Anxiety or Pain? The Impact of Tariffs and Uncertainty on Chinese Firms in the Trade War

Felipe Benguria (U of Kentucky), Jaerim Choi (U of Hawaii),
Deborah L. Swenson (UC Davis), and Mingzhi Xu (Peking University)

Presented for ASSA 2021 Conference

2021.1.3

Introduction

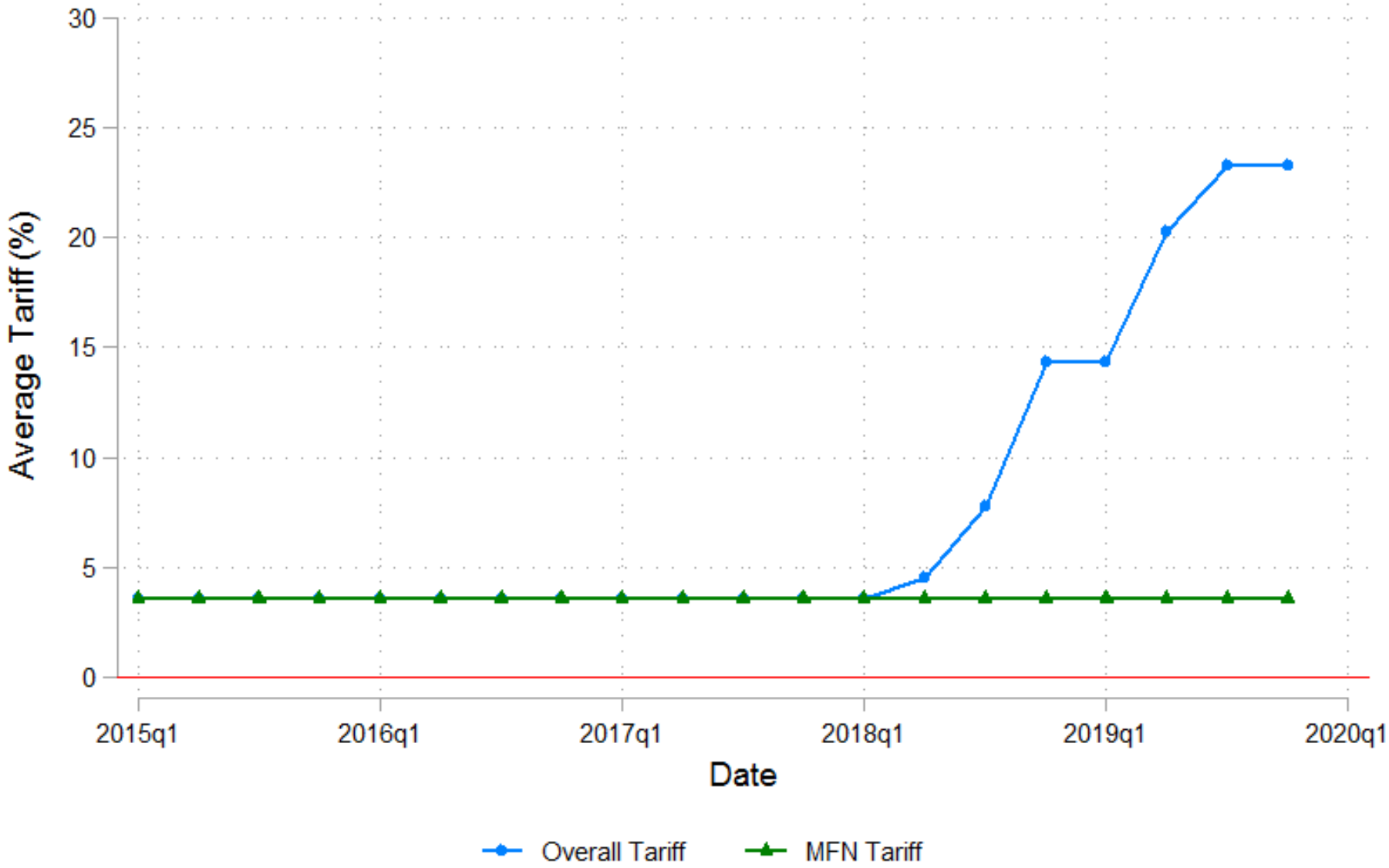
The U.S.-China Trade War

Trade War Timeline:

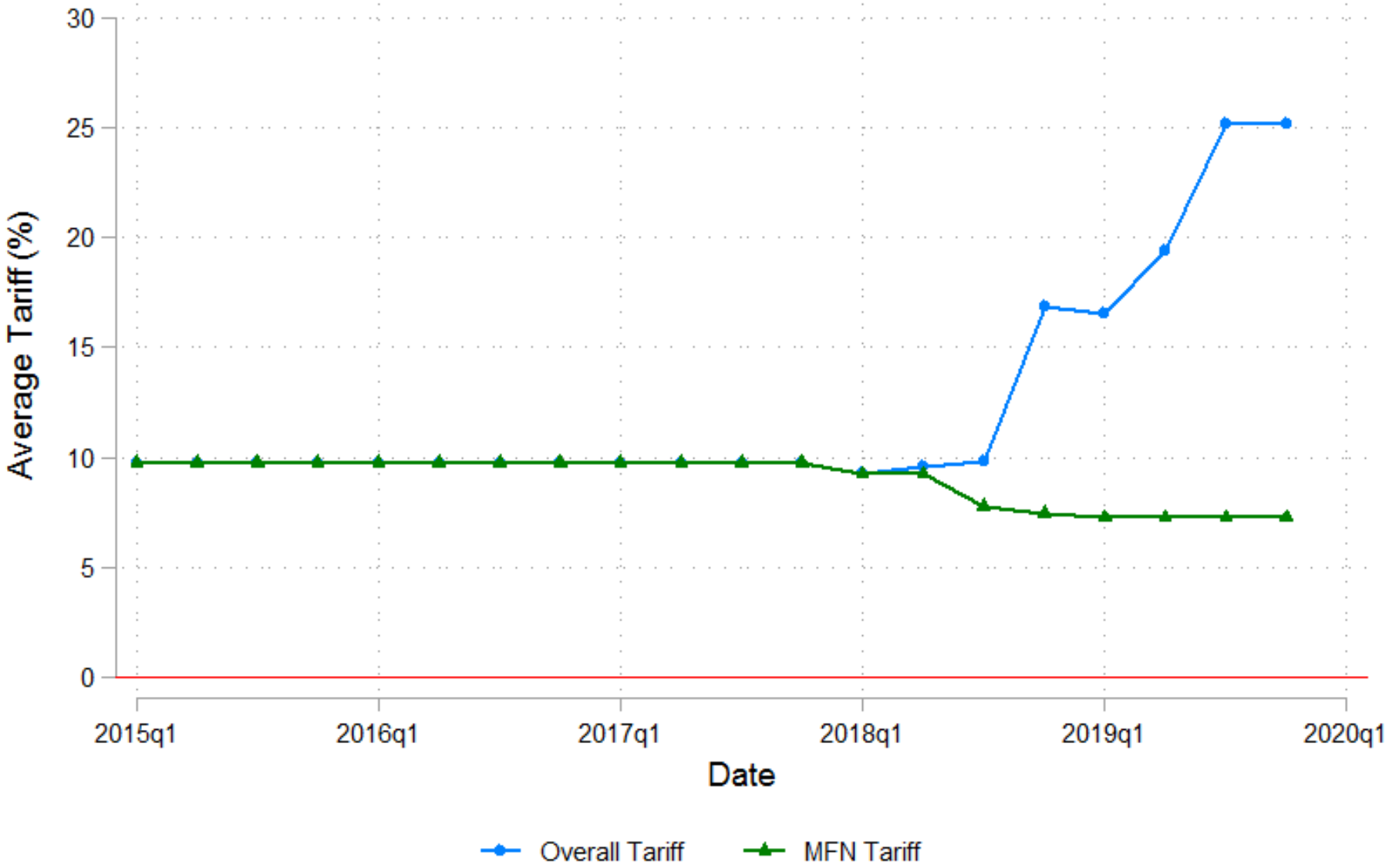
- Newly implemented U.S. trade policies stand in stark contrast with the long trend towards freer trade.

1. **(In the Beginning)** In January 2018 - Safeguard Tariffs on solar panels and washing machines. In March 2018 - Tariffs on steel and aluminum under national security grounds.
2. **(The First Round)** In July/August 2018 - $50 billion US tariff list and $50 billion Chinese tariff list both with 25% rates go into effect.
3. **(The Second Round)** In September 2018 - $200 billion US tariff List with 10% rates and $60 billion Chinese tariff list ranging from 5 to 10% rates go into effect.
4. **(More Tariff Hikes)** In May 2019 - $200 billion US tariff went from 10% rates to 25% rates. In June 2019 - China's tariff rate hike on US exports goes in effect, covering $36 billion of the $60 billion list

U.S. Tariff on Chinese Goods



Chinese Tariff on U.S. Goods



Research Question

Research Question:

- What are the impacts of the 2018-2019 trade war on Chinese firms?

Research Question

Research Question:

- What are the impacts of the 2018-2019 trade war on Chinese firms?

Previous Research: Focused on the U.S. economy

1. Quantify the impact of the trade war on the U.S. economy and find the welfare loss for the U.S equal to 0.4% of GDP. (Fajgelbaum et al, QJE, 2019; Amiti et al, JEP, 2019)
2. Evaluate the investment consequences for U.S. listed firms. (Amiti et al, NBER, 2020)
3. Examine the effects on the financial markets (i.e., stock market returns) of the trade war. (Huang et al, Working Paper, 2020)

$\Rightarrow$ Provide evidence of the trade war on Chinese firms!

The Focus of Our Study

Previous Research: Focused on the price adjustment channel

- Higher tariffs induce higher prices faced by consumers and firms; terms-of-trade effects induce reallocations; it may also lead to GE effects across industries and regions (Fajgelbaum et al, QJE, 2019; Amiti et al, JEP, 2019)

The Focus of Our Study: Trade Policy Uncertainty (TPU)

- In addition to the price adjustment channel, uncertainties perceived by Chinese firms (or U.S. firms) may also increase during the trade war.
- The trade war has significantly raised the uncertainty (IMF, 2018)
- TPU can affect firm-level entry and investment, and have important implications for welfare (Handley, 2014; Handley and Limao 2015, 2017; and Feng, Li and Swenson, 2017)

$\Rightarrow$ Investigate this new TPU channel, which has been rarely studied at the firm-level, and provide new insights on this research arena!

What's New?

Unique and Comprehensive Dataset: Three sources

1. Firm-level measures of tariff exposure
   (Customs data + Trade war tariffs + MFN tariffs)
2. Firm-specific measures of trade policy uncertainty
   (Firms' annual reports - textual analysis)
3. Firm-level real outcome variables
   (COMPUSTAT Global database)

Identification Strategy: U.S.-China Trade War

- Study the sources and consequences of TPU during the trade war
  (Endogenous TPU)

$\Rightarrow$ Using the finely detailed dataset in tandem with a clean identification strategy allows us to shed light on the mechanisms by which the trade war impacts Chinese firms.

Preview

Empirical Strategy:

- Estimate a difference-in-differences empirical specification based on variation across Chinese firms in exposure to trade war tariffs.

We find that:

1. Increases in U.S. tariffs and Chinese retaliatory tariffs both raised TPU for Chinese firms.
2. The impact of tariffs on uncertainty is heterogeneous.
   - Larger among smaller and less capital-intensive firms.
   - Smaller for more diversified exporters, but the diversification effect is hampered when firms have too much dependence on U.S. sales.
3. An increase in TPU leads to a reduction in investment, R&D expenditures, and profits.

Firm-level Measurement

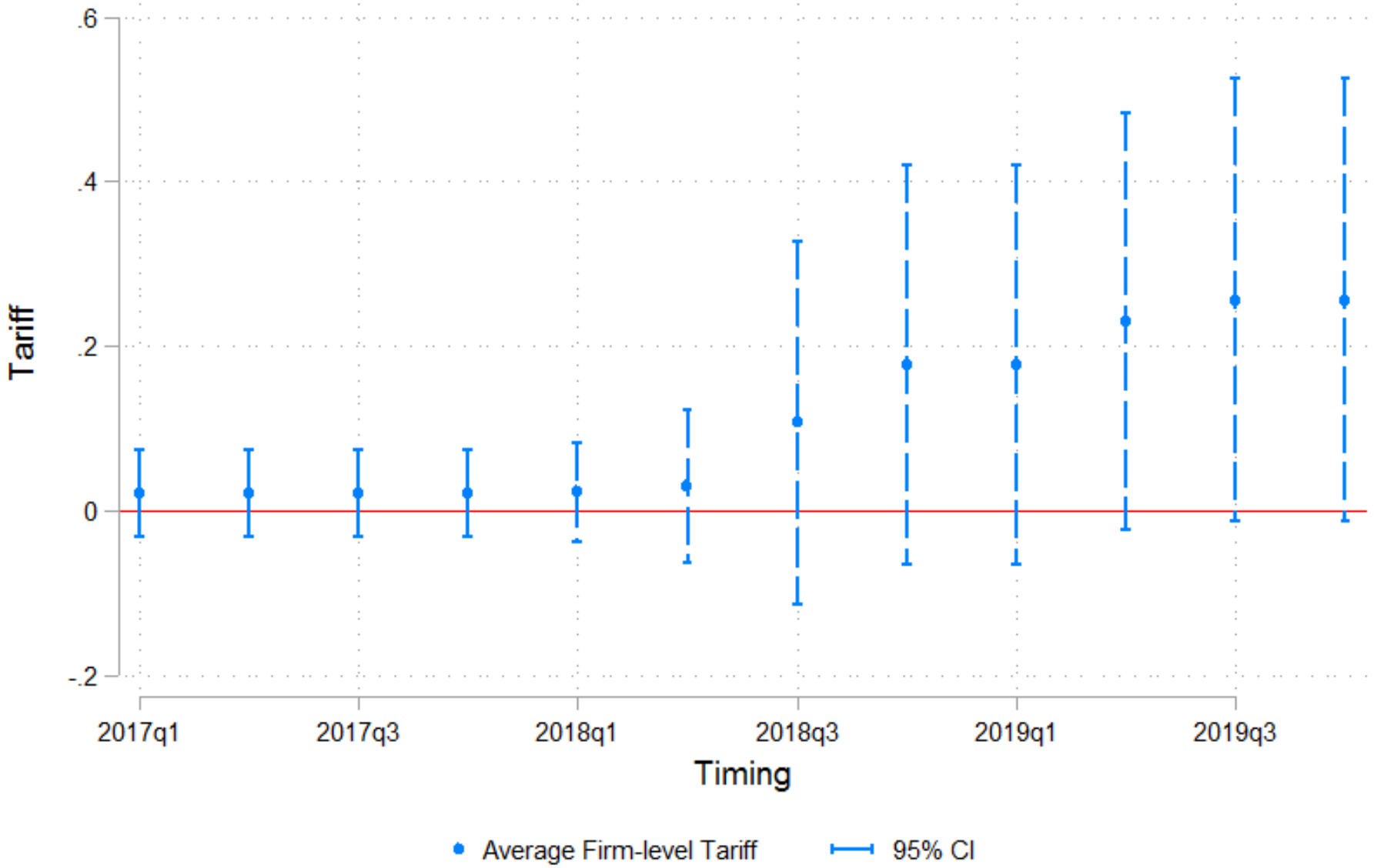
Firm-level Tariff Exposure Measures

- The U.S. tariff exposure of a Chinese firm i in time t:

$$\text{Tariff}_{it}^{\text{U.S.}} = \sum_{j \in J_i^e} \left[\frac{X_{ij0}^{\text{U.S.}}}{\sum_{s \in J_i^e} X_{is0}^{\text{U.S.}}} \tau_{jt}^{\text{U.S.}} \right]$$

  - $\tau_{jt}^{\text{U.S.}}$: Product j's *ad valorem* tariff (i.e., MFN tariff plus trade war tariff) imposed by the U.S. in time t
  - $X_{ij0}^{\text{U.S.}}$: Average exports of good j to the U.S. by firm i during 2013-2016
  - J_i^e: The set of goods exported by firm i

$\text{Tariff}_{it}^{\text{U.S.}}$



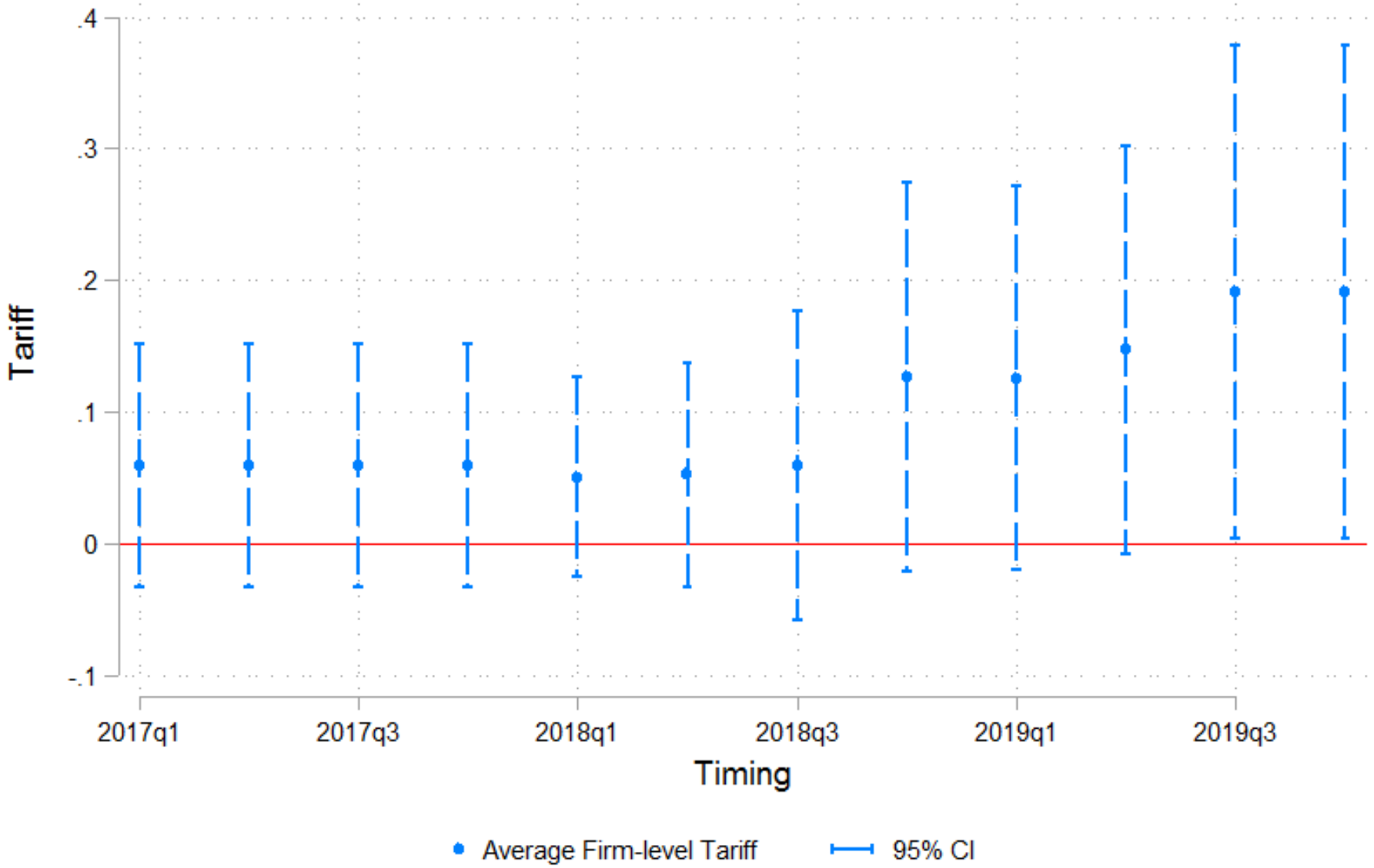
Firm-level Tariff Exposure Measures

- The Chinese tariff tariff exposure of a Chinese firm i in time t:

$$\text{Tariff}_{it}^{\text{CHN}} = \sum_{j \in J_i^m} \left[\frac{M_{ij0}^{\text{U.S.}}}{\sum_{s \in J_i^m} M_{is0}^{\text{U.S.}}} \tau_{jt}^{\text{CHN}} \right]$$

  - τ_{jt}^{CHN}: Product j's *ad valorem* tariff (i.e., MFN tariff plus trade war tariff) imposed by China on the U.S. goods in time t
  - $M_{ij0}^{\text{U.S.}}$: Average imports of good j from the U.S. by firm i during 2013-2016
  - J_i^m: The set of goods imported by firm i

Tariff_{it}^{CHN}



Firm-level Trade Policy Uncertainty Measure

- Our annual firm-level TPU measures are constructed using a textual analysis of the transcript of yearly reports of publicly listed companies in China.
  1. Import annual reports with each line of transcript stored as an observation.
  2. Search each line for the keywords related to uncertainty or future risk such as *uncertainty* and *risk*.
  3. Search each line for trade policy related keywords such as *tariff*, *import duty*, *export tariff*, *protectionism*, *unilateralism*, *trade barriers*, and *anti-dumping*
  4. Find uncertainty-related words and trade-policy-related words in the same line.

Trade Policy Related Keywords in the Annual Report (Angang Steel Company - GVKEY 205808)

38
制度，做到“一点，一措，一责任人”，全方位控制污染。对新、改、扩建项目，严把项目竣工验收关，确保“三同时”执行率 100%。
推进固体废物综合利用及规范化管理工作，推进森林式绿色生态厂区建设；全面实施环保技术改造项目，巩固现有扬尘治理成果，加强环保改造项目管理，加快项目实施步伐，实现“天常蓝、水常青、草常绿、固废零出厂”。

（2）营销风险 Risks in sales

① 风险描述
钢铁产能过剩基本面没有根本改变，国内供需矛盾仍突出，市场竞争激烈。新经济增长点对钢材需求强度明显减弱，传统用钢行业对钢铁产品需求由品种、数量的增长转向质量和品质的提升，对钢铁行业提出了更高要求。钢铁行业原燃材料价格上涨、环保运行成本上升，给钢铁企业带来的成本压力不断增加。
随着世界经济深刻调整，保护主义、单边主义抬头，经济全球化遭遇波折，不稳定不确定因数较大，钢铁企业将面临越来越多的国际贸易争端，给钢材出口带来诸多不利影响。

Protectionism, unilateralism　　Uncertainty increases

② 风险管理解决方案
完善“1+4+N”营销模式，发挥营销体系统筹管理作用。对内，强化调品指数、预期制造、客户服务、销量价格等方面对标；对外，以推进汽车钢一体化协同、中厚板事业部制为突破口，统筹协调华东、华南、华北三大区域重点客户。
拓宽营销渠道，深耕细作东北市场；加大重点工程项目投标力度；响应“一带一路”倡议，拓展海外营销渠道，积极开拓东南亚、印度等新兴市场。
延伸产业链，积极开展深加工处理配送、配套、期现结合等业务；按照产业链融资管理方案，推进实施下游客户金融服务，在增加客户粘性、提高市场占有率的同时增加公司效益。
建立完善以客户体验为导向的科研、质量和营销管理机制，解决客户痛点，增强客户粘结性，不断提高盈利能力。发挥销售龙头带动作用，将市场信息和客户需求反馈给研发、质量、生产部门，提高自身产品质量，提高竞争力。

Firm-level Trade Policy Uncertainty Measure

- Formally, the firm-level TPU for firm i in year t is defined as follows:

$$TPU_{it} = \frac{1}{R_{it}} \sum_{w=1}^{R_{it}} \{1\Big[w \in \text{Keywords}^{\text{Uncertainty}}\Big] \times 1\Big[|w-t| < \text{One Line}\Big]\}$$

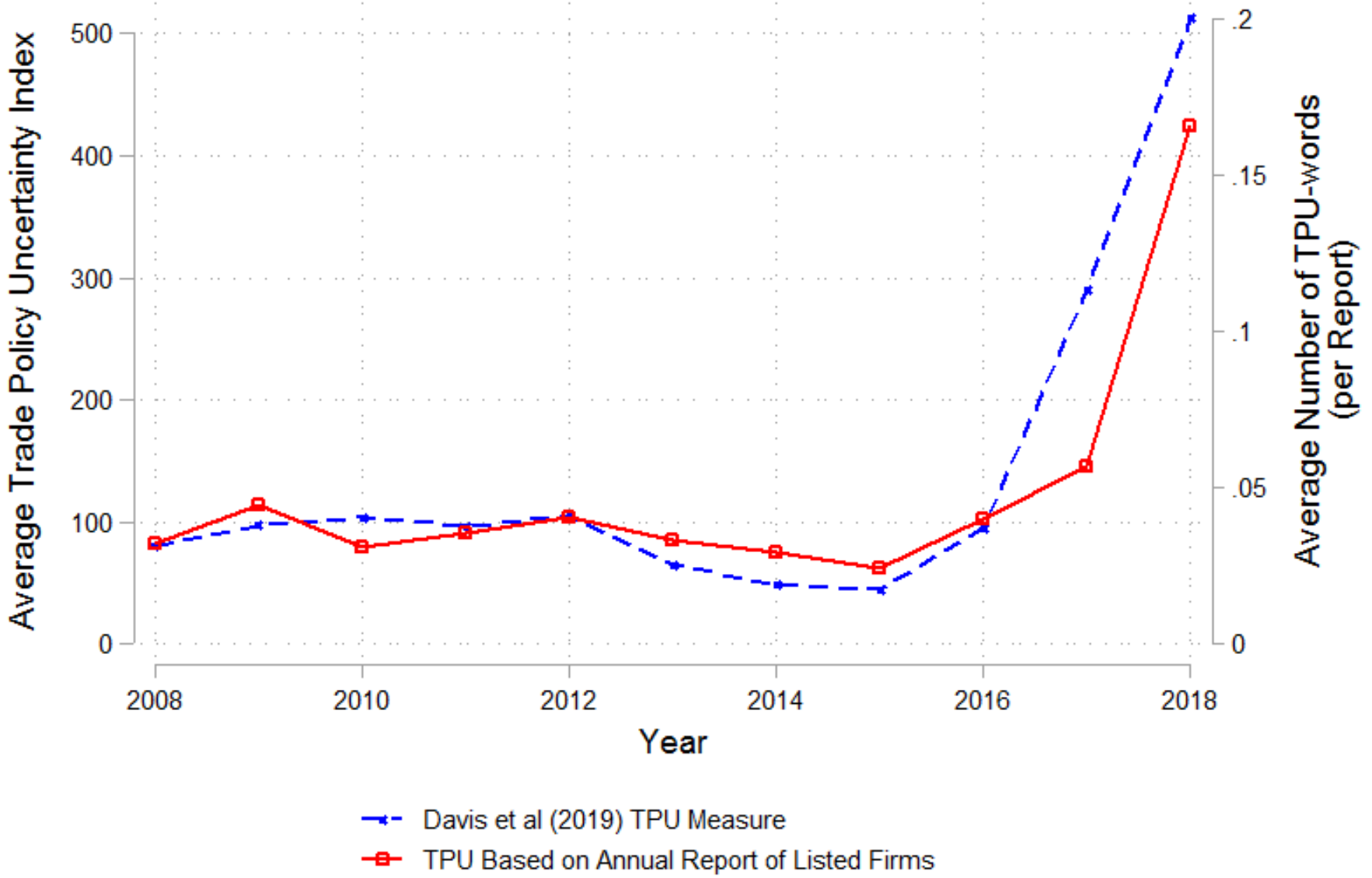
  - $w = 0, 1, ..., R_{it}$: Words contained in the annual report of firm i in t
  - R_{it}: Length of report measured as the total number of Chinese characters
  - t: The position of the nearest synonym of trade policy keywords (i.e., $t \in \text{Keywords}^{\text{Trade policy}}$).

Summary of Firm-level TPU Measure by Year

Year	(I) Appearance in Range of +/− 1 Lines				(II) Appearance in the Same Line			
	Keywords Number		Keywords Share		Keywords Number		Keywords Share	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
2008	0.111	0.377	0.014	0.047	0.039	0.204	0.005	0.028
2009	0.145	0.487	0.017	0.059	0.052	0.246	0.006	0.029
2010	0.076	0.315	0.009	0.039	0.033	0.195	0.004	0.024
2011	0.098	0.373	0.011	0.044	0.036	0.213	0.004	0.025
2012	0.099	0.403	0.012	0.047	0.048	0.278	0.006	0.033
2013	0.070	0.332	0.008	0.038	0.035	0.230	0.004	0.026
2014	0.068	0.314	0.007	0.033	0.031	0.218	0.003	0.023
2015	0.069	0.312	0.007	0.032	0.028	0.187	0.003	0.020
2016	0.112	0.430	0.011	0.041	0.042	0.241	0.004	0.023
2017	0.132	0.461	0.012	0.044	0.063	0.298	0.006	0.029
2018	0.303	0.733	0.026	0.063	0.182	0.536	0.015	0.045

Notes: The table summarizes firm-level TPU measure by year.

Our TPU measure and TPU in Davis et al. (2019)



Empirical Analysis

Firm-level Impact of the 2018-2019 Trade War on TPU

- Estimate the following regression in first-differences:

$$\Delta \text{TPU}_i = \beta \Delta_{\log}(1+\text{Tariff}_i^{\text{U.S.}}) + \gamma \Delta_{\log}(1+\text{Tariff}_i^{\text{CHN}}) + \delta X_i + \psi_{\text{REG}} + \psi_{\text{IND}} + \varepsilon_i$$

  - Δ denotes changes between 2017Q4 and 2018Q4
  - ΔTPU_i: Change in firm i's TPU
  - $\Delta \log(1 + \text{Tariff}_i^{\text{U.S.}})$: Change in firm i's U.S. Tariff
  - $\Delta \log(1 + \text{Tariff}_i^{\text{CHN}})$: Change in firm i's CHN Tariff
  - X_i: Revenue, capital and profits in 2017Q4.
  - ψ_{REG}: Region FEs (e.g., Jiangsu Province, Zhejiang Province)
  - ψ_{IND}: Industry FEs (i.e., SIC 3-digit industry)

$\Rightarrow$ These region dummies and industry dummies absorb region- and industry-specific trends in trade policy uncertainty.

TPU and Tariffs: 2017Q4 - 2018Q4

	Dependent Variable: ΔTrade Policy Uncertainty				
	(1)	(2)	(3)	(4)	(5)
$\Delta\log(1+\text{Tariff}^{\text{U.S.}})$	0.314***		0.245*	0.131	0.126
	(0.121)		(0.125)	(0.128)	(0.133)
$\Delta\log(1+\text{Tariff}^{\text{CHN}})$		0.701**	0.569*	0.722**	0.668**
		(0.296)	(0.307)	(0.303)	(0.310)
Firm Characteristics	No	No	No	No	Yes
Region FE	No	No	No	Yes	Yes
Industry FE	No	No	No	Yes	Yes
Observations	2,180	2,180	2,180	2,168	2,135
R-squared	0.003	0.003	0.005	0.078	0.081

Firm Size and Capital Intensity

- Next, we explore whether the trade war tariffs have had a differential impact on trade policy uncertainty for firms of different sizes:

$$\begin{aligned}\Delta \text{TPU}_i = \alpha &+ \beta_1 \Delta \log(1 + \text{Tariff}_i^{\text{U.S.}}) \\ &+ \beta_2 \Delta \log(1 + \text{Tariff}_i^{\text{U.S.}}) \times \log(\text{Revenue}_i) \\ &+ \gamma_1 \Delta \log(1 + \text{Tariff}_i^{\text{CHN}}) \\ &+ \gamma_2 \Delta \log(1 + \text{Tariff}_i^{\text{CHN}}) \times \log(\text{Revenue}_i) \\ &+ \delta X_i + \psi_{\text{REG}} + \psi_{\text{IND}} + \varepsilon_i\end{aligned}$$

TPU, Tariffs, and Size: 2017Q4 - 2018Q4

	Dependent Variable: ΔTrade Policy Uncertainty					
	Interactions with Revenues			Interactions with Capital		
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta\log(1+\text{Tariff}^{\text{U.S.}})$	1.800***		1.563**	1.687***		1.331**
	(0.589)		(0.609)	(0.592)		(0.609)
$\Delta\log(1+\text{Tariff}^{\text{CHN}})$		3.314**	2.238		4.060***	3.187**
		(1.375)	(1.407)		(1.321)	(1.343)
$\Delta\log(1+\text{Tariff}^{\text{U.S.}})\times$ log(Revenue)	-0.255***		-0.231**			
	(0.095)		(0.098)			
$\Delta\log(1+\text{Tariff}^{\text{CHN}})\times$ log(Revenue)		-0.392*	-0.233			
		(0.213)	(0.219)			
$\Delta\log(1+\text{Tariff}^{\text{U.S.}})\times$ log(Capital)				-0.230**		-0.188*
				(0.094)		(0.096)
$\Delta\log(1+\text{Tariff}^{\text{CHN}})\times$ log(Capital)					-0.490***	-0.367*
					(0.189)	(0.193)
Firm Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,135	2,135	2,135	2,135	2,135	2,135
R-squared	0.082	0.082	0.085	0.081	0.084	0.086

Firm Size and Capital Intensity

- Fan, Li and Yeaple (JIE, 2018) find that, around the time of China's WTO accession, lower productivity firms benefit more from the accession due to the quality upgrading that is facilitated by trade liberalization.

- If Chinese firms were sourcing optimally before the trade war, the reversal of opportunities due to the trade war implies that the damage would be greatest for these firms which are likely to be characterized by low capital intensity, small revenue and low productivity.

Trade Diversification

- In addition to the quality channel, the effect of tariffs on TPU could also depend on firms' product and market diversification patterns:

$$\begin{aligned}\Delta \text{TPU}_i = \alpha &+ \beta_1 \Delta \log(1 + \text{Tariff}_i^{\text{U.S.}}) \\ &+ \beta_2 \Delta \log(1 + \text{Tariff}_i^{\text{U.S.}}) \times N_i^{exp,prod} \\ &+ \gamma_1 \Delta \log(1 + \text{Tariff}_i^{\text{CHN}}) \\ &+ \gamma_2 \Delta \log(1 + \text{Tariff}_i^{\text{CHN}}) \times N_i^{imp,prod} \\ &+ N_i^{exp,prod} + N_i^{imp,prod} + \delta X_i + \psi_{\text{REG}} + \psi_{\text{IND}} + \varepsilon_i\end{aligned}$$

  - $N_i^{exp,prod}$ and $N_i^{imp,prod}$ are the total number of exported and imported products for firm i from 2013 to 2016.

TPU, Tariffs, and Diversification: 2017Q4 - 2018Q4

	Dependent Variable: ΔTrade Policy Uncertainty					
	Number of Products			Number of Partner Countries		
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta\log(1+\text{Tariff}^{\text{U.S.}})$	0.271*		0.173	0.572***		0.392**
	(0.151)		(0.152)	(0.192)		(0.192)
$\Delta\log(1+\text{Tariff}^{\text{U.S.}})\times N_i^{exp,prod}$	-0.003		-0.003			
	(0.002)		(0.002)			
$\Delta\log(1+\text{Tariff}^{\text{U.S.}})\times N_i^{exp,ctry}$				-0.016***		-0.012**
				(0.005)		(0.005)
$\Delta\log(1+\text{Tariff}^{\text{CHN}})$		0.764**	0.732**		0.577	0.570
		(0.373)	(0.366)		(0.459)	(0.471)
$\Delta\log(1+\text{Tariff}^{\text{CHN}})\times N_i^{imp,prod}$		-0.005	-0.006			
		(0.010)	(0.009)			
$\Delta\log(1+\text{Tariff}^{\text{CHN}})\times N_i^{imp,ctry}$					-0.019	-0.019
					(0.035)	(0.035)
Firm Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,135	2,135	2,135	2,135	2,135	2,135
R-squared	0.080	0.081	0.083	0.082	0.083	0.087

Trade Diversification

- Multi-country exporters perceive less uncertainty after an increase in tariff, presumably due to their ability to reroute trade (see Kramarz et al., JIE, 2020; Caselli et al., QJE, 2020).

- Also, if there are sunk costs of searching for trade partners, or fixed investments that are placed as new export destinations are created, the existence of established trade partners helps to explain the diversification effects.

Firm-level Impact of TPU on Economic Outcomes

- Next, we analyze whether heightened firm-level TPU impacts firm-level outcomes:

$$\log(\mathrm{K}_{i,t+k}) - \log(\mathrm{K}_{i,t}) = \alpha + \beta \Delta \mathrm{TPU}_i + \gamma X_i + \psi_{\mathrm{REG}} + \psi_{\mathrm{IND}} + \varepsilon_i$$

  - $\log(\mathrm{K}_{i,t+k}) - \log(\mathrm{K}_{i,t})$: Percent change in capital stocks for firm i from $t = 17\mathrm{Q4}$ to $t + k$ where $t + k$ denotes a quarter after 18Q4 (i.e., $t + k = \{18Q4, 19Q1, 19Q2, 19Q3\}$)

Investment and TPU

	Dependent Variable: Δlog(Capital)			
	(1)	(2)	(3)	(4)
	17Q4-18Q4	17Q4-19Q1	17Q4-19Q2	17Q4-19Q3
ΔTPU (17Q4-18Q4)	-0.034**	-0.034*	-0.040**	-0.048**
	(0.017)	(0.019)	(0.020)	(0.024)
Firm Characteristics	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	2,134	2,135	2,131	2,121
R-squared	0.109	0.113	0.111	0.113

R&D and TPU

	Dependent Variable: Δlog(R&D) (2017-2018)					
	(1)	(2)	(3)	(4)	(5)	(6)
ΔTPU	-0.039	-0.034	-0.048*	-0.052*	-0.049*	-0.063**
(17Q4-18Q4)	(0.028)	(0.027)	(0.025)	(0.030)	(0.028)	(0.025)
$\log(R\&D)_{2017}$		-0.130***	-0.254***		-0.150***	-0.326***
		(0.030)	(0.053)		(0.033)	(0.058)
Firm Characteristics	No	No	Yes	No	No	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	No	No	Yes	Yes	Yes
Observations	2,032	2,032	2,004	2,019	2,019	1,993
R-squared	0.019	0.083	0.160	0.069	0.145	0.260

Profits and TPU

	Dependent Variable: ΔProfit			
	17Q4-18Q4	17Q4-19Q1	17Q4-19Q2	17Q4-19Q3
	(1)	(2)	(3)	(4)
ΔTPU	-24.571	-9.609	-19.786*	-25.915*
(17Q4-18Q4)	(16.381)	(11.278)	(10.503)	(13.598)
Firm Characteristics	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	2,135	2,135	2,131	2,121
R-squared	0.142	0.269	0.191	0.251

Conclusion

Conclusion

Key messages:

(What we do) Explore the sources and consequences of TPU during the ongoing U.S.-China trade war.

(Takeaway I) While it has been generally acknowledged that TPU must have played a role in the trade war (IMF, 2018), there is little understanding of how the process works, the magnitude of this channel, and which firms are more exposed to it.

We move one step in this direction and show that the increases in firm-level TPU seen during this period are systematically associated with exposure to both U.S. tariffs and Chinese tariffs.

(Takeaway II) Document the negative consequences of the TPU spike on firm investment, R&D expenditures and profits.

Overall, our work highlights the importance of the *TPU channel* during the ongoing U.S.-China trade war