ECO862 - International Trade

Lecture 8b: Trade policy uncertainty and inventory dynamics

Taking Stock of Trade Policy Uncdertainty

Evidence from China's WTO Accession

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US-China Trade Policy Uncertainty Pre-2001

- Same U.S.-China uncertainty, but take advantage of the within-year dynamics
    - Before 1980: Non Normal Trade Relation (NNTR, column 2) rates to non-market countries
    - 1980: U.S. grants China normal trade relations (NTR/MFN), big tariff cut
    - 1980-1989: NTR needs to be renewed by President
    - 1990-2001: NTR needs to also be renewed by Congress
        - Uncertainty between July and September.
    - 2001: China joins WTO, gains permanent NTR status
    - Chinese imports to U.S. grow after 2001, even though tariffs **do not** change
- How do imports change in the months before, during after?
    - Consider a model with storable goods and costs of ordering
    - Firms hold inventories to minimize ordering costs
    - Uncertainty can lead to stockpiling of goods

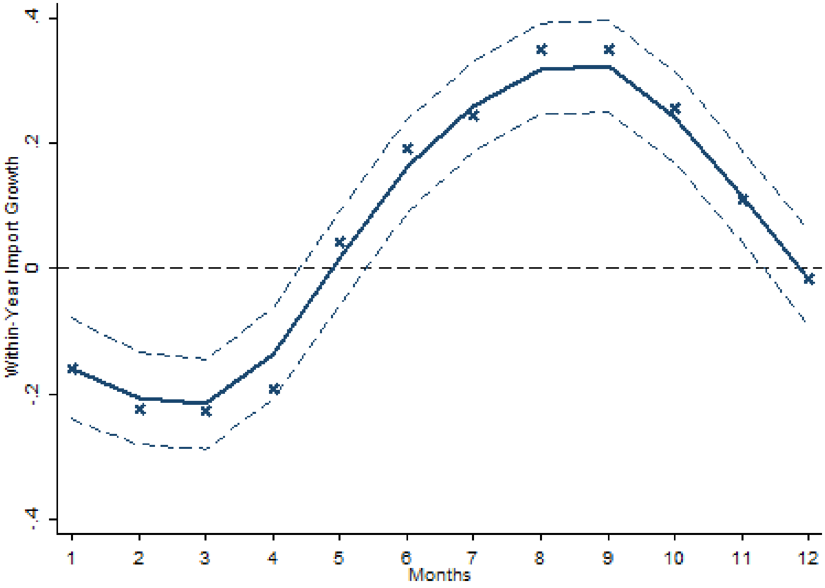
Empirical Strategy

- Uncertainty during 1990s was within-year by nature
- Zoom in to see within year trade flows
- More DiD...

$$\begin{aligned}\log(v^{ijzt}_{m-2:m}/v^{ijzt}_{m-7:m-5}) = &\sum_{m'} \beta^{TPU}_{m'} I_{i=US,j=CHN} I_{m=m'} X_{zt} \\ &+ \sum_{m'} \beta_{m'} I_{m=m'} X_{zt} \\ &+ \gamma_{itm} + \gamma_{jtm} + \gamma_{sm} + \epsilon_{ijztm}\end{aligned}$$

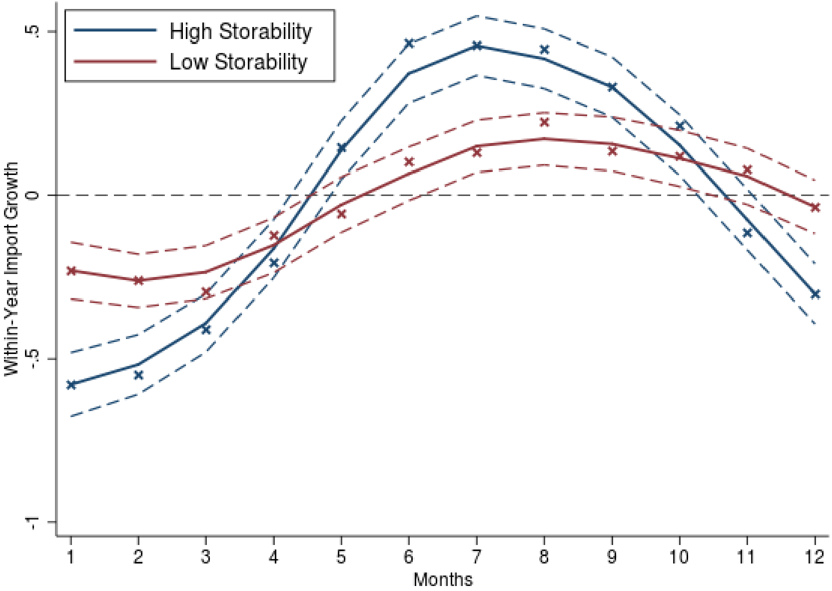
- The growth rate looks at 3-month groups to smooth noise
- $\beta^{TPU}_{m'}$ measures the response to uncertainty (X_{zt} is NTR gap)
- Fixed effects to control for product, importer, and exporter seasonality

Seasonal in NTR gap



The Seasonal and Storability

- This should matter more for goods that are easier to store



Magnitude: Certain vs Uncertain Changes

- Median uncertain tariff increase, 31% relative to monthly average
  - Before uncertainty resolution, imports rise 9.6% (anticipatory elasticity = 0.31)
  - After resolution imports fall 9.6% (resolution elasticity = -0.31)
- Median certain tariff cut of 3% from NAFTA's phase-outs (Khan and Khederlarian, 2021)
  - Before resolution, imports fall 18% (anticipatory elasticity = 6)
  - After resolution imports rise 22.5% (resolution elasticity = - 7.5)
- Back of the envelope:
  - uncertain case (0.31) has a probability multiplier in it
  - separate the multiplier by dividing uncertain w/ certain anticipatory elasticity
  - $\pi \approx 0.31/6 \approx 5\%$

Quantification

- Need a framework to translate anticipation to expectations
- Remember the inventory model?
  - Storable good
  - Fixed cost of ordering
  - Firm faces a potential increase in tariffs, with varying probability
- The higher the probability of losing NTR, the more incentive to stock up
- Find the probability that gets the change in imports in the model closest to the data

Model: Trade Policy Shocks

- Importer decides between Importing or not importing

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

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

$$\text{No order:}\quad V_t^n(s,\nu,\tau) = \max_{p>0} q(p,s,\nu)p + \beta E V_{t'}(s',\nu',\tau')$$

subject to

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

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

- Now: $\tau \in \{1, 1+X_g\}$

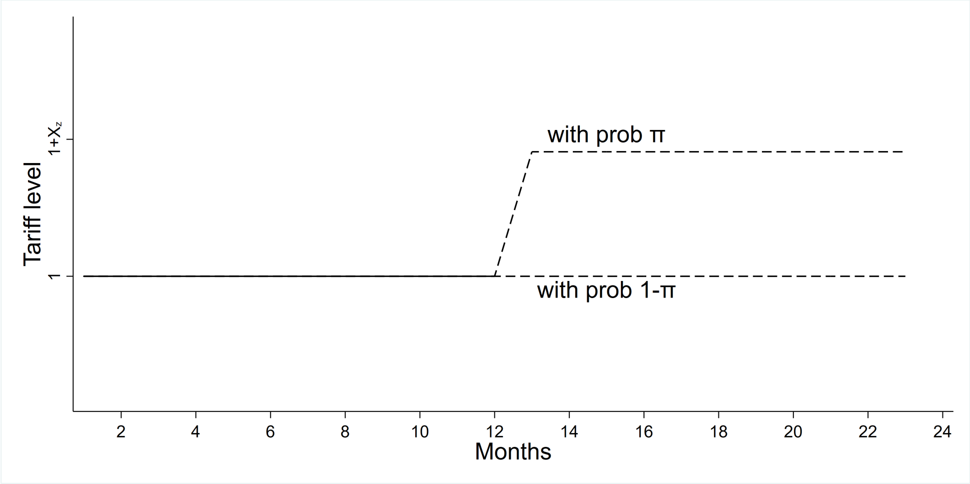
  With a transition matrix Π^{τ} for τ

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 uncertainty resolves

$$\Pi_t^\tau = \begin{cases} I_{|T|} & \text{if } t \neq m_{res} \\ \tilde{\Pi}^\tau & \text{if } t = m_{res} \end{cases}, \qquad \tilde{\Pi}^\tau = \begin{bmatrix} (1-\pi) & \pi \\ 0 & 1 \end{bmatrix}$$

Model: Trade Policy Uncertainty Shock



Computation: Modeling Uncertainty

- We discussed computation when parameter path was deterministic
- Uncertainty is a real concern with any policy change or other shock
- As we study the economics of it, let's see how to solve with it
- In the end it is about adding a few state variables: $V(s, \nu)$ is now $V(s, \nu, \tau)$
- We had a transition matrix for ν before, now need one for τ

Computation: Tariff Process

- For simplicity assume tariff can take 3 values i.e. $\tau \in \{\tau^1, \tau^2, \tau^3\} = \mathcal{T}$
- Let Π^τ be the transition matrix for τ
- Let $F_\tau(\tau)$ be the distribution over tariff level
- Model uncertainty shock using a non-stationary stochastic process for τ
  - transition matrix becomes non-stationary: Π_t^τ

Computation: Modelling Uncertainty shock

- All firms start with $\tau = \tau^1$ i.e. $F_\tau(\tau^1) = 1$ at $t = 0$
- Firms anticipate a change in τ in period $t_0 + 1$
- Make transition matrix time specific, Π_t^τ (hidden state variable)
- Uncertainty resolution period is $t_0 + 1$

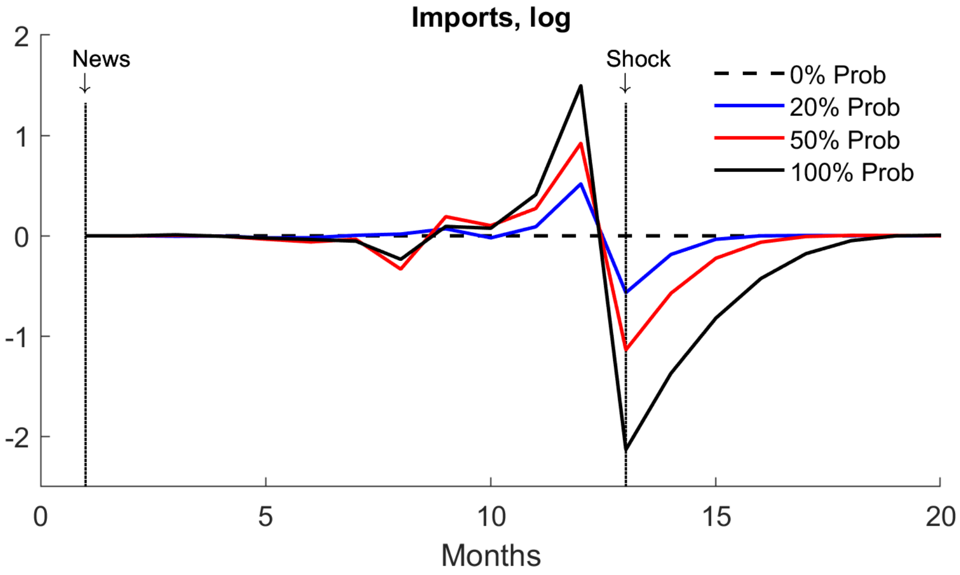
$$\Pi_t^\tau = \begin{cases} I_{|\mathcal{T}|} & \text{if } t \neq t_0 \\ \tilde{\Pi}^\tau & \text{if } t = t_0 \end{cases}$$

Where $I_{|\mathcal{T}|}$ is an identity matrix of size $|\mathcal{T}|$

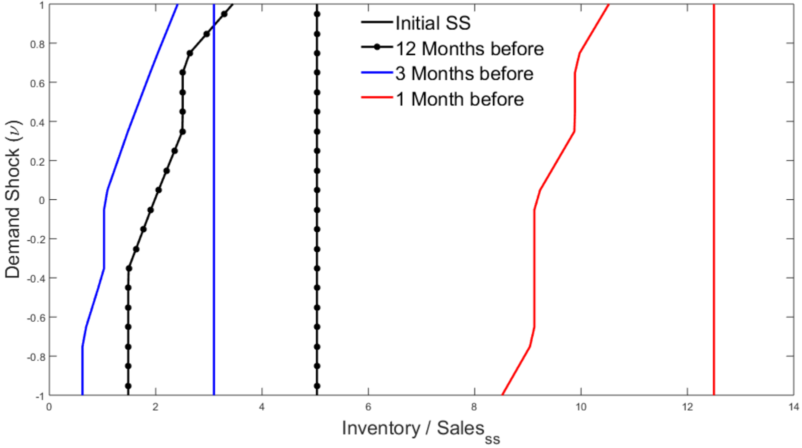
Computation: Solving the model

- Assume convergence in finite periods
- Solve for policy functions backwards using Π_t^τ for expectation over τ_{t+1}
- In pd t_0, use $\tilde{\Pi}^\tau$ to calculate expected value for pd $t_0 + 1$
- After obtaining the policy functions, move forward using initial distribution and transition policy functions
- Can choose multiple realizations when going forward

Path of Imports by probability - 10pp NNTR gap



Decisions Rule - Ordering Cutoffs



Estimating Likelihood of MFN Reversal

- Estimate probability of MFN non-renewal: π
- Match stockpiling in data: average and heterogeneous in storability
- Characterized 1,812 products by,

1. Tariff risk (X_g)	data
2. Fixed ordering cost (f_g)	steady state lumpiness
3. Holding cost (δ_g)	storability & stockpiling around TPU

Estimation Technique

Specify: $1 + \delta_g = \alpha_0 (f_g)^{\alpha_1}$

Proceed in 4 steps:

1. Given π, α_0, α_1: set f_g and $\delta(f_g)$ to match ordering frequency (inverse HH index)

2. Randomly sample 300 products, simulate transition for X_g increase w/ prob π

3. Run the average and heterogeneous effects regressions, as done in the data

4. Obtain π, α_0, α_1 that matches data regression coefficients

Estimation Technique

3 Pool estimations together and estimate:

$$\ln(\tilde{v}^{g}_{m-2:m}/\tilde{v}^{g}_{m-5:m-7}) = \sum_{m'} \beta^{sim}_{1,m'} \mathbb{1}_{\{m=m'\}} \tilde{X}_g + \epsilon_{g,m} \tag{3.1}$$

$$\begin{aligned}\ln(\tilde{v}^{g}_{m-2:m}/\tilde{v}^{g}_{m-5:m-7}) &= \sum_{m'} \beta^{sim}_{2,m'} \mathbb{1}_{\{m=m'\}} \tilde{X}_g \\ &+ \sum_{m'} \beta^{HH,sim}_{m'} \mathbb{1}_{\{m=m'\}} \tilde{X}_g (1/\widetilde{HH_g}) + \epsilon_{g,m}\end{aligned} \tag{3.2}$$

4 Estimate π, α_0, α_1 to match:

$$max_m\{\hat{\beta}^{sim}_{1,m'}\} - min_m\{\hat{\beta}^{sim}_{1,m'}\} = 0.62 \tag{4.1}$$

$$max_m\{\hat{\beta}^{sim}_{2,m'}\} - min_m\{\hat{\beta}^{sim}_{2,m'}\} = 1.29 \tag{4.2}$$

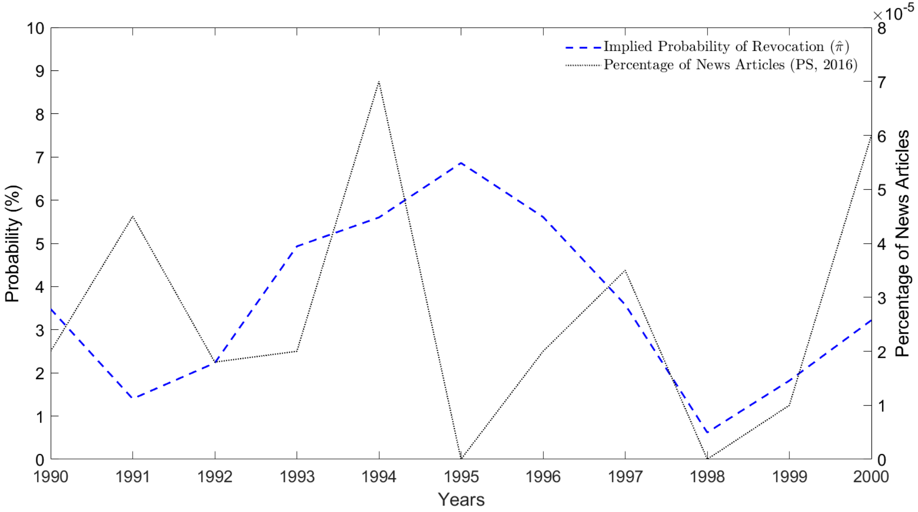
$$max_m\{\hat{\beta}^{HH,sim}_{1,m'}\} - min_m\{\hat{\beta}^{HH,sim}_{1,m'}\} = -0.26 \tag{4.3}$$

Likelihood of MFN Reversal

- Average model-implied expected likelihood of reversal: $\hat{\pi} = 3.2\%$
- Negative relationship between ordering and holding costs: $(\alpha_0, \alpha_1) = (1, -0.02)$
- Redo previous exercise year-by-year to construct annual probability

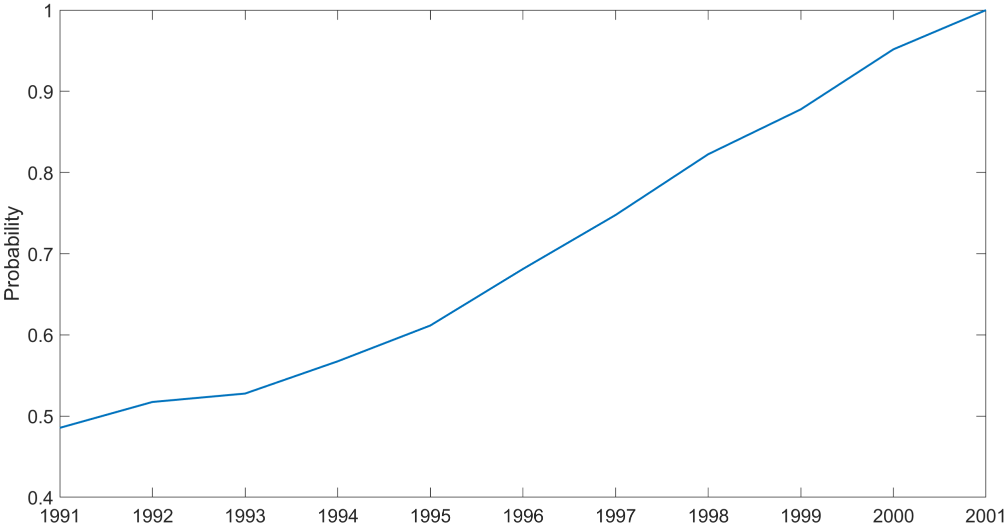
  $\Rightarrow$ Between 1990-2001: $\hat{\pi} \in [1\%, 7\%]$
- Compare annual probability to news-based measures of non-renewal

Annual Probabilities of Revoked Access to MFN Rates



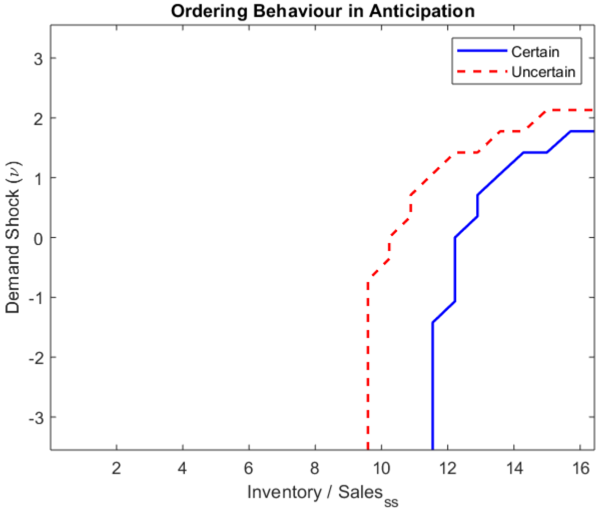
Table

Annual probability of maintaining NTR



Role of Uncertainty vs. First Moment Shock

- Not clear if driven by first moment or pure uncertainty around it
- Consider effect on ordering policy



Role of Uncertainty vs. First Moment Shock

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

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

2. Estimate:

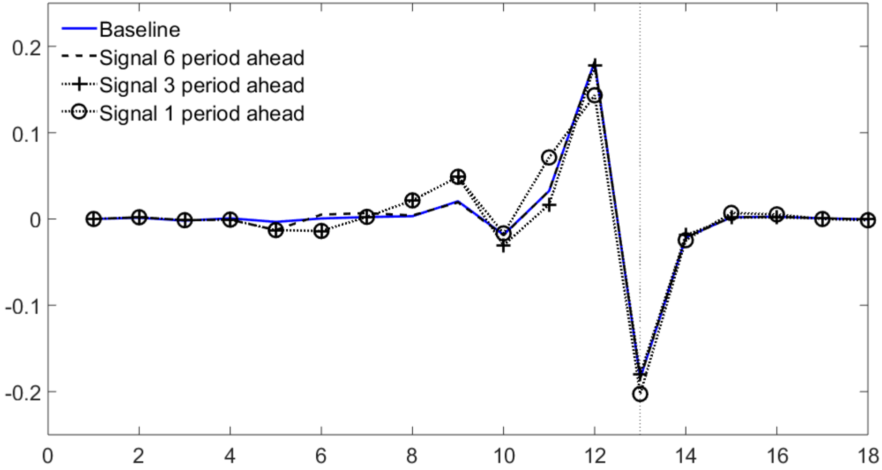
$$\ln(\tilde{v}^{g}_{m-2:m}/\tilde{v}^{g}_{m-5:m-7}) = \sum_{m'} \beta^{sim}_{3,m'} \mathbb{1}_{\{m=m'\}} \tilde{X}_g + \epsilon_{g,m}$$

$\Rightarrow$ Anticipatory response under certainty: $\max_m\{\hat{\beta}^{sim}_{3,m}\} - \min_m\{\hat{\beta}^{sim}_{3,m}\} = 0.79$

- Uncertainty dampens anticipation - "wait and see".
- Expected trade costs explain around 3/4 of trade response (0.62/0.79).

What probability is identified

Changing Probability: 15% to 6%



Interesting stuff!

- We learn a lot from these unique tariff uncertainty episodes
- Are there more examples that can be used?
- Are their examples like this in other kinds of policy?
  - Debt ceiling negotiations?
  - Sunset clauses in antidumping duties?
- With this episode there is always a caveat...
  - NTR gap is correlated with the original liberalization in 1980
  - Explore this in the next class using model of long-run trade dynamics
- Another approach: Feng et al. (2017) study the changes in the number of Chinese exporters and exiters over time. They find exporters and exiters grow by more in the high gap industries.
  - Develop a static Melitz model with congestion on export fixed costs. The model features no SS churning

References I

Feng, Ling, Zhiyuan Li, and Deborah L. Swenson (2017). “Trade policy uncertainty and exports: Evidence from China’s WTO accession.” *Journal of International Economics* 106, pp. 20–36.

Khan, Shafaat Y. and Armen Khederlarian (2021). “How Does Trade Respond to Anticipated Tariff Changes: Evidence from NAFTA.”