Tariff Evasion Under Free Trade Agreement: Empirical Evidence From NAFTA

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Abstract

This paper investigates the nature of tariff evasion occurring under free trade agreements by examining product level trade data between Canada and the U.S. under the successive trade agreements since 1989. I first show that in industries with high import tariffs there are more recorded exports at the source country than recorded imports at its destination indicating the presence of tariff evasion schemes between two developed countries with comparatively low corruption. Secondly, I verify that there are persistent violations against the Rule of Origin in both countries when differences in external tariffs create profitable opportunities through the trafficking of goods using a NAFTA partner. Finally, I demonstrate the existence of a strong positive relationship between the intensity of tariff evasion prior to NAFTA and the subsequent growth of trade during the agreement. This result indicates that trade growth under the agreement may, to some extent, reflect better compliance with trade regulations since trade agreements remove incentives for evading tariffs.

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Keywords: International trade, tariff evasion, free trade agreements.

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1 Introduction

Recent literature analyzing the response of commercial traders to import tariffs has demonstrated that there exists a close relationship between restrictions to trade and a firm's incentive to avoid paying tariffs. It shows that in industries with high tariff rates, firms will tend to undertake various activities to reduce the value of imports reported to customs officials and minimize duty payments. In this paper I expand on this and empirically analyze the case when importing and exporting countries form a Free Trade Agreement (FTA). When such an agreement is present, dealers focus their tariff evasion schemes on exploiting differences between member countries' external tariffs by shipping a good to a high-tariff country through its low-tariff associate. In doing so the dealers are inherently violating the Rules of Origin (ROO) and exploiting the preferential tariff treatment under NAFTA. Moreover, as trade liberalization under FTAs reduces the incentive to evade tariffs between cooperating countries, the trade creation effect of such agreements may be exaggerated because of increased proportion of imports being reported. Using Canadian and U.S. trade data, this paper shows that both factors were at work when the Canada-U.S. FTA was formed.

The starting point of my analysis is the methodology of a pioneering work by Fisman and Wei (2004) who use differences in national trade statistics between countries for estimating the amount of tariff evasion taking place. The authors propose that product-level variation between a source country's export data and the destination country's import data can expose tariff evasion behavior. Calling this difference the 'evasion gap', they show that at the industry level, the variation in China's gap against Hong Kong is closely related to Chinese tariff rates.[1] They interpret the larger value of trade being 'lost' in industries with high tariffs as a signal of tariff evasion with the assumption that firms have a greater incentive to underreport the value of their imports in an environment with higher tariffs. Javorcik and Narciso (2008) apply the same methodology in their study of tariff evasion in ten East European countries, comparing the volume of their imports from Germany with the volume of German exports for the same industry. While confirming the result of Fisman and Wei (2004), they discover that trade records discrepancies between countries are also influenced by the degree of product differentiation. Since trade fraud is more difficult to detect for differentiated products, more imports would be 'lost' in industries with high tariff rates and diversified products.

In addition to the above, I explore other forms that tariff evasion may take in the presence of an FTA through the analysis of national trade statistics. In my analysis I work with Canadian and American trade data for the year 1989, for it was the first year when the Canada-U.S. FTA (CUSFTA) was in place. This is important as it was the beginning of advanced trade liberalization between the two countries while considerable import tariffs were still enforced. Not only does concentrating on this particular year allow for the analysis of the effect tariff rates have on a firms' incentive to circumvent high trade barriers, but it also provides the opportunity to study the role that differences in external tariffs between two countries play in creating indirect trade through an FTA partner, which is essentially a violation of the ROO regulation. My examination into the aforementioned issues exposes a number of new findings. First, I show that between Canada and the U.S., tariff rates have a strong and significant effect on the apparent trade gap among the two. This result is robust to a large variety of specifications and implies that even in developed countries with low corruption, good law enforcement, and

[1] Fisman and Wei call the difference between the destination country's imports and a corresponding source country's exports the "evasion gap". Here, I will call this difference the "trade gap" because it may be unrelated to tariff evasion.

relatively low tariff rates firms are still engaged in tax evasion schemes.[2]

The second main finding of this paper is that the trade gap is correlated with the difference in external tariffs of two countries belonging to an FTA. Specifically, I found that the level of reported imports of one country from its FTA partner is higher in industries where firms are able to save more on duties by importing indirectly through the partner country rather than directly. In other words, some goods that enter the U.S. for re-export to Canada arrive in Canada on the pretense of being produced in the U.S. The value of these goods is higher in industries where exporting through the U.S. will reduce the amount owed to customs as duty payments. In the absence of evasion, the trade gap will not be related to the differences in external tariffs of two FTA member countries and, therefore, this paper reveals a persistent violation of NAFTA's ROO by traders trying to minimize duty payments. This result echoes with Fisman, Moustakerski, and Wei (2008) who show that indirect trade may facilitate tariff evasion. The authors find that high Chinese tariff rates result in increased amount of indirect imports through Hong Kong despite the absence of any tax advantage of shipping goods in so doing.[3] This paper builds upon the available research to show that differences in external tariffs of FTA members provide additional motive for tariff evasion by using the country with lower tariffs as a portal to facilitate indirect trade between member countries.

My third finding, also related to tariff evasion in the presence of an FTA, has important theoretical implications for gauging the actual effectiveness of FTAs in applied empirical studies. Since, as previous research has demonstrated, high tariffs will create more incentive for firms to underreport the values of their imports, trade liberalization will remove these incentives, thus leading to an increase in reported, not real, imports. This suggests that trade agreements may have an additional positive effect on the amount of trade reported through 'whitening' of undisclosed trade, which can be mistakenly attributed as due to trade-creating effects of FTAs. I confirm this hypothesis using Canadian and U.S. trade growth rates during the active phase of the CUSFTA tariff cuts. I find that during the 1990-98 period, the trade growth rate between Canada and the U.S. was negatively affected by the share of undisclosed trade in 1989. That is, industries with large share of misreported imports prior to CUSFTA experienced faster trade growth in periods subsequent to the agreement, controlling for intensity of trade liberalization and industry fixed effects.

Further, this study improves upon Fisman and Wei's approach to measuring tariff evasion in a number of ways. Firstly, I demonstrate that using the trade gap measure for tariff evasion analysis is appropriate only when the exporting country has proficient enforcement of export regulations. Analyses of tariff evasion using the trade gap measure, used in previous studies, implicitly assumes that high tariffs only affect firm's incentives to underreport imports and does not affect its incentives to truthfully report exports, which may not be true for several reasons.[4] For if there are no penalties for misreporting exports, which was largely the case in the U.S. in 1989, there is no reason for dishonest traders to comply with export regulations. In contrast, however, Canadian trade laws impose penalties for non-compliance with stronger enforcement, thus pushing firms to

[2] This result especially contrasts with Javorcik and Narciso (2008) as they found stronger tariff evasion among more corrupt countries and no evasion in countries with low levels of corruption.

[3] They explain this result as evidence towards Hong Kong's advantage in exporting goods to China without paying import tariffs and postulate that countries, actively involved in indirect trade, may act as mediators in tariff evasion schemes.

[4] For instance, a dishonest trader may believe that reporting the true value of exports may increase the chance of fraud detection in the destination country if there is some form of data exchange between the two countries customs. Moreover, compliance with export regulations has been traditionally better enforced than with import regulations. Therefore without proper export controls it may be easier for dishonest traders to use the same set of documents for export and import declarations.

report exports more accurately even with the intention to underreport the value at its destination. I propose that greater reliability of recorded exports data from Canada is a plausible reason for tariff evasion being more responsive to tariff tares in the U.S. than in Canada.

The second improvement upon measuring tariff evasion is through exploring the various factors that lead to non-zero values of the trade gap while showing that our results still hold when I control for these factors. Most importantly, I found that the main reason for discrepancies in trade statistics between Canada and the U.S. is an undercount of exports data due to firms' failure to submit export declarations for reasons unrelated to import tariffs. While tariff evasion activities have a negative impact on the trade gap, export undercount has a positive one. Therefore one would expect the effect of tariffs on the trade gap to be stronger for negative values of the trade gap, where trade statistics are less distorted by inconsistencies in the exports data. Using quantile regression analysis, I show that the negative effect of import tariffs on the trade gap is much stronger in the lower tail of the trade gap distribution where the share of 'missing' imports is the largest. Furthermore, I found that all the other factors associated with tariff evasion activities also have a more pronounced effect in the lower tail of the trade gap distribution. These results provide further evidence that the relationship between import tariffs and the trade gap, identified in this as well as other previous studies, is indeed related to tariff evasion activities.

The rest of the paper is organized as follows: In Section 2, I describe the data used in the study; Section 3 describes the nature of the trade gap and explains possible reasons why a source country's exports and the destination's imports for the corresponding product may not equate; Section 4 describes empirical strategies and the results on tariff evasion in CUSFTA; Section 5 examines the relationship between tariff evasion and trade growth rates under CUSFTA; Section 6 identifies problems in distinguishing the methods of tariff evasion; and Section 7 concludes on our findings.

2 The Data

The Canadian trade data for this project comes from Statistics Canada's Canadian Trade Database. The import data, collected at the 10-digit Harmonized System (HS) product level, is measured in current Canadian dollars and contains information on the quantity and value of imports as well as the applied tariffs. For Canadian exports, the data captures the quantity and value at the 8-digit HS level. The U.S. product-level trade data, obtained from Feenstra, Romalis, and Schott (2002), includes information on the value of U.S. exports and imports with other countries measured in current U.S. dollars and recorded according to the 10-digit HS industry classification. It also has information on the quantity of trade, import duties collected by the U.S. customs, associated transportation costs, and distinguishes imports that fall under NAFTA tariff preferences. Although trade data is available at the eight and ten digit HS level, industry classification is not harmonized beyond a six-digit level between two countries. Therefore, I chose to work with trade data aggregated up to six-digit HS industry classification.

The research is conducted for the year 1989[5] as this was the first year of CUSFTA and increased trade liberalization amongst the countries. Concentrating on year 1989 gives two important advantages because

[5] I limit the time period to the sole year 1989 for technical reasons that will be explained in Section 3.

many of the tariffs between Canada and the U.S. were still in place in 1989, while the CUSFTA was already operating. This provides a unique setting where the within-agreement tariff differences are still high enough for the participants to have enough incentives to engage in tariff evasion.[6] On the other hand, even as early as 1989, CUSFTA had already provided considerable tariff preferences for foreign firms within the FTA. For example, in 1989, the Canadian and U.S. trade weighted import tariffs for non-CUSFTA imports were 5.7% and 4% respectively, as compared to 2.5% and 0.8% for firms from within the agreement.[7] These differences would stimulate domestic importers and foreign exporters to seek for opportunities to violate the CUSFTA rules of origin and export to CUSFTA through a country with the lowest external tariff rate, if such opportunities were present. Therefore, by looking at the year 1989 I am able to analyze the role of tariff evasion and ROO violations at the same time.

3 The nature of trade gap

In this paper I use Fisman and Wei's (2004) methodology to analyze tariff evasion. In particular, I look at the effect of a country's trade policy on the difference between its reported value of imports from a partner country and the corresponding value of exports of the same product reported by the trading partner. Following Javorcik and Narciso (2008), I call this difference the "trade gap":

$$trade\ gap_{cpit} = \ln\left(Imports_{cpit}\right) - \ln\left(Exports_{pcit}\right) \tag{1}$$

where $Imports_{cpit}$ is the value of imports for country c of product i from a partner country p at time t, and $Exports_{pcit}$ is the value of exports reported by a partner country p to country c of the same product i at time t.

Although it could seem that a country's imports would mirror its partner country's export data, this is often the case. As Table 1 shows, in 1989 the mean value of the Canadian trade gap with the U.S. was equal to 0.5, while for the U.S. the mean value was -0.16 with a standard deviation of 1.55. In absolute terms, the total value of Canadian exports to the U.S. was 12% higher than U.S. imports from Canada and the total value of Canadian imports was 17% higher than U.S. exports. The rest of this section explains possible reasons for these differences and describes how they may reflect trade smuggling activities. Section 4.4 verifies that controlling for these other factors of the trade gap does not affect tariff evasion estimates.

The main reason for observed discrepancies in trade statistics is the unit of measurement used since each country measures trade flows in its own currency. After converting Canadian monthly trade data into U.S. dollars using monthly-average exchange rates, the trade gaps fall to 0.35 for Canada and 0.01 for the U.S.[8] However, the variance remains just as high as in Table 1, suggesting that there are some other important factors affecting the differences in trade data.

[6] For example, during the first year of CUSFTA, the simple average Canadian import tariff fell from 6.9% to 6.5%, while trade weighted average import tariff fell only by 0.1% from its initial value of 2.6%.

[7] In terms of the simple average import tariff, Canadian tariff preference under CUSFTA was 1.1% and the U.S. tariff preference was 2.5% in 1989.

[8] In absolute terms, the amount of Canadian exports to the U.S. is 1% less than U.S. imports from Canada, and the amount of U.S. exports is 5% less than Canadian imports.

To understand how a trade gap between two countries can arise, it is first necessary to understand how Canadian and U.S. import and export data are collected and compiled by national statistical agencies. In general, the two systems are very similar so I mostly focus on the Canadian one. The national data on merchandise imports is based on the information submitted to Canadian customs by importers. On the import declarations, importers are required to present information on the value, quantity, weight, origin, and 10-digit Harmonized Tariff Schedule of the good imported. This information is used by customs officials to determine import duties to be collected as well as whether the goods fall under quantitative or any other restrictions. Export statistics, in turn, are based on export declarations by traders. In both countries, reporting exports is mandatory and requires a similar set of information; each exporter has to declare the value and quantity of the good exported together with the certificate of origin and final destination of the good exported.

As the official trade statistics are derived from the import and export declarations made by the dealers, there are at least five reasons why Canadian imports from the U.S. may differ from the corresponding U.S. exports to Canada. In what follows, I will discuss them in-depth individually.

Undercount of export data. The first reason for major discrepancies in trade statistics is the undercount of export data which follows from exporters' failure to properly file export declarations. Some shippers do not file declarations due to the lack of understanding of filing requirements while others simply do not bother to file. Historically, enforcement for complying with import regulations was stricter than with exports regulations, and the resulting undercount of exports data has been a problem for many years. In a 1988 study conducted by the Federal Reserve (Ott, 1988), it was estimated that the total U.S. exports was $10 to $20 billion more than what was officially reported.

To eliminate large discrepancies between import and export data, Canada and the U.S. signed a Memorandum of Understanding (MOU) in 1987 to exchange import data, and as of January 1990 they started substituting each other's import data for their export data. From this date, Canadian and U.S. exports to each other were no longer based on export declarations but rather depend on imports statistics of the counterpart country. To make data exchange possible, the two countries also adopted the Harmonized System (HS) of industry classification in 1989. Although at the 6-digit level the countries implemented an international HS nomenclature, significant differences remained at a higher level of disaggregation. Therefore, for the purpose of this study, I aggregate all trade data between two countries to a 6-digit HS level to make it compatible.

The MOU also imposes a restriction on the time frame available for this project due to the formation of shared data. Prior to 1989, Canada and the U.S. would use different industry classification for trade statistics, making it impossible to compare the two countries imports and exports at the product level. After its application in 1990, the data exchange program under the MOU eliminated all discrepancies between Canadian and U.S. trade statistics, which makes the trade gap equal to zero by construction.[9] This leaves us with the single year 1989 when U.S. and Canadian trade data is compatible and was independently collected by two statistical agencies.

Transit trade. The second major reason for a non-zero trade gap is related to transit trade with third

[9] Some discrepancy still remained mostly due to the difference in the adjustment procedures applied to the data by the two nation's statistical agencies. The mean value for trade gaps in 1990 is almost zero, and the standard deviation falls by a factor of ten relative to the previous year.

countries. For example, Canadian exporters passing their goods to Mexico through the U.S. may fail to declare the outbound movement from the U.S., i.e. they may treat exports to Mexico through the U.S. in the same way as they treat exports to the U.S. Such transactions will be captured as exports to the U.S. in Canadian statistics, while in the U.S. it will be classified as re-exports and will not be reflected in trade data with Canada, thus, leading to a negative U.S. trade gap.

Data adjustments. The third source of discrepancy in trade statistics are the methodological differences between statistical agencies of Canada and the U.S. Each agency edits trade data according to its own procedures. As a result, differences in trade definition, currency conversion, coverage, valuation, etc. can lead to an imbalance in trade statistics between the two countries.

Tariff evasion. The fourth reason for a trade gap to be different from zero is due to various actions undertaken by traders in order to avoid paying import duties. Fisman and Wei (2004) found that the Chinese trade gap with Hong Kong had a strong negative relationship with Chinese tariffs against imports from Hong Kong. Javorcik and Narciso (2008) found similar results for the German trade with ten East European countries studied. In both papers it is implicitly assumed that if the trade gap is driven by a measurement error only, it should be unrelated to any measure of trade policy. Thus, a statistical relationship between a trade gap and tariffs is interpreted as evidence of tariff evasion in industries with high trade barriers. However, given the nature of import and export data, this assumption implies that in industries with high tariffs, traders would tend to underreport the value of imports at the destination country and report the true value of exports at the source country. Are there any reasons to believe that smugglers truthfully report their exports if they can use the same set of documents for export and import declarations? Until it is known how a trade gap and import tariffs are related to a firm's incentive to report its imports and exports, we cannot be sure that the relationship between trade gap and tariffs, found in previous studies, pertains to tariff evasion.

As it turns out, firms' incentives to report imports and exports truthfully vary across countries, depending on the systems of trade controls, penalties for misreporting, and trade law enforcement. Historically, border customs of both countries are more concerned about law enforcement with respect to imports. Cargo examinations, review of import documents, and penalties for non-compliance with import regulations, either monetary or merchandise seizure, were set to ensure importers would do their best to obey import regulations. Export controls are typically much weaker as customs do not strictly enforce the requirements for filling out export declarations properly. This has been especially a problem in the U.S., where traders were not at all forced to report their exports accurately.[10] Consequently, non-compliance with export regulations is the main reason for severe underreporting of exports in the U.S. and a large positive mean value of the Canadian trade gap equal to 0.35 when measured in the same currency. Therefore, it is unclear why a U.S. firm that willingly underreports its imports to Canada may want to fill out export declarations truthfully if there is no risk of punishment for not doing so. Without proper enforcement of export regulations, tariff evasion will reduce both import and export statistics and will not be reflected in the trade gap measure.

Canadian export regulation, on the other hand, is different from the U.S. and provides more inducement for compliance with export rules. Canadian traders who fail to submit an appropriate declaration or to truthfully

[10] In 1989, U.S. traders were expected to voluntarily drop off declaration forms before their exports left the country but faced no penalty for not doing so (United States General Accounting Office (1994)).

answer all of its questions are penalized in the same way regardless of whether they are exporters or importers.[11] Although customs officials are typically more vigilant with respect to goods entering the country than they are with goods leaving the country, Canadian traders who misreport imports at the source country will still have the reason to report exports truthfully, unless by doing so it increases the chance of detection in the source country. The latter would be possible only if Canadian and U.S. customs exchange transaction-level data, which did not occur until 1990 when the MOU was signed.[12] Therefore, unlike their U.S. counterparts, Canadian traders who violate U.S. trade laws in order to avoid paying import duties still have incentives to report truthfully on their exports in Canada. This was probably one of the reasons why in 1986 the amount of export undercount in Canada was only one tenth of the U.S., and the value of the U.S. trade gap in 1989 was only 0.1 as opposed to 0.35 for Canada. Consequently, a negative relationship between the U.S. trade gap and the U.S. import tariff may signal tariff evasion activities by Canadian exporters and U.S. importers. However, since U.S. traders have little incentive to report on their exports accurately or at all, the same relationship is less likely to be found in Canadian trade data even if tariff evasion is taking place.

Tariff evasion by third country firms. In the presence of the free trade agreement between the U.S. and Canada in 1989, the variation in tariff schedules can encourage foreign firms to export to one FTA country through another where import duties are lower. Supposedly, such practices are precluded by customs through rules of origin (ROO) requirements. In practice, however, verification of the country of origin and detection of falsifications may be difficult, given personnel constraints and the increasing complexity of manufacturing and assembly processes. Although marking such violations, which include ROO misrepresentation, accounted for almost two thirds of all violations detected by the U.S. customs in 1990,[13] ROO enforcement still remains a problem. In its 1990 report to the Congress, the U.S. Treasury Advisory Committee expressed serious concerns regarding the effectiveness of the enforcement of ROO labeling.

If ROO violations are taking place in both the U.S. and Canada, these actions may be reflected in national trade statistics and can thus be quantitatively estimated. Suppose, for instance, that a foreign firm will pay less on duties if instead of shipping a good directly to Canada, the firm can ship it through the U.S. In so doing the firm could disguise the actual origin of the product and claim it as American upon entry into Canada. In the U.S., such a transaction would be recorded under "goods for re-export" and not be reflected in its exports statistics whereas in Canada it will be recorded observed as an import from the U.S., thus increasing the value of Canadian trade gap. Although such a tariff evasion scheme can be equally practiced by Canadian importers of non-CUSFTA goods, I call it "evasion by third country firms" in order to distinguish it from the regular tariff evasion discussed previously. The following section explores the relationship between the trade gap and differences in Canadian and U.S. tariff schedules in more details.

[11] For example, a person who intentionally declares false information on the required import or export declaration forms can be penalized either $6000 or 60% of the value of the goods, whichever is greater (Canada Customs Act, 1985).

[12] Even after the MOU was implemented, the countries were not quick to exchange information on importers' identities in order to comply with national laws and regulations protecting confidentiality of traders' data. Also, the countries agreed to exchange trade data for statistical purposes only.

[13] United States General Accounting Office (1990).

4 Estimation strategies and results

4.1 First look at the data

The previous section outlined five different reasons for discrepancies in trade statistics between importing and exporting countries. However, only two of them, tariff evasion conducted by firms in or out of an FTA, are related to importer's trade policy. If the other three reasons, namely the undercount of export data, goods in transit, and data adjustments by statistical agencies, are independent of import tariffs at the source country, then in the presence of tariff evasion by a firm within an FTA, it is reasonable to expect a negative relationship between a country's trade gap and its tariffs. An association as such will reflect the stronger incentive of firms to avoid paying import duties when these duties are high. Figure 1 illustrates the basic relationship between trade gaps and tariffs for both countries. The horizontal axis represents the ten decile average tariff rates and the vertical axis plots the corresponding average trade gap values. For example, the rightmost point on the left panel of the graph shows that the average Canadian tariff for 10% of industries with the highest tariffs is 20.8%, and the average trade gap for this group of industries being 0.51. Figure 1 shows that the trade gap tends to decrease steadily with an increase in the average import tariff. Industries that are subject to higher duties are more likely to report a smaller value of imports to customs, which is consistent with the hypothesis that higher tariffs create stronger incentives for evasion.

However, as discussed in the previous section, trade data discrepancies can also be associated with tariff evasion by third country firms. For example, high Canadian and low U.S. tariff rates for a certain good may stimulate foreign firms to export to Canada through the U.S. and violate Canadian ROO regulation. If this happens, foreign goods exported to the U.S. for re-exportation are shipped to Canada with the deception of being of the U.S. origin. One would then expect a positive relationship between the Canadian trade gap and the difference between Canadian and U.S. external tariffs. To operationalize this hypothesised relationship, I construct the following "tariff savings" measure

$$tariff\_save_{cpit} = tariff\_row_{cit} - tariff\_row_{pit} - tariff\_fta_{cpit} \tag{2}$$

where $tariff\_fta_{cpit}$ is the preferential tariff rate of country c for the FTA partner country p on imports of good i at time t, and $tariff\_row_{pit}$ and $tariff\_row_{cit}$ are the tariffs of countries p and c, respectively, on imports from the rest of the world. This measure shows by how much a third country firm can save on import duties if it indirectly exports to country c through the partner country p disobeying the ROO. In presence of such violations, one would expect that the more a firm can save on tariff differences, the stronger are the incentives for it to avoid tariffs and the larger will be the trade gap. In the presence of such violations, one would expect that the more a firm can save on tariff differences, the stronger are its incentives to engage in evasive activities and the larger will be the trade gap. Since negative savings do not affect firms' choice of shipment route, I replaced all negative values of *tariff_ save* measure with zeroes.

Figure 2 illustrates the relationship between the decile average "tariff savings" and the trade gaps. On the graph one can see that, contrary to our expectations, trade gaps do not increase with the tariff savings measure. However, the graph also shows that in industries where tariff arbitrage opportunities exist (*tariff_ save* measure is positive) the trade gap is almost always greater than in industries without such opportunities. That is, industries that can benefit from exporting goods through an FTA partner country as opposed to direct trade

are characterized by an increase in the trade gap, which is consistent with the hypothesis of tariff evasion and NAFTA ROO infraction by third country firms.

4.2 Basic regression analysis

I start by estimating a simple model of tariff evasion as in Fisman and Wei (2004). If in response to high tariffs traders underreport the value of their imports while reporting exports truthfully, there will be an inverse relationship between the trade gap and import tariffs. Therefore, in the basic specification test of the tariff evasion hypothesis one would expect the coefficient β_1 to be negative:

$$trade\ gap_{cpi} = \beta_0 + \beta_1 tariff_{cpi} + \varepsilon_{cpi} \tag{3}$$

Estimation results for equation (3), presented in Table 2, are consistent with the hypothesis of tariff evasion being present in both countries. In columns (1) and (2) the coefficient β_1 is estimated to be negative and significant, implying that higher tariff rates are associated with lower values of imports reported at the destination country. The estimated β_1 for Canada is -0.847, which means that a 1% increase in a Canadian import tariff reduces the value of dutiable U.S. imports reported to Canadian customs by 0.847%. Note that for the U.S. the magnitude of this effect is five times greater than that of Canada. This result should not be surprising given the stronger export reporting enforcement in Canada. In fact, one can be surprised to find any significant effect of a tariff on the Canadian trade gap given the lack of incentives for U.S. traders to report the true value of their exported goods. Yet a lower β_1 for Canada does not necessarily mean less evasion since the value of this coefficient for Canada is likely to be biased towards zero due to the low quality of the U.S. exports data.

The magnitude of the effect for the U.S. is pretty large though as an additional percentage point in the U.S. tariff lowers reported imports from Canada by 4.6%. This estimated trade gap elasticity with respect to tariffs is greater than what was found in previous studies. Fisman and Wei (2004) estimated the value of β_1 at approximately 3 for the Chinese trade gap with Hong Kong, while the estimates by Javorcik and Narciso (2008) for their ten countries of study varied in range from 0 in Slovenia to 4.5 in Ukraine. However, in the absence of strict enforcement mechanisms with regards to coercing dealers to file export reports in the source country, β_1 underestimates the true magnitude of tariff evasion. Since none of the above studies explain traders' incentives to report exports truthfully, it is impossible to assess a potential downward bias in their estimates. Moreover, given that in 1989 a simple average U.S. tariff rate for Canada was 2.1%, our estimates imply that in an average U.S. industry, imports from Canada was underreported by 9.7%. This result is more realistic than the results for China (108%) and Ukraine (38%), implied by estimates of Fisman and Wei (2004) and Javorcik and Narciso (2008).

Columns (3) and (4) in Table 2 include 2-digit HS industry fixed effects to take into account any possible differences between industries, such as cargo inspection frequencies and others. The results indicate that tariff variation within 2-digit HS product categories have a similar effect on the trade gap as before.

4.3 Sources of tariff evasion

The preceding analysis demonstrate a negative relationship between tariff rates and the propensity to underreport the shipment value of dutiable goods. This form of tariff evasion usually results from falsely reporting the value of imports to customs officials through underinvoicing the shipment value, split invoicing, where the value of the shipment is distributed on two or more invoices, as well as other schemes of similar devious quality. The second most popular form of tariff evasion is related to product misidentification, such as falsely labeling the product in order to claim special exemption from tariffs or misclassification of a high-tax product as a low-tax one. As long as traders themselves are responsible for determining a correct 10-digit tariff classification number for each of their imported item, they may have the temptation to pick a "similar" classification number which is subject to a lower duty rate.

To investigate this possibility, I add additional controls to the benchmark equation (3). In line with Fisman and Wei (2004), I add an average tariff for 'similar' goods, defined as a trade-weighted tariff rate for all other goods within the same 4-digit HS category. If misclassification takes place at the 4-digit level, then we would expect this newly constructed variable, $tariff\_o$, to have a positive effect on the trade gap because a reduction in $tariff\_o$ would encourage exporters to reclassify their product to a lower-taxed 4-digit category, thus having a negative effect on the trade gap.[14] The disadvantage of using this measure lies in its inability to control for potential misclassification within 6-digit categories. To address this issue I introduce a new variable, $tariff\_var$, which measures tariff variance of the 10-digit varieties within the same 6-digit industry. The prior is that in 6-digit industries with high tariff variation at the 10-digit level, there are more opportunities for traders to misclassify imported items to their own advantage.[15]

I also constructed two additional controls to better isolate the non-tariff determinants of tariff evasion. The first one, transportation costs, is measured as the share of transportation expenses in the value of imports ($transp\_costs$). Trade statistics collected in Canada and in the U.S. measures transportation costs on a free on board (F.O.B.) basis, implying that in the absence of tariff evasion, trade costs must be independent of the trade gap. Nevertheless, transportation expenses can be an indicator of split invoicing; a tariff evasion scheme where the exporter will send two invoices for each purchase order while the importer will submit only one to customs and, therefore, pay duty on one invoice only. The invoice that was not submitted by the importer is usually added as "packaging/transportation costs" to avoid rousing suspicion. Thus, a negative coefficient on $transp\_costs$ can indicate tariff evasion activities through masking the value of imports as transportation costs.[16] The second additional explanatory variable is the share of imports from a partner country within the 6-digit HS industry that fall under tariff-free market access ($share\_free$). Duty-free market access would disrupt incentives for tariff evasion. Moreover, a large share of products that are duty free can be related to importers' false claims for tariff exemptions. In either case, an increase in the share of tariff-free market access would lead to an increase in the value of reported imports and, hence, to an increase in the trade gap. Table 1 reports summary statistics for these additional control variables.

[14] Again, my assumption here is that firms that mislabel their imports at the destination country to reduce the applicable duty are, however, truthfully reporting the industry classification at the destination country.

[15] For about 40% of all 6-digit industries with only one subindustry, the tariff variance is unidentifiable. To preserve these observations in my sample, I replace these values with zeros and introduce a dummy variable which takes the value of one for industries with unidentified variance and zero for all others.

[16] The data on transportation costs does not exist for Canada, so I use this variable only for the analysis of the U.S. trade gap.

Javorcik and Narciso (2008) also demonstrate the effect of product differentiation on tariff evasion. They document that evasion is stronger in industries where high tariffs are coupled with a high degree of product homogeneity since in these industries fraud detection is more difficult for customs officials. I also test this hypothesis by constructing a measure of the elasticity of substitution between different varieties of each 6-digit products imported from different destinations, using the estimation methodology developed by Feenstra (1994). Broda and Weinstein (2006) recently applied this methodology to a large number of 10-digit product categories and show economic reasonableness of this estimation approach. However, I found no evidence that evasion is more responsive to tariffs in industries with high elasticity of substitution and therefore do not present these results here.

To examine whether these different channels for tariff evasion matter for Canadian and U.S. trade gaps, I estimate the following model:

$$\begin{aligned} trade\ gap_{cpi} = \beta_0 + \beta_1 tariff_{cpi} + \beta_2 tariff\_o_{cpi} + \beta_3 tariff\_var_{cpi} + \\ + \beta_4 share\_free_{cpi} + \beta_5 transp\_costs_{cpi} + \varepsilon_{cpi} \end{aligned} \tag{4}$$

Table 3 provides estimates of equation (4). The second row shows the effect of tariff evasion from the misclassification of goods (β_2). All the estimates in columns (1)-(5) are positive and mostly significant, which is consistent with our expectation that lower tariffs for similar goods stimulate traders to misclassify imported items and to underreport the value of imports. In other words, firms tend to reclassify their shipments to a different 4-digit industry code in order to save on import duties. In contrast, there is no evidence of misclassification at the 6-digit product level as the coefficient on tariff variance (β_3) is statistically insignificant. In the presence of misclassification at the 4-digit industry level, this result is surprising as one would expect more tariff evasion by misclassification at a higher level of product disaggregation where commodities are more homogeneous. A possible explanation for this result can be the low variation in tariff rates at the 6-digit product level, which is only 1/8 of that for the 4-digit industries. When mislabelling at 6-digit level is not possible, firms look for other opportunities to save on import duties.

The coefficient on the share of duty-free trade within the 6-digit industry (β_4) is positive and significant only for Canada. This result implies that the large share of free trade either weakens the incentives for tariff evasion activities or encourages importers to seek opportunities to falsely qualify for tariff preferences. It may also indicate the misclassification of goods into those product categories that fall under free trade preferences thus making trade gap bigger. Yet at the same time, there is little evidence of such tariff evasion schemes among U.S. importers as the coefficient β_4 for the U.S. is positive and significant only for the specification with industry fixed effects. Finally, the coefficient on transportation costs for the U.S. equation, β_5, is negative as the theory predicts but insignificant. Hence, imprecise estimates of β_5 do not allow us to assess the role of split invoicing schemes in tariff evasion in the U.S.

Overall, there is a consistently strong and significant effect of U.S. import tariffs on the reported value of imports whereas the same relationship in Canada is much weaker. The difference in results reflects differences in trade data collected by the statistical agencies of two countries. A small or insignificant β_1 coefficient for Canada should not be interpreted as less tariff evasion happening in Canada relative to the U.S. but may well imply weak enforcement of export filing regulations in the U.S., making trade gap analysis inappropriate for investigation of tariff evasion in Canada.

4.4 Is it really tariff evasion?

So far I have shown a negative and statistically significant relationship between import tariffs on one hand and the U.S. and Canadian trade gaps on the other. This relationship is consistent with the hypothesis that stronger incentives for evasion arise when tariffs are high. However, as discussed in Section 3, tariff evasion is only one out of five sources of discrepancies between national trade statistics. In this section I show that the effect I have found is indeed tariff evasion and is not related to any of the other four factors that may lead to non-zero values in the trade gap measure. I also show that the trade gap is responsive to differences in external tariffs of the two FTA countries.

4.4.1 Trade data adjustments

One of the reasons for a source country exports not to match a destination country imports is that statistical agencies of two countries may process trade data differently according to their own trade definitions. There is little reason to believe that such data processing is systematically related to trade policy measures though. Nevertheless, it is important to verify that the negative effect of tariffs on the trade gap is not related to such data adjustment differences in two countries. To show that this is the case, I estimate equation (3) for 1990-1997, i.e. for the rest of the CUSFTA tariff phase-out period when the trade data exchange program between Canada and the U.S. was in place. As it was discussed in Section 3, even under the data exchange program the discrepancies in trade statistics persevered, mainly due to data adjustments by national statistical agencies, although the trade gap variance fell by a factor of ten. Once the data exchange program was implemented, however, there were no reasons for the trade gap to be different from zero, other than data adjustments. As all methodological modifications associated with implementing the data exchange program were completed by 1989, the data adjustment procedures of that year and the following ones were similar. Therefore, if the effect I found in the previous section is a consequence of data processing by national statistical agencies, we would expect to find the same results for the time period after 1989.

Columns (5) and (6) of Table 2 provide the estimates of β_1 for 1990-97 time period. The results show that β_1 becomes insignificant for the U.S. and even slightly positive for Canada, although not statistically significant at the 5% confidence level. These results are in line with the hypothesis that trade data adjustments, undertaken by national statistical agencies, are not related to trade policy measures. Therefore, it is safe to conclude that data adjustments, one of the four sources of trade data discrepancies identified in Section 3, cannot be the reason for the observed negative relationship between the trade gap and tariffs in 1989.

4.4.2 Transit trade

Another source causing ambiguities in the trade data is transit trade. As it was discussed earlier, traders may export goods to non-CUSFTA countries through a partner country without properly documenting the transactions, which will tend to decrease the value of the trade gap. Firms exports goods through a partner country mostly for logistical reasons and with a tariff free market access to a partner country's market many firms see no reason to follow procedural requirements for in-bound trade. Therefore, such data distorting behavior

is more likely to take place in industries with a high share of tariff-free market access, and $share\_free_{cpi}$ variable, already included in all specifications, should control for this effect. Moreover, the 2-digit industry fixed effects capture the time-invariant logistical advantage of re-exporting different product categories through a partner country. Finally, if traders do not report re-exports properly only to avoid procedural hassles, then it is reasonable to assume that the share of exports improperly declared to third countries is fixed and thus proportional to the total value of exports to third countries. However, including the log of exports to non-CUSFTA countries to the equation (4) does not alter any of the results.

4.4.3 Undercount of exports

A third cause of bilateral trade data inconsistencies between Canada and the U.S. is the undercount of export data. In its 1994 report to the Congress, the U.S. General Accounting office claimed that traders' failure to report exports to customs is a major source of export undercount which motivated implementation of the trade data exchange program. Trade data distortions, resulting from undercount, lead to overreported imports at the destination relative to the value of exports from the country of origin and tend to increase the trade gap. If we believe that industries with positive values for the trade gap are those with severe export undercounting problems while industries with negative values of trade gap are mainly those with the highest rates of tariff evasion, then we would expect to find a much stronger effect of evasion at the lower tail of the trade gap distribution. At the higher tail of the trade gap distribution the effect of evasion is dominated by the undercount of exports and may be very weak and/or difficult to identify. At the lower tail, in contrast, where undercount is dominated by evasion, we should observe a much stronger relationship between the trade gap and import tariffs if we believe that evasion is the main factor that leads to negative values of the gap.

I employ a quantile regression analysis as introduced by Koenker and Bassett (1978) to test this prediction:

$$\begin{aligned} Q_{gap}(\tau|tariff, X) = \alpha(\tau)\, tariff + X'\beta(\tau) = \alpha(\tau)\, tariff + \beta_1(\tau)\, tariff\_var + \\ + \beta_2(\tau)\, tariff\_o + \beta_3(\tau)\, share\_free + \beta_4(\tau)\, transp\_costs \end{aligned} \tag{5}$$

where X is the set of additional controls introduced in Section 4.3 and $Q_{gap}(\tau|tariff, X)$ is the τ-th conditional quantile function of the trade gap given $tariff$ and X. If the underreporting of imports is mainly driven by tariff evasion then quantile regression should yield a negative coefficient on import tariff for quantiles close to zero. Moreover, the coefficient $\alpha(\tau)$ should increase to zero for higher centiles at which the effect of tariff evasion is dominated by exports undercount.

A quantile regression offers at least two advantages over the conditional mean regressions. First, a stronger negative relationship between the trade gap and tariffs at lower quantiles would provide additional support for the tariff evasion hypothesis and confirm that the results really reflect tariff evasion rather than some other contributing factor. Second, the quantile regression analysis can better isolate the effect of tariff evasion in the presence of an omitted variable that would measure the export undercount. Although there are no reasons to believe that the undercount can be correlated with tariffs and thus bias the β_1 coefficient in the OLS regression, it still represents an additional source of noise to trade gap data. Since tariff evasion and export undercount stretch the lower and upper tails of the trade gap distributions in opposite directions, a quantile regression can provide a more detailed view on the relationship between tariffs and traders' incentives to avoid paying customs duties.

Figure 3 illustrates the quantile regression estimation results of equation (5) for Canada. The four panels of this figure show estimates of the four covariates in equation (5). The solid line in each panel depicts the coefficient estimates for 19 quantiles ranging from 0.05 to 0.95, and the shaded area around each line is the corresponding 95% confidence interval. Standard errors for quantile confidence intervals are obtained by the bootstrap.[17] The dashed lines show the standard mean regression coefficients, with two dotted lines representing their 95% confidence intervals.

The first panel in Figure 3 displays the $\alpha(\tau)$ coefficient and provides much stronger evidence for the tariff evasion hypothesis in Canada than the OLS results. The OLS evidence for evasion in Canada is mixed: although the coefficient on tariff is negative (-0.89), it is not statistically significant at the 5% confidence level. However, as it is evident from the graph, the effect of tariffs on the trade gap is much bigger in the lower tail of the trade gap distribution and is statistically significant from 5^{th} to 40^{th} centiles. At the 5^{th} centile of the trade gap conditional distribution, an additional percentage point increase in import tariff reduces the reported imports by 7.1%. This effect falls gradually to 0.83% at the 40^{th} centile and becomes insignificant at the higher tail of the distribution. Moreover, the tariff evasion model can explain a much larger share of variation in the trade gap at lower centiles. While in the OLS regression the R-square equals to 0.033, the pseudo R-square for the 5^{th} quantile in equation (5) is 0.087 and falls gradually to 0.012 at the 95^{th} centile. These results suggest that there are much more tariff evasion activities in industries where the value of reported Canadian imports is the smallest relative to reported U.S. exports hence conforming with traders' incentives to avoid paying customs duties. Furthermore, evasion is much less likely to take place amid industries where there are more reported imports to Canadian customs than exports reported in the U.S. For these industries, tariff rates are indeed unrelated to the trade gap.

The latter result may have two different interpretations. Firstly, overreporting imports relative to exports is inconsistent with tariff evasion motives and one would not be surprised to see no effect of tariff rates on the trade gap. Consequently, an insignificant $\alpha(\tau)$ coefficient for high τ would imply no tariff evasion for industries at the higher tail of the trade gap distribution. The second possible explanation is that in industries with a high τ, trade smugglers prefer not to report the true value of their exports from the U.S. if they have underreported their imports in Canada. For such industries we could not estimate the effect of evasion with the data we have; however, an insignificant $\alpha(\tau)$ does not necessarily mean fair trade is occurring. In either case, there is enough evidence to show that in 40% of all industries, firms respond to higher tariffs by reporting lower values of reported imports. For the remaining 60%, it is impossible to say whether the trade is fair or fraudulent with the data and empirical methodology of this study.

The quantile regression coefficients on tariff variance within 6-digit HS industries are all estimated to be close to zero and insignificant. Even for the lower tail of the trade gap distribution tariff variance has no negative effect on the dependant variable. This supports our earlier results from the OLS regressions that product reclassification within 6-digit industry codes is not a likely channel for tariff evasion.

The effect of the average tariff rate for other products within the same 4-digit industry ($tariff\_o$) can signal tariff evasion through product misclassification at higher levels of product aggregation. The OLS analysis reveals a strong positive effect of this variable on the trade gap, with the coefficient estimated at 2.79 ($t = 6.66$).

[17] Assuming that each industry observation is independently, but not necessarily identically distributed among 6-digit industries, I generated 100 bootsrtap samples with replacement to obtain standard errors.

I believe that there are two factors at work here reflected in this variable. First, the positive coefficient on $tariff\_o$ implies that in industries with high tariffs relative to other industries traders reclassify imports to similar 6-digit categories where import tariffs are lower. The second factor directly relates to the first one: the value of imports in sectors with relatively low tariff will be over reported. Both effects lead to a positive relationship between the trade gap and the $tariff\_o$ variable. To obtain further insight into this result I use quantile regression analysis. In so doing, I would expect $\beta_2(\tau)$ to increase at percentiles close to zero in reflection of the increasing misclassification of higher taxed imports. But $\beta_2(\tau)$ should also be positive at percentiles close to one mirroring the increase in reported imports within industries with low tariffs.

Figure 3 strongly supports the hypothesis of tariff evasion through the misclassification of high-taxed imports into lower-taxed categories. The coefficient $\beta_2(\tau)$ equals to 7.61 ($t = 7.42$) for $\tau = 5$, falls to 1.65 ($t = 4.36$) for $\tau = 40$, and then stabilizes at around 1.5 at higher centiles. Note two important results. First, unlike $\alpha(\tau)$, $\beta_2(\tau)$ does not converge to zero and remains positive for $\tau > 40$, suggesting that when the trade gap is positive, imports may in fact be over reported to the customs for relatively low-taxed products. That is, a certain share of imports in low-taxed industries is in fact misclassified as high-tax products. Second, for $\tau < 40$ the coefficient $\beta_2(\tau)$ follows the same pattern as $-\alpha(\tau)$. This indicates that misclassification is an important and, perhaps, a primary source of evasion. One explanation for this result can be more careful inspection of imported products with high tariff rates. Intuitively, if high-tax imports is more carefully scrutinized by customs, misclassification of imports into low-tax categories gives an important advantage over other tariff evasion schemes such as underinvoicing: it reduces the risk of cargo inspection and fraud detection by customs.

Finally, the last panel in Figure 3 shows how the trade gap is affected by the share of duty-free imports and also provides some important insights into the forms of tariff evasion happening. An insignificant $\beta_3(\tau)$ in the lower tail implies that in industries where trade fraud is a serious problem, an increase in the share of duty-free trade does not reduce traders' incentives for tariff evasion. Positive values of $\beta_3(\tau)$ in the higher tail, however, support the hypothesis of false claims for tariff exemptions. The intuition is similar to the above argument with the variable $tariff\_o$. Given that a larger share of duty-free trade is associated with higher volumes of over reported imports, it is likely that these imports are high-tax products intentionally categorized as being eligible for tariff-free access to avoid paying proper duties.

Figure 4 illustrates quantile regression results for the U.S. trade gap. Similarly to Canada, it can be seen that U.S. import tariffs have very strong effect on evasion in the lower tail of the distribution, though it is significant up to 55^{th} centile. The larger range of products being affected by tariff evasion is exactly what we would expect in the U.S. since the problem of export undercount in Canada was less severe. As it was the case with Canada, there is no evidence of product misclassification within the 6-digit categories, while misclassification at the 6-digit level is much less important compared to Canada. The coefficient $\beta_2(\tau)$ is positive and significant only for $20 \leq \tau \leq 60$ and surprisingly insignificant at lower centiles. The effect of duty-free market access is also different in the U.S. Positive values of the $\beta_3(\tau)$ coefficient in the lower tail suggest that incentives for evasion are weaker when the share of tariff-free imports is high. However, a negative effect of the $share\_free$ variable in the upper tail not only discards the hypothesis of false claims for tariff exemptions, as is was the case for Canada, but also contradicts the prior that $\beta_3(\tau) \geq 0$. In fact, this is a single result from the quantile regression model that does not fit the prediction of the tariff evasion model. Finally, the negative and partially significant effect of transportation costs for $\tau \leq 40$ offers some limited support for tariff evasion through the

masking of part of the imports value under packing/transportation costs and split invoicing schemes.

Overall, one may see that in the presence of the unobservable undercount of export data, quantile regressions can provide a more informative empirical analysis of tariff evasion reflected in the trade data statistics. I found that industries where the value of reported imports relative to exports is the smallest, are more affected by tariff rates in both countries. Next, I will investigate the role that the differences in external tariffs between two FTA member countries play in tariff evasion, which is the last source of trade data discrepancies discussed in Section 3.

4.4.4 Tariff evasion by third country firms

The preceding sections document extensive evidence of tariff evasion by domestic importers and exporters in Canada and in the U.S. It further suggests that firms do respond to trade barriers with false statements to customs in order to minimize duty payments. If non-compliance behavior is practiced by firms trading within CUSFTA, it is natural to assume that such practices are also available to firms trading with countries which are not party to the trade agreement. As discussed previously, differences in external tariffs between FTA partner countries can stimulate firms to export to one of them through another in violation of the ROO. If a firm can save on duties by exporting to Canada through the U.S., the transaction will be recorded as "re-exports" and will not be part of exports to Canada in the trade data collected by American officials.[18] In Canada, however, the good will arrive camouflaged as a product of the U.S. inflating the value of the Canadian trade gap. To test the hypothesis of ROO violation by third country firms, the model (4) is augmented with the $tariff\_save$ measure as defined by equation (2). This measure shows the percentage of the import value that a firm can save by exporting to one FTA country through another, and is equated to zero when these savings are negative. If firms can circumvent CUSFTA ROO, then the savings opportunities by avoiding the higher tariffs will prompt more indirect imports through an FTA participant country.

Table 4 reports the effect of differences in external tariffs on the trade gaps in the two countries. In Columns (1)-(4) the coefficients on the $tariff\_save$ variable are positive in all specifications. This indicates that in industries where exporting through an FTA partner country in violation of the ROO allows firms to save on tariffs, there are more imports reported at the destination than exports reported at the source country. In other words, some share of imports that traders report to Canadian customs as being originated from the U.S. was not registered as U.S. exports to Canada. The finding that a portion of traders declare foreign goods as American-made is consistent with ROO fraud hypothesis as any other source contributing to a positive trade gap, such as exports undercount, will not be correlated with the difference in external tariff rates.

As for the magnitude of this effect, the coefficient on $tariff\_save$ for the U.S. is half that for Canada, with two possible explanations for this result. Firstly, the benefits of violating the ROO by exporting through an FTA partner country must outweigh all additional costs associated with these activities, such as increased transportation expenses and more complicated logistics. Since Canadian external tariffs in 1989 were considerably higher than in the U.S., there were more benefits to exporters to Canada to violate the ROO, making them more responsive to differences in external tariffs. Secondly, in many cases transportation costs to Canada can

[18] Note that for this reason tariff evasion by third country firms is not affected by the quality of exports data. Therefore, we are just as likely to find this form of evasion for Canada as for the U.S.

be even lower when goods are shipped through the U.S. When this is the case, even small differences in external tariff rates may motivate third country exporters to Canada to get involved into the ROO fraud. Finally, it is also important to note that controlling for differences in external tariff rates does not affect the estimates of tariff evasion by firms within the FTA. This suggests that the channels for tariff evasion used by FTA and non-FTA firms are independent from each other.

If firms export to one FTA country through its partner, they may also claim for tariff exemption in the transit country by reporting their shipment as goods for re-exports. If this is the case, incentives for indirect trade and ROO violations will only be affected by the intra-CUSFTA tariff rate and the external tariff in the country of the ultimate destination. Therefore, we would expect a country's external tariff ($tariff\_row$) to have a positive effect on the trade gap and the tariff for its FTA partner country to have negative. Results with external tariffs are presented in columns (5)-(8) of Table 4. Although the coefficients on intra-FTA and external tariffs are negative and positive, respectively, the latter are mostly insignificant at 5% confidence level. However, quantile regression results in Figures 5 and 6 draw a more decisive evidence on ROO violations. External tariffs have positive and statistically significant effect on the trade gap in both countries in the upper tail of the trade gap distribution. For half of all industries with the largest values of the trade gap, high external tariffs lead to more imports being reported from the country with preferential trade regime. Therefore, differences between external and preferential tariff rates is not only one of the determinants of the discrepancies in trade statistics but also stimulate indirect trade within CUSFTA in circumvention of the ROO.

5 Tariff evasion, CUSFTA tariff cuts, and trade growth

It was demonstrated in previous sections that higher tariffs have the propensity to lead to lower values of reported imports. If this is the case, then trade liberalization would remove all incentives for tariff evasion and lead to an increase in value of reported imports. Therefore, we would expect that trade liberalization, following the free trade agreement between the U.S. and Canada, would increase the amount of trade for industries that undergo largest tariff cuts for two reasons. Firstly, the direct effect of reduced consumer prices of imported goods would raise the demand for imports and the volume of trade. Secondly, the amount of trade recorded by national statistical agencies for high-tariff industries would increase because of the 'whitening' of pre-existing undisclosed trade. Since 1989 was the first year of the CUSFTA, we can analyze the relationship between the amount of pre-FTA undisclosed trade and the future growth of trade following deeper trade liberalization. If a portion of the increased volume of trade under NAFTA is indeed related to the reduction in undisclosed imports, then we would expect more rapid growth of trade in industries originally with a higher share of 'missing' imports.

To test this hypothesis, we estimate the following equation:

$$\%\Delta imports_{cpi} = \gamma_0 + \gamma_1 \left(\Delta tariff_{cpi}\right) + \gamma_2 \left(trade\ gap_{cpi,1989}\right) + Z^{'}\gamma_3 + \varepsilon_{cpi} \tag{6}$$

where Δx is the change in variable x between 1990 and 1991.[19] This equation is similar to that of Clausing (2001) who derived the relationship between the growth rate of imports and changes in tariffs from a simple

[19] Since *imports* is also used in the construction of the trade gap measure, I focus on the import growth rate between 1990 and 1999 to minimize potential simultaneity problem with $trade\ gap_{cpi,1989}$ variable.

import demand and export supply model. The coefficient γ_1, expected to be negative, measures the effect of falling imports prices, caused by trade liberalization, on import demand. The coefficient γ_2 measures the effect of the trade gap in 1989 for the subsequent growth rate of imports. If trade liberalization gives more reason for traders to comply with trade regulations, one would expect the reported amount of imports to grow faster for industries with high share of misreported imports prior to NAFTA. In other words, γ_2 if expected to be negative. Z represents additional controls, such as the unit of measurement of imports and the share of industry i in total imports in 1989. This variable is used to control for possibly faster growth rates in industries with low starting values of imports.

One may also be concerned about potential endogeneity of the trade gap since it is measured with error and only a small fraction of its variation is related to incentives to avoid import duties. Furthermore, the measurement error shocks in imports data can be time persistent. To address trade gap endogeneity issue, I instrument the $trade\ gap_{cpi,1989}$ variable with the tariff rate from 1989 in combination with other determinants of the trade gap, identified in Section 4.3 as being associated with tariff evasion schemes.[20] GMM estimation results for equation (6) are presented in Table 5. We already know that most of the instruments for the trade gap are statistically significant at the first stage. Moreover, the hypothesis of exogeneity of the instruments is never rejected by the Hansen test and it is possible to conclude that we have a valid set of instruments.

Negative and highly significant coefficients for the trade gap confirm the hypothesis that faster trade growth rates occur in industries that had a larger share of underreported import values in 1989. That is, pre-FTA tariff evasion, as reflected in the trade gap measure, leads to faster trade growth rates under the trade agreement. It is important to note that the coefficients on import demand elasticity with respect to tariffs (γ_1) for Canada and the U.S. are smaller in absolute values by 45% and 25%, respectively, when we control for pre-FTA tariff evasion in columns (3)-(4). This is consistent with an upward bias of trade-creation effect of an FTA when pre-FTA tariff evasion is not controlled for. Moreover, this bias can be even stronger for other trade agreements formed by countries with higher levels of corruption. In columns (5)-(8) I estimate equation (6) using annual observations for import growth rates and tariff changes for the time period after 1990 until 1998 when all CUSFTA tariffs were eliminated. Again, the estimation results confirm our earlier findings that the share of misreported imports before CUSFTA trade liberalization affects future trade growth. These results imply that although CUSFTA tariff reduction does promote trade between two partisan countries, some of this growth came as a result of an increase in the accuracy of import reporting by traders and ergo the improved quality of trade data. Therefore, the effect of preferential trade agreements on trade and welfare may be overestimated if one does not take into account the 'whitening' of pre-existing undisclosed trade.

Another way to indirectly test the relationship between tariff evasion and trade growth under the FTA is to compare the corollary of tariff reduction on a country's import and export growth rates. The tariff evasion hypothesis implies that there is a greater value of underreported imports relative to exports. Consequently, when the FTA is implemented, we would expect the destination country's amount of imports to be more responsive to tariff changes than the corresponding value of exports in the source country. To examine this possibility, I compare Canadian import elasticity with U.S. export elasticity with respect to Canadian import tariffs, and vice versa. We can only perform this analysis for the year 1990, since the earlier growth rates are unavailable

[20] The only two variables excluded from the list of instruments are $tariff\_var$ and $tariff\_o$. The former is excluded because of its insignificance at the first stage, the latter does not pass exogeneity test.

and afterwards the MOU on data exchange effectively eliminating any trade data discrepancies.

Table 6 provides the results for Canadian import and export elasticities with respect to tariffs. In columns (1)-(4) one can see a huge difference between Canadian import and U.S. export elasticities. Using the OLS estimates, a one percentage reduction in Canadian tariffs will increase Canadian imports from the U.S. by 3.976% but only increase U.S. exports to Canada by 0.758%, and the latter effect is statistically insignificant. Without tariff evasion, this result is very surprising because in the presence of severe export undercount in 1989, the expectation would be that exports grow faster than imports. Instead, export undercount is entirely captured by a positive and significant constant term in the U.S. export equation. The fact that imports are more responsive to tariffs than exports in the presence of an FTA is consistent with the tariff evasion hypothesis since the growth rate of imports also includes growth in reported trade. The U.S. estimate draws similar conclusions: U.S. imports from Canada are twice as responsive to tariff cuts than corresponding Canadian exports to the U.S. Thus, as hypothesized, CUSFTA tariff reductions lead to a greater increase in imports than exports in both countries. These results provide additional support in demonstrating the occurrence of tariff evasion and highlight a necessity to take the effect of evasion into account when attempting to estimate the various trade effects of regional trade agreements using national trade statistics.

6 Misreported quantity vs. misreported unit value

Thus far, we have analyzed the effect of import tariffs on traders' incentives to report the total value of dutiable imports. As emphasized in earlier studies by Fisman and Wei (2004) and Javorcik and Narciso (2008), firms can underreport the value of imports either by misreporting the number of units imported or the unit value. Although both practices will lead to an underreported value of exports, both studies found that traders avoid paying import duties mainly through misreporting the unit value of their goods. As a next steep I will explore which channel for tariff evasion is the prevalent one in Canada and in the U.S.

Extending the trade gap analysis to quantities and unit values of imports can be problematic due to inconsistencies in quantity data between Canada and the U.S. Even in 1992, three years after the trade data exchange program was implemented, there remained considerable differences in the quantity and pricing measures between the two countries. First of all, for more than 15% of all 10-digit product categories neither country collects data on the quantity of imports, and for another 15% one country requires a quantity measure while the other does not. The problem of missing and inconsistent data introduces a severe measurement error when we aggregate the 10-digit variables into 6-digit ones. Moreover, for an additional 5% of all 10-digit categories both countries collect quantity data but use different non-convertable units of measurement (e.g. units vs. kilograms). The problem is further compounded from the lack of information on the unit of measurement in Canadian official trade data, which makes it impossible to isolate those observations. Although the quality of the quantity and price data derived from official trade statistics at the 6-digit level raises serious concerns, I still present estimation results for comparison with previous studies.

Table 7 provides results for tariff evasion through misreporting quantity and unit value of imports. Columns (1)-(4) show estimates of equation (4), where the dependent variable is the trade gap calculated in quantities of imports defined similarly to (1). Columns (5)-(8) illustrate parallel results for the unit value gap of imports

constructed as the total value of imports divided by quantity. One can see from Table 7 that despite the negative coefficients on import tariffs in all but one specification, the effect is almost always insignificant with similar results for most other variables. Therefore, it appears from the data that it is impossible to separate tariff evasion into those that occur through the misreporting unit value of imports or from the misreporting of quantities. Given potentially strong measurement error in quantity data and, consequently, in prices, it is impossible to identify the effect of import tariff on quantity and unit value trade gaps.

7 Conclusion

This paper provides new empirical evidence for several important features of tariff evasion in the presence of an FTA. First, using trade data between Canada and the U.S. during the first year of NAFTA, it shows that even in developed countries with low corruption and good law enforcement, firms are still actively involved in tariff evasion activities. The analysis of this paper reveals that an additional percentage point increase in import tariff reduces the value of reported imports by 3-5% in the U.S. and by at least 1% in Canada. Second, I found that the difference in external tariffs between FTA members create additional opportunities for tariff fraud by means of exporting to a high-tariff country through a low-tariff FTA partner in violation of the ROO. The results suggest that an additional percentage point tariff rate in excess of a partner country's rate will increase Canadian indirect imports through the U.S. by 3% and U.S. indirect imports through Canada by 1%. Finally, I found that tariff cuts, implied by an FTA, may have a strong effect on subsequent growth in trade by removing incentives for tariff evasion and the 'whitening' out of trade flows. I show that industries with a higher share of unreported trade before NAFTA experienced faster growth in trade after NAFTA trade liberalization.

This paper also makes methodological contributions to the tariff evasion literature improving upon previous studies. I analyze various factors that may cause discrepancies in trade statistics between two partner countries and show that the trade gap approach to measuring tariff evasion, used intensively in previous works, can provide reliable results only with credible exports data. Since firms in the U.S. are not forced to report export transactions, the trade gap measure will not always reflect traders' activities to circumvent trade barriers, which is a likely reason for getting low estimates of tariff evasion elasticity for Canada. Future research in this area should carefully address the quality of export data in order to assess potential bias in tariff evasion estimates. I further propose using a quantile regression for trade gap analysis as it can provide more insight into the tariff evasion effect with noisy trade data. In the presence of other factors that distort trade statistics, the effect of import tariffs must inherently be stronger in industries where the value of unreported imports is the largest. This result is confirmed in the Canadian and U.S. data and provides further evidence in favour of the tariff evasion hypothesis as being an important determinant of the trade gap measure.

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Table 1. Descriptive statistics for protection measures and market shares, 1989.

	mean		median		s.d.	
	Canada	U.S.	Canada	U.S.	Canada	U.S.
trade gap	0.504	-0.161	0.570	-0.104	1.289	1.554
tariff (simple average)	0.068	0.021	0.055	0.009	0.073	0.035
tariff_o	0.045	0.029	0.025	0.007	0.061	0.044
tariff_var	0.009	0.007	0.000	0.000	0.125	0.031
share_free	0.436	0.411	0.295	0.391	0.414	0.372
transp_costs		0.015		0.007		0.033

Table 2. Effect of tariffs on evasion.

Importer:	CAN	USA	CAN	USA	CAN	USA
	(1)	(2)	(3)	(4)	(5)	(6)
tariff	-0.847***	-4.610***	-2.121***	-4.860***	0.095	-0.061
	(0.297)	(1.453)	(0.468)	(1.558)	(0.076)	(0.099)
industry dummies	no	no	yes	yes	no	no
years in the sample	1989		1989		1990-97	
r2	0.01	0.01	0.01	0.01	0.12	0.11
N	4,809	3,887	4,809	3,887	34,085	34,759

Notes: * significant at 10%, ** significant at 5%, *** significant at 1%. Robust standard errors are in parentheses. All regressions include units of measurement dummies as controls. Columns (3) and (4) include 2-digit HS industry fixed effects, and columns (5) and (6) and include time fixed effects.

Table 3. Extender regression analysis of tariff evasion

Importer:	CAN	USA	USA	CAN	USA	CAN	USA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
tariff	-0.889*	-4.782***	-4.784***	-1.317**	-3.653**	0.125	-0.135
	(0.459)	(1.684)	(1.683)	(0.625)	(1.670)	(0.087)	(0.102)
tariff_o	2.790***	1.619*	1.617*	2.265***	2.710***	-0.053	-0.002
	(0.419)	(0.843)	(0.841)	(0.427)	(0.945)	(0.050)	(0.071)
tariff_var	-0.167*	0.119	0.121	-0.080	0.502	-0.012***	-0.015
	(0.090)	(0.495)	(0.495)	(0.065)	(0.680)	(0.001)	(0.067)
share_free	0.210***	0.058	0.054	0.242***	0.206**	-0.002	-0.027***
	(0.067)	(0.082)	(0.082)	(0.084)	(0.088)	(0.008)	(0.007)
transp_costs			-0.641		-1.671*		
			(0.956)		(0.989)		
sample	1989	1989	1989	1989	1989	1990-97	1990-97
ind FE	no	no	no	yes	yes	no	no
r2	0.03	0.03	0.03	0.03	0.03	0.09	0.10
N	4,809	3,887	3,884	4,809	3,884	29,202	30,422

Notes: * significant at 10%, ** significant at 5%, *** significant at 1%. Robust standard errors are in parentheses. All regressions include units of measurement dummies as controls. Columns (4) and (5) include 2-digit HS industry fixed effects, and columns (6) and (7) include time fixed effects.

Table 4. Trade gap and FTA external tariffs

	CAN	USA	CAN	USA	CAN	USA	CAN	USA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
tariff	-0.889*	-5.426***	-1.444**	-4.525***	-1.510**	-4.829***	-1.761**	-3.589***
	(0.530)	(1.490)	(0.641)	(1.020)	(0.737)	(1.691)	(0.795)	(0.959)
tariff_save	3.456**	1.567*	3.512***	1.408*				
	(1.365)	(0.800)	(1.122)	(0.840)				
tariff_row					0.736	1.024*	0.446	1.363***
					(0.667)	(0.588)	(0.614)	(0.487)
tariff_o	2.606***	1.835**	2.260***	2.631**	2.508***	1.363	2.162***	2.528***
	(0.412)	(0.840)	(0.364)	(0.831)	(0.421)	(0.852)	(0.368)	(0.822)
tariff_var	-0.156*	0.156	-0.079	0.749	-0.127	0.162	-0.059	0.728
	(0.084)	(0.834)	(0.164)	(1.175)	(0.086)	(0.496)	(0.150)	(0.900)
share_free	0.176***	0.069	0.185**	0.208**	0.155**	0.048	0.170**	0.205**
	(0.068)	(0.081)	(0.082)	(0.086)	(0.068)	(0.082)	(0.082)	(0.083)
transp_costs		-1.070		-1.798**		-0.611		-1.604*
		(0.956)		(0.917)		(0.953)		(0.891)
ind FE	no	no	yes	yes	no	no	yes	yes
r2	0.03	0.03	0.03	0.04	0.03	0.03	0.02	0.04
N	4,456	3,640	4,456	3,640	4491	3883	4491	3883

Notes: * significant at 10%, ** significant at 5%, *** significant at 1%. Robust standard errors are in parentheses. All regressions include units of measurement dummies as controls. Columns (3)-(4) and (7)-(8) include 2-digit HS industry fixed effects.

Table 5. Pre-NAFTA trade gap and post-NAFTA trade growth rates

	CAN	USA	CAN	USA	CAN	USA	CAN	USA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δtariff	-3.948***	-5.543***	-2.143***	-4.051***	-2.673***	-5.333***	-2.892***	-5.057***
	(0.755)	(1.301)	(0.466)	(1.566)	(0.441)	(0.530)	(0.442)	(0.558)
trade_gap_1989			-0.438**	-0.499**			-0.099*	-0.214***
			(0.207)	(0.219)			(0.055)	(0.066)
sample	1991	1991	1991	1991	1991-98	1991-98	1991-98	1991-98
Hansen J-stat., p-value			0.90	0.42			0.94	0.52
N	4,782	3,883	4,782	3,883	37,392	30,761	37,392	30,761

Notes: dependent variable: in columns (1)-(4) is imports growth rate between 1990 and 1991; in columns (5)-(8) is annual imports growth rate in 1991-99. * significant at 10%, ** significant at 5%, *** significant at 1%. Robust standard errors are in parentheses. All regressions include units of measurement dummies as controls and columns (5)-(8) also include time dummies. Under the null hypothesis of the Hansen J-statistics is that all instruments are exogenous.

Table 6. The effect of NAFTA trade liberalization on imports and exports growth rates

	CANADA				USA			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep.var.:	%Δimport	%Δexport	%Δimport	%Δexport	%Δimport	%Δexport	%Δimport	%Δexport
Δtariff	-3.976***	-0.758	-3.932***	-0.173	-3.539***	-1.849	-3.172***	-2.056**
	(0.742)	(1.060)	(0.461)	(0.852)	(1.187)	(1.358)	(0.699)	(0.958)
Constant	-0.008	0.405***	-0.007	0.414***	-0.094***	0.015	-0.091***	0.014
	(0.012)	(0.021)	(0.011)	(0.021)	(0.021)	(0.027)	(0.020)	(0.026)
sample	1990	1990	1990	1990	1990	1990	1990	1990
ind FE	no	no	yes	yes	no	no	yes	yes
r2	0.017	0.000	0.016	0.000	0.009	0.001	0.006	0.001
N	4,921	4,774	4,071	3,826	4,921	4,774	4,071	3,826

Notes: dependent variable: in columns (1)-(4) is Canadian imports and US exports growth rate in 1990; in columns (5)-(8) is US imports and Canadian export growth rates in 1990. * significant at 10%, ** significant at 5%, *** significant at 1%. Robust standard errors are in parentheses.

Table 7. Tariff evasion in quantities and unit values.

Country:	CAN	USA	CAN	USA	CAN	USA	CAN	USA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep.var.:	quantity gap				price gap			
tariff	1.847	-3.822*	-1.011	-1.926	-2.964***	-0.486	-0.431	-0.531
	(1.331)	(2.135)	(1.247)	(1.740)	(1.115)	(1.094)	(0.982)	(1.246)
tariff_save	2.729	0.240	1.739	-0.058	1.026	1.178	1.312	1.132
	(2.738)	(1.268)	(2.348)	(1.456)	(2.113)	(0.863)	(1.849)	(1.043)
tariff_o	2.052***	1.151	2.586***	3.937***	0.407	-0.067	-0.476	-1.155
	(0.723)	(1.308)	(0.775)	(1.480)	(0.500)	(0.797)	(0.611)	(1.060)
tariff_var	-0.359**	0.260	-0.045	1.962	0.276	-0.304	0.016	-1.340
	(0.181)	(1.214)	(0.252)	(2.010)	(0.171)	(0.687)	(0.199)	(1.439)
share_free	0.688***	0.273	-0.112	0.201	-0.537***	-0.242*	0.215*	0.026
	(0.196)	(0.167)	(0.162)	(0.162)	(0.172)	(0.130)	(0.127)	(0.116)
transp_costs		3.183*		3.754**		-3.887***		-4.985***
		(1.660)		(1.513)		(1.275)		(1.083)
ind FE	no	no	yes	yes	no	no	yes	yes
r2	0.09	0.10	0.04	0.03	0.10	0.15	0.06	0.04
N	2,656	2,413	2,656	2,413	2,656	2,413	2,656	2,413

Notes: dependent variable: in columns (1)-(4) is the quantity trade gap in 1989; in columns (5)-(8) is the unit value tarde gap in 1989. * significant at 10%, ** significant at 5%, *** significant at 1%. Robust standard errors are in parentheses. All regressions include units of measurement dummies as controls.

Figure 1. Trade gap and import tariffs, 1989.

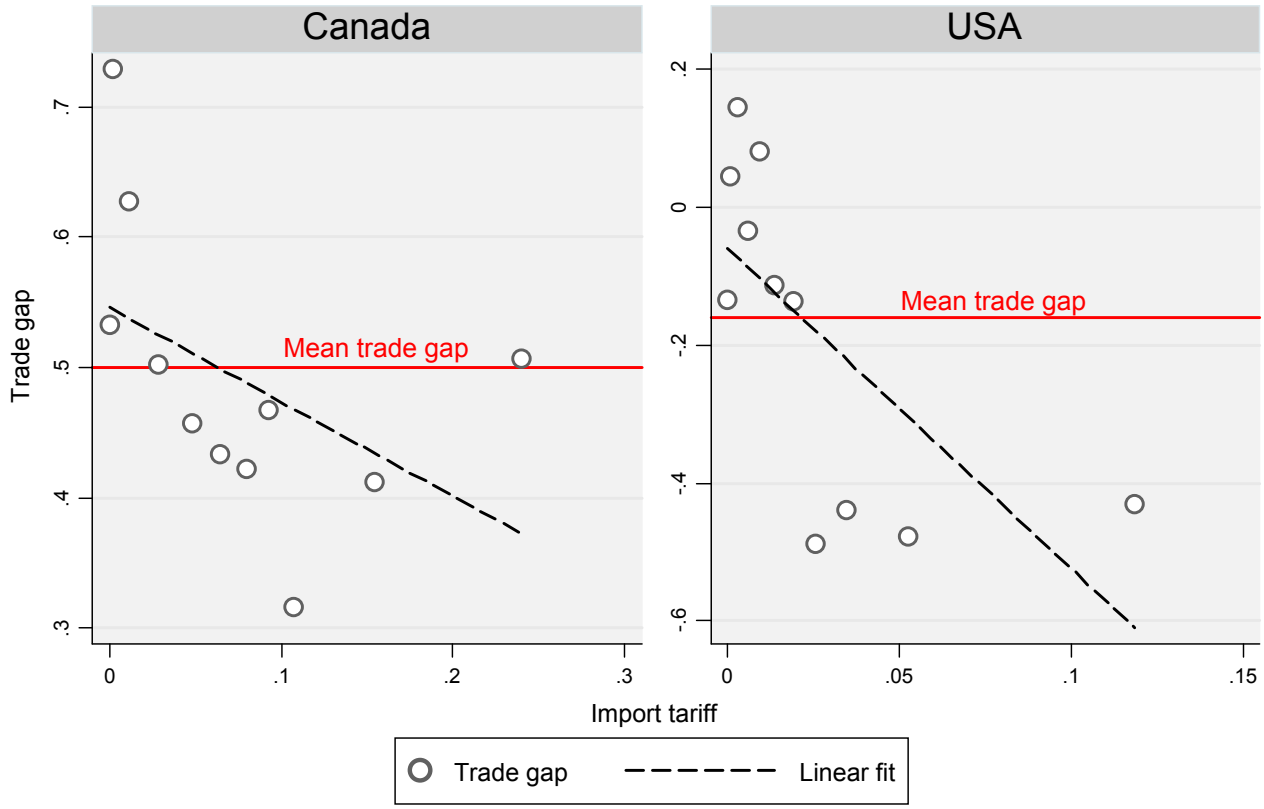

Figure 2. Trade gap and tariff savings from importing through FTA partner country, 1989.

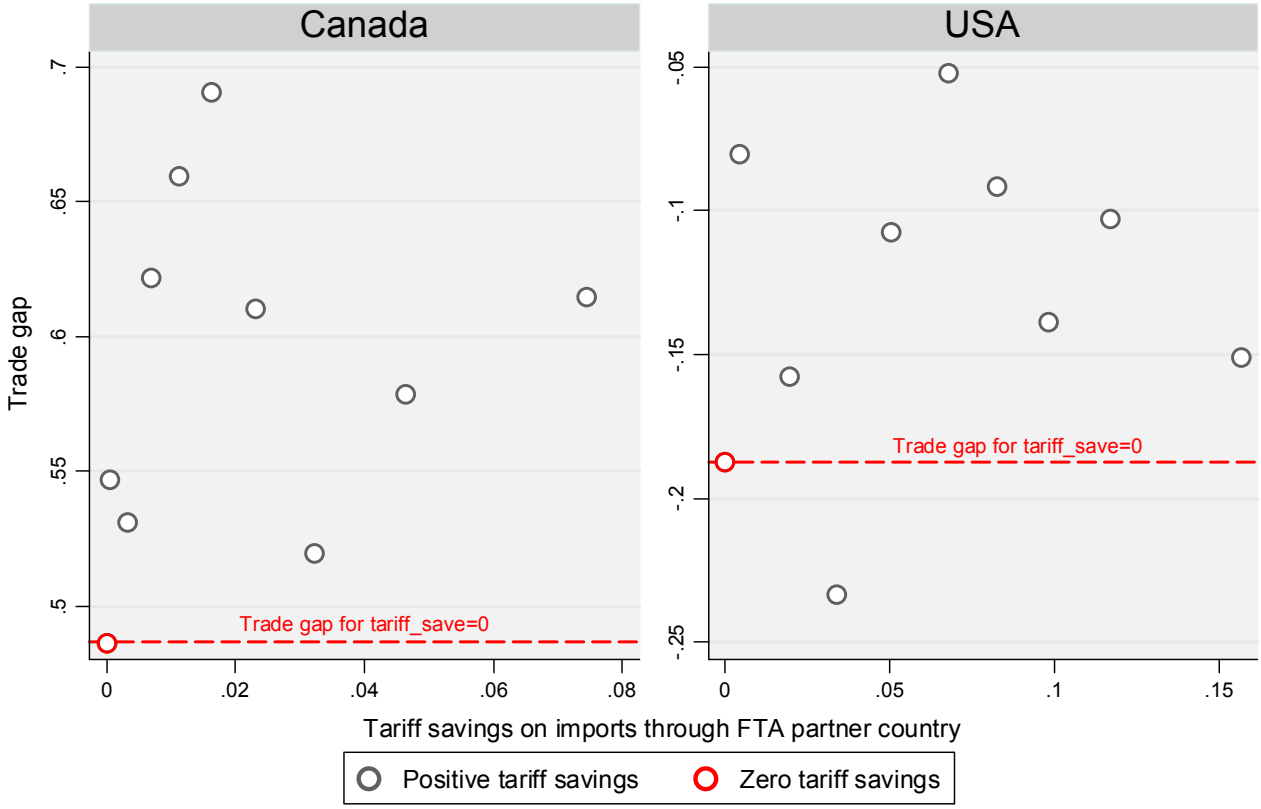

Figure 3. Quantile regression for Canadian trade gap.

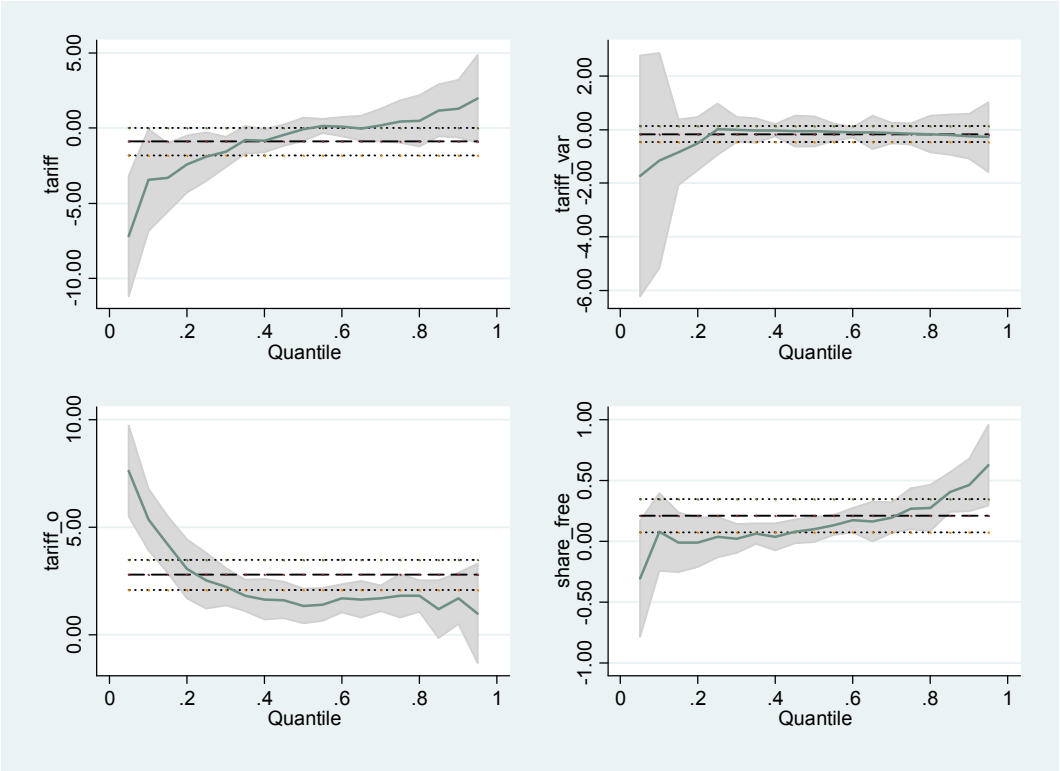

Figure 4. Quantile regression for U.S. trade gap.

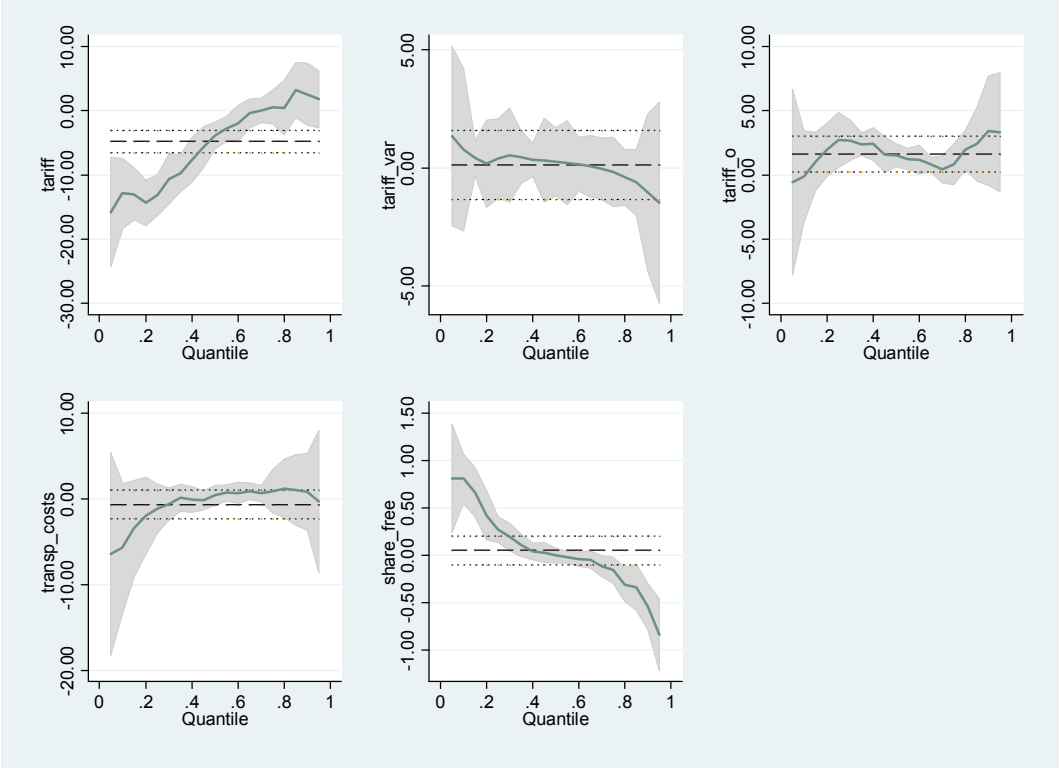

Figure 5. Quantile regression with external tariffs for Canadian trade gap.

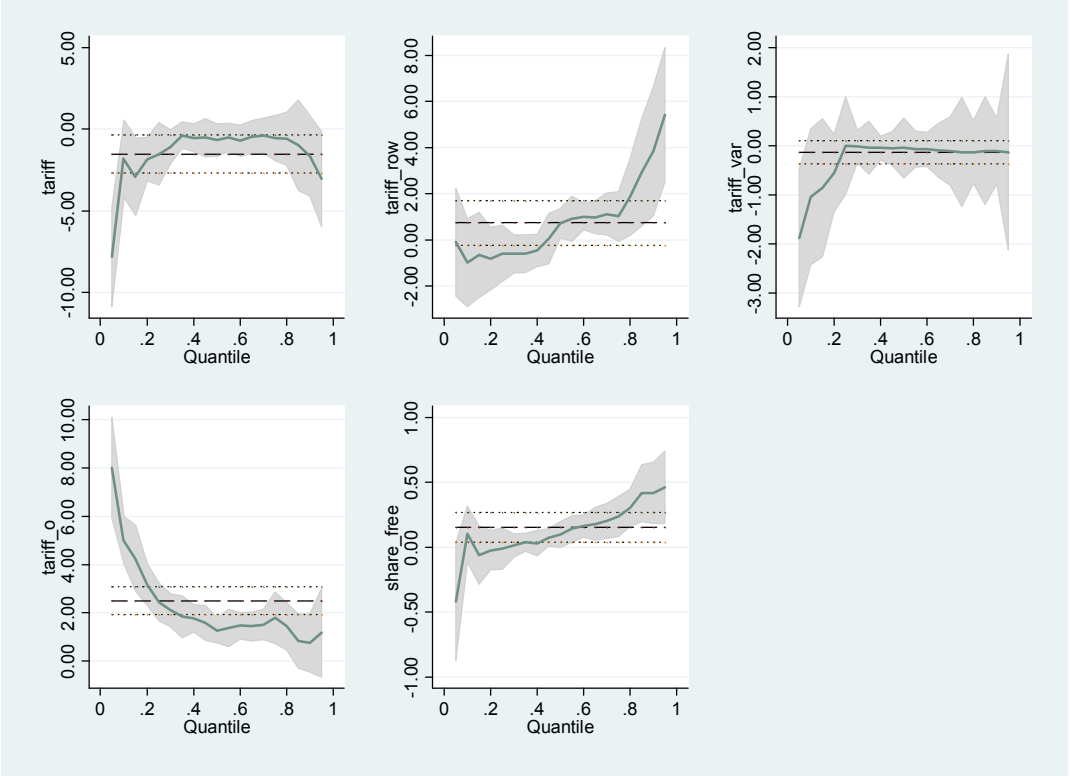

Figure 6. Quantile regression with external tariffs for US trade gap.