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

George Alessandria[1]   Shafaat Y. Khan[2]   Armen Khederlarian[1]

[1]University of Rochester

[2]The World Bank

NBER Summer Institute
July 2020

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Innovation: use within-year variation in future tariff risk from political process.

Preview

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4. Show stockpiling behaviour accounts for 30 percent of TPU effects in annual data.
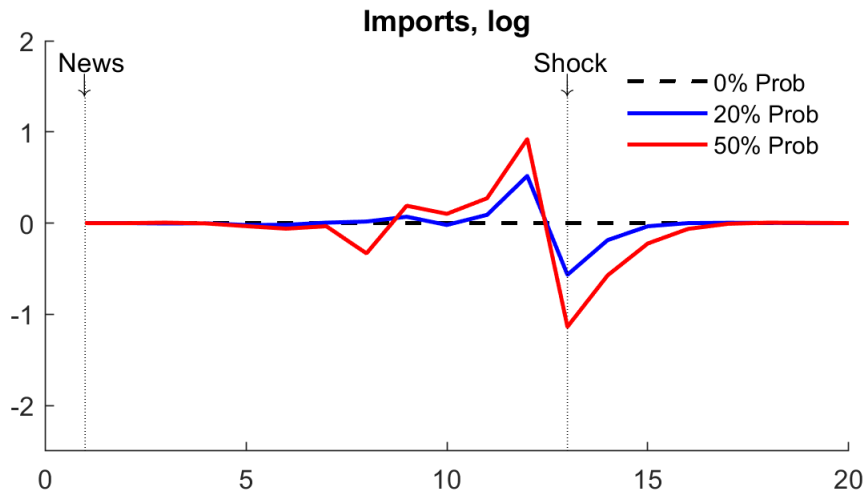
Main idea: Anticipated Risk of a 10% Tariff Hike

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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, π
  - ▶ But, tariff Δ not realized.

- ▶ Firms will shift timing of imports to avoid importing when tariffs are high.

- ▶ Strength of shifting rises in tariffs.

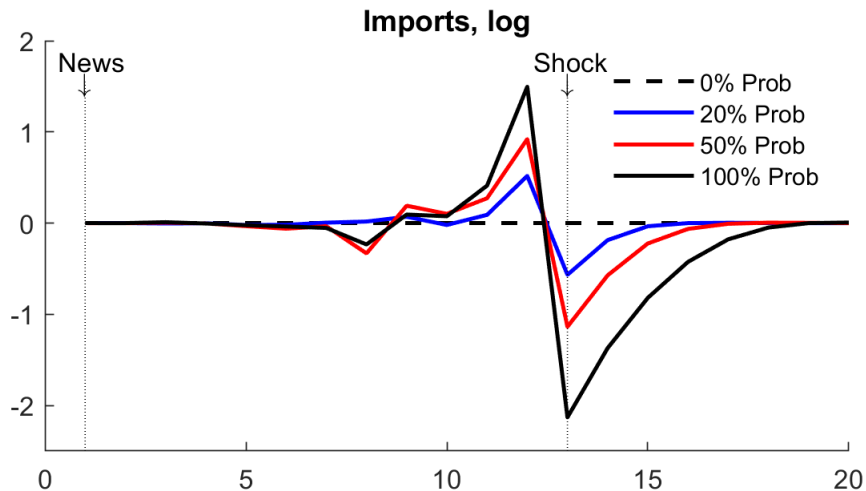- ▶ Only affects imports in narrow window around possible tariff Δ.
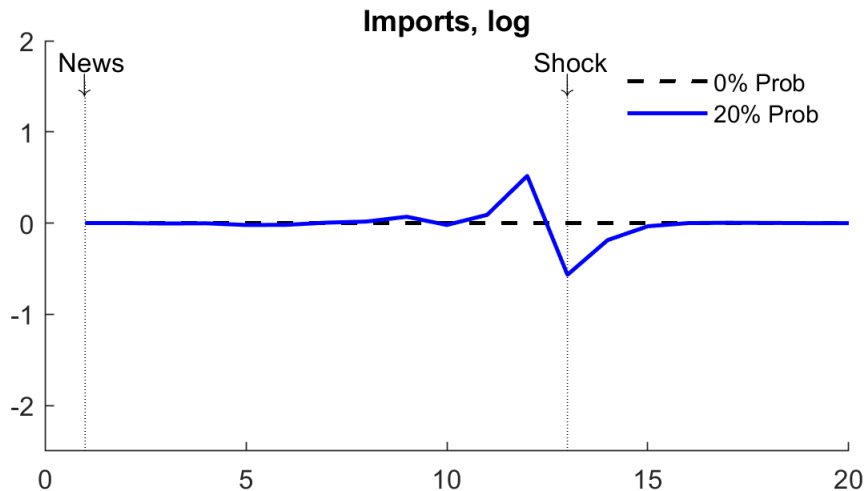
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Imports, log

Main idea: Anticipated Effect of Risky 10% Tariff Hike

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- **Trade Policy Uncertainty**
  Ruhl (2011), Handley & Limao (2014), Crowley et al. (2018), Feng et al. (2017), Pierce & Schott (2016), Steinberg (2019)
    - *New mechanism: Incumbents ordering decisions.*

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- **Anticipation to Policy Changes**
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- **Inventories & Trade**
  Alessandria et al. (2010, 2011), Kropf & Saure (2013), Bekes et al. (2017), Blum et al. (2017), Nadais (2017).
  - *First moment drives majority of the uncertainty effect*

Outline

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Background US Tariff Treatment of China

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

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- ▶ 1990-2000: Congress votes between July and September. Votes
  - ▶ Ex-post, MFN status was always renewed.

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- ▶ 12/2001: China enters the WTO.

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- 12/2001: China enters the WTO.

- 1980: EU grants China MFN unconditionally.

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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

TPU before WTO Accession

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.
  - NNTR rates set in 1930, time-invariant

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

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

- Sample period: 1991-2000.

- Product z at HS 6-digit level, balanced panel of 1812 products

Cross-sectional Distribution
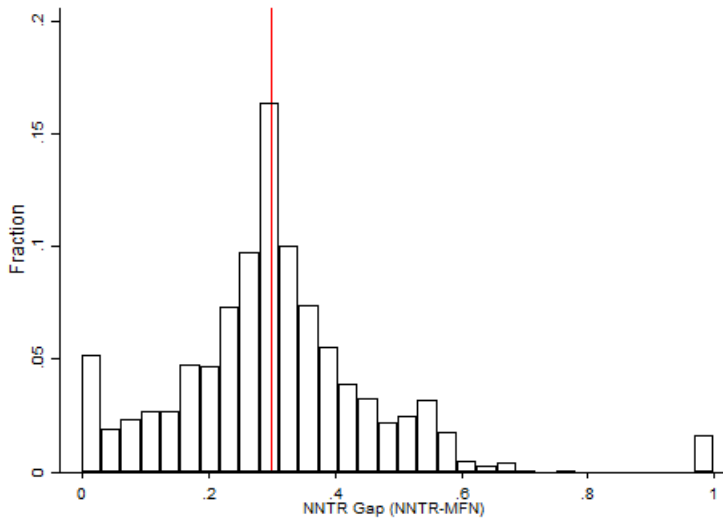
Identification Challenges

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3. Country specific seasonalities.
   - 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

Estimation Equation

$$\ln(v_{m-2:m}^{i,j,z,t}/v_{m-7:m-5}^{i,j,z,t}) = \sum_{m'} \beta_{m'}^{TPU} \mathbb{1}_{\{i=US, j=China\}} \mathbb{1}_{\{m=m'\}} X_{z,t}$$

$$+ \sum_{m'} \beta_{m'} \mathbb{1}_{\{m=m'\}} X_{z,t}$$

$$+ \gamma_{i,t,m} + \gamma_{j,t,m} + \gamma_{s,m} + \varepsilon_{i,j,z,t,m}$$

- Anticipation: $\beta_m^{TPU} > 0$ for months before uncertainty resolution

Baseline Result
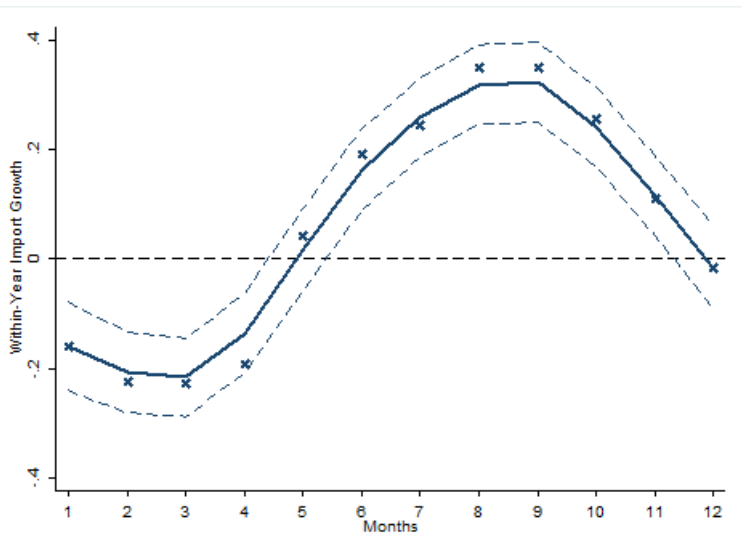
Magnitude: Certain vs Uncertain Changes

- For median **<u>uncertain</u>** 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)

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- For median **<u>certain</u>** tariff cut of 3% from NAFTA's phase-outs Khan & Khederlarian (19)

    - Before resolution, imports fall 15% (anticipatory elasticity = 5)

   - After resolution imports rise 22.5% (resolution elasticity = - 7.5)

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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$$+ \sum_{m'} \beta_{m'}^{Post} \mathbb{1}_{\{i=US,j=China\}} \mathbb{1}_{\{m=m'\}} X_{z,t}$$
$$+ \sum_{m'} \beta_{m'} \mathbb{1}_{\{m=m'\}} X_{z,t}$$
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Pre- relative to Post-WTO
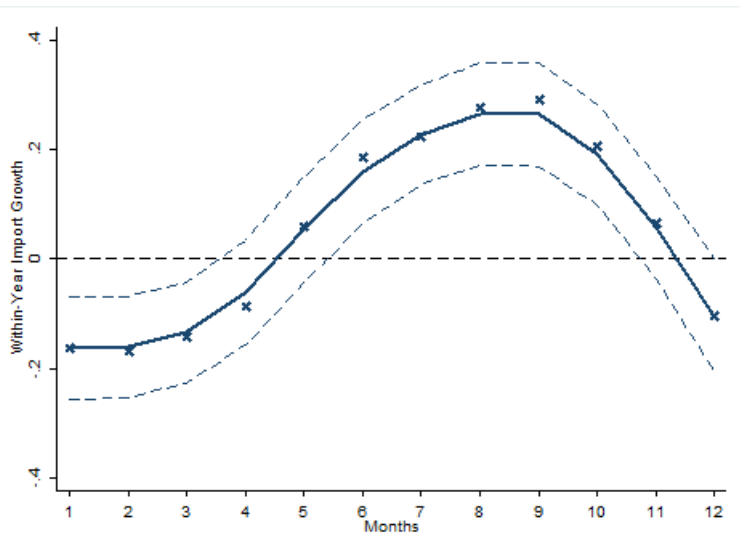
Anticipation & Storability

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- Use trade lumpiness of US imports from RoW over 1991-2000 at HS-6 level.

$$HH_{z,i,t} = \sum_{m=1}^{12} (v_{i,z,t,m} / \sum v_{i,z,t,m})^2 \in [1/12, 1]$$

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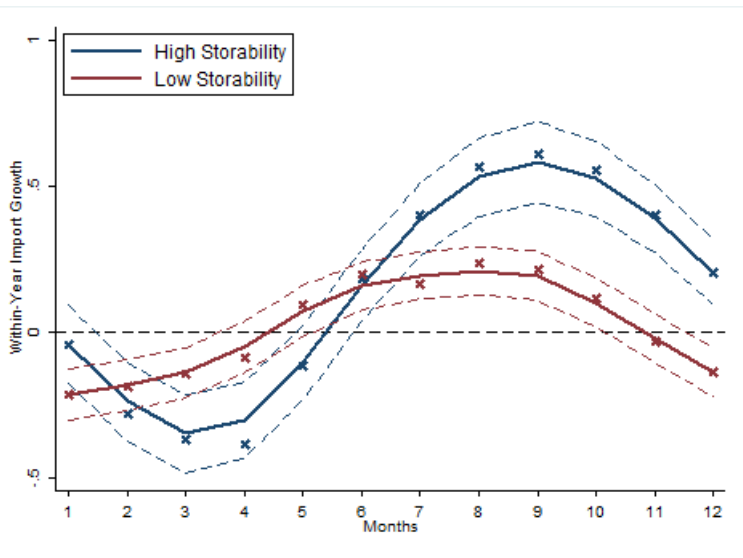$$HH_{z,i,t} = \sum_{m=1}^{12}(v_{i,z,t,m}/\sum v_{i,z,t,m})^2 \in [1/12, 1]$$

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- Consider $1/HH_z$ - the effective number of months w/ shipments

- Lower $1/HH_z \implies$ more storability

Specification with Storability

$$
\begin{aligned}
\ln(v_{m-2:m}^{i,j,z,t}/v_{m-7:m-5}^{i,j,z,t}) = &\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}
\end{aligned}
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- 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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- 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

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

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

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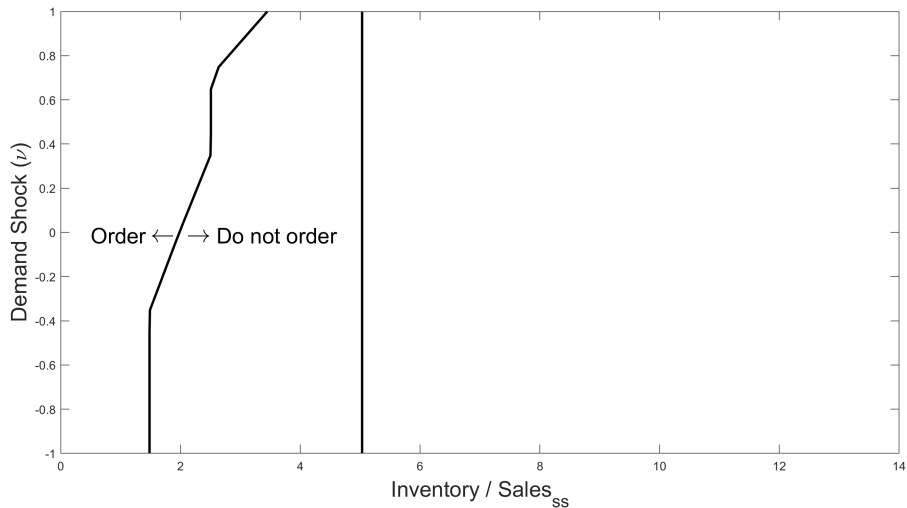
subject to

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

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

Stationary Decisions Rules (constant tariff)

Pricing   Calibration

Model: Trade Policy Shocks

- Importer decides between Importing or not importing

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

$$V_t^a(s, \nu, \tau) = \max_{p, i>0} q(p, s, \nu)p - \tau i - f + \beta E V_{t'}(s', \nu', \tau')$$
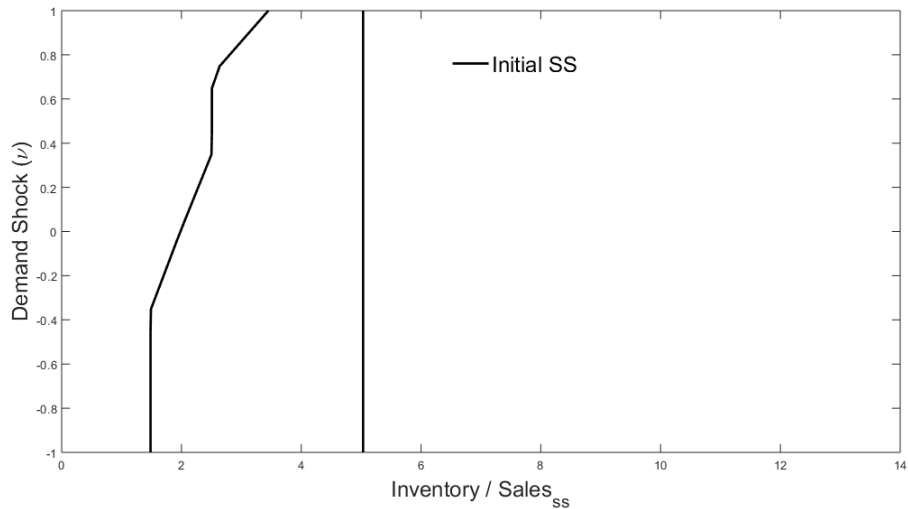$$V_t^n(s, \nu, \tau) = \max_{p>0} q(p, s, \nu)p + \beta E V_{t'}(s', \nu', \tau')$$

- Where $\tau \in \{1, 1 + X_z\}$
- Let Π^τ be the transition matrix for τ
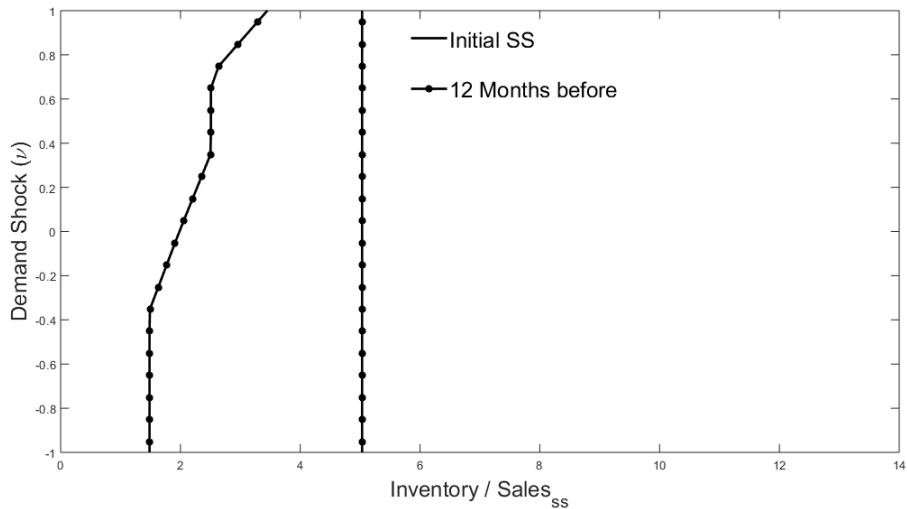
Model: Trade Policy Uncertainty Shock

- All firms start with $\tau = 1$

- Make transition matrix time specific, Π_t^τ

- Firms anticipate a change in τ in period $m_{res} + 1$ when the uncertianty resolves

$$\Pi_t^\tau = \left\{ \begin{array}{ll} I_{|T|} & \text{if } t \neq m_{res} \\ \tilde{\Pi}^\tau & \text{if } t = m_{res} \end{array} \right. \quad , \qquad \tilde{\Pi}^\tau = \left[\begin{array}{cc} (1 - \pi) & \pi \\ 0 & 1 \end{array} \right]$$
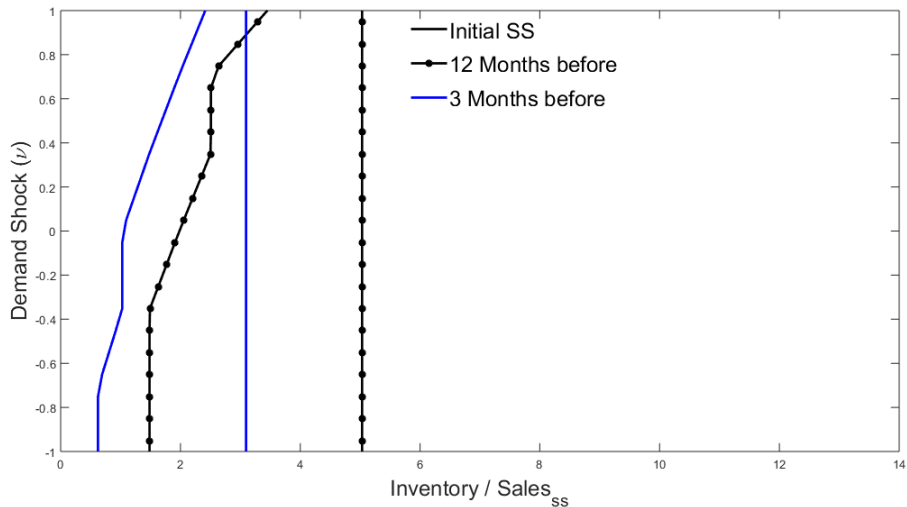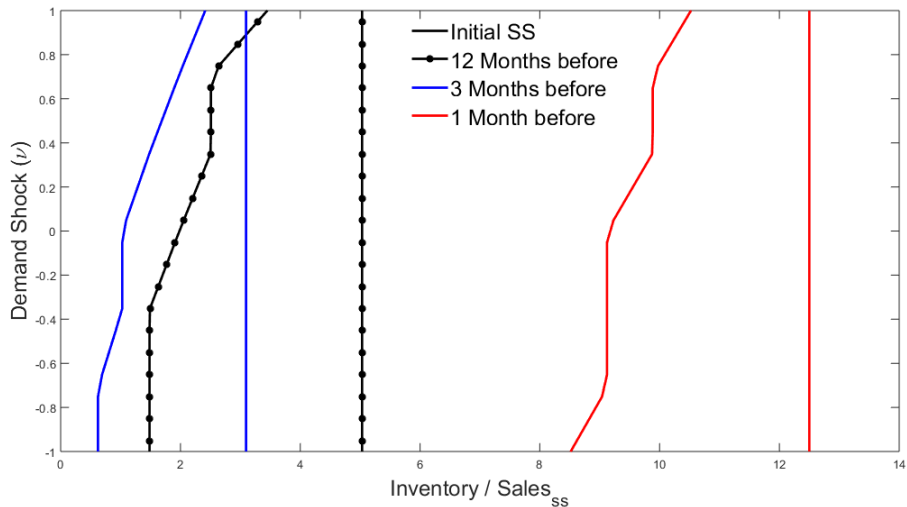
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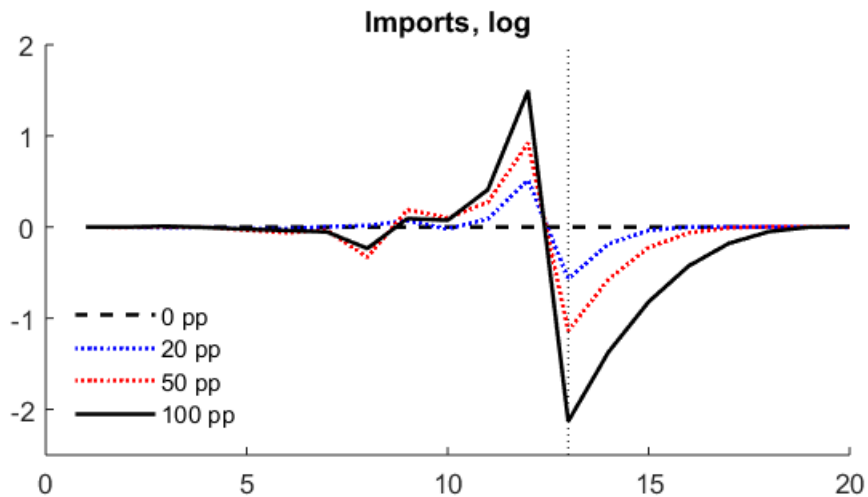
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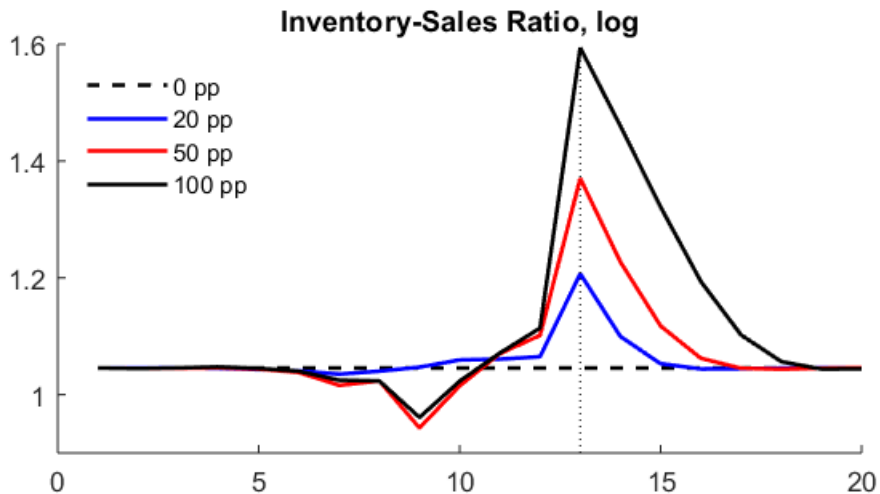
Decisions Rule - Ordering Cutoffs

Path of Imports by NTR gap - 10% probability

Imports, log

Path of Inventories by NTR gap - 10% probability

Inventory-Sales Ratio, log

Legend:
- - - 0 pp
- 20 pp
- 50 pp
- 100 pp

Outline

Measuring Likelihood of MFN Reversal

- Estimate average and time-varying probability of non-renewal, π_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

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$\Rightarrow$ Average model-implied expected likelihood of reversal: $\hat{\pi} = 6\%$

# 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

  $\Rightarrow$ Between 1990-2001: $\hat{\pi} \in [2.4\%, 11\%]$

- Compare annual probability to news-based measures of non-renewal

Annual Probabilities of Revoked Access to MFN Rates
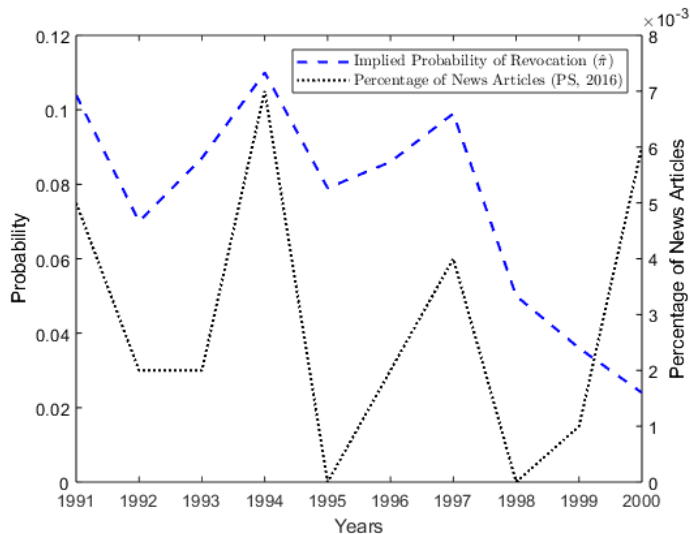
Table

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

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▶ Uncertainty dampens anticipation - "wait and see".

▶ Expected trade costs explains around 3/4 of trade response.

Outline

Effect of Stockpiling on Annual Flows

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

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

▶ But, stockpiling $\implies$ higher holding costs $\implies$ lower annual trade

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

$$\text{Where} \qquad X_{z,t}^{HL} = \left(\frac{1 + \tau_{z,t}^{NNTR}}{1 + \tau_{z,t}^{MFN}} \right)^{-\sigma}$$

Controlling for Lumpiness

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

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

Controlling for Lumpiness

Dep Variable ln($v_{i,j,z,t}$)	(1)	(2)	(3)	(4)
$1_{\{(i,j)=(US,China)\}}1_{\{t \in Pre\}} \times X_{z,t}^{HL}$	0.41***	0.72***	0.20***	0.23***
	(0.13)	(0.06)	(0.07)	(0.07)
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*
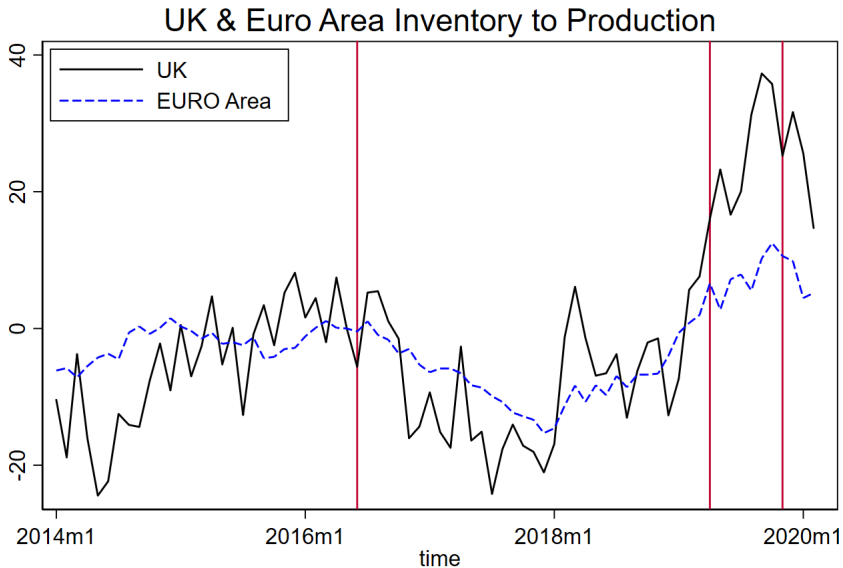
Mechanism at work: US and UK

- ▶ 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
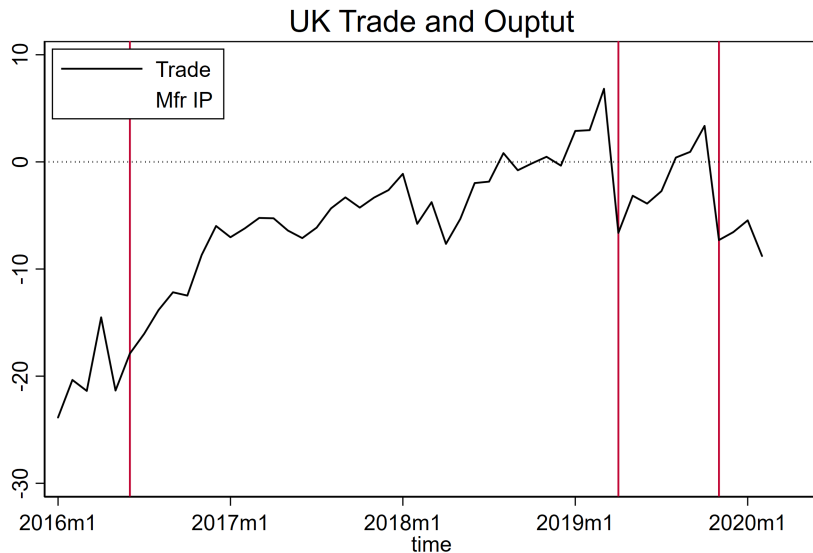

UK Inventory to Production
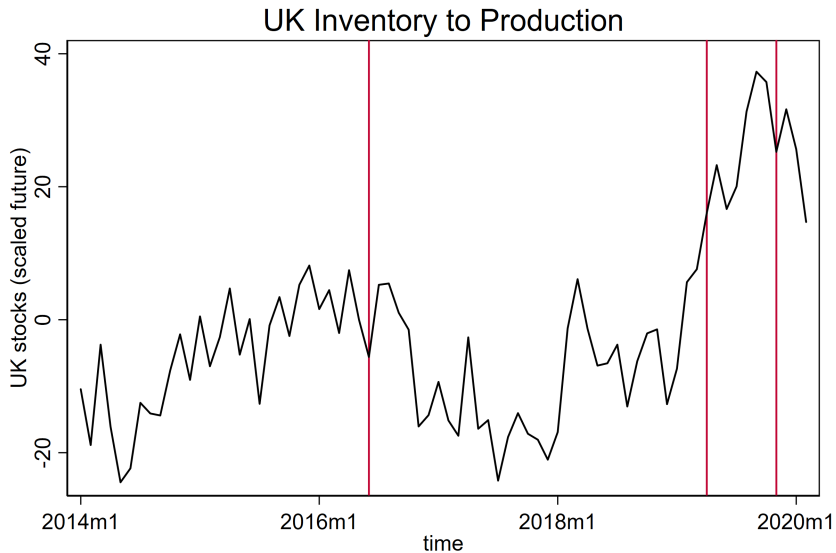
Last date: 02/20

Mechanism at work: UK & Euro Area

UK & Euro Area Inventory to Production

Mechanism at work: UK

UK Trade and Ouptut
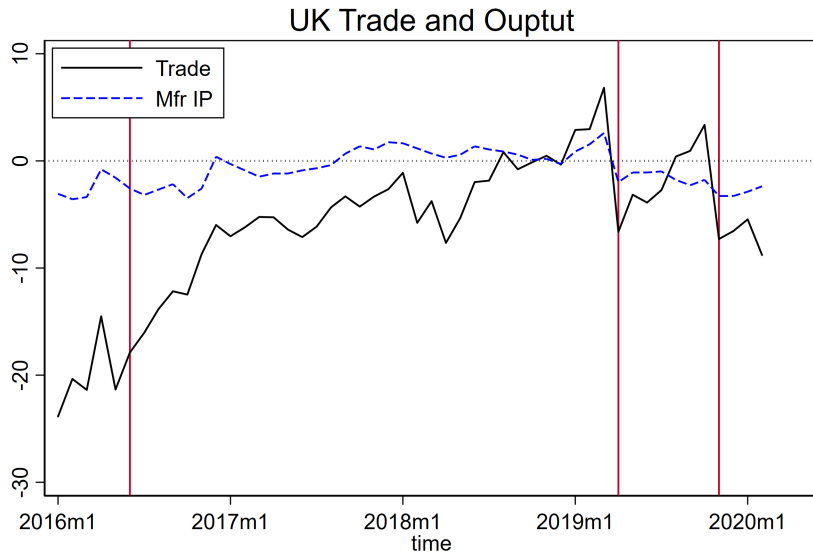
Last date: 02/20; Relative to 18Q4; Source: OECD MEI

Mechanism at work:UK

UK Trade and Ouptut

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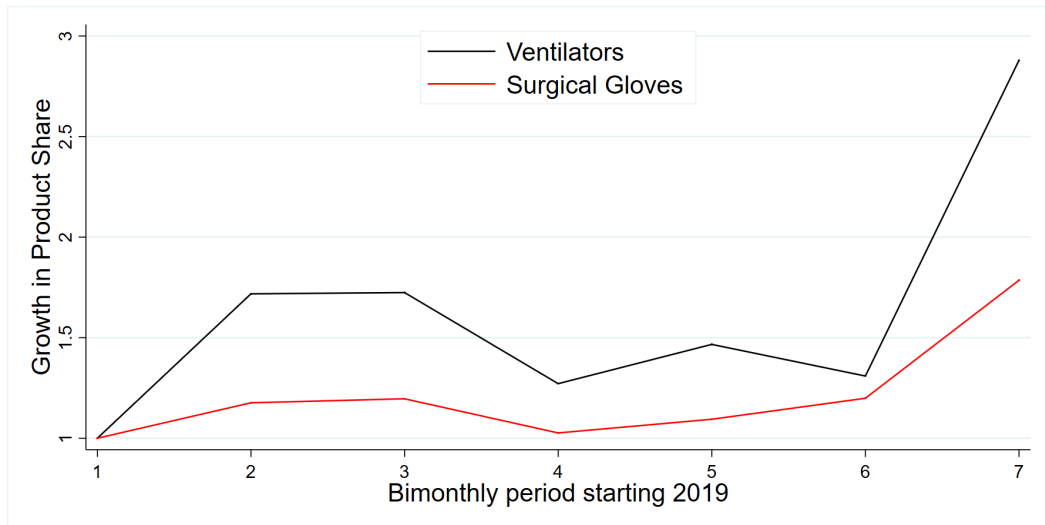
Mechanism at work: Covid-19

- 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 (ρ, α_0, α_1)

- Alternative real-time monitor of global health & policy response.

Mechanism at Work: Covid-19

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?

| Year	Disapproval Res.	Final Status	Alternate bills	Final Status	
1989	None	—	None	—	
1990	H.J.Res. 647	Passed House 10/18 (247-174)	H.R. 4939	Passed House 10/28 (384-30)	
1991	H.J.Res. 263	Passed House 7/10 (223-204) Senate Postponed 7/18, Unanimous Consent	H.R. 2212	Passed House 7/10 (313-112)	Conference Report H.Rept. 102-392 passed House 11/27 (409-21)
	S.J.Res. 153	Senate Postponed 7/18, Unanimous Consent	S. 1367	Passed H.R. 2212 in lieu 7/18 (55-44)	
1992	H.J.Res. 502	Passed House 7/21 (258-135)	H.R. 2212	Conference Report H.Rept. 102-392 passed Senate 2/25 (59-39) Vetoed by President 3/2 House override vote 3/11 (357-61) Senate override vote 3/18 (60-38) - veto sustained	
			H.R. 5318	Passed House 7/21 (339-62) Senate amended with text of S. 2808, passed by voice vote, 9/14	H.R. 5318 vetoed by President, 9/28 House override vote 9/30 (345-74) Senate override vote 10/1 (59-40) - veto sustained
			S. 2808	House passed Senate version 9/22, voice vote	
1993	H.J.Res. 208	House rejected 6/8 (105-318)	H.R. 1835 S. 806	No action	
1994	H.J.Res. 373	House rejected 8/9 (75-356)	H.R. 4590	Amended to impose no conditions, then passed House 6/8 (280-152)	
1995	H.J.Res. 96	House tabled 7/20 (321-107)	H.R. 2058	Passed House 7/20 (416-10)	
	S.J.Res. 37	—			
1996	H.J.Res. 182	House rejected 6/27 (141-286)	H.Res. 461	Passed House 6/27 (411-7)	
	S.J.Res. 56	—			
1997	H.J.Res. 79	House rejected 6/24 (173-259)	—	—	
	S.J.Res. 31 S.Amdt. 890*	— Senate rejected 7/16 (22-77)		*(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.)	
1998	H.J.Res. 121	House rejected 7/22 (166-264)	—	—	
1999	H.J.Res. 57	House rejected 7/27 (170-260)	—	—	
	S.J.Res. 27	Senate rejected motion to discharge committee 7/20 (12-87)	—	—	
2000	H.J.Res. 103	House rejected 7/18 (147-281)	H.R. 4444	House passed 5/24 (237-197)	Signed by President on October 10, 2000, as P.L. 106-286, giving China Permanent NTR upon accession to WTO
	—	—	S. 2277	Senate passed H.R. 4444 on 9/19 (85-13)	
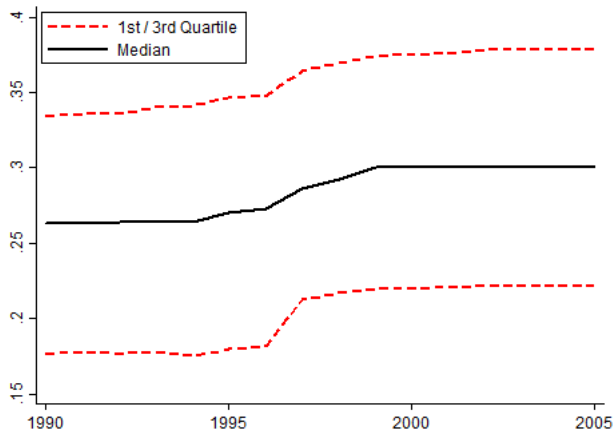
Note: Spread percentiles are calculated each year over NAICS Industries. Gaps are means over HS-8 Product lines from Pierce & Schott (2016).
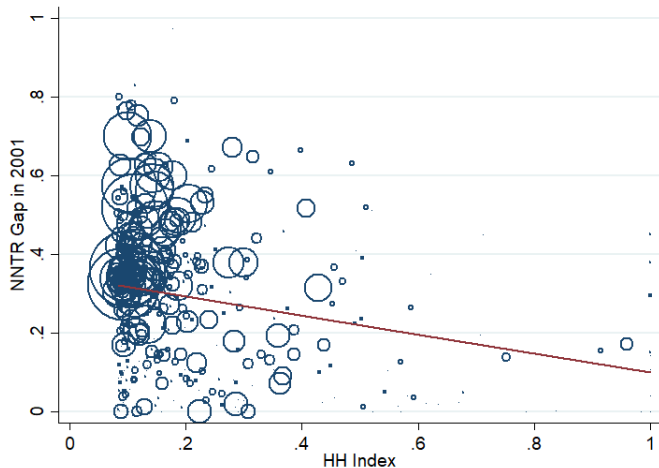
Note: NNTR Gaps are means over HS-8 Product lines from Pierce & Schott (2016). The HH indexes are calculated as the mean HH index of the US imports from China in the second year a product line appears int the sample.
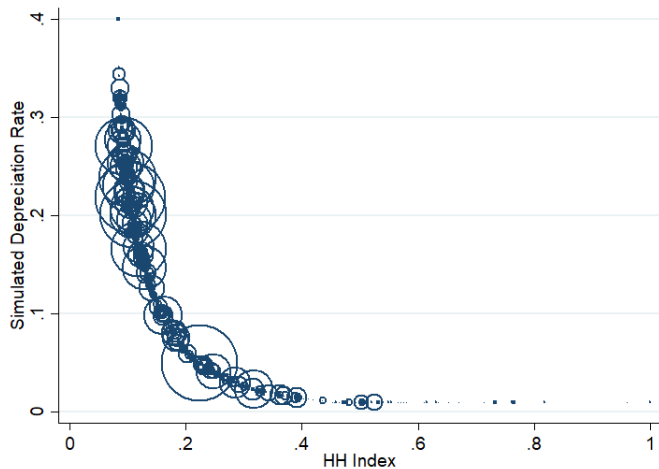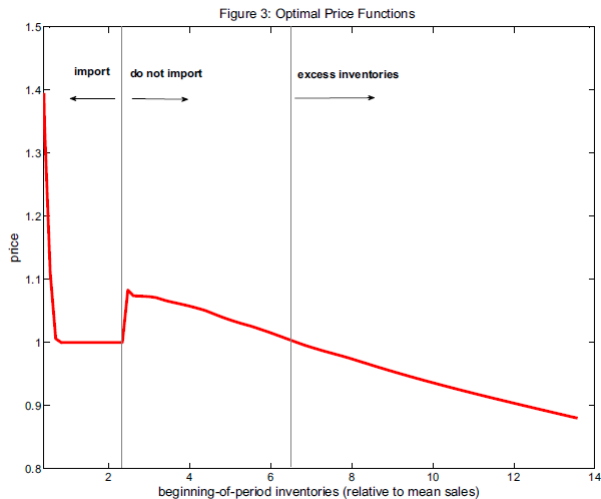
Note: . The HH indexes are calculated as the mean HH index of the US imports from China in the second year a product line appears int the sample.

Stationary Pricing Decision

Figure 3: Optimal Price Functions

| Parameter		Value	Source
β	Annual Discounting factor	0.97	St. Louis Fed
σ	Elasticity of Substitution	4	Literature
f	Fixed Cost Ordering	0.095	Match HH index
μ	Delivery lag	1 pd	AKM
σ_ν	Std Dev of Taste Shocks	0.8	AKM
δ	Annual Depreciation Rate	30%	AKM
Moments			
	HH Index	0.32	75$^{\text{th}}$ pctile in data
	Median Inventory-Sales	3.64 months	
	Mean(Fixed Cost/Revenue)	6.8%	

Back

Baseline Result
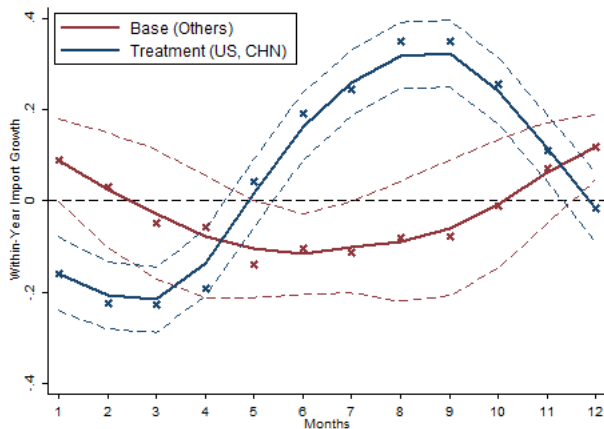
Note: Crosses are point estimates from the baseline estimating equation. Blue are estimates for $\hat{\beta}_m^{TPU}$, red are estimates $\hat{\beta}_m$. Lines is the applied locally weighted scatterplot smoother. Dashed lines are the 90% confidence interval. Standard errors are clustered at HS-6 product level.
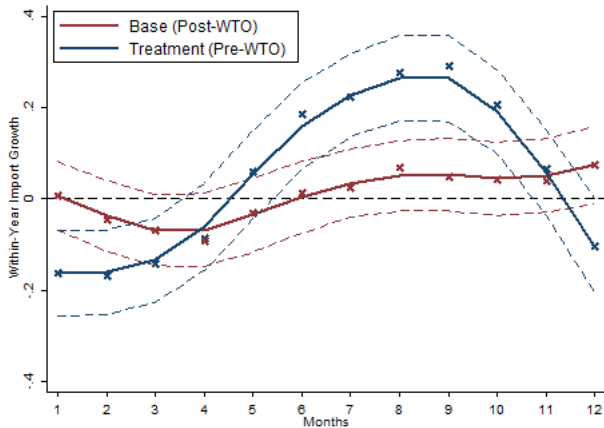
Note: Crosses are point estimates from the baseline estimating equation. Blue are estimates for $\hat{\beta}_m^{TPU}$, red are estimates $\hat{\beta}_m^{Post}$. Lines is the applied locally weighted scatterplot smoother. Dashed lines are the 90% confidence interval. Standard errors are clustered at HS-6 product level.

Annual Probabilities

Year	$\max_m\{\hat{\beta}_m^{TPU}\}$	$\hat{\pi}$	$\hat{\beta}_{m=9}^{TPU}$	m_{max}	Peak-to-Trough
1991	0.61***	10.4%	0.52***	October	1.02***
1992	0.41***	7.0%	0.41***	September	0.57***
1993	0.51**	8.7%	0.47***	August	0.89***
1994	0.65***	11%	0.45***	October	0.88***
1995	0.46***	7.9%	0.46***	September	0.82***
1996	0.50***	8.6%	0.47***	August	0.99***
1997	0.58***	9.9%	0.43***	August	0.83***
1998	0.26**	5.0%	0.23**	June	0.64***
1999	0.21***	3.6%	0.12	August	0.33***
2000	0.14*	2.4%	0.12	October	0.44***
Average					
1991 - 2000	0.43***	7.45%	0.37***	8.6	0.74***
Pooled Sample (Baseline)					
1991 - 2000	0.35***	6%	0.35***	September	0.58***

Controlling for Lumpiness: Model

	$\ln(\widetilde{HH}_b)$	$\ln(\tilde{v}_b)$	$\ln(\tilde{v}_b)$
$\widetilde{X}_b^{HL}$	-0.78***	3.03***	0.23***
	(0.04)	(0.05)	(0.05)
$\ln(\widetilde{HH}_b)$			-3.57***
			(0.08)
Reduction in Effect			92%
Observations	453	453	453

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