The Economic Effects of Trade Policy Uncertainty

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Import Tariffs have Risen...

U.S. Import Tariffs as % Share of Total Imports of Goods
Press Mentions of Trade Uncertainty have Surged

Index of trade policy uncertainty using newspapers’ searches
Our Contribution

We study effects of trade policy uncertainty (TPU) on U.S. economy

1. Construct firm-level and aggregate measures of TPU
   Our measures extend indexes by Hassan et al., 2017 and Baker et al., 2016.

2. Empirical evidence on firm-level and aggregate data:
   Trade policy uncertainty reduced investment 1 percent in 2018

3. We use an open-economy DSGE model to highlight how risk and uncertainty about trade policy affect economic activity
Firm-Level TPU
Firm-Level TPU: Data

We construct firm-level measures of TPU from earnings call transcripts for publicly listed companies (see also Hassan et al., 2017)

Each call follows a common two-part format:

1. Performance review of the last quarter
2. Question & answer session with investors and analysts.
   ▶ Contains information about risks faced by firm

Firm-Level TPU: Textual Analysis

We proceed in two stages:

1. Search the conference calls for set of trade policy (TP) terms
   - E.g., tariff*, import dut*, import barrier*, trade polic*
   - Frequency of TP matches indicates the intensity of trade policy discussions in a conference call

2. Search for uncertainty (U) terms in close proximity to TP terms
   - E.g., risk*, threat*, tension*, uncertain*
   - Must appear within 10 words

\[ TPU = \text{Number of joint instances of TP and Uncertainty (normalized by number of words in the call)} \]
Examples of *TP* and *TPU*

**TP:**
**Goodyear Tire & Rubber - 2013Q3**

“You will note for the fourth quarter, however, that North America will be down year over year, again reflecting the aberration of a year ago, when fourth-quarter dealer orders for low-end tires were high post expiration of Chinese tire tariffs.”

**TPU:**
**Levi & Strauss Co. - 2018Q1**

“The biggest uncertainty I think we’re facing. There are really two, and I don’t know if I want to rank them, but one is the uncertainty around trade and tariffs. That could have significant short-term impact.”
Variation Across Firms and Time

Note: TPU for selected firms.
Variation Across Industries and Time

Note: Share of firms in the industry mentioning TPU in their earnings calls

Comparison with Hassan et al. (2016)
Note: LDA Analysis on Transcripts from All Years. Most Common Bigrams, Grouped by Topic.
Effects of TPU on Firm-Level Investment

- We use Compustat balance-sheet data over 2015Q1-2018Q4
- (Cumulative) Investment constructed from fixed assets $k_{i,t}$ as:
  \[
  \log k_{i,t+h} - \log k_{i,t-1}, \quad \text{where} \quad h \geq 0
  \]

- We estimate, for $h = 0, 1, 2, 3, 4$:
  \[
  \log k_{i,t+h} - \log k_{i,t-1} = \alpha_i + \alpha_{s,t} + \beta_h TPU_{i,t} + \Gamma' X_{i,t} + \epsilon_{i,t}
  \]
  \[
  \alpha_i \text{ and } \alpha_{s,t}: \text{ firm and sector-by-quarter fixed effects}
  \]
  \[
  X_{i,t}: \text{ Tobin’s q, cash-flow, openness, } TPX_{i,t} = TP_{i,t} - TPU_{i,t}
  \]
  \[
  \beta_h: \text{ response of } \log k \text{ in } t + h \text{ to change in TPU in quarter } t
  \]
- We restrict sample to firms in manufacturing, agriculture and mining
Firm-Level Response to High TPU

Cumulative response of log assets after increase in $TPU$ (Cross-Section in 2018)
Local Projections: Robustness

1. Without Controls
Local Projections: Robustness

2. Trade Policy without Uncertainty

Additional Robustness (no Time Effects)
From Firm-Level to Aggregate Effects

How large are these effects in the aggregate?

Consider the 1-year response of $K$ to a TPU shock:

\[-2.5\% \times 10\% \times 43\% \times \frac{\$24 \text{ tn}}{\$2.8 \text{ tn}} \approx -1\%\]

-2.5% × 10% × 43% × $24 \text{ tn}$ ÷ $2.8 \text{ tn}$ ≃ −1%

Note: Calculation ignores general equilibrium effects
Aggregate TPU
Two Measures of Aggregate TPU

News-Based

- Share of newspaper articles mentioning trade uncertainty
- Captures uncertainty surrounding trade actions as perceived by press

Stochastic Volatility

- Based on tariffs rates on imports Tariffs ($\tau_t$) evolve according to:

$$\tau_t = (1 - \rho_\tau) \mu_\tau + \rho_\tau \tau_{t-1} + \exp(\sigma_t) \varepsilon_t, \quad \varepsilon_t \sim N(0, 1)$$

$$\sigma_t = (1 - \rho_\sigma) \sigma + \rho_\sigma \sigma_{t-1} + \eta u_t, \quad u_t \sim N(0, 1)$$

- $u_t$ affects spread of values for tariffs, measures tariff volatility shock
Index = 100 when share of articles mentioning TPU is 1 percent

Comparison with Baker et al. (2016)
News-Based vs. Earnings Calls Based TPU

- Foreign Firms TPU

Graph showing the comparison between News-Based and Earnings Calls Based TPU over calendar quarters from 2006q1 to 2018q1.
Filtered series of tariff volatility. Shaded area: 68-percent credible sets.
Macroeconomic Effects of TPU: VAR Approach

- Baseline specification (ordering TPU measures first):
  1. TPU STOCH.VOL. or TPU NEWS
  2. Real GDP per capita
  3. Real business fixed investment per capita
  4. Ratio of net exports to GDP
  5. Markups (inverse of the labor share)
  6. Federal funds rate

- We start with the 1960-1984 period

- Consider IRFs to 2-standard deviation shock
  ≃ out-of-sample rise in tariff volatility if tariffs rise from 2 to 8 percent
VAR with News-Based TPU: 1960-1984

- News-Based TPU Index
- GDP
- Private Investment
- Net-Exports-to-GDP
VAR with News-Based TPU: 1960-2018
Takeaways from Empirical Analysis

- Firm-Level TPU rises as it did in 2018
  → $K$ of manufacturing firms drops 2.5 percent after 1 year
  → $\approx$ 1 percent decline ($25$ bn) in aggregate U.S. fixed investment.

- Aggregate TPU from VAR rises 2 standard deviations (comparable to recent developments)
  → Investment drops by about 1.5 percent.
Model
Model Framework

- DSGE model to examine transmission of an increase in $TPU$.

- Open-economy version of Christiano et al., 2005, Smets and Wouters, 2007, featuring:
  - Two countries specializing in production of intermediate inputs
  - Armington aggregator of varieties/goods
  - Local Currency Pricing
  - Sticky Prices and Wages, Investment Adjustment Costs, and Financial frictions à-la Gertler and Karadi, 2011

- We consider two shocks sized to reflect recent rise in uncertainty about tariffs (with retaliation)
  1. Anticipated increases in tariffs
  2. Increase in the uncertainty about future tariffs (keeping mean fixed)
Effects of Tariffs: Demand-Switching

- Tariffs increase the relative price of imported goods → consumers switch towards domestic varieties

\[ m_t = -\theta \times (p_{m,t} + \tau^m) + a_t \]

- This effect tends to boost domestic output but
  - Symmetric retaliation abroad reduces foreign demand
  - Supply-side effects lower output
Effects of Tariffs: Supply-Side Distortions

- Price of consumption bundle is $P \left( P_D, P_M, \tau_t^m \right)$

- Tariffs reduce relative price of domestic good

$$PROFITS = \frac{P_D}{P \left( P_D, P_M, \tau_t^m \right)} Y - r^k K - wL$$

- Tariffs akin to uniform increase in taxes on $K$ and $L$

$$PROFITS = \frac{P_D}{P \left( P_D, P_M, 0 \right)} Y - r^k \left( 1 + \tau^k \right) K - w \left( 1 + \tau^L \right) L$$

→ Contractionary effect on investment and output
Experiment 1: Higher Expected Tariffs

- We allow for regime switches in tariffs and beliefs about tariffs
  - Linear MS-DSGE → capture first moment effects

- Tariffs can be either $\tau^{SS} = 0.02$ or $\tau^{HIGH} = 0.08$

- Trade negotiations proceed for 8 periods with no tariff changes
  After 8 periods, 3 equally likely outcomes:
  1. No new tariffs are imposed and risk is resolved
  2. Tariffs increase to $\tau^{HIGH} = 0.08$ and remain there with probability $\rho_\tau$
  3. Trade negotiations restart
Experiment 1: Channels of Transmission

- **Intertemporal Substitution:**
  Higher future tariffs make current C and I relatively cheaper

\[
\tilde{c}_t = \tilde{c}_{t+1} - \frac{1}{\sigma}\tilde{r}_{t+1}(\tau_{t+1}^{m})
\]

\[
\tilde{p}^k_t = r^k \tilde{r}^k_{t+1} + (1 - \delta) \tilde{p}^k_{t+1} - \tilde{r}_{t+1}(\tau_{t+1}^{m})
\]

- **Investment demand falls:**
  Higher future tariffs lower expected asset prices

\[
\tilde{p}^k_t = r^k \tilde{r}^k_{t+1}(\tau_{t+1}^{m}) + (1 - \delta) \tilde{p}^k_{t+1}(\tau_{t+1}^{m}) - \tilde{r}_{t+1}(\tau_{t+1}^{m})
\]

This effect is amplified by financial frictions.
Model Experiment 1: Results

- No Tariff Increase at t=9
- Tariff Increase at t=9

Graphs showing the impact of tariff changes on consumption, investment, net exports, GDP, imports, exports, price of capital, and spreads.
Experiment 2: Higher Uncertainty about Tariffs

1. Assume that tariffs follow an AR(1) process with stochastic volatility (calibrated from our empirical analysis)

$$\tau_t = (1 - \rho_\tau) \mu_\tau + \rho_\tau \tau_{t-1} + \exp(\sigma_t) \varepsilon_t, \quad \varepsilon_t \sim \mathcal{N}(0, 1)$$

$$\sigma_t = (1 - \rho_\sigma) \sigma + \rho_\sigma \sigma_{t-1} + \eta u_t, \quad u_t \sim \mathcal{N}(0, 1)$$

2. Solve model to third order to capture effects of increase in volatility, i.e. $\uparrow u_t$ (as in Andreasen et al., 2017)

3. Consider uncertainty shock size to reflect recent rise in uncertainty
Experiment 2: Channels of Transmission

- When different varieties are substitutes, profit function is asymmetric $\rightarrow$ losses from overpricing smaller than losses from underpricing. Same as in Fernandez-Villaverde et al., 2015

- Uncertainty about tariffs increases the variance of future desired prices

- Producers raise prices to avoid being stuck with relatively low price in the future $\rightarrow$ markups rise, especially in foreign market
Model Experiment 2: Results

Response to TPU: Baseline and Flex Price

- **Consumption**
  - Blue line: Baseline
  - Red dash line: Flex Price
  - % from SS

- **Investment**
  - % from SS

- **Net Exports**
  - % from SS pct of GDP

- **GDP**
  - % from SS

- **Domestic Good Inflation** $\pi_h$
  - Δ from SS bpts a.r.

- **Export Inflation** $\pi_h^*$
  - Δ from SS bpts a.r.

- **Markup in domestic market**
  - % from SS

- **Markup in foreign market**
  - % from SS
Takeaways from Model

- TPU rises as it did in 2018
  
  Anticipation of higher tariffs reduces investment by about 0.5 percent (Experiment 1)

  Uncertainty about future tariffs reduces investment by 0.3 percent (Experiment 2)

- Combined negative effect on investment about 1 percent.
Conclusions

- Recent increase in trade policy uncertainty is large and almost unprecedented (and understudied)

- Using both data and model, we find that a (2018-style) increase in trade policy uncertainty reduces investment by about 1 percent


Cross-Section: 2018 vs. 2017 Investment Growth
TPU from Hassan et al. (2016)
TPU from Baker et al. (2016)
News-Based vs. Tariff Volatility TPU

![Graph showing News-Based vs. Tariff Volatility TPU](image-url)
## Correlation of tariff volatility with other shocks

<table>
<thead>
<tr>
<th>External Shocks</th>
<th>Correlation</th>
<th>(p-value)</th>
<th>Granger F-test</th>
<th>(p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil shocks(^a)</td>
<td>−0.08</td>
<td>(0.45)</td>
<td>0.65</td>
<td>(0.52)</td>
</tr>
<tr>
<td>Monetary policy shocks(^b)</td>
<td>−0.05</td>
<td>(0.70)</td>
<td>0.78</td>
<td>(0.46)</td>
</tr>
<tr>
<td>TFP growth shocks(^c)</td>
<td>−0.01</td>
<td>(0.91)</td>
<td>0.07</td>
<td>(0.94)</td>
</tr>
<tr>
<td>Unanticipated tax shocks(^d)</td>
<td>−0.00</td>
<td>(0.99)</td>
<td>0.19</td>
<td>(0.83)</td>
</tr>
<tr>
<td>Defense spending shocks(^e)</td>
<td>0.06</td>
<td>(0.53)</td>
<td>0.95</td>
<td>(0.39)</td>
</tr>
<tr>
<td>Capital tax vol. shocks(^f)</td>
<td>0.14</td>
<td>(0.28)</td>
<td>1.04</td>
<td>(0.36)</td>
</tr>
</tbody>
</table>

**NOTE:** The entries in the table denote the pairwise correlations and Granger-causality tests between the tariff volatility shock identified under the baseline VAR specification and a set of external instruments. The regressions underlying the pairwise Granger causality tests include a constant and two lags of each external instrument. Sample period for the volatility shocks is 1960:Q3 to 1984:Q4.

\(^a\) Crude oil supply shock from Hamilton (2003).
\(^b\) Monetary policy shocks from Romer and Romer (2004); (1969:Q1–1984:Q4).
\(^c\) Residuals from a first-order autoregressive model of the log-difference in the utilization-adjusted total factor productivity; see Fernald (2012).
\(^d\) Unanticipated tax shocks from Mertens and Ravn (2011).
\(^e\) Defense spending news shocks from Ramey (2011).
\(^f\) Capital tax volatility shocks from Fernandez-Villaverde et al. (2015).
3. No Time Effects

Percent response with 68% c.i.

Quarters

0 1 2 3 4