Comment on: "The Economic Effects of Trade Policy Uncertainty" by Dario Caldara, Matteo Iacoviello, Patrick Molligo, Andrea Prestipino, and Andrea Raffo

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1. Introduction

Amidst the ongoing Brexit negotiations and U.S. President Trump's threats to terminate NAFTA and levy wide-ranging tariffs on Chinese goods, there are growing concerns that uncertainty about trade policy could have significant economic consequences. Studies such as Pierce and Schott (2016) and Handley and Limão (2017), who find that past trade policy uncertainty episodes had substantial effects, suggest that these concerns could have merit, while other studies, such as Steinberg (2019), argue that these concerns are overblown. Measuring trade policy uncertainty, understanding the mechanisms through which it affects the economy, and quantifying these effects remain ongoing challenges.

The paper by Caldara et al. (henceforth CIMPR) makes two contributions to our understanding of the economic effects of trade policy uncertainty (TPU for short). First, the authors construct a novel database of firm-level TPU exposure by analyzing quarterly earnings call transcripts as in Hassan et al. (2016), and show convincingly that firms reduce investment when their exposure to TPU increases. This microeconomic analysis is complemented by use of a VAR to trace out the macroeconomic responses to several new measures of aggregate TPU.

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Second, the authors use an open-economy New Keynesian DSGE model to interpret the economic effects of TPU and propose a clever method of disentangling the anticipatory effects of increases in expected future trade costs from the precautionary effects of increased trade cost volatility. They use a linearized version of the model, in which changes in volatility have no effect, to measure the anticipatory effect, and use a third-order approximation to analyze the effect of a mean-preserving spread to tariffs to measure the precautionary response.

My comments on the paper are twofold. First, the construction of the firm-level TPU measure represents a contribution to the literature in and of itself, but it also opens numerous avenues to investigate empirically the mechanisms underlying the economic effects of TPU. My preliminary analysis, which links the authors' TPU database to several measures of international trade exposure constructed using the U.S. input-output accounts, indicates a range of explanations for firms' concerns about TPU: exporters worry about how changes in trade barriers could affect foreign demand for their products, and other firms are concerned about how restricting imports could change competition as well as production costs.

Second, the contractionary effect of increased tariff volatility in the authors' model, which is driven by sticky export prices, hinges crucially on a positive correlation between foreign demand and domestic marginal costs. I use a simple, two-period model of a sticky-price exporter to illustrate this point and argue that this correlation may be sensitive to some of the authors' key modeling assumptions, and that the anticipatory effects of an increase in expected future tariffs on firms' pricing decisions could offset the precautionary effects of an increase in tariff volatility.

2. Why do firms care about trade policy uncertainty?

In their empirical analysis, the authors construct a new measure of firm-level TPU exposure by counting the frequency of TPU-related terms in quarterly earnings conference call transcripts as in Hassan et al. (2016), and document that firms reduce investment when they are more exposed to TPU. This analysis, however, does not offer any insight into the reasons that firms care about TPU, and I view this as a missed opportunity.

There are several potential mechanisms through which TPU could affect the investment decisions of firms that engage in, or are affected by, international trade:

1. Exporters (or potential exporters) might worry about the possibility that foreign trade barriers on their products could rise in the future;
2. Non-exporters might be concerned about how changes in domestic trade barriers could affect import competition;
3. Firms that import intermediate inputs might worry that changes in domestic trade barriers could affect their production costs.

Additionally, firms without any direct connection to international trade might also worry about general equilibrium effects. While CIMPR and other recent papers in the trade policy uncertainty literature, such as Steinberg (2019), Crowley et al. (2018), and Handley and Limão (2017) have focused on the first mechanism, the sample earnings call transcripts shown in the appendix of CIMPR illustrate that the other mechanisms could also be important. Several transcripts suggest concerns about the cost of imported inputs. For example, in Sunpower's 2017Q3 earnings call, the electronic equipment maker stated that "import tariffs or quotas on solar panels" could "impose a direct burden," and Broadwind Energy's earnings call in the same quarter stated that "a [steel] tariff... would not be a good thing, because of the steel we consume in our businesses." Other transcripts hint at worries about import competition. Renewable Energy Group, for example, which produces biodiesel fuels, discussed its desire for antidumping investigations and countervailing duties against foreign competitors in several earnings call transcripts.

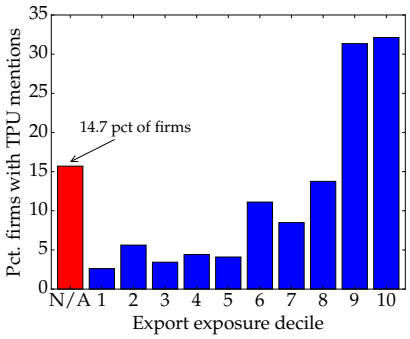
To provide a more systematic analysis of the economics underlying firms' concerns about TPU, I used the input-output accounts published by the U.S. Bureau of Economic Analysis to measure different dimensions of firms' exposure to international trade.[1] For each 6-digit NAICS industry in the input-output data, I computed three measures of trade exposure: export exposure, which is measured as the ratio of exports to value added; import exposure, which is measured as the ratio of imports to value added; and imported input exposure, which is measured as the average import exposure of an industry's intermediate inputs, weighted by those inputs' direct requirement

[1]Detailed industry-level data is available only in benchmark input-output accounts which are produced by the BEA every five years. I used the 2012 benchmark, which was the most recent benchmark available as of this writing. The mapping between NAICS codes and the BEA's commodity codes is not one-for-one, but the BEA publishes a correspondence alongside the input-output tables.

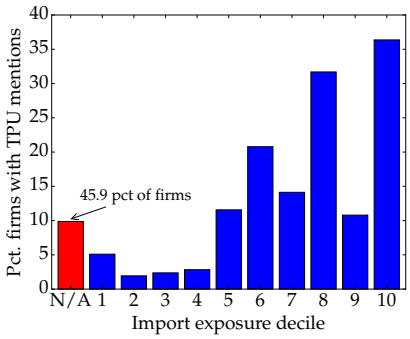
coefficients. I then merged these trade exposure measures with the authors' firm-level TPU dataset using NAICS codes listed in the Compustat database. With this merged dataset, I investigated the strength of the mechanisms proposed above by analyzing the relationships between firm-level TPU in 2018Q4 (the period with the highest overall frequency of TPU mentions in earnings call transcripts) and industry-level trade exposure. These relationships are shown in figure 1.

Figure 1: Trade policy uncertainty and exposure to trade

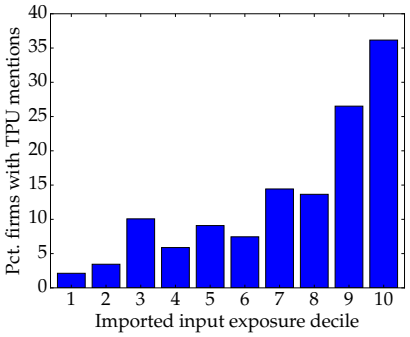
(a) Export exposure



(b) Import exposure



(c) Imported input exposure



Panel (a) of the figure shows that firms in industries with higher export exposure, which are more likely to be exporters, were more likely to mention TPU in their earnings calls. Among firms in industries with nonzero export exposure, there is a strong positive relationship between export exposure and TPU mentions. 33 percent of firms in the last decile of the export exposure distribution mentioned TPU, compared to only two percent of firms in the first decile. Firms in non-exporting industries (labeled "N/A" in the figure) also mentioned TPU in their earnings calls, however; these firms could be concerned about indirect, general equilibrium effects. Panel

(b) shows that firms in industries with higher import exposure, which are more likely to face import competition, were also more likely to mention TPU. 36 percent of firms in the last decile of the import exposure distribution mentioned TPU, compared to five percent of firms for the first decile. As in panel (a), the frequency with which firms in non-importing industries (again labeled "N/A") mention TPU suggests concern about general equilibrium effects. Finally, panel (c) of the figure shows that firms in industries that import more intermediate inputs were also more likely to mention TPU in their earnings calls. 36 percent of firms in the last decile of the imported input exposure distribution mentioned TPU, compared to two percent for the first decile. Together, these results indicate that all three of the mechanisms described above could be important.

There are two caveats to this analysis. First, industry-level measures of trade exposure are imperfect measures of firms' true exposure to trade; some firms in export-intensive industries may not be exporters, other firms in import-intensive industries might not have foreign competitors, and still other firms in industries with high imported input exposures might not import any intermediates. Firm-level measures of trade exposure would provide more definitive answers about the mechanisms underlying the economic effects of TPU. Second, while this analysis indicates that there are several mechanisms underlying firms' concerns about TPU, it does not necessarily follow that these mechanisms have similar economic effects. Interacting these trade exposure measures—or better yet, firm-level ones—with TPU in estimating its effects on firms' investment decisions could provide insight about which mechanisms are most important. Further research is needed on both fronts.

3. Trade policy uncertainty and sticky prices

The New Keynesian DSGE model used in the paper's quantitative analysis has a number of frictions and other features, but sticky prices are the primary driver of the precautionary response to trade policy uncertainty. In response to an increase in tariff volatility, a flexible-price version of the authors' model generates sharply different dynamics—namely, an increase in GDP rather than a decline—compared to the baseline model. The intuition for this result is as follows: in the presence of price adjustment costs, exporting firms raise prices immediately as a precautionary response to the possibility that optimal export prices could rise in the future. The immediate increase in export

prices reduces domestic output and factor demand in the present. This mechanism is similar to the one studied by Fernández-Villaverde et al. (2015) in a closed-economy setting with fiscal policy volatility. In CIMPR, it hinges crucially on the positive correlation between foreign demand and domestic marginal cost that emerges in general equilibrium, and I argue that this correlation is likely to be sensitive to some of the authors' key assumptions.

In order to demonstrate this point more clearly, consider a two-period, partial-equilibrium model of exporting with perfectly sticky prices.[2] In each period $t = 1, 2$, an exporting firm faces a foreign demand curve,

$$y_t(p) = D_t^* p^{-\varepsilon}, \tag{1}$$

that depends on the firm's price, p, and the exogenous level of foreign demand, D_t^* (which in turn could be driven by foreign import tariffs). The firm produces output using a constant-returns-to-scale technology with marginal cost c_t. Thus, the profits from exporting in each period t, taking as given the firm's price, are

$$\pi_t(p) = p y_t(p) - c_t y_t(p). \tag{2}$$

There are two wrinkles to the firm's profit-maximization problem. First, marginal cost and the level of foreign demand in period 2 are uncertain. Second, the firm's price is perfectly sticky over time; the firm must sell its product at the same price in both periods. Thus, the firm's problem in this setting is to choose a price in period 1 to maximize the expected value of its profits in both periods:

$$\max_p \ \{\pi_1(p) + \mathbb{E}\left[\pi_2(p)\right]\} \tag{3}$$

subject to (1)–(2). The solution to this problem is

$$p = \left(\frac{\varepsilon}{\varepsilon - 1}\right)\left(\frac{c_1 D_1^* + \mathbb{E}\left[c_2\right]\mathbb{E}[D_2^*] + \operatorname{cov}(c_2, D_2^*)}{D_1^* + \mathbb{E}\left[D_2^*\right]}\right). \tag{4}$$

Note that in the flexible-price version of this environment, in which the firm could choose a new price in period 2, the firm would set its price equal to a markup of $\varepsilon/(\varepsilon - 1)$ over marginal cost in each period.

[2] This analysis is a greatly simplified version of the analysis presented in appendix G of Fernández-Villaverde et al. (2015).

In the authors' second-moment shock analysis, they study their model's response to a mean-preserving spread to tariffs which, in equilibrium, induces a mean-preserving spread to domestic marginal cost. To capture the idea of their exercise in this simple environment, suppose that foreign demand and domestic marginal cost in period 2 are mean-preserving spreads around their first-period counterparts, i.e., $\mathbb{E}[c_2] = c_1$ and $\mathbb{E}[D_2^*] = D_1$. In this case, the optimal price simplifies to

$$p = \left(\frac{\varepsilon}{\varepsilon - 1}\right)\left(c_1 + \frac{\text{cov}(c_2, D_2^*)}{2D_1^*}\right). \tag{5}$$

If c_2 and D_2^* were uncorrelated, the firm would set its price equal to the standard markup over marginal cost regardless of each variable's variance. In this case, an increase in the volatility of foreign demand (which could be driven by an increase in the volatility of foreign import tariffs) would have no impact on prices, and thus would have no impact on the firm's output or demand for capital. If, on the other hand, c_2 and D_2^* were correlated, as they are in the authors' general equilibrium analysis, an increase in the variance of D_2^* would lead to an increase in $\text{cov}(c_2, D_2^*)$, and thus an increase in export prices and a reduction in output and investment.

This result demonstrates that the sticky-price-driven contractionary effect of tariff volatility depends crucially on the positive correlation between foreign demand and domestic marginal cost. In the authors' analysis, this correlation is a product of two key assumptions. First, the authors assume the tariff process is symmetric across countries: when the level and/or volatility of domestic tariffs changes, a "trade war" causes the same change to occur to the rest of the world's tariffs. Thus, an increase in global tariff volatility in the model leads to an increase in the volatility of demand both at home and abroad, and the increase in domestic demand volatility translates, in equilibrium, into an increase in the volatility of domestic factor prices. If tariff shocks were unilateral, rather than bilateral, this correlation could break down, which would weaken the effect of tariff volatility on exporters' price-setting decisions. Second, domestic import tariffs have no direct effect on domestic marginal cost in the authors' model. The positive relationship between these two variables—which is crucial in generating the positive correlation between foreign demand and domestic marginal cost—is driven by an indirect, general equilibrium effect: an increase in domestic tariffs reduces domestic demand and thus domestic factor prices. If firms used imported

intermediate inputs, tariffs would have a direct effect on marginal cost that works in the opposite direction; an increase in tariffs would cause the cost of imported intermediates, and thus firms' marginal cost, to rise. This could reverse the correlation between foreign demand and domestic marginal cost, which would make TPU expansionary rather than contractionary. This point is not simply theoretical; the analysis in the previous section indicates that firms are indeed concerned about this aspect of trade policy uncertainty.

This simple analysis also suggests that, when average tariffs and tariff volatility both rise, as in the downside-risk exercise in the first part of the authors' quantitative analysis, the sticky-price mechanism may have less bite. Suppose now that, because of an increase in expected future tariffs, demand and marginal cost are lower on average in period 2 than in period 1: $\mathbb{E}[c_2] < c_1$ and $\mathbb{E}[D_2^*] < D_1^*]$. From the solution for the firm's optimal price (4) we can see that, holding fixed $\text{cov}(c_2, D_2^*)$, the firm's optimal price is lower than it would be if average demand and marginal cost were constant over time. As a corollary, an increase in downside risk, which increases future tariffs and tariff volatility, induces sticky-price firms to raise export prices less than they would in response to an increase in volatility alone. In fact, because the covariance between marginal cost and demand has no first-order effect, sticky-price firms would reduce their prices rather than raising them in this scenario in a linearized version of the model. This suggests that in the authors' downside-risk analysis, in which they use first-order approximation of their model, sticky prices actually mitigate, rather than amplify, the anticipatory macroeconomic contraction.

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