Exchange Rates in the Age of Protectionism *

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February 5, 2025

Abstract

To what extent can exchange rates offset the effects of trade interventions? This paper quantifies the impact of trade protectionist measures (both tariff and non-tariff) on the exchange rate using a daily global trade policy actions database combined with sector-level trade data. By constructing an accurate measure of trade policy shocks at the sector level, our approach allows a precise quantification of the exchange rate offset of trade interventions on both countries that are directly targeted, as well as others that are affected indirectly via Global Value Chains (GVCs). Panel estimation results show that 1) a uniform one percent increase in import tariffs is offset by a 0.05-0.1 (direct target), or 0.04-0.07(GVC spillover) percent appreciation of the home currency 2) non-tariff barriers have a larger impact on the exchange rate movements, and 3) the exchange rate responds differently to tariff announcements versus actual inception, with the home currency depreciating in between the announcement and the inception date. We build a simple three country New-Keynesian DSGE model to rationalize these findings.

KEYWORDS: Trade Policy, Exchange Rates, Global Value Chains, Tariffs Non-Tariff Barriers, Local Projections.

JEL CLASSIFICATION: F13, F12, F49

*We are grateful to Valentina Bruno, Camila Casas, Oleg Itskhoki, Adrian Peralta-Alva, Pau Rabanal, Jeongwon Son, and Yipei Zhang for comments, and Ana Francesca Rosales and Joseph Mariasingham from the Asian Development Bank for their generous guidance on helping merge the GTA and ADB MRIO databases. The views expressed here are those of the authors and do not necessarily correspond to those of the International Monetary Fund.

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I Introduction

The relationship between trade barriers and exchange rates has been a core subject on inquiry in international economics for decades. Dornbusch (1974)'s influential work highlighted the important role that trade barriers, such as tariffs, can play in affecting the exchange rate. In a general equilibrium model, import tariffs, for example, make foreign goods more expensive relative to domestic goods, shifting demand towards the latter. This increase in demand for domestic goods tends to cause an appreciation of the tariff imposing country's currency. Taking this insight further Krugman (1982) demonstrated in a Keynesian framework that under floating rates, protectionist trade measures are often found to have a contractionary effect due to a contraction in total demand, which outweighs the direct impact of a tariff in redirecting spending towards domestic goods.

Despite these seminal theoretical contributions made a while back, very few empirical studies have been conducted to examine the relationship. There are two major constraints that limit such exercises. First, bilateral trade volume and price data are usually available only at low frequency - updated typically on an annual basis. According to the Dornbusch (1974) model, the response of the exchange rate to changes in tariffs occurs more swiftly in the short term than in the long term, as a result of the existence of price rigidity in the economy. Second, trade restrictions are often imposed on specific sectors and goods, making it challenging to examine using aggregate trade or production data. Deterrence and diversionary effects of tariffs and the complexity of non-tariff barriers such as quotas, licenses, and regulations further complicate empirical analysis (Goldberg & Pavcnik, 2016).

In this paper, we revisit this question of how much trade barriers are offset by exchange rate movements daily bilateral trade announcements and trade volume data from 69 countries. Our unique dataset allows us to have an accurate measure of trade barrier shocks, which overcome the two constraints mentioned above. Importantly, our empirical analysis goes beyond simply examining exchange rate movements and bilateral trade measures and delves into the second-round effects of trade shocks that propagate through global value chains (GVCs). To our knowledge, this is the first paper to undertake such an endeavor.

Our paper makes at least three contributions to the existing literature on the trade barriers' impact on the exchange rate. First, we use a unique daily trade policy announcement database from the Global Trade Alert (GTA) database to accurately quantify the exchange rate response to tariffs. To estimate the daily impulse response function of the exchange rate to trade shocks, we apply an augmented Jordà and Taylor (2016) panel local projections (LP) method similar to Teulings and Zubanov (2014). For tariffs,

we measure shocks at the sector level, taking into account changes in both the "share" of sectors and the "shift" of tariffs using unpublished data from the GTA to allow us to provide the most accurate capture of the shocks. Second, we explore the response of exchange rates to both *anticipatory tariffs* and the *actual inception of tariffs*, demonstrating that these two types of shocks have unique impacts on exchange rate movements. Lastly, while the majority of our paper focuses on the impact of tariffs on the exchange rate, we expand our analysis to also examine the exchange rate response to non-tariff shocks when these shocks can be accurately measured.

The key findings can be summarized as follows. First, the exchange rate typically responds to offset between 1/20 to 1/10 of the impact of a tariff change on average. Second, non-tariff barriers have a greater impact on exchange rate movements than tariff measures, even though tariffs remain the most common type of interventions used in our sample. Third, in cases where there is a lag between the announcement and implementation of a trade policy, the exchange rate moves in the opposite direction following the announcement vs implementation dates. For example, following a tariff increase intervention, the exchange rate of the home to foreign currency initially depreciates persistently after the announcement date, with exchange rate appreciation only occurring after the policy starts to take effect. This suggests the presence of front-loading on the back of tariff announcements before actual implementation.

The remainder of the paper is structured as follows. This section concludes with a review of the related literature and where our contribution fits in. We introduce a theoretical framework of the exchange response to trade interventions in Section II. Section 3 provides a detailed description of the data used in our analysis and our weighting strategies for computing and aggregating trade measure shocks. In Section 4, we present our methodology and identification strategy for estimating the bilateral exchange rate response to trade interventions. Section 5 summarizes the main findings. In section 6, we offer concluding remarks and highlight the future research agenda.

Literature Review

This paper relates to several strands of literature. The first and closest link is to the vast literature on the relationship between trade policy and exchange rate movements. Using a high frequency database od US-China tariffs-related news, Jeanne and Son (2020) found evidence of US/CNY exchange rate appreciation following an increase in import tariffs announced by the US. Using annual tariff data, Furceri et al. (2019) find the real exchange rate of the country that implements tariffs to appreciate over a horizon of 3 years.

The analysis of of non tariff barries (NTB) in this literature has also witnessed a rise following an increase in trade policy announcements in recent years. Barattieri et al. (2021) use trade policy data from the Global Antidumping Database to analyze the dynamic effects of trade barriers. They show that restrictive trade policy shocks reduce output and raise prices while strengthening the trade balance at least modestly.

In contrast, some studies suggest that even under a floating exchange rate regime, the exchange rate fails to adjust following the tariff interventions. Amiti et al. (2019) and Fontagné et al. (2018) found there to be a complete pass-through to domestic price by tariffs introduced by the USA, hence jeopardizing the consumers' welfare.

The difference between our paper and the previous studies is that we use cross-sectional and high-frequency trade policy data of 69 economies to examine the exchange rate response to tariffs and NTB(s).

This paper also connects to the theoretical and quantitative studies on the macroeconomic impact of trade interventions. Recent studies by Lindé and Pescatori (2019) and Erceg et al. (2018) analyze the short-run macroeconomic effects of trade policy in a dynamic New Keynesian open-economy framework, where import tariffs and export subsidies are expected to trigger only a partial exchange rate offset. This paper contributes to the literature by addressing the aforementioned question empirically, and by providing a quantification of the degree of exchange rate offset in response to trade policy shocks.

Our study also contributes to the burgeoning literature that distinguishes between anticipatory tariffs and tariff implementation, and their distinct implications on various economic factors. The extant literature underscores the potential impacts of these two trade policy approaches on trade flows, investment, consumer behavior, and economic growth. Anticipatory tariffs, which are announced in advance of actual implementation, can introduce trade distortions. Notably, trade frontloading may occur, wherein importers expedite their imports to avoid impending tariff hikes (Bown & Zhang, 2019; Khan & Khederlarian, 2021a). Conversely, tariff implementation, which refers to the actual enforcement of tariff measures, can induce trade diversion. In this case, trading partners reallocate their sourcing to countries that are not subject to tariffs (Amiti et al., 2019). Moreover, anticipatory tariffs can engender uncertainty among businesses and trade partners, prompting firms to postpone or abandon investments (Handley & Limão, 2017; Pierce & Schott, 2020). In light of these insights from the literature, our paper concentrates on scrutinizing the differential exchange rate reactions to anticipatory tariffs and tariff implementation. By doing so, we seek to enrich the understanding of the nuances between these trade policy approaches and their implications for exchange rate dynamics.

II Theoretical Framework

We employ a simple general equilibrium model to examine the exchange rate response to a trade policy shock that is analogous to import and export tariffs. it is based on the framework of Dornbusch (1974), and features a small open economy that both produces and consumes goods produced domestically and abroad. We extend the Dornbusch (1974) model to include other types of trade policy interventions, which are treated as additional costs that deviate from the home country's terms of trade with the world.

We assume that the small open economy in consumes both importable and exportable goods and takes the prices of traded goods as given. Additionally, we assume that the relative prices of both traded goods are flexible, allowing the market for non-traded goods at home to clear.

Consider an equilibrium condition in the market for home goods. The excess demand for non-traded home goods (N) is a function of the relative prices of importables and exportables in terms of home goods (P_m and P_e, respectively) and a real income measured in home currency (I). In equilibrium, market clearing implies that the excess demand for non-tradable goods is zero.

$$N(P_m, P_e, I) = 0 \tag{1}$$

Let $P*$ be the (exogenous) world terms of trade. The domestic terms of trade in turn is then determined by the given world terms of trade times a trade cost costs induced by trade policy interventions T.[1]

$$\frac{P_m}{P_e} = P^* T \tag{2}$$

Here, $T > 1$ if trade policy costs are imposed on imports (i.e. import tariffs, import bans, import quotas). Likewise, $T < 1$ if the trade policy costs are imposed on export goods (i.e. export tariffs, export bans)

The budget constraint of the households is:

$$P_e(E - P^* M) - N = 0 \tag{3}$$

Where M and E denote domestic imports and exports respectively. We then assume that trade policy interventions are only proportional in terms of the total volume of the trade, yielding zero net income effects. After differentiating the market equilibrium condition in equation 1, we have:

[1] In this illustrative model we abstract from other sources of trade costs including transaction costs.

$$\theta_m \hat{P}_m + \theta_e \hat{P}_e = 0 \tag{4}$$

Where θ_m and θ_e represent excess demand elasticities of home goods with respect to the relative prices of importables and exportables respectively. $\hat{P}_m$ and $\hat{P}_E$ are the proportional changes in the relative price of home export and import goods.

To differentiate equation 2, we have:

$$\hat{P}_m - \hat{P}_e = \hat{T} \tag{5}$$

Substituting equation 5 in equation 4, we have:

$$\hat{P}_m = \frac{\theta_e}{\theta_m + \theta_e} \hat{T} \tag{6}$$

And:

$$\hat{P}_e = -\frac{\theta_m}{\theta_m + \theta_e} \hat{T} \tag{7}$$

Let us consider the case where non-traded home goods and traded goods are substitutes, resulting in positive values for θ_m and θ_e. In equilibrium, the trade policy costs are passed on to both import and export prices.

If $\hat{T} > 0$, trade costs are imposed on importable goods. Consequently, the relative price of importables will increase in terms of home goods, while the relative price of exportables declines in terms of home goods.

On the other hand, if $\hat{T} < 0$, trade costs are imposed on exportable goods. In this scenario, the relative price of exportables will increase in terms of home goods, while the relative price of importables declines in terms of home goods.

Exchange Rate Adjustment

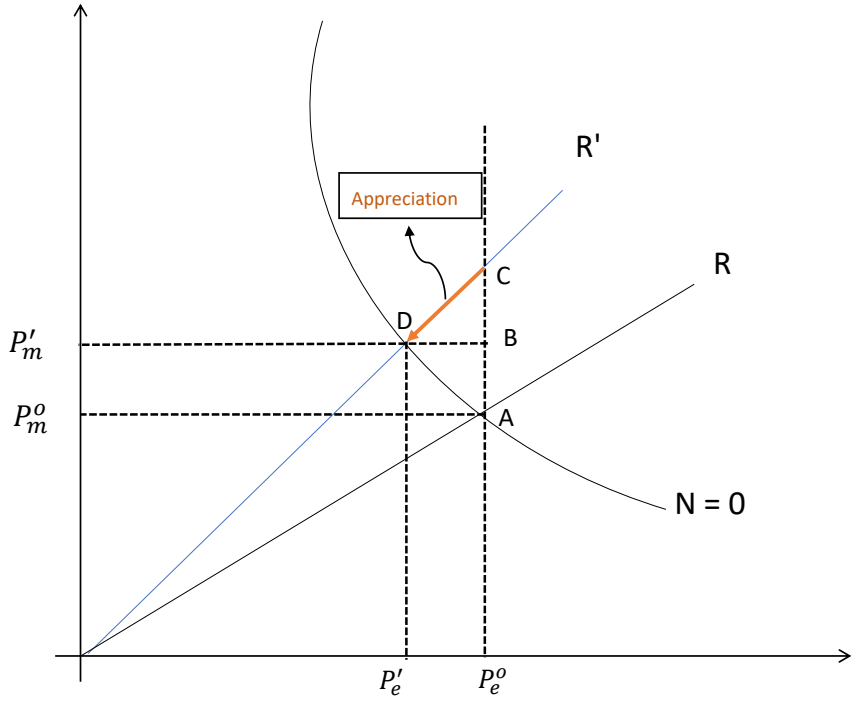
Figure 1 depicts the influence of trade interventions on exchange rate adjustments when $\hat{T} > 0$, with a specific focus on the imposition of trade protection policies, such as import tariffs, by the home country. The downward-sloping line $N = 0$ represents the trade balance equilibrium, as determined by equation 3. Meanwhile, the terms of trade are illustrated by OR, which will shift to OR' in response to trade policy shock costs (T) associated with import tariffs.

As shown in the figure, the equilibrium of traded goods moves from A to D via a two-step process when import tariffs are introduced. Initially, the price of importable goods increases in terms of home goods, causing the economy to move from A to C.

At point C, there is an excess demand for home goods, resulting in an adjustment that moves the economy to D - the new equilibrium. Given that the price of home goods remains fixed and assuming that the central bank maintains a targeted inflation rate, the exchange rate must appreciate - enabling the aforementioned adjustment to take place.

Conversely, when $\hat{T} < 0$, indicating the imposition of trade policy costs on exportable goods, Figure 1 may be interpreted by simply reversing the X-Y axis. The equilibrium of traded goods can be decomposed into two steps: the first involves a movement from A to C, suggesting a trade balance deficit, while the second entails an adjustment from C to D, indicating a currency depreciation.

Figure 1: Trade Policy Cost on Imports: Exchange Rate Adjustment



III Quantifying Trade Intervention Shocks

This section describes the main data sources used in our empirical analysis and discusses the quantification of the trade policy shock. Further details on the data set mapping and construction are available in Appendix A.

III.A Data

Global Trade Alert

The main data source for this analysis is the Global Trade Alert (GTA), which provides comprehensive coverage of 30+ types of trade-discriminatory and trade-liberalizing measures enacted by 195 economies since November 2008 at daily frequency.[2] The GTA documents each action at a highly disaggregated level, including affected sectors on Harmonized System 12 (HS12) 6 digit level, and each action's announcement and inception date. The GTA is extensively managed by global trade policy experts who monitor the announcement of a government initiative and provide a timely and transparent update.

For the convenience of computation, we regrouped the 30+ GTA intervention types into twelve major categories. Table 1 presents a summary of the total number of interventions categorized based on trade liberalization and protection, along with a breakdown of the interventions by categories. Overall, the table highlights that there are more trade policy interventions that are detrimental to trading partners (i.e., "Red" interventions) than those that benefit them (i.e., "Green" interventions). In addition, import tariffs (39,885 observations) continue to be the most frequently used trade policy tool compared to other non-tariff barriers.

There are two additional crucial factors to consider when interpreting the "Green" and "Red" indicators in the GTA dataset. Firstly, it is worth noting that the dataset only records bilateral trade interventions, and thus overlooks the second-round effects that may impact third countries through trade diversion. For instance, an antidumping action (represented by the "Red" indicator) taken by the United States against China may positively impact other countries like Mexico (represented by the "Green" indicator). Again, the GTA only records the direct effect. This consideration is crucial when analyzing the dataset, as it highlights the need to be cognizant of the inherent limitations and complexities of the presented data.

Secondly, it is important to recognize that the GTA dataset records all trade actions in a bilateral format. Therefore, if a country imposes tariffs uniformly on all imports, irrespective of their country of origin, or if it reduces them uniformly across a set of trade partners, say on account of joining a regional trade agreement, the dataset will record multiple entries of this policy action, each featuring all the bilateral countries that export the relevant goods to Country A.

[2]More information is available at: https://www.globaltradealert.org/

Table 1: Trade Policy Interventions Categories

Interventions Categories	Green	Red	Total
Import tariff	25,466	14,419	39,885
State aid	629	24,537	25,166
Import other	13,286	9,825	23,111
Export other_1 (Restrictions)	3,818	7,789	11,607
Export tax	5,146	5,889	11,035
Trade finance	57	10,209	10,266
Labour market access	5,405	4,718	10,123
Financial grant	12	8,253	8,265
Public procurement	1,382	6,774	8,156
Anti-dumping&subsidy	53	7,815	7,868
Export other_2 (Incentives)	2,181	4,887	7,068
Local sourcing incentives	273	4,472	4,745
Total	57,708	109,587	167,295

Notes: This table shows the number of observations for each intervention type in the sample. The intervention types have been reclassified from the original 30+ Global Trade Alert (GTA) categories. The ”Green” interventions refer to trade policies that benefit the relevant trade partners. The ”Red” interventions refer to trade policies that are detrimental to the trading partners.
Source: Global Trade Alert (GTA), prepared by authors.

ADB MRIO

The weight of the affected sectors is measured using the Asian Development Bank (ADB)'s Multi-Regional Input and Output (ADB MRIO) database. With the support of the ADB team, we manually link the ADB 35-sector classification with the GTA HS12 six-digit classification. The ADB MRIO is a comprehensive economic dataset that provides detailed input-output linkages between 69 countries and and 35 industries. One major advantage of the ADB MRIO database is its extensive level of detail, which covers a vast number of countries and industries. Furthermore, the ADB MRIO dataset is available from 2009 onwards, which matches the availability of the GTA dataset that also begins in 2009. The match of GTA HS12 six-digit and ADB C35 sector follows the sector concordance provided by the Asian Development Bank ADB MRIO team. [3]

Using import tariffs as an example of the most frequent intervention category, Table 2 provides a breakdown of the number of tariff actions taken across various sectors according to the ADB-MRIO sector classification. The data used in this table was sourced from the Global Trade Alert (GTA) database and covers bilateral import actions from 2009 to 2022. The table shows that the top five sectors with the highest number of tariff actions were food, beverages, and tobacco (c3), electrical and optical equipment (c14), chemicals and chemical sectors (c9), machinery, nec (c13), and agriculture, hunting, forestry, and fishing (c1). The proportion of tariff actions accounted for by these top five sectors was 63%, indicating their significance in global trade flows and discourse. The top five sectors with the highest number of protection actions follow the same sequence as the sectors with the highest number of tariff actions, and together, they account for approximately 70% of all "Red" tariff actions taken during the period covered by the data.

III.B Weighting Strategies for Different Interventions

An accurate measure of trade intervention entails two components. First, the specific sectors (sectors) that are affected, and their important in overall bilateral trade flows between the two countries. Second, the magnitude of the policy-for instance, the change in tariff rates in the case of import tariffs. Measuring both these elements details significant challenges. While the information on trade intervention shocks is typically provided at a detailed level for tariffs, economic analyses of their impact often require aggregation to a higher level, such as by industry, region, bilateral trade flow, or country, to align with relevant economic outcomes. Moreover, non-tariff barriers, including sector standards, licensing requirements, and technical regulations, pose challenges in developing

[3] ADB MRIO team can be contacted at https://mrio.adbx.online

Table 2: Sector Distribution of Tariff Actions

ADB-MRIO Sector	Green	Red	Total Count	Sector Description
c3	1197	1203	2400	Food, beverages, and tobacco
c14	1236	803	2039	Electrical and optical equipment
c9	1157	829	1986	Chemicals and chemical products
c13	997	696	1693	Machinery, nec
c1	855	800	1655	Agriculture, hunting, forestry, and fishing
c12	837	738	1575	Basic metals and fabricated metal
c15	858	613	1471	Transport equipment
c10	779	588	1367	Rubber and plastics
c4	688	609	1297	Textiles and textile products
c7	617	437	1054	Pulp, paper, paper products, printing, and publishing
c11	451	378	829	Other nonmetallic minerals
c16	424	384	808	Manufacturing, nec; recycling
c8	355	285	640	Coke, refined petroleum, and nuclear fuel
c6	343	273	616	Wood and products of wood and cork
c5	319	251	570	Leather, leather products, and footwear
c2	254	181	435	Mining and quarrying
c17	39	52	91	Electricity, gas, and water supply
c30	47	42	89	Renting of M&Eq and other business activities
c34	41	47	88	Other community, social, and personal services

Notes: This table displays the distribution of tariff actions across various sectors, as classified by the ADB-MRIO system. The import tariff actions included in this table are bilateral imports and are sourced from the Global Trade Alert (GTA) database, covering the period from 2009 to 2022.

a standardized methodology for measuring their impact due to their variety and less transparency.

To address these challenges, we propose three weighting schemes in Table 3 for measuring the extent of trade policy interventions.

Table 3: Weighting Strategies for Trade Policy Shocks Measurement

Weighting Scheme:	**Dummy**	**Single Weight (share)**	**Double Weight (Share X Shift)**
Available for:	All	All	Tariffs, Quota
Best measurement for:	—-	Export & Import Ban	Most
Computation methods:	1, -1	(1,-1) x Sector share	Sector share x Tariffs (quota) shift
Data:	GTA	GTA & ADB-MIRO	GTA, ADB-MIRO, WITS

Our aggregation of the trade shock magnitude is at the **daily** level.

The "Dummy" weighting scheme in the first column is the natural starting point which is least demanding on the data and hence maximizes coverage. it simply assigns numerical values of 1 and -1 to assess the direction of the trade policy intervention, and it is available for all types of trade policy interventions.

The "Single Weight (share)" weighting scheme in the second column employs the sector share to compute the impact of the policy intervention, and it is suitable for some non-tariff barriers, such as export and import bans, and import license restriction/allowance. To determine the weight of affected sectors, we match the HS12-6 digit classification of the GTA with the ADB Input-output tables. Although this weighting scheme still faces limitations in measuring most non-tariff barriers, it allows us to measure the impact of certain types of non-tariff barriers. We use the following formula to quantify trade policy shocks using this single-weighting scheme:

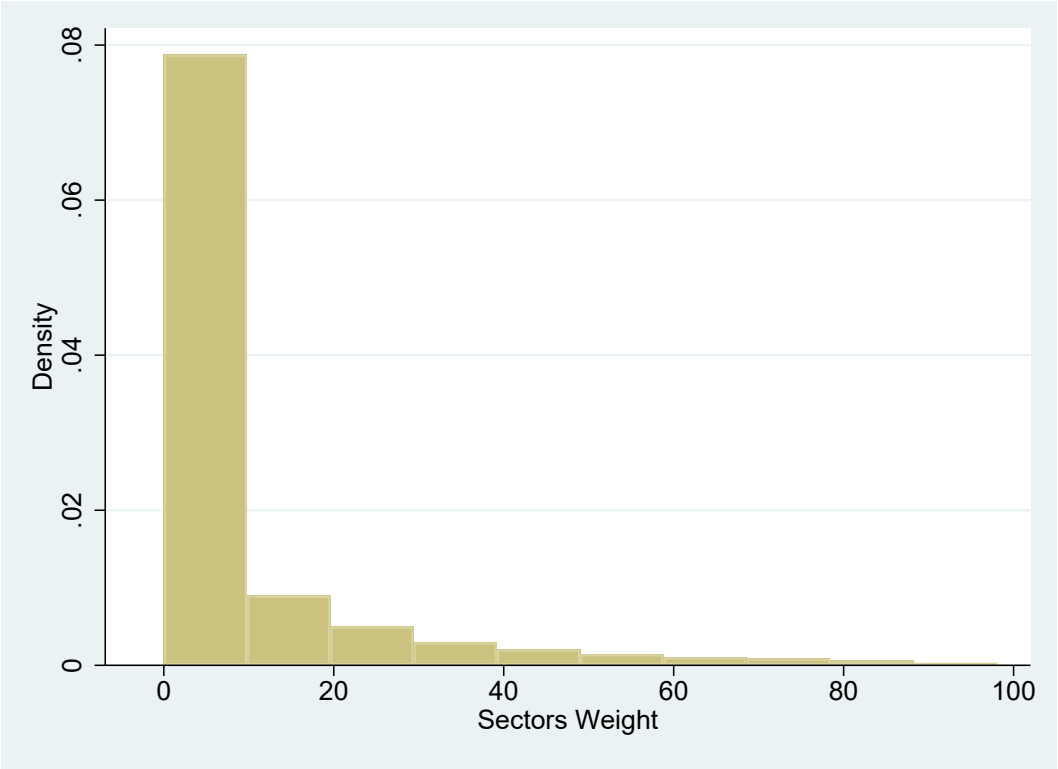
$$Shock_{ij,t}^{Single} = \sum_{s=1}^{n} Shock_{ij,t}^{s} * Share_{ij,t}^{s}$$

Where $Shock_{ij,t}^{Single}$ is the single type of trade policy shock imposed by country i on country j at the **daily** frequency, aggregated by sectors that are being affected by country level. $Shock_{ij,t}^{s}$ is the dummy variable that indicates the direction of the policy intervention at the sector level. $Share_{ij,t}^{s}$ represents the share of the sector that is being affected by the trade policy. The $Share_{ij,t}^{s}$ can be further decomposed into:

$$Share_{ij,t}^{s} = \frac{\sum_{m=1}^{35} \Omega_{ms}^{ij}}{\sum_{k=1}^{35} \sum_{m=1}^{35} \Omega_{mk}^{ij}}$$

where the numerator is the gross exports from country j to i in the particular sector s, and the denominator is the sum of total exports of j to i in all sectors.

Figure 2: Sector Weight Distribution



*Notes:*This figure displays the distribution of sectors being affected by trade policy interventions, classified according to the ADB MRIO 35 sector categories. The x-axis represents the proportion of sectors affected, while the y-axis shows the frequency of sectors falling within each proportion range. On average, 20% of the sectors are being affected by the interventions.

The "Double Weight (Share X Shift)" weighting scheme in the third column utilizes the sector share multiplied by the tariff shift to evaluate the impact of trade policy interventions, making it the ideal measure of any type of trade policy shock. However, it is only viable for import tariffs given the availability of unpublished information on tariff changes provided by the GTA. The precise formula we use for quantifying trade policy shocks using the double-weighting scheme is as follows:

$$Shock_{ij,t}^{Double} = \sum_{s=1}^{n} (Shock_{ij,t}^{s} * Share_{ij,t}^{s} * Shift_{ij,t}^{s})$$

Where $Shift_{ij,t}^{s}$ is the change of tariffs rate of the sector s imposed by country i on

country j.

For all three types of weighting schemes, we aggregate the shocks to the country-pair level at a daily frequency to examine the effects of policy changes between specific pairs of countries on exchange rates over time.

IV Empirical Set Up and Identification

In this section, we detail our set up to investigate the impact of trade interventions on exchange rates using trade policy announcements at daily frequency from 2009 to 2022. The key question is whether exchange rates respond to announcements of tariffs (and NTBs) in a way that is consistent with the theory, and to what extent changes in tariffs (and NTBs) are offset by corresponding fluctuations in the exchange rate in the short term. Two important considerations are worth noting for this exercise. First, we will focus primarily on import tariffs, given their dominant role in all types of trade interventions, as well as the feasibility of providing an accurate measurement of policy shock under current data availability. Second, to allow for comparison with previous literature, we measure tariff shocks using all three weighting mechanisms. For non-tariff barriers, our analysis concentrates on intervention types that can be accurately captured using the single weighting mechanism, such as export bans, import bans, and import license allowances/prohibitions.

In the baseline specification, we use the Jordà (2005)'s local projection method to estimate the impulse response function to different types of trade interventions. Local projections have two advantages in the context of our analysis. First, local projections are generally less parametrically intensive and less prone to model misspecification than alternatives such as vector autoregressions (VARs). This is because they impose minimal structure on the data-generating process. Second, it allows us to control for other shocks that occur between the time of the trade policy shock and the time of the exchange rate response.

The main estimation equation is specified at daily frequency as follows:

$$y_{ij,t+h} = \alpha_{ij}^{h} + \gamma_t + \beta^h Intv_{ij,t} + \sum_{k=1}^{3} \varphi_k^h Intv_{ij,t-k} + \sum_{k=1}^{4} \theta_k^h y_{ij,t-k} + e_{ij,h}^{h} \tag{8}$$

Where:

$$y_{ij,t+h} = \frac{E_{ij,t+h} - E_{ij,t-1}}{E_{ij,t-1}}$$

Here, $E_{ij,t}$ represents the bilateral exchange rate between Implementation Country i and Affected Country j at time t. The variable $Intv_{ij,t}$ is the trade intervention shock measure imposed by the implementation country on its corresponding bilateral trade partner. The length of the estimation horizon is denoted as h. A decrease in $y_{ij,t+h}$ indicates a home country currency appreciation against the trade partner that is affected by the trade intervention.

To facilitate comparison with previous literature, we employ all three weighting mechanisms, namely, the dummy, single-weight, and double-weight schemes to measure $Intv_{ij,t}$ when tariff shocks occur. For selective non-tariff barriers, we utilize the single-weight and double-weight schemes when the single-weighting measure is feasible. However, due to the complex nature of some non-tariff barriers, we limit our measurement of $Intv_{ij,t}$ to a dummy variable that only captures the direction of the measurement.

An important consideration is that the $Intv_{ij,t}$ variable is overestimated due to the use of ADB-MRIO 35 sector categories, which provides a lower level of granularity than the original HS12 6-digit sector code in the GTA. This can attenuate the true relationship between the independent variable and the dependent variable, leading to an underestimation of the true population coefficient. In other words, the true β should be larger than it would be if the independent variable was based on the original HS12 6-digit sector code.

The specification controls for four lags of both the interventions and the exchange rate variables, and includes country-pair fixed effects α_{ij}^{h} to capture time invariant characteristics such as geographical distance. In the robustness section, we also show that the results are not qualitatively sensitive to different dynamic specifications. Additionally, time-fixed effects γ_t are included to control for global economic factors that affect all countries.

We estimate Equation (8) with a time horizon of 30 days. We focus on limiting our analysis to this relatively short time frame since trade interventions are at daily frequency, and exchange rates are fast moving forward looking variables that we expect to react quickly to announcements. That said, in our robustness exercises, we find that extending the time of the horizon to be 60 days does not change the results.

The estimation covers the period from January 2009 to May 2022, and includes 1,521 pairs of bilateral country-sector pairs where both partners follow a floating or managing

floating exchange rate regime.[4]

Identification

The cornerstone of our identification strategy is to leverage daily data on trade policy announcements. Capturing movements in the particular day allows us to limit the effect of confounding factors in the measurement of the shock. To further ensure that the trade intervention shock we capture is accurate, we drop three special cases of trade interventions for each country pair. Firstly, we remove conflicted sign cases, where the country pairs experience tariffs increases and decreases id different sectors on the same day. Secondly, we remove instances where multiple measures are announced on the same day for the country pairs (e.g an increase in import tariff in one sector and a reduction in import quota in another, or if a country pair experiences both tariffs and state aid on the same day) . Lastly, we remove "mirror" action cases, where two countries impose the same type of trade intervention on each other on the same day. After removing these special and potentially confounding cases, we expect that the trade intervention shock that we identify at daily frequency is exogenous and avoids the confounding effects of multiple interventions on the exchange rate.

Moreover, we control for subsequent innovations that occur between t=0 and t=h, following Teulings and Zubanov (2014) and Autor and Salomons (2018). The additional control eliminates the effects of other shocks that occur between the time of the trade policy shock and the time of the exchange rate response as the horizon increases.

IV..1 Timing of the trade shocks

In the context of permanent tariff announcement, an increase in tariffs has a dual impact on the market. On the one hand, it leads to a rise in demand for domestically produced goods as it diverts consumer demand away from foreign goods. On the other hand, it also reduces the supply of goods as it diminishes the purchasing power of wages in terms of imports. As a result, to restore the equilibrium in the market, the currency of the country subject to the tariff must appreciate. This appreciation subsequently lowers the demand for domestically produced goods as it increases their relative price in both domestic and foreign markets.

However, a crucial question is when the exchange rate fully incorporates the information contained in the above mechanism. Traditionally, in the setting of policy shocks,

[4]The total sample size, including all exchange regime types, is 4,751 pairs.

it is assumed that the market fully incorporates the information contained on the announcement date itself. Nonetheless, according to Khan and Khederlarian, 2021b, the anticipated changes in trade policy can lead to a disparity between trade flows and their ultimate consumption. In the case of expected future tariff reductions, firms are motivated to strategically decrease their imports between the trade policy announcement date and the inception date. This could result in sizable anticipatory slumps followed by liberalization bumps in the imports, which could cause a decrease and then an increase in the demand for foreign currency, respectively. As a result, the home country could experience a currency depreciation before the appreciation.

To examine the exchange rate response behavior to anticipatory trade barriers, this study conducts separate analyses setting the time of the shock t to be both at the date of the announcement and the inception. This approach allows us to investigate whether the exchange rate fully incorporates the information contained in the anticipatory trade or if there is a time lag before the exchange rate adjusts to the anticipated changes in trade policy.

V Results

In this section, we examine the quantitative impact of trade interventions on the exchange rate using the identification and estimation strategy discussed in the previous section. We focus specifically on import tariffs, import license requirements, export bans, and import bans, as for these measures we can accurately measure the effects using either a **single- or double-weighting** scheme. For other types of trade interventions that are harder to measure, we present their exchange rate responses in the Appendix using a dummy weighting mechanism. Additionally, we analyze the exchange rate movement based on both the announcement date and the inception date of the intervention, highlighting any differences.

V.A Quantifying the Exchange Rate Offset after Tariff Shocks

We first present the findings of our analysis of the exchange rate response to import tariffs using Local Projections (LPs) with robust standard errors clustered at the country-pair level. Our benchmark regression estimates the exchange rate offset after experiencing import tariff shocks. To measure the tariff shocks accurately, we use the double weighting mechanism, as it is feasible and provides the most precise measure of the import tariff shock. The weight of the tariff shock is standardized such that a 1 percentage increase in the tariff rate by the home country corresponds to a weight of 1.

In line with the Dornbusch (1974) and Krugman (1982) theory, we restrict our sample to countries that have floating and managing floating exchange rate regimes, as defined by Ilzetzki et al. (2019). This classification ensures that our analysis includes only countries with exchange rate regimes that are expected to be responsive to trade shocks.

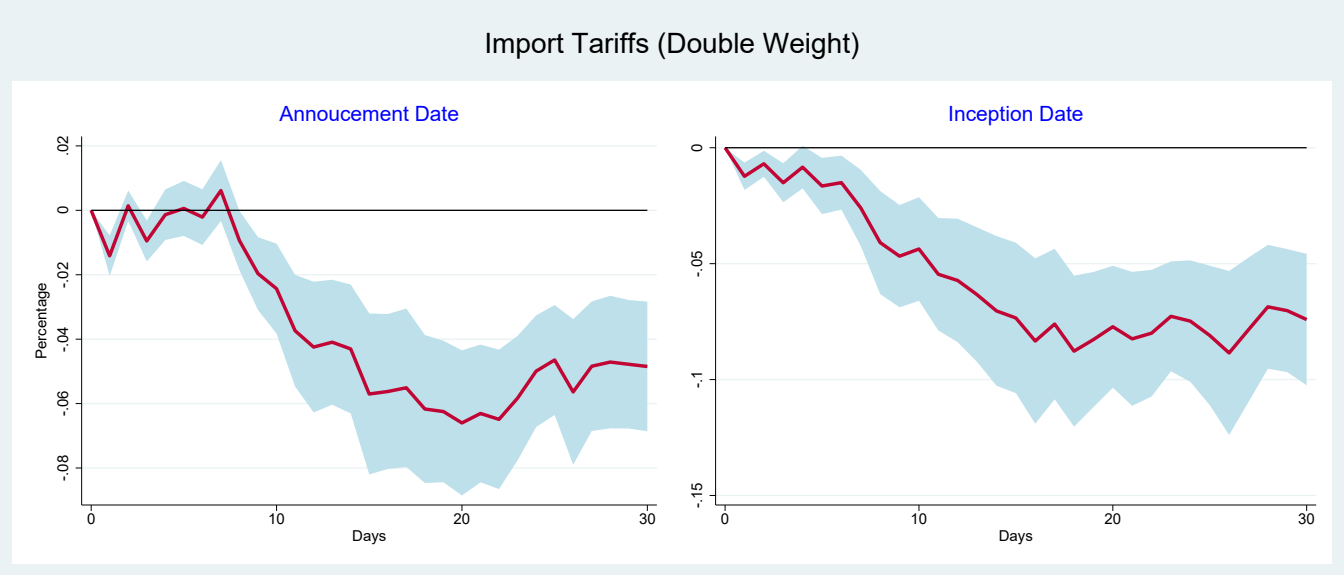
Figure 3 illustrates the results of our benchmark regression. Two elements stand out. First, we observe that the home country's currency appreciates against the foreign trade partner's currency in response to an increase in tariffs on imports imposed by the home country. However, there is a discrepancy in the timing of the response depending on the identification of the shock time. The effect is statistically significant at all horizons when we use the inception date as the shock date, while it becomes only significant a couple of weeks if we use the announcement date as the date of the shock event. This suggests that the time of the "shock" matters for the exchange rate's response.

Quantitatively, we find that a 1% uniform increase in tariff rate leads to an appreciation of the home country's currency by 0.05-0.1% relative to its bilateral trade partner. This appreciation is smaller than what was reported by Jeanne and Son (2020), who observed a 0.2 appreciation of the USD/RMB within 5 hours after the US announced a tariff enhancement on Chinese imports during the period of 2018-2019. Several factors could account for these differences. Apart from the different frequency over which the responses are computed and the difference in the sample (they cover only US and China whereas we have a broad set of bilateral country-sector pairs), it is also worth acknowledging that the use of ADB-MRIO 35 sector categories to classify trade policy interventions may overestimate the independent variable, potentially leading to an underestimation of the true relationship between the independent and dependent variables and a lower population coefficient. Moreover, our finding of a partial offset of the exchange rate by a small proportion, along with the evidence that trade flows are more responsive to tariffs than to exchange rate movements as reported by Fontagné et al. (2018), suggests that tariffs may have a larger medium to long-term impact on trade flows and the trade balance.

V.B Anticipatory Tariffs vs Actual Tariffs Inception

In this subsection, we present additional evidence that the exchange rate responds differently to the *announcement date* versus the *inception date*. As shown in Figure 4, we present the impulse response functions of bilateral exchange to import tariff shocks Equation 8 using both *dummy weighting* and *single weighting* schemes. The comparison of the upper panel with the lower panel shows that anticipated tariffs cause the home country's currency to depreciate first before the exchange rate starts to appreciate. On average, such

Figure 3: Exchange Rate Response to Import Tariffs



Notes: The panels present the impulse response functions of bilateral exchange to import tariff shocks Equation 8 using OLS. The left panel uses the policy announcement date as the shock event date, while the right panel uses the policy inception date as the shock event date. The measurement of the tariff shocks using the *double weighting* is explained in section II. The blue areas represent the two-standard-error confidence bands. The sample is restricted to countries with floating and managing floating exchange rate regimes, as defined by Ilzetzki et al. (2019).

depreciation phases last for about eight days, which is consistent with the average gap between the policy announcement date and the inception date in our sample. [5]

This pattern is consistent with the responses in trade flows that follow tariff reduction announcements. Empirical studies by Khan and Khederlarian (2021a) and Alessandria et al. (2011) for instance have found that during the gap between the bilateral trade agreement's announcement and its effective rollout date, firms tend to decrease their import inventories. As a result, the demand for foreign currency decreases, leading currency appreciation before the depreciation. This reduction of imports during the policy gap period effectively reduces the demand for foreign currency, leading to an increase in the home currency's relative value.

To compare the results obtained using the dummy weighting scheme with those of Jeanne and Son (2020), we note that the magnitudes of the results are consistent. After a 1% increase in the tariff rate, the exchange rate of the home country to the foreign

[5]The average gap between the policy announcement date and the inception date in our sample is 8.7 days.

currency appreciates by 0.2% after 20 days. However, we do not find the exchange rate to appreciate on the first day following the announcement, as in Jeanne and Son (2020) from the announcement date; instead, we find that is depreciates first, as explained earlier. Second, the left panels of Figure 4 and Figure 3 show that the magnitude of the exchange rate offset shrank by half after switching from the dummy weighting mechanism to the single and double weighting mechanisms, which provide a more accurate measurement of the implemented tariff shock.

Figure 4: Exchange Rate Response to Import Tariffs



Notes: The panels present the impulse response functions of bilateral exchange to import tariff shocks using Equation 8 with Teulings and Zubanov (2014) method. The left panels use the policy announcement date as the shock event date, while the right panels use the policy inception date as the shock event date. The upper panels use the measurement of the tariff shocks using the *dummy weighting* explained. The lower panels use the measurement of the tariff shocks using the *single weighting* explained. The blue areas represent the two-standard-error confidence bands. The sample is restricted to countries with floating and managing floating exchange rate regimes, as defined by Ilzetzki et al. (2019).

V.B.1 US and China Bilateral Tariff Interventions

The evidence of the discrepancy in the exchange rate response between the announcement date and the inception date is particularly prominent when examining the bilateral

tariff interventions between the US and China, one of the most significant set of events since the beginning of the database in 2009. Figure 5 displays the impulse response function of the exchange rate to the tariff announcement shock and the policy effective date shock. The average gap between the policy announcement and the implementation date of the US-China bilateral tariff is 73 days, nine times longer than the average gap in the full sample. As shown in the figure, the exchange rate of the home to foreign currency initially depreciates persistently for 30 days after the announcement date, with exchange rate appreciation only occurring after the policy starts to take effect. Additionally, after limiting the sample to the US and China, the magnitude of the exchange rate appreciation in response to a 1% increase in tariffs decreases to 0.03-0.05%, compared to the full sample's range of 0.05-0.1%.

After limiting our sample to the US and China, we were able to make a direct comparison to the previous study conducted by Jeanne and Son (2020). The evidence from our study shows that the exchange rate experienced persistent depreciation during the first 30 days after the tariffs were announced, as firms took advantage of the grace period to stock up on imported inventories. This is in contrast to the findings of Jeanne and Son (2020), who reported an immediate exchange rate appreciation after the US and China policy announcement, although the authors used intra-day higher frequency data of the exchange rate.

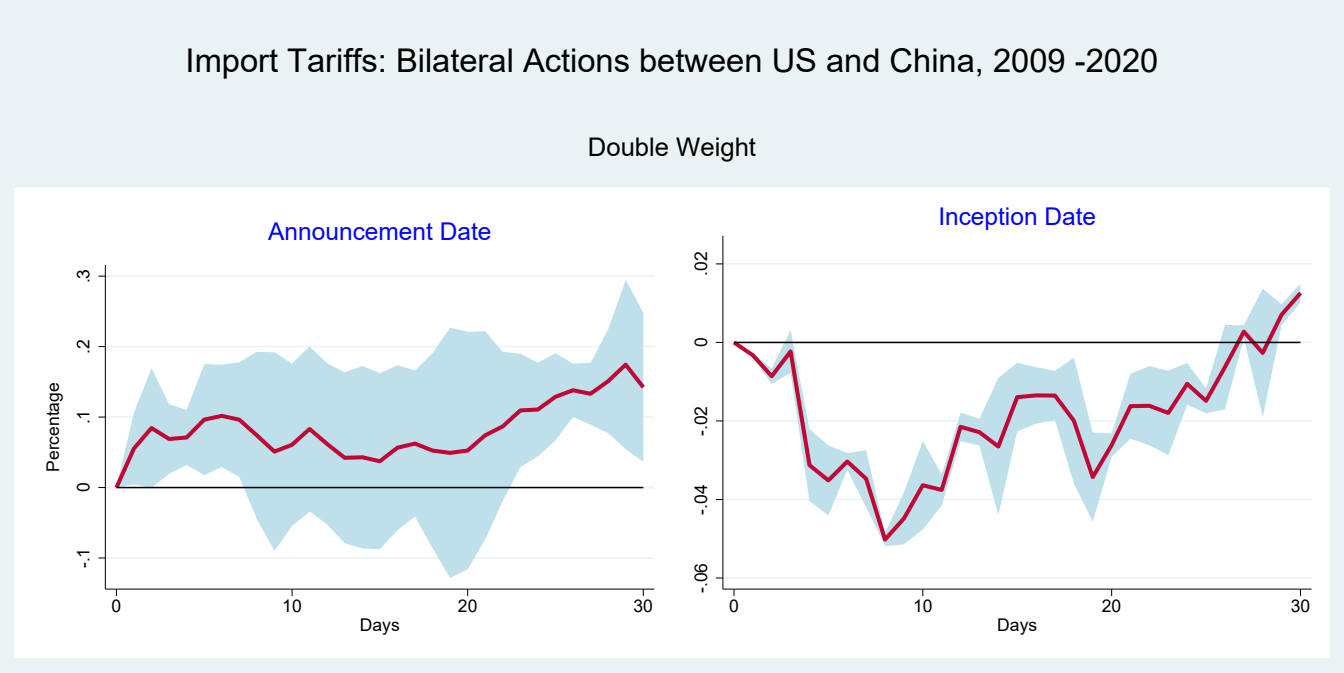
V.C Indirect and Second Round Effects via GVCs

Our investigation so far focused on bilateral pairs involving only the country imposing the tariff measure and the country directly affected by it. However, in general equilibrium, especially in the presence of GVCs, the impact of the shock propagates to third countries not targeted directly via the intervention through input output linkages.

As an example suppose that country A imposes a tariff on imports from country B only. As shown in the stylized model in II, this leads to an increase in demand for goods produced by A relative to those produced by B, causing a depreciation in the exchange rate of B against A. Suppose now that when exporting to A, B sources some inputs from a third country (D). Even if D is not directly affected by the tariff imposed by A, it experiences the knock on effect in the form of a decrease in the demand for its goods relative to those of A, much in the same was as the relative demand for B contracts relative to A.

Figure 6 extends this illustration to a more general setting where country A imposes an import tariff on sectors 1 and 2 in country B, as well as sectors 2 and 3 in country C. To uncover the second round exchange rate effects of this tariff via GVCs, we focus

Figure 5: Exchange Rate Response to Import Tariffs



Notes: The panels present the impulse response functions of bilateral exchange to import tariff shocks using Equation 8 with Teulings and Zubanov (2014) method. The sample is restricted to tariff actions between US and China since 2008. The left panels use the policy announcement date as the shock event date, while the right panels use the policy inception date as the shock event date. The blue areas represent the two-standard-error confidence bands. The measurement of the tariff shocks using the *double weighting* is explained in section II.

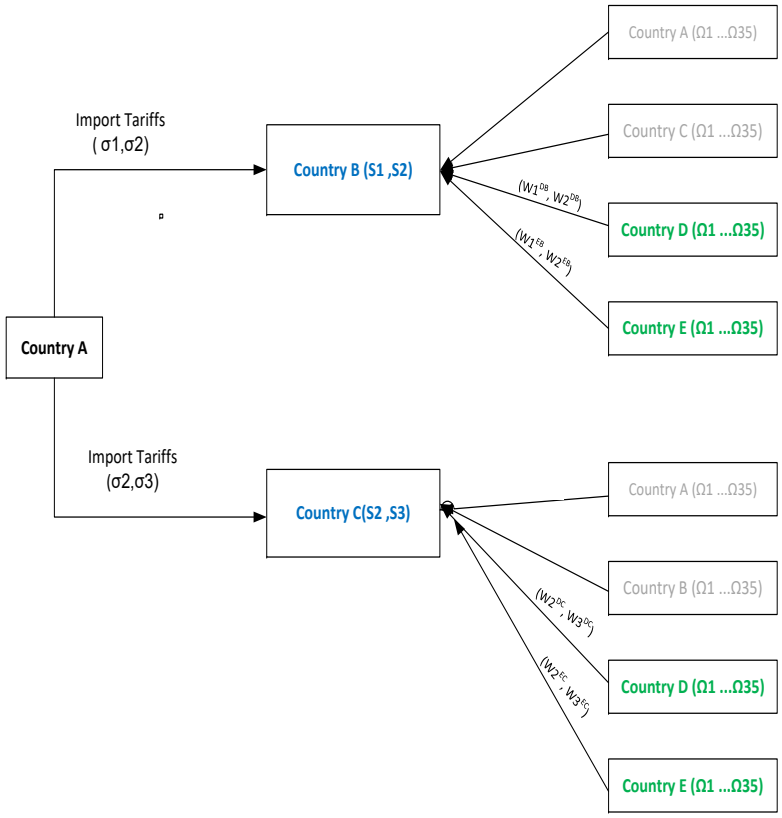
on countries like D and E in the right-most column of the Figure which are (a) not directly affected by the tariff, and (b) are different from the home country. Given the detailed input-output data at the sector level available from the ADB MRIO tables, we can quantify the linkages and compute measures of shares/weights in the same was as we do for capturing the direct effect on country B, by computing weights $\{W_i^{XB}\}, i \in \{1,2\}, X \in \{D,E\}$ and $\{W_i^{XC}\}, i \in \{2,3\}, X \in \{D,E\}$.

To assess the spillover effects of Country (i)'s policy on its indirect GVC partner j, we estimate the following equation via local projections:

$$Y_{ij,t+h} = \alpha_{ij}^h + \gamma_t + \beta^h Intv_{ij,t} + \sum_{k=1}^{3} \varphi_k^h Intv_{ij,t-k} + \sum_{k=1}^{4} \theta_k^h y_{ij,t-k} + e_{ij,h}^h \tag{9}$$

For example, for an aggregated shock of country A on GVC country D iin Figure 6,$Intv_{ij}$ equals to:

Figure 6: Tracing the Impact of Trade Interventions via Global Value chains



Notes: Illustrative example showing the second round GVC effects of country A imposing an import tariff on two sectors in Country B and Country C.

$$Intv_{AD} = \sigma_1^{AB} S_1^{AB} * W_1^{DB} + \sigma_2^{AB} S_2^{AB} * W_2^{DB} + \sigma_2^{AC} S_2^{AC} * W_2^{DC} + \sigma_3^{AC} S_3^{AC} * W_3^{DC} \quad (10)$$

where:

$$W_1^{DB} = \frac{\sum_{i=1}^{35} \Omega_{i1}^{DB}}{\sum_{k=1}^{35} \sum_{i=1}^{35} \Omega_{ik}^{DB}} (11)$$

Figure 7 shows the response of the average bilateral exchange rate of the country imposing the tariff and the country not targeted directly by it. Similar to the direct effects, both announcement and inception dates entail a sharp appreciation of the home country, and a depreciation of the country not directly affected by the tariff, but which engages in GVC trade with directly affected countries that eventually reaches the tariff imposing country. In theory, the exchange rate of countries that are not directly affected by tariffs could be influenced by two opposing forces. One the one hand, trade diversion effects lead to an increase in demand for their exports, putting appreciation pressure on the currency. On the other hand, they experience the knock-on depreciation pressure on account of being suppliers of trade partners directly affected by the tariff. Our results shock that quantitatively, the second effect tends to dominate.

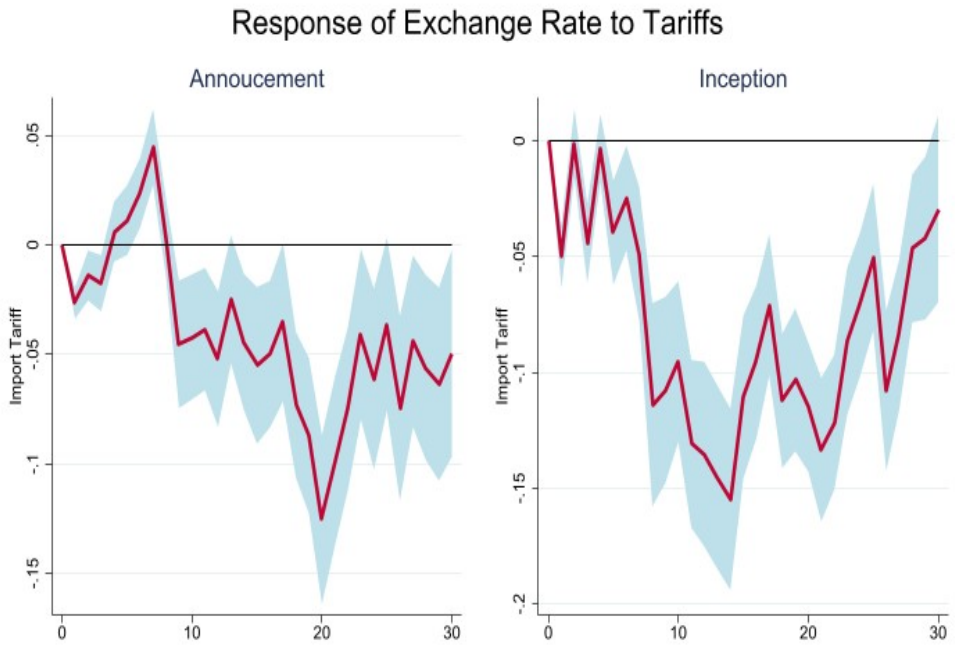
V.D Non Tariff Trade Interventions

In addition to tariffs, non-tariff barriers (NTBs) can also have significant impacts on trade and exchange rate movement. In this subsection, we focus on NTBs that can be accurately measured using the *single-weight mechanism*. Specifically, we examine the exchange rate response to annoucements of changes in import license requirements, export bans, and import bans.

V.D.1 Import License

Import license requirements are a type of non-tariff barrier that requires obtaining a license or permit from the government before importing certain goods into a country. As noted by Baldwin and Evenett (2015), import licenses are implemented to regulate imports, protect domestic industries, and ensure compliance with health, safety, and environmental standards. When these requirements are removed, it can lead to an in-

Figure 7: Impact of Tariff Shocks on Bilateral Exchange Rate of Non-targeted Countries

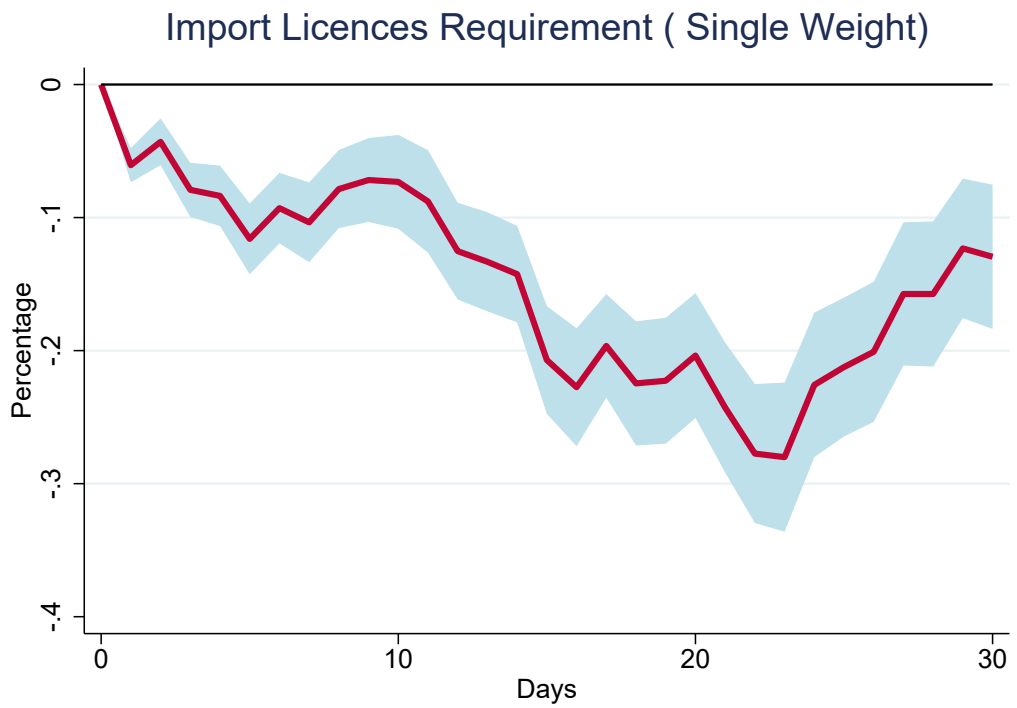


Notes: The panels present the impulse response functions of bilateral exchange of import tariff shocks on indirect trade partners using Equation 9 with Teulings and Zubanov (2014) method. The left panels use the policy announcement date as the shock event date, while the right panels use the policy inception date as the shock event date. The blue areas represent the two-standard-error confidence bands. The sample is restricted to countries with floating and managing floating exchange rate regimes, as defined by Ilzetzki et al. (2019).

crease in imports, which may in turn put pressure on the exchange rate of the importing country by increasing the demand for foreign currency to pay for those imports.

We quantify the response of exchange rates to import license restrictions on the exchange rate using the same identification and estimation strategy as before, and summarize the results in Figure 8. The import license restriction is regarded as a positive shock, and the removal of the license requirement is a negative shock. We scaled the sector weight to reflect the average proportion of the sectors affected by the policies, which is 20%. The main finding is that the exchange rate of the home currency to foreign currency appreciates by about 0.2-0.3% after 20 days following the announcement of the import license restriction.

Figure 8: Exchange Rate Response to Import License Requirement



Notes: The panels present the impulse response functions of bilateral exchange to import license requirement using Equation 8 with Teulings and Zubanov (2014) method. The blue areas represent the two-standard-error confidence bands. The measurement of the import license requirement using the *single weighting* is explained in section II. The shock scales are equal to the average ratio of the sector being affected, which is 20%.

V.D.2 Export and Import Ban

We continue our analysis of the exchange rate response to non tariff trade barrier announcements by moving next to the as of outright import and export bans. Export bans refer to a government policies that prohibits the export of specific goods or services to other countries, while import bans refer to a policy that prohibits the import of specific goods or services from other countries (Baldwin & Evenett, 2015).

The complete prohibition inherent in such bans simplifies one part of the task of quantifying the shock, since the magnitude/intensity/shift element is equal to 1 by definition. The single-weighting mechanism is therefore sufficient in this case and can be used to calculate the proportion of sectors affected, which allows for precise measurement.

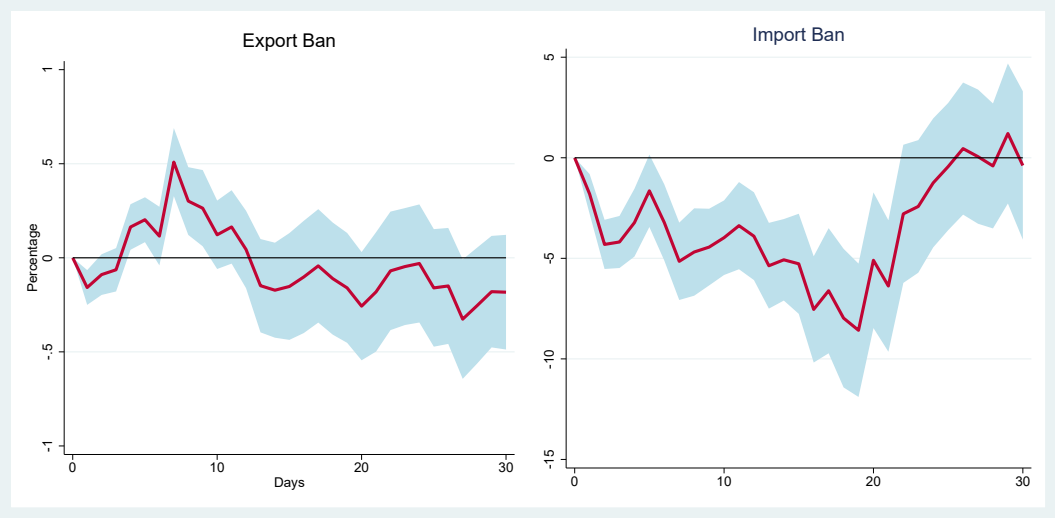
In Figure 9, we present the exchange rate movement within 30 days after the announcement of trade ban policies. The size of the trade ban shock is scaled to the average ratio of the sector being affected, which is 20%. The panel on the left shows the exchange rate response to the *export ban*, while the right panel refers to the exchange rate reaction to the *import ban*. The results for each type of trade ban are as follows: following an export ban that affects 20% of the total export of the home country, the exchange rate of the home country's currency to the foreign partner's currency depreciates by 0.5% on average after 10 days. The exchange rate response to import bans is opposite to that of export bans: following an import ban that affects 20% of the total export of the home country, the exchange rate of the home country's currency to the foreign partner's currency appreciates by 0.5 - 0.8% on average.

The direction of the exchange rate movement following the import and export ban aligns with the the predictions of models including the one discussed in Section II. Specifically, an export ban is expected to result in the depreciation of the home country's currency as the supply of goods decreases, leading to a reduction in demand for the home currency. On the other hand, an import ban is expected to cause an appreciation of the home currency as the supply of foreign goods decreases, resulting in an increase in demand for the home currency.

VI Conclusions

This paper revisits the classical question of trade protectionism's impact on exchange rates by employing a unique daily global trade policy announcement database. Our method involves constructing a precise measure of trade policy shocks at the bilateral-sector level, which allows us to quantify the exchange rate offset in response to trade

Figure 9: Exchange Rate Response to Trade Bans



Notes: The panels present the impulse response functions of bilateral exchange to trade bans using Equation 8 with Teulings and Zubanov (2014) method. The blue areas represent the two-standard-error confidence bands. The left panel refers to the export ban, and the right panel refers to the import ban. The measurement of the trade requirement using the *single weighting* is explained in section II. The shock scales are equal to the average ratio of the sector being affected, which is 20%.

interventions. Estimates reveal that a 1 percent increase in uniform import tariffs results in a 0.05-0.1 percent appreciation of the home currency relative to the foreign currency. This outcome aligns qualitatively with theoretical predictions, but also demonstrates that the exchange rate offset occurs only to a very limited extent. That said, given that trade barriers are often imposed on fine and specific goods categories, whereas trade flows are only measured at a higher level of sectoral aggregation, our estimates are likely to be biased downwards and could be interpreted as lower bound estimates.

We also uncover two additional key patterns. Firstly, non-tariff barriers exert a more substantial impact on exchange rate movements compared to tariffs. Secondly, the exchange rate response diverges between tariff announcements and implementations, with the home currency depreciating between the announcement and inception dates, possibly on account of frontloading behavior. The latter finding underscores the importance of distinguishing between the two types of policy shock dates when examining macroeconomic implications.

Our study paves the way for several potential directions for future research. One promising avenue involves further exploration of the role of global value chains (GVCs) in the relationship between trade policy and exchange rates. GVCs could modify the

transmission of trade shocks across countries, with bilateral trade barriers potentially generating spillover effects on nations' primary trade partners through GVC linkages. While our focus has been on exchange rates, the same high-frequency dataset can also be used to assess the consequences of trade interventions on other macroeconomic variables and financial variables such as equity returns, trade balance and inflation. Such analyses would contribute to a more comprehensive understanding of the wide-ranging ramifications associated with trade protectionism.

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Appendices

A Tariff Shocks and Exchange Rates: Insights from a Three Country New Keynesian DSGE Model with GVC Linkages

A.A Model Setup

The model builds on Cook and Patel, 2023 where the world economy comprises of three countries: the global economy (U) and two small open economies X and Y. We consider a permanent change in tariffs from 0% to 10% on all exports from country X to U, and no tariffs on B. The model is calibrated at quarterly frequency, and assumes a trade openness of 0.5, and GVC share of trade to be 0.5. WE consider four versions of the model. [6]

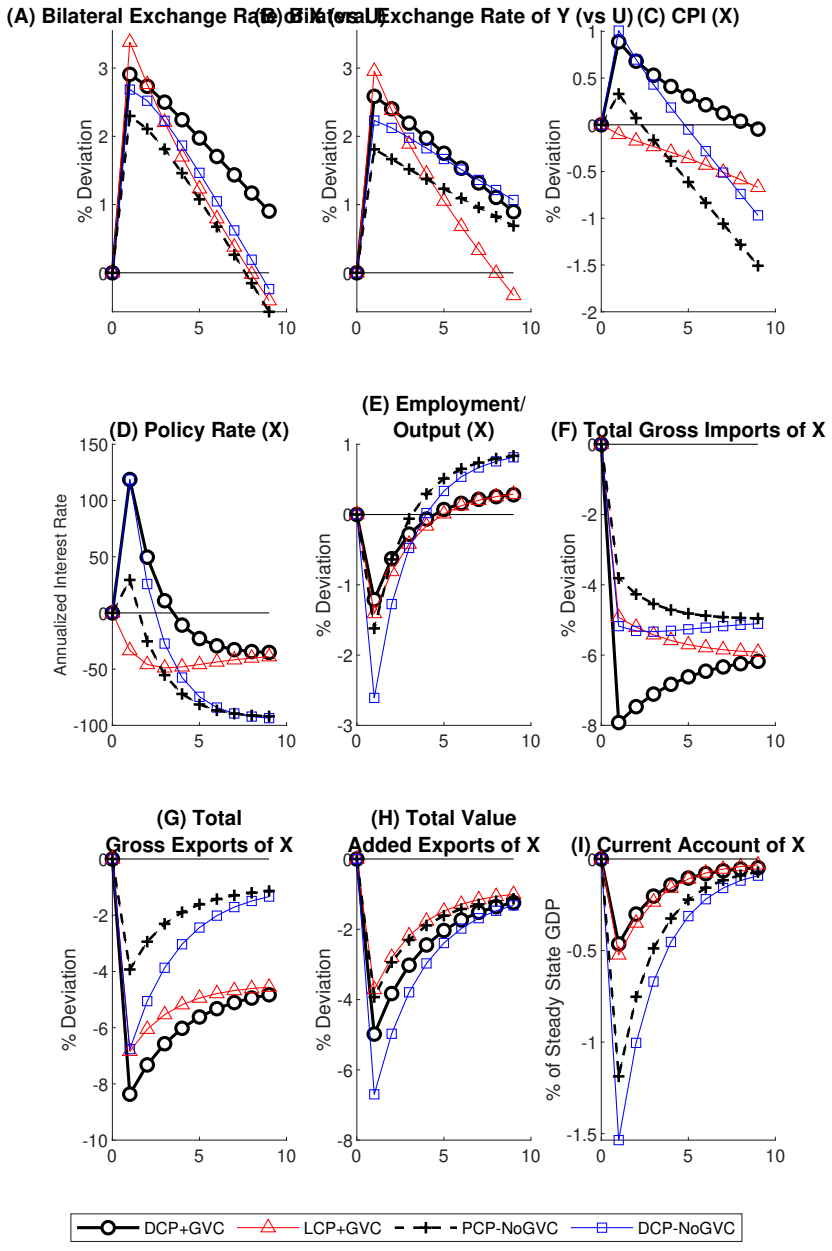
1. Benchmark model with Dominant (U) currency pricing and GVC linkages (DCP+GVC)
2. Local currency pricing and GVCs (LCP+GVC)
3. A "textbook" model with producer currency pricing and no GVCs(PCP-NoGVC)
4. A model with dominant currency pricing and no GVCs (DCP-NoGVC)

A.B Simulation Results

Figures A.1-A.3 show the response of key variables in countries x and Y to the tariff imposed by U on A. Panel (A) in Figure A.1 shows a depreciation of the bilateral exchange rate of X against U, and Panel (B) shows the same for country Y. In terms of magnitude, irrespective of the assumptions made on pricing, the response of X's exchange rate is sharper than that of Y. Gross exports decline in both countries under the benchmark, but the decline is much sharper in X. This is in part due to trade diversion effects-as show in panels J and U, while gross exports of X to U which are directly impacted by the tariff decline sharply, gross exports of Y to U actually increase. This effect is also reflected in the sharper deterioration in the current account and total output in Y relative to X.

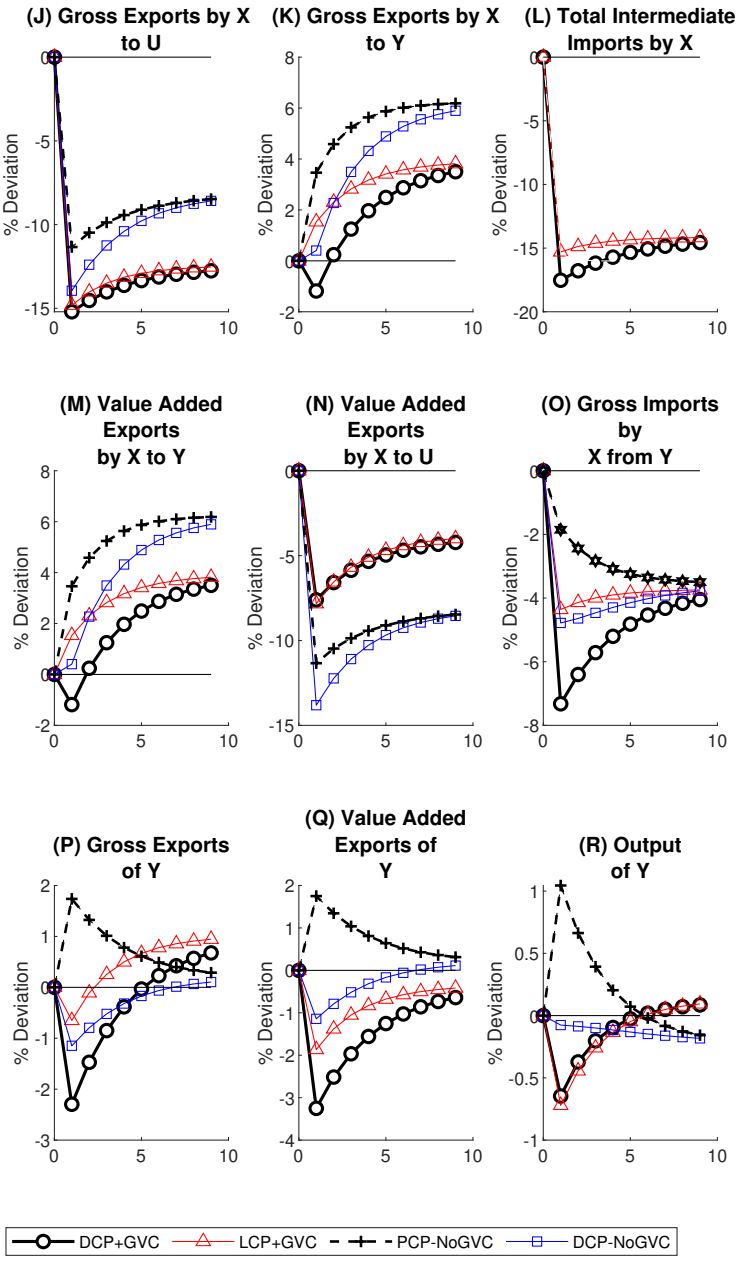
[6] see Cook and Patel, 2023 for more details on the model and calibration

Figure A.1: Impulse Response to Permanent 10% Tariff Shock



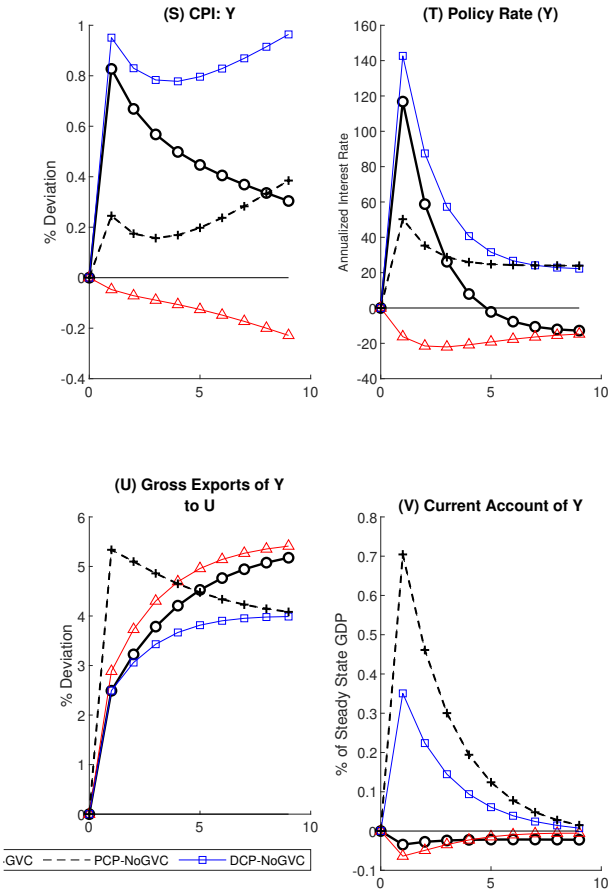
Notes: The Figure shows the response of a 10% Tariff imposed on gross exports by Country U on country A. Country B engages in direct exports to U as well as GVC exports to A which are partly re-exported to U, and is not directly impacted by the Tariff from a

Figure A.2: Impulse Response to Permanent 10% Tariff Shock



Notes: The Figure shows the response of a 10% Tariff imposed on gross exports by Country U on country A. Country B engages in direct exports to U as well as GVC exports to A which are partly re-exported to U, and is not directly impacted by the Tariff from a

Figure A.3: Impulse Response to Permanent 10% Tariff Shock



Notes: The Figure shows the response of a 10% Tariff imposed on gross exports by Country U on country A. Country B engages in direct exports to U as well as GVC exports to A which are partly re-exported to U, and is not directly impacted by the Tariff from a

B Data Merging Process

Country Level:

- The GTA data is merged with BIS bilateral exchange rate data using the keys: **'Date of Interventions', 'Country-Pair'**. We keep the bilateral exchange rate pairs when at least one observation of the GTA is recorded.
- At the country-pair level, we treat GTA observations as NaN (missing) if different types of intervention measures happen on the same day (e.g., import tariffs and export tax) OR if any of the interventions of the same type have opposite directions (red and green). If none of these conditions are satisfied, we collapse and keep only one entry for each intervention type.

Sector Level:

- The GTA uses the HS12 six-digit level. For interventions that include sector-level information, the associated sectors are selected based on the United Nations' correspondence table for HS12 six-digit and HS 2012.
- We convert the GTA dataset to 35 sectors available from the ADB-MRIO tables. To achieve the maximum matching accuracy with ADB-MRIO, we use the HS 2012 6-digit sector level code for mapping.
- If country A applies certain intervention without sectors recorded, we assume this action applies to all sectors by assigning Weight1 to be 1.
- We drop country pairs that are not reported by ADB since the sector level data is missing.

C Enriching the analysis with sectoral information and input-output linkages data

Notation:

- A = Importing country/country imposing the trade measure
- B = Exporting country

- S = Sector on which the measure is imposed
- M = Type of measure (e.g., import tax, export tariff, etc.)
- T = Date on which the measure is imposed

Step 0: Mapping GTA and ADB MRIO sectors

We use the mapping provided by ADB to match the ADB C35 sectors with GTA HS-6 sectors. Once this mapping is done, we only consider the ADB C35 notion to mark the sector.

Step 1: Eliminating "duplicate" observations to ensure identification restrictions are satisfied

On a given day (T), let $\Omega_{AB} = [M_{1AB}, M_{2AB}, \ldots, M_{nAB}]$ be the set of measures imposed by country A on country B, and let $\Omega_{BA} = [M_{1BA}, M_{2BA}, \ldots, M_{nBA}]$ be the set of measures imposed by country B on A on the same day T. Note that each of these Ms can correspond to multiple rows in the dataset corresponding to multiple sectors. For example, M_{1BA} can contain 10 import tariffs imposed by country A on 10 different sectors in country B.

Define $\Omega^{AB} = \Omega_{AB} \cup \Omega_{BA}$.

- If Ω^{AB} contains any two measures that are of different types, then we ignore all rows in the dataset that correspond to Ω^{AB}.
- If all measures in Ω^{AB} are of the same type (i.e., all import tariffs, for example), then we drop all the rows that correspond to Ω^{AB} as above, except if the following three conditions are all satisfied:

1. All measures within Ω_{AB} are of the same color (e.g., all green or all red).
2. All measures in Ω_{BA} are of the same color.
3. The color of Ω_{AB} and Ω_{BA} are opposite.

If the three conditions above are simultaneously satisfied, keep all rows corresponding to Ω_{AB} and Ω_{BA} and add a new variable to the dataset (call it weight1). The weights for Ω_{AB} could be the value of gross exports from B to A in the particular sector divided

by the sum of total exports of B to A in all sectors (including from those sectors that are not part of Ω_{AB}). Similar weights for Ω_{BA}. Note that the denominator Ω_{AB} should contain not only exports from B to A but also from all countries that are in a currency union with B. The numerator will be independent of any currency union effects.

Step 2: Direct effects regressions

Collapse the dataset prepared in Step 1 to a single-sector version. This essentially means that if there is more than one sector (row) for a particular country pair on a given day, then retain only one of them, and for the corresponding weight variable, call it "weight2," use the sum of "weight1" computed in the previous step.

- Run two sets of regressions on this dataset (1) unweighted as we have been running till now, and (2) weighted, with weights given by "weight2"
- compare unweighted and weighted regression results.

D Appendix: Trade Policy Interventions

E Appendix: Additional Empirical Results

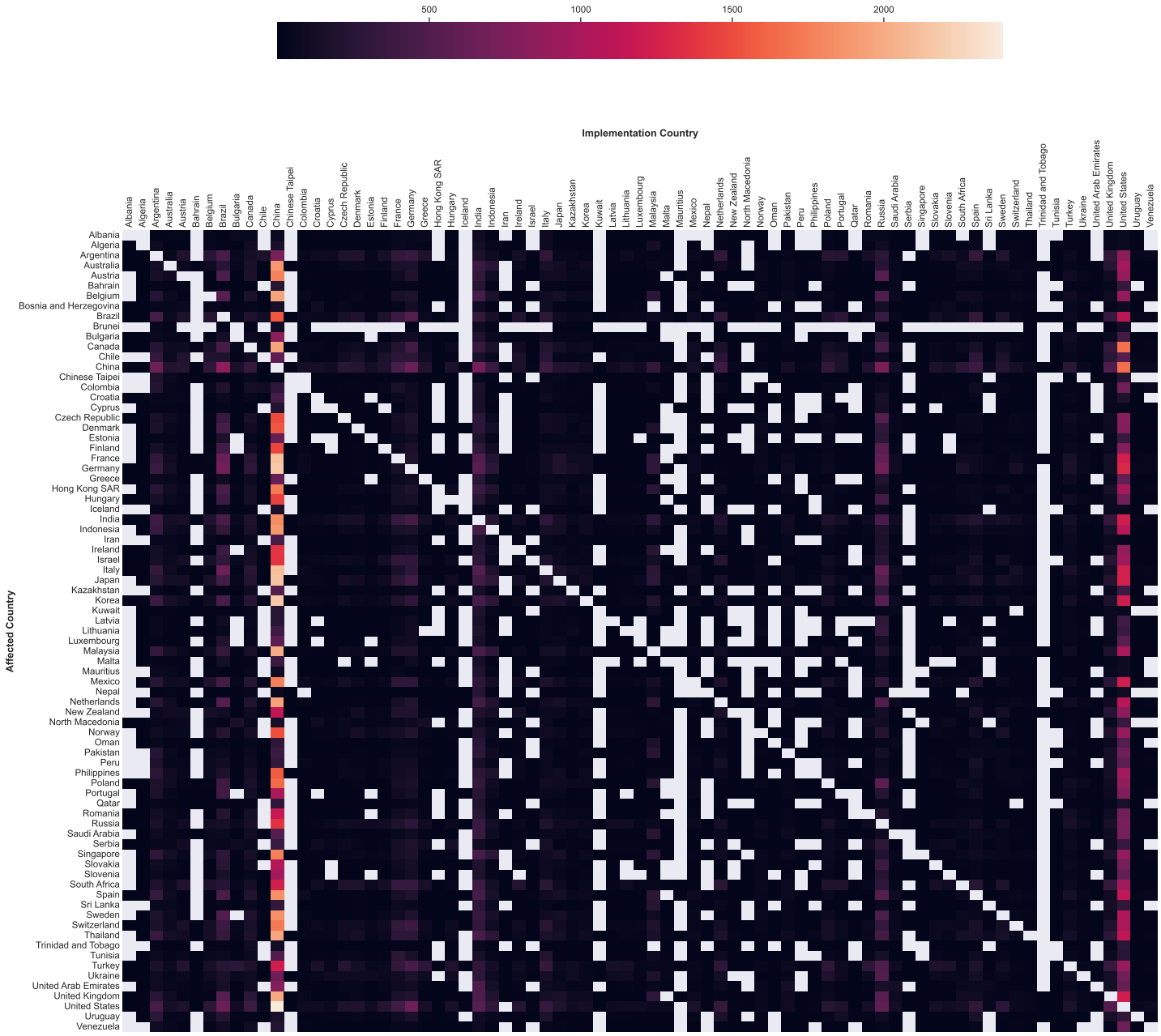
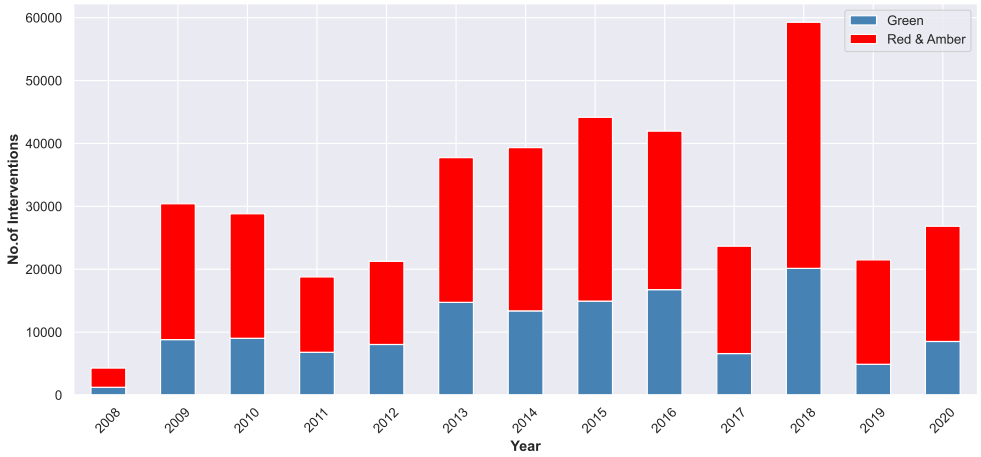


Figure D.1: Trade Interventions Density Heat-map - All

Notes: This figure shows the total count of trade interventions between each country-pair from 2009 to 2022. Each "cell" is interpreted as the number of interventions imposed by the corresponding country at the x-axis(top) on the country at y-axis. The spectrum goes from the dark color to the light one, with increasing density of interventions. Gray areas suggest there were no interventions.

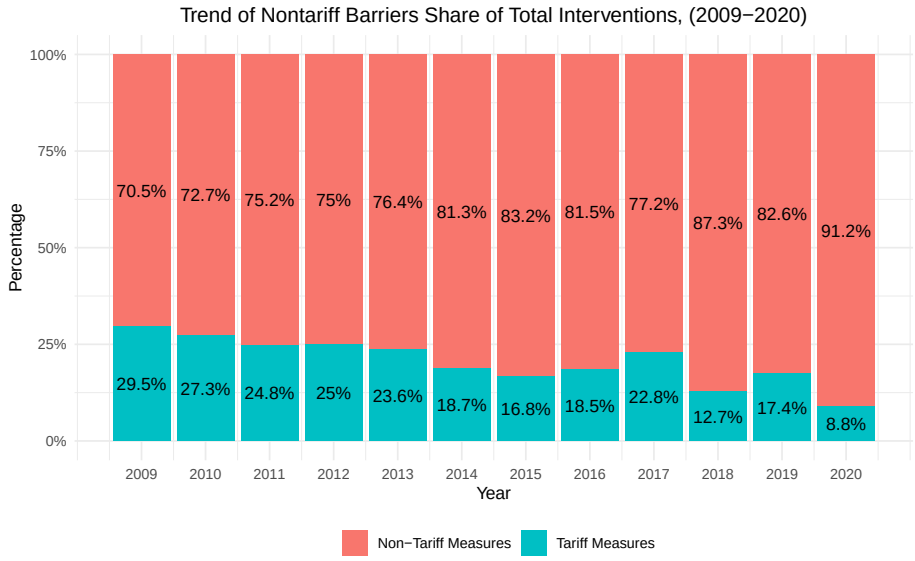
Source: Global Trade Alert. Prepared by authors

Figure D.2: Trend of Trade Liberalization vs Trade Protection (2008 - 2020)



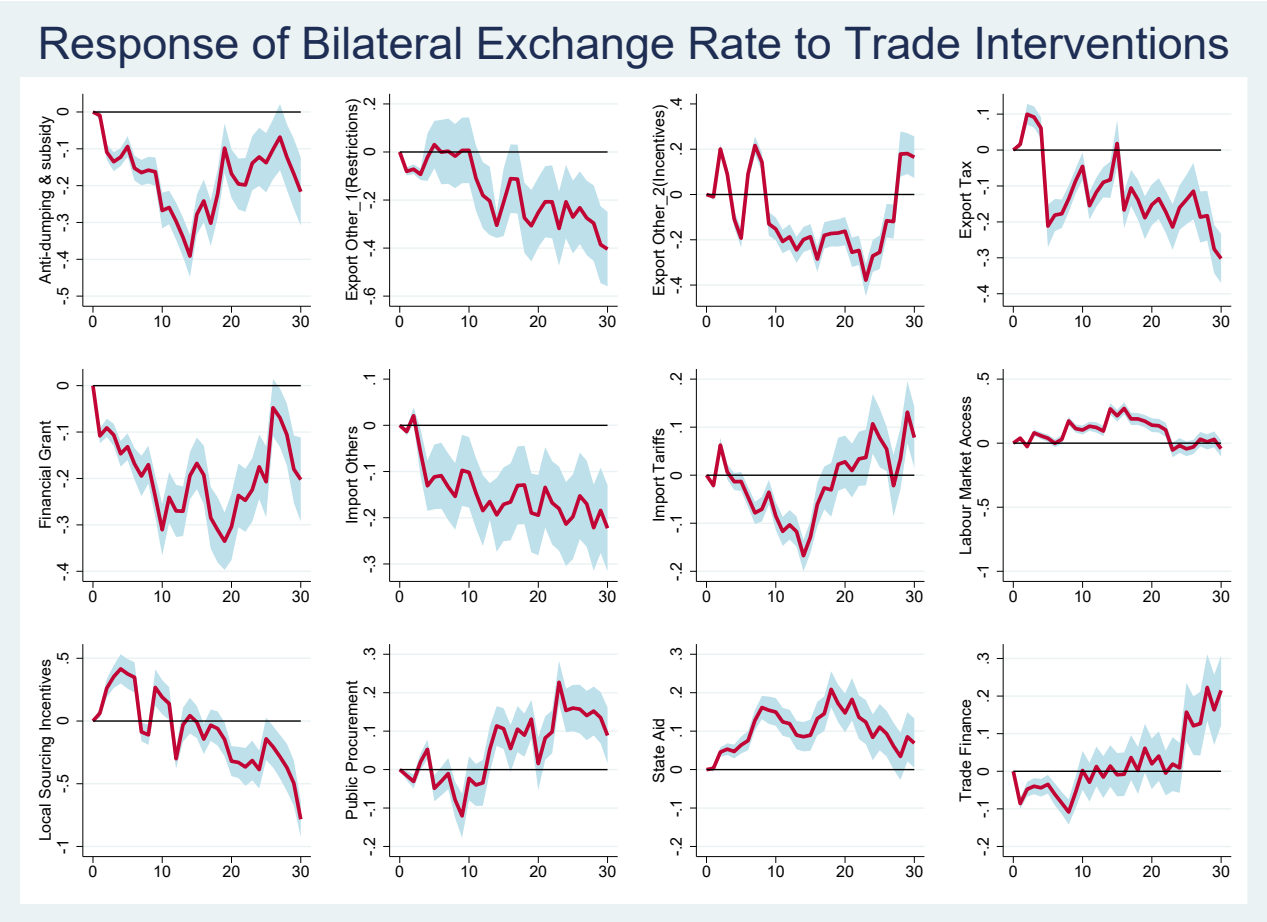
Notes: This figure displays the annual trend in the total number of trade interventions. The blue bars indicate trade policies that benefit partner countries, while the red bars indicate interventions that harm them. In the Global Trade Alert, harmful trade interventions are identified as "Red or Amber" actions and beneficial interventions are identified as "Green" actions.
Source: Global Trade Alert. Prepared by authors

Figure D.3: Trend of NTBs Share of Total Interventions (2009 - 2020)



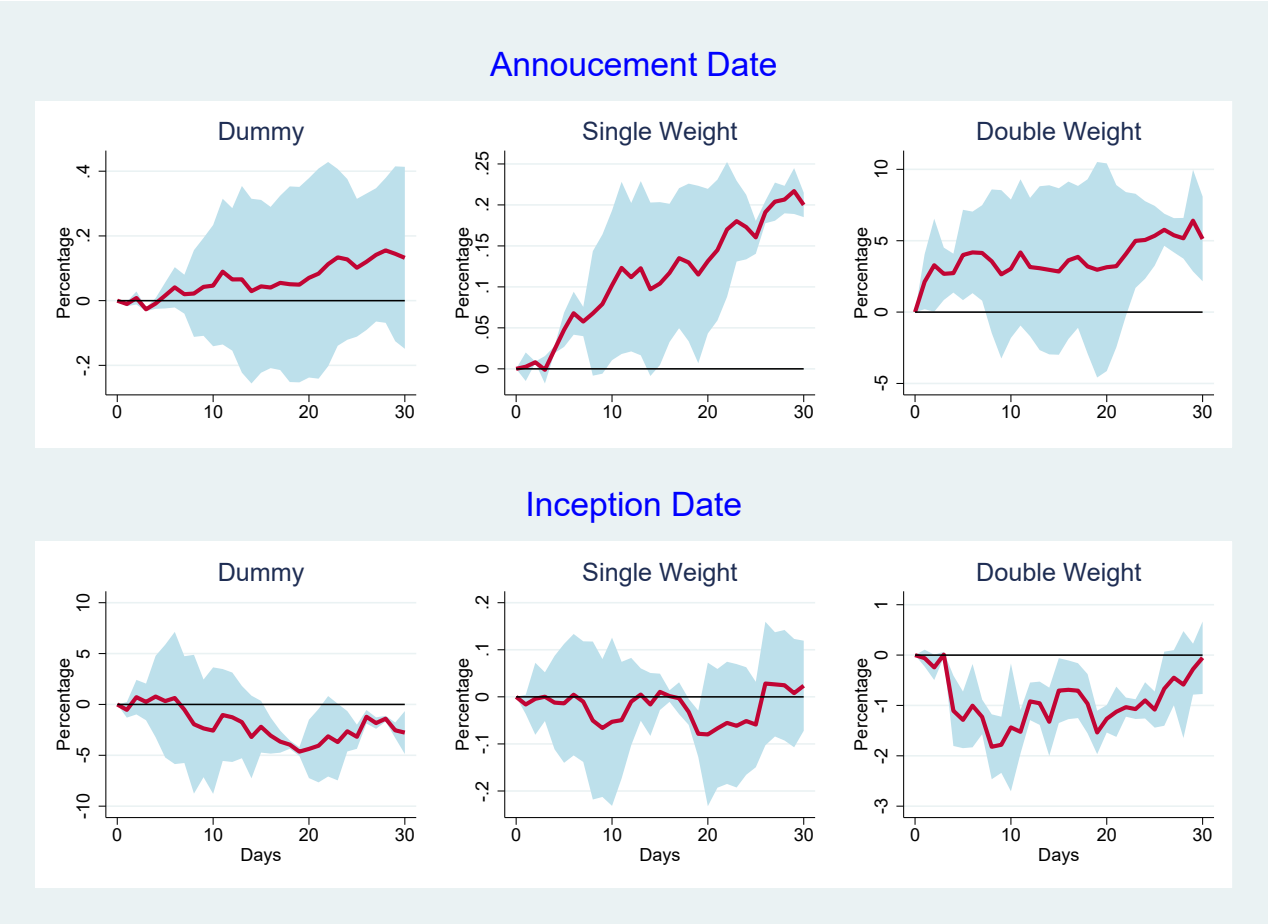
Notes: Share of tariff vs non-tariff barriers (NTBs) from 2009 to 2020, using "Net Increase". Net interventions are calculated as the **difference** between "Harmful" and "Liberalising" inceptions.
Source: Global Trade Alert. Prepared by authors

Figure E.1: Exchange Rate Response to Twelve Intervention Types (Dummy Measurement)



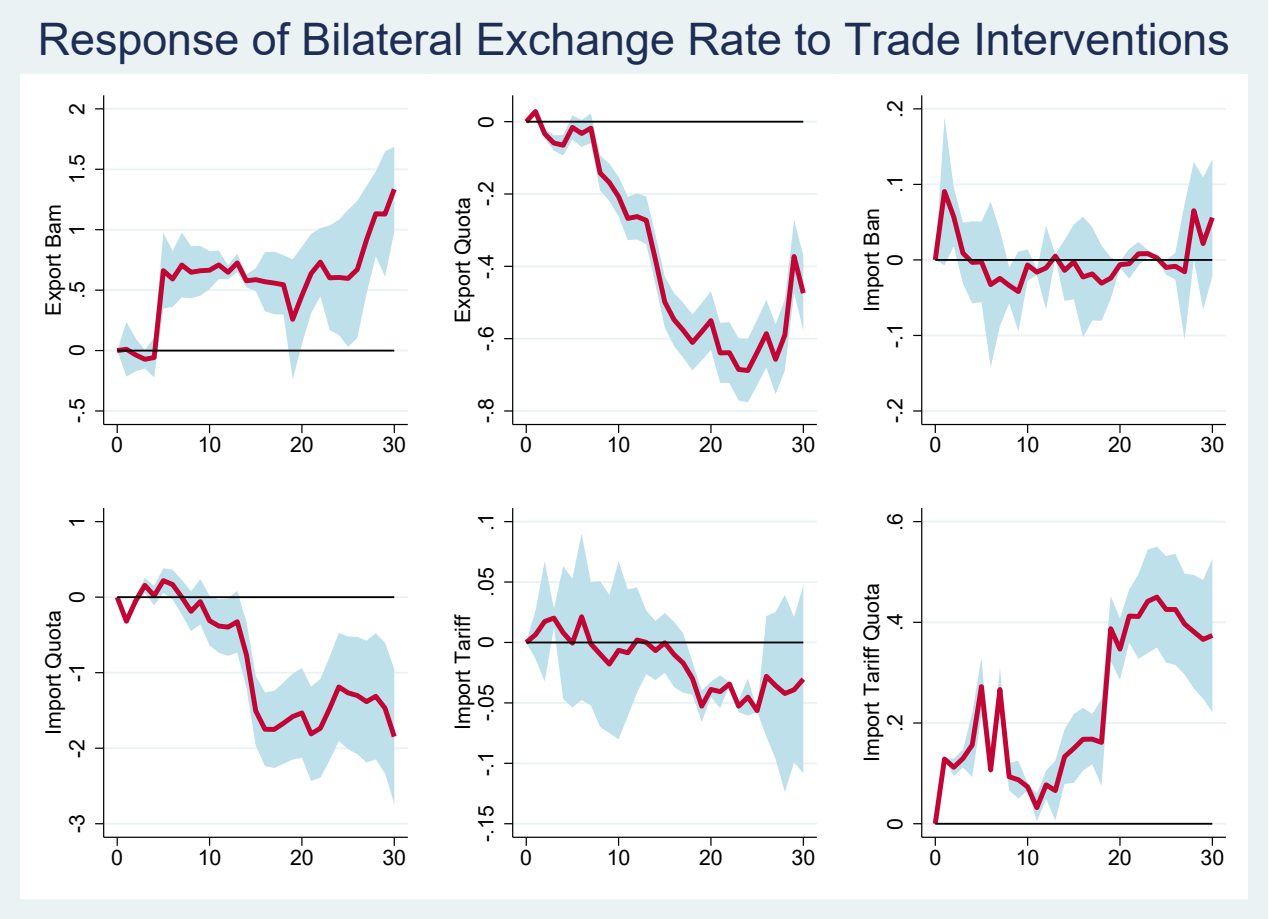
Notes: Bilateral exchange Rate response to shocks from different policy instruments. **Methods**: Dummy(unweighted). **Exchange Rate Regime**: No control. **Shock Date**: Announce.

Figure E.2: Exchange Rate Response to Import Tariffs Actions - US & China



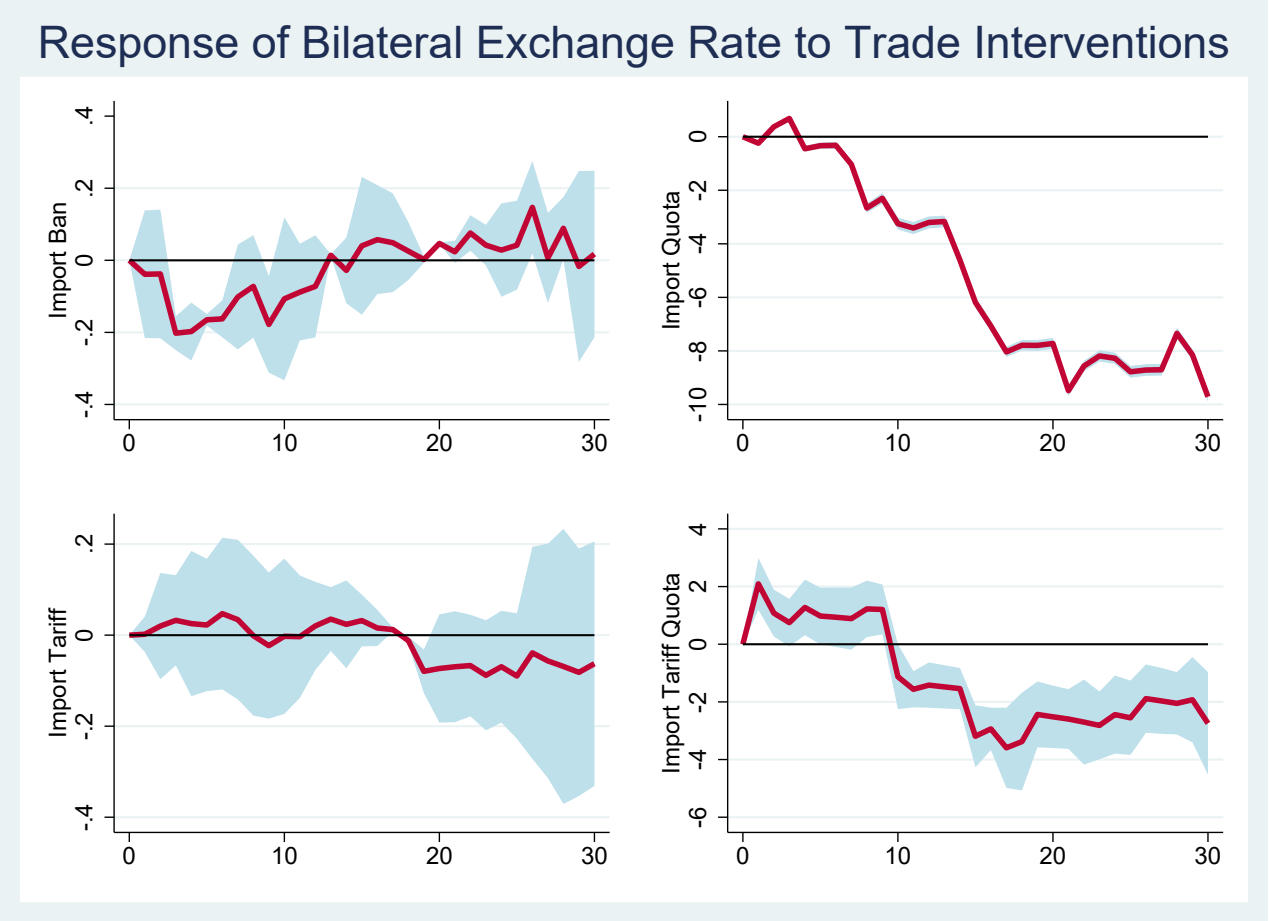
Notes: Bilateral exchange Rate response to shocks from different policy instruments. **Methods**: Dummy(unweighted). **Exchange Rate Regime**: No control. **Shock Date**: Announce.

Figure E.3: Sector(Weighted) Response - US China Bilateral



Notes: This figure shows the impact of import related trade intervention announcement shocks on the bilateral exchange rate . Following the approach of Teulings and Zubanov (2014), we also control for subsequent intervention announcement shocks occurring between t = 0 and t = k. **Country Sample**: China on US or US on China. **Methods**: Index(Weighted). **Time Period**: 2009 -2022. TZ method. **Shock day**: Inception date

Figure E.4: Sector(Weighted) Response - US China Bilateral - Trade War Period



Notes: This figure shows the impact of import related trade intervention announcement shocks on the bilateral exchange rate . Following the approach of Teulings and Zubanov (2014), we also control for subsequent intervention announcement shocks occurring between t = 0 and t = k. **Country Sample**: China on US or US on China. **Methods**: Index(Weighted). **Time Period**: 2018 -2019. TZ method. **Shock day**: Inception date