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Do words hurt more than actions? The impact of trade tensions on financial markets

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Abstract

In this paper, we apply textual analysis and machine learning algorithms to construct an index capturing trade tensions between US and China. Our indicator matches well-known events in the US-China trade dispute and is exogenous to the developments on global financial markets. By means of local projection methods, we show that US markets are largely unaffected by rising trade tensions, with the exception of those firms that are more exposed to China, while the same shock negatively affects stock market indices in EMEs and China. Higher trade tensions also entail: i) an appreciation of the US dollar; ii) a depreciation of EMEs currencies; iii) muted changes in safe haven currencies; iv) portfolio re-balancing between stocks and bonds in the EMEs. We also show that trade tensions account for around 15% of the variance of Chinese stocks while their contribution is muted for US markets. These findings suggest that the US-China trade tensions are interpreted as a negative demand shock for the Chinese economy rather than as a global risk shock.

Keywords: Trade Shocks; Machine Learning; Stock indexes; Exchange rates

JEL Codes: D53; E44; F13; F14; C55

Non-technical summary

Since the beginning of the 2016 US electoral campaign, trade deficits, trade agreements, exchange rate management and tariffs imposition have been at the core of the economic policy debate. In the subsequent years there has been an escalation in trade tensions between US and China, a period that is often referred to as the Sino-American "trade war", whereby both countries have implemented bilateral tariffs aimed at harming key sectors of the opponent's economy, in an attempt to force it into a more favourable trade treaty.

As to the consequences of trade tensions for the global economy, academics and policy makers are still struggling to quantify the extent to which such tensions have spoken to the global economic slowdown of 2019. In this regard, the dominant view argues that "*the weakness in growth is driven by a sharp deterioration in manufacturing activity and global trade, with higher tariffs and prolonged trade policy uncertainty damaging investment and demand for capital goods*" (Gopinath (2019)). There are several channels through which tariffs can hamper global economic activity. For example, higher tariffs increase the price of imported goods, shifting demand towards domestic production and reducing revenues for foreign producers. Such losses may be further amplified by second-round effects through the global value chain (i.e. production-reducing exporters in turn decrease their demand for intermediate goods) which can eventually feed back into the tax-imposing country. Another channel is related to risk: tariff threats might increase uncertainty around the profitability of investment projects, thus making them less appealing and leading to a delaying of investments with detrimental on the economic outlook. There is not however a strong consensus on which of these channel prevails or on the quantification of the effects of rising trade tensions. For example, general equilibrium models based on trade elasticities produce sizable effects of trade barriers only when assuming large shocks. Recent contributions have also suggested that these results might be driven by significant asymmetries in the response to tariffs (Furceri et al. (2018)), or by changes in exchange rate adjustments mechanism over the last decade (Eichengreen (2017)).

Against this backdrop, our paper proposes three innovative contributions to the existing literature. First, we construct a proxy for trade tensions shocks by adopting a novel approach, which is based on textual analysis. Specifically, we use a supervised machine learning algorithm to assess the relative "protectionism content" of a large set of announcements in the Sino-American "trade war". The time series of such scores provides a trade tension measure, which can be used to quantify their impact on the global economy. Second, we show that the constructed measure is exogenous to financial market developments (both domestic and global), thus supporting the main assumption that announcements have been largely unanticipated by markets. This result is indeed relevant as allows to use the indicator as a measure of *unexpected* trade-policy surprises. Finally, we use the index to assess the reaction of financial agents to an increase in trade tensions. We show that a trade tension shock leaves the US stock market almost unaffected, except for those companies heavily exposed to China, while also inducing a contraction of stock market indexes both in China and other emerging market economies (EMEs). Moreover, the same shock entails an appreciation in the US dollar, a broad depreciation in EMEs currencies, while safe heaven currencies remain almost unaffected. The absence of safe-haven effects seems to suggest that trade tension shocks are interpreted by international investors as a negative demand to Chinese production rather than as a global risk aversion shock, with the US dollar appreciation simply reflecting a trade re-balancing. This intuition is further reinforced by the results for fixed income markets. While, indeed, US long term yields do not react significantly to the shock, market participants in EMEs tend to substitute stocks with bonds, thus effectively re-balancing their portfolios.

1 Introduction

Since the beginning of the 2016 US electoral campaign, trade deficits, trade agreements, exchange rate management and tariffs imposition have been at the core of the economic policy debate[1]. In the subsequent years there has been an escalation in trade tensions between US and China, a period that is often referred to as the Sino-American "trade war", whereby both countries have implemented bilateral tariffs aimed at harming key sectors of the opponent's economy, in an attempt to force it into a more favourable trade treaty. The barriers effectively implemented, however, are minor compared to those each contender threatened to raise (Figure 1). The US administration got to the point of suggesting it would withdraw from the WTO, should the organization not "shape up" to tackle alleged unfair trade practices by China[2].

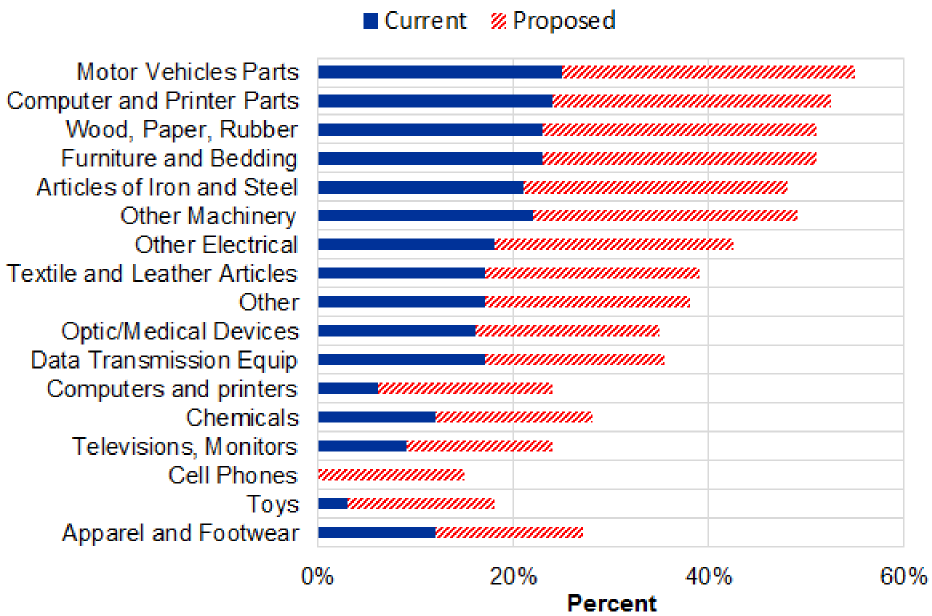


Figure 1: Current and proposed US tariffs against China by good category.
Source: Congressional Research Service (2019).

The "trade war" seems to have then entered a phase of armed truce, with the US and China involved in the definition of a "phase one deal", which is still ongoing at the time of redaction of this paper. As to the consequences of trade tensions for the global economy, academics and policy makers have in particular tried to quantify the extent to which such tensions have spoken to the global economic slowdown of 2019. In this regard, the dominant view argues that "*the weakness in growth is driven by a sharp deterioration in manufacturing activity and global trade, with higher tariffs and prolonged trade policy uncertainty damaging investment and demand for capital goods*" (Gopinath (2019)). Specifically, tariffs can hamper global economic activity via

[1] See for example the 2018 Charlevoix G7 Summit Communique.
[2] See "*Donald Trump threatens to pull US out of the WTO*", The Financial Times, 31 August 2018.

two main channels. First, higher tariffs trigger direct effects through trade, as higher tariffs interfere with the optimal price equilibrium, thus giving rise to deadweight losses as per the Harberger triangle. Such losses are then amplified by second-round effects through the global value chain (i.e. production-reducing exporters in turn decrease their demand for intermediate goods) which can eventually feed back into the tax-imposing country (Meinen (2019)). The second channel is mainly related to risk: the mutual barrages of tariff threats between the US and China might have raised market participants' concerns about the profitability of investment projects, thus making them less appealing[3]. This in turn leads to further delay investments, with detrimental effects on both aggregate demand and (possibly) future output contractions stemming from productivity losses.

Our paper proposes three innovative contributions to the existing literature on trade tensions between the US and China. First, we construct a proxy for trade tensions shocks by adopting a novel approach, which makes use of the announcements regarding the US-China trade dispute on the US President Twitter© account to measure innovations in the history of Sino-American trade tensions that are exogenous to macroeconomic and financial developments. The new indicator is based on the "protectionism content" of each tweet. Specifically, we download all tweets from President Trump's Twitter© account and we deploy textual analysis and machine learning techniques to assign a score quantifying the degree of protectionism to each tweet. The time series of such scores provides us with the trade tension measure, which we name *Trade Tension Tweet Index* (3T-Index).

Second, we show that the 3T-Index is exogenous to financial market developments (both domestic and global), which indicates that announcements have not been anticipated by markets. Finally, we use the 3T-Index to assess the reaction of financial agents to an increase in trade tensions. We show that a trade tension shock leaves the US stock market almost unaffected, except for those companies heavily exposed to China, while also inducing a contraction of stock market indexes both in China and other emerging market economies (EMEs). Moreover, the same shock entails an appreciation in the US dollar, a broad depreciation in EMEs currencies, while safe heaven currencies remain almost unaffected. The absence of safe-haven effects seems to suggest that trade tension shocks are interpreted by international investors as a negative demand to Chinese production rather than as a global risk aversion shock, with the US dollar appreciation simply reflecting a trade re-balancing. This intuition is further reinforced by the results for fixed income markets. While, indeed, US long term yields do not react significantly to the shock, market participants in EMEs tend to substitute stocks with bonds, thus effectively

[3] This is often referred to as the "confidence channel" (Gloe Dizioli and van Roye (2018)).

re-balancing their portfolios. These results are reinforced by the analysis of the contribution of the 3T-Index to the forecast error variance decomposition (FEVD) of financial variables. We show that the index explains 10% to 15% of the volatility of EMEs financial markets while its contribution is muted for US stocks; the index also does not explain movements of safe have assets such as US 10-year yields or the Japanese yen.

Our results suggest that market participants have read trade-related surprises as real shocks to Chinese demand, rather than an increase in global risk.

1.1 Related literature

This paper is related to and builds on three main strands of literature: i) research assessing the macroeconomic implications of trade shocks; ii) research focusing on the role of uncertainty; iii) research applying machine learning and textual analysis techniques to economics.

The macroeconomic implications of trade shocks

The beginning of the so-called "trade war" between the US and China has brought about several contributions investigating the effects of rising protectionism. One strand of literature uses multi-country general equilibrium models to assess the implications of rising trade barriers. Berthou et al. (2018), for example, finds that a general increase of tariffs by 10% would contract global GDP by 2% on impact. Gloe Dizioli and van Roye (2018) reach similar conclusions under slightly different assumptions. Moving to empirical approaches, Barattieri et al. (2018) use country-level VARs to show that tariffs act as a supply shock for the imposing country with limited effects on the trade balance. Other papers, such as Feenstra et al. (2019), Autor et al. (2016), Feenstra and Sasahara (2018) and Acemoglu et al. (2016), analyse sector-level data and find that reducing import barriers have positive spillovers to domestic sectors, which in turn leads to an expansion of domestic output and employment. Another stream of research assesses the impact of trade-induced uncertainty on the business cycle. Among others, Caldara et al. (2019) derive a text-based measure of trade policy uncertainty.

One of the main drawbacks of these contributions, however, is that sizable movements in real variables can be induced only by very severe shocks. For instance, the framework proposed by Berthou et al. (2018) is able to generate an economic contraction by 2% of GDP by assuming that all countries worldwide rise bilateral tariffs on all goods by 10% at once. In Barattieri et al. (2018), a one standard deviation increase in trade barriers can shrink GDP by 0.2%. An explanation to these results is provided by Furceri et al. (2018), who find that the effects of changes in protectionism are highly non-linear, with the imposition of trade barriers being much more impactful than trade liberalization. Therefore, trade models estimated with historical data might produce downward biased results, since episodes of trade liberalization strongly dominate the sample. Alternatively, as highlighted by Eichengreen (2017), the exchange rate adjustment to tariffs might have changed in the last decade.

Measures of uncertainty

Fernández-Villaverde et al. (2011) show in a closed economy model that increasing volatility of macro variables have significant real effects. One of the reasons why volatility can increase is indeed higher uncertainty related to trade policy developments.

In this regard, since the seminal paper by Bloom (2009), many researchers have tried to quantify uncertainty. A stream of this research makes use of high-frequency stock data to construct uncertainty measures. Caggiano et al. (2014), for instance, use the VIX to estimate the effect of uncertainty on US employment[4], while Baker and Bloom (2013) uses the stock market reaction to natural disasters as a natural experiment to measure uncertainty shocks. The drawback of this approach is that asset valuation in the short run is mostly driven by factors other than uncertainty, in spite of the quick reaction on the part of financial markets to new information. Hence the constructed measure might relate to economic activity only indirectly.

An alternative method consists of defining uncertainty as the unexplained component of economic forecasts. Jurado et al. (2015) measure uncertainty as the error term of a forecast model based on a large time-varying VAR and show that the constructed measure of uncertainty spikes around well-known uncertainty episodes. In their approach, however, also common large shocks might be identified as uncertainty, since they inflate the residual of the forecast model by construction.

Finally, the strand of literature which is closest to our work includes several papers that extract measures of uncertainty from text data. Baker et al. (2016) and Caldara and Iacoviello (2018) define uncertainty as the share of newspaper articles discussing US or global geopolitical tensions. Caldara et al. (2019), on the other hand, count the number of occurrences of tariffs-related words in CEO earning calls to construct an index of trade uncertainty. Differently from these contributions, however, our purpose is not to construct a measure of trade uncertainty, but rather to measure the intensity of trade shocks. In addition, we go beyond simple word counting in that we deploy a sophisticated learning model to derive a trade tension index.

[4] Bekaert et al. (2013) further decompose the VIX into a "risk aversion" and an "uncertainty" component.

Textual analysis and machine learning in economics

There is a growing literature that applies machine learning and textual analysis tools to economic problems[5]. Gholampour and van Wincoop (2019), Bianchi et al. (2019), Hansen et al. (2018) and Ke et al. (2019) are the most recent contributions that are relevant for our paper. Specifically, Gholampour and van Wincoop (2019) extract information from the tweets of professional traders which is found to improve the forecast of exchange rate movements at high frequency. Bianchi et al. (2019), on the other hand, use Twitter© announcements as proxy for shocks to the FED independence by assessing their impact on fed fund futures. Hansen et al. (2018) as well analyse monetary policy decision-making by analysing the FOMC minutes via computation linguistic algorithms. Finally, Ke et al. (2019) construct a time series of relevant information by applying textual analysis methods to the Dow Jones Newswires. Such series is found to significantly improve the forecast of stock prices[6].

These analyses mainly leverage on the existing time lag between the availability of new information in text data, their pricing-in on the part of markets and their final effect on slower-moving macroeconomic variables. Textual analysis methods can summarize these information in a quantitative indicator, in a manner which is not different from the synthesis across different time series performed by a principal component analysis. In particular, the index is assumed to include information that have not been already priced in by market participants, thus providing additional insights as to future movements of stock indices. In this paper we exploit similar techniques to quantify the "degree of protectionism" of different announcements that have not been anticipated by markets. The resulting index can be used as a proxy for the severity of the surprise of each event.

The remainder of the paper is structured as follows: Section 2 presents the main data, explains how the index is constructed and, in Section 2.5, performs the validation of the exogeneity assumption; Section 3 assesses the reaction of financial markets to rising trade tensions; Section 4 concludes.

2 Data and the 3T-Index

This section describes how we construct the 3T-Index, starting with the analysis of the tweets by President Trump. Important events in the Sino-American trade dispute have been often pre-announced by the US president on social medial. The most striking example are the Steel

[5]See Currie et al. (2019) and Gentzkow et al. (2019) for an extensive review.

[6]Other contributions include Werner and Murray (2004), Bollen et al. (2011), Da et al. (2011), Leung and Ton (2015), Loughran and McDonald (2011).

and Aluminium tariffs, which have been discussed on Twitter© posts since March 1 2018, well in advance of the official decision by the US administration on March 9 2018 (Figure 2). This pattern is consistent across all major actions undertaken by the US administration during the trade dispute which have strongly impacted global markets[7]. On top of that, not only have large policy changes been communicated by social media, but also information on the US trade stance have been leaked almost daily, thus signalling small and large developments in the Sino-American negotiations. Our objective is to construct a quantitative indicator of the relevance of each of those communications by selecting the ones related to trade tensions, in order to assess their medium-term effect on financial variables.

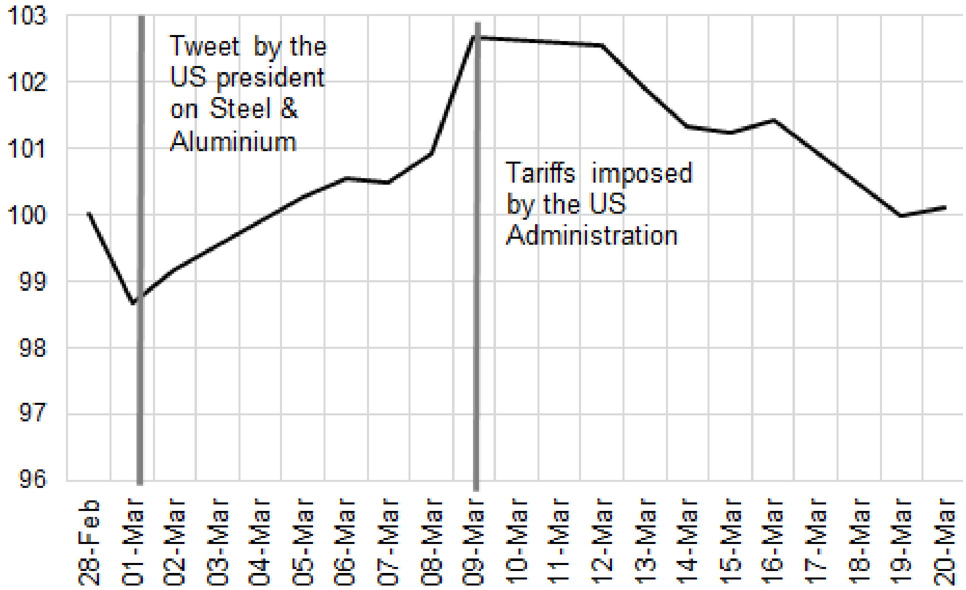


Figure 2: Reaction of the S&P500 Index to the Steel and Aluminium tariff announcement.
Notes: the S&P500 Index is standardized to 100 on February 28 2018.

Specifically, we exploit Twitter© posts to assess the stance of the US communication. The baseline assumption of this paper is that such tweets, though unexpected by markets, have been nonetheless used after their release to extrapolate information on the likely stance of the US administration on a trade deal with China. We then use these tweets to track developments in the trade dispute.

A potential caveat to our analysis stems from the possible endogenous nature of the index, especially vis-à-vis financial markets developments. For example, the language used by President Trump might have changed in response to movements in the US stock market or in the US dollar exchange rate. This would ultimately make the whole analysis biased. Therefore, in Section 2.5 we first test for the presence of endogeneity by regressing the 3T-Index on lagged and contemporaneous financial market developments. Results show that our constructed indicator

[7]It is widely accepted by economic commentators that Trump's tweets have moved markets ("*Trump's Tweets Drive The Market*", Forbes, Jan 8, 2020). In this regard, additional evidence is provided in Section 2.1.

cannot be systematically predicted by either US or Chinese financial data. In Section 2.4 we also report the summary statistics for the other main variables of interest.

2.1 Preliminary evidence

In this section we show that announcements on social media had indeed effects on financial markets. We first select days where the US President published tweets on (1) China, (2) China & Trade and (3) China & Tariffs. Figure 3 depicts the the average absolute daily change on those days against all trading days for the following variables: the S&P 500 Index, the Shanghai Stock Market Index, the JP Morgan EMEs stock market index and the nominal effective exchange rate of the US dollar, the renminbi and emerging market economies[8]. All in all, the average absolute change of the variables of interest is higher on days featuring releases of tweets related to China and tariffs (green bars), compared to other days (blue bars), the only exception to this trend being the change in the US dollar exchange rate. This stylized fact already suggests that markets were responsive to social media communications related to the developments of trade negotiations between the US and China.

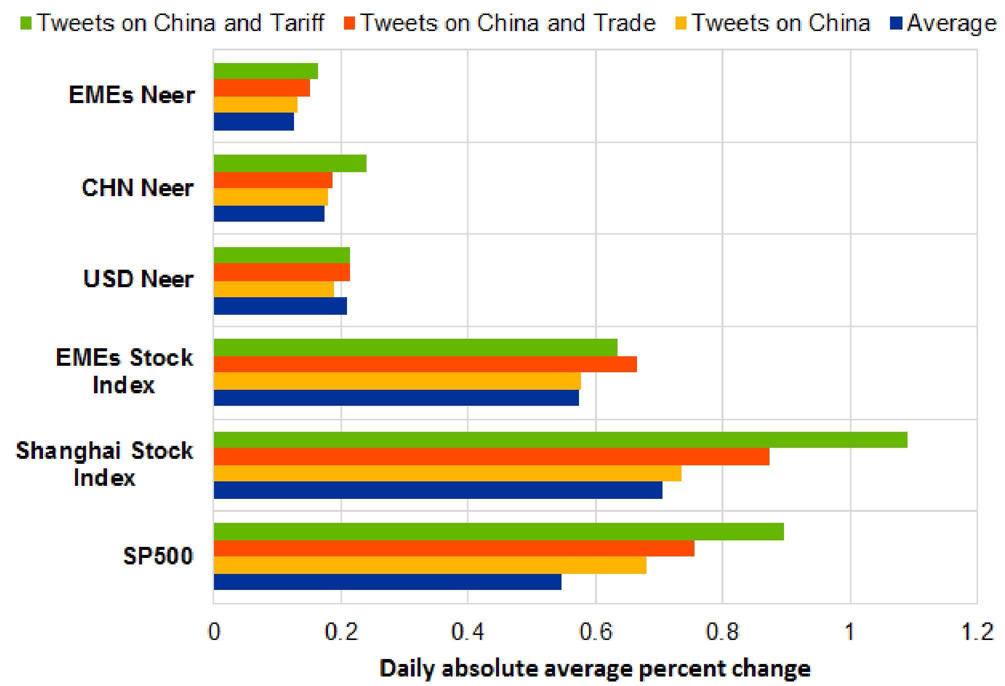


Figure 3: Average absolute daily changes in days with tweets related to (1) China and tariffs; (2) China and trade; (3) China; (4) all other days.

We check more formally for the significance of such changes by setting up an event study as follows:

$$\Delta y_{t-1,t+k} = \alpha_k + \beta_k Event_t + \varepsilon_{t+k} \tag{2.1}$$

[8]We use absolute changes to avoid that positive and negative changes net out in the averaging.

where $\Delta y_{t-1,t+k}$ is the log change in the variable of interest between $t-1$ and $t+k$ for $k = 0, 1, 2$.[9] $Event_t$ is a dummy taking value of 1 (-1) for days with positive (negative) tweets as identified by the Bloomberg "trade war" timeline.[10] The coefficient β_k, therefore, captures the impact of such events relative to the average change of the dependent variable at horizon k. If β_k is positive (negative) a positive event leads to a larger positive (negative) change of the dependent variable relative to all other days.

We consider four key financial variables: the S&P500, the Shangahai stock market index, the US dollar NEER and the bilateral Chinese renminbi/US dollar exchange rate. Results from the estimation of Equation (2.1) are reported in Table 1. Large events in the trade war, as captured by the timeline, had indeed a significant effect on financial markets. Notably, positive developments in the trade war (release in trade tensions) lead to an increase in the stock valuations in the US and China and a depreciation of the US dollar, both in nominal effective terms and bilaterally against China. On the contrary, rising trade tensions negatively impact stock markets and trigger an appreciation of the US dollar.

Table 1: Daily impact of trade war events

	S&P 500 index				Shanghai stock narket index		
k	0	1	2		0	1	2
β_k	0.104*	0.181**	0.228**	β_k	0.106*	0.335***	0.326***
	(0.062)	(0.084)	(0.111)		(0.059)	(0.078)	(0.118)
α_k	0.070	0.169*	0.234**	α_k	0.037	-0.040	-0.040
	(0.064)	(0.098)	(0.104)		(0.065)	(0.103)	(0.118)
Obs.	212	161	155	Obs.	212	161	155
R^2	0.011	0.020	0.024	R^2	0.012	0.057	0.035
	USD NEER				CHN/USD		
β_k	-0.027	-0.083***	-0.086**	β_k	-0.040	-0.134***	-0.151***
	(0.019)	(0.020)	(0.038)		(0.026)	(0.028)	(0.046)
α_k	-0.005	-0.008	0.006	α_k	-0.006	-0.025	0.008
	(0.020)	(0.030)	(0.035)		(0.016)	(0.025)	(0.031)
Obs.	212	161	155	Obs	212	161	155
R^2	0.008	0.047	0.031	R^2	0.022	0.140	0.109

Notes: estimates of Equation (2.1) on daily data for the S&P500 index, the Shanghai stock market index, the USD nominal effective exchange rate and the CHN/USD exchange rate. The dependent variable is expressed in log changes $\times100$ and $Event_t$ is a dummy of value 1 (-1) for positive (negative) tweets as identified by the Bloomberg "trade war" timeline. We consider the contemporaneous daily change ($k = 0$) and the change 1 and 2 days after the event. Robust standard errors are reported in parentheses with *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ confidence intervals.

The event study outcome seems to validate the preliminary evidence depicted in Figure 3: large events in the trade dispute between the US and China had an impact on financial markets.

[9] Notice that for $k = 0$ the dependent variable is the daily change.

[10] See: https://www.bloomberg.com/news/articles/2019-08-28/u-s-china-trade-war-timeline-what-s-happened-since-may-2019. Table B.1 reports the events and the related tweets used to construct the dummies.

However, the framework provided by Equation (2.1) has several limitations which make it less appealing for an analysis over the medium-term.

First, the events considered are only the largest and most significant in the trade dispute history, which means that conclusions from the event study cannot be generalized to *any* event not explicitly included in the sample. Second, the sampled events are considered as all equally important, while we know that some of them have been more relevant than others. Third, announcements on the trade dispute have often been contradictory, with positive statements being closely followed (even within the same day) by negative ones. This complicates the evaluation of single events as it is hard, with simple dummies, to disentangle which of them have been dominated. Consider for example the sequence of tweets started on May 13 2018. At 15:03 a tweet was posted, suggesting that the US administration would commit to reduce barriers on the imports of ZTE, a Chinese tech giant. This is clearly a positive and relevant development. However, already at 19:22 another tweet was published on the the US President account stating: "*negotiations have been so one sided in favor of China for so many years that it is hard for them to make a deal that benefits both countries*", a clear setback in negotiations. A careful evaluation of the trade stance needs then to take into account these intra-day communication changes. Fourth, events in the trade war have escalated over time, involving more than a single tweet. A throughout indicator of the trade stance would therefore need to combine the information from several tweets and to weight them by relevance.

The index we derive in the next sections addresses each of these issues, in that it quantifies the relative strength (positive or negative) of each tweet, thus allowing to weight and compare different events. In addition, it also automatically disentangles trade-related tweets from all others. Finally, by constructing a complete time-series for the development of the trade dispute, we are able to evaluate the impact on stock markets of each event assessing the medium-term implications of escalating trade tensions.

2.2 A textual analysis approach to protectionism

To go beyond a simple event study approach and evaluate the impact of rising trade tensions over longer horizons, we develop a quantitative indicator for the degree of protectionism of each communication by the US President. The index allows us to evaluate each tweet, distinguishing which part of it (if any) is linked to trade tensions and which is not. We aggregate the index at a weekly frequency taking into account all communications related to trade tensions and not limiting only to the largest and most significant events. The weekly aggregation is preferable for our analysis as several events occur outside trading hours or during weekends. It is worth underlining that only tweets discussing trade tensions are used to compute the indicator and that the proposed methodology automatically selects them based on historical regularities.

There are few important caveats that need to be considered in this analysis. First, tweets concerning trade tensions need to be systematically teased out from all other tweets. This is even more complicated, given that a single tweet can touch upon different topics at once. Second, not all communications are the same. Although the most relevant of them are included in the Bloomberg's Trade War history, there are however many more that are not included in the list, but contributed to increase tensions on a daily basis. These tweets contain important information for our analysis, as they capture the vast majority of developments in trade tensions, which are not as extreme as the events in the Timeline. Finally, all communications need to be systematically evaluated and converted into a quantitative indicator for aggregation.

The literature on computational linguistic has developed several alternative methods to conduct this type of analyses[11]. Historically the first approach, and by far the most straightforward to implement, is the so-called word count: in each text sample the words associated to a specific sentiment are counted and the indicator is the ratio between them and all words in text[12]. This methodology is simple, but suffers from an important drawback: the researcher needs to set *a priori* a dictionary of sentiment words which outlines the list of words associated to each sentiment. There exist some pre-compiled dictionaries, e.g., the Harvard-IV[13], which provide a list of "positive" and "negative" words. These classifications are constructed based on standardized language patterns used in texts discussing general topics. For this reason, they often perform poorly when applied to specific language or specialized topics. Gholampour and van Wincoop (2019), for example, show that such dictionaries do not capture well economic assessments. Alternatively, some authors have came up with their own dictionaries, tailored to the text and context of interest. This solution, unfortunately, could not suit our sample, as all tweets come from the same source and use a very specific language. Moreover, most tweets are unrelated to trade tensions and should not be used to inform the classification of words for the subsample of posts we are focusing on.

As an alternative to these problems, we apply an algorithm that jointly identifies the words used in tweets about trade tensions and their relative "sentiment"[14]. This approach has several advantages. First, we do not need to make any *a priori* choice about the relevance of specific words, but we extract information from the available text so that the resulting indicator is

[11]Refer to Gentzkow et al. (2019) for applications to economics.

[12]This approach is used, among others, by Bloom (2009) and Caldara et al. (2019).

[13]Other examples are Wilson et al. (2005), Hutto and Gilbert (2014) and Chung and Pennebaker (2004).

[14]In other terms the algorithm distinguishes words that contribute to ease tensions (e.g., the expression "great trade deal") or increase them (e.g., the expression "increase tariffs").

really tailored to the specific analysis. Second, selected words do not have a binary connotation ("positive" vs "negative"), but receive a specific score so that words can be ranked in an ordinal manner and compared to others[15]. This is a key and important characteristic of the model, which allows to automatically select the text used to compile the indicator. Text samples where none of the selected words is present receive zero score and are automatically excluded from the computation of the indicator. Third, the set of words is defined by a statistical model exploiting the correlation across different words. In other terms, the choice is based on the occurrence of words. For example, those used in a text sample with a negative connotation are picked as negative and the more often they are used in such context, the higher is the score associated to them.

Practically, the algorithm works in three steps. First, a training sample (generally a subset of all available data) of relevant text needs to be identified. This is the only choice that the researcher needs to take *a priori*. The algorithm then uses that sample to select and score words associated to the desired topics. In this application we use the tweets included in the Bloomberg's Trade War history before 2018, as we have shown how those tweets coincided with events that had a significant impact on markets (Table 1).

The training sample provides us with the writing patterns featured by trade-related announcements, thus ensuring that our indicator captures only communications pertaining trade. Concretely, and this is the second step, a statistical model is estimated on the training sample. Each word enters the regression as a dummy variable and is used to explain the text used for the training[16]. Intuitively, dummies associated to non-relevant words should have a zero coefficient, while positive or negative coefficients capture the relative importance of selected words. In many applications, including ours, it is impossible to consider all the dummies at the same time as the number of words exceeds the number of text in the training sample (in our case, after standardization, the training sample includes more than 600 unique words). For this reason, the model is estimated using shrinking regression methods that score only the relevant dummies. This is a common choice in the textual analysis literature (Gentzkow et al. (2019), Hansen et al. (2018), Ke et al. (2019)).

The final step consists of constructing an indicator that is simply the "fitted value" of the model for all texts in the sample (including the "observations" not used for the training). Each text, in fact, receives a score given by the sum of the scores of all words contained therein. For example, if a tweet is completely unrelated to trade tensions, all the coefficients would be zero

[15] As an example, the algorithm puts more weight on the use of the word "barriers" rather than "deficit" despite both of them are associated with an increase of tensions.

[16] Each text sample is scored so that the dummies for words are used to explain the score. In our application we rely on the Bloomberg's "trade war" timeline for scoring, all scored tweets are reported in the Appendix.

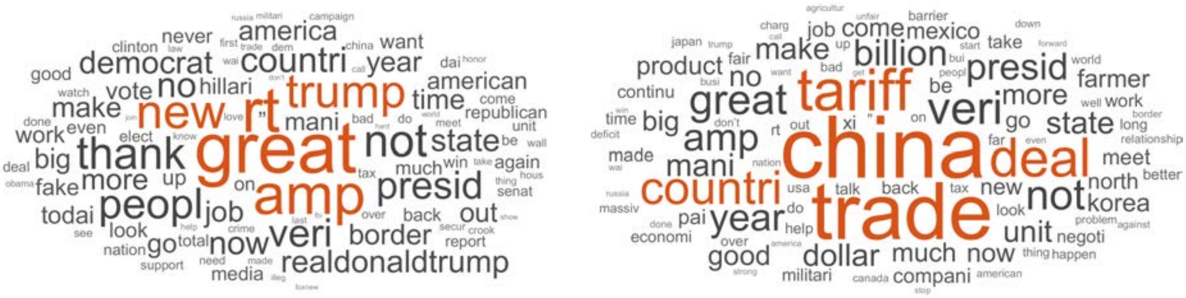
and, hence, the overall score would be zero. As such, the text is identified as non-related to trade announcements and becomes irrelevant for the later part of the analysis.

This approach is particularly useful to identify text samples that discuss mixed topics as the part of the text unrelated to trade tensions would get zero score, while the part discussing them would contribute positively or negatively. The next section presents more in detail the methodology used, which is an example of a so-called “supervised machine learning” algorithm, in that the model needs to be provided with a set of relevant observations for the training sample. Once this is done, however, the selection and scoring of words based on the sample is completely automatized.

2.3 Construction of the 3T-Index

In this section, we formally explain the algorithm used to quantify the change in the protectionist stance of each tweet by President Trump related to the US-China trade negotiations. We name the resulting indicator the *Trade Tensions Tweet Index* (3T-Index), which is scaled so that higher values are associated to a more accommodating trade stance towards China, whereas harsher threats of trade barriers and retaliation correspond to lower values of the index.

The first step consists of collecting all tweets by President Trump from January 2016 to November 2019[17]. These tweets cover the period since the beginning of President’s Trump



(a) All tweets since January 2016 (b) Tweets in Bloomberg’s Trade War timeline

Figure 4: Word clouds

presidential campaign, when he started tweeting about (what was wrong with) the trade deal with China.

Figure 4 compares word clouds for all tweets since 2016 (Figure 4a) and only for those related to the Bloomberg’s Trade War timeline (Figure 4b). In each cloud, words are thicker depending on the frequency of appearance. Hence, they provide an indication of the topics covered in the

[17] These tweets can be downloaded directly from Twitter or from the Trump Twitter Archive. The tweets are cleaned using standard methods. For instance, we remove all stop-words, singular and plural endings and include certain bigrams (i.e., two subsequent words are treated as one unit; for example, “good deal” is treated differently from “bad deal”), as commonly done in textual analysis applications (Gholampour and van Wincoop (2019), Werner and Murray (2004)). Appendix A reports the full list of standardization techniques.

underlying text. At a first glance, it seems that tweets in the "trade war" sample use a different language compared to the others. Figure 4b indeed shows that "China", "tariff", "trade" and "deal" are the most used words compared to "great", "Trump" and "new", which on the other hand prevail in Figure 4a. Comparing the two word clouds also suggests that tweets in the training sample discuss very specific topics like trade deals and the US dollar and are closely related to developments in trade, which make them very well-suited to train the model.

In this regard, the algorithm actually goes beyond the simple word counting, as it quantifies to what extent each tweet is tilted towards "protectionism". Notably, tweets of the Bloomberg's Trade War timeline are analysed using a supervised machine learning algorithm, since standard dictionaries (even economic ones) are not suitable to construct a sentiment indicator based on tweets' text. Constructing an ad-hoc dictionary, as done by Gholampour and van Wincoop (2019) on the basis of the language used by traders in trading rooms, is not an alternative either for three main reasons: i) the tweets we focus on do not use a standard language set; ii) second, they are all taken from the same source, which does not allow to identify common patterns; iii) third, some tweets use idiomatic words or sentences that are missing in pre-compiled dictionaries. Given this, the most viable approach consists of adopting an algorithm to identify the sets of words that are more frequently deployed in episodes of heightened trade tensions with China and, then, construct the sentiment indicator.

With this aim, we first retrieve the single tweets corresponding to the events listed in the Bloomberg's Trade War timeline before January 2019[18] and score them between 1 and -1 depending on whether the tweet is associated to a relaxation of trade tensions or, on the contrary, to a tightening. These tweets and their relative scores, provides us with the training sample for the algorithm[19].

We then model tweets' sentiment by fitting an elastic net framework on the training sample. This statistical method allows to select relevant regressors among a large pool of variables which cannot be used simultaneously in the estimation. The elastic net combines also the benefits of the lasso and the ridge regressions, in that the framework: i) includes a penalty term in the score function that constrains the number of estimated coefficients (in this way models with redundant explanatory variables are penalized); ii) shrinks the number of coefficients to zero the higher the penalty term becomes[20]. Therefore, the elastic net selects by construction more parsimonious models, a feature which is particularly useful when dealing with a large set of

[18] See https://www.bloomberg.com/news/articles/2019-08-28/u-s-china-trade-war-timeline-what-s-happened-since-may-2019.

[19] The complete list of tweets and related scores that make the training sample up are reported by Table B.2 in Appendix B.1

[20] Refer to Tibshirani (1996), Zou and Hastie (2005) and Hastie et al. (2009) for further details.

potential explanatory variables that are also highly correlated[21]. Specifically, the model solves:

$$\min_{\beta_0,\beta}\left[\frac{1}{2N}\sum_{i=1}^{N}\left(S_i-\beta_0-x_i^T\beta\right)^2+\lambda P_\alpha\left(\beta\right)\right], \tag{2.2}$$

with

$$P_\alpha\left(\beta\right)=\frac{(1-\alpha)}{2}||\beta||^2+\alpha||\beta||. \tag{2.3}$$

In Equation (2.2), S_i is the score attached to tweet i, x_i is a matrix of dummy variables equal to 1 if a word is present in tweet i and zero otherwise, β_0 and β are the estimated parameters, λ and $\alpha \in [0,1]$ are tuning parameters. In particular, β_0 is the loading of the constant, β is a vector of loadings for each dummy variable in x_i and λ is the penalization parameter. Hence, the higher is λ, the fewer words (dummies) are included as explanatory variables. Finally, α is a scaling parameter that sets the penalty function in Equation (2.3) as a weighted average of the penalty under the lasso ($\alpha = 1$) and the ridge ($\alpha = 0$). When λ is zero, Equation (2.2) simply coincides with the OLS estimator.

The elastic net approach presents a distinct advantage, in that it allows to select the most powerful predictors in x_t while maintaining (feasible) degrees of freedom even with very large sets of potential explanatory variables. In our specific case, the model selects only 27 out of more than 600 unique words in the training sample to construct the final sentiment indicator. Figure 5 reports the trace plot for the estimated coefficients and the optimal value of λ, i.e. the joint path of the estimated coefficients and λ from the initial condition to the optimum (λ^*)[22]. The latter is detected by using a five fold cross-validation approach, whereby λ is chosen based on the mean squared prediction error. In practice, the algorithm draws a value of λ and α, estimates Equation (2.2) for different combinations of explanatory variables (dummies in x_i^T) and selects the model with the lowest score. It then moves on to another draw of λ and α until convergence (i.e. the score of Equation (2.2) stops improving). Figure 5 plots the loadings β associated to the 27 selected dummies at each iteration from the starting point of the optimization ($\lambda = 0.25$) to the optimum ($\lambda = 0.04$). The final values of β for $\lambda = 0.04$ are the loadings selected by the model.

We use the estimated coefficients to fit the model on the remaining tweets after 2018. The model's predicted values are the implied sentiment from each tweet, the 3T-Index. Figure 6 shows the 3T-Index at weekly frequency against the most relevant Bloomberg's Trade War timeline events[23]. The index tracks relatively well negative events in the sample, which are also

[21] In this exercise each word is treated as a separate independent variable.
[22] In Table B.3 of the Online Appendix we report the full list of the selected words with the related loadings.
[23] When there are more than one tweet in each day or week we sum the index in that day or week. Refer to Figure B.1 in the Appendix for the daily version of the index.

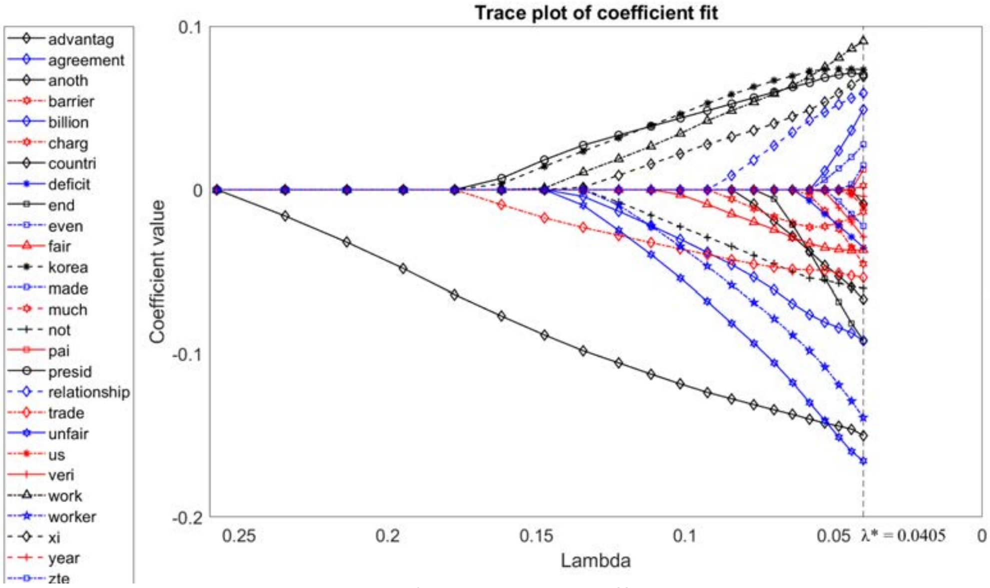


Figure 5: Trace plot of elastic net coefficient estimates

largely dominant. The only relevant positive event, the tweet on May 13 2018 in which President Trump committed to remove barriers to the imports of the Chinese tech firm ZTE, is missed. As also explained in Section 2.1 above, this is mainly due to the peculiar communication strategy adopted by the US President on that occasion: at 15:03 President Trump tweeted in support of ZTE but, in a later tweet on the same day (19:22), he largely scaled that commitment down[24]. The index averages out the events, thus damping the overall daily effect. Communication in the previous week, on the contrary, was mainly positive and this is the reason why the index spikes before this event.

2.4 Other data

Other relevant weekly data are taken from Haver Analytics and cover the period between January 2016 and November 2019. Table 2 reports the list of the variables included in our dataset, together with their summary statistics. The 3T-Index is aggregated at weekly frequency to

Table 2: Summary statistics

	SP500	Dow Jones	Shanghai Stock	EME Stock	USD NEER	CHN NEER	EME NEER	USD/EUR
Mean	2534.46	22634.12	3031.20	703.73	119.95	117.22	95.18	1.13
Std dev.	323.56	3384.30	231.09	76.63	3.03	2.46	1.37	0.04
Min	1850.27	15918.04	2481.51	508.50	113.09	112.84	91.90	1.04
Max	3142.19	28100.89	3552.40	878.92	125.84	124.21	97.97	1.24
Start	01/01/2016	01/01/2016	01/01/2016	01/01/2016	01/01/2016	01/01/2016	01/01/2016	01/01/2016
End	29/11/2019	29/11/2019	29/11/2019	29/11/2019	29/11/2019	29/11/2019	29/11/2019	29/11/2019
	VIX	US 2-year yield	US 10-year yield	Citi US Surprise	EMBI+	Shanghai bond price		
Mean	14.80	1.68	2.32	-1.52	807.03	164.38		
Std dev.	4.05	0.69	0.47	33.94	39.52	6.36		
Min	9.34	0.58	1.38	-76.38	698.33	154.58		
Max	31.51	2.94	3.21	78.94	887.26	177.45		
Start	01/01/2016	01/01/2016	01/01/2016	01/01/2016	01/01/2016	01/01/2016		
End	29/11/2019	29/11/2019	29/11/2019	29/11/2019	29/11/2019	29/11/2019		

[24] Refer to Table B.2 in the Appendix.

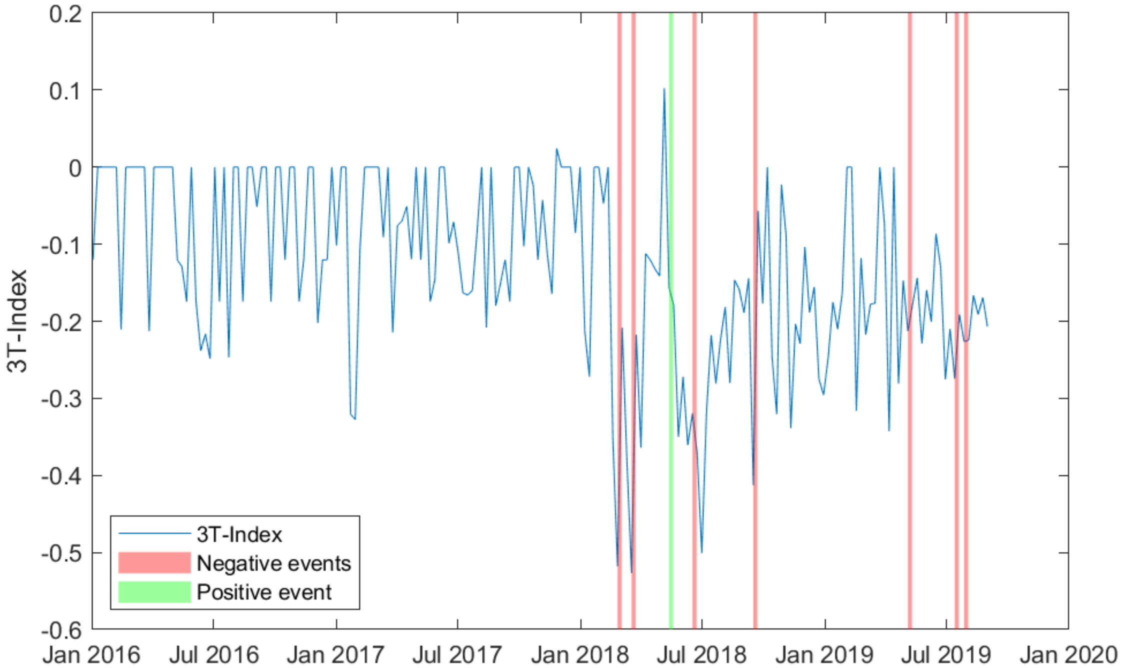


Figure 6: Weekly 3T-Index (blue solid line) and Bloomberg's trade war events (vertical bars)

smooth out volatility in the daily sentiment indicator and account for weeks where several trade-related tweets were posted.

2.5 Endogeneity checks

A major caveat to our approach might derive from the potential endogeneity of the US President's communication strategy in the context of the "trade war" vis-à-vis the developments on financial markets. For example, the President's stance towards China might have become harsher if the US stock market underperformed or the US dollar appreciated. If this was the case, the tweets would be endogenous to financial variables and the 3T-Index could not be used as instrument of the harshness of the US administration's trade stance.

It is possible to test for the presence of endogeneity by regressing the 3T-Index on contemporaneous and lagged stock indices and the (log-change of) US dollar NEER[25]:

$$\Delta Index_t = \alpha + \sum_{i=0}^{L} \beta^i \Delta SP500_{t-i} + \sum_{i=0}^{L} \gamma^i \Delta NEER_{t-i}^{USD} + \sum_{i=0}^{L} \delta^i \Delta Stock_{t-i}^{CHN} + \varepsilon_t \tag{2.4}$$

If the relevant coefficients in Equation (2.4) were found to be statistically significant, this would mean that financial variables can somewhat drive the 3-T Index, thus hindering its validity

[25] As a robustness check, Table B.4 in the Appendix shows that results are robust to using the 3-T Index in levels instead of first-difference.

as exogenous instrument to capture trade tension shocks. The set of regressors in Equation (2.4) also includes the contemporaneous changes in financial market variables to test for the existence of common shocks that might move both financial markets and the 3-T Index. Results reported in Table 3 show that changes in the 3T-Index are not systematically predicted by developments in financial markets as measured by changes in the US stock market, the Chinese stock market and the US dollar NEER, the latter being also a measure of global risk. All specifications reported show non-significant coefficients and explain a very limited share of the volatility of the index. Moreover, results of the $F-test$ show that coefficients are not jointly significant. The Index is found to be exogenous to both domestic and foreign financial market developments also when estimating Equation (2.4) at the daily frequency (Table 4)[26].

In the following sections we use the index at weekly frequency, which is better suited to analyse the medium-term impact of trade tensions on financial markets for several reasons: i) many relevant events have occurred outside trading hours. Daily financial variables would therefore miss the contemporaneous effects and would be biased by the information priced-in by markets before the next opening (this can indeed be significant in the case of weekends); ii) it has often been the case that negative (positive) communications have closely followed positive (negative) ones within the same day or week. In this context, financial markets receive opposite signals that could off-set each other, thus adding noise to the estimation; iii) not all communications have the same relevance and some of them might be more relevant than others.

Aggregating at weekly frequency then allows to smooth part of that volatility by netting positive and negative communication within the same week and computing the prevailing stance in that time frame. The aggregation is made possible by the specific characteristics of our index, that allow to directly compare and cumulate different events using their implied score.

3 Impact on financial variables

In this section, we assess the effect of an increase in the US-China trade tensions by means of local projections à là Jordà (2005). Notably, we estimate:

$$y_{t+k} = \alpha + \beta^k \hat{S}_t + \delta y_{t-1} + \Gamma' X_t + \varepsilon_t \tag{3.1}$$

where y_t is the (logged) variable of interest, X_t collects a set of control variables and $\hat{S}_t$ is the 3T-Index, given by the fitted values from Equation (2.2). As $\hat{S}_t$ is exogenous to financial market movements[27], the coefficient β^k can be interpreted as the impact of changes in $\hat{S}_t$ on

[26] Table B.5 reports the same regression with the index in levels.
[27] See Section 2.5.

Table 3: Estimates from equation Equation (2.4) at weekly frequency

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
$\Delta SP500_t$	-0.096			-0.090	-0.203		-0.165
	(0.588)			(0.620)	(0.583)		(0.609)
$\Delta SP500_{t-1}$	0.147			0.296	0.128		0.231
	(0.984)			(0.999)	(1.027)		(1.031)
$\Delta SP500_{t-2}$	0.706			0.414	0.691		0.478
	(0.839)			(0.849)	(0.819)		(0.832)
$\Delta NEER_t^{USD}$		0.129		0.035		0.493	0.373
		(1.574)		(1.653)		(1.629)	(1.680)
$\Delta NEER_{t-1}^{USD}$		1.581		1.709		1.334	1.318
		(1.900)		(2.030)		(2.056)	(2.138)
$\Delta NEER_{t-2}^{USD}$		-3.018*		-2.694		-2.587	-2.368
		(1.591)		(1.658)		(1.711)	(1.756)
$\Delta Stock_t^{CHN}$			0.382		0.474	0.445	0.482
			(0.483)		(0.493)	(0.505)	(0.514)
$\Delta Stock_{t-1}^{CHN}$			-0.555		-0.707	-0.544	-0.672
			(0.477)		(0.514)	(0.495)	(0.532)
$\Delta Stock_{t-2}^{CHN}$			0.816		0.645	0.679	0.562
			(0.549)		(0.521)	(0.580)	(0.548)
Constant	-0.002	-0.001	-0.001	-0.002	-0.002	-0.000	-0.002
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Observations	190	190	190	190	190	190	190
F test	0.757	1.208	1.017	0.879	0.684	1.374	0.999
F prob	0.519	0.308	0.386	0.511	0.663	0.227	0.442
R^2	1.20	1.21	1.22	1.22	1.23	1.24	1.24

Notes: explanatory variables are in log-differences; the China stock index is the Shanghai stock market index. T-stats reported in parenthesis below coefficients and computed based on HAC standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

the dependent variable at any future horizon k going from 0 (i.e. the impact effect) to 12 weeks in the future. The sequence $\{\beta^k\}_{k=0}^{12}$ is then the (non-linear) impulse response of variable y to an innovation in $\hat{S}$. β^k can be estimated with linear regressions using HAC standard errors, as residuals of Equation (3.1) are autocorrelated by construction (see Newey and West (1987) and Jordà (2005)). It has been shown that local projection estimates suffer from larger uncertainty than VARs (Kilian and Kim (2011)). In addition, developments not directly captured by the 3-T Index might impact the dependent variable. For these reasons, we include the lag of the US 2-year yield, the VIX and the US Citigroup macroeconomic surprise index among the controls. These variables should indeed capture the effect that shocks in the US and world economy other than those to the -implied- US trade stance might exert onto financial markets.

One of the advantages of local projections is that they are piece-wise linear and, hence, easily scalable. Therefore, we scale the responses by the value of the index on the announcement of

Table 4: Estimates from equation Equation (2.4) at daily frequency

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
$\Delta SP500_t$	1.164			-0.080	3.250		1.856
	(4.944)			(5.477)	(4.671)		(5.096)
$\Delta SP500_{t-1}$	0.821			-0.447	1.432		0.292
	(4.010)			(3.882)	(4.482)		(4.671)
$\Delta SP500_{t-2}$	3.729			3.420	2.266		2.338
	(3.535)			(3.718)	(3.164)		(3.275)
$\Delta SP500_{t-3}$	1.176			2.181	1.333		2.258
	(6.761)			(7.656)	(8.136)		(8.560)
$\Delta NEER_t^{USD}$		1.460		0.501		-7.380	-6.627
		(13.543)		(14.194)		(9.642)	(10.375)
$\Delta NEER_{t-1}^{USD}$		-9.874		-10.421		-9.079	-8.193
		(14.237)		(14.987)		(11.496)	(12.482)
$\Delta NEER_{t-2}^{USD}$		-9.648		-6.532		-6.998	-4.436
		(11.374)		(13.061)		(12.593)	(14.156)
$\Delta NEER_{t-3}^{USD}$		6.568		9.603		4.550	6.332
		(9.214)		(8.027)		(13.186)	(10.237)
$\Delta Stock_t^{CHN}$			-11.013		-11.816	-11.598	-12.101
			(8.607)		(9.880)	(8.704)	(9.971)
$\Delta Stock_{t-1}^{CHN}$			-1.079		-1.606	-1.718	-1.997
			(4.126)		(4.221)	(4.016)	(4.027)
$\Delta Stock_{t-2}^{CHN}$			5.715		4.845	4.636	3.901
			(4.092)		(3.686)	(4.114)	(3.437)
$\Delta Stock_{t-3}^{CHN}$			2.007		1.476	2.111	1.606
			(2.820)		(3.330)	(3.011)	(3.544)
Constant	-0.041	-0.037	-0.027	-0.041	-0.029	-0.027	-0.029
	(0.043)	(0.041)	(0.042)	(0.040)	(0.037)	(0.039)	(0.035)
Observations	158	158	158	158	158	158	158
F test	0.463	0.458	0.974	0.442	0.989	0.921	0.741
F prob	0.708	0.712	0.407	0.849	0.434	0.482	0.671
R^2	0.00	0.00	3.32	0.00	1.24	1.26	0.00

Notes: explanatory variables are in log-differences; the China stock index is the Shanghai stock market index. T-stats reported in parenthesis below coefficients and computed based on HAC standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

the 2018 Steel and Aluminum tariff, so that our results can be interpreted as the reaction of financial markets to that specific announcement. The data sample spans from the US President election in November 2016 to November 2019[28].

Stock indices

A trade tension shock comparable to the 2018 Steel and Aluminum tariff announcement exerts a non significant impact on the US stock market as proxied by the S&P 500 (Figure 7). However,

[28]Our results are robust to a number of additional checks that are presented in Section 3.1.

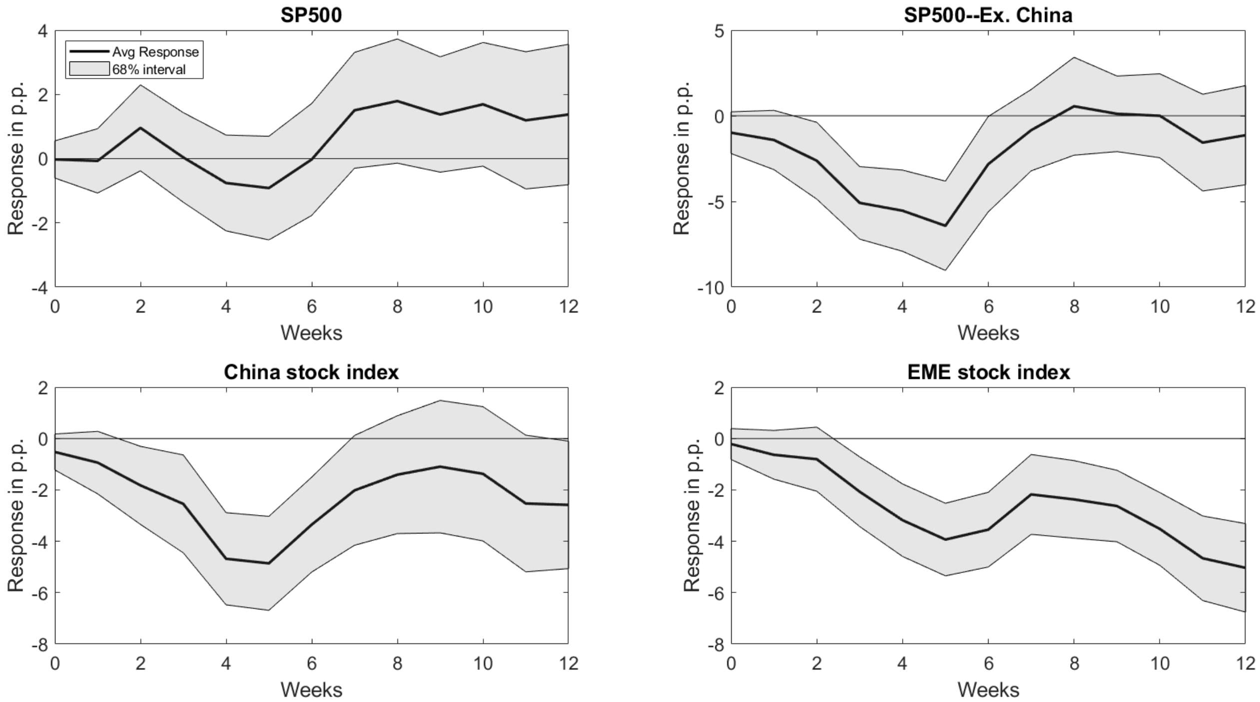


Figure 7: Response of stock market indices to the 2018 steel and aluminium tariff announcement.
Source: Haver Analytics and authors' calculations.
Notes: We use the Shanghai stock market index as proxy for the stock index of China. The subindex of S&P 500 exposed to China is computed including in the S&P 500 only those firms that generate at least 10% of revenues from China.

the shock has a sizeable effect on stocks of US companies exposed to Chinese demand[29]. Those stocks indeed depreciate by around 5% in a four-week window. The Chinese stock market reacts in a very similar way, with the Shanghai stock index depreciating by 6% four weeks after the shock. Figure 7 also suggests that US-China tariffs announcements have significant spillovers to other EMEs, as the aggregate stock market index of emerging market depreciates by about 4% within four weeks and grows weaker in the following months.

Exchange rates

As to exchange rates, Figure 8 shows two main results. First, the US dollar appreciates six to twelve weeks after the trade tension shock, both in bilateral terms against the euro and in nominal effective terms[30]. Second, the Chinese renminbi and the synthetic EME exchange rate[31] tend to depreciate at shorter horizons, while the reaction is muted over the longer-term. This latter evidence might depend on the fact that many EME currencies (including the renminbi) are either officially or *de facto* pegged to the US dollar.

[29]We use here a sub-index of the S&P 500 including only shares of companies that have at least 10% of their revenues originating from China.
[30]We use the bilateral USD/EUR exchange rate as this is the most liquid exchange rate market in the world (Bank for International Settlements (2019)).
[31]Specifically, this is the J.P. Morgan EME nominal effective exchange rate index.

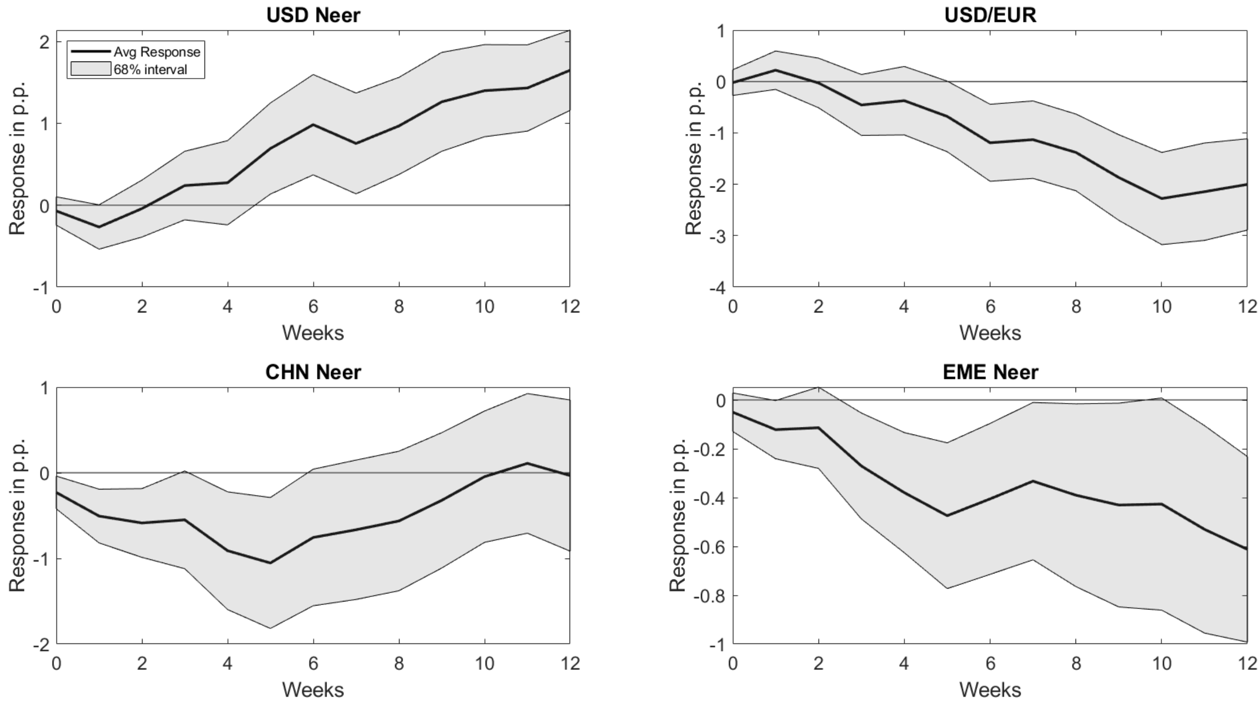


Figure 8: Response of exchange rates to the 2018 steel and aluminium tariff announcement.
Source: Haver Analytics and authors' calculations.

Safe haven currencies, on the other hand, show a muted reaction to an increase in trade tensions (Figure 9). This result seems to suggest that financial market participants do not consider a tariff shock as a pure risk-off scenario, with investors selling risky asset to acquire safe securities. On the contrary, the reaction of exchange rates suggests a change in expectations over the international economic outlook and trade. Investors anticipate the slowdown in EMEs economic activity, with a subsequent reduction in trade flows, and consequently rebalance their portfolios. These dynamics trigger an appreciation of the US dollar, in that most of these currencies are actively traded against the USD[32].

Bond markets

The estimated impact on bond markets suggests that financial agents do not read trade shocks as global risk shocks, but rather as changes to expectations on future economic performance (Figure 10). Results indeed highlight a very muted reaction of both US 10-year yields, which even increase at longer horizons, and the Chinese 10-year yield. This is inconsistent with a global risk shock that should trigger a portfolio rebalancing towards safe assets (i.e. US bonds), and consequently decrease their yields. Meanwhile, both the Shanghai government bond total return index and the EMBI+ index contract, which might be due to an increase in demand of these assets on the part of international investors. Coupled with the reaction of stock indices

[32]See Bank for International Settlements (2019).

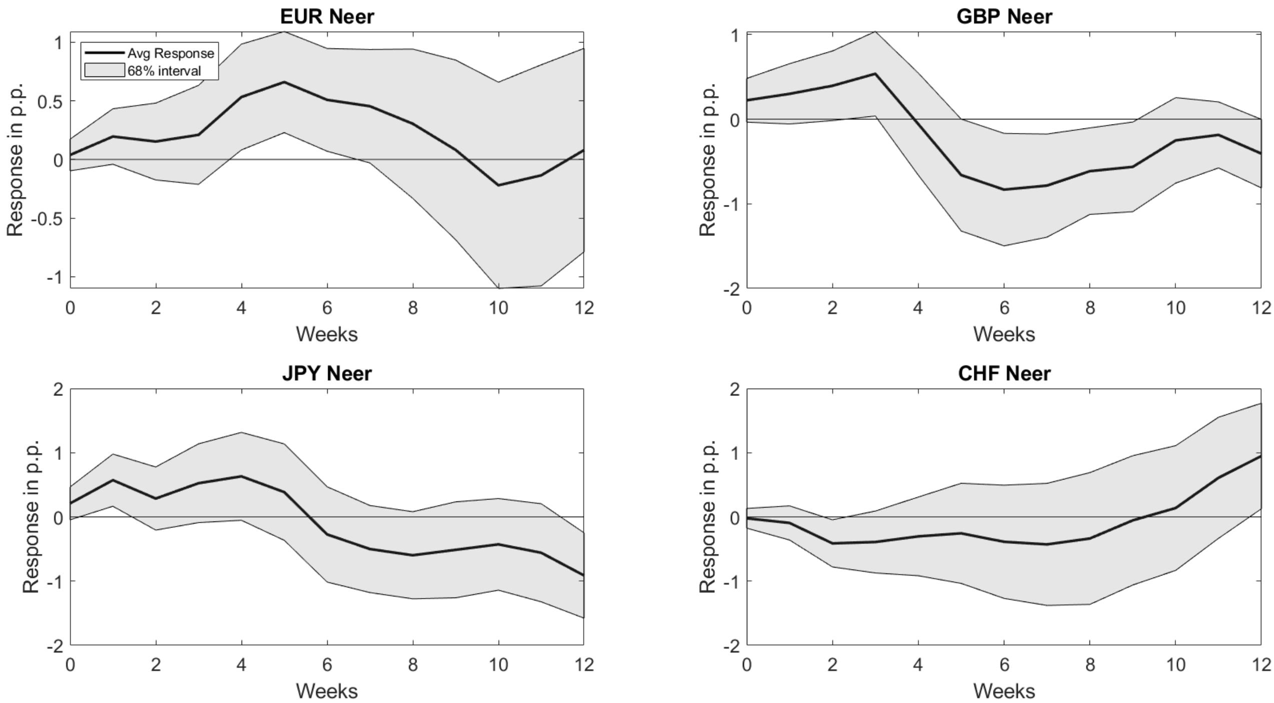


Figure 9: Response of safe haven currencies to the 2018 steel and aluminium tariff announcement.
Source: Haver Analytics and authors' calculations.

(Figure 10), these findings show that trade tension shocks provoked a portfolio rebalancing effect within China and, more generally, emerging markets, with investors selling stocks and buying bonds. This behaviour is more consistent with a shift in expectations towards lower profitability of EME companies due to a contraction of their foreign trade. Finally, as several emerging market bonds are denominated in US dollar, the contraction in the EMBI+ index is compatible with the US dollar appreciation.

Discussion

Market reactions to a heightening of trade tensions is different from the reaction to rising global risk. Global risk shocks have negative effects on the US stock market, contract US yields in the wake of capital flows to the United States and lead to a dollar appreciation (Caballero and Kamber (2019)). At the same time, emerging market bond spreads increase, due to a devaluation of EMEs fixed-income assets (Akıncı (2013)).

Estimates of Equation (3.1) deliver quite different conclusions. While an increase in trade tension still triggers an appreciation of the US dollar, US sovereign bond yields do not move significantly and aggregate stock market indices remain broadly stable. However, the stocks of US companies exposed to China face a strong devaluation in the short-to-medium-run. As concerns the foreign exchange rate markets, currencies of countries that are more exposed to trade tensions depreciate, whereas safe haven currencies do not react. Moreover, EMEs do not

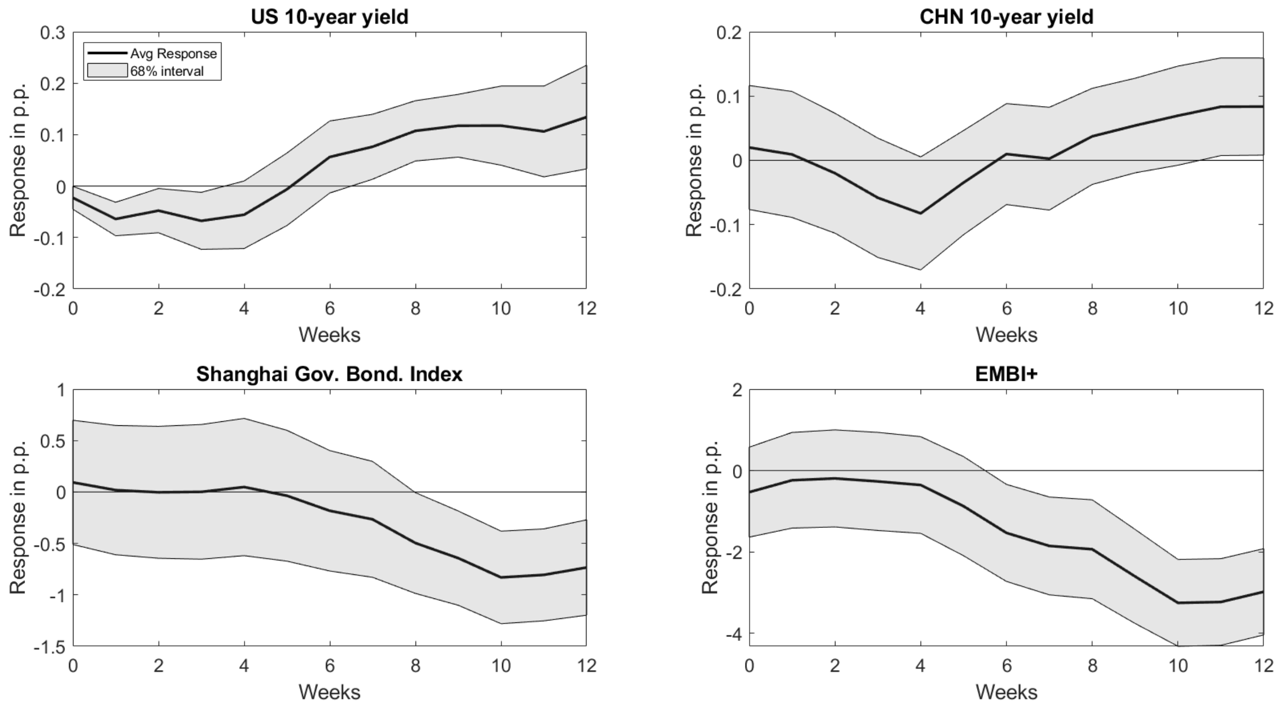


Figure 10: Response of bond indices to the 2018 steel and aluminium tariff announcement.
Source: Haver Analytics and authors' calculations.

seem to experience a net capital outflow, but rather a rebalancing between portfolio equity and debt, as indicated by the contraction in bond yields. This collection of results show that financial markets do not react to an increase in trade tension as they would when facing a global risk shock[33].

Our results are indeed more aligned with the findings of standard economic models analyzing the impact of protectionism. When trade tensions rise, output contracts as trade is jeopardized. This is anticipated by investors, which then dis-invest from companies that might be hit harder by the shock, i.e. those companies operating in the countries and regions potentially targeted by the restrictive trade measures.

3.1 Robustness checks

We additionally perform several robustness checks on our baseline specification. Notably, we augment Equation (3.1):

$$y_{t+k} = \alpha + \beta^k \hat{S}_t + \delta y_{t-1} + \Gamma' X_t + \Xi' G_t + \varepsilon_t \tag{3.2}$$

where G is a matrix of additional control variables. First, we include a time-trend to account for an unobserved component that might affect both the dependent variable and the 3T-Index.

[33]See Ioannou et al. (2020) for estimates of global risk aversion shocks.

Figure B.2 reports the impulse responses for this extended model, which are broadly in line with the baseline estimates: following a positive trade tension shock, stock indices contract in EMEs, the US dollar appreciates and EMEs currencies depreciate. There are not significant effects on safe haven currencies and the EMBI+ total return index goes down, thus signalling the presence of portfolio re-balancing within EMEs. However, differently from the baseline results, the S&P500 significantly increases over the longer-term, which is in line with expectations for improvements in US real activity triggered by trade diversion from EMEs.

In a further check, we alternatively include two lags of controls and one lag of the 3-T Index in G, in order to account for persistence in the data. Figure B.3 and Figure B.4 present the impulse response functions under the two alternative specifications: results are not significantly different from the baseline.

Finally, we check for the presence of some systematic factors in the 3T-Index that are orthogonal to market data, which would potentially generate an omitted-variable bias in the estimates of $\{\beta^i\}_{i=0}^K$ in Equation (2.4). We can filter-out these components by estimating an auxiliary AR(1) process[34]:

$$\hat{S}_t = \alpha + \varrho \hat{S}_{t-1} + \eta_t \tag{3.3}$$

where $\hat{S}_t$ is the 3-T Index. We then take the estimated residuals $\hat{\eta}_t$ as the proxy for the trade tension shock in Equation (3.1). Figure B.5 reports the results, which are again broadly in line with our baseline estimates.

3.2 Contribution to financial market developments

Section 3 shows that trade tension shocks have a sizeable impact on financial markets, which interpret them as a negative demand shock for the Chinese economy. However, those shocks might be rare events which do not systematically contribute to the volatility of stock prices and bonds. In other words, financial markets might have reacted to large trade announcements, but, on a daily basis, changes in the communication stance of the US government might have been largely ignored by agents.

We shed some light on this particular issue by estimating the contribution of the 3-T Index to the volatility of financial variables. Notably, we adopt the methodology proposed by Gorodnichenko and Lee (2019) to perform a forecast error variance decomposition (FEVD) of the variables of

[34] Assume that the variable Y depends on a latent factor S which has a persistent functional form. Formally: $Y_t = \alpha + \beta S_t + \varepsilon_t^1$ and $S_t = \gamma + \rho S_{t-1} + \varepsilon_t^2$, where ε_t^1 and ε_t^2 are two error terms. The equation can be rewritten as: $Y_t = \alpha + \beta[\gamma + \rho(\frac{Y_{t-1}}{\beta} - \frac{\alpha}{\beta} - \frac{\varepsilon_t^1 - 1}{\beta}) + \varepsilon_t^2] + \varepsilon_t^1 \equiv \delta + \psi Y_{t-1} + \eta_t$ where $\delta = \alpha + \beta\gamma - \frac{\alpha}{\beta}$, $\psi = \beta\frac{\rho}{\beta}$ and $\eta_t = \beta\varepsilon_t^2 + \varepsilon_t^1 - \epsilon_{t-1}^1$. Fitting Equation (3.3) allows to extract η_t. When used in local projections η_t delivers a clean (but inefficient) estimate of the impact of ε_t^1 ($\{\beta^i\}_{i=0}^K$ of Equation (3.1)) as ε_t^1 and ε_t^2 are uncorrelated and the Newey-West corrections control for the autocorrelation of η_t.

interest at different horizons[35]. For each dependent variable, the contribution of the 3-T Index quantifies the share of the variance of that variable with is explained by our index at each horizon $k = 0, \ldots, K$. Following Gorodnichenko and Lee (2019), we also apply a small sample bias correction to our estimates.

Figure 11 shows the FEVD for stock market indices at different horizons.[36] As suggested by the impulse responses presented in Section 3, rising trade tensions do not contribute significantly to the volatility of US stocks. This is also true for the subsample of stocks exposed to Chinese demand, suggesting that US stock market reacts only to large changes in the trade stance of the US administration. EMEs stocks, on the contrary, seem to have been more affected by the increase in trade tensions between 2017 and 2019. The 3-T index indeed explains about 10% of monthly returns on the Chinese stock market, with a peak contribution of 15% over three months. More generally, the escalation of trade tensions between the US and China has contributed for around 10% to the volatility of EME markets in a 1 to 4-month horizon.

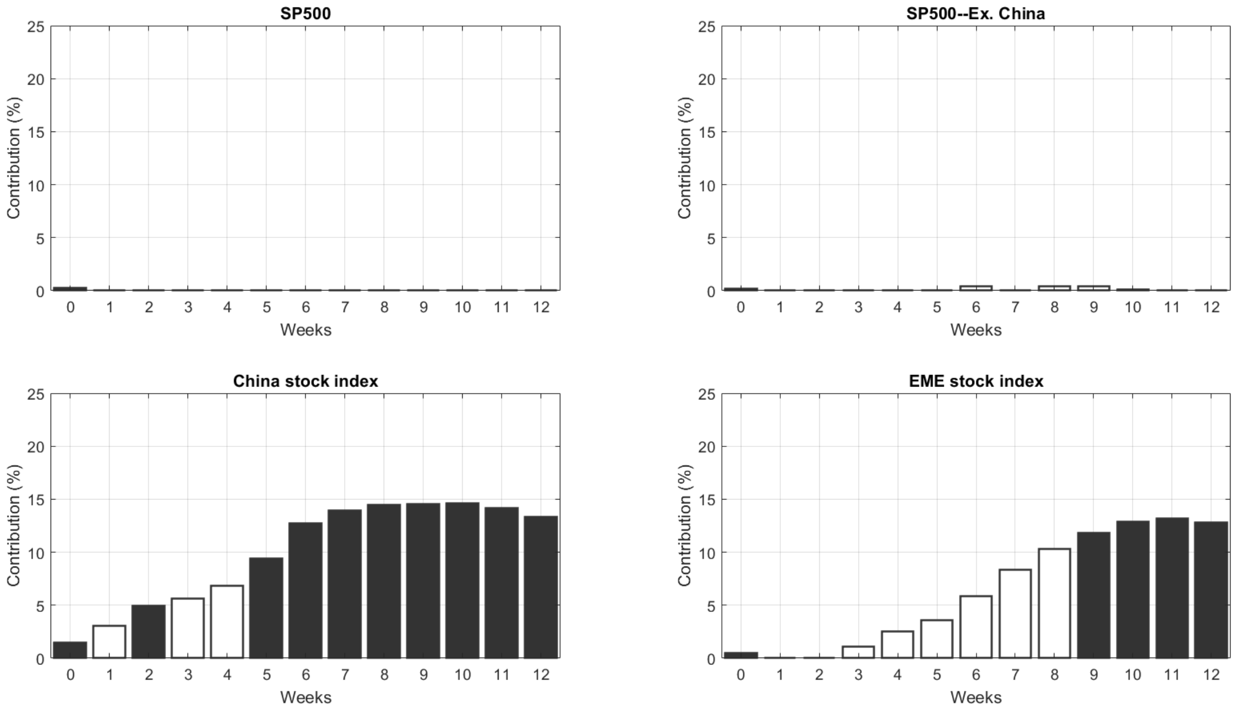


Figure 11: Contribution of trade tensions shocks to the FEVD of stock markets between 2017 and 2019.
Notes: White bars indicate contributions that are not statistically different from 0 at the 68% confidence level.
Source: Haver Analytics and authors' calculations.

Meanwhile, exchange rates of advanced economies are not significantly driven by rising tensions (Figure 12 and Figure B.6), a result that directly derives from the interpretation of

[35] Gorodnichenko and Lee (2019) show that the contribution to the FEVD decomposition of a shock x at horizon k can be computed with local projections as the R^2 of an auxiliary regression of the local projection residuals at horizon k on the sequence of shocks $\{x_{t+k}, ..., x_t\}$.

[36] The FEVD is computed on the full sample 2017-2019.

trade tensions as demand shocks for China rather than as global risk shocks. In addition, the 3-T Index does not contribute significantly to the volatility Chinese renminbi either, most likely because the Chinese currency is *de facto* pegged to the US dollar. On the contrary, the FEVD of the EMEs exchange rates index, which includes several fully floating exchange rates, shows a significant contribution of trade tensions over a 3-month horizon (Figure 12).

Finally, the 3-T Index contributes little to the FEVD of 10-year yields, both in the US and Asia, which is in line with the absence of safe haven flows (Figure B.7). Rising trade tensions, instead, contribute to the volatility of the Shanghai government bond index, which is a composite of Chinese government securities of different maturities. This suggests that the escalation between the US and China have affected the short-end of the yield curve in emerging markets.

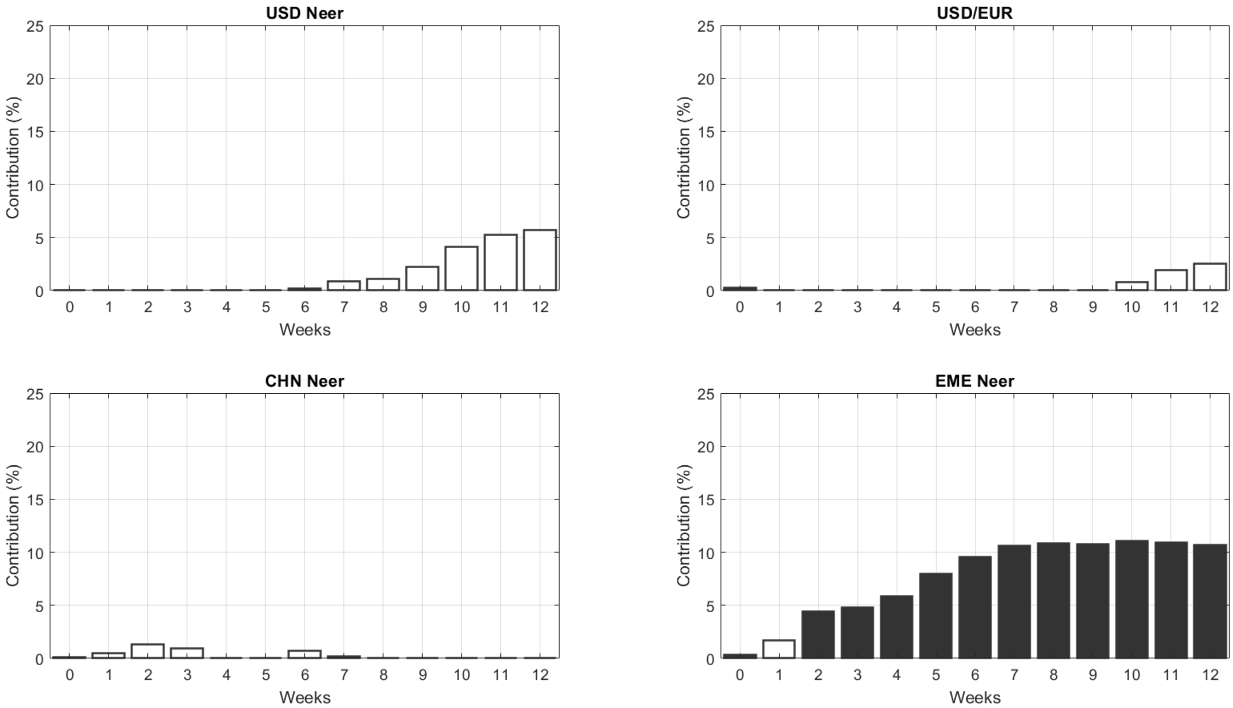


Figure 12: Contribution of trade tensions shocks to the FEVD of exchange rates between 2017 and 2019.
Notes: White bars indicate contributions that are not statistically different from 0 at the 68% confidence level.
Source: Haver Analytics and authors' calculations.

4 Conclusion

This paper proposes a novel identification approach to assess the impact that rising trade tensions have on financial markets. Notably, we take into consideration those announcements on the US-China trade dispute that were made on social media and we shoe that they were largely unanticipated by markets. Given this, we use machine learning tools to quantify the degree of "protectionism" of Twitter© posts related to the Sino-America trade tensions. We show that the constructed measures (3-T Index) is exogenous to financial markets developments and we use it in local-projection regressions to assess how global markets react to changes in trade tensions.

Our results show that rising trade tensions lead to a contraction of stock valuation in China and EMEs. That contraction is economically significant and explains 10 to 15% of the volatility of those stock indices. US stocks instead are largely unaffected, except for those companies whose revenues heavily depend on trade with China. Moreover, the US dollar appreciates, EMEs exchange rates depreciate, while safe have currencies do not react. Finally, on bond markets, there are no signs of safe have flows to the US, while in EMEs there is evidence of a portfolio re-balancing between stocks and bonds.

These findings, especially the lack of safe-haven effects, challenge the interpretation of trade tensions as global risk aversion shocks. On the contrary, results suggest that financial markets rather interpret trade tensions as a more standard negative demand shock for China, which, in turn, might help explain the contraction in global output observed in 2019.

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Appendix

A Standardization and cleaning of the tweets

Tweets (and retweets) by the US President are downloaded from the Trump Twitter Archive (http://www.trumptwitterarchive.com/) for the period January 2016 to November 2019. All special characters and numbers are removed. The remaining letters are converted to lowercase, common stop words are removed, and word endings standardized (stemmed) according to (44). Finally, words occurring only once in the entire sample, as well as single character words, are deleted. Tweets are then merged with identical timestamps (occurring in the same second).

This sample of cleaned tweets is narrowed down by keeping only those that feature one or several of the keywords *China*, *trade*, or *tariff*. From the training sample (Section 2), we include frequently occurring bigrams (two consecutive words forming a unit to retain their meaning). After these steps, the training sample features 662 unique words or bigrams which are used as regressors in the elastic net estimation.

B Figures

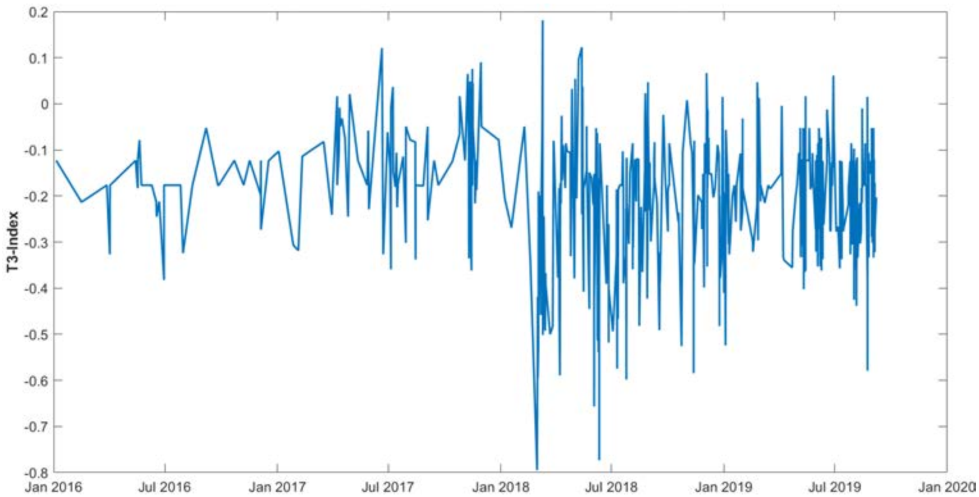

Figure B.1: 3T-Index at daily frequency

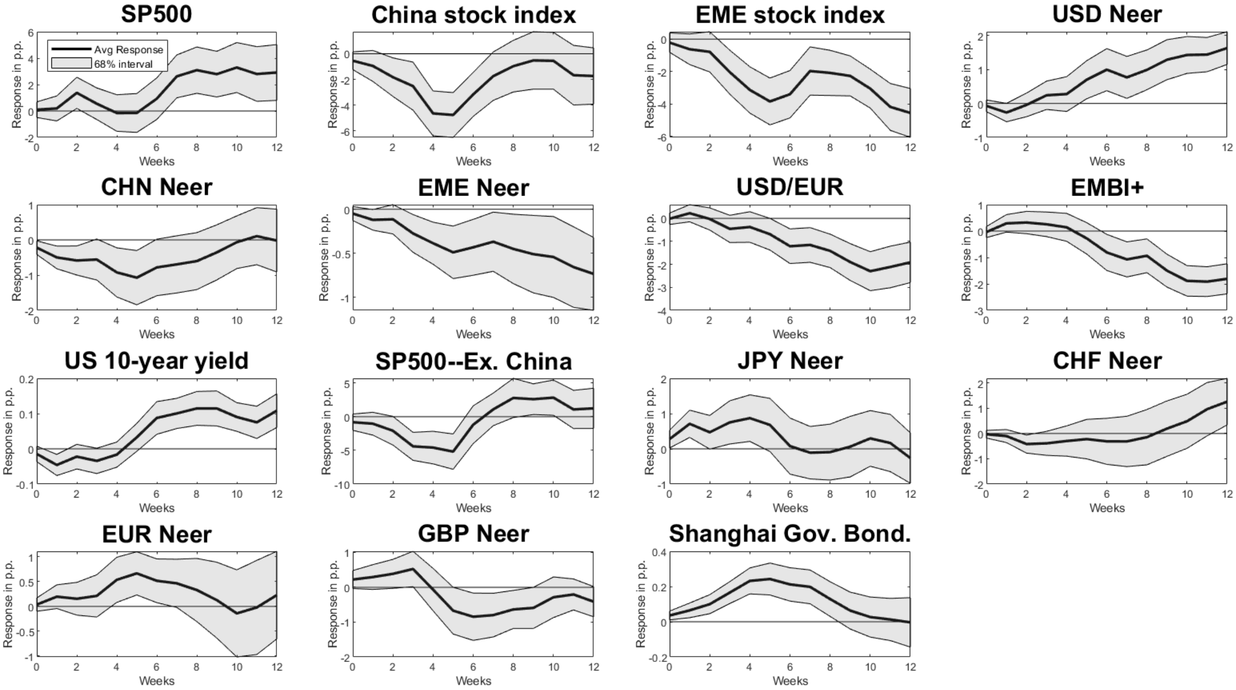

Figure B.2: IRFs to the 2018 steel and aluminium tariff announcement - full sample with time trend

Source: Haver Analytics and authors' calculations.

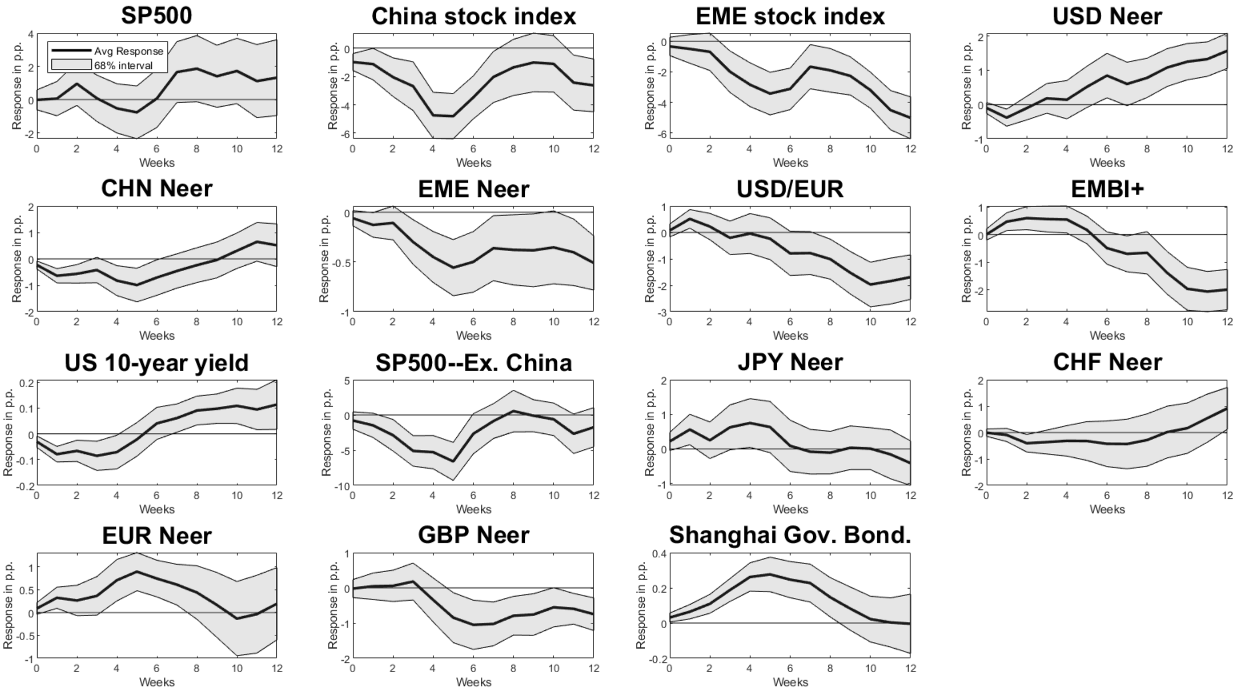

Figure B.3: IRFs to the 2018 steel and aluminium tariff announcement - full sample with 2 lags of controls and endogenous variable.

Source: Haver Analytics and authors' calculations.

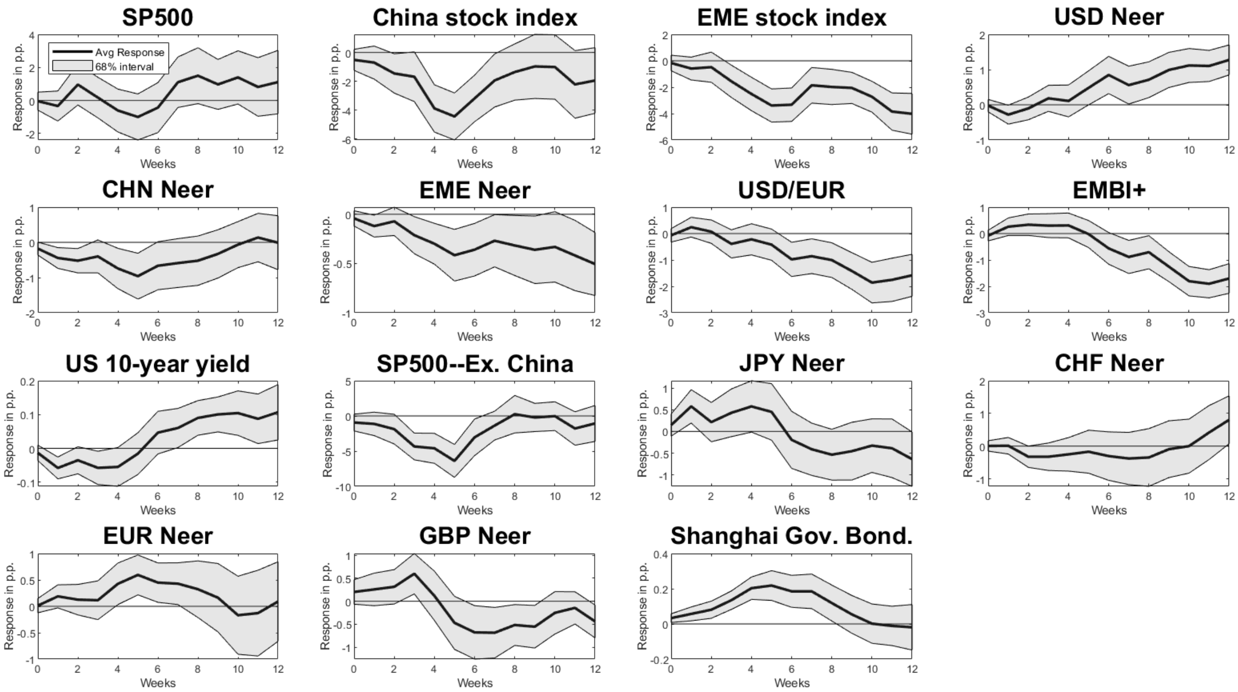

Figure B.4: IRFs to the 2018 steel and aluminium tariff announcement - full sample with 1 lag of the Index.
Source: Haver Analytics and authors' calculations.

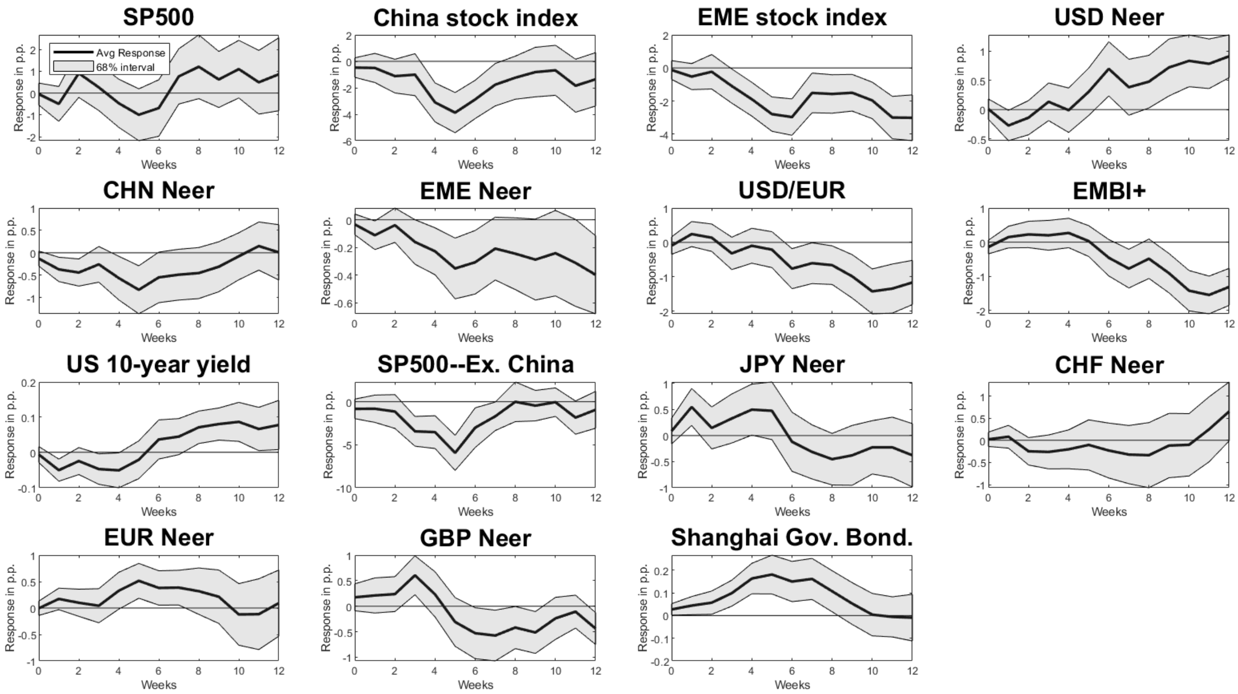

Figure B.5: IRFs of bond indices to the 2018 steel and aluminium tariff announcement - full sample, shocks are computed as residuals from an AR(1) estimated on the index.
Source: Haver Analytics and authors' calculations.

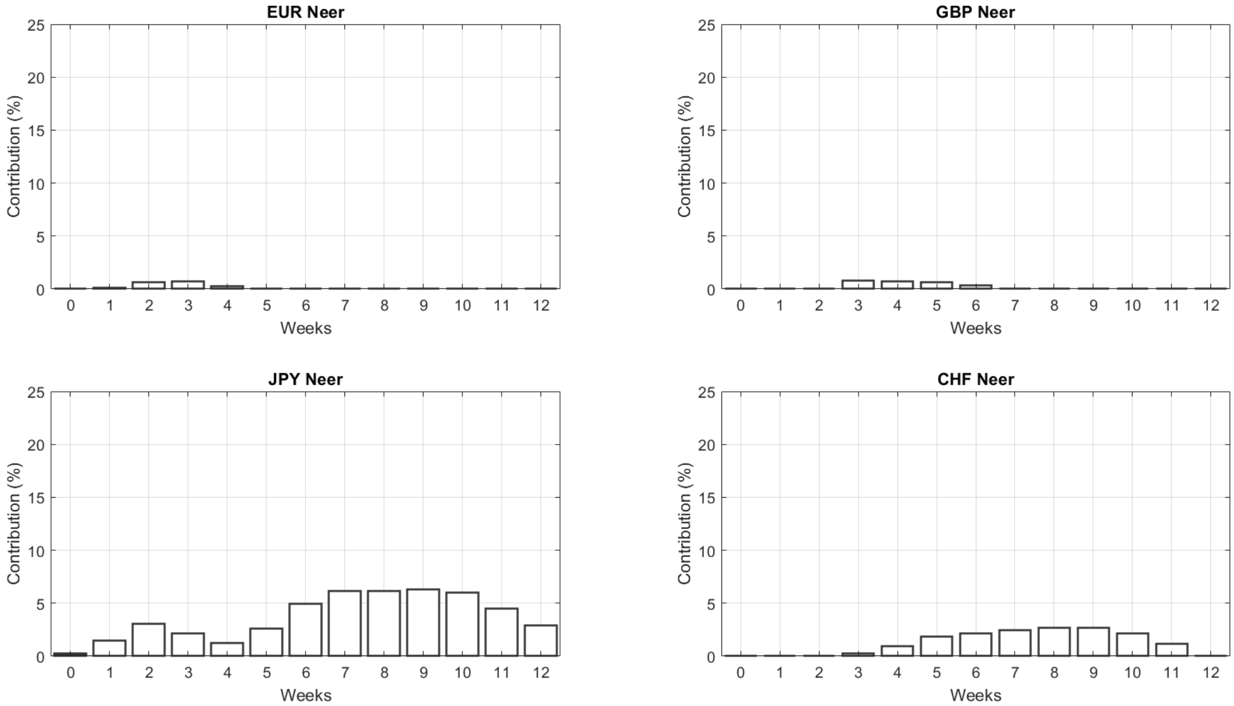

Figure B.6: Contribution of trade tensions shocks to the FEVD of safe haven exchange rates between 2017 and 2019.
Notes: White bars indicate contributions that are not statistically different from 0 at the 68% confidence level.
Source: Haver Analytics and authors' calculations.

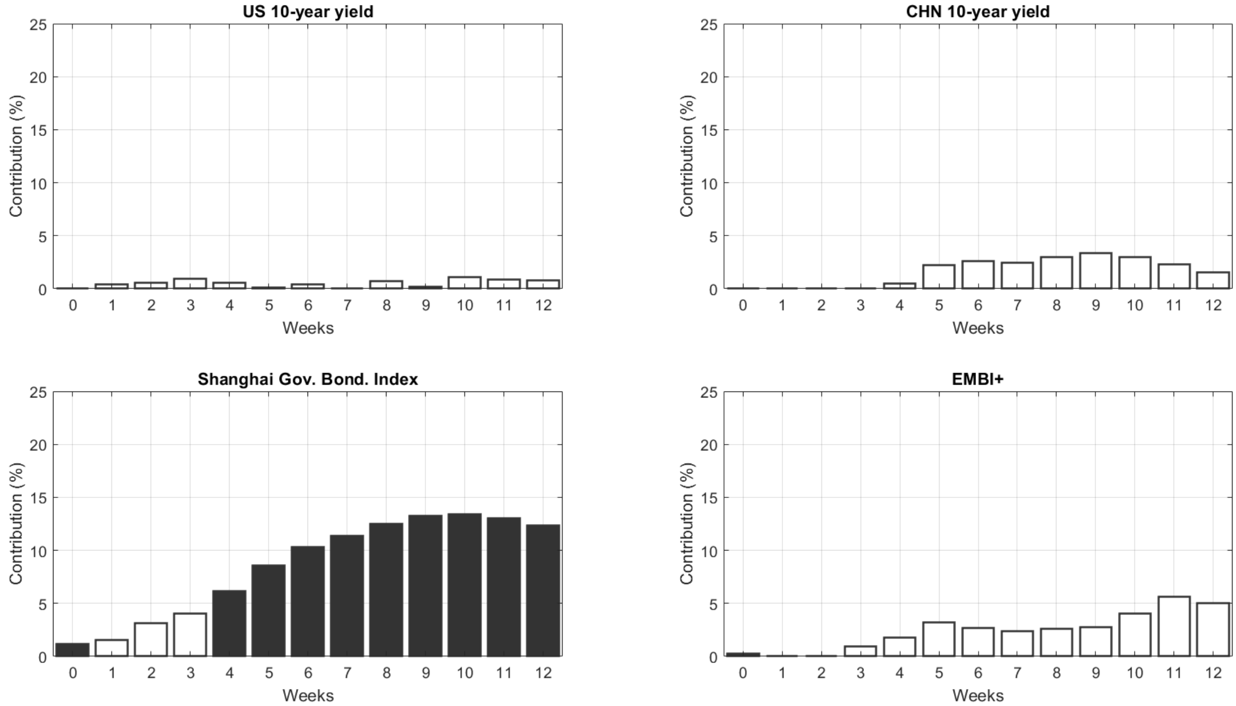

Figure B.7: Contribution of trade tensions shocks to the FEVD of bond yields between 2017 and 2019.
Notes: White bars indicate contributions that are not statistically different from 0 at the 68% confidence level.
Source: Haver Analytics and authors' calculations.

B.1 Tables

Table B.1: Trade war tweets included in the event study

Date & Time	Original Tweet	Assessment
01/03/2018 12:12	Our Steel and Aluminum industries (and many others) have been decimated by decades of unfair trade and bad policy with countries from around the world. We must not let our country companies and workers be taken advantage of any longer. We want free fair and SMART TRADE!	Negative
02/03/2018 10:50	When a country (USA) is losing many billions of dollars on trade with virtually every country it does business with trade wars are good and easy to win. Example when we are down $100 billion with a certain country and they get cute don't trade anymore-we win big. It's easy!	Negative
02/03/2018 13:57	When a country Taxes our products coming in at say 50% and we Tax the same product coming into our country at ZERO not fair or smart. We will soon be starting RECIPROCAL TAXES so that we will charge the same thing as they charge us. $800 Billion Trade Deficit-have no choice!	Negative
08/03/2018 12:38	Looking forward to 3:30 P.M. meeting today at the White House. We have to protect & build our Steel and Aluminum Industries while at the same time showing great flexibility and cooperation toward those that are real friends and treat us fairly on both trade and the military.	Negative
09/03/2018 22:48	Spoke to PM @TurnbullMalcolm of Australia. He is committed to having a very fair and reciprocal military and trade relationship. Working very quickly on a security agreement so we don't have to impose steel or aluminum tariffs on our ally the great nation of Australia!	Positive
10/03/2018 15:22	Chinese President XI XINPING and I spoke at length about the meeting with KIM JONG UN of North Korea. President XI told me he appreciates that the U.S. is working to solve the problem diplomatically rather than going with the ominous alternative. China continues to be helpful!	Positive
10/03/2018 16:15	Chinese President XI JINPING and I spoke at length about the meeting with KIM JONG UN of North Korea. President XI told me he appreciates that the U.S. is working to solve the problem diplomatically rather than going with the ominous alternative. China continues to be helpful!	Positive
10/03/2018 17:23	Spoke to Prime Minister Abe of Japan who is very enthusiastic about talks with North Korea. Also discussing opening up Japan to much better trade with the U.S. Currently have a massive $100 Billion Trade Deficit. Not fair or sustainable. It will all work out!	Negative
10/03/2018 21:29	The European Union wonderful countries who treat the U.S. very badly on trade are complaining about the tariffs on Steel & Aluminum. If they drop their horrific barriers & tariffs on U.S. products going in we will likewise drop ours. Big Deficit. If not we Tax Cars etc. FAIR!	Negative
22/03/2018 18:40	As a candidate I pledged that if elected I would use every lawful tool to combat unfair trade protect American workers and defend our national security. Today we took another critical step to fulfill that commitment. https://t.co/7NBI0Dibmx https://t.co/nmzqos3BUA	Negative
27/03/2018 00:44	Trade talks going on with numerous countries that for many years have not treated the United States fairly. In the end all will be happy!	Negative
28/03/2018 10:16	Received message last night from XI JINPING of China that his meeting with KIM JONG UN went very well and that KIM looks forward to his meeting with me. In the meantime and unfortunately maximum sanctions and pressure must be maintained at all cost!	Negative
28/03/2018 16:14	.@USTradeRep just announced an agreement in principle with South Korea on KORUS! A great deal for American and Korean workers. Let's now focus on our important security relationship.	Negative
04/04/2018 11:22	We are not in a trade war with China that war was lost many years ago by the foolish or incompetent people who represented the U.S. Now we have a Trade Deficit of $500 Billion a year with Intellectual Property Theft of another $300 Billion. We cannot let this continue!	Negative
05/04/2018 13:10	The Fake News Washington Post Amazon's "chief lobbyist" has another (of many) phony headlines "Trump Defiant As China Adds Trade Penalties." WRONG! Should read "Trump Defiant as U.S. Adds Trade Penalties Will End Barriers And Massive I.P. Theft." Typically bad reporting!	Negative
06/04/2018 11:11	Despite the Aluminum Tariffs Aluminum prices are DOWN 4%. People are surprised I'm not! Lots of money coming into U.S. coffers and Jobs Jobs Jobs!	Negative
06/04/2018 11:29	RT @realDonaldTrump: We are not in a trade war with China that war was lost many years ago by the foolish or incompetent people who repr...	Negative
06/04/2018 14:32	China which is a great economic power is considered a Developing Nation within the World Trade Organization. They therefore get tremendous perks and advantages especially over the U.S. Does anybody think this is fair. We were badly represented. The WTO is unfair to U.S.	Negative
16/04/2018 12:31	Russia and China are playing the Currency Devaluation game as the U.S. keeps raising interest rates. Not acceptable!	Negative
17/04/2018 12:24	I am in Florida and looking forward to my meeting with Prime Minister Abe of Japan. Working on Trade and Military Security.	Negative
25/04/2018 14:11	Looking forward to my meeting with Tim Cook of Apple. We will be talking about many things including how the U.S. has been treated unfairly for many years by many countries on trade.	Negative
27/04/2018 11:50	Please do not forget the great help that my good friend President Xi of China has given to the United States particularly at the Border of North Korea. Without him it would have been a much longer tougher process!	Positive
02/05/2018 11:45	There was no Collusion (it is a Hoax) and there is no Obstruction of Justice (that is a setup & trap). What there is is Negotiations going on with North Korea over Nuclear War Negotiations going on with China over Trade Deficits Negotiations on NAFTA and much more. Witch Hunt!	Negative
03/05/2018 03:45	Our great financial team is in China trying to negotiate a level playing field on trade! I look forward to being with President Xi in the not too distant future. We will always have a good (great) relationship!	Positive
13/05/2018 15:01	President Xi of China and I are working together to give massive Chinese phone company ZTE a way to get back into business fast. Too many jobs in China lost. Commerce Department has been instructed to get it done!	Positive
13/05/2018 19:22	China and the United States are working well together on trade but past negotiations have been so one sided in favor of China for so many years that it is hard for them to make a deal that benefits both countries. But be cool it will all work out!	Negative
14/05/2018 20:06	ZTE the large Chinese phone company buys a big percentage of individual parts from U.S. companies. This is also reflective of the larger trade deal we are negotiating with China and my personal relationship with President Xi.	Positive
15/05/2018 12:35	Trade negotiations are continuing with China. They have been making hundreds of billions of dollars a year from the U.S. for many years. Stay tuned!	Negative
16/05/2018 13:09	The Washington Post and CNN have typically written false stories about our trade negotiations with China. Nothing has happened with ZTE except as it pertains to the larger trade deal. Our country has been losing hundreds of billions of dollars a year with China...	Negative
16/05/2018 13:09	...haven't even started yet! The U.S. has very little to give because it has given so much over the years. China has much to give!	Negative
16/05/2018 13:09	...We have not seen China's demands yet which should be few in that previous U.S. Administrations have done so poorly in negotiating. China has seen our demands. There has been no folding as the media would love people to believe the meetings...	Negative
17/05/2018 21:27	Talking trade with the Vice Premier of the People's Republic of China Liu He. https://t.co/9T7Iq6F3Xe	Positive
21/05/2018 11:21	I ask Senator Chuck Schumer why didn't President Obama & the Democrats do something about Trade with China including Theft of Intellectual Property etc.? They did NOTHING! With that being said Chuck & I have long agreed on this issue! Fair Trade plus with China will happen!	Negative
21/05/2018 11:27	China has agreed to buy massive amounts of ADDITIONAL Farm/Agricultural Products - would be one of the best things to happen to our farmers in many years!	Positive
21/05/2018 11:31	On China Barriers and Tariffs to come down for first time.	Positive
21/05/2018 13:16	Under our potential deal with China they will purchase from our Great American Farmers practically as much as our Farmers can produce.	Positive
23/05/2018 11:55	Our Trade Deal with China is moving along nicely but in the end we will probably have to use a different structure in that this will be too hard to get done and to verify results after completion.	Negative
25/05/2018 22:45	Funny to watch the Democrats criticize Trade Deals being negotiated by me when they don't even know what the deals are and when for 8 years the Obama Administration did NOTHING on trade except let other countries rip off the United States. Lost almost $800 Billion/year under "O"	Negative
25/05/2018 23:13	...but complain and obstruct. They made only bad deals (Iran) and their so-called Trade Deals are the laughing stock of the world!	Negative
29/05/2018 11:27	Sorry I've got to start focusing my energy on North Korea Nuclear bad Trade Deals VA Choice the Economy rebuilding the Military and so much more and not on the Rigged Russia Witch Hunt that should be investigating Clinton/Russia/FBI/Justice/Obama/Comey/Lynch etc.	Negative
04/06/2018 12:41	China already charges a tax of 16% on soybeans. Canada has all sorts of trade barriers on our Agricultural products. Not acceptable!	Negative
04/06/2018 13:47	Farmers have not been doing well for 15 years. Mexico Canada China and others have treated them unfairly. By the time I finish trade talks that will change. Big trade barriers against U.S. farmers and other businesses will finally be broken. Massive trade deficits no longer!	Negative
07/06/2018 11:57	Isn't it Ironic? Getting ready to go to the G-7 in Canada to fight for our country on Trade (we have the worst trade deals ever made) then off to Singapore to meet with North Korea & the Nuclear Problem...But back home we still have the 13 Angry Democrats pushing the Witch Hunt!	Negative
07/06/2018 19:55	PM Abe and I are also working to improve the trading relationship between the U.S. and Japan something we have to do. The U.S. seeks a bilateral deal with Japan that is based on the principle of fairness and reciprocity. We're working hard to reduce our trade imbalance... https://t.co/pnqEHoplk0	Positive
07/06/2018 22:04	Please tell Prime Minister Trudeau and President Macron that they are charging the U.S. massive tariffs and create non-monetary barriers. The EU trade surplus with the U.S. is $151 Billion and Canada keeps our farmers and others out. Look forward to seeing them tomorrow.	Negative
08/06/2018 02:15	Why isn't the European Union and Canada informing the public that for years they have used massive Trade Tariffs and non-monetary Trade Barriers against the U.S. Totally unfair to our farmers workers & companies. Take down your tariffs & barriers or we will more than match you!	Negative
08/06/2018 10:16	Canada charges the U.S. a 270% tariff on Dairy Products! They didn't tell you that did they? Not fair to our farmers!	Negative
08/06/2018 10:25	Looking forward to straightening out unfair Trade Deals with the G-7 countries. If it doesn't happen we come out even better!	Negative
08/06/2018 11:22	I am heading for Canada and the G-7 for talks that will mostly center on the long time unfair trade practiced against the United States. From there I go to Singapore and talks with North Korea on Denuclearization. Won't be talking about the Russian Witch Hunt Hoax for a while!	Negative
26/06/2018 11:16	Early this year Harley-Davidson said they would move much of their plant operations in Kansas City to Thailand. That was long before Tariffs were announced. Hence they were just using Tariffs/Trade War as an excuse. Shows how unbalanced & unfair trade is but we will fix it.....	Negative
26/06/2018 11:25	....We are getting other countries to reduce and eliminate tariffs and trade barriers that have been unfairly used for years against our farmers workers and companies. We are opening up closed markets and expanding our footprint. They must play fair or they will pay tariffs!	Negative
26/06/2018 11:37	....When I had Harley-Davidson officials over to the White House I chided them about tariffs in other countries like India being too high. Companies are now coming back to America. Harley must know that they won't be able to sell back into U.S. without paying a big tax!	Negative
26/06/2018 11:49	....We are finishing our study of Tariffs on cars from the E.U. in that they have long taken advantage of the U.S. in the form of Trade Barriers and Tariffs. In the end it will all even out - and it won't take very long!	Negative
10/07/2018 09:35	Getting ready to leave for Europe. First meeting - NATO. The U.S. is spending many times more than any other country in order to protect them. Not fair to the U.S. taxpayer. On top of that we lose $151 Billion on Trade with the European Union. Charge us big Tariffs (& Barriers)!	Negative
10/07/2018 10:59	Thank you to all of my great supporters really big progress being made. Other countries wanting to fix crazy trade deals. Economy is ROARING. Supreme Court pick getting GREAT REVIEWS. New Poll says Trump at over 90% is the most popular Republican in history of the Party. Wow!	Negative
10/07/2018 18:52	The European Union makes it impossible for our farmers and workers and companies to do business in Europe (U.S. has a $151 Billion trade deficit) and then they want us to happily defend them through NATO and nicely pay for it. Just doesn't work!	Negative
11/07/2018 12:40	I am in Brussels but always thinking about our farmers. Soy beans fell 50% from 2012 to my election. Farmers have done poorly for 15 years. Other countries' trade barriers and tariffs have been destroying their businesses. I will open...	Negative
11/07/2018 16:50	What good is NATO if Germany is paying Russia billions of dollars for gas and energy? Why are their only 5 out of 29 countries that have met their commitment? The U.S. is paying for Europe's protection then loses billions on Trade. Must pay 2% of GDP IMMEDIATELY not by 2025.	Negative
11/07/2018 17:07	What good is NATO if Germany is paying Russia billions of dollars for gas and energy? Why are there only 5 out of 29 countries that have met their commitment? The U.S. is paying for Europe's protection then loses billions on Trade. Must pay 2% of GDP IMMEDIATELY not by 2025.	Negative
12/07/2018 06:03	Presidents have been trying unsuccessfully for years to get Germany and other rich NATO Nations to pay more toward their protection from Russia. They pay only a fraction of their cost. The U.S. pays tens of Billions of Dollars too much to subsidize Europe and loses Big on Trade!	Negative
20/07/2018 12:43	China the European Union and others have been manipulating their currencies and interest rates lower while the U.S. is raising rates while the dollars gets stronger and stronger with each passing day - taking away our big competitive edge. As usual not a level playing field...	Negative
20/07/2018 12:51	....The United States should not be penalized because we are doing so well. Tightening now hurts all that we have done. The U.S. should be allowed to recapture what was lost due to illegal currency manipulation and BAD Trade Deals. Debt coming due & we are raising rates - Really?	Negative
20/07/2018 13:04	Farmers have been on a downward trend for 15 years. The price of soybeans has fallen 50% since 5 years before the Election. A big reason is bad (terrible) Trade Deals with other countries. They put on massive Tariffs and Barriers. Canada charges 275% on Dairy. Farmers will WIN!	Negative
17/09/2018 10:11	Tariffs have put the U.S. in a very strong bargaining position with Billions of Dollars and Jobs flowing into our Country - and yet cost increases have thus far been almost unnoticeable. If countries will not make fair deals with us they will be "Tariffed!"	Negative
18/09/2018 12:50	China has openly stated that they are actively trying to impact and change our election by attacking our farmers ranchers and industrial workers because of their loyalty to me. What China does not understand is that these people are great patriots and fully understand that.....	Negative
18/09/2018 12:55	.....China has been taking advantage of the United States on Trade for many years. They also know that I am the one that knows how to stop it. There will be great and fast economic retaliation against China if our farmers ranchers and/or industrial workers are targeted!	Negative
23/09/2018 20:52	Going to New York. Will be with Prime Minister Abe of Japan tonight talking Military and Trade. We have done much to help Japan would like to see more of a reciprocal relationship. It will all work out!	Positive
24/09/2018 20:44	US-Korea Free Trade Agreement Signing Ceremony! https://t.co/yLFkAZgagG	Positive
24/09/2018 21:46	Joint Statement on the United States-Korea Free Trade Agreement: https://t.co/m0jW8nqdQW https://t.co/lcrhsJtv00	Positive
04/12/2018 14:30	The negotiations with China have already started. Unless extended they will end 90 days from the date of our wonderful and very warm dinner with President Xi in Argentina. Bob Lighthizer will be working closely with Steve Mnuchin Larry Kudlow Wilbur Ross and Peter Navarro.....	Positive

Table B.2: List of tweets used in the training sample

Date & Time	Original Tweet	Score	Date & Time	Original Tweet	Score	Date & Time	Original Tweet	Score
01/03/2018 12:12	Our Steel and Aluminum industries (and many others) have been decimated by decades of unfair trade and bad policy with countries from around the world. We must not let our country companies and workers be taken advantage of any longer. We want free fair and SMART TRADE!	-1	16/05/2018 13:09	...haven't even started yet! The U.S. has very little to give because it has given so much over the years. China has much to give!	-0.6	10/07/2018 18:52	The European Union makes it impossible for our farmers and workers and companies to do business in Europe (U.S. has a $151 Billion trade deficit) and then they want us to happily defend them through NATO and nicely pay for it. Just doesn't work!	-0.4
02/03/2018 10:50	When a country (USA) is losing many billions of dollars on trade with virtually every country it does business with trade wars are good and easy to win. Example when we are down $100 billion with a certain country and they get cute don't trade anymore-we win big. It's easy!	-1	16/05/2018 13:09	...We have not seen China's demands yet which should be few in that previous U.S. Administrations have done so poorly in negotiating. China has seen our demands. There has been no folding as the media would love people to believe the meetings...	-0.6	11/07/2018 12:40	I am in Brussels but always thinking about our farmers. Soy beans fell 50% from 2012 to my election. Farmers have done poorly for 15 years. Other countries' trade barriers and tariffs have been destroying their businesses. I will open...	-0.5
02/03/2018 13:57	When a country Taxes our products coming in at say 50% and we Tax the same product coming into our country at ZERO not fair or smart. We will soon be starting RECIPROCAL TAXES so that we will charge the same thing as they charge us. $800 Billion Trade Deficit-have no choice!	-1	17/05/2018 21:27	Talking trade with the Vice Premier of the People's Republic of China Liu He. https://t.co/9T7Iq6F3Xe	0.1	11/07/2018 16:50	What good is NATO if Germany is paying Russia billions of dollars for gas and energy? Why are their only 5 out of 29 countries that have met their commitment? The U.S. is paying for Europe's protection then loses billions on Trade. Must pay 2% of GDP IMMEDIATELY not by 2025.	-0.2
08/03/2018 12:38	Looking forward to 3:30 P.M. meeting today at the White House. We have to protect & build our Steel and Aluminum Industries while at the same time showing great flexibility and cooperation toward those that are real friends and treat us fairly on both trade and the military.	-0.4	21/05/2018 11:21	I ask Senator Chuck Schumer why didn't President Obama & the Democrats do something about Trade with China including Theft of Intellectual Property etc.? They did NOTHING! With that being said Chuck & I have long agreed on this issue! Fair Trade plus with China will happen!	-0.3	11/07/2018 17:07	What good is NATO if Germany is paying Russia billions of dollars for gas and energy? Why are there only 5 out of 29 countries that have met their commitment? The U.S. is paying for Europe's protection then loses billions on Trade. Must pay 2% of GDP IMMEDIATELY not by 2025.	-0.2
09/03/2018 22:48	Spoke to PM @TurnbullMalcolm of Australia. He is committed to having a very fair and reciprocal military and trade relationship. Working very quickly on a security agreement so we don't have to impose steel or aluminum tariffs on our ally the great nation of Australia!	0.2	21/05/2018 11:27	China has agreed to buy massive amounts of ADDITIONAL Farm/Agricultural Products - would be one of the best things to happen to our farmers in many years!	0.5	12/07/2018 06:03	Presidents have been trying unsuccessfully for years to get Germany and other rich NATO Nations to pay more toward their protection from Russia. They pay only a fraction of their cost. The U.S. pays tens of Billions of Dollars too much to subsidize Europe and loses Big on Trade!	-0.1
10/03/2018 15:22	Chinese President XI XINPING and I spoke at length about the meeting with KIM JONG UN of North Korea. President XI told me he appreciates that the U.S. is working to solve the problem diplomatically rather than going with the ominous alternative. China continues to be helpful!	0.1	21/05/2018 11:31	On China Barriers and Tariffs to come down for first time.	0.3	19/07/2018 13:30	....proliferation cyber attacks trade Ukraine Middle East peace North Korea and more. There are many answers some easy and some hard to these problems...but they can ALL be solved!	0
10/03/2018 16:15	Chinese President XI JINPING and I spoke at length about the meeting with KIM JONG UN of North Korea. President XI told me he appreciates that the U.S. is working to solve the problem diplomatically rather than going with the ominous alternative. China continues to be helpful!	0.1	21/05/2018 11:40	China must continue to be strong & tight on the Border of North Korea until a deal is made. The word is that recently the Border has become much more porous and more has been filtering in. I want this to happen and North Korea to be VERY successful but only after signing!	0	20/07/2018 12:43	China the European Union and others have been manipulating their currencies and interest rates lower while the U.S. is raising rates while the dollars gets stronger and stronger with each passing day - taking away our big competitive edge. As usual not a level playing field...	-0.1
10/03/2018 17:23	Spoke to Prime Minister Abe of Japan who is very enthusiastic about talks with North Korea. Also discussing opening up Japan to much better trade with the U.S. Currently have a massive $100 Billion Trade Deficit. Not fair or sustainable. It will all work out!	-0.3	21/05/2018 13:16	Under our potential deal with China they will purchase from our Great American Farmers practically as much as our Farmers can produce.	0.2	20/07/2018 12:51	....The United States should not be penalized because we are doing so well. Tightening now hurts all that we have done. The U.S. should be allowed to recapture what was lost due to illegal currency manipulation and BAD Trade Deals. Debt coming due & we are raising rates - Really?	-0.2
10/03/2018 21:29	The European Union wonderful countries who treat the U.S. very badly on trade are complaining about the tariffs on Steel & Aluminum. If they drop their horrific barriers & tariffs on U.S. products going in we will likewise drop ours. Big Deficit. If not we Tax Cars etc. FAIR!	-0.8	23/05/2018 11:55	Our Trade Deal with China is moving along nicely but in the end we will probably have to use a different structure in that this will be too hard to get done and to verify results after completion.	-0.8	20/07/2018 13:04	Farmers have been on a downward trend for 15 years. The price of soybeans has fallen 50% since 5 years before the Election. A big reason is bad (terrible) Trade Deals with other countries. They put on massive Tariffs and Barriers. Canada charges 275% on Dairy. Farmers will WIN!	-0.5
22/03/2018 18:40	As a candidate I pledged that if elected I would use every lawful tool to combat unfair trade protect American workers and defend our national security. Today we took another critical step to fulfill that commitment. https://t.co/7NBI0Dibmx https://t.co/nmzqos3BUA	-1	25/05/2018 22:45	Funny to watch the Democrats criticize Trade Deals being negotiated by me when they don't even know what the deals are and when for 8 years the Obama Administration did NOTHING on trade except let other countries rip off the United States. Lost almost $800 Billion/year under "O"	-0.6	31/07/2018 10:14	The globalist Koch Brothers who have become a total joke in real Republican circles are against Strong Borders and Powerful Trade. I never sought their support because I don't need their money or bad ideas. They love my Tax & Regulation Cuts Judicial picks & more. I made.....	0
27/03/2018 00:44	Trade talks going on with numerous countries that for many years have not treated the United States fairly. In the end all will be happy!	-0.8	25/05/2018 23:13	...but complain and obstruct. They made only bad deals (Iran) and their so-called Trade Deals are the laughing stock of the world!	-0.2	24/08/2018 09:57	Target CEO raves about the Economy. "This is the best consumer environment I've seen in my career." A big statement from a top executive. But virtually everybody is saying this & when our Trade Deals are made & cost cutting done you haven't seen anything yet! @DRUDGE$_{R}EPORT$	0
28/03/2018 10:16	Received message last night from XI JINPING of China that his meeting with KIM JONG UN went very well and that KIM looks forward to his meeting with me. In the meantime and unfortunately maximum sanctions and pressure must be maintained at all cost!	-0.2	29/05/2018 11:27	Sorry I've got to start focusing my energy on North Korea Nuclear bad Trade Deals VA Choice the Economy rebuilding the Military and so much more and not on the Rigged Russia Witch Hunt that should be investigating Clinton/Russia/FBI/Justice/Obama/Comey/Lynch etc.	-0.1	24/08/2018 17:36	...Additionally because of our much tougher Trading stance with China I do not believe they are helping with the process of denuclearization as they once were (despite the UN Sanctions which are in place)...	0
28/03/2018 16:14	.@USTradeRep just announced an agreement in principle with South Korea on KORUS! A great deal for American and Korean workers. Let's now focus on our important security relationship.	-0.3	04/06/2018 12:41	China already charges a tax of 16% on soybeans. Canada has all sorts of trade barriers on our Agricultural products. Not acceptable!	-0.5	24/08/2018 17:36	...Secretary Pompeo looks forward to going to North Korea in the near future most likely after our Trading relationship with China is resolved. In the meantime I would like to send my warmest regards and respect to Chairman Kim. I look forward to seeing him soon!	0
04/04/2018 11:22	We are not in a trade war with China that war was lost many years ago by the foolish or incompetent people who represented the U.S. Now we have a Trade Deficit of $500 Billion a year with Intellectual Property Theft of another $300 Billion. We cannot let this continue!	-0.6	04/06/2018 12:43	The U.S. has made such bad trade deals over so many years that we can only WIN!	0	17/09/2018 10:11	Tariffs have put the U.S. in a very strong bargaining position with Billions of Dollars and Jobs flowing into our Country - and yet cost increases have thus far been almost unnoticeable. If countries will not make fair deals with us they will be "Tariffed!"	-0.7
05/04/2018 13:10	The Fake News Washington Post Amazon's "chief lobbyist" has another (of many) phony headlines "Trump Defiant As China Adds Trade Penalties." WRONG! Should read "Trump Defiant as U.S. Adds Trade Penalties Will End Barriers And Massive I.P. Theft." Typically bad reporting!	-0.4	04/06/2018 13:47	Farmers have not been doing well for 15 years. Mexico Canada China and others have treated them unfairly. By the time I finish trade talks that will change. Big trade barriers against U.S. farmers and other businesses will finally be broken. Massive trade deficits no longer!	-0.2	18/09/2018 12:50	China has openly stated that they are actively trying to impact and change our election by attacking our farmers ranchers and industrial workers because of their loyalty to me. What China does not understand is that these people are great patriots and fully understand that.....	-0.2
06/04/2018 11:11	Despite the Aluminum Tariffs Aluminum prices are DOWN 4%. People are surprised I'm not! Lots of money coming into U.S. coffers and Jobs Jobs Jobs!	-0.1	06/06/2018 01:23	Chris Farrell Judicial Watch. "They were running an operation to undermine a candidate for President of the U.S. These are all violations of law. This is intelligence tradecraft to steer an election. There's nothing more grave when it comes to abuse of our intelligence system...	0	18/09/2018 12:55	.....China has been taking advantage of the United States on Trade for many years. They also know that I am the one that knows how to stop it. There will be great and fast economic retaliation against China if our farmers ranchers and/or industrial workers are targeted!	-0.6
06/04/2018 11:29	RT @realDonaldTrump: We are not in a trade war with China that war was lost many years ago by the foolish or incompetent people who repr...	-0.1	07/06/2018 11:57	Isn't it Ironic? Getting ready to go to the G-7 in Canada to fight for our country on Trade (we have the worst trade deals ever made) then off to Singapore to meet with North Korea & the Nuclear Problem...But back home we still have the 13 Angry Democrats pushing the Witch Hunt!	-0.1	23/09/2018 20:52	Going to New York. Will be with Prime Minister Abe of Japan tonight talking Military and Trade. We have done much to help Japan would like to see more of a reciprocal relationship. It will all work out!	0.2
06/04/2018 14:32	China which is a great economic power is considered a Developing Nation within the World Trade Organization. They therefore get tremendous perks and advantages especially over the U.S. Does anybody think this is fair. We were badly represented. The WTO is unfair to U.S.	-0.7	07/06/2018 14:01	Looking forward to seeing my friend Prime Minister @AbeShinzo of Japan at noon. Will be discussing North Korea and Trade.	0	24/09/2018 20:44	US-Korea Free Trade Agreement Signing Ceremony! https://t.co/yLFkAZgagG	0.4
16/04/2018 12:31	Russia and China are playing the Currency Devaluation game as the U.S. keeps raising interest rates. Not acceptable!	-0.3	07/06/2018 19:55	PM Abe and I are also working to improve the trading relationship between the U.S. and Japan something we have to do. The U.S. seeks a bilateral deal with Japan that is based on the principle of fairness and reciprocity. We're working hard to reduce our trade imbalance... https://t.co/pnqEHoplk0	0.3	24/09/2018 21:46	Joint Statement on the United States-Korea Free Trade Agreement: https://t.co/m0jW8nqdQW https://t.co/lcrhsJtv00	0.4
17/04/2018 12:24	I am in Florida and looking forward to my meeting with Prime Minister Abe of Japan. Working on Trade and Military Security.	-0.1	07/06/2018 22:04	Please tell Prime Minister Trudeau and President Macron that they are charging the U.S. massive tariffs and create non-monetary barriers. The EU trade surplus with the U.S. is $151 Billion and Canada keeps our farmers and others out. Look forward to seeing them tomorrow.	-0.3	25/10/2018 13:57	The New York Times has a new Fake Story that now the Russians and Chinese (glad they finally added China) are listening to all of my calls on cellphones. Except that I rarely use a cellphone & when I do it's government authorized. I like Hard Lines. Just more made up Fake News!	0
25/04/2018 14:11	Looking forward to my meeting with Tim Cook of Apple. We will be talking about many things including how the U.S. has been treated unfairly for many years by many countries on trade.	-0.3	08/06/2018 02:15	Why isn't the European Union and Canada informing the public that for years they have used massive Trade Tariffs and non-monetary Trade Barriers against the U.S. Totally unfair to our farmers workers & companies. Take down your tariffs & barriers or we will more than match you!	-0.8	04/12/2018 14:30	The negotiations with China have already started. Unless extended they will end 90 days from the date of our wonderful and very warm dinner with President Xi in Argentina. Bob Lighthizer will be working closely with Steve Mnuchin Larry Kudlow Wilbur Ross and Peter Navarro.....	0.2
27/04/2018 11:50	Please do not forget the great help that my good friend President Xi of China has given to the United States particularly at the Border of North Korea. Without him it would have been a much longer tougher process!	0.2	08/06/2018 10:16	Canada charges the U.S. a 270% tariff on Dairy Products! They didn't tell you that did they? Not fair to our farmers!	-0.5			
02/05/2018 11:45	There was no Collusion (it is a Hoax) and there is no Obstruction of Justice (that is a setup & trap). What there is is Negotiations going on with North Korea over Nuclear War Negotiations going on with China over Trade Deficits Negotiations on NAFTA and much more. Witch Hunt!	-0.1	08/06/2018 10:25	Looking forward to straightening out unfair Trade Deals with the G-7 countries. If it doesn't happen we come out even better!	-0.5			
02/05/2018 22:40	"This isn't some game. You are screwing with the work of the president of the United States." John Dowd March 2018. With North Korea China the Middle East and so much more there is not much time to be thinking about this especially since there was no Russian "Collusion."	0	08/06/2018 11:22	I am heading for Canada and the G-7 for talks that will mostly center on the long time unfair trade practiced against the United States. From there I go to Singapore and talks with North Korea on Denuclearization. Won't be talking about the Russian Witch Hunt Hoax for a while!	-0.4			
03/05/2018 03:45	Our great financial team is in China trying to negotiate a level playing field on trade! I look forward to being with President Xi in the not too distant future. We will always have a good (great) relationship!	0.1	26/06/2018 11:16	Early this year Harley-Davidson said they would move much of their plant operations in Kansas City to Thailand. That was long before Tariffs were announced. Hence they were just using Tariffs/Trade War as an excuse. Shows how unbalanced & unfair trade is but we will fix it.....	-0.2			
13/05/2018 15:01	President Xi of China and I are working together to give massive Chinese phone company ZTE a way to get back into business fast. Too many jobs in China lost. Commerce Department has been instructed to get it done!	0.7	26/06/2018 11:25	....We are getting other countries to reduce and eliminate tariffs and trade barriers that have been unfairly used for years against our farmers workers and companies. We are opening up closed markets and expanding our footprint. They must play fair or they will pay tariffs!	-0.3			
13/05/2018 19:22	China and the United States are working well together on trade but past negotiations have been so one sided in favor of China for so many years that it is hard for them to make a deal that benefits both countries. But be cool it will all work out!	-0.5	26/06/2018 11:37	....When I had Harley-Davidson officials over to the White House I chided them about tariffs in other countries like India being too high. Companies are now coming back to America. Harley must know that they won't be able to sell back into U.S. without paying a big tax!	-0.2			
14/05/2018 20:06	ZTE the large Chinese phone company buys a big percentage of individual parts from U.S. companies. This is also reflective of the larger trade deal we are negotiating with China and my personal relationship with President Xi.	0.2	26/06/2018 11:49	....We are finishing our study of Tariffs on cars from the E.U. in that they have long taken advantage of the U.S. in the form of Trade Barriers and Tariffs. In the end it will all even out - and it won't take very long!	-0.7			
15/05/2018 12:35	Trade negotiations are continuing with China. They have been making hundreds of billions of dollars a year from the U.S. for many years. Stay tuned!	-0.4	10/07/2018 09:35	Getting ready to leave for Europe. First meeting - NATO. The U.S. is spending many times more than any other country in order to protect them. Not fair to the U.S. taxpayer. On top of that we lose $151 Billion on Trade with the European Union. Charge us big Tariffs (& Barriers)!	-0.5			
16/05/2018 13:09	The Washington Post and CNN have typically written false stories about our trade negotiations with China. Nothing has happened with ZTE except as it pertains to the larger trade deal. Our country has been losing hundreds of billions of dollars a year with China...	-0.3	10/07/2018 10:59	Thank you to all of my great supporters really big progress being made. Other countries wanting to fix crazy trade deals. Economy is ROARING. Supreme Court pick getting GREAT REVIEWS. New Poll says Trump at over 90% is the most popular Republican in history of the Party. Wow!	-0.1			

Table B.3: Selected words and loadings by elastic net algorithm, Equation (2.2)

Word	Loading
advantag	-0.06667
agreement	0.049195
anoth	-0.00874
barrier	-0.01356
billion	-0.09218
charg	-0.04538
countri	-0.15007
deficit	-0.03529
end	-0.09196
even	-0.0222
fair	-0.03681
korea	0.073555
made	0.027548
much	0.00242
not	-0.06014
pai	0.012072
presid	0.07043
relationship	0.059126
trade	-0.05362
unfair	-0.1656
us	-0.01003
veri	-0.02898
work	0.090961
worker	-0.13911
xi	0.069126
year	-0.00401
zte	0.015077

Table B.4: Estimates from equation Equation (2.4) at weekly frequency

Dep. variable 3-T Index (lev.)	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
$\Delta SP500_t$	0.381			0.326	0.201		0.186
	(0.673)			(0.707)	(0.714)		(0.733)
$\Delta SP500_{t-1}$	0.208			0.313	0.073		0.156
	(0.738)			(0.749)	(0.768)		(0.786)
$\Delta SP500_{t-2}$	1.055			0.871	1.021		0.889
	(0.659)			(0.665)	(0.675)		(0.693)
$\Delta NEER_t^{USD}$		-0.764		-0.595		-0.355	-0.260
		(1.485)		(1.558)		(1.532)	(1.575)
$\Delta NEER_{t-1}^{USD}$		0.959		1.019		1.010	0.793
		(1.416)		(1.415)		(1.495)	(1.472)
$\Delta NEER_{t-2}^{USD}$		-2.181		-1.575		-1.679	-1.321
		(1.695)		(1.664)		(1.586)	(1.612)
$\Delta Stock_t^{CHN}$			0.496		0.541	0.503	0.524
			(0.475)		(0.510)	(0.479)	(0.516)
$\Delta Stock_{t-1}^{CHN}$			-0.144		-0.382	-0.132	-0.362
			(0.488)		(0.548)	(0.509)	(0.560)
$\Delta Stock_{t-2}^{CHN}$			0.684		0.442	0.592	0.394
			(0.590)		(0.615)	(0.590)	(0.616)
Constant	-0.135***	-0.131***	-0.131***	-0.135***	-0.134***	-0.131***	-0.134***
	(0.012)	(0.011)	(0.011)	(0.012)	(0.011)	(0.011)	(0.011)
Observations	190	190	190	190	190	190	190
F test	0.984	0.891	0.882	0.675	0.827	0.917	0.751
F prob	0.401	0.447	0.451	0.670	0.551	0.483	0.662
R2	0.02	0.01	0.02	0.03	0.03	0.03	0.04

Notes: explanatory variables are in log-differences; the China stock index is the Shanghai stock market index. T-stats reported in parenthesis below coefficients and computed based on HAC standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table B.5: Estimates from equation Equation (2.4) at daily frequency at daily frequency

Dep. variable 3-T Index (lev.)	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
$\Delta SP500_t$	2.900			4.173	5.763		6.145
	(4.387)			(4.688)	(3.915)		(4.179)
$\Delta SP500_{t-1}$	2.213			2.217	3.105		2.761
	(3.076)			(2.936)	(3.384)		(3.196)
$\Delta SP500_{t-2}$	1.943			2.019	0.976		1.317
	(3.084)			(3.370)	(2.536)		(2.699)
$\Delta SP500_{t-3}$	1.470			1.906	4.930		4.975
	(6.894)			(7.720)	(8.325)		(8.720)
$\Delta NEER_t^{USD}$		12.661		17.702		-0.689	4.551
		(12.172)		(11.921)		(8.296)	(9.182)
$\Delta NEER_{t-1}^{USD}$		-10.890		-6.087		-9.268	-3.904
		(12.308)		(13.732)		(10.613)	(11.999)
$\Delta NEER_{t-2}^{USD}$		3.355		6.481		3.228	6.965
		(7.672)		(9.856)		(10.034)	(11.592)
$\Delta NEER_{t-3}^{USD}$		0.014		0.519		-3.561	-2.032
		(10.158)		(9.254)		(14.232)	(11.313)
$\Delta Stock_t^{CHN}$			-11.422		-13.507	-11.453	-13.126
			(9.092)		(10.342)	(9.110)	(10.392)
$\Delta Stock_{t-1}^{CHN}$			1.411		0.720	0.943	0.487
			(3.675)		(3.766)	(3.789)	(3.720)
$\Delta Stock_{t-2}^{CHN}$			-2.260		-4.311	-2.195	-3.709
			(3.458)		(2.875)	(4.020)	(3.301)
$\Delta Stock_{t-3}^{CHN}$			-1.322		-2.656	-1.577	-2.858
			(2.180)		(2.781)	(2.394)	(3.028)
Constant	-0.368***	-0.363***	-0.363***	-0.364***	-0.357***	-0.358***	-0.354***
	(0.040)	(0.038)	(0.038)	(0.037)	(0.033)	(0.034)	(0.031)
Observations	158	158	158	158	158	158	158
F test	0.458	0.476	1.274	0.557	0.942	0.655	0.656
F prob	0.712	0.699	0.285	0.764	0.466	0.686	0.747
R^2	0.00	0.00	3.13	0.00	2.78	0.88	0.37

Notes: explanatory variables are in log-differences; the China stock index is the Shanghai stock market index. T-stats reported in parenthesis below coefficients and computed based on HAC standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

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