

The Economic Effects of Trade Policy Uncertainty

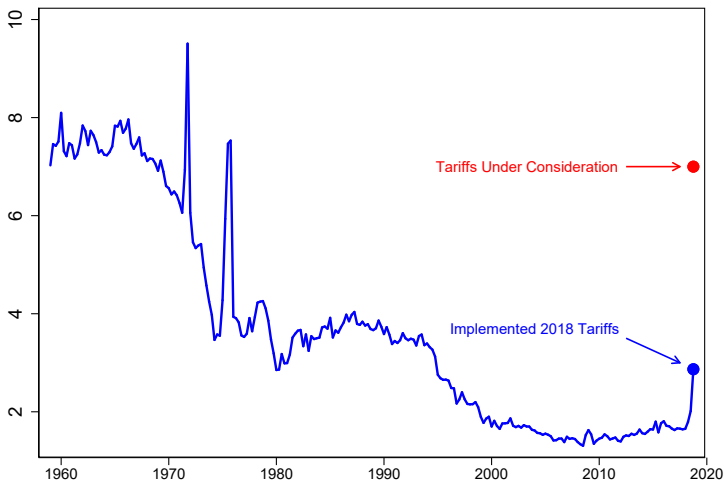
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The End of Free Trade?



U.S. Import Tariffs as % Share of Total Imports of Goods



Our Contribution

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

1. **Measurement:** We construct 3 TPU measures based on firm-level and aggregate data
2. **Quantification:** We provide firm-level and aggregate evidence that higher TPU reduced U.S. investment by about 1.5 percent in 2018
3. **Transmission:** We use an open-economy DSGE model to highlight how risk and uncertainty about trade policy affect economic activity

Firm-Level TPU

Measuring 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 earnings call follows a common two-part format:

1. Performance review of the last quarter
2. Q&A sessions with investors and analysts.
 - ▶ They contain information about risks faced by firm

Our sample: 160,000 transcripts, 7,500 firms, 2005Q1-2018Q4.

Measuring Firm-Level TPU: Textual Analysis

We proceed in two steps:

1. Search the earnings call transcripts for 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 = 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

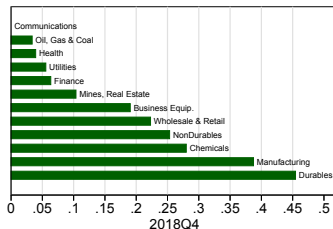
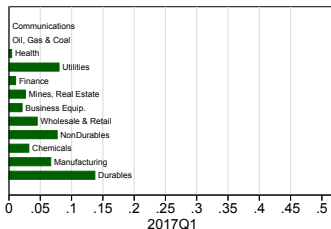
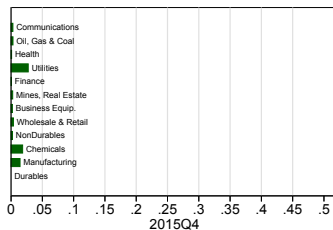
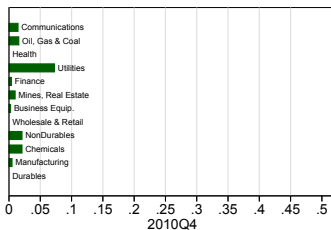
- “You will note for the fourth quarter, however, that North America will be down year over year, again reflecting the aberration of a year ago, when fourth-quarter dealer orders for low-end tires were high post expiration of Chinese tire tariffs.”

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 Industries and Time



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

Quantifying the Effects of Firm-Level TPU on Investment

- We use Compustat balance-sheet data over 2015Q1-2018Q4
- (Cumulative) Investment constructed from fixed assets $k_{i,t}$ as:

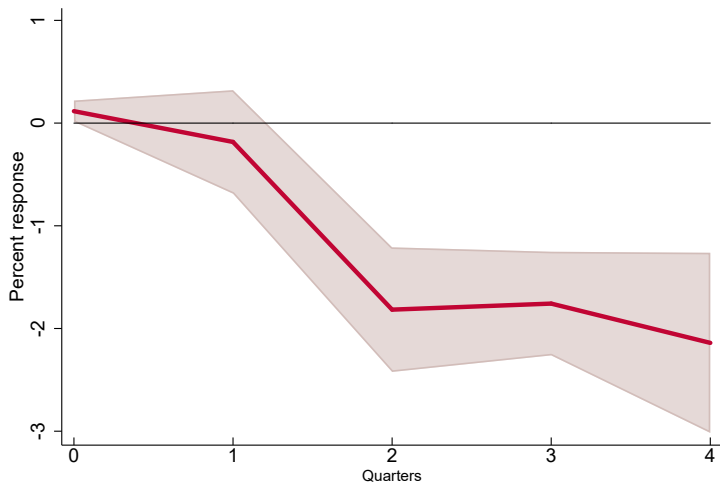
$$\log k_{i,t+h} - \log k_{i,t-1}, \text{ where } h \geq 0$$

- We estimate, for $h = 0, 1, 2, 3, 4$:

$$\log k_{i,t+h} - \log k_{i,t-1} = \alpha_i + \alpha_t + \beta_h TPU_{i,t} + \Gamma' X_{i,t} + \varepsilon_{i,t}$$

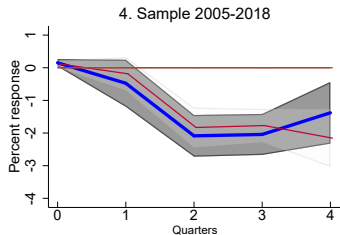
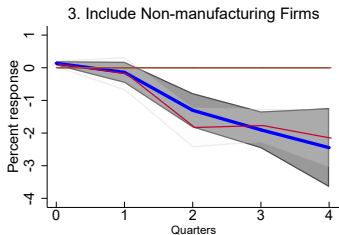
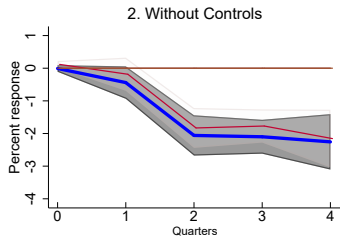
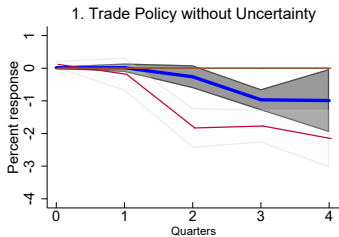
- α_i and α_t : firm and time fixed effects
- $X_{i,t}$: Tobin's q, cash-flow, openness, $\log k_{i,t-1} - \log k_{i,t-2}$, $TPU_{i,t-1}$
- β_h : response of $\log k$ in $t+h$ to change in TPU in quarter t
- We restrict sample to firms in manufacturing, agriculture and mining

Firm-Level Response to High TPU



Cumulative response of log assets after increase in *TPU* Cross-Section in 2018

Local Projections: Robustness



Aggregation of Firm-Level Estimates

Our estimates imply that the 2018 increase in TPU reduced U.S. investment by 1 percent through direct firm-level effects:

$$\underbrace{-2.5\%}_{\text{effect on } K \text{ of firm hit in 2018}} \times \underbrace{10\%}_{\text{share of firms hit by high TPU in 2018}} \times \underbrace{43\%}_{\text{asset share of mfg. firms}} \times \underbrace{\$24 \text{ tn}}_{\text{stock of US fixed assets in 2018}} \div \underbrace{\$2.8 \text{ tn}}_{\text{US investment in 2018}} \simeq \underbrace{-1\%}_{\text{decline in private investment}}$$

Note: Calculation ignores indirect effects through general equilibrium channels.

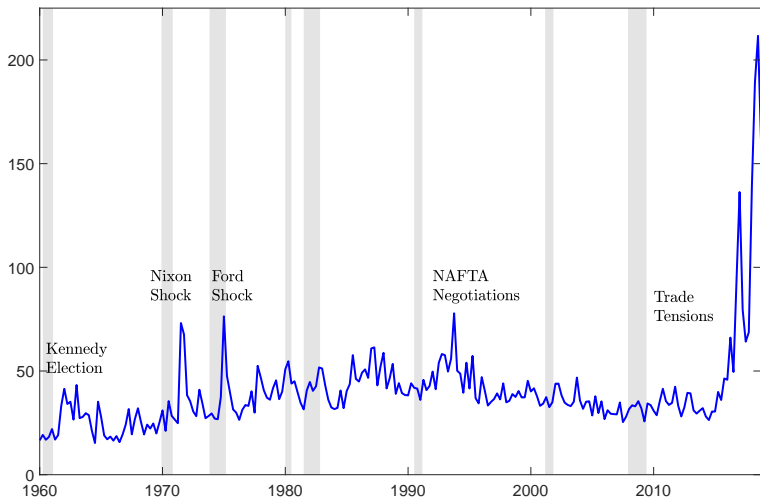
Aggregate TPU

Measuring Aggregate TPU

1. News-Based Using Textual Analysis ([Baker et al., 2016](#))

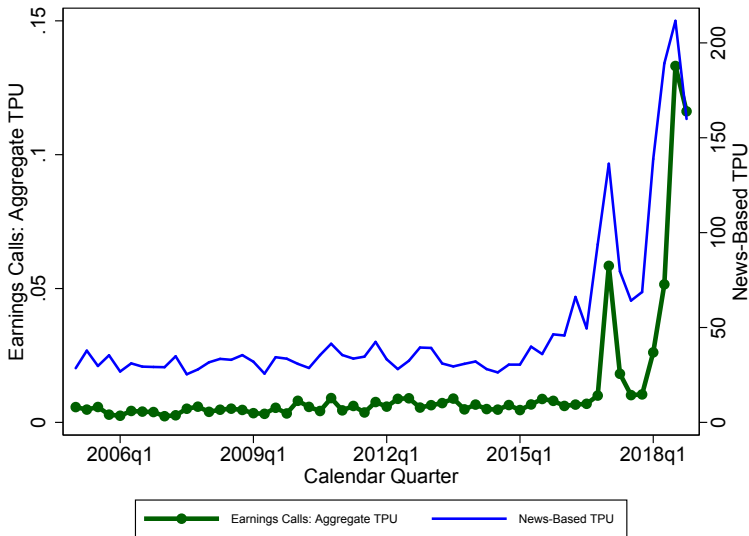
- We search for TPU words in newspaper articles
- Hence, this index captures TPU as perceived by press

News-Based TPU



Index=100 when share of articles mentioning *TPU* is 1 percent

News-Based vs. Earnings Calls Based TPU



Measuring Aggregate TPU

1. News-Based Using Textual Analysis ([Baker et al., 2016](#))

- We search for TPU words in newspaper articles
- Hence, this index captures TPU as perceived by press

2. Stochastic Volatility Using Tariff Data ([Fernandez-Villaverde et al., 2015](#))

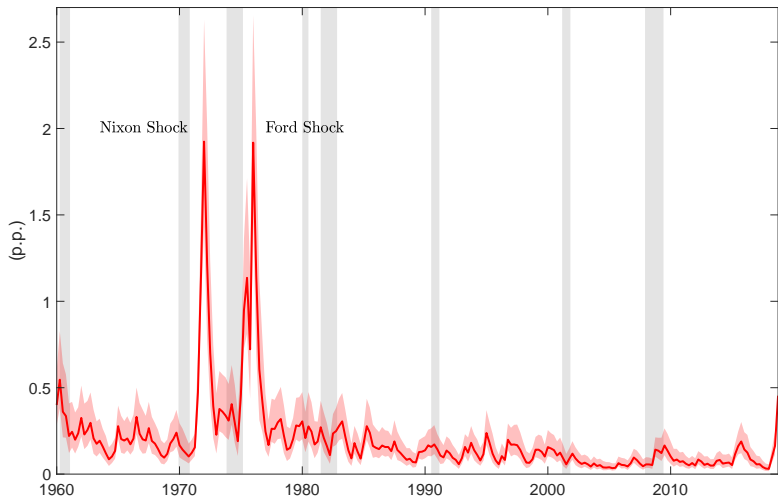
- We estimate the process:

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

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

- u_t affects spread of values for tariffs (i.e. tariff volatility shock)

Tariff Volatility TPU



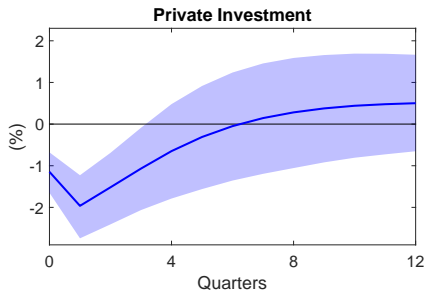
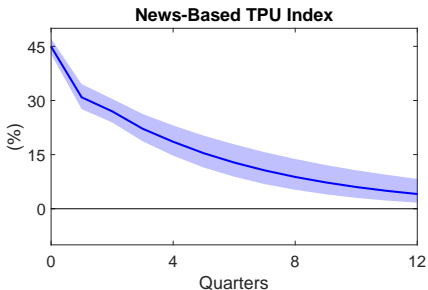
Filtered series of tariff volatility. Shaded area: 68-percent credible sets.

Comparison with news-based TPU

Quantifying the Effects of Aggregate TPU

- Estimation of VAR
- Baseline specification and ordering:
 1. News-Based TPU
 2. Real business fixed investment per capita
- Alternative specifications (see paper):
 - ▶ **Tariff volatility TPU:**
 - ▶ **Additional controls:** tariff rate, real GDP per capita, JLN uncertainty, exchange rate, tax rate on capital income.
- Sample: 1960Q1-2018Q4
- Consider IRFs to 2-standard deviation shock

Aggregate Effects: Baseline VAR



Taking Stock of the Empirical Evidence

- 2018 Increase in Firm-Level TPU
 - K of manufacturing firms drops 2.5 percent after 1 year
 - \simeq 1 percent decline (\$25 bn) in aggregate U.S. fixed investment.

- 2 standard deviations increase in aggregate TPU (comparable to recent developments)
 - \simeq 2 percent decline in U.S. investment.

TPU Transmission: DSGE Model

Framework

- Medium-scale DSGE model featuring:
 - ▶ Two countries specializing in production of traded intermediate inputs
 - ▶ Armington CES aggregator for traded intermediate inputs
 - ▶ Sticky prices and wages
 - ▶ Investment adjustment costs
 - ▶ Entry into and exit from export market (as in [Alessandria and Choi, 2007](#))
- Goal: Trace out aggregate GE effects and firm-level effects of an increase in TPU.
- Assumption: Tariffs are perfectly correlated across countries (full retaliation).

Effects of Tariffs

- Tariffs increase the relative price of imported goods → consumers switch towards domestic varieties **Demand switching**
- Tariffs induce supply-side distortions: They act like taxes on K and L **Supply Distortion**
- Tariffs reduce the value of exporting → mass of exporters shrinks and aggregate productivity declines **Entry Distortion**

Experiment: An Increase in TPU

- We isolate two effects of an increase in TPU
 - ▶ Rise in expected tariffs (first moment)
 - ▶ Mean-preserving increase in the volatility of future tariffs (second moment)
- Tariffs follow a SV process with news:

$$\tau_t^m = (1 - \rho_\tau) \mu_\tau + \rho_\tau \tau_{t-1}^m + \exp(\sigma_{t-1}^m) \varepsilon_t^\tau + \varepsilon_{t-1}^N \quad (1)$$

$$\sigma_t^m = (1 - \rho_{\sigma^m}) \sigma^m + \rho_{\sigma^m} \sigma_{t-1}^m + \eta u_t \quad (2)$$

where $\{\varepsilon_t^N\}_{t=0}^T$ is a news shock about the level of future tariffs

- We calibrate the parameters of this SV process using the empirical estimates

Experiment: Calibration of the Shocks

1. Time 0: Agents learn that there is probability $p_0 = \frac{1}{2}$ that tariffs increase from $\tau^{SS} = 0.02$ to $\tau^{HIGH} = 0.08$ Tariff Rates

$$\varepsilon_0^N = p_0 \cdot 0.08 + (1 - p_0) \cdot 0.02 = 0.03$$

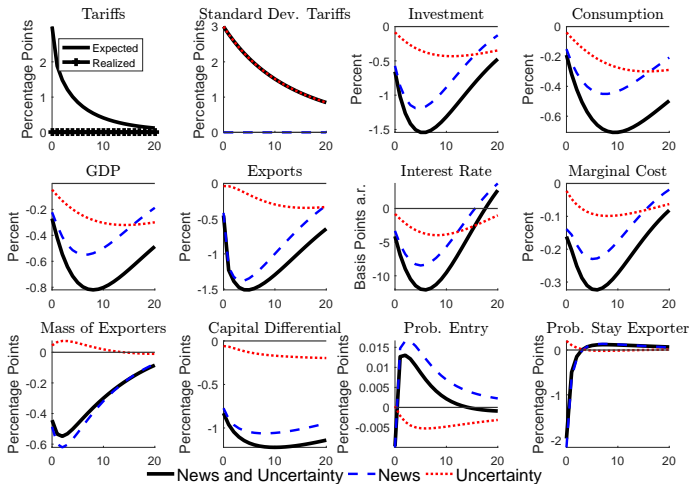
$$\sigma_0^m = \sigma^m(p_0) = \log(0.03)$$

where $\sigma^m(p)$ satisfies $\exp(\sigma^m) = \Delta\tau^m \sqrt{p(1-p)}$

2. From $t = 1, \dots, T$ **no change in tariffs occurs** i.e. $\tau_t^m = \tau^{SS}$ but **uncertainty about tariffs persists:**

- ▶ As agents observe no increase in tariffs they update p_t so that $\sigma^m(p_t) = \sigma_t^m$ follows SV law of motion (2)
- ▶ Expectation of tariffs adjust accordingly: $\varepsilon_t^N = p_t \cdot 0.08 + (1 - p_t) \cdot 0.02$

Model Experiment: Results



Tariff News: Channels of Transmission News Effects

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

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

$$\tilde{p}_t^k = r^k \tilde{r}_{t+1}^k + (1 - \delta) \tilde{p}_{t+1}^k - \tilde{r}_{t+1}(\tau_{t+1}^m)$$

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

$$\tilde{p}_t^k = r^k \tilde{r}_{t+1}^k(\tau_{t+1}^m) + (1 - \delta) \tilde{p}_{t+1}^k(\tau_{t+1}^m) - \tilde{r}_{t+1}(\tau_{t+1}^m)$$

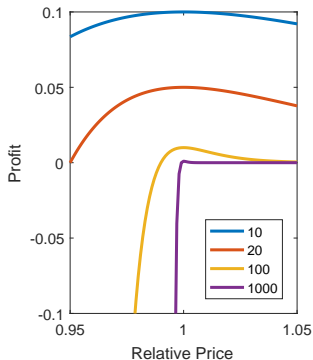
- With sticky prices, real interest rate does not drop much and second channel dominates.

Uncertainty: Channels of Transmission

Uncertainty Effects

1. Aggregate demand falls because of precautionary motive.
2. Markups increase. (as in [Fernandez-Villaverde et al., 2015](#))

- Uncertainty about tariffs increases the variance of future desired prices.
- When different varieties are substitutes, profit function is asymmetric → losses from overpricing smaller than losses from underpricing.



- Producers raise prices to avoid being stuck with relatively low price in the future → markups rise, especially in foreign market.

Taking Stock of the Model Results

- 2018 increase in TPU lowers investment by nearly 1 percent
 - ▶ Experiment 1 (mean effect): Anticipation of higher tariffs reduces investment by about 0.5 percent
 - ▶ Experiment 2 (variance effect): Uncertainty about future tariffs reduces investment by 0.3 percent

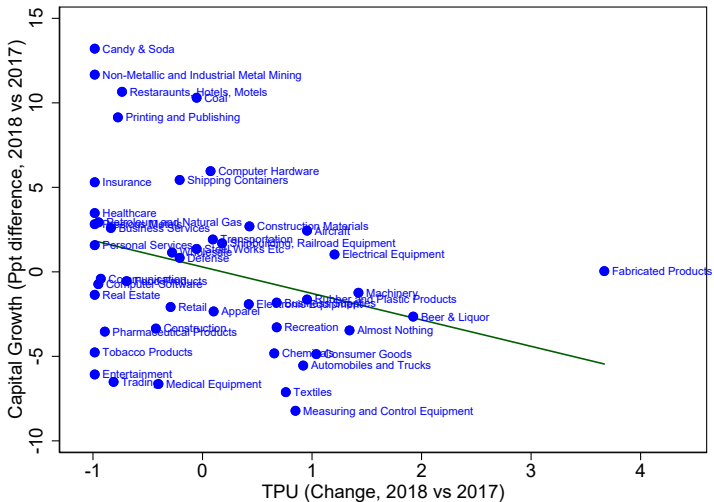
Conclusions

- **Measurement:** We construct firm-level and aggregate measures of TPU using both textual analysis and estimation of a stochastic volatility process.
- **Quantification:** We provide empirical evidence that the 2018 increase in TPU may have reduced U.S. investment by about 1-2 percent.
- **Transmission:** We study quantitatively the role of changes in expected tariffs and in volatility of future tariffs in an open-economy DSGE model with heterogeneous firms and sticky prices.

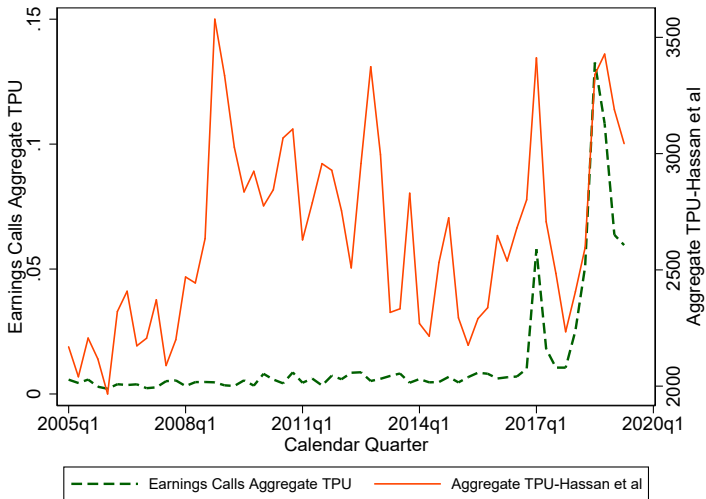
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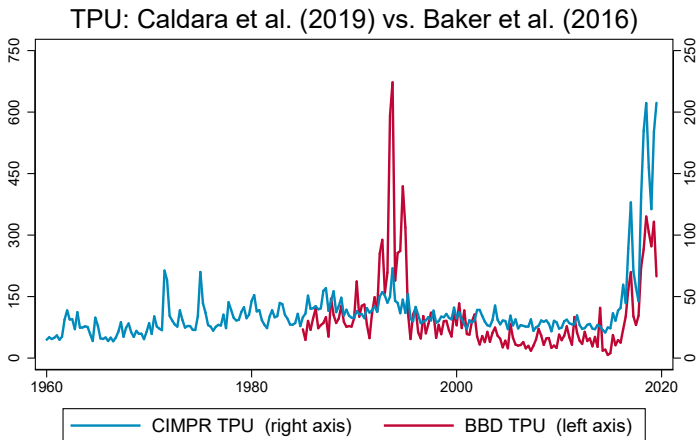
Cross-Section: 2018 vs.2017 Investment Growth



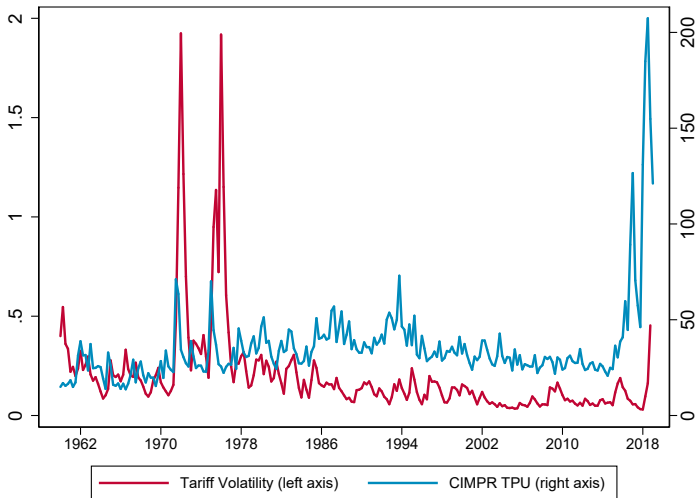
TPU from Hassan et al. (2019)



TPU from Baker et al. (2016)



News-Based vs. Tariff Volatility TPU



Correlation of tariff volatility with other shocks

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

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 \(2012\)](#).

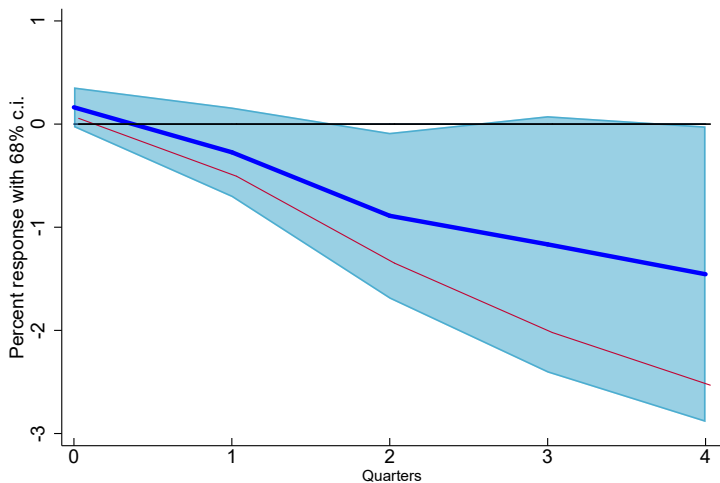
^d Unanticipated tax shocks from [Mertens and Ravn \(2011\)](#).

^e Defense spending news shocks from [Ramey \(2011\)](#).

^f Capital tax volatility shocks from [Fernandez-Villaverde et al. \(2015\)](#).

Local Projections: Robustness

3. No Time Effects



Topics List in Earnings Calls

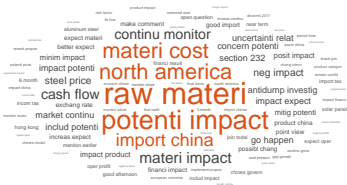
Topic 1



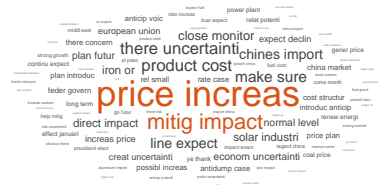
Topic 2



Topic 3

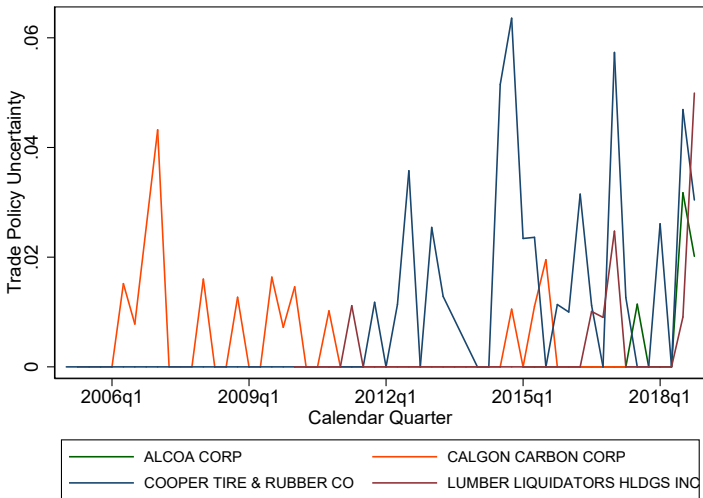


Topic 4



Note: LDA Analysis on Transcripts from All Years. Most Common Bigrams, Grouped by Topic.

Firm-Level TPU: Variation Across Firms and Time



Note: TPU for selected firms.

Effects of Tariffs: Demand-Switching

Back

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

$$m_t = -\theta \times (p_{m,t} + \tau_t^m) + a_t$$

imports
trade elasticity
price of imports
domestic absorption

- This effect tends to boost domestic output but
 - Symmetric retaliation abroad reduces foreign demand
 - Supply-side distortions reduce domestic production

Effects of Tariffs: Supply-Side Distortions

Back

- 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 are akin to a 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

Effects of Tariffs: Firm Entry

Back

- Firm exports at t if productivity is above threshold z_m^*

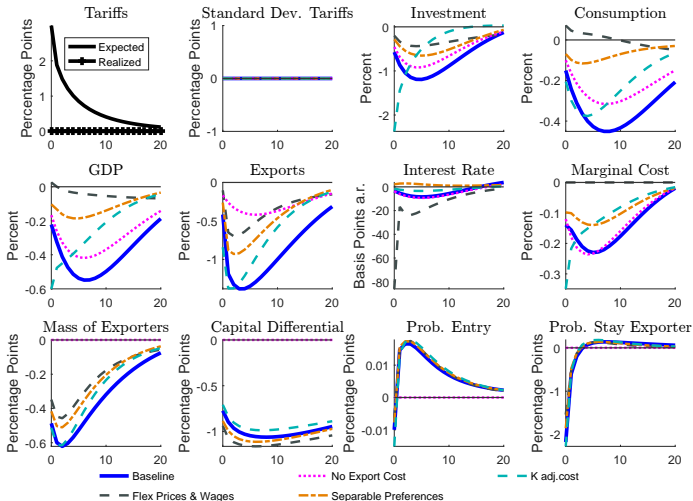
$$\underbrace{p^k \Delta k}_{\text{extra investment}} + \underbrace{W_t c_m}_{\text{fixed cost}} = \underbrace{z_m^{*\gamma}}_{\text{threshold}} \underbrace{\pi(W_t, K_{mt})}_{\text{unit profit}} (\Gamma_{\text{exp}}^V - \Gamma_{\text{no exp}}^V) + E \Delta V$$

market size gain
gain in contin. value

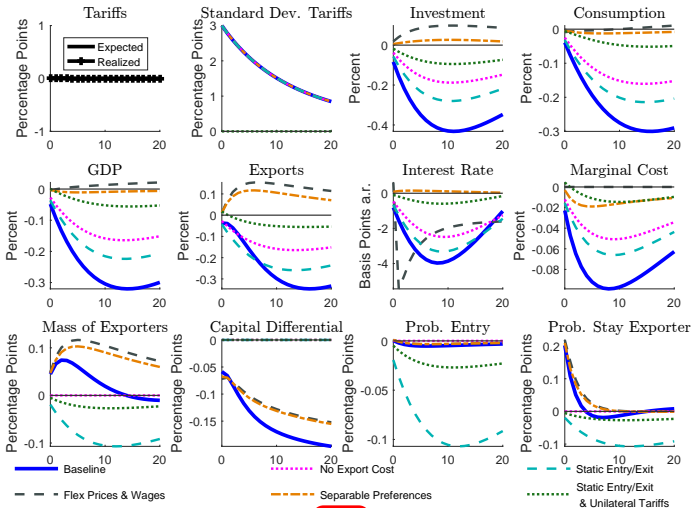
where $m \in \{ \text{Exporter at } t-1, \text{ Non Exporter at } t-1 \}$

- Gain in market size $(\Gamma_{\text{exp}}^V - \Gamma_{\text{no exp}}^V)$ shrinks because of demand switching at home and abroad
- Thresholds z_m^* declines and so Entry declines and exit increases
- Aggregate productivity declines as cross-sectional correlation between output and idiosyncratic productivity declines

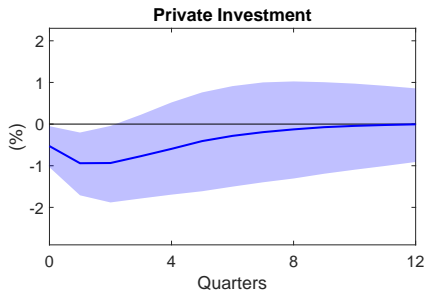
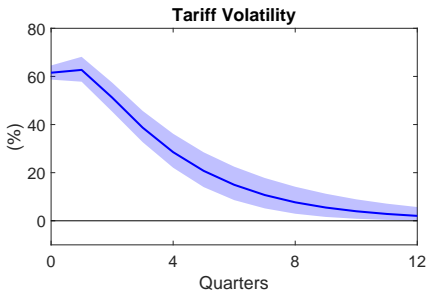
Model Experiment: Robustness (I)



Model Experiment: Robustness (II)

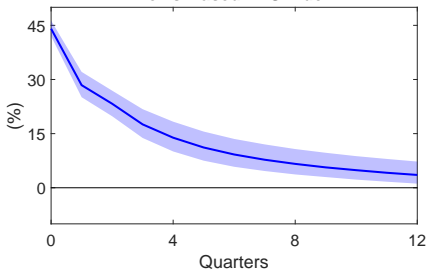


Aggregate Effects: Stochastic Volatility TPU



Aggregate Effects: Additional Controls

News-Based TPU Index



Private Investment

