. Standard errors are clustered at HS-6 product level.
## Annual Probabilities

<table>
<thead>
<tr>
<th>Year</th>
<th>( \max_m { \hat{\beta}_{m}^{TPU} } )</th>
<th>( \hat{\pi} )</th>
<th>( \hat{\beta}_{m=9}^{TPU} )</th>
<th>( m_{max} )</th>
<th>Peak-to-Trough</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>0.61***</td>
<td>10.4%</td>
<td>0.52***</td>
<td>October</td>
<td>1.02***</td>
</tr>
<tr>
<td>1992</td>
<td>0.41***</td>
<td>7.0%</td>
<td>0.41***</td>
<td>September</td>
<td>0.57***</td>
</tr>
<tr>
<td>1993</td>
<td>0.51**</td>
<td>8.7%</td>
<td>0.47***</td>
<td>August</td>
<td>0.89***</td>
</tr>
<tr>
<td>1994</td>
<td>0.65***</td>
<td>11%</td>
<td>0.45***</td>
<td>October</td>
<td>0.88***</td>
</tr>
<tr>
<td>1995</td>
<td>0.46***</td>
<td>7.9%</td>
<td>0.46***</td>
<td>September</td>
<td>0.82***</td>
</tr>
<tr>
<td>1996</td>
<td>0.50***</td>
<td>8.6%</td>
<td>0.47***</td>
<td>August</td>
<td>0.99***</td>
</tr>
<tr>
<td>1997</td>
<td>0.58***</td>
<td>9.9%</td>
<td>0.43***</td>
<td>August</td>
<td>0.83***</td>
</tr>
<tr>
<td>1998</td>
<td>0.26**</td>
<td>5.0%</td>
<td>0.23**</td>
<td>June</td>
<td>0.64***</td>
</tr>
<tr>
<td>1999</td>
<td>0.21***</td>
<td>3.6%</td>
<td>0.12</td>
<td>August</td>
<td>0.33***</td>
</tr>
<tr>
<td>2000</td>
<td>0.14*</td>
<td>2.4%</td>
<td>0.12</td>
<td>October</td>
<td>0.44***</td>
</tr>
</tbody>
</table>

### Average

<table>
<thead>
<tr>
<th>Year</th>
<th>( \max_m { \hat{\beta}_{m}^{TPU} } )</th>
<th>( \hat{\pi} )</th>
<th>( \hat{\beta}_{m=9}^{TPU} )</th>
<th>( m_{max} )</th>
<th>Peak-to-Trough</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991 - 2000</td>
<td>0.43***</td>
<td>7.45%</td>
<td>0.37***</td>
<td>8.6</td>
<td>0.74***</td>
</tr>
</tbody>
</table>

### Pooled Sample (Baseline)

<table>
<thead>
<tr>
<th>Year</th>
<th>( \max_m { \hat{\beta}_{m}^{TPU} } )</th>
<th>( \hat{\pi} )</th>
<th>( \hat{\beta}_{m=9}^{TPU} )</th>
<th>( m_{max} )</th>
<th>Peak-to-Trough</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991 - 2000</td>
<td>0.35***</td>
<td>6%</td>
<td>0.35***</td>
<td>September</td>
<td>0.58***</td>
</tr>
</tbody>
</table>
## Controlling for Lumpiness: Model

<table>
<thead>
<tr>
<th></th>
<th>$\ln(\tilde{HH}_b)$</th>
<th>$\ln(\tilde{v}_b)$</th>
<th>$\ln(\tilde{\nu}_b)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\tilde{X}_b^{HL}$</td>
<td>-0.78***</td>
<td>3.03***</td>
<td>0.23***</td>
</tr>
<tr>
<td></td>
<td>(0.04)</td>
<td>(0.05)</td>
<td>(0.05)</td>
</tr>
<tr>
<td>$\ln(\tilde{HH}_b)$</td>
<td></td>
<td></td>
<td>-3.57***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.08)</td>
</tr>
</tbody>
</table>

### Reduction in Effect

92%

### Observations

453 453 453

*Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. 

[Back](#)