The Macroeconomic Effect of Modern Protectionism

Cristian Espinosa*

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This paper explores the dynamic effects of import tariffs on key macroeconomic aggregates. The simultaneity between tariffs and the business cycle—due to the countercyclical nature of tariffs—induces attenuation bias in the estimation of impulse response functions. To address this, I develop a novel instrument based on retaliatory tariffs, constructed from a database of temporary trade barriers. Under World Trade Organization (WTO) rules, countries typically respond by matching the tariff rate imposed by their trade partners. As a reaction to foreign policy actions, retaliatory tariffs are less likely to correlate with the country's own business cycle. Using these as an instrument within a Proxy-SVAR framework to identify the effect of an exogenous tariff shock, I find that tariff increases: (i) are inflationary (for consumer prices); (ii) have a negative and persistent impact on GDP; and (iii) worsen the trade balance on impact. The results are robust across a range of alternative specifications, and the estimated effects are larger than those obtained using standard timing restrictions.

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*University College London (UCL). Email: cristian.espinosa@ucl.ac.uk. I would like to thank Morten Ravn and Kalina Manova for their continuous support, as well as their valuable comments and suggestions. I am also grateful for the suggestions provided by Raffaella Giacomini and for the feedback received from various conferences where this paper was presented. All views expressed in this paper are solely my responsibility.

1 Introduction

In recent years, policymakers have increasingly employed commercial policy as a tool for macroeconomic management, rekindling debates among scholars about the dynamic aggregate effects of import tariffs. However, estimating these dynamic effects poses significant challenges due to identification issues. A key concern is the simultaneity between tariffs and economic activity: governments often raise tariffs during economic downturns as a way to generate revenue—a behavior known as countercyclical protectionism. This implies that observed changes in tariffs respond to the same economic conditions that affect macroeconomic aggregates, making it difficult to isolate the causal effect of tariffs on the economy.

To address this issue, I develop a novel instrument to estimate the dynamic effect of an exogenous tariff shock on key macroeconomic aggregates. This involves decomposing aggregate tariffs into protective and retaliatory components. Retaliatory tariffs—implemented in response to another country's actions rather than to domestic economic conditions—serve as a source of exogenous variation for identifying the tariff shock. This decomposition isolates the portion of tariff changes that are uncorrelated with domestic economic activity, thereby overcoming the simultaneity bias introduced by countercyclical protectionism.

Using retaliatory tariffs as an instrument for an import tariff shock requires that the tariff rate be orthogonal to the country's own domestic shocks. Under the principle of reciprocity, retaliatory responses are constrained by World Trade Organization (WTO) rules, which typically require countries to match the tariff rate imposed by their trade partner. Moreover, because retaliation is triggered by another country's action, the resulting tariff changes are less likely to correlate with the country's own business cycle. These two conditions support the exogeneity condition of the instrument.

As retaliation is a response to a trade partner's defection, retaliatory tariff rates are orthogonal to the country's own economic fluctuations. This remains true even after controlling for global shocks. Intuitively, WTO regulations constrain the extent to which tariff rates can vary with the business cycle, even if they remain correlated with the trade partner's economic conditions. The estimation focuses on the Canadian economy, using quarterly data from 1985 to 2015.[1] Using a Proxy-SVAR model, I employ the instrument to estimate the impulse responses of an import tariff shock on several macroeconomic aggregates.

The contribution of this paper to the literature is the construction of a novel instrument for identifying structural shocks. This approach accounts for the feedback effect between

[1] Canada is considered one of the largest developed small open economies. In large economies, tariffs can improve the terms of trade and generate general equilibrium effects that complicate the estimation of tariff shocks. By focusing on a small open economy—where the terms of trade are exogenous and foreign prices are unaffected—we obtain a cleaner identification of causal effects.

tariffs and economic activity, which timing restrictions may overlook. Utilizing this instrument and a unique dataset of Canadian tariffs, I find that the effects of import tariffs on macroeconomic aggregates are significantly larger than those reported in previous studies.

A growing body of empirical research examines the macroeconomic effects of import tariffs. Recent studies—such as Barattieri et al. (2021) and Furceri et al. (2018, 2021)—have explored this question at the aggregate level. However, their methodologies face challenges related to both the identification and measurement of tariff shocks. The limited number of macro-level empirical studies partly reflects the difficulty of identifying real effects in the presence of simultaneity, which tends to bias standard estimates toward zero. The well-documented countercyclical relationship between tariffs and economic activity, as emphasized by Bown and Crowley (2013, 2014), further complicates efforts to isolate tariff shocks that are uncorrelated with macroeconomic fluctuations. Recent literature attempts to address this identification issue by employing timing restrictions in Cholesky-identified SVAR models. For example, Barattieri et al. (2021) estimates the effect on real GDP under the assumption that tariffs do not respond contemporaneously to changes in GDP—effectively imposing a zero contemporaneous feedback effect. However, if tariffs are countercyclical, this may lead to bias in the estimated impulse response functions (IRFs).

Historically, tariffs have been employed for various purposes: (i) to increase government revenue, (ii) to protect domestic industries from foreign competition, and (iii) for populist or ideological reasons. The first two motives often lead to countercyclical policies, as governments raise taxes during recessions to offset revenue losses, and firms demand more protection during economic downturns. To limit the use of tariffs, the General Agreement on Tariffs and Trade (GATT) promotes free trade agreements, contributing to a decline in customs-level import tariffs over the past two decades. Additionally, the World Trade Organization (WTO) has established a framework for temporary trade remedies in cases of dumping and safeguard duties. However, the lack of stringent regulation has made temporary tariffs the preferred tool for policymakers seeking to implement protectionism.[2] Appendix C.1 illustrates a clear trend: lower customs duties have been overtaken by a rise in temporary trade tariffs.

Temporary Trade Barriers (TTBs) involve substantial duties applied to a limited number of goods. In Canada, the affected products account for 4.2% of the quantity imported, representing 6.3% of total import value and approximately 2.2% of annual GDP. TTBs can generate significant propagation effects. As Handley and Limão (2017) points out, they create high policy uncertainty, which can dampen investment and, consequently, reduce real

[2] Indeed, the majority of tariffs imposed in 2018 fall into this category. In particular, Trump tariffs enacted under Section 232 correspond to safeguard duties.

activity. Moreover, a large share of these tariffs is imposed on essential intermediate inputs, further amplifying their effects through production networks. The process of imposing a new tariff begins with a domestic industry submitting an antidumping petition to local authorities. The government then initiates an investigation and may impose duties if material injury to the domestic industry is found and the estimated dumping margins are significant. Such investigations typically take around ninety days to complete.

Beyond identification concerns, there is also a measurement issue. Following Bown and Crowley (2013), the TTB literature commonly uses the number of products involved in new antidumping investigations as a proxy for temporary import tariffs. While this metric may capture the intensity of protectionist activity, it can diverge significantly from actual tariff rates, especially when estimating dynamic effects. Barattieri et al. (2021) employs this product-based measure to estimate the impact of tariffs on Canada and finds a small negative effect on real GDP. This muted response may be explained by a combination of contemporaneous feedback effects and the limitations of using a proxy that does not reflect actual tariff magnitudes.

This paper directly tackles these challenges by constructing a new measure of temporary trade protection. Specifically, I use the implied duty associated with each newly opened temporary trade barrier investigation and aggregate it to the quarterly level using product-level import shares. To the best of my knowledge, this is the first attempt to use such a metric within the TTB framework to estimate impulse response functions (IRFs). By employing this measure within a Proxy-SVAR framework, I find that the identified responses are larger, sharper, and more persistent than those reported in the related literature. In doing so, this paper opens a new avenue for research by offering a novel approach to identifying exogenous trade shocks.

The use of instrumental variables (IV) to address identification concerns is not new. Furceri et al. (2021) use data on customs duties at annual frequencies to estimate the effects of tariffs using the Jordà (2005) local projections methodology, applied to a panel data of countries. Their instrument—the weighted average of tariff changes by the closest trading partners—yields IV results that are significantly larger (in absolute terms) than their OLS counterparts. This underscores the endogeneity concerns inherent in the latter approach. A key difference relative to their methodology is that this paper disentangles protective from retaliatory tariffs at higher frequencies—quarterly rather than annual. During recessions, countries are more likely to adopt protective tariffs. In a global crisis, if many countries raise tariffs simultaneously, their instrument may capture endogenous interactions rather than exogenous variation.

The findings of this paper indicate that temporary tariffs have more immediate and pronounced contractionary effects on GDP than previously documented in the literature. These effects materialize more rapidly—within the first year after the shock—highlighting the importance of analyzing temporary trade barriers (TTBs) at higher frequencies. This suggests that TTBs can be particularly harmful in the short run, and that macroeconomic evaluations should reflect this timing. Finally, some limitations must be acknowledged when interpreting the results. This study focuses exclusively on temporary trade barriers and therefore omits the potential effects of non-tariff barriers. These are difficult to quantify in practice due to limited data availability. As such, the results should be interpreted with caution and viewed as a lower bound for the overall impact of protectionism, since non-tariff barriers may be even more detrimental than traditional trade restrictions.

This paper is structured as follows. Section 2 describes the data sources and presents the empirical evidence. Section 3 outlines the theoretical framework, identification strategy, and properties of the instrument. Sections 4 and 5 present the main results and robustness checks, respectively. Section 6 concludes.

2 Empirical Evidence

This section begins by describing the data on temporary trade barriers used in the analysis. It then documents four stylized facts that help illustrate the empirical challenges addressed in the theoretical framework. Finally, it outlines the construction of the retaliatory tariff instrument used in the estimations.

2.1 Data

The main source of information is the Temporary Trade Barriers Database compiled by Bown (2016), which comprises a panel dataset of WTO member countries covering the period from 1985 to 2015. For each country, it reports newly opened antidumping, countervailing, and safeguards investigations.[3] This dataset includes details such as the date when investigations are opened, the products involved, the named (target) country, the resolution, and any tariffs imposed. It also contains information on Dispute Settlement Unit (DSU) cases—legal complaints brought to the WTO to challenge tariffs imposed by member countries. These

[3]Antidumping investigations originate when a trading partner is suspected of dumping exports, meaning they are sold at prices deemed "less than fair value." In such cases, WTO rules entitle a country to initiate an investigation, which may ultimately result in the imposition of antidumping tariffs. Countervailing cases are typically tied to antidumping investigations and involve duties applied on top of the antidumping ones when the foreign firm is subsidized by its government. Finally, safeguards are temporary measures—such as tariffs or quotas—used to protect a domestic industry from an unforeseen surge in imports that causes or threatens to cause serious injury.

cases are useful for identifying and classifying retaliation events.

In Canada, out of the 479 investigations, 86% are antidumping cases, 13% are countervailing, and 1% are safeguards. The predominance of antidumping cases is consistent across countries, with respective averages of 85%, 11%, and 4%. The dataset structure allows for the construction of average tariffs at various frequencies. The second source of data is standard macroeconomic series, primarily from the Organization for Economic Co-operation and Development (OECD). This includes quarterly series for real GDP, trade balance, and core CPI, which are used in the baseline estimation. Details for each variable are described in Appendix A.

Initiating an investigation involves a three-stage procedure. First, the local industry files a formal petition to the government. This is not public and requires the firms to gather evidence of dumping margins before presenting the case. In the second stage, if the government decides to open an investigation, the process then becomes public. If so, government agencies have to assess the material injury to the local industry and the dumping margins of the foreign products. The average duration to reach an outcome is ninety days, but the government is entitled to impose preliminary duties in the early stages of the investigation.

If the investigation concludes that there is material injury and non-negligible dumping margins, final duties are imposed. These reflect the estimated dumping margins and are therefore forecastable. To control for this, I use the date at which the investigation is opened. Lastly, if the imposed duty is significantly higher than the actual dumping margin, the counterpart can retaliate by applying countermeasure tariffs and filing a DSU complaint.[4] A short summary of the three stages is provided in Appendix C.2.

The metric used for the analysis is the average import duty associated with each newly opened TTB investigation. In practice, this corresponds to the final imposed duty; when the final duty is unavailable, the preliminary one is used instead. Each investigation typically covers a broad set of goods to which these tariffs apply. To calculate the average tariff rate at quarterly or annual frequencies, import duties are weighted by the 2010 import share of each affected good. This weighting is performed both within each investigation and across all investigations in a given period. For consistency, import shares are normalized to sum to one at the relevant frequency.

Tariffs can affect GDP through two key channels. First, because a large share are levied

[4] One can think of retaliatory tariffs as a reaction function of the form: $RT_t = f\left(T_t^*(Y_t^*) - DM_t\right)$. Here, the foreign tariff T_t^* may depend on the foreign business cycle Y_t^*. If the tariff imposed by the trading partner significantly exceeds the estimated dumping margin DM_t, the country can respond with retaliatory tariffs. For example, Canada might decide to protect its lumber industry by raising duties by 20% against the U.S. If the U.S. replies with countermeasure tariffs of 60%, Canada could then impose retaliatory tariffs equivalent to the difference and bring the case to the WTO. A similar episode occurred during the Softwood Lumber trade dispute between these two countries.

on intermediate inputs, they propagate through production networks, raising costs across the economy. Second, these policies often involve high tariff rates that remain in effect for extended periods. At the same time, they are accompanied by considerable policy uncertainty. As highlighted by Handley and Limão (2017), trade-related uncertainty can delay investment decisions and, in turn, weigh on aggregate output. These channels provide plausible mechanisms through which tariffs influence GDP—mechanisms explored further in the following section on stylized facts.

2.2 Stylized Facts

This section documents four empirical findings: (i) tariffs are predominantly imposed on intermediate inputs; (ii) TTBs are associated with high policy uncertainty; (iii) import tariff rates have increased over time; and (iv) import tariffs are countercyclical. To establish these facts, I construct an aggregate measure of tariffs, considering only those expressed in ad-valorem terms, as this provides a normalized metric across different types of goods. I then aggregate these tariffs to the quarterly level using constant import share weights (see Appendix A for details on the methodology).

Stylized Fact 1: *Tariffs are predominantly imposed on intermediate inputs*

Table 1 shows that intermediate inputs account for 84% of the products subject to investigation and exhibit the second-highest average tariff rate. This represents an important channel through which tariffs affect GDP, as many of these duties fall on essential inputs in the production process. The resulting cost increases propagate throughout the economy, generating a powerful amplification mechanism.

Table 1: Temporary Tariffs by Type of Good

Type of Good	Share of Products (%)	Tariff Rate (%)
Capital goods	2	29
Consumption goods	14	38
Intermediate goods	84	36

Stylized Fact 2: *TTBs are associated with high policy uncertainty*

Table 2 shows that the average tariff is 33.4%, with a standard deviation of 22.3%. This indicates that although high duties are imposed on these goods, there is considerable dispersion, as reflected in the large coefficient of variation. Moreover, these remain in place for a long time, as the average duration is 20 quarters. However, some tariffs can even remain in place for up to 10 years. The high policy uncertainty of these measures can have a detrimental effect on real activity.

Table 2: Temporary Tariffs Statistics

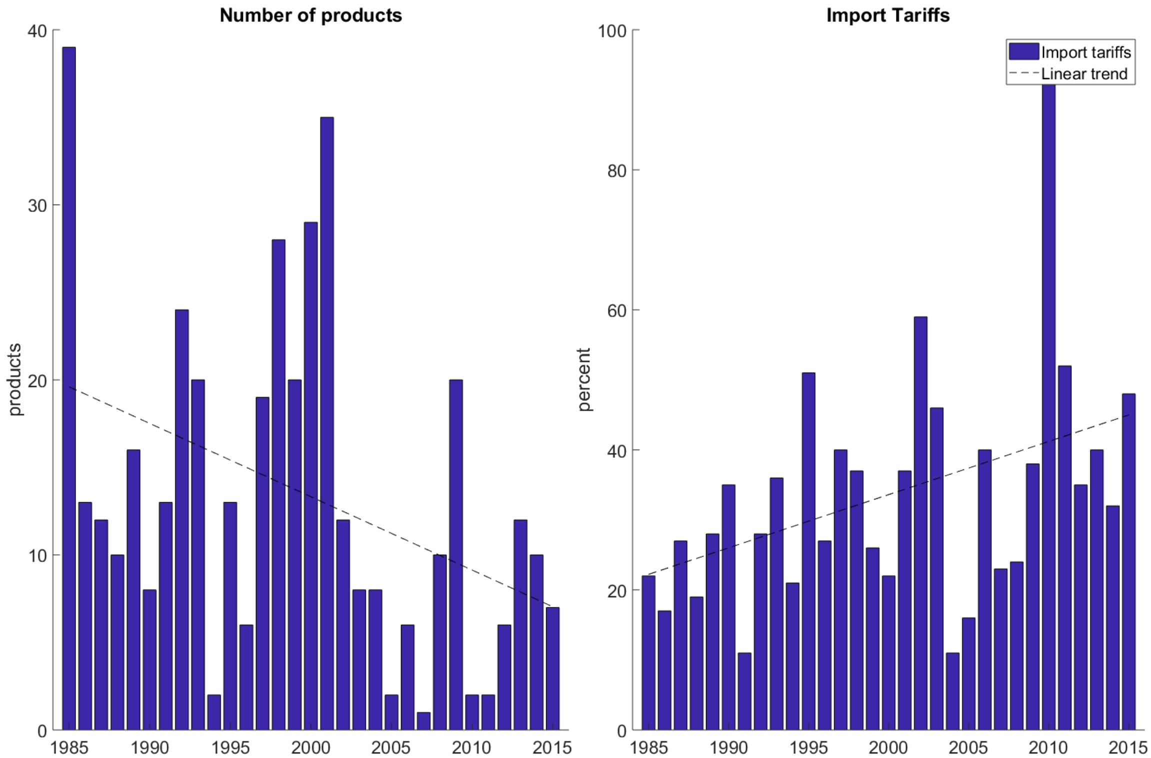
Tariff Statistics	Obs.	Mean	Median	Std. Dev.	Min	Max
Average Tariff Rate (%)	413	33	32	22	2	162
Periods in Place (quarters)	413	20	21	20	0	120

Stylized Fact 3: *Import tariff rates have increased over time*

The related literature has often used the number of products (at the 6-digit level) involved in each investigation as a proxy for the intensity of temporary trade barriers. I contrast this with a measure based on the average tariff rate of newly opened TTB investigations. This is constructed by taking the import duties applied to all goods subject to these measures in a given period and computing a weighted average using the 2010 import share of each good.

Figure 1 compares the product-based measure with the constructed tariff rate estimates, both computed at an annual frequency. The left panel shows the number of goods subject to TTBs from newly opened investigations in a given year. The right panel, by contrast, displays the corresponding weighted average tariff rate.

Figure 1: Evolution of Product Measures and Import Tariff Rates



Notes: The left panel shows the number of products involved in newly opened investigations by year, with a dashed line indicating the OLS-fitted linear trend. The right panel presents the implied import duty associated with these investigations, also shown with a corresponding linear trend.

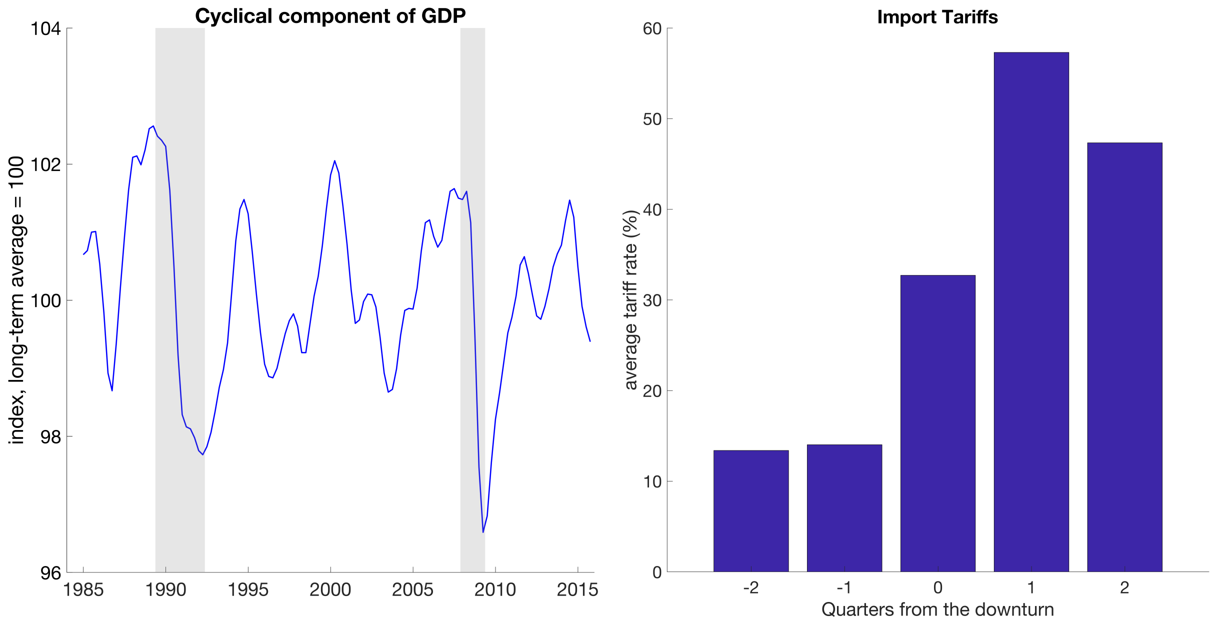
The two series display a stark contrast: while the number of products under investigation has declined significantly over time, average tariff rates have trended upward. In other words, increasingly higher tariffs are being imposed on a smaller set of goods—implying that the tariff-to-product ratio has risen over time. This divergence suggests that product counts alone fail to capture the evolving nature of trade protection and are therefore an incomplete proxy for use in empirical estimation.

Stylized Fact 4: *Import tariffs are countercyclical*

To explore the countercyclical relationship between tariffs and GDP, I focus on two major crises that Canada experienced during the period of analysis: the debt crisis of the early 1990s and the Great Financial Crisis of 2008. The left panel of Figure 2 displays the cyclical component of GDP (sourced from the OECD), with these crisis periods shaded in gray. The right panel shows the evolution of tariffs relative to the onset of each downturn, labeled as period zero.[5] Each bar represents the average tariff rate for the corresponding quarter.

[5]The start of each contraction is defined as the first quarter of 1990 and the third quarter of 2008, respectively.

Figure 2: Countercyclical Tariffs



Notes: The left panel shows the cyclical component of GDP from the OECD, with shaded areas indicating economic crisis periods. The right panel displays the average tariff rate around the onset of each episode. Period zero marks the start of the contraction, immediately following the business cycle peak. The series covers two quarters before and after that point.

The tariff path displays a pronounced step increase at the onset of each crisis. In particular, a sharp 20 percentage point rise at time zero highlights a potential violation of the contemporaneous exogeneity assumption. This endogenous pattern is consistent with the countercyclical nature of the product-based tariff measures documented in earlier literature. To address this, I decompose the tariff measure into two components: a protective and a retaliatory one. I then show that the latter is uncorrelated with business cycle fluctuations.

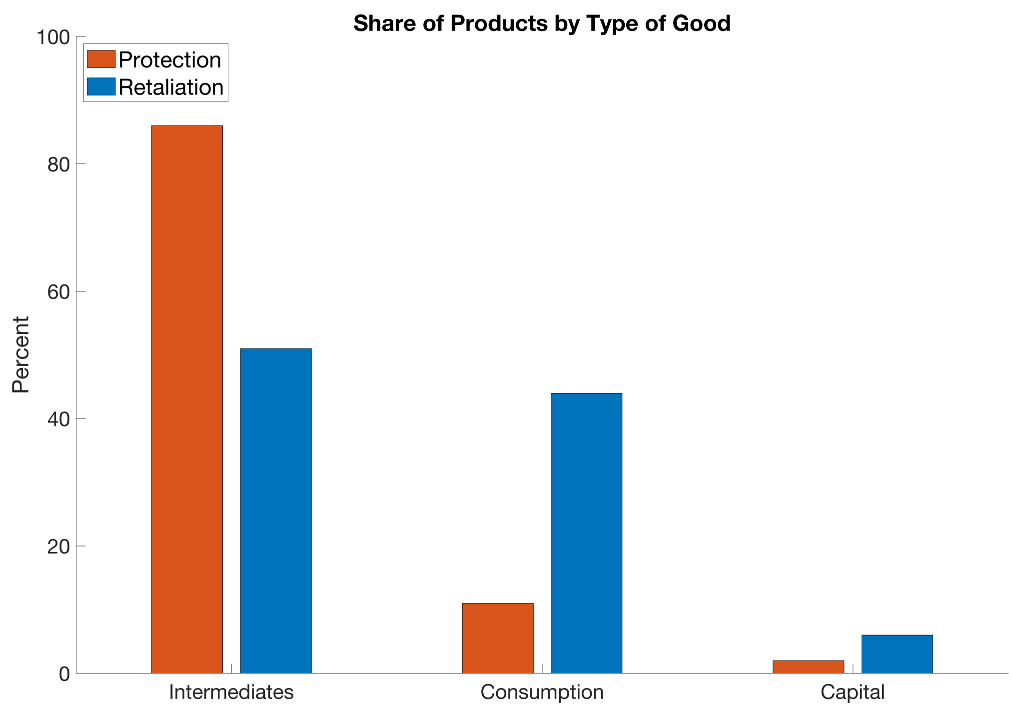
2.3 Retaliatory Tariffs

Prusa and Skeath (2002, 2008) classify the motivations behind temporary trade barriers into two main categories: economic and strategic. Economic motivations are consistent with endogenous filing patterns—protective duties imposed in response to poor economic performance or trade imbalances.[6] Strategic motivations, by contrast, reflect deterrence behavior. As argued by Blonigen and Bown (2003), countries retaliate against a trade partner's defection to pressure them into reducing protectionist measures, ultimately aiming to restore a free trade equilibrium. This retaliation often takes the form of countermeasure tariffs, legal complaints at the WTO, or both. These actions typically follow a tit-for-tat dynamic, with the punishment persisting until the original protective duty is removed.

[6]For instance, an import surge that abruptly worsens the trade balance.

To classify whether the imposed duty from an investigation is retaliatory, I follow the approach outlined by Feinberg and Reynolds (2006, 2018), which defines an action as retaliatory if it is taken against a trade partner that has targeted the country within the previous year. Consistent with the view of retaliation as a form of punishment, it must occur concurrently with, or shortly after, the initial defection. This suggests that retaliation is primarily a government-driven policy, with policymakers deliberately selecting the products through which to implement the response. Figure 3 displays the types of goods targeted during episodes of retaliation and compares them to those affected by protectionist measures.

Figure 3: Goods Targeted by Retaliatory vs. Protectionist Tariffs



Notes: Orange bars show the share of goods targeted by protectionist tariffs, normalized to one and split by type. Blue bars show the same for retaliatory tariffs.

Retaliatory tariffs targeting consumption goods account for 44% of the products involved in retaliation cases—an increase of 30 percentage points relative to protectionist measures. This shift is largely driven by a decline in the share of intermediate inputs, which drops from 86% under protectionism to 51% in retaliation cases.

In practice, I check which of the Canadian investigations are challenging a trading partner's duty levied within a year. In addition, if there is a dispute in place, that window is expanded by an additional year. Table 3 presents summary statistics for the tariff rates and durations associated with both protectionist and retaliatory measures.

Table 3: Retaliatory and Protectionist Tariffs Statistics

Type of Tariff	Obs.	Mean	Median	Std. Dev.	Min	Max
Protectionist Tariff Rates (%)	348	34	32	22	2	162
Protectionist Tariff Duration (quarters)	348	23	22	22	0	85
Retaliatory Tariff Rates (%)	65	31	22	23	8	127
Retaliatory Tariff Duration (quarters)	65	12	4	14	2	120

In terms of tariff rates, protectionist duties are only three percentage points higher than retaliatory ones, and both exhibit similar levels of dispersion. Importantly, the null hypothesis of equal average tariff rates between the two groups cannot be rejected. Regarding duration, protectionist tariffs remain in place for nearly six years, whereas retaliatory tariffs typically last about half as long. This supports the view that retaliation serves as a strategic tool to deter prolonged protectionism by trade partners. It is also worth noting that, since countries do not engage in retaliation frequently, this component accounts for only about 20% of the average aggregate tariff rate.

3 Theoretical Framework

Consider the following structural vector autoregression (SVAR) model:

$$A_0 Y_t = A(L) Y_t + \varepsilon_t, \tag{1}$$

where Y_t is an $n \times 1$ vector of observables, A_0 is a nonsingular $n \times n$ matrix of structural parameters that captures the contemporaneous relationships among the variables, and ε_t is an $n \times 1$ vector of structural (latent) shocks with $E(\varepsilon_t) = 0$, $E(\varepsilon_t \varepsilon_t') = I_n$, and $E(\varepsilon_t \varepsilon_s') = 0$ for $t \neq s$, where I_n denotes the n-dimensional identity matrix. The matrix polynomial $A(L)$ encodes the lag structure of order p.

To illustrate the identification challenges, consider a bivariate SVAR model used to estimate the effect of import tariffs (T_t) on GDP (y_t). The goal of this exercise is to assess the impact of Canadian tariffs on Canada's own economy. Although this effect may also depend on trading partner tariffs (T_t^*) and their GDP (Y_t^*), these variables can be controlled for within the SVAR framework. Furthermore, and without loss of generality, assume that the model has no dynamics, so it simplifies to:

$$Y_t = A_0^{-1}\varepsilon_t \quad \Leftrightarrow \quad \begin{pmatrix} T_t \\ y_t \end{pmatrix} = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} \varepsilon_{T,t} \\ \varepsilon_{y,t} \end{pmatrix}. \tag{2}$$

In this context, coefficient c captures the effect of a structural shock to tariffs on GDP. The direction of this effect is *a priori* uncertain. Theory does not provide a clear prediction: on one hand, tariffs induce *expenditure switching* towards local production, which could stimulate GDP. On the other hand, *expenditure changing* implies that a larger share of expenditure is spent on foreign goods, lowering real income and ultimately reducing GDP. Thus, the short-run effect is uncertain and depends on the relative strength of these two forces.

To determine the magnitude of this coefficient, the estimation must address intrinsic simultaneity bias. The effect of a shock to GDP on tariffs is captured by coefficient b. Unless $b = 0$, standard OLS regressions will be biased due to this contemporaneous relationship. There is ample evidence in the trade literature that this coefficient is negative: protective tariffs tend to be raised during periods of economic contraction. This pattern has been documented by Bown and Crowley (2013, 2014) and earlier by Prusa and Skeath (2008), as well as in the stylized facts presented in this paper. A negative value of b implies that the estimate of c is biased toward zero, and consequently, the impulse response function (IRF) underestimates the true impact of a tariff shock.

Traditionally, the SVAR literature has addressed the identification problem by imposing timing restrictions. For example, Barattieri et al. (2021) employs a recursive Cholesky-identified VAR in which GDP is assumed not to affect tariffs contemporaneously. This is equivalent to imposing $b = 0$, thereby overlooking the potential negative feedback effect.

A less restrictive approach is to use an external instrument for the import tariff shock. If such an instrument Z_t exists, the exogeneity condition requires that it not be driven by economic motivations and, therefore, be uncorrelated with the stage of the business cycle. Conversely, instrument relevance implies that Z_t is correlated with the import tariff shock—something that can be tested via the first-stage F-statistic of the IV estimation.[7] Following Mertens and Ravn (2013) and Stock and Watson (2012, 2018), parameter c can be estimated using Z_t in the context of a Proxy-SVAR. The identification of the first column of A_0^{-1} implies this can be used to compute the dynamic effects of a tariff shock.

When using retaliatory tariffs as an instrument, $Z_t = \lambda T_t^*(y_t^*)$, where the instrument is modeled as a response to the trade partner's own business cycle. Additionally, since the

[7]Values above 10 are typically considered evidence of a strong instrument. This is commonly referred to as the Staiger and Stock (1997) "rule of thumb".

retaliatory response is regulated by the WTO, the parameter λ is treated as exogenous and not a function of the model's fundamentals. Under the principle of reciprocity, this means that λ is expected to be equal to one. If these conditions are satisfied, the instrument can be used to identify the effect of the structural tariff shock, ε_{1t}.

3.1 Instrument Validity

Express import tariffs rates as a weighted average of protective and retaliatory tariffs:

$$T_t = \alpha\, Z_t + (1-\alpha)\, P_t \tag{3}$$

with P_t denoting protectionist tariffs, Z_t retaliatory tariffs, and α the weight on the retaliatory component. Following Caldara and Herbst (2019), the series of retaliatory tariffs can be expressed as a function of current and past shocks:

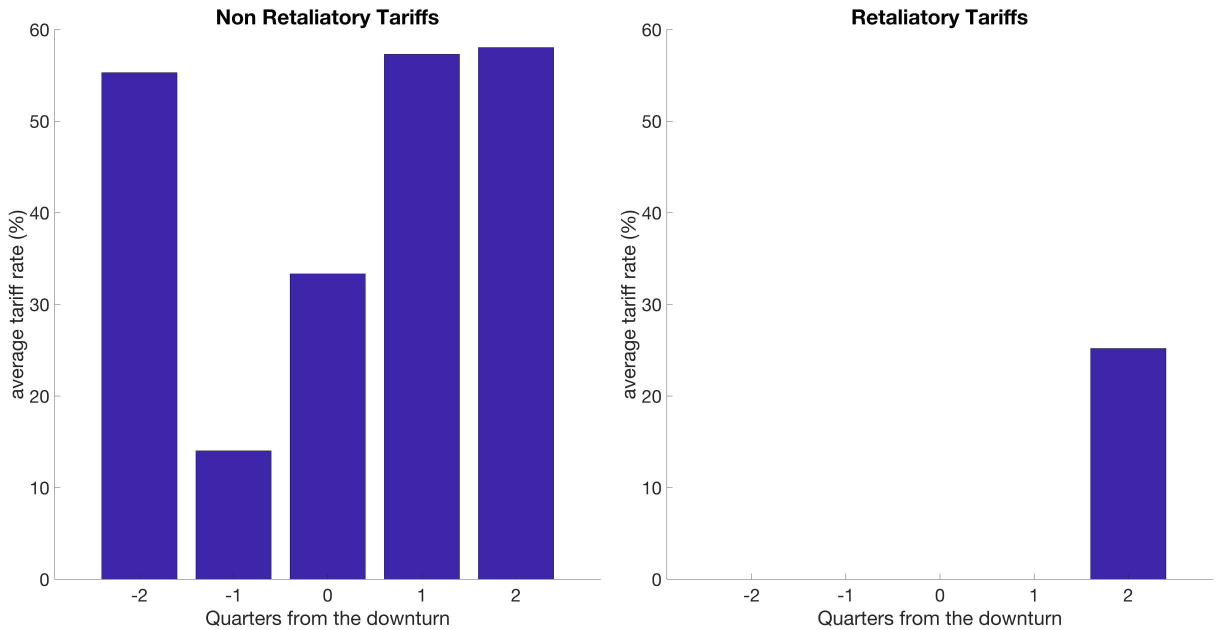
$$Z_t = \alpha\varepsilon_{T,t} + \sigma_\eta \eta_t + f(\varepsilon_{t-1}, \varepsilon_{t-2}, \ldots), \tag{4}$$

where η_t is an i.i.d. measurement error and $f(\cdot)$ is a linear combination of past structural shocks. Essentially, the relevance condition assesses how large $\alpha\varepsilon_{T,t}$ is relative to the measurement error, which is what the first-stage F-statistic indirectly captures.

The exogeneity condition, on the other hand, requires the instrument to be uncorrelated with the remaining structural shocks in the model. Although this assumption is not directly testable—since structural shocks are latent—it can be motivated by showing that the instrument is uncorrelated with the stage of the business cycle. Figure 4 replicates the right panel of Figure 2, but disentangles between retaliatory and protectionist tariffs.

The left panel considers only those TTBs classified as protectionist that fall within two quarters of the onset of both crises, pooled together. In each of these quarters, a weighted average is computed across all involved products. Similarly, the right panel includes only those investigations classified as retaliatory.

Figure 4: Retaliatory vs Protectionist Tariffs Cyclical Behavior



Notes: The left panel displays the weighted average protectionist tariff rate around the onset of each crisis. Period zero marks the beginning of the contraction, immediately after the business cycle peak. The series covers two quarters before and after this point. The right panel shows the corresponding weighted average for retaliatory tariffs.

The two profiles contrast sharply. While protectionist tariffs display the same step-like pattern as aggregate tariffs, retaliatory tariffs do not exhibit any systematic behavior. This suggests that the endogenous countercyclical dynamics are driven entirely by the protectionist component, as retaliatory actions appear unresponsive to adverse domestic shocks. This pattern is partly explained by the fact that during the Great Financial Crisis, Canada implemented only protectionist measures. Retaliation may have been avoided to prevent escalating tensions into a trade war—a particularly costly scenario during an economic downturn.

Although the crisis episodes were selected for illustrative purposes, it is also useful to analyze tariff behavior beyond these two specific periods. To do so, I use a recession indicator from the OECD that identifies recession dates for Canada. In this definition, a contraction spans the period from peak to trough, thereby dividing the business cycle into expansions and recessions. To further examine the relationship between tariffs and the business cycle, I estimate a simple regression of import tariffs on this recession indicator. Two specifications are reported: an OLS regression using the tariff level and a Probit model in which the dependent variable is an indicator for whether a tariff is imposed in a given quarter. These correspond to the intensive and extensive margins, respectively. Table 4 presents the results.

Table 4: Retaliatory vs. Protectionist Tariffs Regressions

Series	Indicator	Coefficient	SE
Import Tariffs	Contraction (OLS)	6.1 (*)	3.49
	Contraction (Probit)	0.09	0.08
Protectionist Tariffs	Contraction (OLS)	9.7 (***)	3.72
	Contraction (Probit)	0.18 (**)	0.08
Retaliatory Tariffs	Contraction (OLS)	−2.6	2.66
	Contraction (Probit)	−0.12	0.08

Notes: (***): $p < 0.01$, (**): $p < 0.05$, (*): $p < 0.1$. Standard errors are calculated using Newey-West estimator with four lags. For efficiency reasons, time dummies are used to control for the tariffs in the top 5% upper tail. Results remain robust to their inclusion.

These results reinforce the hypothesis that protectionist tariffs are responsible for the countercyclical profile. On average, tariffs are 6 percentage points higher during contractions relative to expansions, representing a third of the expansion reference level. Regarding the extensive margin, there is no evidence that more tariffs are imposed during recessions. This result is entirely driven by the protectionist component, which increases by almost 10 percentage points during contractions—about 70% of the expansion level. Additionally, the likelihood of imposing duties during these periods is 18% higher; both margins are statistically significant. In contrast, retaliatory tariffs do not respond to the stage of the business cycle. In fact, they are nearly 3 percentage points lower during recessions, although this difference is not statistically significant. A similar conclusion holds when analyzing the extensive margin.

These findings remain robust when including the controls used in the baseline SVAR. Additionally, we address concerns about predictability using Granger causality tests.[8] The results, shown in Appendix B, reveal that the level of protectionist tariffs is predicted by lagged GDP, while retaliatory tariffs are not. Altogether, this evidence suggests that retaliatory tariffs do not respond systematically to changes in economic conditions, supporting the exogeneity condition of the instrument.

This evidence suggests that retaliatory tariffs, unlike their protectionist counterparts, are unrelated to the stage of the business cycle. In the context of the Proxy-SVAR, the instrument accounts for the feedback effect from GDP to tariffs, thereby enabling identifi-

[8] For example, this approach is common in the tax shocks literature; see Romer and Romer (2010) and Cloyne (2013).

cation of the causal impact of an exogenous tariff shock. A first-stage F-statistic exceeding 10 typically indicates a strong correlation between the instrument and the structural shock, confirming that the instrument is both valid and relevant. In practice, this statistic is obtained by regressing the reduced-form tariff residuals on the instrument. This condition is formally tested in the results section.

4 Results

The baseline model is a four-dimensional Proxy-SVAR specified as $Y_t = [T_t, \ln(y_t), tby_t, \ln(P_t)]'$. In this setup, T_t denotes newly imposed temporary tariffs, while the remaining variables are detrended series: the logarithm of real GDP, $\ln(y_t)$; the trade balance-to-GDP ratio, tby_t; and the logarithm of core CPI, $\ln(P_t)$.[9] This specification aligns with other VAR models in the related literature, allowing for direct comparison of results. The sample comprises quarterly data from 1985 to 2015. The lag structure $A(L)$ is a second-order polynomial, selected using the Akaike Information Criterion (AIC).[10]

To test the relevance condition, I compute the F-statistic of the first stage. This involves a regression of the reduced-form tariff residuals on the instrument. Table 5 reports different estimators of this and compares them to critical values to test the hypothesis of weak instruments.

Table 5: First-Stage F-Statistics

Methodology	F-Statistic
Kleibergen-Paap	44.23
HAC SE	20.86
Montiel Olea-Pflueger	20.99

Note: Each statistic uses a different method to compute standard errors in the first-stage regression of tariff residuals on the instrument.

The first-stage F-statistics indicate a strong instrument. The Kleibergen and Paap (2006) statistic yields 44.23, the Newey-West HAC-adjusted version is 20.86, and the Olea and

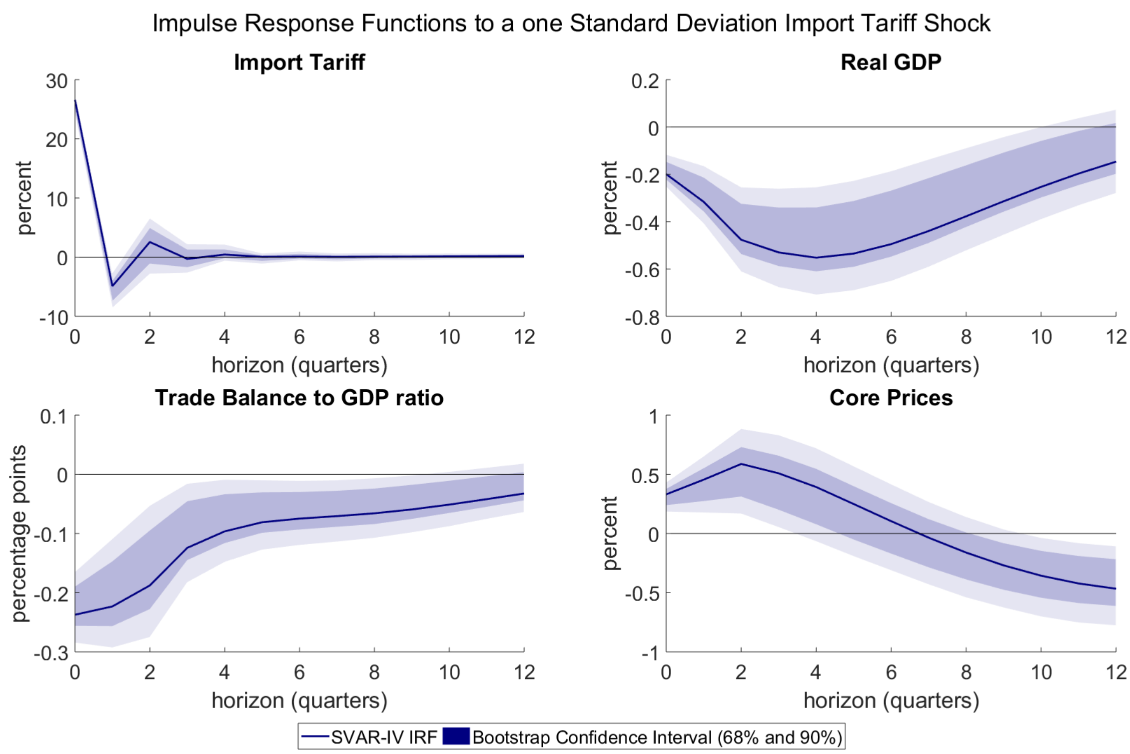
[9]The choice of core CPI over headline CPI follows Barattieri et al. (2021), who argue that core CPI is more appropriate given that energy goods are not subject to tariffs.

[10]Other criteria, such as BIC and HQ, also suggest using two lags. While four lags are common in quarterly models, we follow the information criteria to improve efficiency. Robustness checks using a four-lag specification are presented in a later section.

Pflueger (2013) effective F-statistic—commonly reported in the literature for its robustness to heteroskedasticity and autocorrelation—is 20.99. All three exceed the rule-of-thumb threshold of 10 and the critical value of 16 from the weak instrument test, indicating that the instrument satisfies the relevance condition.[11]

The impulse responses are obtained by simulating a one standard deviation shock to the identified import tariff measure over a 12-quarter forecast horizon. This specification aligns with previous studies in the literature and facilitates direct comparison. Since the tariff measure reflects a weighted average of newly imposed duties under TTBs, the underlying time series exhibits low persistence. The magnitude of the shock can be interpreted as the effect of opening a new investigation that imposes an average-sized tariff, consistent with the typical rate observed in temporary trade barrier measures. Figure 5 shows the responses for each of the variables.

Figure 5: Import Tariff Shock Impulse Response Functions



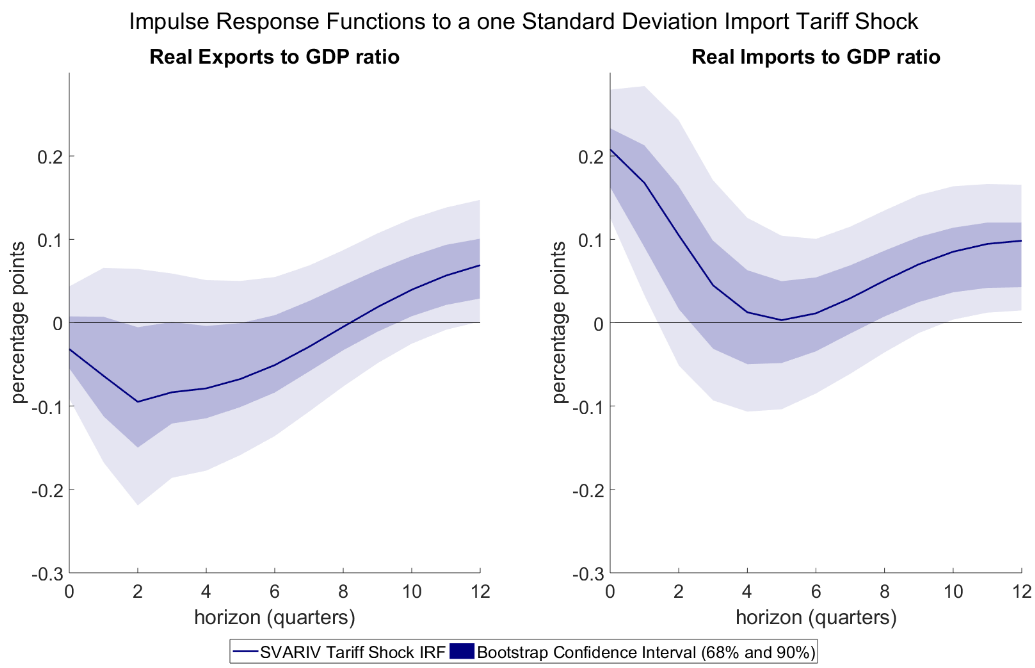
Notes: Impulse responses of the Proxy-SVAR to a one standard deviation shock to import tariffs, shown over a forecast horizon of three years. Confidence intervals are reported at the 68% and 90% levels and are computed using 10,000 replications of the recursive wild bootstrap.

A transitory one standard deviation shock produces an immediate 0.2% decline in real GDP, indicating that the *expenditure-changing* effect dominates. The response is persistent, reach-

[11]The Stock and Yogo (2005) critical value corresponds to a 5% significance level and a maximum relative bias of 10% between IV and OLS estimates, which is standard in the literature.

ing a peak decline of 0.6% in the fourth quarter after the shock, and gradually returning to its original level in subsequent periods. Annual inflation rises by 0.3% on impact, peaks at 0.6% in the second quarter, and then decays rapidly. This inflationary effect arises from the fact that a portion of the tariffs are levied on final consumption goods. Finally, the trade balance experiences a significant drop of 0.25 percentage points (pp) on impact, which is slowly reversed over the following quarters. To understand this, Figure 6 presents the impulse responses of imports and exports separately.

Figure 6: Impulse Response Functions for Imports and Exports

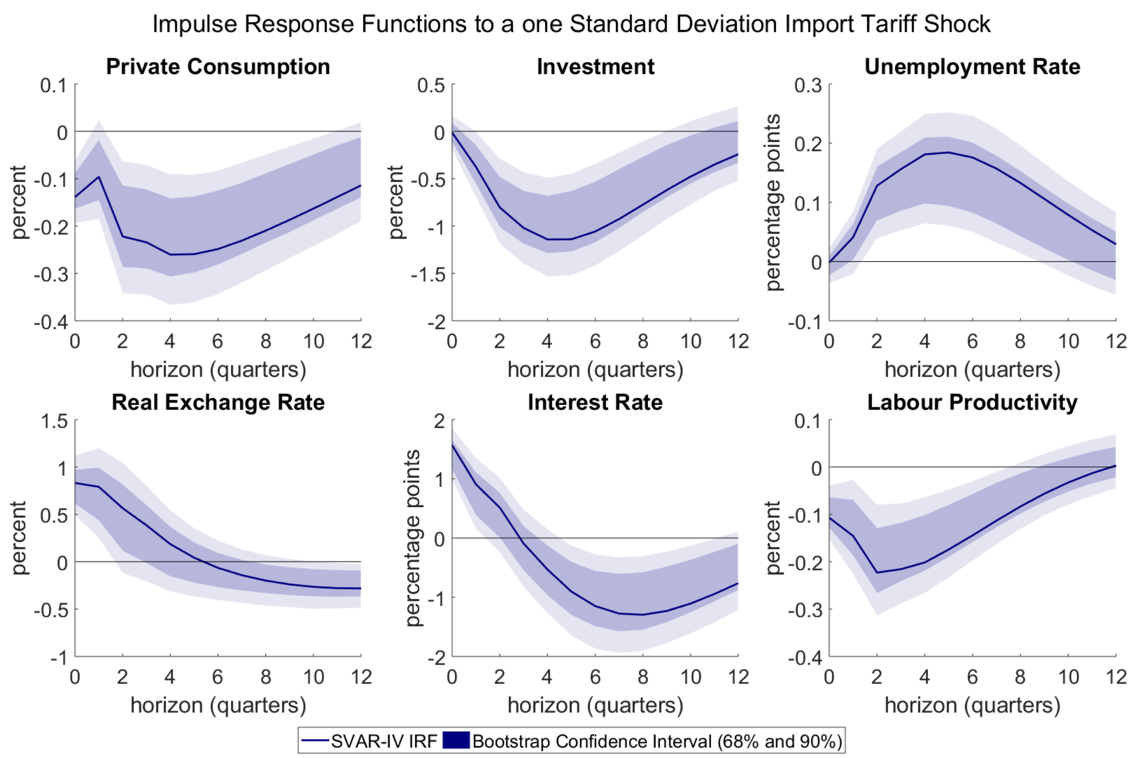


Notes: Impulse responses of the Proxy-SVAR to a one standard deviation shock to import tariffs, shown over a forecast horizon of three years. Confidence intervals are reported at the 68% and 90% levels and are computed using 10,000 replications of the recursive wild bootstrap.

The decline is consistent with an increase in real imports. This pattern is largely driven by retaliatory tariffs imposed on intermediate inputs. Since protective tariffs are predominantly applied to intermediate goods—and a portion of retaliation often targets the same categories previously protected by the trade partner—agents anticipate the imposition of duties on these goods once an investigation is opened. As a result, they front-load imports, which explains the immediate drop in the trade balance.

To understand the transmission mechanisms underlying the baseline results, I examine the effects of a tariff shock on other macroeconomic variables. In particular, I analyze the real exchange rate (RER) and its influence on the trade balance, as well as the short-term interest rate, which captures the central bank's response to inflation. The labor market is also key, as it reflects changes in productivity and unemployment. Additionally, tariffs can create policy uncertainty, potentially affecting investment and private consumption. Figure 7 presents the impulse responses of a tariff shock on the detrended series of the logarithm of the RER (where an increase indicates an appreciation of the local currency), labor productivity (real GDP per employed worker), investment, private consumption, the overnight market rate (to capture short-term interest rate dynamics), and the unemployment rate (to assess labor market responses).

Figure 7: Transmission Mechanism Impulse Response Functions



Notes: Impulse responses of the Proxy-SVAR to a one standard deviation shock to import tariffs, shown over a forecast horizon of three years. Confidence intervals are reported at the 68% and 90% levels and are computed using 10,000 replications of the recursive wild bootstrap.

The import tariff shock induces an immediate appreciation of the local currency by 0.8%, which quickly dissipates. This response is consistent with the exchange rate adjusting to partially offset the price impact of the tariff. As imports become more expensive, the currency appreciates to moderate this effect. However, this appreciation can also reduce export competitiveness, thereby affecting the trade balance. Another key variable is the short-run real interest rate, which is determined by the central bank following a Taylor rule.[12] The annual interest rate rises by 1.5 percentage points (pp) on impact, reflecting a policy response to rising inflation. Subsequently, the output gap begins to dominate, leading to a decline in

[12]Canada has followed an inflation-targeting regime since 1991.

the interest rate.

In terms of the labor market response, the tariff produces an immediate drop of 0.1% in productivity, with a peak decline of 0.2% in the second quarter after the shock. The unemployment rate response takes time to build, peaking at almost 20 basis points during the first year. As for productivity, the peak decline is achieved after the third year, with magnitudes higher than those reported here. Finally, private consumption drops by 0.12% on impact and reaches a peak decline of 0.26% in the first year. Investment does not react on impact but peaks during the first year at a magnitude of 1.2%. All of these results are statistically significant.

4.1 Proxy vs. Cholesky-Identified SVAR

A natural benchmark estimator of A_0^{-1} for comparison is one based on timing restrictions. Assuming that import tariffs do not respond contemporaneously to other variables in the model, tariffs can be ordered first in the SVAR. This implies that the reduced-form residual of the tariff rate corresponds to the structural shock. Such an assumption is equivalent to assuming $b = 0$, effectively ignoring the countercyclical behavior of tariffs. Table 6 reports the estimated impact effects from both the Proxy-SVAR and the Cholesky-identified VAR, using the same shock magnitude as identified in the former model.

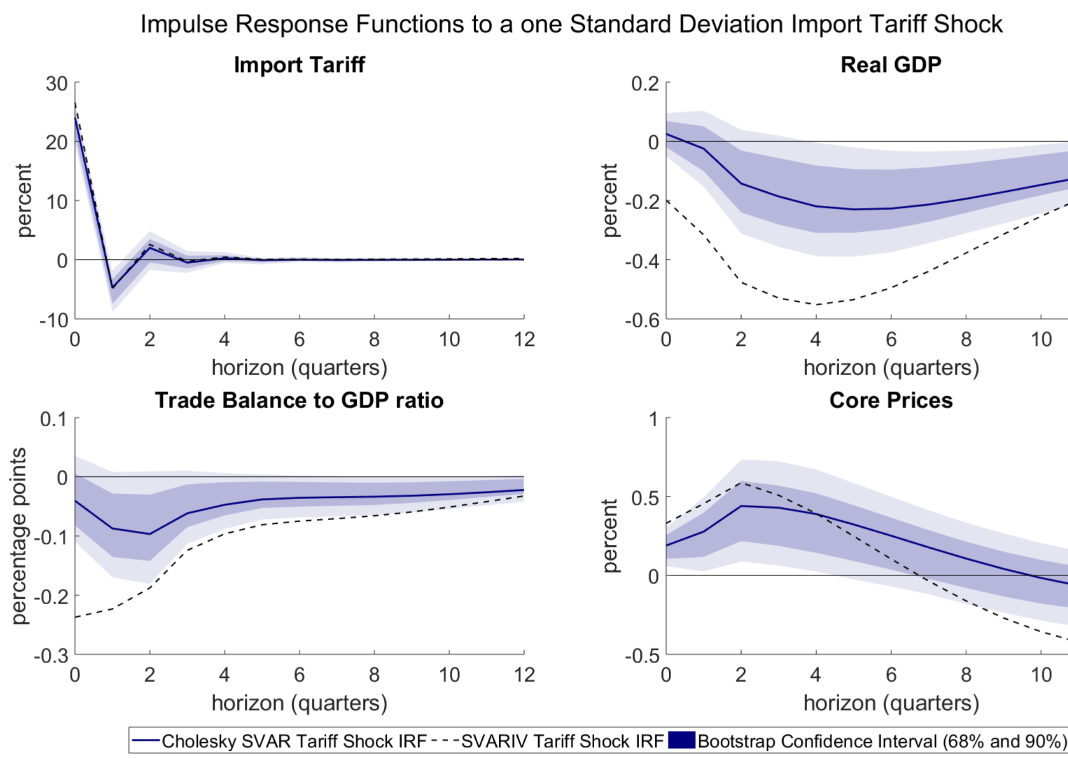
Table 6: Proxy-SVAR vs. Cholesky Impact Effects

IRF	Proxy-SVAR	Cholesky-SVAR
GDP	−0.20 (***)	0.02
Trade Balance	−0.24 (***)	−0.04
Inflation	0.33 (***)	0.19 (**)

Note: Bootstrapped standard errors using 10,000 repetitions.
(*): $p < 0.01$, (**): $p < 0.05$, (***): $p < 0.1$

The results indicate that when estimation relies on timing restrictions, the impact effects are biased toward zero—a bias that is more pronounced for variables that are highly procyclical. The IRFs from the Proxy-SVAR are statistically significant at the 99% confidence level, whereas in the Cholesky-SVAR only the core inflation response is significant, and only at the 95% level. These differences are especially notable in the estimated IRFs for GDP and the trade balance. For GDP, the IV estimate is ten times larger (in absolute value) than its Cholesky counterpart, while for the trade balance it is six times larger. Both differences are statistically significant at the 99% level. In contrast, the difference in core inflation responses is relatively small and statistically insignificant. Figure 8 illustrates how these estimation approaches yield different IRF dynamics across variables.

Figure 8: Cholesky-Identified SVAR Impulse Responses



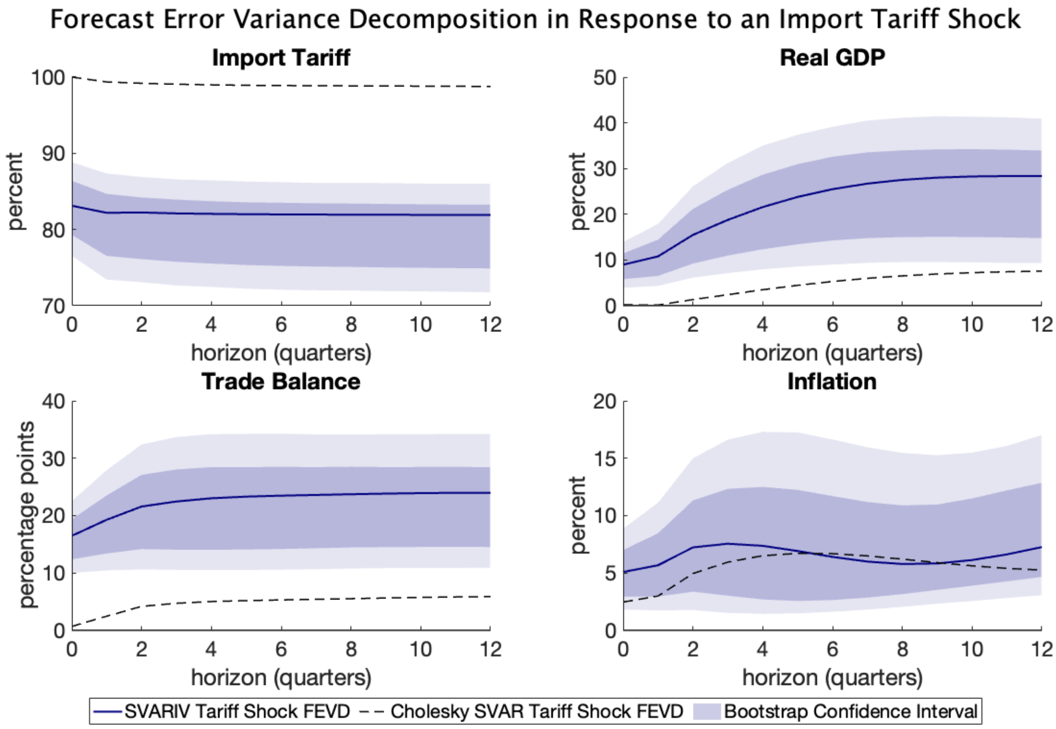
Notes: Impulse responses of the Cholesky-identified SVAR to a one standard deviation shock to import tariffs, shown over a three-year forecast horizon. Confidence intervals are reported at the 68% and 90% levels, based on 10,000 replications of the recursive wild bootstrap. Dashed lines indicate the Proxy-SVAR impulse responses, included for comparison.

The large differences in the impact effects are also reflected in the dynamic responses of the variables in the model. For GDP, the gap between the two IRFs peaks in the fourth quarter and does not begin to close until the third year, highlighting a significant divergence between the two estimation methods. For the trade balance, the discrepancy is concentrated in the impact effect, whereas for inflation, the differences are comparatively minor.

4.2 Forecast Error Variance Decomposition

The forecast error variance decomposition (FEVD) quantifies the extent to which the import tariff shock contributes to the forecast error variance of the other variables in the SVAR, serving as a measure of the identified shock's explanatory power. Figure 9 plots the FEVD for each of the four variables in the SVAR and compares them to those from the Cholesky-identified model.

Figure 9: Tariff Shock Forecast Error Variance Decomposition



Notes: Forecast error variance decomposition (FEVD) of the Proxy-SVAR in response to an import tariff shock, shown over a three-year forecast horizon. Confidence intervals are reported at the 68% and 90% levels and are computed using 10,000 replications of the recursive wild bootstrap. Dashed lines from the Cholesky-identified SVAR are included for comparison.

The Cholesky SVAR explains the totality of the contemporaneous variation in tariffs, compared to 83% in the Proxy-SVAR—consistent with the latter capturing a contemporaneous feedback effect. For the other variables, the import tariff shock explains a larger share of the forecast error variance in the Proxy-SVAR than in the model with timing restrictions. Averaging across forecast horizons, the tariff shock accounts for 22% of GDP variation in the Proxy-SVAR, compared to only 5% in the Cholesky-identified model. Similarly, it explains 23% of the trade balance variation, dropping to 5% under timing restrictions that ignore the countercyclical pattern. For core inflation, the differences are minor: the baseline model explains 6% of the variance, while the Cholesky model explains 5%. In all cases, however, the FEVD is statistically significant and higher in the Proxy-SVAR than in the model identified through timing assumptions.

Comparing this result to other identified shocks in the broader literature, the contribution to GDP is sizable. For instance, Caldara and Herbst (2019) find that monetary policy shocks explain up to 20% of the variation in industrial production—comparable to the contribution found here. Nonetheless, caution is warranted in interpreting these figures, as the analysis is based on a small-scale model; the variance shares could differ in a larger or more detailed specification.

4.3 Comparison with the Literature

The most direct sources for comparison are Barattieri et al. (2021) and Furceri et al. (2021). The two key variables used for this comparison are real GDP and the trade balance, as both are included in the baseline specifications of those studies.[13] Table 7 summarizes the impact effects, peak responses, and the quarters in which these occur for both real GDP and the trade balance under each methodology. For consistency, the comparison is limited to the first three years of the forecast horizon.

Table 7: Comparison with the related literature

	Panel A: GDP			Panel B: Trade balance		
Methodology	Impact	Peak	Quarter	Impact	Peak	Quarter
Baseline results	-0.20 (*)	-0.55 (*)	4	-0.24 (*)	-0.24 (*)	**0**
Baratieri et al.	0.02	-0.12 (*)	2	0.03	0.08	4
Furceri et al. OLS	0.05	-0.24	12	-0.10	-0.10	0
Furceri et al. IV	0.39 (*)	-0.59	12	-0.27	-0.27	0

Notes: (*): $p < 0.01$. This is the only significance level available in the literature.

The results of this paper are larger and more persistent than those in Barattieri et al. (2021), and comparable in magnitude to the IV estimates reported by Furceri et al. (2021), though the effects identified here materialize in the short run. In terms of GDP, and compared to Barattieri et al. (2021), the impact effect is 0.02%, and the peak decline level reaches 0.12% in the second quarter, quickly dying out thereafter. Compared to Furceri et al. (2021), the results are similar in magnitude to their IV estimation but with peaks occurring in the short run, during the first year after the shock. Their impact effect is positive, and the peak decline levels are experienced in the third year after the shock—0.24% and 0.59% for the OLS and IV IRFs, respectively. It is important to note that at these forecast horizons, the IRFs are not significant, but this changes from the fourth year onward (not considered in this analysis). It is also important to highlight the sharp difference in the impact effect: while in both papers these are positive, the baseline result of this paper shows they are negative and significant.

[13] In terms of the sample period, Barattieri et al. (2021) use the same Canadian dataset as this paper, but their IRFs are based on a one standard deviation shock to the number of products involved in new investigations. Furceri et al. (2021), on the other hand, focus on a panel of countries and use tariff data at lower frequencies. Their IRFs are simulated as responses to a one standard deviation shock over a five-year forecast horizon.

The trade balance effect in both papers is insignificant. In Barattieri et al. (2021), the impact effect is positive and remains at a relatively flat level of 0.05 pp for the remaining periods. For Furceri et al. (2021), however, the impact effect (and also the peak levels) of both OLS and IV estimations are negative, -0.10 and -0.27 pp, respectively. The deterioration of the trade balance in the short run is consistent with the baseline results, though they do not identify the strong anticipation pattern that we find in the data. This can be attributed to differences in the tariffs used in the analysis.

Finally, two concerns are worth considering when comparing these results to the related literature. Regarding Barattieri et al. (2021), as shown in this paper, the product measure is not a reliable proxy for import tariffs. As a result, the identified shock cannot be interpreted as a true tariff shock, given the different dynamics exhibited by the two measures.

The second concern relates to the exogeneity condition of the IV approach used in Furceri et al. (2021). Their instrument—the weighted average of tariff changes by a country's closest trading partners—may capture endogenous interactions during periods of global economic distress. In such times, countries are more likely to implement protective trade policies, undermining the exogeneity between tariffs and domestic GDP. This issue is particularly relevant during the Great Financial Crisis, when only protective tariffs were raised. By contrast, our instrument isolates the exogenous component of tariffs and, therefore, avoids contamination from such episodes.

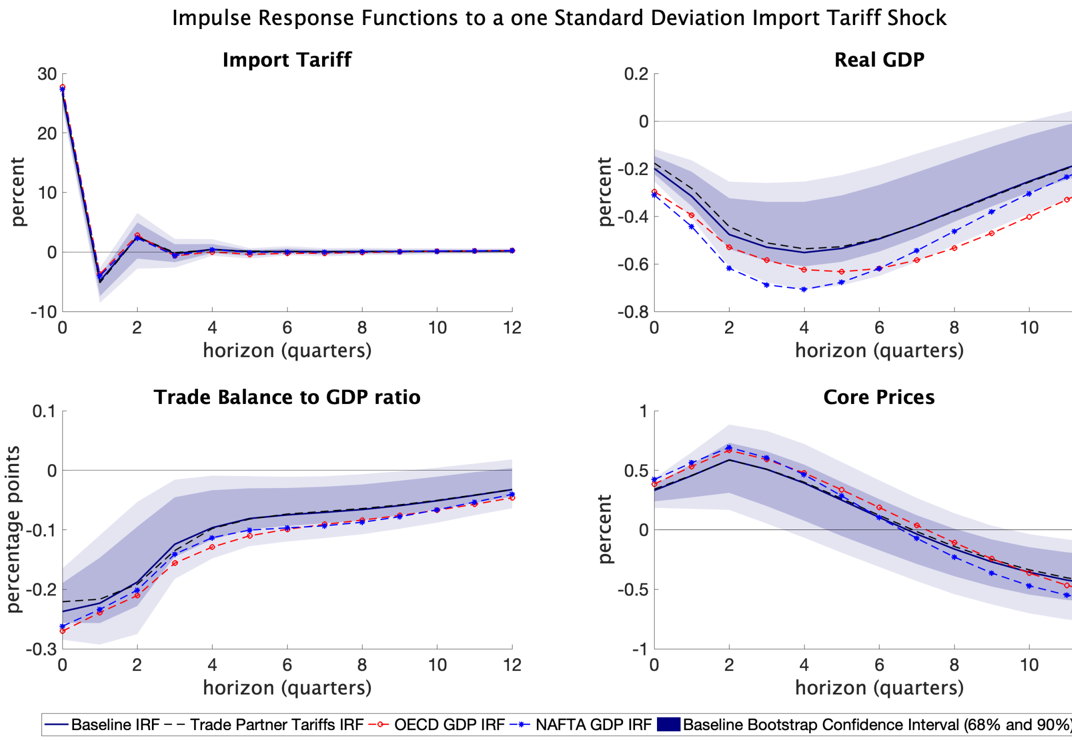
5 Robustness Checks

This section assesses the robustness of the baseline results across several alternative specifications: (i) controlling for foreign variables; (ii) controlling for other economic shocks; (iii) varying the lag structure of the SVAR; (iv) exploring alternative detrending methodologies; and (v) estimating the SVAR in first differences.

5.1 Controlling for Foreign Tariffs and GDP

The variables in the SVAR also depend on the actions of trading partners—namely, foreign tariffs, T_t^*, and foreign GDP, Y_t^*. Foreign duties are constructed using the tariffs imposed on Canada and are aggregated to the quarterly level using constant import-share weights. For foreign GDP, we use the level of OECD real GDP. As an alternative, given that a large share of Canada's trade occurs within the North American Free Trade Agreement (NAFTA), I also consider the real GDP of the NAFTA region (excluding Canada). Figure 10 shows that the results remain robust when controlling for foreign tariff and GDP shocks.

Figure 10: Controlling for Foreign Tariffs and GDP Impulse Responses



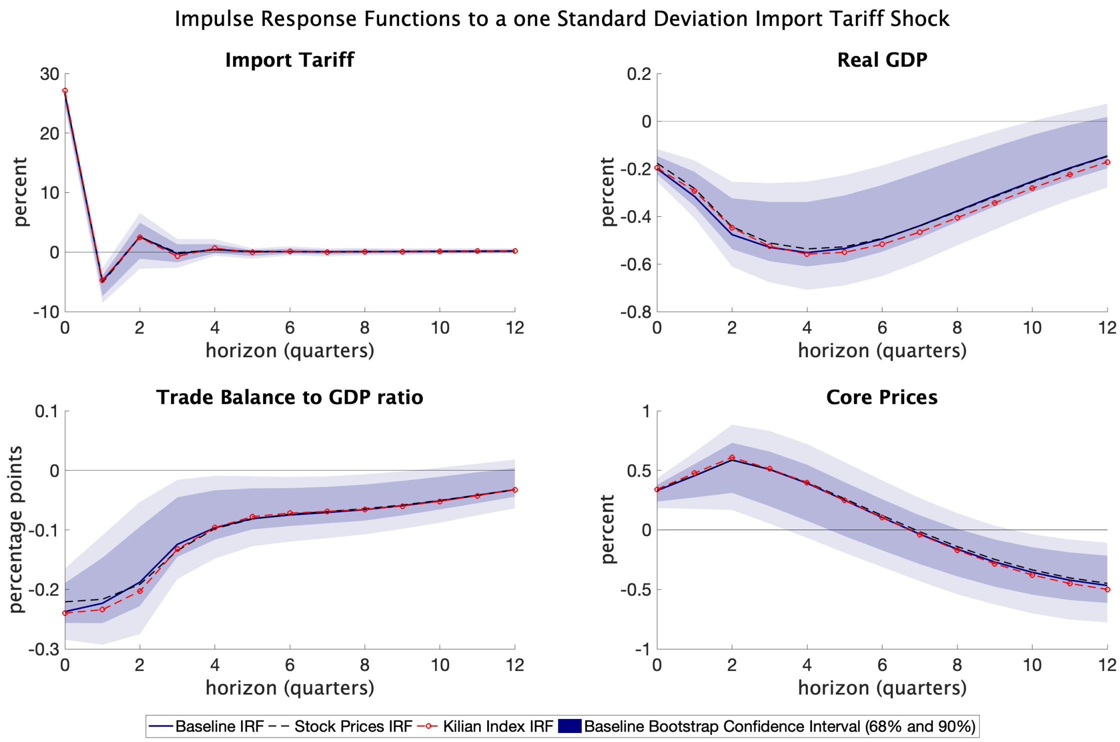
Notes: Impulse responses of the Proxy-SVAR to a one standard deviation shock to import tariffs, shown over a forecast horizon of three years. Confidence intervals at the 68% and 90% levels are reported for the baseline model and are computed using 10,000 replications of the recursive wild bootstrap. Dashed lines correspond to the IRFs of alternative specifications.

The results are broadly consistent with those obtained in the baseline model. When foreign tariffs are included in the SVAR, the impulse responses remain nearly identical to the original estimates. A similar pattern holds when accounting for global shocks. However, both OECD and NAFTA GDP controls yield slightly larger effects on domestic GDP, particularly in the case of NAFTA, where the IRF reaches its highest level during the first year after the shock. Despite these minor differences, the overall conclusions remain robust across all specifications. Importantly, the fact that the main results hold even after controlling for global shocks suggests that the instrument is indeed capturing exogenous variation in tariffs—independent of whether these shocks are explicitly included in the model.

5.2 Controlling for Other Shocks

Another concern is that import tariffs may be imposed in anticipation of future economic conditions not captured by the SVAR. To address this issue, I incorporate forward-looking variables that may reflect such expectations. Specifically, I include two leading indicators: Canadian stock prices and an index of global economic activity based on industrial commodity markets. The latter, developed by Kilian (2019), is designed to capture global economic dynamics not fully reflected in contemporaneous GDP levels. Figure 11 presents the impulse response functions (IRFs) after controlling for these variables.

Figure 11: Controlling for Other Shocks Impulse Responses



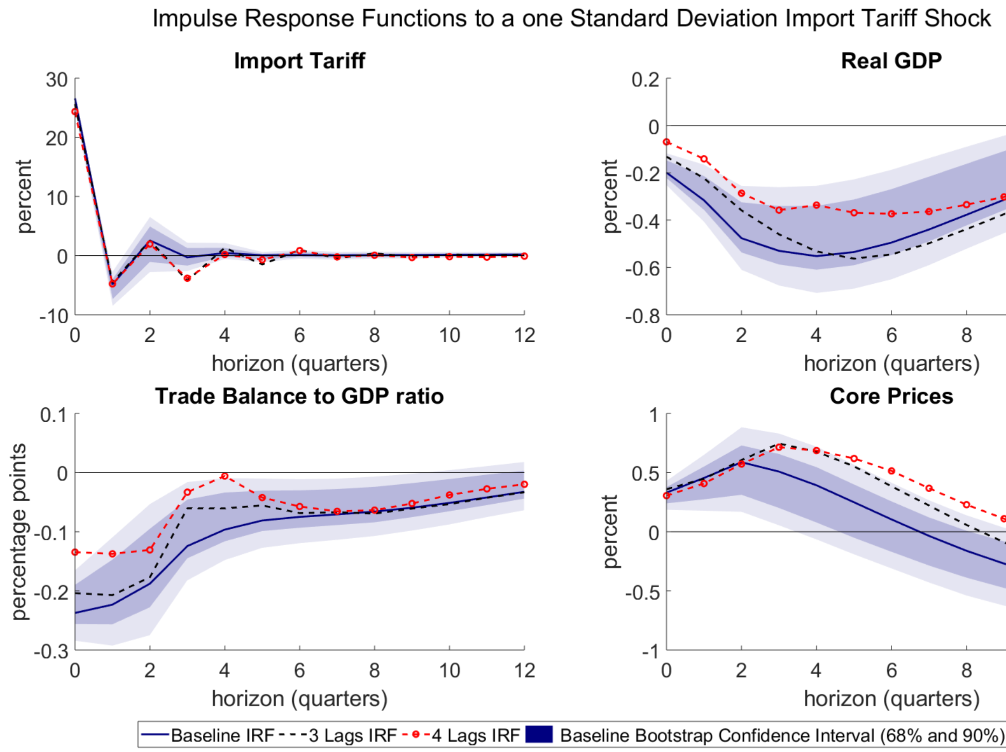
Notes: Impulse responses of the Proxy-SVAR to a one standard deviation shock to import tariffs, shown over a forecast horizon of three years. Confidence intervals at the 68% and 90% levels are reported for the baseline model and are computed using 10,000 replications of the recursive wild bootstrap. Dashed lines correspond to the IRFs of alternative specifications.

Including either stock prices or the index of future economic conditions does not alter the main conclusions of the baseline results. The impulse response functions (IRFs) remain largely unchanged, suggesting that these forward-looking variables do not materially affect the estimated effects.

5.3 Changing the Lag Structure

I also estimate the model using alternative lag structures to assess the sensitivity of the results to this specification choice. While the baseline model employs a short-dimension VAR selected based on information criteria, a common rule of thumb is to use four lags for quarterly data. Figure 12 displays the impulse responses for each variable under specifications with two, three, and four lags.

Figure 12: Impulse Responses with Different Lag Structures



Notes: Impulse responses of the Proxy-SVAR to a one standard deviation shock to import tariffs, shown over a forecast horizon of three years. Confidence intervals at the 68% and 90% levels are reported for the baseline model and are computed using 10,000 replications of the recursive wild bootstrap. Dashed lines correspond to the IRFs of alternative specifications.

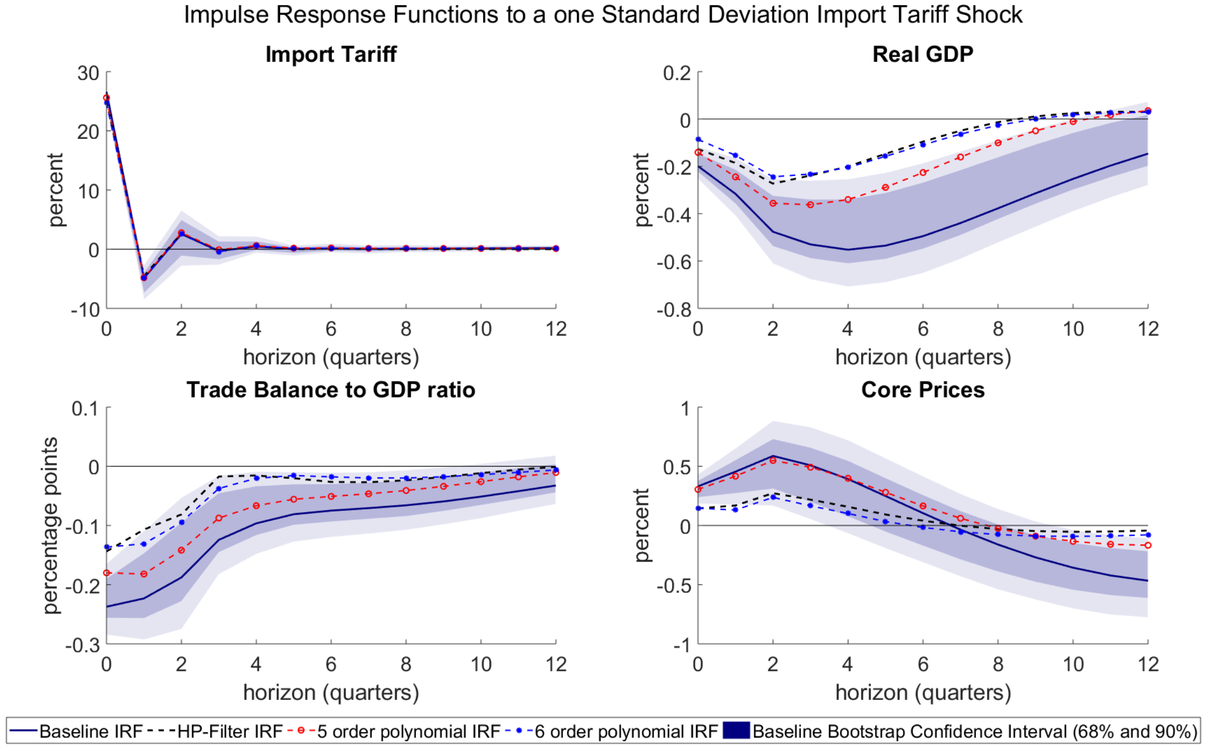
The results remain robust across all lag specifications. In each case, the tariff shock leads to a significant contraction in GDP and a deterioration of the trade balance, while inflation increases in the short run. These patterns are consistent with the baseline findings, suggesting that the dynamic responses of the macroeconomic aggregates are not sensitive to the choice of lag length in the SVAR model.

5.4 Changing the Detrending Methodology

The baseline results are computed using a fourth-order polynomial, as lower-order specifications fail to capture key features of the Canadian business cycle. To assess the robustness of the detrending approach, this exercise compares alternative methods. Figure 13 presents the results obtained using fifth- and sixth-order polynomials, as well as the Hodrick-Prescott (HP) filter.[14]

[14]The smoothing parameter for the HP filter is set to 16,000, which is standard for quarterly data.

Figure 13: Impulse Responses with Different Detrending Methods



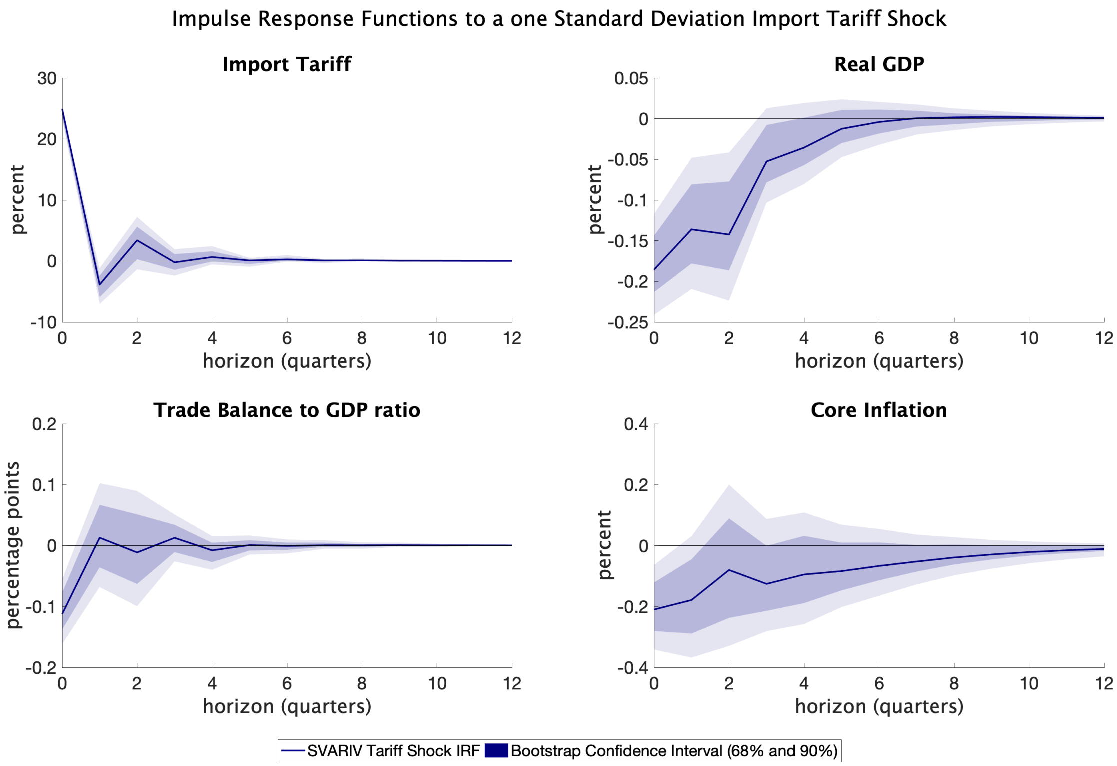
Notes: Impulse responses of the Proxy-SVAR to a one standard deviation shock to import tariffs, shown over a forecast horizon of three years. Confidence intervals at the 68% and 90% levels are reported for the baseline model and are computed using 10,000 replications of the recursive wild bootstrap. Dashed lines correspond to the IRFs of alternative specifications.

The main conclusions remain robust across different detrending methods. While some impulse response functions (IRFs) exhibit slightly lower magnitudes, they consistently show that import tariffs are contractionary.

5.5 Estimation in First Differences

An alternative way to carry out the estimation is to treat the variables in differences. In this case, the model is $A_0 \Delta Y_t = A(L) \Delta Y_t + \varepsilon_t$. The main drawback of this estimation is that any medium- or long-run relationships between the variables are lost. Indeed, the difference estimation only depicts the short-run effect of each variable and, therefore, the results are less persistent compared to the baseline model. Figure 14 shows the IRFs of the variables estimated in first differences.

Figure 14: Impulse Responses from Estimation in Differences



Notes: Impulse responses of the Proxy-SVAR to a one standard deviation shock to import tariffs, shown over a forecast horizon of three years. The IRFs correspond to the baseline model variables expressed in first differences. Confidence intervals are reported at the 68% and 90% levels and are computed using 10,000 replications of the recursive wild bootstrap.

The IRFs of the model in first differences indicate a significant contraction in both GDP and the trade balance. The GDP response exhibits a similar impact effect to the detrended specification and returns to its original level within six quarters. The trade balance also shows a negative impact that is quickly reversed. In both cases, the results confirm the conclusions of the baseline model. The response of inflation, however, moves in the opposite direction and is inconsistent with previous findings. Nevertheless, as noted earlier, this result should be interpreted with caution, as first-differencing removes the persistence component inherent in the original series.

6 Conclusion

The countercyclical profile of import tariffs presents a challenge for identifying exogenous tariff shocks at the aggregate level. Econometric estimations that fail to account for the simultaneous relationship between import duties and real activity tend to be biased toward zero.

This paper proposes a novel approach to address this problem. Using a database of temporary trade barriers, I construct an instrument that is correlated with import tariff shocks but orthogonal to business cycle fluctuations. This is achieved by decomposing aggregate duties into an endogenous protectionist component and an exogenous retaliatory component. Employing the latter as an instrument within a Proxy-SVAR framework enables the identification of an exogenous shock. The resulting impulse responses are sharp, persistent, and peak during the first year after the shock. The effect on GDP is a 0.2% decline on impact, reaching approximately 0.6% by the fourth quarter. In terms of the trade balance, the shock generates an immediate deterioration consistent with anticipation behavior and induces short-run inflation. Furthermore, the contractionary effects of import tariff shocks remain robust across various specifications.

Compared to models that impose timing restrictions—where tariffs are ordered first in the SVAR—the impulse responses in the Proxy-SVAR are significantly larger in absolute terms. Ignoring the feedback effect leads to coefficient estimates that are biased toward zero. This discrepancy is also reflected in the forecast error variance decomposition: while the tariff shock in timing-identified models explains only about 5% of the variability in GDP and the trade balance, the baseline results indicate a substantially higher explanatory power of approximately 22%.

The effects on GDP are larger and more persistent than those reported in the related literature. These differences can be attributed to two key improvements in this paper: first, it directly uses the implied tariff rate rather than relying on the number of products involved in new investigations; and second, it explicitly accounts for the simultaneity between tariffs and real activity. Furthermore, in contrast to studies using customs duties at lower frequencies, the baseline results presented here show that the contractionary effects of tariff shocks materialize primarily in the short run—within the first year after the shock.

There is ample scope for future research in this area. While this paper relies on an external instrument to achieve identification, alternative strategies could complement and extend the analysis. For instance, one promising direction would be to embed retaliation within a fully structural model, where it arises endogenously from strategic interactions between trading partners and governments respond optimally to foreign tariff actions. Such a framework would not only validate the empirical patterns found here but also allow for rich counterfactual analysis of trade wars and optimal policy design under various institutional rules.

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A Appendix A: Data description

This section provides a brief description of the variables used in the estimation and their sources:

Real GDP: Taken from the OECD quarterly national accounts database. In particular, we use the VPVOBARSA measure.

Real trade balance: Taken from the OECD quarterly national accounts database. Specifically, the measure used is VPVOBARSA.

Core CPI: Taken from the OECD prices database. It reflects the price level excluding the energy and food sectors. Although it is not seasonally adjusted, we deseasonalized it using X-13ARIMA.

Real effective exchange rate: Taken from the Bank for International Settlements. Quarterly series are constructed using the value from the last month of each quarter.

Interest rates: Taken from the OECD main economic indicators. It corresponds to the interbank overnight interest rate and is used as a proxy for the policy rate.

Investment: We use the real Gross Fixed Capital Formation (GFCF) series taken from the OECD quarterly national accounts.

Private consumption: We use the real private consumption series taken from the OECD key economic indicators.

Unemployment rate: Taken from the OECD labour market statistics. Quarterly series are constructed by taking the value from the last month of each quarter.

Labour productivity: Taken from the OECD productivity statistics. This variable measures GDP per employed worker.

Import tariffs: Tariff information is obtained from the Temporary Trade Barriers Database. To construct quarterly series, we take a weighted average of the ad-valorem duties from each investigation in a given quarter. To do this, we employ constant shares based on the import distribution at the product level in the year 2010.

Traditionally, tariff information can be recorded in two formats: ad-valorem or specific duties. The latter is more commonly used by developing countries and was also prevalent during earlier periods in developed economies. This creates a challenge for constructing a normalized aggregate measure of tariffs, as specific duties must be expressed as a percentage of the price.

For Canada, most tariffs are expressed in ad-valorem terms. However, to increase coverage, we converted some of the earlier specific duties into ad-valorem equivalents. This was done by analyzing each case using official Canadian records available from the Canada Border Services Agency (CBSA) and re-expressing those for which sufficient detail was available.

Another concern is the type of tariff used in the analysis. When a product is taxed, two tariffs can be applied: preliminary or final. The former is usually imposed near the date the investigation is opened and reflects the estimated dumping margin. The median duration of an investigation is around 90 days, after which a final duty is imposed, typically corresponding to the adjusted dumping margin estimate. Normally, the difference between preliminary and final tariffs is small, averaging around four percentage points.

For construction purposes, we use a combination of criteria based on these two types. When only preliminary or final duties are available, we use that value. If both have non-zero entries, we compare them with an additional source that contains the estimated dumping margins of the foreign firms. We then select the source closest to the dumping margin. On average, this is not a major concern, as the differences are relatively small. However, when differences are large and exceed a certain tolerance level, we consult the official records to determine which is closer to the true dumping margin.

B Appendix B: Exogeneity condition tests

Controlling for the variables used in the baseline VAR does not change the main conclusions. Protectionist tariff levels are higher in recessions than in expansions, while retaliatory tariffs do not respond to the stage of the business cycle.

Table 8: Tariff components and business cycle behavior: with controls

Series	Indicator	Coefficient	SE
Import Tariffs	Contractions (OLS)	6.8	4.97
	Contractions (Probit)	0.09	0.11
Protectionist tariffs	Contractions (OLS)	11.8 (***)	4.53
	Contractions (Probit)	0.18	0.12
Retaliatory tariffs	Contractions (OLS)	-2.2	3.90
	Contractions (Probit)	-0.07	0.11

Note: (*): $p < 0.01$, (**): $p < 0.05$, (***): $p < 0.1$

The predictability tests are carried out following Cloyne (2013). I present a VAR Granger causality test and a Probit regression using the same variables as in the Granger test, with the dependent variable being an indicator for whether a tariff is imposed in a given quarter. These tests are run separately for each tariff component to assess whether the parameters associated with GDP are significantly different from zero. As in the baseline model, I use two lags for each variable.

Table 9: Tariff components and business cycle behavior: predictability tests

Series		Test statistic	p-value
Protectionist tariffs			
	Granger Causality	7.7	0.06 (*)
	Probit Model	9.2	0.03 (**)
Retaliatory Tariffs			
	Granger Causality	0.7	0.87
	Probit Model	2.3	0.51

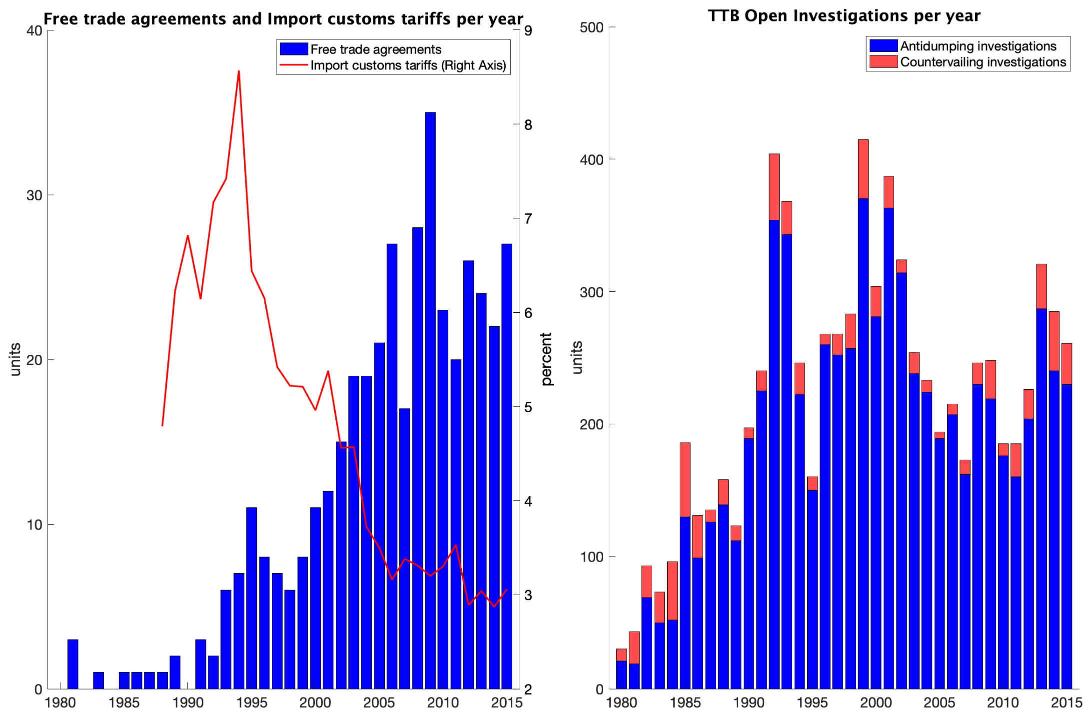
Note: (*): $p < 0.01$, (**): $p < 0.05$, (***): $p < 0.1$

The results show that the null hypothesis is rejected for both tests in the case of protectionist tariffs. This implies that past economic conditions help predict the current level of these tariffs, both at the intensive and extensive margins. In contrast, neither test finds evidence that retaliatory tariffs are predicted by past GDP levels. These findings further support the assumption that retaliatory tariffs serve as a source of exogenous variation suitable for identifying the effect of import tariffs.

C Appendix C: Other Figures

C.1 Custom Duties and Temporary Tariffs

Figure 15: Evolution of Custom Duties and Temporary Tariffs



C.2 Investigation stages

Raising an investigation involves a three-stage procedure:

Figure 16: Stages of the Investigation Process