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CIREQ, Université de Montréal
C.P. 6128, succursale Centre-ville
Montréal (Québec) H3C 3J7
Canada
Téléphone : (514) 343-6557
Télécopieur : (514) 343-7221
cireq@umontreal.ca
http://www.cireqmontreal.com

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Tariffs and the Exchange Rate: Evidence from Twitter*

Dmitry Matveev† and Francisco Ruge-Murcia‡

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Abstract

This paper examines Mundell's conjecture that in a flexible exchange rate regime, an increase in tariffs on foreign goods leads to the real appreciation of the local currency or, conversely, to the real depreciation of the foreign currency (Mundell, 1961). We focus on the exchange rate market's reaction to government communication in the form of tweets by the U.S. president that contain information about possible tariff increases on Canadian and Mexican goods. Results show that the anticipation of trade restrictions by the U.S. leads to a 0.022% depreciation in the Canadian dollar, and a 0.049% depreciation in the Mexican peso, with respect to the U.S. dollar.

JEL classification: F13, F31
Key Words: NAFTA, commercial policy, high-frequency identification.

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†Canadian Economic Analysis Department, Bank of Canada. Email: dmatveev@bank-banque-canada.ca

‡Department of Economics, McGill University, and CIREQ. Email: francisco.ruge-murcia@mcgill.ca

1. Introduction

An important result in a classical paper by Robert Mundell (Mundell, 1961) is that in a flexible exchange rate regime, an increase in the tariff on the foreign good leads to the real appreciation of the local currency or, conversely, to the real depreciation of the foreign currency. Mundell also finds that contrary to the possible intention of the policy, domestic output may actually fall following the tariff increase because the improvement in the terms of trade increases savings via the Laursen-Metzler effect and reduces aggregate demand (Laursen and Metzler, 1950).[1] These theoretical results have attracted renewed attention in light of the recent application by the United States of a commercial policy whereby tariffs and other restrictions on international trade attempt to influence exports, imports, and the resulting trade balance.

A crucial empirical issue is that actual changes in U.S. tariffs were relatively infrequent until recently and when they occurred, they covered narrowly defined product categories.[2] Hence, it may be hard to detect aggregate effects based on historical data and to identify a causal relation between actual tariff changes and exchange rate movements. This accounts for the limited empirical evaluation of Mundell's theoretical results above.[3] We respond to this challenge by focusing instead on the exchange rate market's reaction to the possible tariff increases that would have taken place if the United States had withdrawn from the North American Free Trade Agreement (NAFTA) or if the negotiations for a new trade agreement would have failed. Canada and Mexico are, respectively, the second and third largest U.S. trade partners, and trade with the other NAFTA members accounted in 2016 for 68%, 66%, and 29% of all international trade by Canada, Mexico, and the U.S., respectively.[4] Hence, the aggregate implications of U.S. restrictions on trade with these two countries are likely to be large and the foreign exchange market would react to even the possibility that tariffs would be imposed.[5]

The uncertainty regarding NAFTA was driven by U.S. commercial policy and, more specifically,

[1] Similar results are reported by Chan (1978), Eichengreen (1981), Krugman (1982), and Ostry (1991). More recently, Erceg, Prestipino, and Raffo (2018) find that a combination of import tariffs and export subsidies may be expansionary in a flexible exchange rate regime. Other recent work that examines the aggregate effects of trade policy include Barattieri, Cacciatore, and Ghironi (2018) and Caldara, Iacoviello, Molligo, Prestipino, and Raffo (2019).

[2] For example consider the countervailing and antidumping rates of 27% on Canadian softwood lumber that were announced by the U.S. Department of Commerce in April 2002.

[3] The only exceptions we are aware of are Ostry and Rose (1992) and, more recently, Furceri, Hannan, Ostry, and Rose (2019), who use vector autoregressions to examine the effect of tariff changes in various macroeconomic variables, including the real exchange rate.

[4] Authors' calculations based on data from the World Bank available at https://wits.worldbank.org/. The figures are the sum of imports from and exports to the other two NAFTA members over the sum of total exports and imports, all in millions of U.S. dollars.

[5] Some tariffs were imposed, for instance, in June 2018 when tariffs of 25% and 10% were respectively imposed on steel and aluminum imports from Canada and Mexico. These tariffs were lifted in May 2019 but, after the ratification of the new USMCA trade agreement, a tariff of 10% was imposed again on Canadian aluminum in August 2020.

by the "America First" policy during the presidency of Donald Trump. Although the U.S. Congress has competency over trade policy, the powers of the president have been considerably expanded through laws like the Trade Expansion Act of 1962 and the Trade Act of 1974. The United States Trade Representative is part of the Executive Office of the President and is the agency responsible for developing and recommending trade policy to the president, conducting trade negotiations, and coordinating trade policy with other government agencies. During the period considered, a key source of news regarding trade policy and, in particular, on tariffs were public communications by the U.S. president, frequently in the form of tweets. Given the powers of the presidency on international trade matters, these tweets are potentially consequential.

We quantify the causal effect on the bilateral exchange rates of the possible and actual imposition of tariffs on Canada and Mexico as gleaned from presidential tweets. Identification is based on a high-frequency strategy that computes the change in the nominal exchange rate between two points in a narrow time window around the twitter feed. In principle, other economic news could induce movements in the exchange rate during the day and the identifying assumption is that the twitter feed was likely the only source of new information arriving during the brief time interval around it. Furthermore, although our data on exchange rates correspond to the nominal, rather than the real, rate, it is safe to assume that the price level is basically unchanged over the time window around the tweet, so that a high-frequency movement in the nominal exchange rate translates one-to-one into a high-frequency movement in the real exchange rate.

This high-frequency identification strategy is used by previous literature that studies the effect of monetary policy announcements on long-term interest rates (Cochrane and Piazzesi, 2002, and Gürkaynak, Sack, and Swanson, 2005), on the volatility of the stock returns of individual firms (Gorodnichenko and Weber, 2016), and on expected inflation and output growth (Nakamura and Steinsson, 2018). The strategy is also used by a recent literature that examines the effect of tweets on the Chinese and U.S. stock markets (Blanchard and Collins, 2019) and on the federal funds futures market (Bianchi, Kung, and Kind, 2019, and Camous and Matveev, 2019). As the above-mentioned literature, our paper is concerned with the effects of government communication on economic variables. In the context of fiscal policy, this literature also includes Romer and Romer (2010), who use a wide array of government publications and presidential speeches to construct a time-series of tax changes and quantify their effect on aggregate output, and Ramey (2011), who examines the effects of news regarding military spending as reported by *Business Week.* In the same spirit, we use presidential tweets to shed light on Mundell's conjecture regarding the response of the exchange rate to changes in tariffs, which until now has not been fully evaluated empirically due to data limitations and the lack of a clean identification strategy.

Our results show that the anticipation of trade restrictions by the U.S. leads to a 0.022% depreciation in the Canadian dollar, and a 0.049% depreciation in the Mexican peso, with respect to the U.S. dollar within five minutes of the tweet. These figures are economically and statistically significant and generally robust to including additional regressors. As a whole, these results provide empirical support for Mundell's conjecture at high frequencies. Up to the extent that nominal exchange rates are well approximated by a unit-root process–for which an innovation has permanent effects—and nominal prices are rigid, the results would support Mundell's conjecture at lower frequencies as well.

This paper is organized as follows. Section 2 describes the data used in this project, section 3 presents case studies that examine the effects of presidential tweets on bilateral exchange rates, section 4 contains the main empirical analysis and examines the robustness of the results, and section 5 concludes.

2. Data

The raw data for this study consists of 336 tweets by Donald Trump, first as candidate and then as U.S. president, between January 1, 2016, and November 29, 2019. These tweets were selected from more than 40,000 tweets available at the publicly-availably repository www.trumptwitterarchive.com using the keywords: Canada, Mexico, Canadian, Mexican, NAFTA, USMCA, and CUSMA. We disregard re-tweets, which by definition contain no new information, and weekend tweets, when foreign exchange markets are closed. We consider tweets from the same thread jointly if they fall within the same identification window and as separate tweets otherwise. The identification window is six minutes long. The window starts one minute before, and ends five minutes after, the publication of the tweet. To verify that our identification strategy is not tainted by any public or private data release that may fall within the window, we collected data on the release of major economic indicators from www.tradingeconomics.com and verified their timestamp. We found 11 instances where the timestamp was within the identification window and, hence, we abstained from using the associated tweets in our empirical analysis. The final sample consists of 177 tweets for Canada and 180 for Mexico.

The information content of a tweet is classified into one of five possible categories and coded in a variable denoted by c as follows. Tweets that openly criticize NAFTA, threaten new tariffs, or threaten to end NAFTA or the negotiations for a new treaty are taken to signal a potential increase in tariffs and trade restrictions on Mexican and/or Canadian goods coming into the U.S., and are coded as $c = 1$.[6] An example of such a tweet is:

[6] We include in this category tweets where trade issues are explicitly linked to immigration, border control, or the

We are in the NAFTA (worst trade deal ever made) renegotiation process with Mexico and Canada. Both being very difficult. May have to terminate?

published on August 27, 2017, at 13:51. (As a convention all tweet timestamps below are on Greenwich Mean Time or GMT.) There are 83 of these tweets in our sample, of which 51 were published at times when foreign exchange markets were open.

At the time there was some discussion in the economic press as to whether the president could unilaterally withdraw the U.S. from NAFTA and what tariff regime would take place in that case. Article 2205 of NAFTA states that "a Party may withdraw from this Agreement six months after it provides written notice of withdrawal to the other Parties," so clearly the U.S. could have withdrawn unilaterally from NAFTA if desired. As to whether the president could have initiated the process without Congress approval, Murrill (2016) notes in a legal opinion for the non-partisan Congressional Research Service (CRS) that the president possesses exclusive constitutional authority to communicate with foreign powers and, if characterized under that authority, the president's delivery of a notice of withdrawal to other free trade agreement (FTA) partners "appears sufficient to terminate the agreements as a matter of international law." For most trade agreements such a notice initiates a six-month period until the actual termination of, or withdrawal of a party from, the agreement. Under the Vienna Convention, withdrawing under the provisions of the agreement would have released the U.S. from its obligations under NAFTA from the date that withdrawal or termination became effective (Murrill, 2016, p. 10).

Murrill suggests that section 125 of the Trade Act of 1974, which Congress has made applicable to most free trade agreements signed by the U.S., authorizes the president to proclaim the restoration of tariff rates to what they would be without the agreement. The president shall recommend to Congress the appropriate rates of duty for affected imports within 60 days after termination of, or withdrawal from, an agreement. However, it is reasonable to assume that President Trump would have proposed tariffs no lower than those under NAFTA for a wide array of Canadian and Mexican goods entering the U.S. Hufbauer (2017) argues that the president could have invoked the call for "reciprocal and mutually advantageous concessions" in the North American Free Trade Agreement Implementation Act of 1993 to raise U.S. tariffs applicable to Canada, Mexico, or both to the most-favored-nation (MFN) levels that apply to countries that have no free trade agreement with the U.S. Without any presidential action, the section allows the same duties or other import restrictions under the FTA to remain in place for up to a year.[7]

construction of a wall along the Mexico-U.S. border

[7] This is not to say that Congress is powerless. The Constitution grants Congress the power to impose tariffs on imports and the presidential power to proclaim modifications to tariff rates derives from a statutory delegation of this power. Presumably, Congress could alter the language of the legislation or repeal the relevant statues, but this

Compared with Mexico, the case of Canada is somewhat more complicated because the Canada-U.S. Free Trade Agreement (CUSFTA) was suspended, rather than terminated, when NAFTA entered into force in 1994. Thus, should NAFTA be terminated, the CUSFTA may ensure continuation of free trade between Canada and the United States unless separately terminated. However, the discussion above suggests that the president could unilaterally withdraw the U.S. from CUSFTA as well. Still, this implies that the immediate consequences of the U.S. withdrawing from NAFTA would be larger for Mexico than for Canada and, hence, we would expect the exchange rate effects of presidential tweets to be quantitatively larger for the former than for the latter.

Even, without leaving NAFTA, the U.S. president was allowed to impose tariffs on Canadian and Mexican steel and aluminum starting in June 2018 under section 232 of the Trade Expansion Act of 1962. This section permits the president to impose tariffs when "an article is being imported into the United States in such quantities or under such circumstances as to threaten or impair the national security." The section was upheld by the Supreme Court in 1976 and the Court refused to hear a new challenge to its constitutionality in June 2019. The president also instructed the Secretary of Commerce to investigate the effect of imports of automobiles, trucks, and automotive parts on national security under section 232 in May 2018.[8]

The above discussion motivates our coding strategy as it indicates that presidential tweets criticizing NAFTA or threatening to impose new tariffs, to withdraw the U.S. from NAFTA, or to end the negotiations for a free-trade agreement were potentially consequential and unambiguously signalled the possible increase in tariffs on Canadian and Mexican goods.

Tweets that indicate progress in the trade negotiations signal the continuation of the status quo and potentially a decrease in tariffs, and are coded as $c = -1$. An example of such a tweet is:

Our relationship with Mexico is getting closer by the hour. Some really good people within both the new and old government and all working closely together . . . A big Trade Agreement with Mexico could be happening soon!

published on August 25, 2018, at 13:22. There are only 16 of these tweets in our sample, of which 9 were published at times when foreign exchange markets were open. We include in this category a tweet announcing a new sugar deal with Mexico published on June 29, 2017 at 12:27 and a tweet calling for more open trade with Canada published on June 1, 2018 at 13:18.

Tweets concerning border issues alone were identified using the keywords: wall, immigration,

may require bipartisan support.

[8] Section 232 was also used to justify tariffs on solar panels and washing machines in January 2018, on steel and aluminum in March 2018, and on products made of steel and aluminum (e.g., staples, nails, car bumpers, etc.) in January 2020. These tariffs targeted countries other than Canada and Mexico although, as discussed in the text, tariffs on steel and aluminum were extended to both countries in June 2018.

border, caravan, migrants, and drugs, and are coded as $c = 2$. An example of such a tweet is:

Mexico will pay for the wall!

published on September 1, 2016, at 13:22. There are 107 of these tweets, of which 79 were published at times when foreign exchange markets were open.

Tweets regarding economic and political issues, only marginally related to trade, are coded as $c = 3$. We include in this category tweets demanding that Congress approves the new USMCA treaty or extolling the benefits of this new treaty. These tweets contain no new information about tariffs or trade, and reflect primarily internal U.S. politics. An example of such a tweet is:

Great reviews on the USMCA - sooo much better than NAFTA!

published on November 30, 2018, at 20:23, two months after the successful ending of negotiations with Canada had been announced. There are 103 of these tweets, of which 75 were published at times when foreign exchange markets were open.

Finally, remaining tweets with no relevance for trade or immigration are coded as $c = 0$ and include, for example,

Happy Canada Day to all of the great people of Canada and to your Prime Minister and my new found friend @JustinTrudeau

published on July 1, 2017, at 12:44. There are 27 of these tweets, of which 13 were published at times when foreign exchange markets were open.

The exchange rate data were obtained from Refinitiv (formerly part of Thompson Reuters) and consists of the Canadian dollar/US dollar and Mexican peso/US dollar currency pairs. The data is sourced from Refinitiv FX Matching platform, which is a primary inter-dealer electronic trading venue based on the central limit order book or "CLOB." The data is recorded at the level of individual executed trades. Transaction-level (tick-by-tick) data are essential to implement the high-frequency identification of the effects of presidential tweets on the exchange rates.

3. Case Studies

This section explores the possible effects of presidential tweets on the Canadian dollar/U.S. dollar and the Mexican peso/U.S. dollar exchange rates by focusing on three specific instances.

3.1 Trade Deficit with Mexico (January 26 and 27, 2017)

In the week following his inauguration on January 20, 2017, the U.S. president expressed dissatisfaction with the existing trade arrangement with Mexico as follows:

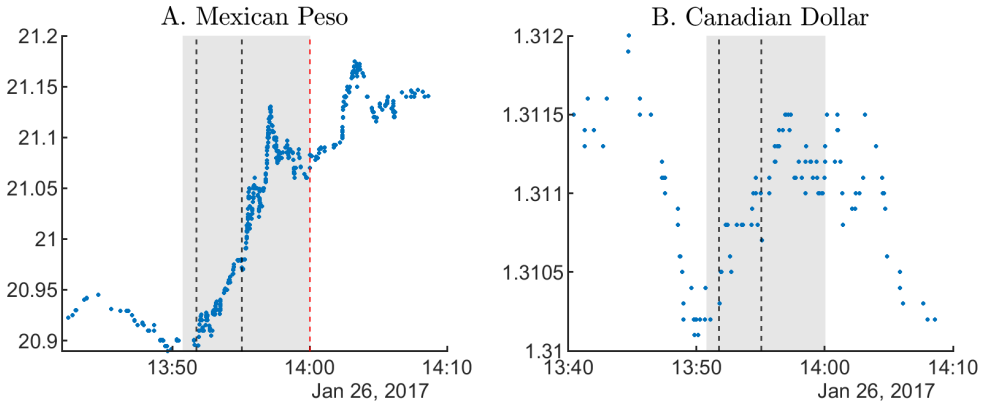

Figure 1: The figure plots the price of a U.S. dollar around the time tweets were published at 13:51 and 13:55 GMT.

The U.S. has a 60 billion dollar trade deficit with Mexico. It has been a one-sided deal from the beginning of NAFTA with massive numbers of jobs and companies lost. If Mexico is unwilling to pay for the badly needed wall then it would be better to cancel the upcoming meeting...

This thread published on January 26 was the first trade-related comment by the president and combined the criticism of NAFTA with immigration issues. Figure 1 plots the Mexican peso/U.S. dollar and Canadian dollar/U.S. dollar exchange rates with the tweet marked in black dotted line, a data release marked with a red dotted line, and the identification window marked as a shaded grey area. The vertical axis is the price of the U.S. dollar in Mexican pesos (panel A) and Canadian dollars (panel B) and the horizontal axis is time. The figure shows a depreciation of the peso by 0.871%. The tweet does not mention Canada explicitly but the negative depiction of NAFTA led to a depreciation of the Canadian dollar by 0.084%.

The follow-up tweet on February 27 again leads to a depreciation of the Mexican Peso, albeit of a smaller magnitude (see figure 2):

Mexico has taken advantage of the U.S. for long enough. Massive trade deficits & little help on the very weak border must change NOW!

The first thread was published shortly before the release of economic data on the Mexican balance of trade. One can readily compare their effects and conclude that a U.S. president's tweet on trade can potentially affect the exchange rate by more than the release of actual trade data. Similarly, the follow-up tweet was published not long before the release of data on durable goods orders and the personal consumption expenditures price index in the U.S.. One can see that the effects of the tweet and the data release on the Mexican peso/U.S. dollar exchange rate are of comparable magnitude.

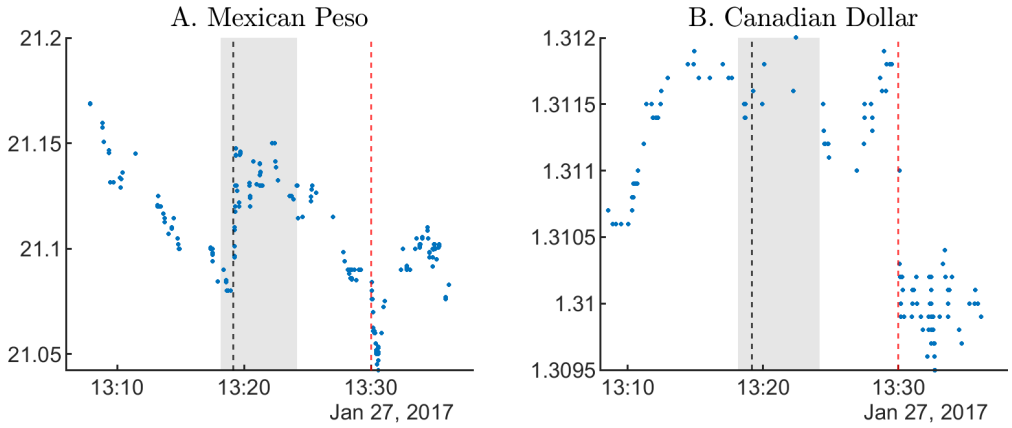

Figure 2: The figure plots the price of a U.S. dollar around the time a tweet was published at 13:19 GMT.

3.2 Calls to Renegotiate NAFTA (April 27, 2017)

Approaching the 100th day of his presidency, President Trump was reportedly considering to withdraw the United States from NAFTA. Leaders of both Mexico and Canada reached out to the U.S. president and the withdrawal was averted. These events led to the following tweets:

I received calls from the President of Mexico and the Prime Minister of Canada asking to renegotiate NAFTA rather than terminate. I agreed..

published on April 27, 2017, at 11:12, followed by

...subject to the fact that if we do not reach a fair deal for all, we will then terminate NAFTA. Relationships are good-deal very possible!

published the same day, a few minutes later, at 11:21. The corresponding exchange rate dynamics is displayed in figure 3. The first tweet signals that the focus has shifted towards reworking NAFTA. The exchange rates of both the Mexican peso and the Canadian dollar appreciate by 0.192% and 0.066%, respectively, relative to the US dollar. The follow-up tweet contains a qualifying statement that maintains the withdrawal as a contingency and results in a partial reversal of exchange rates with the Mexican peso depreciating by 0.079% and the Canadian dollar depreciating by 0.037%.

3.3 Tariffs and Migration Crisis (May 30 2019)

As attempts to secure funding for the wall along the border with Mexico had proven unsuccessful, President Trump promised to impose escalating tariffs on Mexican goods over illegal immigration. The announcement was made on Twitter on May 30, 2019 at 23:30 as follows:

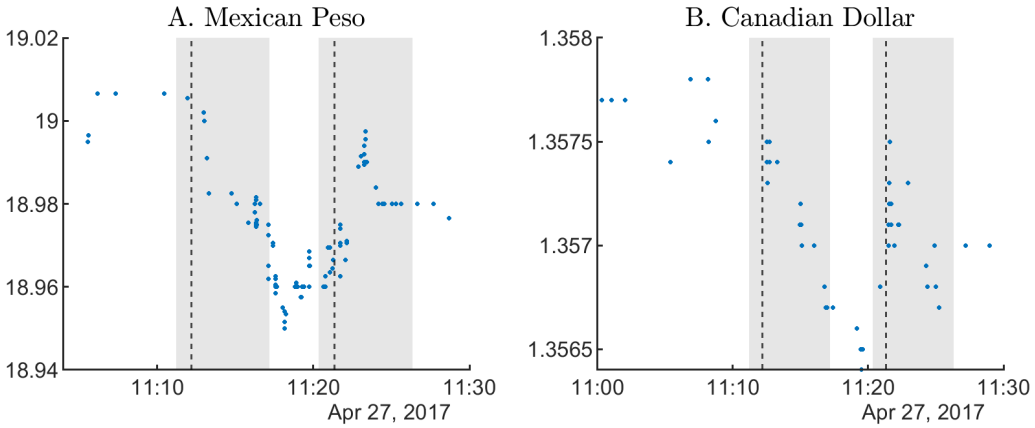

Figure 3: The figure plots the price of a U.S. dollar around the time tweets were published at 11:12 and 11:21 GMT.

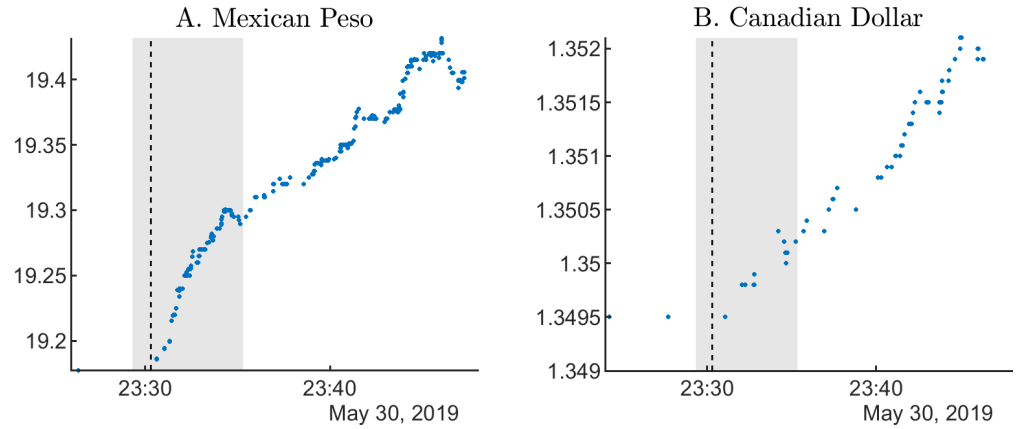

Figure 4: The figure plots the price of a U.S. dollar around the time a tweet was published at 23:30 GMT.

On June 10th, the United States will impose a 5% Tariff on all goods coming into our Country from Mexico, until such time as illegal migrants coming through Mexico, and into our Country, STOP. The Tariff will gradually increase until the Illegal Immigration problem is remedied, at which time the Tariffs will be removed. Details from the White House to follow.

Figure 4 shows that both the exchange rates of the Mexican peso and the Canadian dollar with respect to the U.S. dollar reacted to this announcement. The Mexican peso depreciated by 0.615% and the adjustment persisted well beyond our identification time window. Even though the announcement did not directly concern Canada, it put the recently negotiated USMCA trade agreement at risk and as result, led to a depreciation of the Canadian dollar by 0.059%.

The above case studies suggest that in line with Mundell's conjecture, (the possibility of) the

increase in trade tariffs leads to the real depreciation of the foreign currency or, conversely, to real appreciation of the local currency. In the following section, we examine whether this results holds more broadly for the complete set of tweets in our sample.

4. Empirical Analysis

Consider the ordinary least squares (OLS) projection

$$\ln(e_{t+\delta}) - \ln(e_{t-\varsigma}) = \alpha + \beta D_t + x_t'\gamma + u_t, \tag{1}$$

where $\ln(e_{t+\delta}) - \ln(e_{t-\varsigma})$ the change in the nominal bilateral exchange rate in a window of $\delta + \varsigma$ minutes around the twitter feed, a is an intercept term, β is a coefficient, D_t is a dummy variable that takes value 1 if $c = 1$, -1 if $c = -1$, and zero otherwise, γ is a vector of coefficients, x_t is a vector with additional regressors, and u_t is a disturbance term independent of D_t and x_t. This specification imposes the restriction that tweets that signal an increase and a decrease in tariffs on Canadian and/or Mexican goods have the same quantitative effect. This restriction will be relaxed below. Note that the identification window is no necessarily symmetric around the twitter feed and in this paper $\varsigma = 1$ minute and $\delta = 5$ minutes.

Consider first the benchmark results reported in column 1 of tables 1 and 2 for Canada and Mexico, respectively. A tweet by the U.S. president signalling a potential increase in tariffs on Canadian goods leads to a 0.0228% depreciation of the Canadian dollar with respect to the U.S. dollar in the five minutes following its publication. The effect is even larger in the case of Mexico where such a tweet leads to a 0.0508% depreciation of the Mexican peso. Both effects are statistically significant at the five percent significance level. To put these figures in perspective, note that the average change (in absolute value) in six-minutes time intervals for the full sample from January 1, 2016, to November 29, 2019, is 0.014% and 0.022% for the Canadian dollar and Mexican peso, respectively. Hence, the quantitative effect of a presidential tweet is economically significant, as well.

Column 2 in both tables examines the robustness of the results to using only data from the two most liquid exchange rate markets, namely, New York and London. This reduces the number of observations by 50 for both Canada and Mexico. Results for Canada are virtually unchanged, while for Mexico the estimated depreciation of the peso is lower at 0.0311% but it is still statistically significant. Moreover, the benchmark estimate of 0.0508% is contained in the 95% confidence interval around 0.0311%. Hence, conclusions do not appear to be driven by the lower liquidity in the other markets in our sample.

Column 3 considers separately tweets involving only the other NAFTA partner (i.e., Mexico in the case of Canada and *vice-versa*). In the case of Canada, tweets mentioning Mexico alone have the same effect on the Canadian dollar/U.S. dollar exchange rate as tweets mentioning both countries, NAFTA, or Canada alone. In contrast, in the case of Mexico, tweets mentioning only Canada have basically no effect on the Mexican peso/U.S. dollar exchange rate. There are two possible explanations for this result. First, the number of tweets that mention only Canada is smaller (11) than the number that mentions only Mexico (19). Second, the language in the latter tweets is considerably more aggressive than that in the former and, hence, more likely to receive the attention of traders.

Column 4 considers separately tweets before and after Donald Trump's elections as president. In both cases, pre-election tweets have no effect on exchanges rates, possibly because markets may have assigned a relative low probability to his winning the election. These estimates suggest that results are driven by tweets following the election on November 8, 2016.

Columns 5 and 6 consider additional tweets that concern only border issues (e.g., immigration, the construction of a wall along the Mexico-U.S. border, etc.) or economic and political issues that are only marginally related to trade and mostly reflect internal U.S. politics. In all cases, the coefficients of those tweets are quantitatively small and statistically insignificant. These results indicate that the information content of tweets regarding tariffs is indeed different from other tweets and have explanatory power over changes in the bilateral exchange rates.

Columns 7 and 8 control for instances where there was a public or private data release in the 60 minutes before or after the identification window. In all cases, the coefficient of the tariff tweets is similar to the one in the benchmark regression and the coefficient of the control variable is not statistically significant.

Finally, column 9 perform a regression that allows the effect of tweets signalling a possible increase in tariffs—criticizing NAFTA, threatening new tariffs, or threatening to end NAFTA or the negotiations for a new treaty—to be different from the effect of tweets signalling progress in the negotiations or the reduction of tariffs. The OLS regression in this case is

$$\ln(e_{t+\delta}) - \ln(e_{t-\varsigma}) = \alpha + \beta I_t + \rho J_t + u_t, \tag{2}$$

where ρ is a coefficient, I_t is a dummy variable that takes value 1 if $c = 1$, J_t is a dummy variable that takes value 1 if $c = -1$, and the remaining notation is as previous defined. In the case of Canada, tweets that signal a potential increase in tariffs lead on average to a 0.0195% depreciation of the Canadian dollar, while tweets that signal a potential decrease lead to a 0.0353% appreciation. Both coefficients are statistically significant, but in the later case only at the ten percent significance

level. In the case of Mexico, tweets that signal a potential increase in tariffs lead on average to a 0.0563% depreciation of the Mexican peso, while tweets that signal a potential decrease lead to a 0.0296% appreciation, but the latter effect is not statistically different from zero. For both countries, the hypothesis that both coefficients are same in absolute value cannot be rejected at the five percent level. However, this result should be interpreted with caution because the number of tweets that signal a potential decrease in tariffs is small (8 for both countries) and, thus, the estimate of ρ is noisy.

While the above estimates concern the nominal exchange rate, it is safe to assume that the price level is unchanged over the time window around the tweet. Hence, the high-frequency movement in the nominal exchange rate translates one-to-one into a high-frequency movement in the real exchange rate in the same direction. Overall, these results provide empirical support for Mundell's conjecture that in a flexible exchange rate regime, an increase in tariffs on foreign goods leads to the real appreciation of the local currency (in this case, the U.S. dollar) or, conversely, to the real depreciation of the foreign currency (the Canadian dollar or Mexican peso). These results are in line with recent work by Furceri, Hannan, Ostry, and Rose (2019), who construct a tariff series based on trade tariff rate data at the product level for 16 sectors in 39 countries and compute the response of several variables to an increase in tariffs. Their aggregate results show that an increase of one standard deviation in the tariff rate (about 3.6 percentage points) leads to a statistically significant real appreciation of the local currency in the short run. This appreciation offsets the potential benefits of the tariff increase leading to a small effect on the trade balance and a decrease in output and productivity.[9]

In interpreting our results it is important to consider the following caveats. First, the support for Mundell's conjecture is qualitative–that is, the foreign currency depreciates when an increase in local tariffs is announced or expected—rather than quantitative. The actual magnitude of the depreciation depends on variables (e.g., the probability of the tariff increase as perceived by the trader) that is unobservable by the econometrician. Second, our results concern high-frequencies, measured in minutes. However, up to the extent that nominal exchange rates are well approximated by a unit-root process–for which an innovation has permanent effects—and nominal prices are rigid, the results would also support Mundell's conjecture at lower frequencies

[9] An earlier paper by Ostry and Rose (1992) uses tariff revenues divided by the value of dutiable imports as a measure of the tariff rate and finds that one cannot reject the hypothesis that tariffs are statistically insignificant determinants of the real exchange rate, output, and the trade balance for the U.S.

5. Conclusions

Mundell (1961) makes a basic prediction about the effect of tariff increases on the exchange rate in a flexible exchange rate regime. Evaluating this prediction empirically is difficult because, in the past, changes in tariffs were infrequent and affected a limited set of goods, and identification was problematic. We use government communication in the form of potentially-consequently presidential tweets about NAFTA and trade, more generally, to address both issues and find qualitative support for Mundel's conjecture.

Table 1. Canada

	Regression								
Description	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	−.0013	.0010	−.0014	−.0012	−.0036	−.0014	−.0032	−.0027	.0001
	(.0031)	(.0037)	(.0031)	(.0031)	(.0045)	(.0039)	(.0033)	(.0031)	(.0029)
Tariffs	.0228*	.0235*	.0222*	.0243*	.0244*	.0228*	.0227*	.0229*	.0195*
	(.0062)	(.0077)	(.0075)	(.0064)	(.0068)	(.0066)	(.0062)	(.0061)	(.0058)
Tariffs (Mexico)			.0240*						
			(.0089)						
Pre-election				.0127					
				(.0152)					
Wall					.0056				
					(.0059)				
Political						.0001			
						(.0063)			
Release before							.0063		
							(.0063)		
Release after								.0041	
								(.0060)	
Agreement									−.0353†
									(.0209)
Number of obs.	177	127	177	177	177	177	177	177	177
F-statistic	2.752	15.661	1.335	1.746	1.836	1.317	1.993	1.662	1.975
p-value	$< .001$	$< .001$	$< .001$	$< .001$	$< .001$	$< .001$	$< .001$	$< .001$	$< .001$
R^2	.106	.111	.106	.110	.111	.106	.112	.109	.112

Note: The dependent variable is the percentage change in the Canadian dollar/U.S. dollar exchange rate in a window from one minute before to five minutes after the tweet timestamp. The figures in parenthesis are Huber-White heteroskedasticity consistent standard errors. The superscripts $*$ and † denote statistical significance at the five and ten percent levels, respectively.

Table 2. Mexico

	Regression								
Description	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	−.0144	.0112	−.0140	−.0138	−.0093	−.0156	−.0249	−.0242	−.0169
	(.0181)	(.0067)	(.0182)	(.0182)	(.0083)	(.0253)	(.0239)	(.0254)	(.0218)
Tariffs	.0508*	.0311†	.0620*	.0565*	.0472*	.0517*	.0508*	.0513*	.0563†
	(.0220)	(.0177)	(.0245)	(.0238)	(.0181)	(.0252)	(.0222)	(.0221)	(.0301)
Tariffs (Canada)			.0017						
			(.0299)						
Pre-election				.0118					
				(.0216)					
Wall					−.0125				
					(.0435)				
Political						.0042			
						(.0274)			
Release before							.0352		
							(.0256)		
Release after								.0294	
								(.0251)	
Agreement									−.0296
									(.0395)
Number of obs.	180	130	180	180	180	180	180	180	180
F-statistic	2.752	4.964	1.731	1.522	1.432	1.374	1.927	1.751	1.413
p-value	.099	.028	.180	.221	.242	.256	.149	.177	.246
R^2	.015	.037	.019	.017	.016	.015	.021	.019	.016

Note: The dependent variable is the percentage change in the Mexican peso/U.S. dollar exchange rate in a window from one minute before to five minutes after the tweet timestamp. The figures in parenthesis are Huber-White heteroskedasticity consistent standard errors. The superscripts $*$ and † denote statistical significance at the five and ten percent levels, respectively.

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