Global Integration and the Effects of Protectionist Measures

Occasional Paper No. 231

Export-Import Bank of India

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This study is based on the doctoral dissertation titled "Global Integration and the Effects of Protectionist Measures", which is selected as the winning entry for the Export-Import Bank of India's BRICS Economic Research Annual Citation (BRICS Citation) 2025. The dissertation was written by Dr. Anirban Sanyal, currently Assistant Adviser, Reserve Bank of India, Mumbai, under the supervision of Prof. Alan Spearot; Prof. Galina Hale; Prof. Brenda Samaniego De La Parra and Prof. Chenyue Hu. Dr. Sanyal received his doctoral degree in 2023 from the University of California Santa Cruz, USA.

July 2025

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Executive Summary

The World as a "Global Village" was first envisaged by Marshall McLuhan, a media and communication theorist, in 1964. In today's world, we live in a global economy inter-connected by trade, capital flows and technology. The unprecedented integration among economies which started since 1990 was blamed for contagion effects of the global financial crisis in 2008 (IMF, 2012). Different countries responded with various policy measures to counter the spillover impacts. While import tariffs were used as policy tool to protect domestic interests (UNCTAD, 2013), capital controls along with other macro prudential measures, were used to safeguard domestic economies from global financial uncertainties (Korinek & Sandri, 2015). The study focuses on the implication of such policy measures on the inter-connectedness of economies, mainly highlighting the impact of tariffs on trade and the effect of capital control measures on international capital flows. The chapters of the study are briefly described in the following section.

The first chapter of the study focuses on the empirical evidence of trade diversion from the recent trade war between the United States and China for India. The recent trade dispute between the US and other trade partners resulted in higher tariffs imposed by the United States Trade Commission on other trade partners. The tariff imposition happened between 2018 and 2020. A majority of tariffs during this trade war targeted imports from China. China retaliated with similar large tariffs on significant imports from the US. This opened up an opportunity for other trade partners like India. In this chapter, the trade diversion effect on India is evaluated on account of the higher tariffs between US and China. The empirical analysis studies the change in trade intensity between 2017 and 2019 using detailed product level trade flows of India with the US and China. The average change in trade intensity to India is estimated using a difference-in-difference regression. Due to the short-term nature of the trade war tariffs, the average effect of trade intensity can be grossly under-estimated due to differing levels of elasticity of substitution across different product categories. Hence, the framework is refined with triple interactions by introducing product level heterogeneity in the specification. For that, three broad categories of product classifications is considered namely (i) final goods vs intermediate goods (ii) homogeneous goods vs differentiated goods and (iii) highly elastic vs less elastic goods. The intermediate goods, used for final goods production, are not easily substitutable compared to final goods. Hence, one can expect that any short run effect of trade diversion is likely to increase trade intensity in final goods products, compared to intermediate goods products. Similarly, differentiated goods are hard to be substituted for and are the less elastic goods. The empirical findings suggests that India benefitted from the higher tariffs on China as India's export intensity increased to the US. However, no such effect was observed in India's export to China. This finding suggests that Indian manufacturers benefitted from the higher tariffs on China due to similar or comparable comparative advantages in products targeted under US tariffs on China. However, India does not have similar comparative advantages with the US manufacturers on products targeted by China (like soybean, agriculture products, and electronics, among others). The empirical findings of average impact on imports was not statistically significant. Further, the findings suggest significant product heterogeneity in trade diversion for India. More specifically, India's export intensity to the US increased in final products, homogeneous goods and highly elastic goods.

The second chapter analyzes changes in trade policy uncertainty (TPU) and its effect on global trade flows using a structural model. The recent literature on the trade war observed that different trade partners experience varying degree of trade diversion on account of higher tariffs between US and China. During the same period of trade war, the trade policy uncertainty index scaled to historical high values due to lack of clarity on the trade war scenarios. Researchers have attributed the heterogeneity in trade diversion to the change in trade policy uncertainty. In this chapter, the impact of trade policy uncertainty is examined on global trade flows by introducing trade policy uncertainty in a multi-country Ricardian trade model. The proposed model uses multi-country multi-sector trade model proposed by Eaton & Kortum (2002) and builds in the uncertainty component. The trade policy uncertainty is drawn from two sources - first, the uncertainty around trade policy changes and second, stochastic uncertainty around the tariff sizes. The trade policy uncertainty affects the price distribution which translates to demand uncertainty. The rationale behind using these two sources of uncertainty is drawn from the experience in global protectionism like Brexit and US trade war. The policies adopted under these episodes increased uncertainty about trade environment as the trade partners were unsure about the possibility of trade policy changes and the effect of the trade policy changes on trade costs. Such uncertainties in trade policy creates challenges for trade partners due to the high adjustment cost in production planning. The trade partners make their production plans when there is lack of clarity about the future trade policy and allocates the factors of production accordingly. However, the trade policies are announced at later stage when it becomes difficult to modify the factor allocations. The trade policy uncertainty is introduced in the model by adding a distribution of beliefs about future trade policy. Each partner has beliefs about the probability of a trade policy change and the possible change in tariff sizes on account of the policy change. The stochastic nature of tariff sizes and the probability of the policy change translates into the trade partners' assessment of final demand conditions which can be very different from actual tariff scenario (after trade policy is announced). The model establishes the effect of trade policy uncertainty using analytical derivations and quantitative calibration of the model. The analytical derivations shows that the possible heterogeneity in trade diversion is driven by the stochastic choice of trade partners about future policy. Further, it also provides the boundary conditions of different trade diversion scenarios given trade partners' belief. Later, the model is extended to the analytical model to full scale calibration using two stage approach. The trade policy uncertainty is calibrated under different scenarios of tariff sizes and probability of policy changes. Lastly, a full scale model is demonstrated to reciprocate other scenarios where uncertainty may appear due to other externalities like lockdown imposed by China.

The third chapter investigates the heterogeneous effect of capital controls on the gross capital flows across sectors. Capital controls are macro-prudential policies adopted by different countries to safeguard their domestic interest from the volatility of capital flows. Often times these policies include taxation on foreign investments, volume restrictions on foreign inflows, legislative steps on foreign investment etc. Generally, advanced economies invest in emerging markets in search for higher yields. However, as the domestic and global investment conditions deteriorate in the destination countries, the direction of capital flows reverses towards advanced economies and other emerging market economies. Such sudden reversal of the foreign capital flows destabilizes the domestic currency, worsens the trade balance, widens the debt burden and de-stabilizes the growth potentials of the emerging market economies. Most Latin American economies and South-East Asian economies faced currency crisis on account of the volatile capital flows during 1990’s. In response, the International Monetary Fund (IMF) prescribed capital controls as suitable macro-prudential policy measures to safeguard the emerging market economies from the volatile capital flows from advanced economies. Capital controls are used as macro-prudential policy to safeguard domestic economy from the volatility of external capital flows. The effects of capital controls are studied across many dimensions. Beyond the intended consequence of capital controls, the indirect effects of such policies are often highlighted by the investors. The survey of investors, carried out by Forbes et. al. (2016), observed that the capital control policies send a signal to the global investors about the state of domestic economy. Such signaling effect of capital control interacts with the intended effect and can lead to heterogeneous outcome on gross capital flows across different institutional sectors. The institutional sectors, namely government, banks and private corporates, have different risk profiles and the portfolio allocations across these sectors are driven by the risk profile heterogeneity. Following investors assessments about the domestic economy, one can expect that the signaling effect of capital controls can trigger heterogeneous effects on capital flows across these institutional sectors.

Further, the framework is extended to examine such heterogeneity in the direct and spillover effects of capital control on gross capital flows using cross-country international capital flows data across various sectors. The direct effect of capital control captures the effect of capital control on gross capital flows across these sectors. The spillover effect, on the other hand, is mainly driven by the network effect of capital flows restrictions on capital flows among different recipient nations. In this chapter, a theoretical underpinning of the possible signaling effects is provided and then, the reduced form is validated for identifying the heterogeneity using sector level global capital flows data. First, the signaling effect of capital controls is introduced in a portfolio choice model with a multi-country set up to demonstrate the possible heterogeneity in the direct effect and the spillover effect on gross capital flows as one country increases capital taxation on capital inflows. The direct effect and spillover effect of capital control can be heterogeneous on capital inflows due to the signaling effect of capital controls. To validate the heterogeneity, the spatial regression framework is estimated on quarterly capital flows data to different institutional sectors in a spatial econometric framework. The empirical findings indicate that the domestic direct effect of capital controls moderates portfolio inflows to the public sector whereas the portfolio inflows to banks and the corporate sector does not respond to the domestic capital control measures. The spillover effect of capital controls increases capital inflows to all sectors in other countries.

1. Impact of US-China Trade War on India's External Trade

Protectionist measures are commonly used to safeguard domestic producers from foreign competition. The recent trade dispute of the US with other trade partners, EU common agricultural policy, food tariffs imposed by Argentina and anti-dumping duties, among others are recent examples of trade protectionism. One of the common measures of trade protectionism is tariffs. Higher tariffs on any country create new opportunities for other trade partners to increase their trade volume. In this chapter, the trade diversion effects is analyzed on India due to higher tariffs imposed by the US on China during 2018-19.

The recent tariff war between the US and China ushered in a new era of protectionism in international trade. Starting in 2018, the US increased average tariffs on imported products from China through different tranches of announcements, and ultimately, the average tariff on imported products increased from 2.6% to 20.6%[1].According to Fajgelbaum et. al. (2020), tariffs of around 12000 products (10800 imports are targeted from China) increased under the US action. These protectionist measures resulted in similar retaliation from major trading partners of the US including China, European Union (EU), Mexico, Russia and Turkey. Among these nations, China led the retaliation by imposing tariffs of similar magnitudes on products imported from the US. The impact of trade war was felt immediately on the US and China as trade volumes plummeted significantly after the tariffs (Amiti et. al. (2020), Fajgelbaum et. al. (2020), Cavallo et. al. (2019)). Further, higher tariffs are found to reduce consumption growth which led to a welfare loss for the

[1] Tariffs representing weighted average tariffs imposed at HS-8 level.

US (Waugh, 2019). The trade war also affected export growth through supply chains (Handley et. al. (2020)). On the other hand, higher tariffs imposed by the US, reduced the profit margin of the firms in China (Wang et. al. (2020)).

Beyond the direct impact of the higher tariffs on the US and China, the tariff war was of a size that may have significant impacts globally. Comparative advantage along with changes in tariffs resulting from the trade war may lead to a meaningful substitution of commodities from other trade partners having access to targeted country's markets and not subject to the direct impacts of the trade war. Thus, the trade war may provide a positive benefit to outsiders in selling to markets directly impacted by the tariff war (Bekker & Schroeter (2020), Bolt et. al. (2019)). India, being a major common trading partner to both US and China, is an ideal case study for analyzing possible trade diversion resulting from the US-China tariff war. With this background, the chapter analyses the short-term impact of the US-China tariff war on India's external trade at aggregate level and across different product categories. Recently on similar topic, Khandelwal (2022) analyzed the average impact of the trade war on Indian exports using product level export data. The chapter documents an insignificant impact of trade diversion due to the trade war tariffs between US and China. However, the chapter looks at the sectoral impact of tariffs but ignores the product heterogeneity. This chapter analyzes the trade diversion effect on India by factoring in heterogeneity across product groups.

Using product-level export and import data, this chapter documents that the tariff war by the US and subsequent retaliation by China, impacted India's export growth significantly at the aggregate level. The effect is found to be more prominently driven by US tariffs, rather than China's retaliatory tariffs. On average, higher US tariffs on Chinese imports reduced imports from China and significantly increased imports intensity by 0.7 from India. Retaliatory tariffs levied by China, However, had an insignificant impact on trade diversion to India. This is due to the similar comparative advantages of India in the products targeted under US tariffs[2].

[2] US tariffs targeted wide variety of imports from China where India has comparative advantages. China tariffs targeted mainly agricultural and electronics products where India does not have comparative advantages

The heterogeneous effects is further examined through intermediate vs. final goods, homogeneous vs. differentiated goods and high vs. low elastic goods. Trade diversion is more pronounced and significant on the exports of final consumption goods and insignificant in case of intermediate goods. This is intuitive since final goods are more easily substituted whereas the intermediate goods are used in the production process, are sometimes specialized, and thereby take a longer time. Lastly, the differentiated and homogeneous product classification proposed by Rauch et al. (1999) is used to check any heterogeneity in this dimension. Exports from India to the US increased in homogeneous goods subject to US tariffs on China, and not significantly for differentiated goods. Also, the findings suggest similar effect for highly elastic products (using estimates from Broda ad Weinstein (2006)). These findings corroborate the rigidity of replacing non-homogeneous goods (and inelastic goods) in the global value chains at least in the short run.

On the import side, the findings are inconclusive. The impact of the tariff war is found to be significant on the aggregate level. However, the impact of tariffs on heterogeneous product classes reveals that the import of final goods increased significantly from China, whereas imports from the US are unaffected. Import of homogeneous goods increased due to the tariffs, and a similar effect is observed in high elastic goods. In short, the US-China trade war increased Indian exports to the US, especially in substitutable product classes namely final goods, homogeneous goods and highly elastic goods.

This chapter contributes to two strands of literature. First, the chapter analyzes the effect of the US-China trade war and its implications on neutral trade partner like India, and thus, it contributes to the larger literature on the US-China trade war. Among the papers analyzing the direct effect of the trade war, Fajgelbaum et al. (2020) provides a comprehensive analysis of the trade war, identifying the anti-consumer impact of the US tariffs on China, with no reduction in China's terms of trade. Waugh (2019) analyzes the impact of the tariffs imposed due to US-China trade war on new car sales data (as proxy of consumption), the paper argues that the retaliatory tariffs imposed by China, caused a significant decline in the aggregate consumption. Carter & Steinbach (2020) document a significant decline in food exports by the US and a realignment of trade patterns across countries. South American countries and Europe benefit due to the reorientation of the trade flows. Analyzing the impact of retaliatory tariffs on investments, Amiti et. al. (2020) observed that the announcement of tariffs is expected to reduce the investment growth of the exposed firms by 1.9% by end of 2020. Relatedly, Handley et. al. (2020) analyze the effects of higher tariffs on exports of US firms via supply linkages. They observe high tariffs on imported inputs and reduced the competitiveness of US exports[3].

The chapter also contributes to the trade diversion literature. Following the trade war and higher tariffs imposed by the US and China, a significant trade diversion is documented toward India, a trade partner which remained neutral in the trade war. A large portion of trade diversion literature is concentrated on the trade creation and trade diversion due to North American Free Trade Agreement (NAFTA). Krueger (1999) analyzes the early impact of NAFTA on Mexico using micro level data on bilateral trade and other country specific controls, and documents that Mexico's trade with the US and Canada increased after NAFTA.

Similarly, Fukao et. al. (2002) use trade data across major industry sectors at HS-2 digit level and found similar effects of NAFTA. In terms of larger, general equilibrium models, Caliendo & Parro (2012) analyze the impact of NAFTA on welfare, and estimate that the welfare of Mexico increased by 1.31% whereas welfare of the US increased by 0.08%. However, Canada faced a decline of welfare around (-0.06%). Clausing (2001) analyzed the impact of tariff liberalization on trade pattern between the US and Canada. The empirical analysis observed significant trade creation happening due to the FTA with very little evidence towards trade diversion. Magee (2008) observed a significant effect on trade creation due to the FTA whereas the impact on

[3] Another strand of literature analyzes the impact of tariff using ex-post analysis across industry segments, regions and firms. Attanasio et al. (2003) identified three primary channels through which tariff reduction impacted welfare and inequality. These three channels, namely increasing return to college education, changes in relative industry wages and informality in industry, impacted the labour market widely depending upon the specialization and job types. Topalova (2010) commented that the impact of trade liberalization was more pronounced across sectors in rural areas, resulting in a sloIr decline in poverty and loIr consumption growth.

trade diversion as found to be muted. Dai et al. (2014), However, observed significant trade diversion from non-participating countries due to the FTA. Mattoo et al. (2017) corroborated the strong trade diversion hypothesis due to the FTA. The impact of trade war has been analyzed through the aspects of trade diversion. Meinen et al. (2019) analyze the impact of US-China tariff on 30 countries using product-level observations. Using a difference-in-difference approach, they conclude that higher tariffs did not result in trade diversion significantly. Balistreri et al. (2018), Bellora & Fontagne (2019) highlighted the long-term positive impact to third trading partner due to US-China trade war as trade diversion to other trading partners increases. Bolt et al. (2019) proposed similar findings using a simulation-based approach. IMF (2018) expected similar effects of trade diversion to other trading partners in the short term. Bekker and Schroeter (2020) contradict the findings of trade diversion in the context of US-China trade war, and they observed significant trade diversion across trading partners using ex-post and simulation-based approaches. However, the trade diversion impact was found to be more effective after the initial waves of tariff imposition. Bekker & Schroeter (2020) also highlights that the impact of the first phase of tariff increases had limited effects on global trade due to US importers' commitment to buy Chinese products. Apart from trade diversion, the indirect effect of tariff war was found to be a drag on Japanese multilateral companies as the demand of Chinese goods reduced significantly due to US tariff (Chang et al. (2020)). Compared to the existing literature, this chapter undertakes an extensive analysis of trade war impact on India by analyzing the overall impact and product heterogeneity in the trade diversion. Khandelwal (2022) analyzed the impact of the trade war on the trade diversion to India using product level. The paper observed an insignificant effect of the higher tariffs between US-China on the average export intensity of India. However, the paper did not considered product heterogeneity. This chapter provides detailed analysis of the trade diversion across different product classifications.

Apart from the overall impact of trade war, the chapter also analyzes the heterogeneous impact of trade war on various product categories. In that way, the chapter contributes the large literature of firm and product heterogeneity. Melitz (2003) introduced firm heterogeneity in Krugman's model. Extending the framework, Arkolakis (2010) established the broader response of low tariff goods during trade liberalization through the lens of loIr marketing cost. Spearot (2012), on the other hand, extended Melitz and Ottaviano (2008) framework and observed the impact of trade liberalization significantly higher in case of high elastic goods. Feenstra and Weinstein (2010) postulated similar observations of trade liberalization on differentiated products categories. On product level heterogeneity, Rauch (1999) identified three different types of products namely exchange traded products, referenced price products and differentiated products. In his paper, Rauch observed that the proximity and common language as two main factors for matching buyers and sellers in the differentiated goods market. Broda & Weinstein (2006) observed significant welfare implications due to product variety. They estimated the elasticity of substitution at SITC 5 classifications and observed an upward bias in price index estimate.

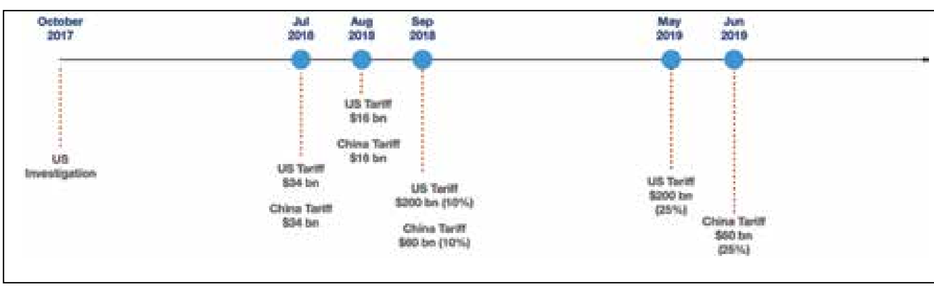
The effects of trade war on neutral trade partners like India, can happen through different channels including trade channel, labor market implications and price transmission, among others. The trade diversion observed in this chapter, indicates greater export intensity in response to higher tariffs structure. However, the net impact of trade war on India remains unclear. Following Handley et. al. (2020), the impact of supply chain linkages can provide important insight about the resulting impact of export growth on import intensity. For instance, higher demand for imported inputs is likely to increase import intensity and thereby can result in higher trade deficit. One needs to perform a comprehensive analysis of supply chain linkages and resulting trade patterns due to trade diversion before drawing any conclusion on the welfare implications of trade war on neutral trade partner.

The reminder of the chapter is organized as follows: A short history of US-China tariff war is illustrated in Section 2. Section 3 documents compelling facts about Indian tariff scenario during the trade war timeline. Section 4 documents data description and stylized facts. The overall impact of US-China trade war on India's trade is illustrated in Section 5. Product level heterogeneity is covered in Section 6. The chapter concludes with a discussion of the findings in Section 7.

2. The US-China Trade War of 2018

The US imposed higher tariffs on Chinese imports using a mix of allegations, from unfair trade practice to national security grounds. Early tariffs on solar panels and washing machines are proposed in October and November of 2017, and implemented on January 22, 2018. Retaliatory investigations occurred almost immediately resulting in anti-dumping duties of 178.6% on sorghum imports from the US. A cascading trade war followed with the US imposing tariffs of 10% and 25% on steel and aluminum on all trading partners during March 2018. A retaliatory tariff was imposed by China up to 25% on 128 US products on April 2, 2018. The US consequently responded with 10 and 25% tariffs on Chinese imports worth US$50 billion on April 3, 2018. Waves of higher tariffs are imposed by US and China in subsequent moves between April - September 2018. During this time, the average tariff increased from 10% to 25% on various categories of products by US and China (Source: Reuters[4]). The timeline of US-China trade war is illustrated in Fig 1.1.

Fig 1.1: US-China Trade War timeline

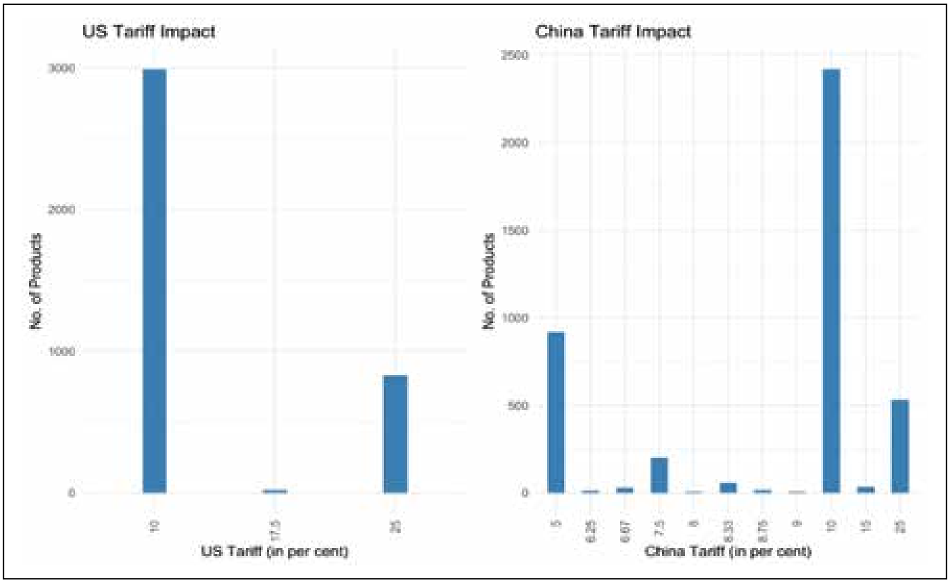


Note: The timelines are drawn using the tariff announcement dates of each tranche from USITC.

Before the tariff war (i.e. in 2017), China exported around 4573 different products to the US at the HS-6-digit level. The tariffs imposed by the US are organized in three tariff brackets, namely 10%, 17.5% and 25%. A majority of the HS6 products, targeted under the US tariff, experienced 10% tariff. China tariffs, on the other hand, are designed at different levels though the majority had tariffs of 10% or below (refer to Fig 1.2).

[4] Timeline: Key dates in the U.S.-China trade war https://www.reuters.com/article/us-usa-trade-china-timeline/timeline-key-dates-in-the-u-s-china-trade-war-idUSKBN1ZE1AA.

Fig 1.2: US-China Tariff Impact on HS-6 products



Source: Fajgelbaum et. al. (2020) and author's calculations

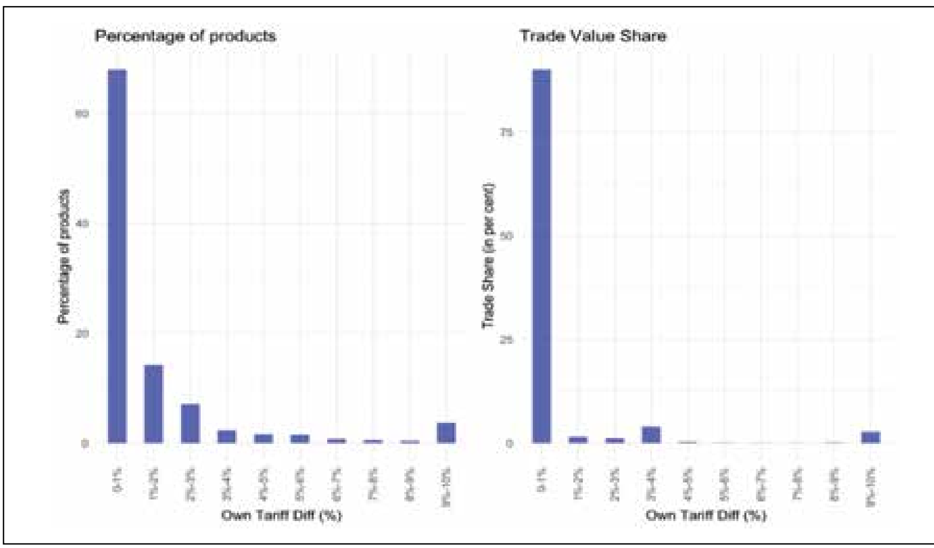
3. India's Tariff

In order to analyze the impact of trade war between the US and China on India, one should also evaluate tariffs that are also applied by India during this same period. One of the largest changes for India was that the US government terminated India's designated position in the Generalized System of Preferences (GSP), effective June 5, 2018. GSP was designed by the US as duty free avenue for the goods coming from beneficiary countries and to promote economic development. Founded in 1974, GSP reduced US import tariffs on imported goods from 119 developing countries. India's exit from GSP, therefore, must be considered alongside any effects of the US China Trade war[5]. In order to analyze the magnitude of tariff changes under GSP,

[5] The impact of losing GSP status was examined by Mukhopadhyay & Sharma (2020) and Chauhan (2020), which observed varying impacts losing GSP on different industry segments in India. Further they highlighted that among all sectors, there was a significant impact of higher import tariffs on sectors like organic chemicals, nuclear reactors, vehicles and parts, iron and steel, plastic and products, electrical machinery, leather, rubber and rubber products etc.

the change in tariffs is calculated across products at HS-6-digit level[6] between 2019 and 2017. From the histogram of tariff difference, the maximum increase of tariffs is found to be around 10% in the post GSP period. Further majority of products traded by Indian manufacturers, are found to have no change or small change (less than 5%) in tariff levels during post the GSP period. Also in Fig. 1.3, the impact of these tariffs appears to be largely unaffected in terms of trade value share.

Fig 1.3: Summary of trade value share and products across own tariff difference



Source: UN Comtrade and author's calculations

4. Data used and Stylized facts

The primary data used in this chapter is sourced from the Directorate General of Foreign Trade (DGFT) for Indian External Trade data. The bilateral trade data is gathered at HS-6 digit and HS-8-digit levels. The HS-6-digit level information is used to map tariff details across products and countries (due

[6] Tariffs of each year are expressed as iceberg cost.

to international harmonization). The data is collected at an annual frequency[7] to smooth out monthly variation in exports and imports. The data is collected at the product - destination level and it represents an unbalanced panel due to products which are exclusively traded to any destination or are not traded at all. The data period for analysis is 2012-2019[8].

The products impacted by US tariffs are defined at the HS10 digit level whereas China tariffs can be mapped at HS8 digit. The US tariffs are imposed in different waves over time. Further, the tariff rates are altered over time. Hence the effective tariff[9] is used for empirical analysis. US Tariff data is collected from USITC data using the information on collected duties and dutiable value across products. The effective tariffs are calculated as a ratio of duties collected and dutiable value. Information on China's retaliatory tariff is sourced from Fajgelbaum et. al. (2020) at HS8 digit level. Average tariffs across the HS-6 digit level is used as proxy of retaliatory tariff at HS6 digit level. For the sake of simplicity, the simple average is used to estimate tariff rate at HS6 products. However, the tariff estimated using this approach, does not necessarily imply the tariff shock, rather it factors in any existing tariff placed on the products. Hence the tariff shock has been estimated by removing the MFN tariff across destination countries at product level. MFN data is sourced from WTO database. India's tariff data (i.e tariffs imposed on India's exports and tariffs charged by India) are collected from WTO database to verify any change in tariff structure during US-China trade war timeline in order to assess the robustness of trade diversion findings by factoring the effect of India's exit from GSP.

In the analysis that follows, products will be further classified into product classes to understand any differential impact of tariff across product categories. These products are classified into mutually exclusive categories, namely (i) intermediate goods vs final goods (ii) differentiated goods vs

[7] The annual data on India's external trade corresponds to the financial year i.e. April to March for every year.

[8] Financial year 2020 ends by March 2020 when the COVID impact was still in nascent stage in India. I restrict our analysis till March 2020 to avoid any overlap with COVID lockdown restrictions across countries.

[9] Effective tariff refers to the tariff after rounds of tariff wave imposed by the US on China.

homogeneous goods and (iii) high elastic goods vs less elastic goods. Intermediate goods refer to those used as inputs for manufacturing. The intermediate goods are identified based on the broad economic classification (BEC) using the mapping between HS codes and BEC code (Source: UN Stat and Comtrade)[10]. Beyond the usage of products, another aspect of trade diversion may be related to the substitutability of products. The empirical analysis further examines the substitutability of products in two dimensions: homogeneous vs differentiated, and different elasticities of substitution. Differentiated goods classification are drawn from Rauch et al. (1999), where manufactured products have been classified into three major categories depending upon their trading patterns: (1) products traded in organized exchange (2) reference prices and (3) differentiated goods. The differentiated goods are not substituted easily due to the uniqueness of these products. Traded products and reference priced products can be easily substituted (Rauch, 1999). Accordingly, any trade diversion due to the US-China trade war can be expected to be more dominantly felt across non-differentiated goods and less prevalent for differentiated goods in the short run[11]. The last product category, i.e. the elasticity of substitution, provides a different aspect of substitutability. The elasticity of substitution is sourced from Broda & Winstein (2006). Following Feenstra (1994), the elasticity of substitution has been calculated across products at SITC level for 1972-1988 and 1990-2001. The elasticity parameters used for the analysis are drawn from 1990-2001 estimates.

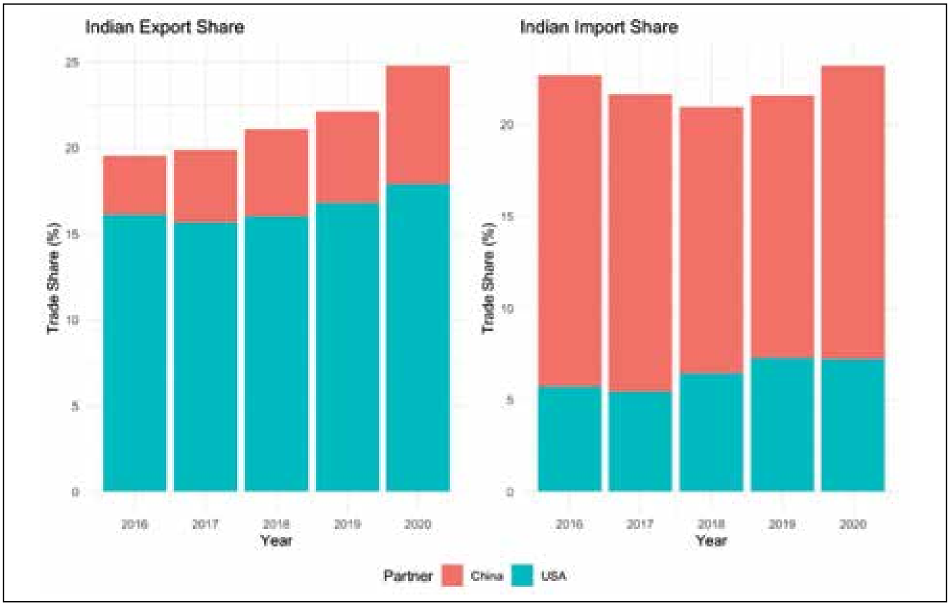
Even after collecting trade data and other ancillary information, the broad question remains: Why is India a potential case study for analyzing the impact of the US-China tariff war? The US-China trade war impacted the trade volume of the United States and China directly through higher tariff rates.

[10] BEC Codes are introduced in 1961 to classify the products into industrial supplies, food, capital equipment, consumer durables and consumer non-durables. Following revision 5, BEC codes 111 (Primary for the industry), 121 (Processed for the industry), 21 & 22 (Industrial supplies), 31 & 322 (fuel & lubricants), 41 (Capital Goods), 42 (Parts and accessories), 53 (Transport equipment) have been considered as intermediate goods (Source: Classification by Broad Economic Categories, UN)

[11] Both conservative and liberal classification of differentiated goods are used in this chapter for robustness.

Countries like India are not directly impacted by tariffs[12], but through either demand or supply chain effects may nevertheless be impacted by the tariffs. Since India's external trade share with the US and China is relatively high with both countries, this suggests that Indian firms may adjust to changes in in both countries (refer to Fig 1.5). Also, the import share of the US with China decreased drastically since 2018 and remained at a lower level in 2020. At least descriptively, the US import share with India increased marginally during the same time which supports trade diversion towards India (refer to Fig. 1.4).

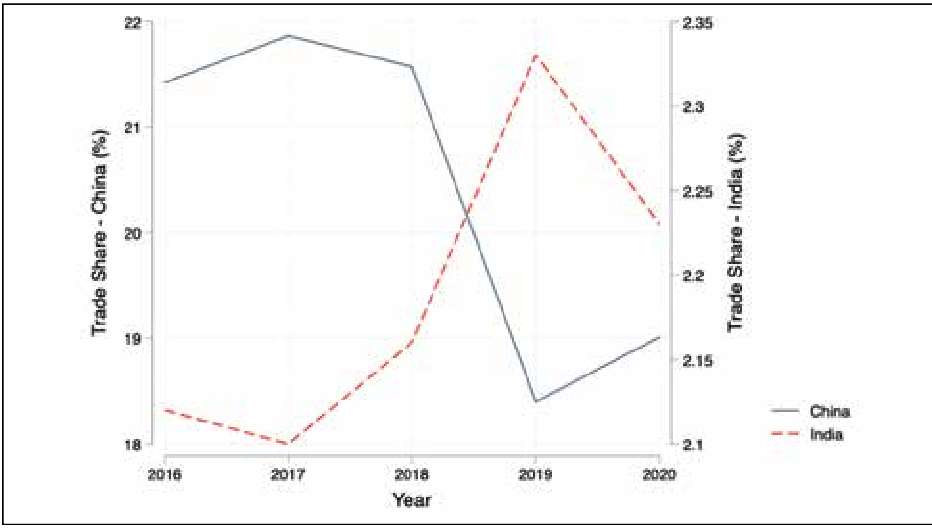
Fig 1.5: India's trade share in percentage



Source: UN Comtrade and author's calculations; The trade shares are ratio of India's trade with US (and China) with respect to India's total trade. The ratio is defined in terms of trade value.

[12] Except for Aluminum and Steel.

Fig 1.6: US Import share in percentage



Source: UN Comtrade and author's calculations;

Apart from the market access, Indian firms are often compared with China in terms of comparative advantage. Bagaria, Santra & Kumar (2014) argued that the comparative advantage of Indian firms is estimated to be like that of Chinese firms across different product categories. Wei & Balasubramanyam (2015) compared the relative comparative advantages of Indian and Chinese manufacturers on capital and labor intensity. Hence, higher US tariffs on China are likely to drive off Chinese firms and may provide favorable entry condition for Indian manufacturers. Following market access and these comparative advantages, India appears to be suitable for a trade diversion case study due to higher tariffs imposed due to US-China trade war.

Among the targeted products at a HS-6 level, Indian export growth to the US increased in more than 50% products, whereas 32% products experienced a decline in exports. A similar pattern is observed for products imported from China. Among 1930 products under the purview of US tariffs, import intensity[13] increased for 63% of products. On the contrary, the tariffs imposed by China are found to be less traded by Indian firms. At the HS - 6-digit level, only 283 products that are currently exported to China are impacted, and 341 impacted products are imported from the US.

13 Measured in terms of import growth between 2019 vs 2017.

While the above paragraph focuses mainly on the impact on the extensive margin, the trade diversion is measured through the primary impact of US-China tariffs using trade value. The exported value of products targeted under US tariffs and those not targeted by tariffs can be traced over time. Fig 1.7 illustrates the time plot of India's exports to the US and India's exports to China. Ignoring any spillover effects from US tariffs on exports to China, the time plot demonstrates a distinctive pattern. The Indian exports of products subject to tariffs applied by the US against China increased after the imposition of these tariffs. Such differentiated pattern of export intensity indicates that Indian exporters started exporting the targeted products to the US as higher tariffs increases the price of Chinese products and thereby points towards possible trade diversion. A similar pattern is also observed for products targeted under China retaliatory tariffs. However, the Indian exports of products under China's retaliatory tariffs (towards the US) started decreasing visibly since end of 2019.

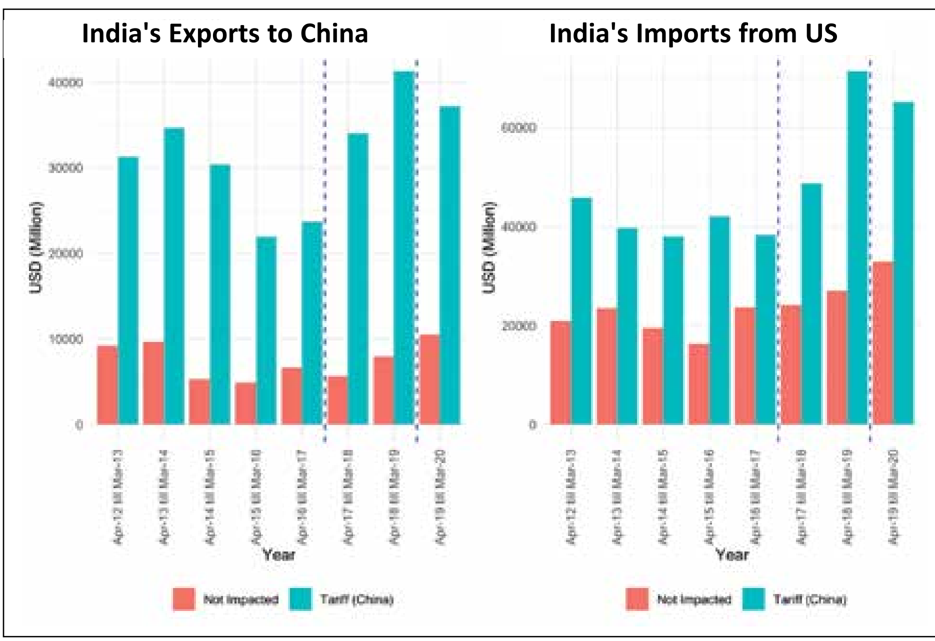
Fig 1.7: Impact of US Tariff on exports

Note: Tariffs increased in between the two dotted lines;

Source: UN Comtrade and author's calculation

On the flip side, imports from the US increased sharply for products subject to higher tariff imposed by China due to the tariff war. US manufacturers increased exporting products to India following higher tariffs imposed by Chinese authorities. The left panel of Fig 1.8 illustrates a sharp increase of imports from the US for products impacted by Chinese tariffs. The right panel of Fig 1.8 showcases the imported value of targeted products impacted by higher US tariffs vis-vis non-impacted products over time. Higher tariffs imposed by US authorities, forced Chinese manufacturers to redirect their trade flow to India as India's import of these products registered sharp increase during 2018 and remained at elevated level in 2019.

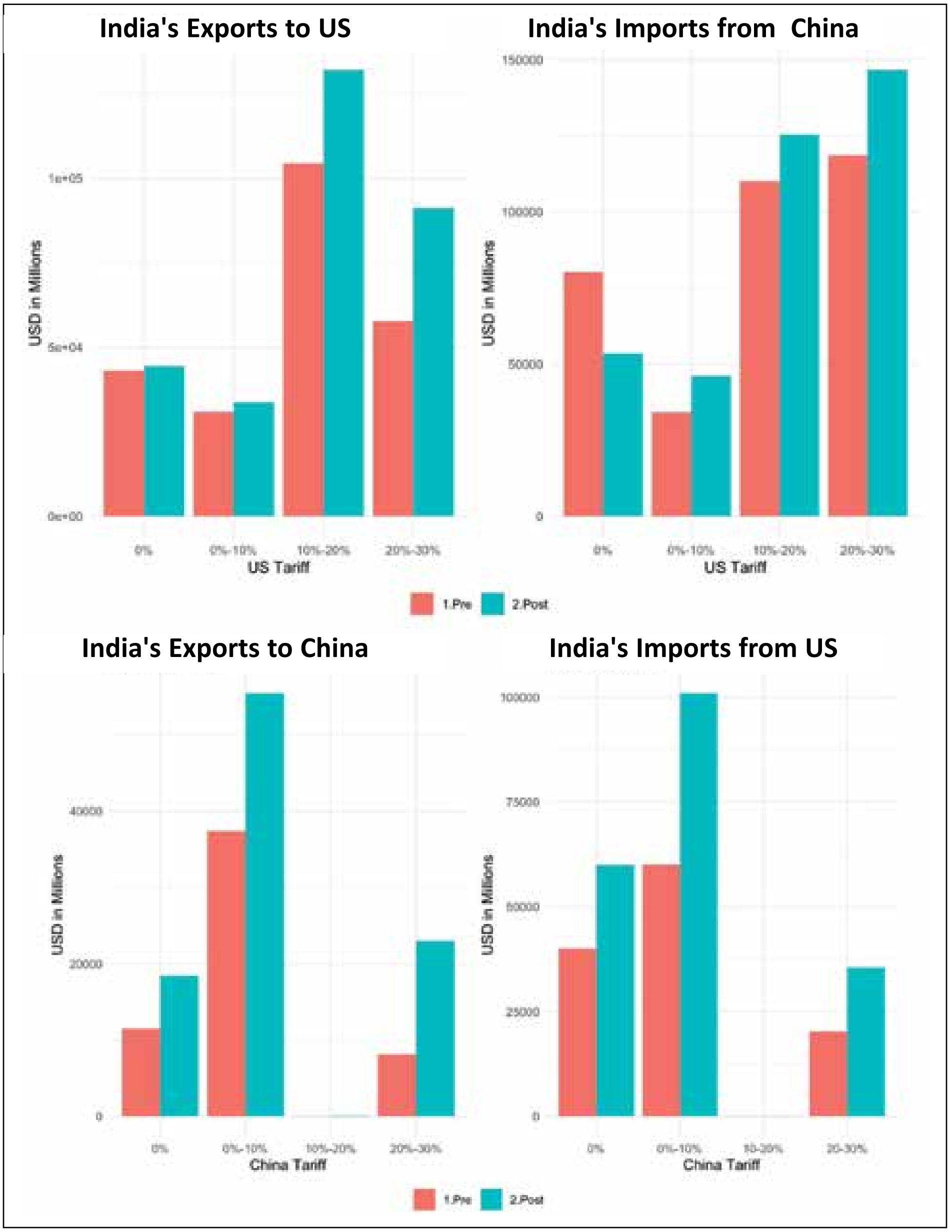
Fig 1.8: Impact of US Tariff on imports



Tariffs increased in between the two dotted lines
Source: UN Comtrade and author's calculation

In Fig 1.9, the total value of exports and imports is plotted for products across different tariff brackets. The period is segregated into two intervals - the 'Pre' period represents one year before tariff (i.e. FY 2017) and the Post period is one year after the tariff (FY 2020). The trade value has been aggregated across different tariff brackets for US tariffs and China tariffs separately.

Fig 1.9: Impact of US and China Tariffs on Trade Value



Source: UN Comtrade and author's calculation

The upper-left panel of Fig 1.9 represents India's exports to the US across different brackets of US tariff. The upper-right panel represents the value of import from China across these tariff brackets. The height of the bars represents the total value of trade in millions of USD. Comparing the height of bars, the exports increased during the post tariff period to the US. A similar impact was visible in the case of imports from China. These findings support the hypothesis that the trade diversion happened during post tariff period. Similar effects are observed for products affected by China tariff also (refer to Fig 1.9).

5. Overall Impact of US-China Tariffs on India's External Trade

5.1 Empirical Framework

Both short and long differences are used to examine the impact of the US-China trade war on imports and exports from India. The short difference is calculated as the difference in trade value between FY 2020[14] and FY 2017[15]. Specifically, the short difference calculates the change in the log trade value between the financial year ending in March 2020 and financial year ending in March 2017. Similarly, the long difference is defined as the difference between FY 2020 and the average trade value of the last five years before the tariff war (i.e. April 2012 till March 2017). Both the short and long differences are calculated across HS6-country group pairs. To allow for zeros in the trade data, and to interpret as elasticities, both differences are calculated using inverse hyperbolic transformation[16].

The estimates from difference-in-difference regression specification in difference in difference regression are only valid under the assumption of no pre-existing trends in the trade value. To examine these pre-existing trends,

[14] FY stands for financial year i.e. April to March. FY 2020 implies April 2019 till March 2020. The study follows the difference calculations using financial year rather than calendar year due to availability of Indian trade data.

[15] FY 2017 implies April 2016 till March 2017.

[16] Aihounton & Henningsen (2019) highlighted the sensitivity of inverse hyperbolic transformation on the units of measurement. Hence robustness checks are done using log-transformation on the trade value. The results are found to be robust using log-transformation. A separate appendix (Not included in this document) is prepared with the robustness results.

a placebo test is performed using the following similar specification for pre-trade war period.

5.2. Empirical Findings

5.2.1. Impact on India's exports

The estimated coefficients are reported in Table 1.1 across different specifications. The first four columns report the estimated coefficients using short differences and the last four columns using long differences as dependent variables. Among the first four columns, the estimation methodology uses product fixed effects at HS -1,2,3 and 4[17] levels and robust standard errors also defined for same product clusters.

The estimates in Table 1.1 provides clear evidence that the US-China trade war led to significant trade diversion toward India. While exports to the US and China are generally falling over this period relative to exports to the rest of the world (rows 1 and 2), there was a significant increase in exports to the US in products that the US targeted in the trade war against China. The elasticity of Indian exports to the US due to US tariffs applied on China imports, ranges between .67 and .87, and in all cases is significant at conventional levels. In terms of Chinese retaliatory tariffs, it appears that exports to the rest of the world increased, but not to China itself.

The direct effects of US tariffs and China tariffs demonstrate a asymmetric substitution effect on Indian exports to different destinations. The average impact of US tariffs (on China) on Indian exports to all destinations, is insignificant across all specifications. This implies that the tariffs imposed by US authority on products during the US-China trade war, does not influence India's export value to other destinations. However, the impact is found to be significant when the destination country is the US. This implies that the impact of higher US tariffs during US-China tariff war, boasts Indian export to the US but not to other destinations. The increase in export value to

[17] HS 1,2,3 and 4 refer to the first 1-4 digits of the HS-6 codes. The rationale of defining the fixed effects at these levels is to absorb the product heterogeneity and product quality variations among these products

US, therefore, supports the trade diversion hypothesis, highlighting the substitution effect of US tariffs in form of short-term substitution of Chinese imports by Indian imports. As higher tariffs imposed by the US, makes Chinese export costly, Indian manufacturers can reap the benefit of higher tariffs by increasing higher export value to the US. The substitution effect is found to be robust across all specifications. The difference-in-difference estimates, translated into differential impact across different tariff brackets, indicate an increase of 12%-16% in India's export of products under the 25% tariff bracket[18]. However, the negative and significant coefficient of the intercept estimates an average decline in India's export to the US, implying that the products which are not impacted by tariffs, faced a contraction in exports to US, compared to those impacted by tariffs[19].

On the other hand, the impact of Chinese retaliatory tariffs had a muted impact on Indian exporters. The average impact on India's exports is insignificant resulting from China's tariffs on the US. Further India's exports to China also remained unaffected by China's retaliatory tariff. Such muted impact supports the hypothesis that the substitution effect is more prominently felt between Indian and Chinese manufacturers in exports to the US. However, a similar substitution effect between US and India is muted in case of exporting to China. Such observations corroborate the hypothesis that the comparative advantage of Indian firms is comparable with Chinese manufacturing in products affected by US tariffs. Further China's retaliatory tariff targeted products where Indian manufacturers don't have any comparative advantages which resulted in muted impact of China tariff on Indian exports. On the other hand, the indirect impact is found to be insignificant across all destinations (except for one specification using short difference and HS4 classification). The insignificant indirect effect of tariffs and retaliatory tariffs supports the fact that the spillover impact of the tariffs was limited in nature.

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[18] Calculated based on estimated coefficient of tariffs impact to India's export to the US and tariff bracket.

[19] The average negative impact on the other products (i.e. not targeted products) may be explained in terms of relative change in export share of targeted and other products. As tariffs increased the export value of targeted products, export value share of other products declined with respect to the targeted products.

Table 1.1: DiD Estimates for tariff impact on India's exports

VARIABLES	(1) Short	(2) Short	(3) Short	(4) Short	(5) Long	(6) Long	(7) Long	(8) Long
$\mathbf{1}_{US}$	-0.217***	-0.217***	-0.217***	-0.217***	-0.186**	-0.186***	-0.186***	-0.186***
	(0.063)	(0.053)	(0.049)	(0.046)	(0.073)	(0.053)	(0.049)	(0.048)
$\mathbf{1}_{China}$	-0.165*	-0.165***	-0.165***	-0.165***	-0.186**	-0.186***	-0.186***	-0.186***
	(0.080)	(0.058)	(0.061)	(0.052)	(0.072)	(0.048)	(0.044)	(0.043)
Tariff	0.263	0.248	0.222	0.110	0.069	0.035	0.025	-0.102
	(0.224)	(0.203)	(0.243)	(0.223)	(0.292)	(0.235)	(0.229)	(0.207)
Re. Tariff	0.560	0.594**	0.617**	1.042***	0.217	0.228	0.228	0.624**
	(0.424)	(0.287)	(0.279)	(0.270)	(0.555)	(0.314)	(0.301)	(0.278)
Tariff x $\mathbf{1}_{US}$	0.677*	0.677**	0.677**	0.677**	0.869*	0.869**	0.869***	0.869***
	(0.312)	(0.307)	(0.290)	(0.270)	(0.443)	(0.345)	(0.301)	(0.281)
Re. Tariff x $\mathbf{1}_{China}$	-0.644	-0.644	-0.644	-0.644	-0.293	-0.293	-0.293	-0.293
	(0.860)	(0.503)	(0.460)	(0.432)	(0.858)	(0.440)	(0.440)	(0.367)
Re. Tariff x $\mathbf{1}_{US}$	-0.229	-0.229	-0.229	-0.229	0.207	0.207	0.207	0.207
	(0.607)	(0.347)	(0.327)	(0.273)	(0.829)	(0.400)	(0.390)	(0.319)
Tariff x $\mathbf{1}_{China}$	0.135	0.135	0.135	0.135	0.216	0.216	0.216	0.216
	(0.491)	(0.397)	(0.432)	(0.372)	(0.473)	(0.370)	(0.331)	(0.281)
Observations	14,364	14,364	14,364	14,364	14,364	14,364	14,364	14,364
Number of HS	10	98	175	1,202	10	98	175	1,202
Fixed Effect	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4
Cluster SE	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4

The left hand side variable is inverse hyperbolic sine of export value
1_{US} takes value of 1 if the product is exported to the US.
1_{China} is the dummy variable when export destination is China.
Tariff stands for the US tariffs imposed on China
Re. Tariff is the retaliatory tariffs imposed by China on the US.
Robust standard errors are reported in the parenthesis.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
The row, highlighted in the table, highlights the change in export elasticity

The placebo test estimate suggests that the pre-trend effect of the tariffs is not observed on Indian exports i.e. Indian exports did not alter in anticipation of the tariffs before those tariffs were imposed (Table 1.2).

Table 1.2: Placebo Effect on Export

VARIABLES	(1) placebo	(2) placebo	(3) placebo	(4) placebo
1_{US}	0.028	0.028	0.028	0.028
	(0.016)	(0.025)	(0.023)	(0.020)
1_{China}	0.020**	0.020	0.020	0.020
	(0.007)	(0.019)	(0.020)	(0.019)
Tariff	0.042	-0.015	-0.013	-0.061
	(0.101)	(0.105)	(0.111)	(0.124)
Re. Tariff	-0.046	-0.129	-0.156	0.170
	(0.144)	(0.177)	(0.178)	(0.208)
Tariff x 1_{US}	-0.080	-0.080	-0.080	-0.080
	(0.123)	(0.124)	(0.143)	(0.136)
Re. Tariff x 1_{China}	0.203	0.203	0.203	0.203
	(0.117)	(0.197)	(0.172)	(0.168)
Re. Tariff x 1_{US}	0.178	0.178	0.178	0.178
	(0.157)	(0.230)	(0.218)	(0.195)
Tariff x 1_{China}	-0.054	-0.054	-0.054	-0.054
	(0.098)	(0.112)	(0.126)	(0.130)
Observations	14,364	14,364	14,364	14,364
Number of HS	10	98	175	1,202
Fixed Effect	HS1	HS2	HS3	HS4
Cluster SE	HS1	HS2	HS3	HS4

1_{US} takes value of 1 if the product is exported to the US.
1_{China} is the dummy variable when export destination is China.
Tariff stands for the US tariffs imposed on China
Re. tariff is the retaliatory tariffs imposed by China on the US.
Robust standard errors are reported in the parenthesis.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5.2.2. Including impact of India's Exit from GSP

India's exit from GSP countries increased tariff rate imposed by the US on Indian exports in selected sectors[20]. Accordingly, the panel regression framework is modified by incorporating the change in US tariff on India. The regression uses the difference of tariffs between 2017 and 2019 as an additional control in the difference in difference regression to evaluate the trade diversion effect.

The correlation between own tariffs (i.e. tariffs on India's export to US after GSP exit) is found to be insignificant with US Tariff on China and China's tariff on the US[21]. The panel regression estimates indicate significant trade diversion between India and China to the US in response to the US tariffs imposed on China. Further, a significant moderation in India's export is observed due to change in tariff structure due to India's exit from GSP countries. The findings further strengthen the trade diversion hypothesis and also highlights the decline in India's export due to US decision towards excluding India from GSP country group (Table 1.3).

[20] The tariffs increased on imports from India and some of the products were targeted by the US tariffs on China.

[21] Correlation between own tariff and US tariffs on China is 0.11 and correlation between own tariff and China's tariff on the US is 0.05.

Table 1.3: Spillovers from Trade War - Accounting for India losing GSP Status

VARIABLES	(1) Short	(2) Short	(3) Short	(4) Short	(5) Long	(6) Long	(7) Long	(8) Long
1_{US}	-0.215***	-0.215***	-0.215***	-0.215***	-0.181**	-0.181***	-0.181***	-0.181***
	(0.064)	(0.054)	(0.049)	(0.046)	(0.074)	(0.054)	(0.049)	(0.048)
1_{China}	-0.163*	-0.163***	-0.163***	-0.163***	-0.184**	-0.184***	-0.184***	-0.184***
	(0.079)	(0.058)	(0.062)	(0.052)	(0.073)	(0.048)	(0.045)	(0.043)
Tariff	0.275	0.253	0.216	0.100	0.057	0.016	0.000	-0.129
	(0.233)	(0.206)	(0.244)	(0.224)	(0.294)	(0.241)	(0.230)	(0.207)
Re. Tariff	0.555	0.592**	0.616**	1.044***	0.210	0.224	0.225	0.624**
	(0.425)	(0.288)	(0.271)	(0.270)	(0.561)	(0.317)	(0.302)	(0.279)
Tariff x 1_{US}	0.700**	0.700**	0.700**	0.700***	0.939*	0.939***	0.939***	0.939***
	(0.304)	(0.300)	(0.289)	(0.270)	(0.427)	(0.339)	(0.300)	(0.277)
Re. Tariff x 1_{China}	-0.641	-0.641	-0.641	-0.641	-0.289	-0.289	-0.289	-0.289
	(0.866)	(0.504)	(0.460)	(0.432)	(0.865)	(0.443)	(0.441)	(0.367)
Re. Tariff x 1_{US}	-0.225	-0.225	-0.225	-0.225	0.217	0.217	0.217	0.217
	(0.614)	(0.352)	(0.330)	(0.274)	(0.843)	(0.410)	(0.397)	(0.322)
Tariff x 1_{China}	0.158	0.158	0.158	0.158	0.245	0.245	0.245	0.245
	(0.500)	(0.400)	(0.432)	(0.373)	(0.474)	(0.376)	(0.333)	(0.281)
Tariff(US GSP)	-0.702	-0.219	0.175	0.028	0.992	1.413	1.560	1.250
	(0.595)	(0.819)	(1.048)	(1.092)	(0.645)	(0.887)	(1.060)	(1.218)
1_{US} x Tariff(US GSP)	-1.670	-1.670	-1.670	-1.670	-4.967**	-4.967***	-4.967***	-4.967**
	(1.384)	(1.389)	(1.051)	(1.620)	(1.963)	(1.697)	(1.603)	(2.401)
1_{China} x Tariff(US GSP)	-1.629	-1.629	-1.629	-1.629	-2.015*	-2.015*	-2.015	-2.015
	(1.489)	(2.119)	(2.248)	(2.287)	(0.980)	(1.054)	(1.681)	(1.700)
Observations	14,364	14,364	14,364	14,364	14,364	14,364	14,364	14,364
Number of HS	10	98	175	1,202	10	98	175	1,202
Fixed Effect	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4
Cluster SE	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4

1_{US} takes value of 1 if the product is exported to the US.
1_{China} is the dummy variable when export destination is China.
Tariff stands for the US tariffs imposed on China
Re. tariff is the retaliatory tariffs imposed by China on the US.
Tariff (GSP) are US tariffs imposed on Indian exports after GSP.
Robust standard errors are reported in the parenthesis.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Following similar specification, the placebo regression is estimated using imports data from pre-trade war period. The estimated coefficients indicate no statistically significant effect of trade war tariffs on India's export prior to 2017 (refer to Table 1.4).

Table 1.4: Placebo regressions from Trade War - Accounting for India losing GSP Status

VARIABLES	(1) placebo	(2) placebo	(3) placebo	(4) placebo
1_{US}	0.031*	0.031	0.031	0.031
	(0.016)	(0.025)	(0.024)	(0.020)
1_{China}	0.019**	0.019	0.019	0.019
	(0.007)	(0.019)	(0.020)	(0.019)
Tariff	0.054	-0.007	-0.011	-0.069
	(0.101)	(0.104)	(0.111)	(0.124)
Re. Tariff	-0.050	-0.130	-0.156	0.171
	(0.144)	(0.177)	(0.178)	(0.208)
Tariff x 1_{US}	-0.033	-0.033	-0.033	-0.033
	(0.105)	(0.118)	(0.134)	(0.132)
Re. Tariff x 1_{China}	0.201	0.201	0.201	0.201
	(0.118)	(0.197)	(0.172)	(0.168)
Re. Tariff x 1_{US}	0.184	0.184	0.184	0.184
	(0.164)	(0.231)	(0.219)	(0.194)
Tariff x 1_{China}	-0.067	-0.067	-0.067	-0.067
	(0.098)	(0.113)	(0.127)	(0.131)
Tariff(US GSP)	-0.733*	-0.494	-0.486	0.031
	(0.364)	(0.436)	(0.471)	(0.733)
1_{US} x Tariff(US GSP)	-3.354***	-3.354***	-3.354***	-3.354***
	(0.337)	(0.830)	(0.972)	(1.266)
1_{China} x Tariff(US GSP)	0.946**	0.946	0.946	0.946
	(0.336)	(0.868)	(0.874)	(0.731)
Observations	14,364	14,364	14,364	14,364
Fixed Effect	HS1	HS2	HS3	HS4
Cluster SE	HS1	HS2	HS3	HS4

1_{US} takes value of 1 if the product is exported to the US.
1_{China} is the dummy variable when export destination is China.
Tariff stands for the US tariffs imposed on China
Re. tariff is the retaliatory tariffs imposed by China on the US.
Tariff (GSP) are US tariffs imposed on Indian exports after GSP.
Robust standard errors are reported in the parenthesis.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5.2.4. Impact on India’s Imports

The impact of the US-China trade war on India’s import value, represents a different scenario compared to the exports. Following Table 1.5, the direct impact of the tariffs imposed by the US during US-China tariff war, is found to have increased India’s import across all destinations on average. On the other hand, the direct impact of US tariffs on India’s import from China, remains insignificant implying that Indian manufacturers started importing from elsewhere (other than China) for products affected by higher US tariffs. The direct impact from tariffs imposed by China in retaliation to US tariffs, is also found to be significant on India’s total import. Higher retaliatory tariff induced higher imports by India. The effect was found to be significant and robust across all products fixed effect specifications. The effect of China’s tariffs is found to be more effective on India’s import compared to the impact of US tariffs. Unlike the average impact, the direct impact on import intensity appears to remain unchanged for imports from US and China respectively. This observation highlights the fact the higher tariffs induce higher imports but not necessarily from US and China. US-China trade war appears to benefit manufacturers from other destinations. The indirect effect on India’s import, on the contrary, has reduced imports from the US and China. The negative and significant coefficient of the interaction terms of US Tariffs and import to US, provides a compelling insight about the decline of India’s import from US manufacturers. Such decline can be tagged with the degree of uncertainty created by the US-China trade war. As the trade war introduced higher tariff barriers, the impact of uncertain trade environment reduced domestic production of US manufacturers (Fajgelbaum et. al. (2020)), resulting in a decline of exports by domestic manufacturers. Similar observations can be extended for negative and significant indirect effect of retaliatory tariff and imports from China.

Summarizing the pattern observed in the effects of tariffs imposed by the US and China during the recent trade war, it is concluded that trade diversion appeared to have helped manufacturers from other destination countries as manufacturers from the US and China face uncertain trade environment. The net impact of tariffs imposed by the US and China appears to have affected exports from respective countries, but other countries have benefitted from trade diversion. Further, the increase in import intensity from other destinations are found to be robust across different product level fixed effects. While the direct effect of tariffs is found to have significant impact on import intensity, the indirect effects of tariffs are found to be insignificant which confirms no significant spillover impact from either tariff.

Table 1.5: Fixed Effect Estimate of Indian Imports

VARIABLES	(1) Short	(2) Short	(3) Short	(4) Short	(5) Long	(6) Long	(7) Long	(8) Long
1_{US}	-0.019	-0.019	-0.019	-0.019	0.016	0.016	0.016	0.016
	(0.012)	(0.013)	(0.014)	(0.014)	(0.023)	(0.021)	(0.019)	(0.018)
1_{China}	-0.054***	-0.054***	-0.054***	-0.054***	-0.036**	-0.036	-0.036*	-0.036**
	(0.016)	(0.017)	(0.016)	(0.015)	(0.016)	(0.022)	(0.019)	(0.018)
Tariff	0.343***	0.353***	0.338***	0.317**	0.793***	0.788***	0.800***	0.800***
	(0.109)	(0.092)	(0.103)	(0.123)	(0.112)	(0.149)	(0.140)	(0.174)
Re. Tariff	0.302	0.257	0.270	0.179	1.204***	1.210***	1.187***	1.347***
	(0.263)	(0.272)	(0.247)	(0.277)	(0.253)	(0.369)	(0.323)	(0.342)
Tariff x 1_{US}	-0.382***	-0.382***	-0.382***	-0.382***	-0.570***	-0.570***	-0.570***	-0.570***
	(0.073)	(0.120)	(0.120)	(0.124)	(0.113)	(0.156)	(0.152)	(0.149)
Re. Tariff x 1_{China}	-0.123	-0.123	-0.123	-0.123	-0.125	-0.125	-0.125	-0.125
	(0.273)	(0.347)	(0.304)	(0.330)	(0.289)	(0.399)	(0.363)	(0.361)
Re. Tariff x 1_{US}	-0.167	-0.167	-0.167	-0.167	-1.083***	-1.083***	-1.083***	-1.083***
	(0.217)	(0.332)	(0.283)	(0.285)	(0.278)	(0.356)	(0.333)	(0.314)
Tariff x 1_{China}	0.010	0.010	0.010	0.010	0.025	0.025	0.025	0.025
	(0.150)	(0.136)	(0.125)	(0.144)	(0.146)	(0.180)	(0.155)	(0.163)
Observations	17,961	17,961	17,961	17,961	17,961	17,961	17,961	17,961
Number of HS	10	98	175	1,261	10	98	175	1,261
Fixed Effect	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4
Cluster SE	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4

1_{US} takes value of 1 if the product is exported to the US.
1_{China} is the dummy variable when export destination is China.
Tariff stands for the US tariffs imposed on China
Re. tariff is the retaliatory tariffs imposed by China on the US.
Robust standard errors are reported in the parenthesis.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

However, the observations from Table 1.5 is only valid subject to the assumption of no pre-existing trend from the tariffs. Hence the placebo regression is run to validate any pre-existing trend in the import patterns. The placebo regression results indicate significant impact of tariffs on the import intensity prior to trade war. However, the coefficients lack robustness. The placebo results and the robustness of estimates using short and long differences rule out the concern of pre-existing trend of India's import prior to imposition of tariffs (refer to Table 1.6).

Table 1.6: Placebo Effect on Indian Imports

VARIABLES	(1) placebo	(2) placebo	(3) placebo	(4) placebo
$\mathbf{1}_{US}$	0.020	0.020	0.020	0.020
	(0.019)	(0.015)	(0.014)	(0.013)
$\mathbf{1}_{China}$	-0.005	-0.005	-0.005	-0.005
	(0.014)	(0.015)	(0.014)	(0.013)
Tariff	0.167**	0.150	0.157	0.132
	(0.055)	(0.094)	(0.107)	(0.103)
Re. Tariff	-0.508*	-0.434*	-0.452*	-0.368*
	(0.264)	(0.222)	(0.256)	(0.215)
Tariff x $\mathbf{1}_{US}$	-0.113	-0.113	-0.113	-0.113
	(0.131)	(0.120)	(0.115)	(0.115)
Re. Tariff x $\mathbf{1}_{China}$	0.457**	0.457**	0.457*	0.457*
	(0.177)	(0.198)	(0.247)	(0.253)
Re. Tariff x $\mathbf{1}_{US}$	0.019	0.019	0.019	0.019
	(0.456)	(0.293)	(0.289)	(0.249)
Tariff x $\mathbf{1}_{China}$	-0.071	-0.071	-0.071	-0.071
	(0.058)	(0.087)	(0.107)	(0.110)
Observations	17,961	17,961	17,961	17,961
Number of HS	10	98	175	1,261
Fixed Effect	HS1	HS2	HS3	HS4
Cluster SE	HS1	HS2	HS3	HS4

$\mathbf{1}_{US}$ takes value of 1 if the product is exported to the US.
$\mathbf{1}_{China}$ is the dummy variable when export destination is China.
Tariff stands for the US tariffs imposed on China
Re. tariff is the retaliatory tariffs imposed by China on the US.
Robust standard errors are reported in the parenthesis.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5.3. Heterogeneous Impact of US-China Tariffs on India's External Trade across Product Categories

5.3.1 Empirical Framework

The regression specification (used previously) assumes a average impact of tariffs across all product categories. However, the assumption of uniform impact is restrictive in nature due to heterogeneity in the types of products. For instance, specialized intermediate goods cannot be replaced easily compared to those products which are used as final goods. Hence any Indian firm, producing intermediate goods, will not get benefits from the US China trade war whereas Indian firms producing final goods, may get benefitted due to a large market. Similarly, products which are traded on organized exchanges, can be replaced easily whereas differentiated products (Rauch et. al., 2006) cannot be replaced that easily at least in the short run. The product level heterogeneity, therefore, can drive the short run impact of US-China tariffs on Indian exports[22]. With this background, the regression framework has been modified to introduce product level heterogeneity in the specification. The impact of tariffs is also estimated by different product classifications using a similar panel regression framework by introducing product classifications and corresponding interactions.

5.3.2. Empirical Findings

The heterogeneous impact of tariffs imposed by the US and China during the recent trade war has been estimated coefficients from the heterogeneous regression with different product classifications. Table 1.7 represents the estimates from regression equation using annual data from 2013-2020. However, it is very difficult to evaluate the net impact of US tariffs and China's retaliatory tariffs from Table 1.7. The net effects of tariff have been analyzed using sum of coefficients, as indicated in previous section. Table 1.8 represents the net impact of trade war on India's exports on final goods and Input (or intermediate) goods. The net impact of US tariffs and China's tariff, calculated from Table 1.7 is represented in Table 1.8. The significance level

[22] Such heterogeneous impact was also observed by Bekker & Schroeter (2020) on the products targeted in phase 1 of the tariff war due to commitment of US firms to buy from Chinese firms.

of net impact, derived using standard error of estimates, is reported at 5% level and statistically significant impact of the tariffs is indicated with ** in the coefficient estimates. The panel regression is separately carried out for three types of classification of products namely (i) intermediate goods vs consumption goods (ii) homogeneous goods vs differentiated goods and (iii) high elastic goods vs less elastic goods. The panel regression estimates for first classification of products (i.e. intermediate vs final goods) is presented in Table 1.7 whereas the other panel regression estimate for other classifications are represented in Annex 1. Only the summary table for each product classification is reported in Table 1.8, Table 1.9 and Table 1.10 respectively.

Table 1.8 provides the panel regression estimates for net effect of US tariffs and China tariffs. The estimated coefficient of final goods indicates positive and significant impact of the export of final consumption goods to US due to US tariffs. However, the impact of China retaliatory tariffs does not provide any significant change in India's export of final goods to China. The export of intermediate goods (or input goods) does not register any significant change to the US and to China due to the trade war. This finding corroborates with the fact that final goods are easily replaceable where intermediate goods, used in production process, is not easily replaceable. The impact of tariffs on export of final goods is also found to be robust in nature. Finally, India's export of final goods as well as intermediate goods to other destinations does not change significantly due to tariffs imposed by the US and China during the trade war.

Tariffs impact on exports has also been analyzed on homogeneous goods and differentiated goods. The net effect of US tariffs and China retaliatory tariffs, represented in Table 1.9, indicates that homogeneous goods export from India increased to US due to US tariffs whereas India's export of differentiated goods did not have any significant impact due to tariffs posed by the US during trade war. The impact of China's retaliatory tariff is found to be muted on export of homogeneous goods and differentiated goods.

A similar analysis was carried out on highly elastic goods and low elastic goods. The trade elasticity estimates are drawn from Broda & Winstein (2006) at HS6 digit level. High elastic goods are those goods which have a substitution elasticity higher than median trade elasticity. Using same specification, the net effect of the tariffs on India's export revealed that export of high elastic goods increased to US due to tariffs imposed by the US where the short-term impact of the low elastic products are found to be insignificant. No significant impact was visible in case of India's export to China for high and low elastic products.

Summarizing the panel regression estimates across different classifications of products, it can be inferred that the export intensity of easily replaceable products increased to the US due to the tariffs imposed by the US during US-China tariff war. Products like specialized products, low elastic products cannot be easily replaced in short run which is reflected in the estimated net effect coefficients. The impact of retaliatory tariffs imposed by the Chinese authority during the trade war, does not have any significant impact on India's export intensity. Exports to other destinations did not register any significant changes due to US-China trade war. The findings broadly corroborate with the trade diversion mechanism in short term. Trade diversion appeared to have positive thrust due to higher export to the US and such strong positive effect underlines significant substitution happening with Chinese export being substituted by India's export to the US. The substitution effect is found to be strongly significant due to similar comparative advantage of producing targeted products by the Indian and Chinese firms. However, the tariffs imposed by the Chinese Authorities are primarily agricultural commodities where India appears to have no comparative advantage, resulting in an insignificant impact.

Table 1.7: Intermediate Goods: Fixed Effect Estimate

VARIABLES	(1) Short	(2) Short	(3) Short	(4) Short	(5) Long	(6) Long	(7) Long	(8) Long
Class	0.048	0.055	0.049	0.109*	0.023	0.038	0.036	0.083*
	(0.048)	(0.043)	(0.051)	(0.057)	(0.041)	(0.044)	(0.047)	(0.048)
1_{US}	-0.225**	-0.225***	-0.225***	-0.225***	-0.208**	-0.208***	-0.208***	-0.208***
	(0.080)	(0.063)	(0.065)	(0.061)	(0.088)	(0.069)	(0.067)	(0.065)
1_{China}	-0.154*	-0.154***	-0.154***	-0.154***	-0.144*	-0.144***	-0.144***	-0.144***
	(0.078)	(0.053)	(0.057)	(0.051)	(0.073)	(0.050)	(0.046)	(0.044)
Tariff	0.121	0.075	0.026	-0.030	-0.159	-0.172	-0.194	-0.277
	(0.282)	(0.232)	(0.285)	(0.273)	(0.264)	(0.223)	(0.253)	(0.231)
Re. Tariff	0.377	0.363*	0.363	0.737***	0.119	0.166	0.150	0.520*
	(0.336)	(0.215)	(0.236)	(0.276)	(0.464)	(0.256)	(0.265)	(0.295)
Tariff x Input	0.102	0.129	0.171	-0.022	0.301**	0.259	0.277	0.122
	(0.183)	(0.208)	(0.233)	(0.258)	(0.122)	(0.171)	(0.217)	(0.222)
Re. Tariff x Input	0.291	0.318	0.365	0.303	0.050	-0.093	-0.058	-0.117
	(0.477)	(0.356)	(0.336)	(0.421)	(0.327)	(0.303)	(0.316)	(0.366)
1_{US} x Input	0.008	0.008	0.008	0.008	0.043	0.043	0.043	0.043
	(0.074)	(0.066)	(0.074)	(0.072)	(0.068)	(0.070)	(0.075)	(0.071)
1_{China} x Input	-0.030	-0.030	-0.030	-0.030	-0.139**	-0.139*	-0.139**	-0.139**
	(0.085)	(0.081)	(0.091)	(0.080)	(0.060)	(0.073)	(0.065)	(0.060)
Tariff x 1_{US}	1.123**	1.123***	1.123***	1.123***	1.463***	1.463***	1.463***	1.463***
	(0.418)	(0.347)	(0.371)	(0.359)	(0.422)	(0.374)	(0.388)	(0.364)
Re. Tariff x 1_{US}	-0.181	-0.181	-0.181	-0.181	0.230	0.230	0.230	0.230
	(0.563)	(0.326)	(0.315)	(0.264)	(0.746)	(0.357)	(0.362)	(0.303)
Re. Tariff x 1_{China}	-0.611	-0.611	-0.611	-0.611	-0.350	-0.350	-0.350	-0.350
	(0.664)	(0.406)	(0.433)	(0.382)	(0.704)	(0.376)	(0.376)	(0.334)
Tariff x 1_{China}	0.165	0.165	0.165	0.165	0.319	0.319	0.319	0.319
	(0.531)	(0.415)	(0.452)	(0.378)	(0.446)	(0.357)	(0.334)	(0.280)
1_{US} x Tariff x Input	-0.681	-0.681*	-0.681*	-0.681*	-0.958**	-0.958**	-0.958**	-0.958***
	(0.380)	(0.376)	(0.385)	(0.360)	(0.339)	(0.370)	(0.378)	(0.355)
1_{China} x Re. Tariff x Input	0.022	0.022	0.022	0.022	0.701	0.701	0.701	0.701
	(1.450)	(1.104)	(0.950)	(0.903)	(0.617)	(0.600)	(0.656)	(0.614)
Observations	14,364	14,364	14,364	14,364	14,364	14,364	14,364	14,364
Fixed Effect	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4
Cluster SE	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4

1_{US} takes value of 1 if the product is exported to the US.
1_{China} is the dummy variable when export destination is China.
$Tariff$ stands for the US tariffs imposed on China
$Retariff$ is the retaliatory tariffs imposed by China on the US.
$Input$ is a dummy variable for intermediary goods
Robust standard errors are reported in the parenthesis.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Following Table 1.7, the effect of the tariffs (US tariffs on China and Chinese tariffs on US) are evaluated to assess the total heterogeneous effect on different product categories.

Table 1.8: Fixed Effect Estimate: Intermediate Goods and Final Goods

VARIABLES	(1) Short	(2) Short	(3) Short	(4) Short	(5) Long	(6) Long	(7) Long	(8) Long
Export of Final Goods - US	1.051**	0.920**	0.868**	0.867**	1.112**	1.065**	1.035**	1.005**
Export of Final Goods - China	-0.010	0.351	0.391	0.447	-0.156	0.029	0.064	0.131
Export of Input Goods - US	-0.447	-0.334	-0.287	-0.515	-0.518**	-0.538	-0.508	-0.690
Export of Input Goods - China	0.343	0.114	0.056	0.334	-0.164**	-0.201	-0.275	-0.153
Fixed Effect	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4
Cluster SE	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4

Refer to Table 1.8 for details
Robust standard errors are reported in the parenthesis.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 1.9: Fixed Effect Estimate: Differentiated Good and Homogeneous Good

VARIABLES	(1) Short	(2) Short	(3) Short	(4) Short	(5) Long	(6) Long	(7) Long	(8) Long
Export of Homogenous Goods - US	0.767**	0.739**	0.711**	0.571**	0.842**	0.757**	0.751**	0.578**
Export of Homogenous Goods - China	0.376	0.740	0.729	1.066**	-0.229	0.073	0.048	0.268
Export of Diff Goods - US	-0.144	-0.125	-0.130	-0.145	-0.216	-0.116	-0.139	-0.035
Export of Diff Goods - China	-0.257	-0.484	-0.502	-0.607	-0.324	-0.627	-0.628	-0.623
Fixed Effect	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4
Cluster SE	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4

Refer to Table 1.9 for details
Robust standard errors are reported in the parenthesis.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 1.10: Fixed Effect Estimate: High vs Low Elasticity

VARIABLES	(1) Short	(2) Short	(3) Short	(4) Short	(5) Long	(6) Long	(7) Long	(8) Long
Export of High Elastic Goods - US	0.544**	0.498**	0.358	0.672**	0.551**	0.549**	0.449**	0.799**
Export of High Elastic Goods - China	-1.066	-0.671	-0.521	-0.716	-0.968	-0.777	-0.702	-1.082
Export of Low Elastic Goods - US	0.306	0.297	0.425	-0.017	0.321	0.266	0.367	-0.112
Export of Low Elastic Goods - China	1.377*	1.197	1.046	1.582**	.688	.656	.564	1.209**
Fixed Effect	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4
Cluster SE	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4

Refer to Table 1.10 in appendix for details
Robust standard errors are reported in the parenthesis.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5.3.3. Impact on India's Import

The detailed panel regression results are reported in Annex 2 for reference. The net effects, calculated using sum of coefficients, are reported in the summary table. The heterogeneous impact of tariffs is analyzed across three different classifications of products. Table 1.11, Table 1.12 and Table 1.13 reports the net effects of US tariffs and China tariffs for each type of classifications.

India's import intensity appears to remain unchanged across product classification when traded with the US and China. The import of final goods increased using long difference - in - difference. A similar pattern is observed in case of homogeneous goods and elastic goods also. However, the robustness of estimates cannot be ensured as the impact changes sign across different product fixed effects. Also, the difference-in-difference estimates using short difference show insignificant impact of tariffs. This corroborates with the fact that India's import from the US and China did not show any significant impact due to US-China tariff war. However, the impact was found to be significant for imports from other destinations.

Table 1.11: Fixed Effect Estimate: Intermediate and Final Goods

VARIABLES	(1) Short	(2) Short	(3) Short	(4) Short	(5) Long	(6) Long	(7) Long	(8) Long
Fixed Effect	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4
Cluster SE	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4
Import of Final Goods - US	-0.071	-0.136	-0.156	-0.215	0.027	-0.084	-0.094	-0.107
Import of Final Goods - China	-0.107	0.151	0.129	-0.031	0.759**	1.120*	1.028**	1.064**
Import of Input Goods - US	-0.119	-0.054	-0.039	0.078	-0.040	0.012	0.015	0.051
Import of Input Goods - China	-0.131	-0.288	-0.297	-0.232	-0.628	-0.868	-0.805	-0.914

Refer to Table 1.18 in appendix for details
Robust standard errors are reported in the parenthesis.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 1.12: Fixed Effect Estimate: Differentiated and Homogeneous Good

VARIABLES	(1) Short	(2) Short	(3) Short	(4) Short	(5) Long	(6) Long	(7) Long	(8) Long
Fixed Effect	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4
Cluster SE	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4
Import of Homogenous Goods - US	-0.180	-0.180	-0.175	-0.122	0.058	0.016	0.021	0.057
Import of Homogenous Goods - China	-0.151	-0.004	-0.032	-0.229	0.427	0.690*	0.677*	0.644*
Import of Diff Goods - US	0.130	0.069	0.023	-0.118	0.050	0.024	0.042	0.082
Import of Diff Goods - China	0.079	0.071	0.046	0.192	-0.025	-0.191	-0.233	-0.132

Refer to Table 1.19 in appendix for details
Robust standard errors are reported in the parenthesis.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 1.13: Fixed Effect Estimate: High Elastic and Low Elastic Goods

VARIABLES	(1) Short	(2) Short	(3) Short	(4) Short	(5) Long	(6) Long	(7) Long	(8) Long
Fixed Effect	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4
Cluster SE	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4
Import of High Elastic Goods - US	0.158	0.225	0.269	0.190	0.471	0.536*	0.603*	0.205
Import of High Elastic Goods - China	-0.137	-0.051	-0.100	-0.482	0.450	0.564*	0.477	0.232
Import of Low Elastic Goods - US	-0.314	-0.421	-0.476	-0.398	-0.405	-0.541	-0.599	-0.153
Import of Low Elastic Goods - China	-0.009	0.051	0.074	0.316	0.035	0.143	0.195	0.476

Refer to Table ?? in appendix for details
Robust standard errors are reported in the parenthesis.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

6. Concluding Remarks

The tariff war introduced a new era of protectionism in international trade. Higher tariff imposed by US was retaliated with high tariff barriers by China and other large trading partners on US export. In this context, the chapter looks at the implication of tariff war on neutral trading partner like India. Using product level data, the chapter evaluates the impact of tariffs imposed by the US and retaliatory tariffs imposed by China on overall exports and imports from India. Further the chapter introduces product classifications across different dimensions, to understand any product level heterogeneity in tariff impact.

Using product level export and import data at HS-6-digit level, the chapter documents a asymmetric impact of the tariffs imposed by the US and the retaliatory tariff imposed by China on aggregate trade of India. The export data showcases strong substitution of Chinese exports for Indian exports to the US. The impact of US tariffs appears to be the major driver behind the influx of exports to the US. The retaliatory tariffs, imposed by China, appears to have insignificant impact on India's export. The indirect impact of tariffs is insignificant on Indian exports. The substitution effect from US tariffs highlights that Indian firms exhibit similar comparative advantage of producing tariff impacted products.

Unlike export impact, the impact of US tariffs and retaliatory tariffs by China are mainly contributed towards higher import value from other destinations. Such positive and significant impact on India's export to the US and India's import from other destinations follows trade diversion mechanism where neutral trade partner benefits from trade war due to diversion of trade from countries involved in trade war.

Further, the impact of US-China trade war has significant impact on easily replaceable products in short term. The chapter uses three different classifications of products to assess the heterogeneity in impact of US tariffs and China's retaliatory tariffs. India's final goods export increased to the US due to trade war whereas the export of intermediate goods does not show similar effect from tariffs. Similar result follows using other product classifications namely homogeneous vs differentiated goods classification and highly elastic vs low elastic goods. In both the cases, export intensity increased for products which can be easily substituted. The effect of trade war appears to be similar in case of imports also. However, unlike the exports, the import intensity appears to have increased for easily substituted products from other destinations.

Finally, the impact of tariffs imposed by the US and China influenced the unit value of exports. Tariffs imposed by the US improved the pricing power of Indian firms whereas the impact of China's retaliatory tariffs is found to have muted impact on export price. The quantity impact remains insignificant in case of Indian exports. On the other hand, the tariff appears to have significant impact on quantity of imports by Indian firms and households. The price burden from imports remained at same level as higher tariffs does not influence the unit value of imports.

Annex 1: Heterogeneous impact on exports of different product categories

VARIABLES	(1) Short	(2) Short	(3) Short	(4) Short	(5) Long	(6) Long	(7) Long	(8) Long
Diff (C)	0.562	0.745	0.778	0.938*	0.091	0.282	0.318	0.220
	(0.564)	(0.585)	(0.540)	(0.504)	(0.336)	(0.469)	(0.434)	(0.436)
$\mathbf{1}_{US}$	-0.765	-0.765	-0.765	-0.765	-1.203	-1.203**	-1.203**	-1.203**
	(0.658)	(0.603)	(0.577)	(0.534)	(0.670)	(0.563)	(0.549)	(0.537)
$\mathbf{1}_{China}$	-0.476	-0.476	-0.476	-0.476	-0.309	-0.309	-0.309	-0.309
	(0.562)	(1.143)	(0.896)	(0.783)	(0.599)	(0.884)	(0.706)	(0.604)
Tariff	0.316	0.287	0.259	0.119	0.153	0.069	0.063	-0.110
	(0.208)	(0.214)	(0.246)	(0.240)	(0.256)	(0.238)	(0.230)	(0.222)
Re. Tariff	0.209	0.573	0.562	0.900*	-0.172	0.131	0.105	0.326
	(0.558)	(0.558)	(0.491)	(0.474)	(0.362)	(0.451)	(0.424)	(0.400)
Tariff x Diff (C)	-0.194	-0.176	-0.180	-0.195	-0.109	-0.009	-0.032	0.073
	(0.208)	(0.190)	(0.226)	(0.233)	(0.140)	(0.143)	(0.187)	(0.215)
Re. Tariff x Diff (C)	-0.278	-0.505	-0.523	-0.628	0.042	-0.260	-0.262	-0.256
	(0.528)	(0.532)	(0.469)	(0.441)	(0.373)	(0.432)	(0.377)	(0.381)
$\mathbf{1}_{US}$ x Diff (C)	-0.016	-0.016	-0.016	-0.016	0.191	0.191	0.191	0.191
	(0.248)	(0.310)	(0.366)	(0.349)	(0.240)	(0.343)	(0.362)	(0.362)
$\mathbf{1}_{China}$ x Diff (C)	-0.173	-0.173	-0.173	-0.173	0.367	0.367	0.367	0.367
	(0.963)	(1.303)	(1.162)	(1.009)	(0.714)	(0.966)	(0.828)	(0.693)
Tariff x $\mathbf{1}_{US}$	0.452	0.452	0.452	0.452*	0.688	0.688*	0.688**	0.688**
	(0.287)	(0.302)	(0.281)	(0.273)	(0.437)	(0.369)	(0.300)	(0.280)
Re. Tariff x $\mathbf{1}_{US}$	0.082	0.082	0.082	0.082	0.302	0.302	0.302	0.302
	(0.457)	(0.470)	(0.429)	(0.417)	(0.387)	(0.416)	(0.435)	(0.425)
Re. Tariff x $\mathbf{1}_{China}$	0.166	0.166	0.166	0.166	-0.058	-0.058	-0.058	-0.058
	(0.687)	(1.209)	(0.987)	(0.805)	(0.569)	(0.933)	(0.751)	(0.630)
Tariff x $\mathbf{1}_{China}$	0.167	0.167	0.167	0.167	0.185	0.185	0.185	0.185
	(0.376)	(0.367)	(0.405)	(0.356)	(0.370)	(0.324)	(0.292)	(0.263)
$\mathbf{1}_{US}$ x Tariff x Diff (C)	0.050	0.050	0.050	0.050	-0.107	-0.107	-0.107	-0.107
	(0.201)	(0.258)	(0.306)	(0.295)	(0.187)	(0.292)	(0.307)	(0.306)
$\mathbf{1}_{China}$ x Re. Tariff x Diff (C)	0.021	0.021	0.021	0.021	-0.367	-0.367	-0.367	-0.367
	(0.930)	(1.246)	(1.099)	(0.954)	(0.675)	(0.920)	(0.781)	(0.650)
Observations	14,364	14,364	14,364	14,364	14,364	14,364	14,364	14,364
Fixed Effect	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4
Cluster SE	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4

$\mathbf{1}_{US}$ takes value of 1 if the product is exported to the US.
$\mathbf{1}_{China}$ is the dummy variable when export destination is China.
$Tariff$ stands for the US tariffs imposed on China
$Retariff$ is the retaliatory tariffs imposed by China on the US.
$Input$ is a dummy variable for intermediary goods
Robust standard errors are reported in the parenthesis.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

VARIABLES	(1) Short	(2) Short	(3) Short	(4) Short	(5) Long	(6) Long	(7) Long	(8) Long
high_elas	-0.310	-0.136	-0.113	-0.185	0.369	0.460	0.449	0.296
	(0.704)	(0.640)	(0.628)	(0.741)	(0.384)	(0.516)	(0.529)	(0.688)
$\mathbf{1}_{US}$	-0.244	-0.244	-0.244	-0.244	-0.398	-0.398	-0.398	-0.398
	(0.816)	(0.735)	(0.755)	(0.659)	(0.530)	(0.534)	(0.616)	(0.592)
$\mathbf{1}_{China}$	0.657	0.657	0.657	0.657	0.420	0.420	0.420	0.420
	(1.227)	(1.109)	(1.053)	(1.148)	(1.190)	(0.902)	(0.880)	(0.867)
Tariff	0.467	0.420	0.280	0.594	0.530	0.528	0.428	0.778*
	(0.401)	(0.381)	(0.435)	(0.438)	(0.378)	(0.321)	(0.388)	(0.454)
Re. Tariff	-0.494	-0.099	0.041	-0.144	-0.411	-0.220	-0.145	-0.525
	(0.654)	(0.515)	(0.500)	(0.718)	(0.475)	(0.473)	(0.504)	(0.670)
Tariff x Elasticity (L)	-0.164	-0.173	-0.045	-0.486	-0.432	-0.487*	-0.387	-0.865**
	(0.362)	(0.347)	(0.414)	(0.413)	(0.294)	(0.291)	(0.384)	(0.433)
Re. Tariff x Elasticity (L)	0.659	0.479	0.328	0.864	0.266	0.234	0.142	0.788
	(0.480)	(0.437)	(0.441)	(0.687)	(0.327)	(0.392)	(0.447)	(0.641)
$\mathbf{1}_{US}$ x Elasticity (L)	-0.711	-0.711	-0.711	-0.711	-1.011*	-1.011**	-1.011*	-1.011**
	(0.605)	(0.599)	(0.639)	(0.549)	(0.471)	(0.469)	(0.531)	(0.478)
$\mathbf{1}_{China}$ x Elasticity (L)	-0.981	-0.981	-0.981	-0.981	-0.640	-0.640	-0.640	-0.640
	(1.156)	(1.260)	(1.149)	(1.247)	(1.000)	(1.006)	(0.961)	(0.913)
Tariff x $\mathbf{1}_{US}$	0.078	0.078	0.078	0.078	0.021	0.021	0.021	0.021
	(0.556)	(0.539)	(0.561)	(0.457)	(0.391)	(0.374)	(0.418)	(0.376)
Re. Tariff x $\mathbf{1}_{US}$	0.169	0.169	0.169	0.169	0.424	0.424	0.424	0.424
	(0.420)	(0.471)	(0.430)	(0.423)	(0.360)	(0.417)	(0.441)	(0.435)
Re. Tariff x $\mathbf{1}_{China}$	-0.572	-0.572	-0.572	-0.572	-0.557	-0.557	-0.557	-0.557
	(1.050)	(1.009)	(1.000)	(1.108)	(0.944)	(0.835)	(0.840)	(0.828)
Tariff x $\mathbf{1}_{China}$	-0.020	-0.020	-0.020	-0.020	0.159	0.159	0.159	0.159
	(0.368)	(0.353)	(0.401)	(0.335)	(0.378)	(0.327)	(0.288)	(0.251)
$\mathbf{1}_{US}$ x Tariff x Elasticity (L)	0.470	0.470	0.470	0.470	0.754	0.754*	0.754	0.754*
	(0.523)	(0.518)	(0.563)	(0.475)	(0.432)	(0.407)	(0.466)	(0.407)
$\mathbf{1}_{China}$ x Re. Tariff x Elasticity (L)	0.717	0.717	0.717	0.717	0.422	0.422	0.422	0.422
	(1.075)	(1.175)	(1.074)	(1.177)	(0.913)	(0.918)	(0.874)	(0.852)
Observations	14,364	14,364	14,364	14,364	14,364	14,364	14,364	14,364
Fixed Effect	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4
Cluster SE	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4

$\mathbf{1}_{US}$ takes value of 1 if the product is exported to the US.
$\mathbf{1}_{China}$ is the dummy variable when export destimation is China.
$Tariff$ stands for the US tariffs imposed on China
$Retariff$ is the retaliatory tariffs imposed by China on the US.
$Input$ is a dummy variable for intermediary goods
Robust standard errors are reported in the parenthesis.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Annex 2: Heterogeneous impact on imports of different product categories

VARIABLES	(1) Short	(2) Short	(3) Short	(4) Short	(5) Long	(6) Long	(7) Long	(8) Long
Diff (C)	0.562	0.745	0.778	0.938*	0.091	0.282	0.318	0.220
	(0.564)	(0.585)	(0.540)	(0.504)	(0.336)	(0.469)	(0.434)	(0.436)
$\mathbf{1}_{US}$	-0.765	-0.765	-0.765	-0.765	-1.203	-1.203**	-1.203**	-1.203**
	(0.658)	(0.603)	(0.577)	(0.534)	(0.670)	(0.563)	(0.549)	(0.537)
$\mathbf{1}_{China}$	-0.476	-0.476	-0.476	-0.476	-0.309	-0.309	-0.309	-0.309
	(0.562)	(1.143)	(0.896)	(0.783)	(0.599)	(0.884)	(0.706)	(0.604)
Tariff	0.316	0.287	0.259	0.119	0.153	0.069	0.063	-0.110
	(0.208)	(0.214)	(0.246)	(0.240)	(0.256)	(0.238)	(0.230)	(0.222)
Re. Tariff	0.209	0.573	0.562	0.900*	-0.172	0.131	0.105	0.326
	(0.558)	(0.558)	(0.491)	(0.474)	(0.362)	(0.451)	(0.424)	(0.400)
Tariff x Diff (C)	-0.194	-0.176	-0.180	-0.195	-0.109	-0.009	-0.032	0.073
	(0.208)	(0.190)	(0.226)	(0.233)	(0.140)	(0.143)	(0.187)	(0.215)
Re. Tariff x Diff (C)	-0.278	-0.505	-0.523	-0.628	0.042	-0.260	-0.262	-0.256
	(0.528)	(0.532)	(0.469)	(0.441)	(0.373)	(0.432)	(0.377)	(0.381)
$\mathbf{1}_{US}$ x Diff (C)	-0.016	-0.016	-0.016	-0.016	0.191	0.191	0.191	0.191
	(0.248)	(0.310)	(0.366)	(0.349)	(0.240)	(0.343)	(0.362)	(0.362)
$\mathbf{1}_{China}$ x Diff (C)	-0.173	-0.173	-0.173	-0.173	0.367	0.367	0.367	0.367
	(0.963)	(1.303)	(1.162)	(1.009)	(0.714)	(0.966)	(0.828)	(0.693)
Tariff x $\mathbf{1}_{US}$	0.452	0.452	0.452	0.452*	0.688	0.688*	0.688**	0.688**
	(0.287)	(0.302)	(0.281)	(0.273)	(0.437)	(0.369)	(0.300)	(0.280)
Re. Tariff x $\mathbf{1}_{US}$	0.082	0.082	0.082	0.082	0.302	0.302	0.302	0.302
	(0.457)	(0.470)	(0.429)	(0.417)	(0.387)	(0.416)	(0.435)	(0.425)
Re. Tariff x $\mathbf{1}_{China}$	0.166	0.166	0.166	0.166	-0.058	-0.058	-0.058	-0.058
	(0.687)	(1.209)	(0.987)	(0.805)	(0.569)	(0.933)	(0.751)	(0.630)
Tariff x $\mathbf{1}_{China}$	0.167	0.167	0.167	0.167	0.185	0.185	0.185	0.185
	(0.376)	(0.367)	(0.405)	(0.356)	(0.370)	(0.324)	(0.292)	(0.263)
$\mathbf{1}_{US}$ x Tariff x Diff (C)	0.050	0.050	0.050	0.050	-0.107	-0.107	-0.107	-0.107
	(0.201)	(0.258)	(0.306)	(0.295)	(0.187)	(0.292)	(0.307)	(0.306)
$\mathbf{1}_{China}$ x Re. Tariff x Diff (C)	0.021	0.021	0.021	0.021	-0.367	-0.367	-0.367	-0.367
	(0.930)	(1.246)	(1.009)	(0.954)	(0.675)	(0.920)	(0.781)	(0.650)
Observations	14,364	14,364	14,364	14,364	14,364	14,364	14,364	14,364
Fixed Effect	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4
Cluster SE	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4

$\mathbf{1}_{US}$ takes value of 1 if the product is exported to the US.
1_{China} is the dummy variable when export destination is China.
$Tariff$ stands for the US tariffs imposed on China
$Retariff$ is the retaliatory tariffs imposed by China on the US.
$Input$ is a dummy variable for intermediary goods
Robust standard errors are reported in the parenthesis.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

VARIABLES	(1) Short	(2) Short	(3) Short	(4) Short	(5) Long	(6) Long	(7) Long	(8) Long
Diff (C)	0.074**	0.071*	0.080**	0.078**	0.135**	0.139***	0.136***	0.184***
	(0.029)	(0.039)	(0.033)	(0.032)	(0.044)	(0.045)	(0.045)	(0.048)
$\mathbf{1}_{US}$	-0.019	-0.019	-0.019	-0.019	0.015	0.015	0.015	0.015
	(0.017)	(0.015)	(0.015)	(0.014)	(0.025)	(0.024)	(0.022)	(0.020)
$\mathbf{1}_{China}$	-0.025	-0.025*	-0.025*	-0.025*	-0.012	-0.012	-0.012	-0.012
	(0.018)	(0.014)	(0.013)	(0.014)	(0.022)	(0.021)	(0.019)	(0.019)
Tariff	0.256*	0.257**	0.261**	0.315**	0.731***	0.688***	0.694***	0.710***
	(0.135)	(0.112)	(0.112)	(0.144)	(0.174)	(0.158)	(0.144)	(0.187)
Re. Tariff	0.406**	0.554**	0.526**	0.328	1.230***	1.502***	1.480***	1.447***
	(0.154)	(0.223)	(0.224)	(0.302)	(0.337)	(0.289)	(0.316)	(0.372)
Tariff x Diff (C)	-0.005	-0.066	-0.112	-0.252	-0.063	-0.089	-0.070	-0.195
	(0.194)	(0.149)	(0.150)	(0.178)	(0.200)	(0.210)	(0.202)	(0.256)
Re. Tariff x Diff (C)	-0.413*	-0.421	-0.446	-0.301	-0.913**	-1.079***	-1.121***	-1.020**
	(0.192)	(0.261)	(0.272)	(0.315)	(0.328)	(0.282)	(0.327)	(0.396)
$\mathbf{1}_{US}$ x Diff (C)	-0.073	-0.073	-0.073	-0.073*	-0.086	-0.086*	-0.086*	-0.086*
	(0.055)	(0.044)	(0.045)	(0.042)	(0.066)	(0.050)	(0.049)	(0.046)
$\mathbf{1}_{China}$ x Diff (C)	-0.095**	-0.095*	-0.095**	-0.095**	-0.057	-0.057	-0.057	-0.057
	(0.034)	(0.049)	(0.045)	(0.039)	(0.045)	(0.059)	(0.047)	(0.042)
Tariff x $\mathbf{1}_{US}$	-0.436***	-0.436***	-0.436***	-0.436***	-0.672***	-0.672***	-0.672***	-0.672***
	(0.072)	(0.135)	(0.131)	(0.140)	(0.139)	(0.158)	(0.148)	(0.160)
Re. Tariff x $\mathbf{1}_{US}$	0.329**	0.329	0.329	0.329	-0.195	-0.195	-0.195	-0.195
	(0.118)	(0.234)	(0.235)	(0.264)	(0.223)	(0.266)	(0.255)	(0.286)
Re. Tariff x $\mathbf{1}_{China}$	-0.557	-0.557	-0.557	-0.557	-0.803	-0.803**	-0.803***	-0.803**
	(0.389)	(0.351)	(0.339)	(0.339)	(0.446)	(0.341)	(0.297)	(0.333)
Tariff x $\mathbf{1}_{China}$	0.200	0.200	0.200	0.200	0.139	0.139	0.139	0.139
	(0.147)	(0.125)	(0.138)	(0.141)	(0.132)	(0.173)	(0.166)	(0.161)
$\mathbf{1}_{US}$ x Tariff x Diff (C)	0.135	0.135	0.135	0.135	0.113	0.113	0.113	0.113
	(0.216)	(0.178)	(0.209)	(0.224)	(0.279)	(0.240)	(0.252)	(0.253)
$\mathbf{1}_{China}$ x Re. Tariff x Diff (C)	0.492	0.492	0.492	0.492	0.888	0.888	0.888*	0.888*
	(0.437)	(0.555)	(0.523)	(0.475)	(0.511)	(0.509)	(0.533)	(0.506)
Observations	17,961	17,961	17,961	17,961	17,961	17,961	17,961	17,961
Fixed Effect	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4
Cluster SE	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4

$\mathbf{1}_{US}$ takes value of 1 if the product is exported to the US.
$\mathbf{1}_{China}$ is the dummy variable when export destimation is China.
$Tariff$ stands for the US tariffs imposed on China
$Retariff$ is the retaliatory tariffs imposed by China on the US.
$Input$ is a dummy variable for intermediary goods
Robust standard errors are reported in the parenthesis.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

VARIABLES	(1) Short	(2) Short	(3) Short	(4) Short	(5) Long	(6) Long	(7) Long	(8) Long
high_elas	-0.011	-0.005	-0.001	-0.024	-0.075	-0.064	-0.064	-0.104***
	(0.021)	(0.026)	(0.032)	(0.036)	(0.044)	(0.047)	(0.046)	(0.035)
$\mathbf{1}_{US}$	-0.052	-0.052	-0.052	-0.052	-0.084***	-0.084*	-0.084*	-0.084
	(0.041)	(0.038)	(0.039)	(0.048)	(0.023)	(0.049)	(0.047)	(0.059)
$\mathbf{1}_{China}$	-0.039	-0.039	-0.039	-0.039	-0.070	-0.070	-0.070	-0.070
	(0.032)	(0.030)	(0.038)	(0.049)	(0.039)	(0.049)	(0.046)	(0.048)
Tariff	0.345***	0.412**	0.456**	0.378	0.488	0.553*	0.620**	0.222
	(0.094)	(0.172)	(0.227)	(0.383)	(0.351)	(0.318)	(0.270)	(0.344)
Re. Tariff	-0.180	-0.094	-0.143	-0.524	0.263	0.377	0.290	0.044
	(0.316)	(0.418)	(0.416)	(0.505)	(0.302)	(0.494)	(0.545)	(0.587)
Tariff x Elasticity (L)	-0.008	-0.114	-0.169	-0.091	0.371	0.235	0.177	0.624*
	(0.130)	(0.173)	(0.219)	(0.381)	(0.370)	(0.317)	(0.268)	(0.353)
Re. Tariff x Elasticity (L)	0.522	0.583	0.606	0.847*	0.770	0.878	0.930*	1.211**
	(0.387)	(0.446)	(0.417)	(0.494)	(0.440)	(0.550)	(0.533)	(0.591)
$\mathbf{1}_{US}$ x Elasticity (L)	0.022	0.022	0.022	0.022	0.090**	0.090*	0.090*	0.090
	(0.035)	(0.038)	(0.040)	(0.049)	(0.034)	(0.051)	(0.048)	(0.061)
$\mathbf{1}_{China}$ x Elasticity (L)	-0.003	-0.003	-0.003	-0.003	0.050	0.050	0.050	0.050
	(0.039)	(0.034)	(0.041)	(0.041)	(0.043)	(0.052)	(0.047)	(0.049)
Tariff x $\mathbf{1}_{US}$	-0.187	-0.187	-0.187	-0.187	-0.017	-0.017	-0.017	-0.017
	(0.269)	(0.237)	(0.243)	(0.301)	(0.206)	(0.297)	(0.310)	(0.350)
Re. Tariff x $\mathbf{1}_{US}$	0.255*	0.255	0.255	0.255	-0.288	-0.288	-0.288	-0.288
	(0.120)	(0.218)	(0.223)	(0.254)	(0.242)	(0.255)	(0.246)	(0.276)
Re. Tariff x $\mathbf{1}_{China}$	0.043	0.043	0.043	0.043	0.187	0.187	0.187	0.187
	(0.563)	(0.600)	(0.519)	(0.497)	(0.780)	(0.759)	(0.589)	(0.562)
Tariff x $\mathbf{1}_{China}$	0.087	0.087	0.087	0.087	0.110	0.110	0.110	0.110
	(0.139)	(0.125)	(0.127)	(0.137)	(0.145)	(0.167)	(0.150)	(0.158)
$\mathbf{1}_{US}$ x Tariff x Elasticity (L)	-0.307	-0.307	-0.307	-0.307	-0.777**	-0.777***	-0.777**	-0.777**
	(0.249)	(0.218)	(0.226)	(0.296)	(0.246)	(0.285)	(0.304)	(0.348)
$\mathbf{1}_{China}$ x Re. Tariff x Elasticity (L)	-0.532	-0.532	-0.532	-0.532	-0.735	-0.735	-0.735	-0.735
	(0.617)	(0.641)	(0.544)	(0.529)	(0.848)	(0.801)	(0.622)	(0.600)
Observations	17,961	17,961	17,961	17,961	17,961	17,961	17,961	17,961
Fixed Effect	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4
Cluster SE	HS1	HS2	HS3	HS4	HS1	HS2	HS3	HS4

$\mathbf{1}_{US}$ takes value of 1 if the product is exported to the US.
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$Input$ is a dummy variable for intermediary goods
Robust standard errors are reported in the parenthesis.
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2. Caught in the Crossfire: How Trade Policy Uncertainty Impacts Global Trade

1. Introduction

Trade policy uncertainty has become a major concern for global trade in the wake of recent economic policy changes like Brexit, trade protectionism measures, China's lockdowns etc. For example, US Trade policy uncertainty index, developed by Bloom et. al. (2016) and Caldara et. al. (2018) rose to its highest level in 2017 as the protectionist measures were discussed. Similar patterns were observed in China, United Kingdom and European Union. This chapter introduces trade policy uncertainty in neo-classical multi-country trade models to provide a structural understanding of the uncertainty effect on global trade flows.

Changes in trade policies impacts trade partners in different ways. Generally, higher tariffs moderates trade intensity among trade partners. However, these policy changes introduce uncertainty among trade partners. The effect of uncertainty complicates firms' decision-making process. The unavailability of future policy information at the time of planning, triggers uncertainty in the firms' forward-looking allocations and thereby, modulates firms' optimal choice. The effect of TPU affects the global trade partners via trade linkages. The trade protectionist measures adopted by the United States, elevated trade policy uncertainty for the trade partners due to lack of clarity in terms of possible tariff sizes and duration of those policies. These trade policies targeted many trade partners, though most of these tariffs were targeted towards China. Higher tariffs increased price level of products coming from those targeted countries and thereby, created an opportunity of trade diversion for other trade partners. However, empirical evidence suggests that the effect of those high tariffs moderated global trade and there was no clear winner from the trade war (Fajgelbaum et. al. (2022)). Also, different trade partners experienced different level of trade intensity in those targeted products (Sanyal (2020); Choi & Nguyen (2021)). The direct effect of higher tariffs moderated consumption demand and increased domestic price level in the United States (Waugh (2019); Fajgelbaum et. al. (2020)). The effect on higher tariffs also affected US consumer through global value chain due to higher tariffs on intermediate goods (Bellora & Fontagne (2020)). The impact of trade war also affected export growth of the US through supply chains due to higher trade tariffs (Handley et. al. (2020)). On the other hand, higher tariffs imposed by the US, marginalized the profit margin of the firms in China (Wang et. al. (2020)). Apart from the direct effect of tariffs, the uncertainty reduced trade volume between China and US (Ongan & Gocer, 2020; Yan & Xiao, 2022; Benguria et. al., 2022). Similar effects were observed during the Brexit vote in 2016. Lack of clarity and widespread speculations about future policies increased uncertainty during Brexit. This uncertainty slowed investment momentum and affected productivity (BoE, 2019) and reduced trade volume by 16-20% between EU and UK (Kren & Lawless (2022)). The recent lockdown in China also imparted similar effects on export intensity and global value chain (Nie, 2022).

From the theoretical point of view, multi-country trade models are used to derive the direct effect of tariffs on different trade partners. Changes in the tariff sizes changes the iceberg trade costs and thereby, impacts the price distribution at the originating country. However, these models do not account for the policy uncertainty. This chapter provides a generalization of the trade policy uncertainty in multi-country trade models to address the effect of uncertainty on global trade flows and re-allocations. The model uses the multi-country trade set up under perfect competition following Eaton & Kortum (2002) and introduces trade policy uncertainty from two sources - probability of trade policy changes and possible tariff sizes. The firms make their production plans at the beginning of the period when the trade policies are not yet declared. The uncertainty in trade policy affects the trade intensity as the price distribution in the originating country becomes uncertain. The policy uncertainty, thereby, translates to lower than potential trade intensity among trade partners. The proposed model starts with trade policy changes between two countries i.e. higher tariff is proposed by one country on another. Using the probability of trade policy changes and the possible size effect of tariffs, the model provides an analytical derivation of the effect of TPU on global trade and domestic prices. The model is then extended to a generalized scenario where policy uncertainty affects trade cost on all trade partners. Such generalization can be related to China's recent lockdown. Using this generalized set up, the comparative statics of TPU parameters shows similar effect on all trade partners. Later, the quantitative model is calibrated using different scenarios of tariffs sizes and probability of policy changes to demonstrate the effect of TPU.

The chapter contributes to two strands of the literature. The first strand addresses trade integration in multi-country multi-sector Ricardian models (Caliendo and Parro 2010; Shikher 2011; Costinot, Donaldson, and Komunjer 2012). Dekle et. al. (2007, 2008) used similar framework to explain the impact of trade balances on factort costs and welfare. Eaton, Kortum, Neiman and Romalis (2011) extended the model framework to explain the role of trade in global recession. Giovanni et. al. (2014) used similar framework to address the welfare implication of trade partners in the wake of China's trade integration and technological changes. Costinot & Rodriguez-Clare (2014) provided survey of findings of global inter-connectedness and sectoral heterogeneity. Similar model set up was used for explaining equity home bias (Hu, 2022), spatial risk sharing (Arora et. al., 2022). This chapter provides a generalization of the Eaton and Kortum (EK) framework (2002) with uncertainty in the trade cost. The paper also contributes to the growing literature of trade policy uncertainty. Some of the notable papers in this context are Handley & Limao (2018, 2022), Steinberg (2015, 2018) and Caldara et. al. (2018). Compared to these papers, the current chapter addresses the trade policy uncertainty in multi-country and multi-sector set up and analyzes the impact of the uncertainty on trade flows and global re-allocations.

The remaining of the chapter is organized as follows - Section 2 provides the model details with analytical derivations, Section 3 details the calibration approach, Section 4 summarizes the findings of the model simulations followed by concluding remarks in Section 5.

2. Model

2.1. Setup

The model uses Ricardian trade model set up with multiple countries and multiple sectors following Eaton & Kortum (2002). There are N countries (for simplicity, it is assumed that country 1 is United States and Country 2 is China). There are J traded sectors and one non-traded sector in each country. The production process happens in two stages. In the first stage, each country produces intermediate goods using labor, capital, and other intermediate inputs. In the second stage, the final goods are produced using intermediate goods.

The markets are perfectly competitive and international trade is costly. The price charged by each country is a markup on the unit cost of production adjusting for the trade cost. The final price distribution in any country is derived from the minimum price offered by all trade partners. The capital and labor endowment in each country is fixed. The firms choose factors of production depending upon the final demand of each sector. The productivity distribution follows Frechet distribution.

Further, it is assumed that trade is costly and there is iceberg trade costs between any two countries. The trade policy changes the trade cost. For simplicity and ease of initial derivations, possible trade policy changes is assumed to increase the trade cost on imports from Country 2 to Country 1[23]. The trade policy uncertainty has two components - the probability of trade policy change and possible size of tariffs.

The firms make production plans at the beginning of the period before the trade policy is announced and allocates the factors of production (labor, capital and intermediate goods) based on perception of final demand under uncertainty. It is assumed that the factor allocations are subject to adjustment costs and hence, cannot be modified after realization of the trade policy. This creates a wedge between potential trade diversion and actual trade diversion on account of higher tariffs imposed by Country 1.

[23] This assumption will be generalized in later part of derivations.

2.2. Novelty of the Approach

Abstracting from the mathematical configurations, the two channels of the trade policy uncertainty provide additional lever to disentangle the effects of uncertainty due to policy changes and the quantum of policy changes. The first component can be related to the recent announcements of the reciprocal tariffs. After the declaration of the reciprocal tariffs, the tariff sizes were announced with a tentative date of enforcement, but that date was later pushed back. This sequential push-back of the implementation date of high tariffs is aptly captured through the first component. The second component i.e. the uncertainty around the tariff sizes, adds another layer of uncertainty for the firms. Drawing experience from the recent reciprocal tariff announcements, the tariff sizes were declared initially but those proposed tariffs were modified over time as the bilateral tariff discussion progressed. The tariff sizes act as an iceberg trade costs which increases the consumer prices. The stochastic component around the tariffs sizes generates uncertainty around the consumer prices. Later, it is shown that the framework of introducing trade policy uncertainty can be configured suitably to understand the impact of various episodes of trade policy uncertainty including the COVID lockdown and China's WTO access, among others.

2.3. Firm dynamics

The dynamics of the trade policy uncertainty is generated through the firms' action. The firms have a standard Cobb-Douglas production function with labour, capital, and intermediate goods as factor inputs. The intermediate goods used in the production can be sourced domestic or through imports. The goods produced by the firms is used for domestic consumption and exports. The market is perfectly competitive in nature[24]. The producer price is the marginal cost of production. As the goods are traded across regions, the trade frictions act as iceberg trade costs. The price charged by the producers for sending their products to any destination is a markup on the producer price and the markup amounts to the tariffs. The consumers of the destination countries choose the price which is minimum among the prices

[24] This is standard assumption used in neo-classical trade models. The assumption of perfect competition is for simplicity of the mathematical derivations.

offered by the trade partners. The total factor productivity is assumed to follow type-II extreme value distribution.

The trade policy uncertainty introduces a stochastic component in the price expression offered by the firms. Here, the underlying assumption is that the factor allocations are costly and cannot be modified frequently. This rigidity in the factor allocations restricts the firms to alter their choices in response to the frequent changes in the allocations of the factor inputs as the trade policy is revealed. This is a crucial assumption in this formation. As the factor allocations cannot be changed very frequently, the firms assign their factors of production in response to their assessment of the future trade policies and the stochastic uncertainty get imbibed into the decision-making process of the firms.

2.4. Trade Policy Uncertainty and Interaction with Firm Dynamics

The two sources of the trade policy uncertainty are implemented differently in the model. The first component follows a Markov switching process where the probability of the trade policy changes varies between 0 and 1. If the probability is zero, then the trade policy remains unchanged and if the probability is 1, then the trade policy changes with certainty. These are the two extreme cases of the policy changes. However, the model allows the trade policy uncertainty to vary over a continuous scale of 0 and 1.

The second component of the trade policy uncertainty is the uncertainty around the possible changes in the tariff sizes. The distribution of the possible tariff sizes follows a stochastic process and can assume any value within the support of the distribution with some assigned probability. Here, the assumption of the tariff size distribution is crucial. However, it may be mentioned that the firms may not have any prior knowledge about the possible tariff sizes that they are going to face in future. The implication is that the firms' belief about the future tariffs may follow uninformative prior or objective prior with a defined upper bound of tariff sizes. This upper bound of the tariff sizes is sourced from the prior episodes of extreme tariff impositions. For instance, one may assume that the highest level of tariffs can be from the Smoot-Hawley Tariffs.

Combining these two components, the final tariff distribution is a mixture of the current state of tariffs and the possible future values of the tariffs, the weights being equal to the probability of trade policy changes. It may be noted here that as the tariff sizes follow a distribution. The final expression of the prices and trade intensity, therefore, involves a convex combination of the current state of trade policy and all possible states of future trade policy with a stochastic weighting pattern. The trade intensity and the consumer prices, therefore, is dictated by these choices which establish the importance of trade policy uncertainty on consumer prices and trade pattern.

As the final expression of the consumer prices and trade pattern is a convex combination of the current state of tariffs and various possible tariff levels, the assessment of the future tariffs decides the final impact of these uncertainties on the economy. To simplify the scenario, any uncertainty on trade policy arising due to the almost sure changes in the policy, is entirely driven by the firms' assessment about the future tariffs. If the firms expect any hostile tariff rates, the price charged by the firms increases with their assessment of the tariffs sizes. If the firms expect extreme values of tariffs, their final price on consumers increases significantly upwards. Similar extension can be drawn from the probability of the trade policy changes. If the firms believe in a lower probability of the trade policy changes, then the effect of the trade policy uncertainty moderates on the consumer prices and trade pattern remain mostly unchanged from the current state.

2.5. Mapping these Trade Policy Uncertainties for Various Episodes

In the latest episode of the reciprocal tariffs, the probability of the trade policy changes varied over 0 and 1 as the ambiguity around the implementation of the high tariffs was not clear. However, the narrative behind the tariff changes was so strong that the firms expressed their concerns about the trade restrictions. This implies that the probability of the trade policy changes was very high (may be close to 1). The tariff sizes under reciprocal tariffs, though announced discretely, created an uncertainty as the follow-up discussions progressed. After the announcements of the reciprocal tariffs, the bilateral discussions were initiated, and the sunset clause of the tariff moderation was proposed.

Similarly, for the COVID pandemic episodes, the probability of the changes in the trade policy uncertainty was almost sure event but the tariff sizes were uncertain as different economies imposed the economic lockdown at different points of time and the trade movements shuttered in response to those lockdowns. China's WTO accession is also relatable to this framework. The uncertainty in that scenario was entirely driven by the changes in the trade policy uncertainty, whereas the tariff sizes in the post accession period was certain.

2.6. Extension of the Framework in Multilateral Trade Disputes

The model framework is flexible to extend in the multi-country trade dispute setup. As countries take up hostile trade policies, the uncertainty pattern varies across country and sector. The resultant effect of these trade policy uncertainties convolutes to a mixture of convex combinations with firms having their assessment on each destination country's tariff stance. The final expression of the consumer prices includes all the effects of the policy uncertainty from various countries and different sectors.

2.7. Model validation and calibration

In the first stage, the non-TPU parameters of the model is estimated following the approach suggested by Levchenko & Zhang (2011) and Giovanni et. al. (2014). The approach estimates (i) productivity parameters (ii) trade costs under no uncertainty (iii) production function parameters (iv) labor and capital endowments and elasticity & preference parameters. The non-TPU model parameters should not be impacted by the trade policy uncertainty. Hence, these parameters are estimated using annual data over 2012-2015. In the calibration, 62 countries and 20 sectors were included. These sectors are at 2-digit ISIC code level (Table 2.1).

Table 2.1: Sectors Considered for Calibration

Food - Beverage (15)	Tobacco products (16)
Text (17)	Wearing apparels (18)
Leather and products (19)	Wood products (20)
Paper and products (21)	Printing (22)
Coke, refined petroleum (23)	Chemical and products (24)
Rubber and products (25)	NMMP (26)
Basic metal (27)	Fabricated metal (28)
Offrice, accounting (29)	Electrical machinery (31)
Medical precision (33)	Transport equipment (34)
Furniture (36)	Services (non-traded) (4A)

The second part involves TPU parameters i.e. upper bound of tariffs and probability of trade policy changes. These parameters are tested using different choices of tariff upper bounds and probability of policy changes. The possible values of tariff upper bound is drawn from (i) bounded tariffs under MFN agreements (ii) Highest value of Pre-WTO accession tariffs and (iii) maximum value of Column 2 tariffs. These values are representing the highest tariffs agreed under MFN agreements or highest tariffs imposed by the United States in different occasions. We assume that the trade partners form their belief about the possible tariff sizes based on the benchmark tariff rates from these references. Lastly, the model is calibrated with different values of probability of trade policy changes (between 0.1 and 0.9). For the calibration purpose, one sided tariff imposed by the United States on China were only considered. The goodness of the fit of the model is evaluated using the correlation analysis of the bilateral trade flows from 2018-19 with the model predictions. Correlation is also derived using the model predicted consumer prices and the observed consumer prices of the United States[25].

[25] The recent example of reciprocal tariffs was not used for the model validation as the effect is still unfolding.

3. Findings

3.1. Non-TPU parameters

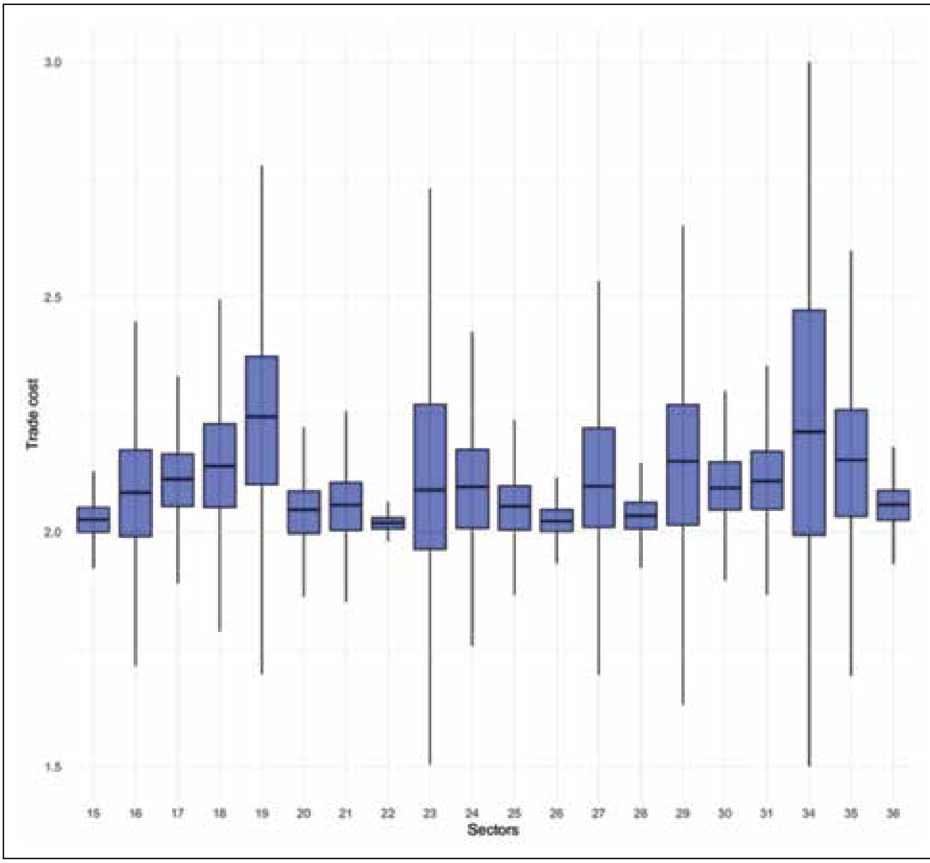
The first round of parameter estimation provides an estimate of the non-TPU parameters. The estimate of absolute comparative advantages in each sector provides an overview about the heterogeneity of the sectors in terms of comparative advantages (refer to Table 2.2).

Table 2.2: Estimate of productivity parameters

ISIC	Min	Q1	Median	Mean	Q3	Max	ISIC	Min	Q1	Median	Mean	Q3	Max
15	0.00	0.03	0.05	0.08	0.08	1.06	16	0.00	0.01	0.01	0.11	0.03	3.23
17	0.00	0.03	0.05	0.08	0.07	1.10	18	0.00	0.01	0.02	0.05	0.04	1.00
19	0.00	0.00	0.00	0.02	0.01	1.17	20	0.00	0.02	0.04	0.08	0.06	1.27
21	0.00	0.03	0.05	0.09	0.08	1.22	22	0.00	0.01	0.02	0.05	0.03	1.05
23	0.01	0.05	0.09	0.16	0.13	1.51	24	0.00	0.02	0.03	0.06	0.04	1.06
25	0.00	0.03	0.05	0.08	0.07	1.19	26	0.00	0.02	0.03	0.06	0.04	1.20
27	0.01	0.05	0.08	0.11	0.12	1.12	28	0.00	0.02	0.03	0.06	0.05	1.05
29	0.00	0.01	0.02	0.05	0.04	0.98	30	0.00	0.03	0.05	0.10	0.07	1.76
31	0.00	0.03	0.05	0.08	0.07	1.11	34	0.00	0.03	0.06	0.10	0.09	1.27
35	0.00	0.02	0.04	0.08	0.05	1.18	36	0.93	0.94	0.98	0.99	1.04	1.08

The non-TPU trade cost estimates distribution, derived using the gravity equation, highlights the variation in trade cost across different traded sectors. The variation, represented in boxplot, varies between (1.5,3.0) for all sectors with major variation observed in transport equipment (ISIC = 34) and coke & refined petroleum products (ISIC = 23) (Fig. 2.1)

Fig. 2.1: Trade cost estimates



Using the estimated parameters, the wage and rental rate of capital are derived using LZ (2011) and the goodness of fit of these prices indicates a close fit of the data moments with the model predictions (Table 2.3).

Using the baseline parameters, different scenarios are constructed to incorporate the trade policy uncertainty in the model. These scenarios were derived using different values of TPU parameters i.e. probability of trade policy changes and possible tariff sizes. The choice of the upper bound of tariff, can be benchmarked against the higher tariff episodes. Some examples include the tariff levels under no-cooperation (i.e. US tariff on Cuba, North Korea, among others) higher tariffs imposed on China during pre-WTO accession period or upper bound of tariffs negotiated by the US on China. For calibration purpose, the higher tariff levels are set from the bounded tariff limits which were negotiated by the United States with China under trade agreements. These tariffs varied across different sectors. The scenarios were developed using values from the tariff distribution (Table 2.4 provides the variation in these tariff levels).

Table 2.3: Moment matching between model and data using 2012-2016 annual data

	Model	Data
Wage values		
Mean	0.34	0.42
Median	0.32	0.29
Percentile(25th)	0.15	0.11
Percentile(75th)	0.44	0.60
Correlation	0.78	
Rental rate		
Mean	0.78	0.86
Median	0.45	0.66
Percentile(25th)	0.25	0.31
Percentile(75th)	0.74	0.90
Correlation	0.78	
Trade share π_{ni} $(n \neq i)$		
Mean	0.0238	0.0205
Median	0.0015	0.0021
Correlation	0.65	
Own trade share π_{ni} $(n = i)$		
Mean	0.5898	0.6256
Median	0.6342	0.7635
Correlation	0.64	

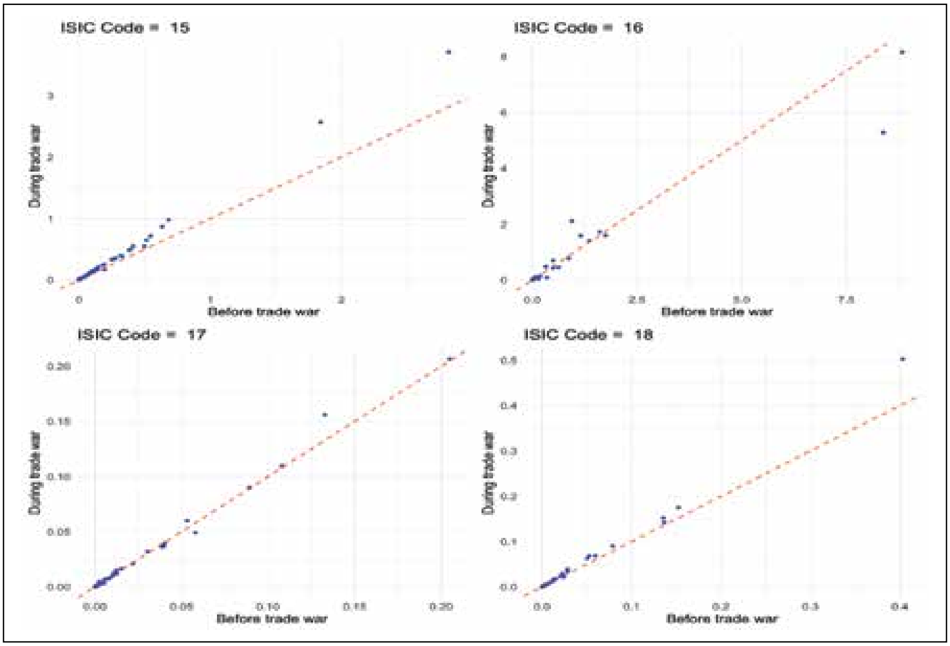
Table 2.4: US Tariffs

	Max	Min
1930 - 1950	65%	15%
1950 - 1990	15%	8%

The probability of trade policy changesis calibrated over range of values varying over 0.05 to 0.95. Low values of the probability represent lower chance of trade dispute whereas higher values of the probability represent imminent threat of trade dispute. Lastly, the combination of discretize values of upper tariff bounds, and probability created different TPU scenarios. The model prediction is generated using the baseline non-TPU parameters and the choice of TPU parameters from each scenario. These predictions were matched with actual trade share data during the recent US trade dispute period. The targeted bilateral trade data is collected from WITS at ISIC 2 digit level for 2019 to capture the trade dispute outcomes.

The model predictions are generated using the trade share equation and price distribution are generated by simplifying the TPU equations in incomplete Gamma format (Refer to Appendix for the simplified version of these equations). The scatter plot of trade share from before and after trade dispute period provides a glimpse of heterogeneity in trade re-allocations after the trade dispute. Fig 2.2 plots the average trade share ratio of other trade partners (excluding China). The horizontal axis is the average trade share over 2016-17 and the vertical axis is the trade share in 2019. The plots are fitted with a 45-degree line - any point on the dotted red line represents no change in relative trade share after the trade dispute (The plots are shown for ISIC 15-18 in the main text, other plots are available in Appendix).

Fig 2.2: Trade share ratio plots (from data)

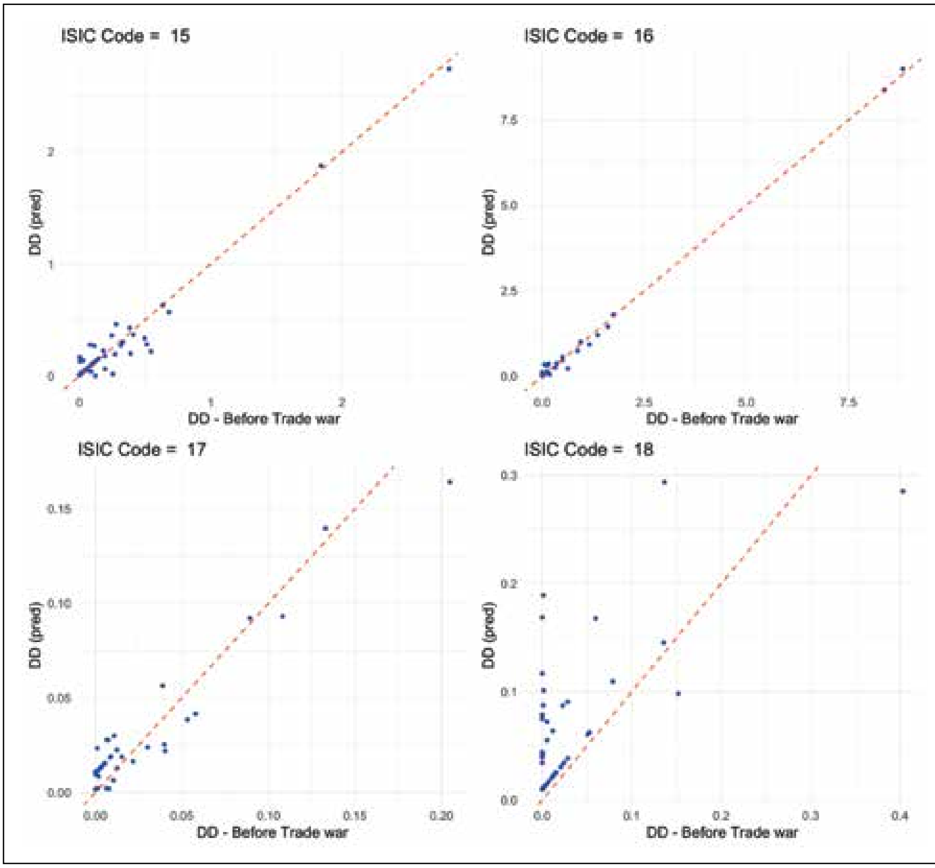


Note: The trade shares ratios are defined across ISIC sectors using UN Comtrade data; "Before trade war" period is 2016-2017 and "During trade war" is 2019 data. The industry labeling is not incorporated in the chart for better readability.

Following Fig. 2.2, the trade share ratios increased for ISIC Code 15 (Food and Beverages) which implies trade diversion across all trade partners. However, such broad-based trade diversion intensity did not happen for other industry segments. In fact, the heterogeneity in the trade diversion is visible in tobacco products (ISIC = 16), wearing apparels (ISIC = 18), printing (ISIC = 22), chemical and products (ISIC = 24), non-metallic mineral products (ISIC = 26) and basic metals (ISIC = 27).

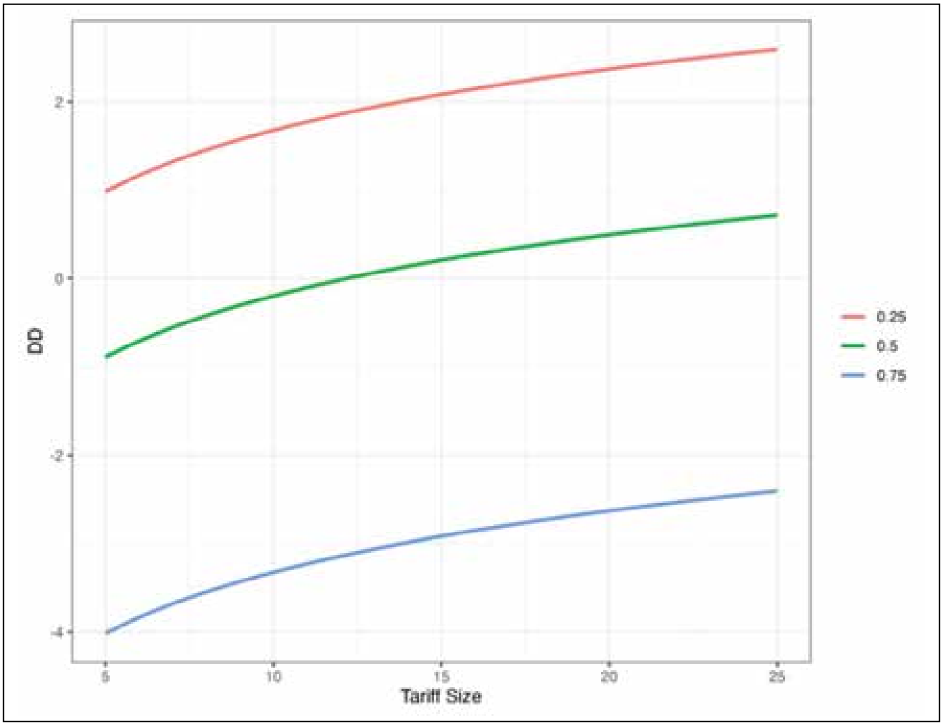
The trade share ratio for the before trade dispute period from the model prediction and data is plotted. Fig. 2.3 provides scatter plot of the trade share prediction against the observed variation from data. The predicted values fall close to the red dotted line which implies that the model predictions match with data (Refer to Annex-3 for other goodness of fit).

Fig 2.3: Trade share prediction before trade war



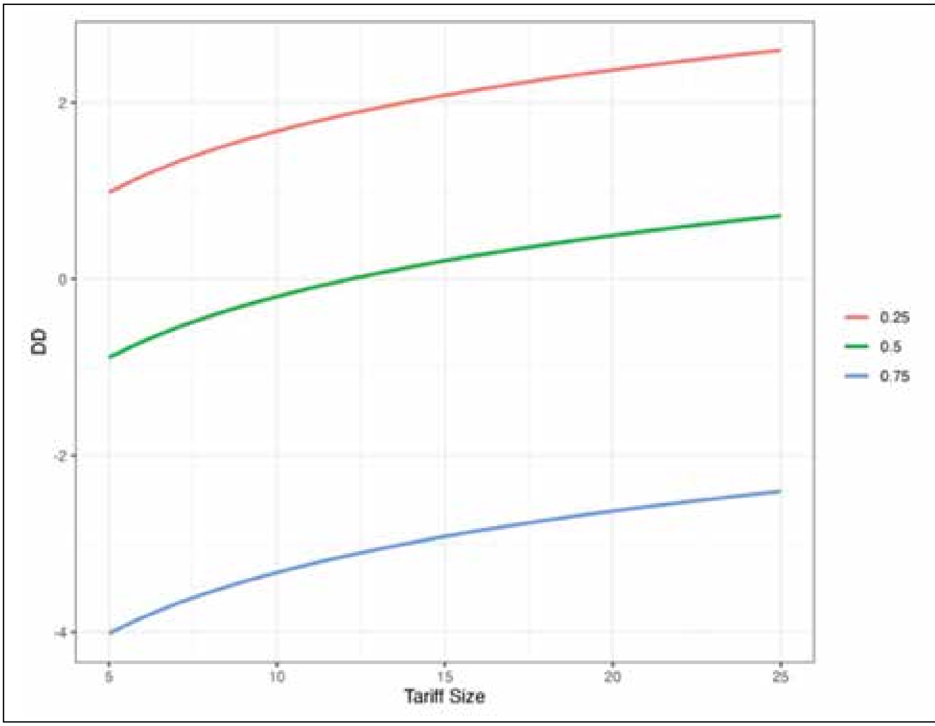
Next, the model predict the trade share to the United States using different values of probability and tariff sizes and calculate the ratio measures. The average trade share ratio is plotted against the tariff size brackets and trade policy change probability. The trade diversion intensity, measured by, remains high when the probability of tariff changes are high (the plot uses probability of trade policy changes in the horizontal axis which represents the probability of no change in tariffs). The trade diversion intensity increases with the probability of trade diversion. The prediction is intuitive - as the trade partners starts believing in imminent trader dispute, they make their production plan accordingly and the trade diversion happens more intensely to other trade partners. The trade diversion intensity increases with the higher bounds of tariff sizes. As the trade partners expect large tariff changes on Country 2, the high trade cost offsets the relative comparative advantages of Chinese firms and creates opportunity for other trade partners to increase their export to the United States (refer to Fig. 2.4).

Fig 2.4: Trade share ratio under different Tariff brackets



Next, the average prediction of trade diversion is plotted against the tariff sizes for different beliefs on uncertainty about trade policy changes. Here, the trade diversion intensities increase with the tariff sizes. Such increasing pattern in trade diversion intensity reflects the increase in trade partners' assessment about the final export demand to the US under different beliefs about the trade policy changes (refer to Fig. 2.5).

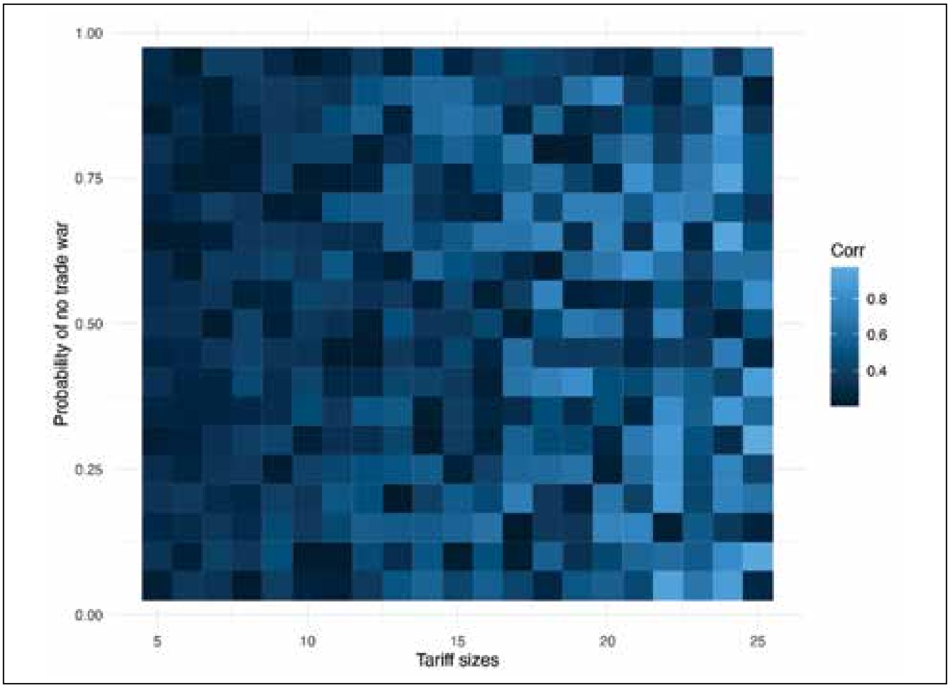
Fig 2.5: Trade share ratio under different Probability brackets



The prediction of trade diversion intensity from the model is compared with the patterns observed from data. For that, the trade diversion ratio is calculated from bilateral trade flows data for 2018-19 data. The predictions are matched against the trade shares from the data and correlation between the model the model predictions and the actual realizations are calculated for each scenario. The correlation increases with tariff sizes and probability of trade dispute. For relatively lower tariff level, the correlation is highest when the belief about the tariff dispute is very high (refer to Figure 2.6).

The correlation pattern provides some intuition behind the trade partners' belief about the trade dispute between US and China. The trade partners factored in higher tariff scenario under trade dispute. The rationale behind such belief of high tariff can be drawn from the average tariff on China before WTO accession. The higher correlation values at high tariff sizes reveals that the trade partners believed very high tariffs drawing from the pattern of higher tariffs on China since 1980. At such higher tariffs, the correlation is high at relatively lower probability of trade dispute. Combining these two outcomes, the trade partners appear to be less certain about the implementation of higher tariffs, but they were near certain about very high tariff values.

Fig 2.6: Correlation of trade diversion intensity - prediction and realization



4. Concluding Remarks

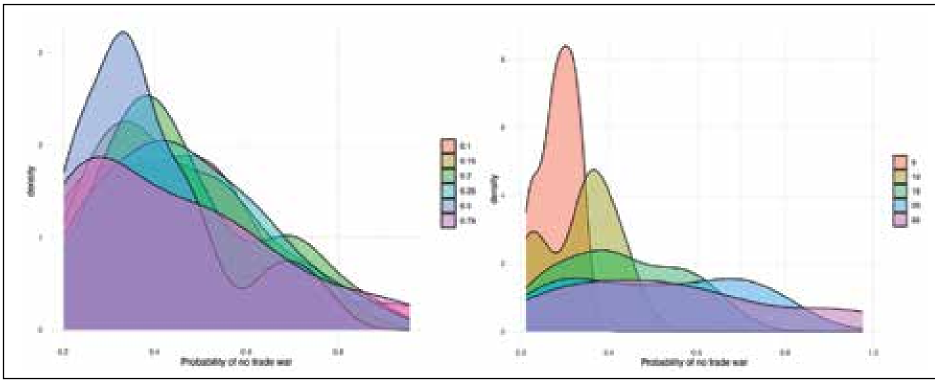
A structural model is proposed to assess the impact of trade policy uncertainty on the global trade flows. Previous literature has demonstrated that the policy uncertainty affects firms' decision to enter a new export market, leading to attenuation of new investment and technology upgrades. In this chapter, the existing multi-country neoclassical trade model is extended the trade policy uncertainty to a multi-country multi-sector trade model to demonstrate the effect of policy uncertainty on global trade flows. Uncertainty arises from two sources: the probability of trade policy change and the uncertainty around the tariff sizes. The framework assumes that the trade partners make their production plan at the beginning of the period when there is lack of clarity about the trade dispute. They have their belief about possible trade dispute which leads to uncertainty around the price distribution and the final demand. The trade partners' belief is modeled by assuming a uniform distribution on tariffs and probability of trade policy changes. Given the uncertainty, the trade partners decide the trade intensity by factoring in their assessment of final demand and prices.

The effect of trade policy uncertainty is examined using an analytical solution and full-scale calibration of the model under different scenarios. The analytical solution establishes that the trade policy uncertainty moderates the trade diversion intensity and increases the price distribution in the destination market. The effect depends upon the stochastic distribution of the tariff sizes and the probability of trade policy changes. The calibration of the structural model is done by estimating the model parameters in two stages. The chapter uses the recent US-China trade war to demonstrate the effectiveness of the proposed framework in explaining the global trade flows after the US imposed higher tariffs on China and other trade partners. In the first stage, the trade model parameters, not pertaining to uncertainty components, are estimated from bilateral trade data before the recent trade disputes of the United States. In the second stage, the trade policy uncertainty is introduced in the model using different assumptions on the tariff sizes and probability of trade policy changes. Lastly, the model prediction under different assumptions of trade policy uncertainty parameters, are matched with the trade flows data and changes in price movements.

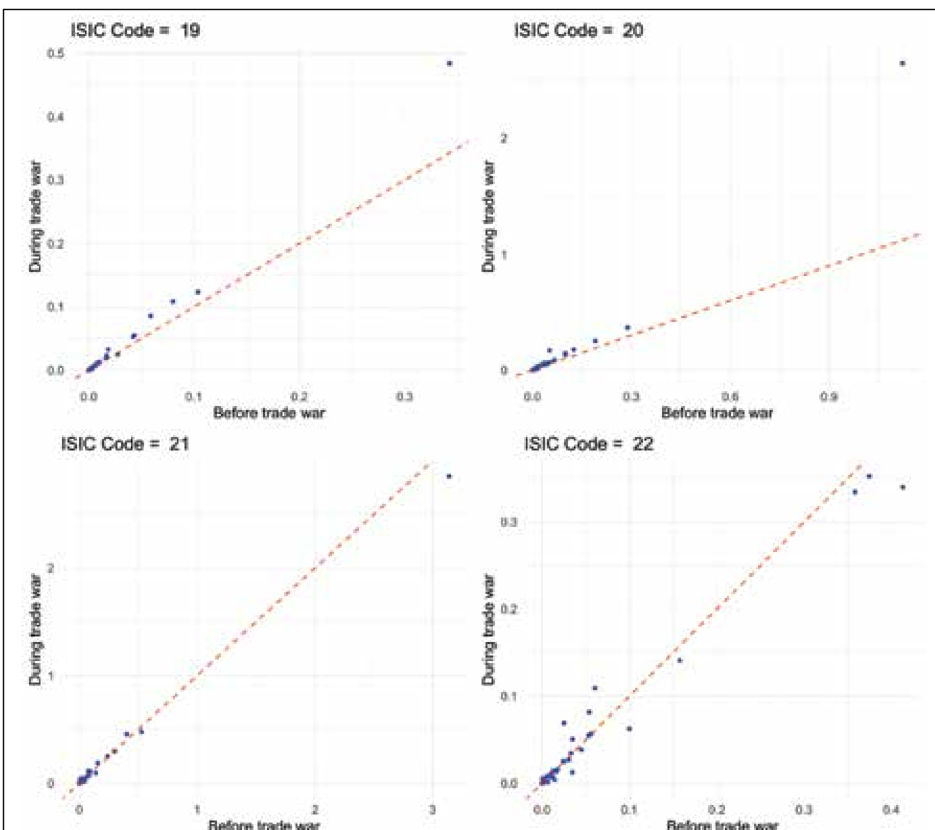
The chapter observes that trade diversion intensity increases with the belief about the upper bound of tariff level and the probability of the trade dispute. As the trade partners plan for the possible tariff imposition with certainty, they plan their production accordingly. The effect of trade policy uncertainty and the adjustment cost of production plans creates a wedge among trade partners in terms of trade diversion intensity. The model prediction are matched with the trade diversion pattern from post-trade war period. The correlation between the model prediction and realization provides an intriguing pattern about the trade partners' belief. The trade partners belief aligned with the possibility of higher tariffs imposition, but they were uncertain about the implementation of higher tariffs.

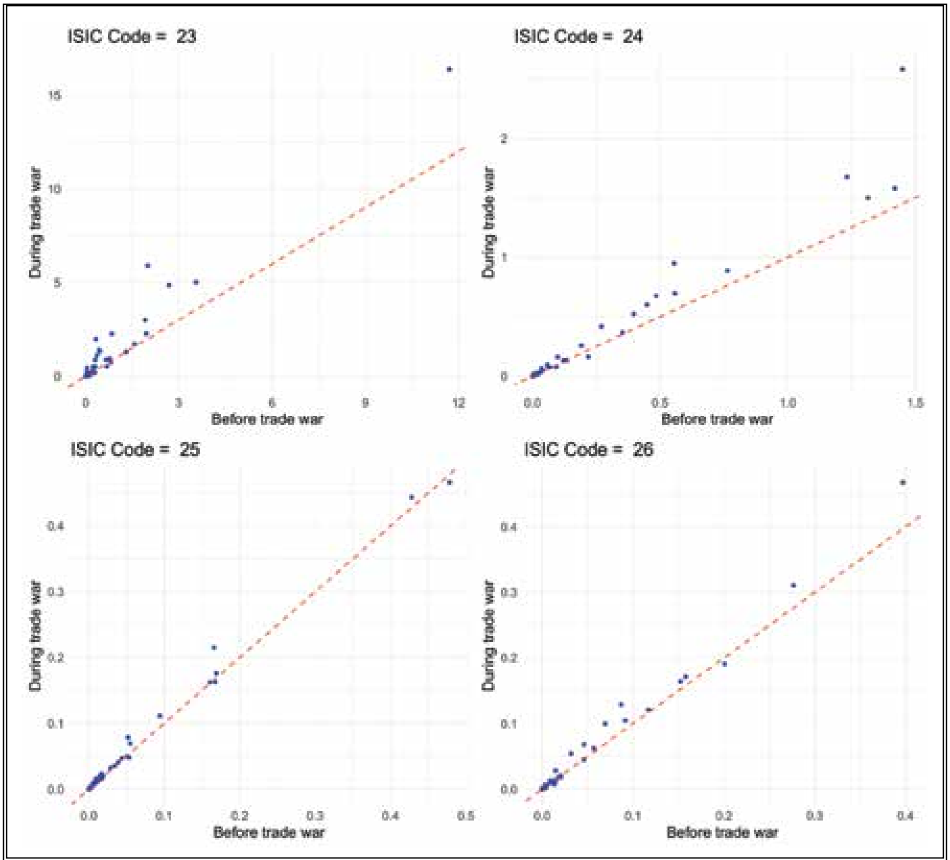
The chapter contributes to the increasing literature of trade policy uncertainty and Ricardian trade models by introducing the effect of trade policy uncertainty on global trade flows. The generalization proposed in this chapter, adds more flexibility in the multi-country trade models by relaxing the assumption of fixed trade cost. The approach can be generalized to different situations like Brexit uncertainty or uncertainty around the lockdown measures imposed by China. The model can generate the disruptions in trade intensity due to global events leading to uncertain trade environments. The main driver of the trade policy uncertainty is drawn from the belief about the trade dispute and uncertainty about the possible tariff sizes. The beliefs can be generalized to introduce heterogeneity in the country level experience of trade diversion.

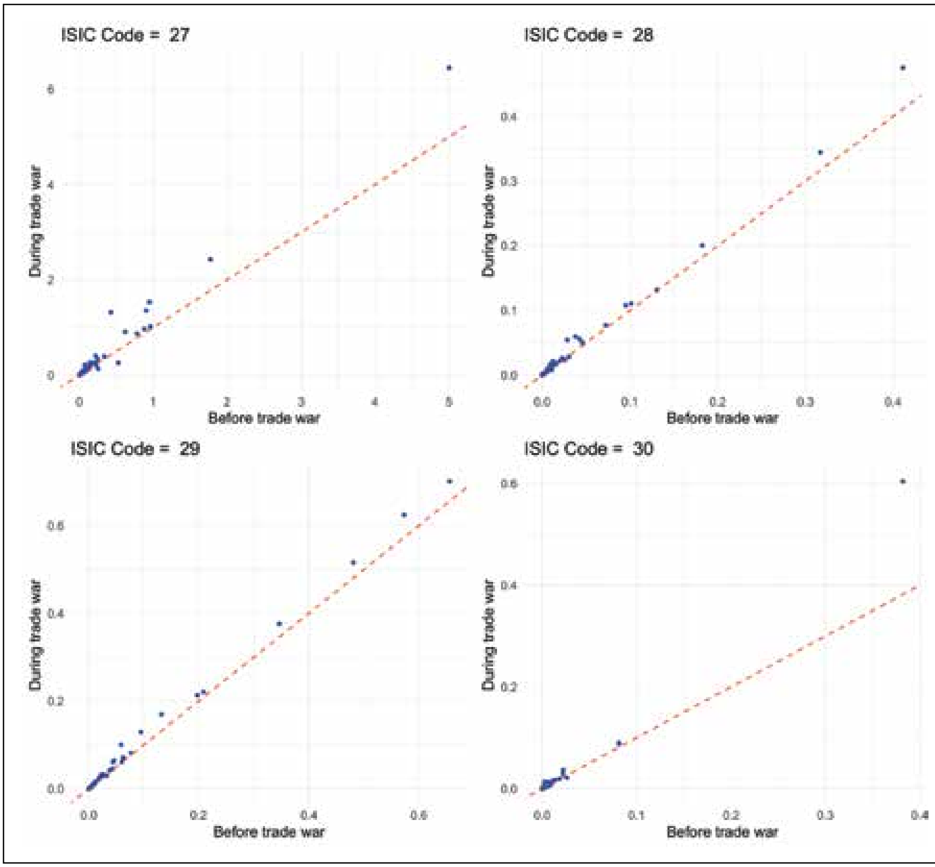
Annex 3: Distribution of prediction accuracy



Trade share ratio across industry segments




ISIC Code = 23
ISIC Code = 24
ISIC Code = 25
ISIC Code = 26
During trade war
Before trade war


ISIC Code = 27
During trade war
Before trade war
ISIC Code = 28
During trade war
Before trade war
ISIC Code = 29
During trade war
Before trade war
ISIC Code = 30
During trade war
Before trade war

3. Breaking Down Borders: The Impacts of Capital Control and Heterogeneous Spillover

Introduction

As global integration increased, emerging market economies experienced greater association with global financial cycles. Accessibility to cheap foreign capital increased during the boom phase of financial cycles whereas sudden stops triggered capital flight translating into macroeconomic crisis. In this context, capital controls appeared to be a suitable policy measure for safeguarding the domestic economy from volatility of foreign capital flows (Korinek, 2010, 2011; Jeanne and Korinek, 2010; Costinot et al., 2014). However, capital controls measures also imparts signaling effect to foreign investors about the state of domestic economy. Bartolini & Drazen (1997) and Drazen (1997) argued that the signaling effect of capital controls policies paints adverse image in the minds of foreign investors in terms of lack of domestic controls. On the other hand, capital controls also lead to have spillovers to other countries as capital flows diverts to other destination countries. The direct and spillover effects, thereby, modulates the flows of international capital across destination countries. However, the nature of the capital flows varies widely across different institutional sectors namely Public sector, Corporate and Banks. Following recent papers by Avdjiev et. al. (2018) and Emter, Killeen & McQuade (2021), the drivers of capital flows to these institutional sectors can be very different. According to their findings, the global risk aversion appears to drive capital flows to banking and corporate sectors whereas the effect of global risk aversion is muted in case of capital flows to public sector. Following the heterogeneity of capital flows across these institutional sectors, this chapter evaluates the heterogeneous effect of capital controls as policy measures on gross capital inflows to different sectors of economy in terms of the direct effect and the spillover effect. Further, the chapter provides a structural interpretation of such heterogeneity by incorporating signaling effects within a portfolio choice model.

This chapter addresses three major strand of literature. First, it analyzes the effect of capital controls in terms of direct effects and spillover effects. Second, it extends the effects of capital controls on capital flows across different institutional sectors and lastly, the chapter proposes a structural framework to explain the heterogeneous effect of capital controls using a portfolio choice model with signaling effect. Capital controls emerged as a policy toolkit for countries facing volatile capital flows. Emerging market economies have been liberalizing capital accounts since early 1990. Greater accessibility of foreign financial markets leads to portfolio rebalancing decisions of global investors as investors searched for higher yields. On the recipient side, these countries experienced cheap foreign capital during financial boom. However, the bust episodes of global financial cycle also led to adverse impact on these economies. As optimism about the global financial cycle faded, the foreign capital started to withdraw from these countries, leading to currency depreciation and balance of payment crisis. Existing financial integration led to heightened macroeconomic and financial instability (Reinhart and Rogoff, 2009). The policymakers responded by restricting the capital flows. In this context, capital controls emerged as a possible toolkit to modulate capital flows in these countries.

Capital controls, more aptly known as a tool for controlling capital account of any country, is often considered as a part of macroprudential toolkit. The effectiveness of capital controls measures is debated in the literature. Capital controls restrict the volatility of capital flows, safeguard domestic economies from sudden stops and currency fluctuations, thereby leading to macroeconomic and financial stability. According to the literature, the welfare gains from capital controls provides policy justifications (Korinek et. al. (2010); Jeanne and Korinek, 2010; Costinot et al., 2014). Apart from the macroeconomic stability, the financial stability is ensured by the capital controls (IMF, 2011, 2012). The effectiveness of capital controls, therefore, provides a strong justification towards its inclusion in policy tool (Ostry, 2011 & 2011). However, the effectiveness of capital controls was questioned by the signaling effect of capital controls (Bartolini & Drazen (1997) and Drazen (1997)). The imposition of capital account restrictions was viewed as hostile policy by the foreign investors. Bartolini & Drazen (1997) argued that the foreign investors viewed these controls as lack of domestic controls and instability of domestic economy. Capital controls, thereby, appeared to have longer lasting effect on capital flows to the recipient countries. In more recent work, Jinjarak, Noy, and Zheng (2013) observed similar signaling effect of capital controls in their empirical analysis. Forbes et. al. (2016) also observed similar effect of capital controls in an interview with top fund managers of global banks ad the effect was more prominent for public sector flows. The spillover effect of capital controls, on the other hand, is observed in the deflection of capital flows to other destination countries. Following Forbes et. al. (2016),Giordani et. al. (2017),Pasrica et. al. (2018), the spillover effect of capital controls is mainly driven by risk transfer motive of the global investors. As one country increases capital account restrictions, capital flows diverts to other destinations in search of higher returns. However, the spillover exposes other destination countries to multilateral externalities on social welfare (Korinek, (2011); Costinot et al. (2014)).

This chapter analyzes the direct and spillover effects of capital controls in a multi-country set up by focusing on portfolio inflows and other investment inflows separately. The rationale of differentiating between these two types of inflows is that the nature of these flows is very different from each other. The existing literature suggests that the portfolio inflows are mainly adjusted in short term and thereby, are more responsive to capital controls (Forbes et. al. (2016)). Beyond this segmentation of inflows, the chapter adopts a novel identification for analyzing the direct effect and spillover effect of capital controls in a more parsimonious way. The empirical specification of existing literature on capital controls effects, imposes identifying restrictions on the propagation of capital controls shocks across countries. These recent works used a panel of countries for analyzing the direct effect of capital controls where the direct effect originates from own countries' capital account openness and spillover effect emerges from capital controls of another set of countries. This chapter extends the spatial Durbin model to analyze the impact of direct effect and spillover effect by introducing own-country capital account openness and spatial lagged values of capital account openness of other countries (except own country) in the panel regression. The benefit of using such spatial models lies in the fact that the identification of spillovers is governed by the spatial dependence and thereby, becomes more parsimonious in nature.

Apart from identification, the chapter also augments the heterogeneous effects of capital controls on global capital flows on different institutional sectors - public, banks and corporate. Recent research by Avdjiev et. al (2018) observes that the capital flows to different institutional sectors are heterogeneous in nature. The factors influencing these flows varies across the sectors. Global risk aversion modulates capital flows to banks and corporate more prominently whereas the effect of global risk aversion is not significant in case of capital flows to public sector. On similar topic, Emter et.al. (2020) analyzed the cross-border claims of banking sector to non-banking institutions for Ireland and they observed that the cross-border flows to non-financial institutions are affected by tightening of monetary policy and macro prudential policies. Kim and Zhang (2020) observed that the business cycle fluctuation of global capital flows differ between private sector and public sector flows - the private sector capital flows are generally pro-cyclical in nature whereas flows to public sector counter-cyclical in nature. Such heterogeneity in the drivers and the nature of these flows underlines the importance of a sector-wise analysis of capital flows in the context of capital controls shocks. The capital controls shocks are often designed to manage capital account openness and thereby, affects the capital flows at aggregate level. However, the effect of such capital account restrictions, can be different across sectors due to the underlying heterogeneity. Hence a detailed analysis of heterogeneous impact of capital controls may provide better insights to policymakers in terms of designing suitable policy measures. Beyond the nature of the institutional flows, the role of these institutional flows also varied across different crisis episodes. For instance, sovereign debt was mainly influential in Latin American balance of payment crisis during early 1990's (Aguiar and Amador, 2011; Gourinchas and Jeanne, 2013) whereas private sector flows dried up in case of East Asian Crisis in 1997 (Corsetti et. al. 2000; Rajan, 2009). This chapter analyzes the direct and spillover effect of capital controls on capital inflows across these institutional sectors to unveil any heterogeneity in the effect of capital controls.

Using capital flows data on quarterly frequency, the chapter observes that the capital controls measures moderate portfolio inflows to public sector significantly. The inflows to banks and corporate are less effected by the direct effect of capital controls. This heterogeneity in capital controls effect, can be linked to the signaling effect of capital controls. One can argue that the investors perceive the capital controls measures as lack of domestic controls in the destination countries. The private signal of investors dictates the global investors to rebalance their portfolio away from the public sector of foreign countries. Following Forbes et. al. (2016), the fund managers highlighted that the capital controls signal controls risk for sovereign bonds. Heterogeneity in the direct effect of capital controls aligns with the view. Further, the spillover effect of capital controls was observed across all sectors. The spillover effect was marginally higher in case of corporate, followed by the banking sector. The findings of spillover effect can be explained by the hedging mechanism and risk aversion of investors. The effect of capital controls follows similar pattern in case of other investments. However, the effects are not statistically significant. Further, the portfolio adjustment due to direct and spillover effect appeared to be immediate in nature. As investors face the shock of higher capital account restrictions, they adjust their portfolio debts immediately away from the destination country imposing capital controls. The adjustment happens in case of portfolio flows to public sector. The spillover effect, on the other hand, starts immediately as investors start aligning their portfolio to other destination countries and the adjustments happen over time. The corporate flows respond more strongly than public sector flows and the adjustment takes 1-3 quarter. Combining these observations, it can be argued that the effect of capital controls on capital flows is highly heterogeneous in nature. Further, the signaling effect appears to be one of the dominating factors inducing such heterogeneity.

In order to support the signaling mechanism, the chapter proposes a portfolio choice model in a multi-country set up. Following Devereux & Sutherland (2006,2010) and Tille & Van-wincoop (2011), the current analysis extends the portfolio choice into three country set up where the capital controls shock is modeled as iceberg trade cost. The signaling effect of capital controls is introduced as incomplete information in the investors' portfolio choice problem. The chapter argues that the heterogeneity in signaling effect introduces the heterogeneity in the portfolio choice which corroborates with the empirical findings. The comparative statics, further, demonstrates that the direct effect and spillover effect of capital controls is homogeneous in nature in the absence of the signaling effect. The main contribution of the chapter is to validate the heterogeneity in the effect of capital controls across different institutional sectors and extending the findings to a portfolio choice model for identifying the signaling mechanism of capital controls.

Remaining of the chapter is organized as follows - The portfolio choice model is described in Section 2. Section 3 describes the empirical framework, data descriptions are provided in section 4, empirical findings are illustrated in Section 5. The chapter concludes with summarizing of the findings in Section 6.

2. Portfolio choice with signaling effect

The direct effect and spillover effect of capital controls is explained using portfolio choice model augmented with signaling effect from capital controls. The rationale of using signaling effect in capital controls is drawn from Forbes et. al. (2016). Forbes et. al. (2016) observed that the fund managers perceive capital controls as an adverse signal towards the destination country. The signal effect is considered more severe in case of sovereign bonds. The model is extended to understand the signaling effect in the investors' portfolio choice problem to explain the heterogeneity in direct and spillover effect of capital controls.

2.1. Setup

The structural model is built upon the portfolio choice model of Tille & Van wincoop (2011). There are three countries - Country H, F1 and F2. Each country has one type of bond with maturity of 1 year. The net supply of bonds is unity in each country. There is one unit of capital and one unit of labor available for production in each country. Capital controls in this model are modeled as iceberg trade cost - as investors invest outside their home country, they lose their return from foreign bonds due to capital controls measures. Investors have different degrees of risk aversion. The signaling effect is generated due to private signal received by the investors about the future state of economy and the signal is drawn from the announcement of capital controls. Investors can invest in home country as well as foreign country bonds. The investors' choice is dictated by the optimizing their portfolio return.

2.2. Non-portfolio Choice

The non-portfolio part of the model is kept simple. Similar structure is used by Tille & Van wincoop (2011) and Devereux & Sutherland (2006,2010). The production function is Cobb-Douglas with labor and capital as input of production. Household utility is a CES aggregator of home produced and foreign produced goods. The consumers have home bias in consumption i.e. they spend more home-produced goods.

2.3. Asset Market

Each country has their domestic bond with maturity of 1 year. The net supply of bonds is kept as unity for simplicity. The price of country i bond is $Q_{\{i,t\}}$. The holder of country bond has a claim of (1 - θ) of the total production of country i. Hence, the nominal return of bond i is given by

$$R_{i,t+1} = \frac{Q_{i,t+1} + (1-\theta)A_{i,t+1}P_{i,t+1}}{Q_{i,t}}$$

The portfolio choice of investors is given by $\kappa^{i}_{j,t}$ (for i,j = 1,2,3) where i represents the residence country of the investor and $\kappa^{i}_{j,t}$ stands for the destination country portfolio share of country j at time t by investor from country i. Hence, $\sum_{i=1}^{3} \kappa^{i}_{j,t} = 1$ for all i = 1(1)3. However, investing outside the home country incurs an iceberg trade cost, represented by $\tau^{i}_{j,t}$. Hence the portfolio return of the investor from country i is given by

$$R_{t+1}^{p,i} = \left[\sum_{j=1}^{N} e^{-\tau_{j,t}^{i}} \kappa_{jt}^{i} R_{j,t+1}\right] \frac{P_t^i}{P_{t+1}^i}$$

Since the financial market is incomplete, the wealth distribution is non-stationary in nature. Hence we assume that ϕ proportion of investors die every year and new investors born with same probability. The dying investors consume their net worth whereas the new investors are not eligible to participate in the financial market. The new investors work for the first year and then they can participate in the financial market. Given that assumption, the total wealth of nation follows stationary distribution. The wealth accumulation of typical investor from country i is given by

$$W_{t+1}^{i} = W_t^{i} * R_{t+1}^{p,i}$$

The wealth accumulation of any nation differs from previous equation as the iceberg trade cost are assumed to be paid to the newborn investors as endowment[26]. This assumption is required to ensure that there is no permanent transfer of assets from any country. The nation's wealth accumulation is given by

$$W_{i,t+1} = (1-\phi) \underbrace{\left[\sum_{j} \kappa_{jt}^{i} R_{j,t+1}\right] W_{i,t} \frac{P_t^i}{P_{t+1}^i}}_{\text{Wealth accumulation from investment}} + \theta \underbrace{\frac{A_{i,t+1} P_{i,t+1}}{P_{t+1}^i}}_{\text{Labor income}}$$

2.4 Signaling effect in portfolio choice

The investors get their private signal from the capital controls policy. The actual iceberg trade cost is given by $\tau_{j,t}^{i}$. We assume that $\tau_{j,t}^{i}$ is solely due to capital controls and $\tau_{j,t}^{i} > 0$. The private signal of the investors arises due to information asymmetry of investor from country i about the state of economy of country j when $i \neq j$. As foreign investors lacks information about the true state of economy of country j, the information asymmetry arises. The private signal of country i investor about country j is given by

26 This assumption follows Tille & Van wincoop (2011).

$$\theta_{j,t+1}^{i} | \tau_{jt}^{i} \sim F^{j}(\tau_{jt}^{i}, \gamma^{i})$$

$F^{j}\left(\tau_{jt}^{i}, \gamma^{i}\right)$ is the distribution of the signal which depends upon the risk aversion of investor and their perception about country *j*.

Given the private signal, the investor from country i creates an additional wedge $\theta_{j,t+1}^{i}$ about the future state of economy and investor's perceived iceberg trade cost becomes[27]

$$\tau_{jt}^{i*} = \tau_{jt}^{i} + \theta_{j,t+1}^{i} \text{ for } j \neq i$$

Following the signaling effect, the portfolio return of country i investor changes to

$$R_{t+1}^{p,i} = \left[\sum_{j=1}^{N} \underbrace{e^{-\tau_{j,t}^{i*}}}_{\text{Perceived wedge}} \kappa_{jt}^{i} R_{j,t+1} \right] \frac{P_{t}^{i}}{P_{t+1}^{i}}$$

2.5. Investor Problem

The decision space of any investor is the choice of $\left(\left(\kappa_{jt}^{i}\right)\right)$ so that they can maximize their utility. The investor's Bellman equation is given by

$$V\left(W_{t}^{i}\right) = (1-\phi)\beta E V\left(W_{t+1}^{i}\right) + \phi\beta E U\left(W_{t+1}^{i}\right)$$

where $V\left(W_{t}^{i}\right)$ is the value of wealth. The first part of the future value from Bellman Equation is due to the expected value of wealth given the investor survives and the last part is due to probability of dying. We assume that the utility function is given by

$$U\left(W_{t+1}^{i}\right) = \frac{\left(W_{t+1}^{i}\right)^{1-\gamma^{i}}}{1-\gamma^{i}}$$

[27] We assume that the investor has complete information about the state of economy of his home country and hence the signaling effect is assumed to be zero for home country.

The first order condition is

$$E_t\Lambda^i_{t+1}\left(e^{-\tau^{i*}_{jt}}R_{j,t+1} - R_{i,t+1}\right) = 0 \;\; \forall i$$

and the Bellman equation is

$$e^{v+f_i(S_t)} = \beta E\left((1-\phi)e^{v+f_i(S_{t+1})} + \phi\right) \backslash Bigg(R^{p,i}_{t+1}\big)^{1-\gamma^i}$$

The portfolio switching towards other foreign country bonds is dictated by hedging which explains relative broad-based impact of spillover effect of capital controls. However, following the first equation, the reduction in portfolio share of country 2 happens in every positive shock of and hence it does not explain the heterogeneity of the direct effect of capital controls on portfolio allocations. Here, the signaling effect comes into help. So, we derive the same comparative statics under the assumption of signaling effect. The comparative statics is given by

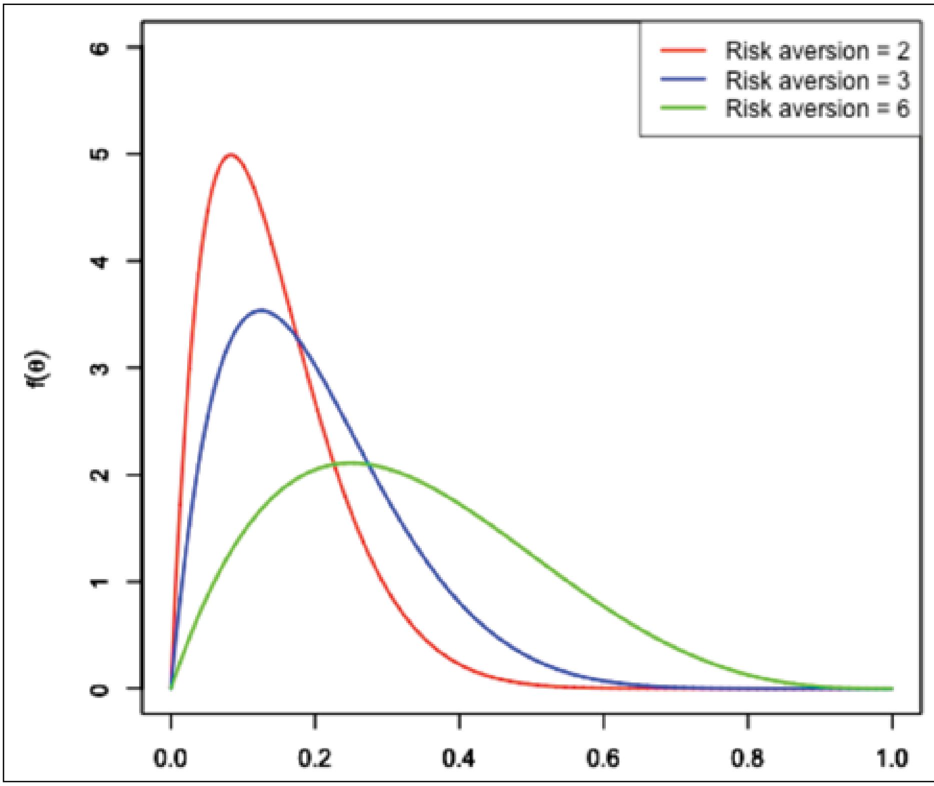
$$\begin{aligned}
\frac{\partial \kappa^1_{2t}}{\partial \tau^1_{2t}} &= \frac{1}{\Delta} * \left[-\frac{1}{\gamma}\right] * \mathbf{E}_t\Lambda^1_{t+1}(R^{p,1}_{t+1})^{-1}\left(1 + \frac{\partial \theta^1_{2,t+1}}{\partial \tau^1_{2t}}\right)(RX_{13,t+1})^2 \\
&= \frac{1}{\Delta} * \left[-\frac{1}{\gamma}\right] * \mathbf{E}_t\Lambda^1_{t+1}(R^{p,1}_{t+1})^{-1}\left(1 + \frac{\partial}{\partial \tau^1_{2t}}\mathbf{E}^*_t(\theta^1_{2,t+1})\right)(RX_{13,t+1})^2 \\
\frac{\partial \kappa^1_{3t}}{\partial \tau^1_{2t}} &= \frac{1}{\Delta} * \left[-\frac{1}{\gamma}\right] * \underbrace{\mathbf{E}_t\Lambda^1_{t+1}(R^{p,1}_{t+1})^{-1}\left(1 + \frac{\partial \theta^1_{2,t+1}}{\partial \tau^i_{jt}}\right)(RX_{13,t+1} * RX_{12,t+1})}_{\text{Hedge}}
\end{aligned}$$

The comparative statics provides better insight about the role of signaling in the change of portfolio allocations due to capital controls shock. Here, the additional term is i.e. $\left(1 + \frac{\partial}{\partial \tau^1_{2t}} E_t \theta^1_{2,t+1}\right)$ captures the change in investor's perception about the state of economy given the capital controls shocks. The source of heterogeneity in the direct effect and spillover effect is derived from this additional term. The differential change in the expected value of $\theta^i_{j,t+1}$ represents the change in private signal of investor about country 2. Any investor will make greater change in the portfolio share of country 2 bonds in his portfolio depending upon the magnitude of $\frac{\partial}{\partial \tau^1_{2t}} E_t \theta^1_{2,t+1}$.

Following the fund managers' view from Forbes et. al. (2016), the change in the investor sentiment about the future state of economy of country 2 dictates the change in the portfolio share from country 2 (direct effect). If the fund managers perceives worsening of public sector due to their private signal from capital controls measures, the investors will change their portfolio from public sector of country 2 to a greater extent. On the other hand, if the investors' private signal does not provide worsening off signal about the other sectors of economy (like banks and corporate), the direct effect of capital controls will be muted. In terms of the spillover effect, one can use similar justification to explain the broad-based spillover effect across all sectors. The degree of hedging along with investor's private signal dictate their decision to switch to other country bonds when country 2 increases capital controls.

The source of heterogeneous direct effect and spillover effect of capital controls is thereby, modulated by the change in expected private signal about future wedge in response to the capital controls shocks. The expected value of $\theta^{1}_{2,t+1}$ depends upon the degree of risk aversion of investors and their assessment about the sector. The change in the distribution of the signal can be visually represented in following way - higher risk averse investors will adjust the value of θ^{1}_{2t} in greater magnitude than an investor with lower degree of risk aversion. Similarly, greater change in capital account restrictions leads to greater adjustment of θ^{1}_{2t} i.e. higher capital controls in terms of greater tax on foreign investors will convey greater loss of investor sentiment. Finally, the sector heterogeneity in the private signal modulates the wedge parameter θ^{1}_{2t}. So combining these three factors, the final wedge θ^{1}_{2t} will be the source of heterogeneous direct effect and spillover effect (refer to Fig. 3.1 for visual illustrations).

Fig. 3.1: Signaling effect of risk aversion



3. Empirical Evaluation

To test heterogeneity in capital controls effects, the reduced form analysis uses a multi country panel to estimate the direct and spillover effects of capital controls using a spatial Durbin model. Before getting into details, the rationale behind the choice of spatial models is examined. The empirical framework is designed to estimate the direct and spillover effect of capital controls. Though the direct effect is relatively easier to identify, the spillover effect is difficult to quantify without suitable identifying restrictions. Unlike the existing literature, the spillover shock of capital controls is defined as the weighted average of capital account restrictions of other countries. For instance, the spillover effects of capital controls on any particular country (say, Brazil) depends upon the capital account openness of other similar countries. These other countries can be considered as destination substitutes for capital flows. Hence, increases in capital account restrictions in any one of these countries can divert capital flows towards Brazil. Hence the spillover effect is a combined measure of capital account restrictions in other countries (except own country). More specifically, the spillover shock variable can be written as

$$Cap_{it}^{Spill} = \sum_{j \neq i} W_{ij} Cap_{jt}$$

where W_{ij} is a suitable choice of weight matrix which estimates spillovers and Cap_{jt} is the capital account restrictions/ openness in country j at time t. We assume that the weights are time-invariant to avoid possible endogeneity in the estimation. The choice of w_{ij} dictates the spillover effects, w_{ij} can be interpreted as the weight of capital account openness/ restrictions of country j on country i. Since the choice of this weight matrix influences the empirical specification, a detailed discussion on w_{ij} is provided after the empirical specification.

Following the definition of spillovers and a suitable choice of weight matrix, the empirical framework can be described as follows

$$C_{it} = \gamma_D Cap_{i,t-1} + \gamma_S \sum_{j \neq i} w_{ij} Cap_{j,t-1} + \theta_D^M Macro_{i,t-1} + \beta X_{i,t-1} + \alpha_i + \epsilon_{it}$$

The regression framework is equivalent to spatial lagged exogenous model (SLX in short) where w_{ij} are the bilateral spatial weights. The model can be estimated using ordinary least squares. However, the framework fails to include the unobserved characteristics of investors which dictates capital flows to foreign countries. A typical example of such unobserved characteristics includes investor sentiments towards these destination countries. These unobserved effects pose threat to the coefficient estimates due to omitted variable bias. To over the bias, suitable instrument is used which is weighted average of capital inflows to other destinations as proxy of investor unobserved characteristics. The rationale behind the instrument, can be drawn from the seminal work of Autor, Dorn and Hanson (2013). If the other destination countries are experiencing higher capital flows, the global investors are likely to be upbeat about their investment sentiment and that is likely to increase capital flows to destination country i. The same weight matrix is applied to estimate the instrument variable. Here, the underlying assumption is that the influence of other country's capital controls spillover is proportional to the weight of those countries' capital flows. With the modification, the reduced form regression transforms to

$$C_{it} = \rho^S \sum_{j \neq i} w_{ij} C_{jt} + \gamma_D Cap_{i,t-1} + \gamma_S \sum_{j \neq i} w_{ij} Cap_{j,t-1} + \theta_D^M Macro_{i,t-1} + \beta X_{i,t-1} + \alpha_i + \epsilon_{it}$$

The above equation includes spatial lagged values of capital inflows and the specification follows a Spatial Durbin Model (SDM). SDM models cannot be estimated using ordinary least squares due to the presence of spatial lagged terms (Elhorst, 2009). The regression is estimated using the estimation methodology suggested by Elhorst (2009) and LeSage (2006,2010) at a quarterly frequency.

Next, the empirical specification is modified by relaxing the assumption about lagged impact of capital controls. Here the above regression is modified by introducing different lag length (including positive and negative lags). The negative lag value corresponds to the leading effect of capital controls. A significant value of the direct and spillover effects should indicate possible anticipation effect given a negative lag value. On the other hand, statistically significant coefficient value corresponding to positive lag value refers to gradual adjustment of the portfolio choice given the capital controls shocks. The empirical specification can be written as

$$C_{it} = \rho \sum_{j} W_{ij} log(C_{jt}) + \gamma_{D,k} Cap_{it-k} + \gamma_{S,k} \sum_{j} W_{ij} Cap_{jt-k} + \theta_{D,k}^M Macro_{i,t-k} + \beta X_{it-1} + \epsilon_{it}, \text{ for } k = -1(1)5$$

The modified regression is estimated using the same quarterly data and the lag values varied. All the lagged variables are not included at the same time in the regression due to possible multi-collinearity issue. As the capital account restriction are slow moving variables, the subsequent lag values can be exactly identical in nature and hence, multiple lag values will create multi-collinearity, resulting in oversize coefficient estimates.

3.1. Choice of Spatial Matrix

As indicated previously, the choice of weights plays a crucial role in the estimation of the direct and spillover effect. The spatial weights are derived as correlations between cross-border gross capital flows to destination i and j over time. Here the rationale is that if two countries receive similar gross capital inflows i.e. high correlation in absolute terms, they are deemed to strategic complements (if correlation is positive) or strategic substitutes (if correlation is negative). A typical global investor is likely to consider Country j as destination for his investment portfolio when country i increases capital account restrictions. With this rationale, the weights are also justified for spatial lagged variables.

The choice of correlation coefficient as the weight matrix can be justified from the gravity models of portfolio flows. Following the gravity equations, two countries with highly correlated capital flows are likely to have similar profile in the investors' choice set and thereby should be highly influenced by capital account restrictions of each other. However, the criticism of using time invariant correlation comes with the choice of time episodes. As countries experience different levels of capital account openness over time, I use full sample and sub-sample-based correlation weights to quantify the spillover variable and lagged spatial variable. The weights is normalized such that sum of weights for country i adds up to 1 and own country weight become 0.

4. Data used

The Spatial Durbin Model is estimated using quarterly data. This choice of high frequency is dictated by the findings of recent studies of capital flows (e.g. Avdjiev et. al (2018); Emter et. al. (2020) etc.). These studies observed immediate adjustments of capital flows in higher frequency. The time period of estimation is from Q1 1997 till Q4 2018. The choice of time period is dictated by the availability of quarterly cross border flows, capital account restriction index and other controls variables. The empirics consider 20 emerging market economies for the analysis given quarterly data availability. These countries are:

Argentina	Brazil	Chile	Colombia	Mexico
Peru	China	India	Indonesia	Malaysia
Philippines	Thailand	South Africa	Costa Rica	Latvia
Poland	Romania	Hungary	Turkey	Ukraine

The effect of capital controls is estimated on gross capital inflows given our choice of countries and the fact that majority of capital controls measures adopted by these countries targeted capital inflows (Forbes et. al. (2016)). The cross-border gross capital flows data is sourced from BIS CBS and Avdjiev et. al (2018). BIS Consolidated Banking Statistics (CBS) provides cross border flows of capital inter-mediated by the banks. The data covers capital flows to banks and non-financial institutions. However, the coverage of capital flows in BIS data is mainly confined to cross-border loans and deposits. To get a better understanding about the overall portfolio and other investment flows, the newly constructed data from Avdjiev et. al (2018) is used. This quarterly gross capital flows data provides a comprehensive coverage of capital flows covering data from IMF Balance of payments, BIS LBS and CBS data, BIS Debt Securities, World Bank data (Quarterly Debt Statistics and Debt reporting system) data with suitable imputation methods following BPM 6 accounting techniques[28]. In this data, the capital flows are segregated into portfolio flows and other investment flows. Currency & Deposits, Loans, Trade credit and Account receivables constitute other investments. The portfolio flows mainly represent portfolio debt flows as portfolio debt constitute majority of portfolio flows in balance of payment.

The shock variable is sourced from the capital account restriction index constructed by Fernandez et. al. (2016) and Pasricha et. al. (2018). One of the advantage of using these capital account restriction indices is that it differentiates between inflow and outflow-based restrictions across different asset categories. Since the analysis primarily focuses on portfolio flows and other investment flows, we use overall inflow based restriction index as our primary shock variable. The other and most commonly used index is due to

[28] For more details, refer to the data appendix of Avdjiev et. al (2018)

seminal work of Chinn-Ito (2008). However, Chinn-Ito index is constructed at aggregate level and does not differentiate between inflows and outflows.

Table 3.1: Different Capital Account Openness Indices

Chinn & Ito (2008)	Fernandez (2016)	Pasricha (2018)
IMF Report on Exchange controls and Exchange Openness		
		Local authority announcement
4 asset classes	6 asset classes	6 asset classes
181 countries	100 countries	16 countries
1970-2021	1995-2019	2001-2015
Aggregate	Inflow - Outflow	6 dimensions
Multiple exchange Rate	Money Market	Portfolio Debt
Current Account	Bonds	Portfolio Equity
Capital Account	Equity	FDI
Export proceeds	Mutual Fund	Financial Derivatives
	Financial Credit	Other Investment
	Derivatives	
	Commercial Credit	
	Guarantees (LOC)	
	Real Estate	
	FDI	

Next, the SDM model also includes country level macro-prudential policies as controls of capital flows. The country level macro-prudential policy is sourced from IMF iMaPP database. The database provides the status of macroprudential policies by tagging binary dummy variables across each category of macro-prudential policies and the category-wise policy status is sourced from survey information sought from each country. The index, constructed by Alam et. al. (2019), is averaged across all policy categories to construct the overall index of macro-prudential policy.

The choice of controls variables are sourced from existing literature of capital flows. Following Forbes and Warnock (2012), Ghosh et. al. (2014) and Giordani et. al. (2017), different pull and push factors of capital flows are included as controlss in the main regression. The destination-wise pull factors include real GDP growth, domestic inflation, financial openness index (proxy by Chinn-Ito Index), exchange rate regime and exchange rate. The exchange rate regime data is sourced from Ilzetzki, Reinhart and Rogoff (2021). Domestic macro variables are sourced from IMF International Financial Statistics database and real exchange rate data is sourced from BIS. The global push factors are global risk aversion (proxy by global VIX) and 2 years Treasury yield (as proxy of global interest rate).

Lastly, the spatial weight matrix is derived from the correlation coefficient of gross capital inflows between two countries for the full sample as well as sub-samples. The estimation considers two sub-samples 2000-2007 and 2012-2018 to incorporate time variation in correlation values prior to global financial crisis and in recent times.

5. Empirical Findings

5.1. Direct and Indirect Effect of Capital Controls through Banking Channel

The first set of findings are reported from BIS CBS data. Table 3.2 reports the coefficients estimates of spatial lagged term, direct effect, spillover effect and effect of macro-prudential policy. The first few rows of the estimates are derived by using absolute value of correlation coefficient, the middle portion of the table reports the coefficient value for countries with positive correlation coefficient (i.e. strategic complement countries) and the last portion reports the coefficients for strategic substitutes. Following the coefficient values, the direct effect of own capital account restrictions is found to be negative which implies that greater capital account restrictions, reduces capital inflows to destination countries. The spillover effect, on the other hand, is positive and weakly significant. This implies that the capital inflows increase in response to capital account restrictions in other countries. Another noticeable feature from the coefficient estimates is that the estimates are stable with respect to strategic complements and strategic substitutes which implies symmetric effect. Further, it justifies using absolute value of correlation coefficient to define spillover shocks.

Table 3.2: Spatial Durbin Model Estimates using BIS CBS Data

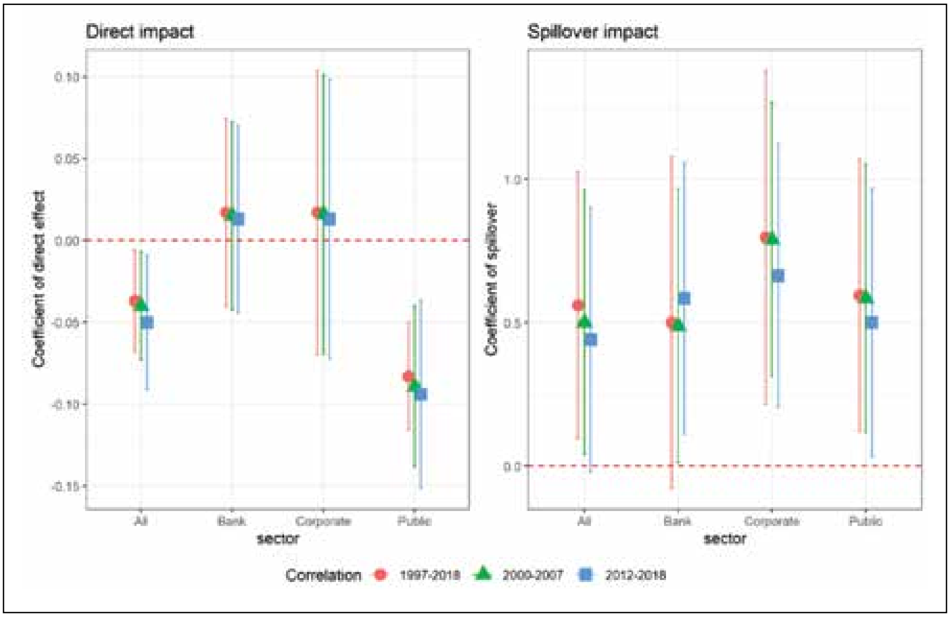
	ρ^S (Spatial AR)	γ_D (Cap. A/C Openness)	γ_S	$(\theta_D)_M$ (Macro-pru)
Absolute value of correlation coefficient				
Full sample	0.38***	-0.05	0.18***	-0.01
(1997-2018)	(0.00)	(0.11)	(0.00)	(0.44)
Latest Period	0.37***	-0.05	0.12*	0.01
(2012-2018)	(0.00)	(0.12)	(0.09)	(0.44)
Strategic complements				
Full sample	0.38***	-0.04	0.15***	0.01
(1997-2018)	(0.00)	(0.11)	(0.00)	(0.44)
Latest Period	0.37***	-0.05	0.11*	0.01
(2012-2018)	(0.00)	(0.15)	(0.08)	(0.44)
Strategic substitutes				
Full sample	-0.38***	-0.03	0.22***	0.01
(1997-2018)	(0.00)	(0.12)	(0.00)	(0.46)
Latest Period	-0.39***	-0.05	0.20*	0.01
(2012-2018)	(0.00)	(0.11)	(0.08)	(0.34)

p-values are reported in parenthesis.
* $p<0.05$, ** $p<0.01$, *** $p<0.001$

Next, we run similar regression on the portfolio flows and other investment flows data from Avdjiev et. al (2018). The coefficient estimates of direct effect and spillover effect along with 90% confidence bands are reported in Fig 3.2. The direct effect of capital controls appears to moderate capital inflows to public sector whereas the inflows to banks and corporate remain unaffected due to the own-country capital controls. On the other hand, the spillover effect of capital controls appears to be broad based compared to the direct effect. The portfolio inflow increases in response to the capital account restrictions in other countries. The spillover effect appears to be higher in case of portfolio flows to corporate sector. These results correspond to the absolute value of correlation coefficient in the weight matrix[29].

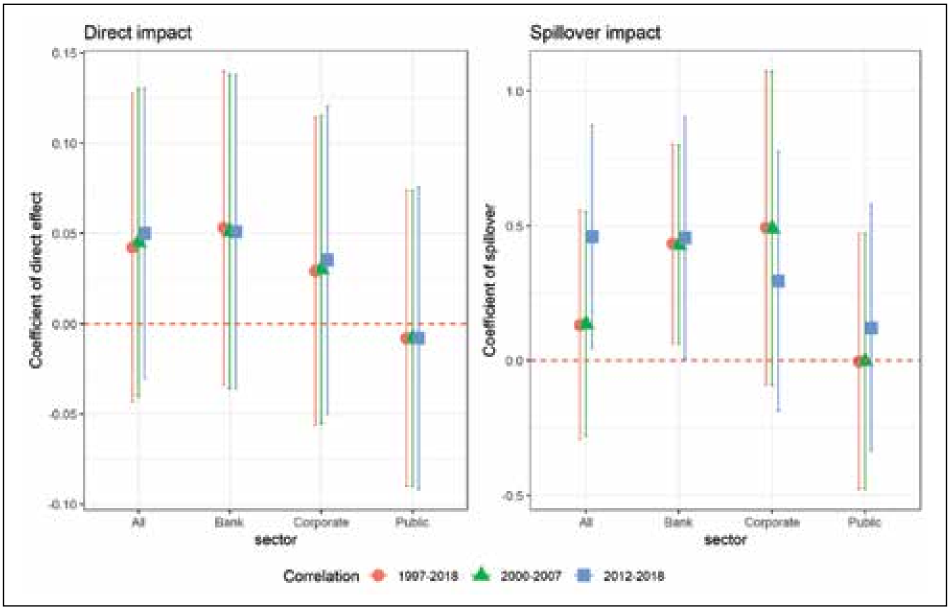
[29] Separate regression is run for strategic complements and strategic substitute countries and results are found to be in similar lines

Fig 3.2: Direct and spillover effect on portfolio flows



Next, the estimates are used to analyze the coefficient plot of direct and spillover effect of capital controls on other investment flows. The point estimates of direct effect indicate marginal negative effect of capital controls on other investment inflows. However, the effects are statistically insignificant. The spillover effect is found to be more pronounced in case the flows are directed towards corporate and banking sector. The spillover effect of capital controls is almost in case of other investment flows going to public sector (refer to Fig. 3.3).

Fig. 3.3: Direct and spillover effect on other investment flows



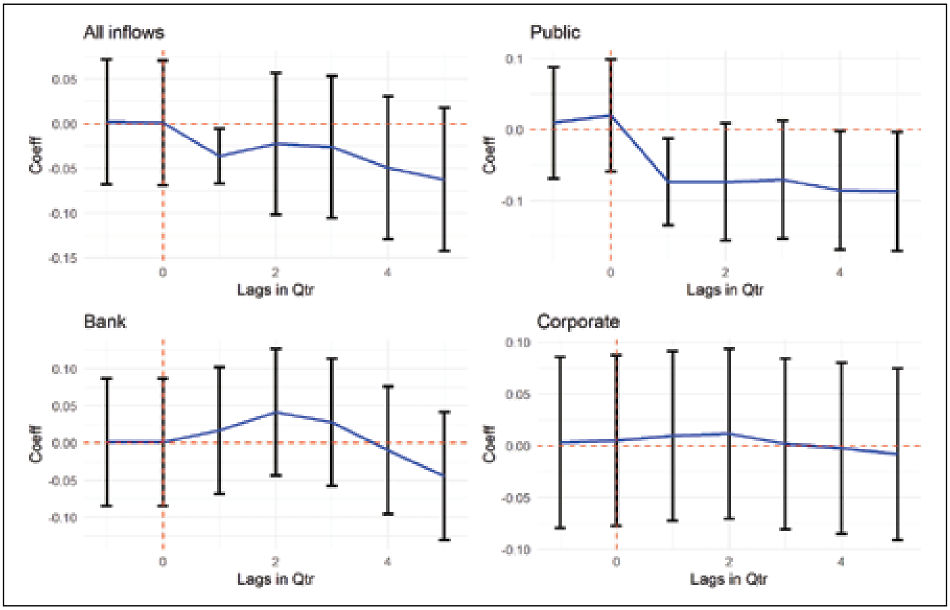
The same SDM framework is estimated with varying lag structure. The effect of the capital controls is represented in terms of coefficient plot with 90% confidence bands. The coefficient values along with confidence bands are plotted against the lag values for all inflows and inflows to different sectors. In the plots, the red vertical dotted line corresponds to lag value of 0 (i.e. current quarter). If the confidence bands of the coefficient estimates include the zero line (red dotted horizontal line), the effect is insignificant in nature. the correlation matrix is used from latest period (i.e. 2012-2018) for the presentation of results. Similar findings were found using full sample correlation estimates also. Further we restrict our analysis on the portfolio flows only following the empirical findings from previous sub-section30.

Following Fig. 3.4 the direct effect of capital controls appears to reduce overall portfolio inflows. The rebalancing appears to immediate in nature as the direct effect dissipates with higher lags. Among the sectoral flows,

[30] The coefficient plots of lagged effect of capital controls on other investment inflows is available in Appendix A1.

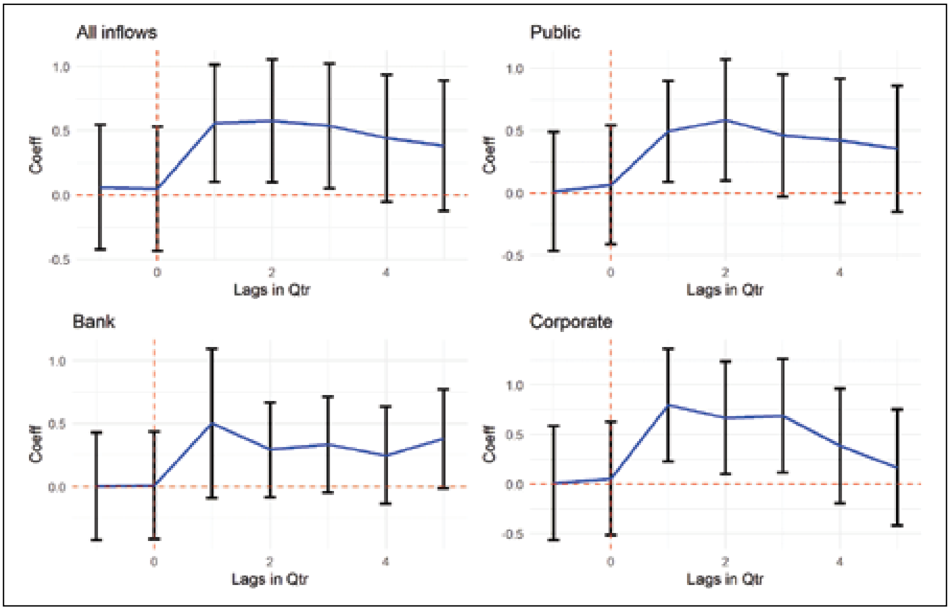
the inflow to public sector adjusts in response to the capital controls shock whereas inflows to banks and corporate does not demonstrate any statistically significant effect.

Fig. 3.4: Lagged direct impact of capital controls on portfolio inflows



The spillover effect, on the other hand, appears to be adjusting gradually and the effect persists over relatively longer horizons. Total portfolio inflows increase in response to capital account restrictions in other countries and the portfolio rebalancing effect continues till 3 quarters. The effect appears to be entirely driven by the flows going to the corporate sector and public sector. Similar effects are observed in the inflows to banks; However the effect is marginally insignificant in nature (refer to Fig. 3.5).

Fig. 3.5: Lagged spillover impact of capital controls on portfolio inflows



5.2. Robustness Check

As indicated previously, the empirical specification relies heavily on the choice of the spatial weight matrix. In order to validate the robustness of empirical findings, some alternative choices are considered in the weight matrix. These alternatives include absolute distance measures between pairs of countries. the inverse of geo-distance of major populated cities and inverse of geo-distance between country capital cities for each pair of countries is also used in the weight matrix. The distance data is sourced from CEPII.

Further, additional controls are introduced in the spatial regression model to factor in destination country heterogeneity. These additional controls are fiscal deficit as percentage of GDP and size of country (proxy by nominal GDP size). The results are found to be stable under these alternate specifications. Lastly, China is excluded from the collection of countries in the panel to check robustness. The results appear to be robust under alternate country choices.

6. Concluding remarks

Global financial integration provided investors with easy access of financial markets across countries. The search for higher returns lead to greater portfolio allocations to emerging market economies. However, the financial integration also exposed these countries to the risk of sudden stops and capital flight resulting in currency depreciation and balance of payment crisis. In this context, capital controls emerged as a possible policy tool for managing the flow of foreign capital into domestic market and thereby, safeguarded the domestic economy from the disturbances in global financial cycle. Capital controls measures helped in safeguarding domestic economy but the signaling effect of the capital controls left an adverse impact on the investors about the future state of domestic economy. On the other hand, the capital controls adopted by one country lead to portfolio adjustments of global investors which lead to greater capital inflow to other destination countries. In this background, this chapter analyzes the effect of capital controls on capital inflows to different sectors in terms of the direct effect and spillover effect. The advantage of using sectoral analysis lies in the fact that the drivers of capital inflows to different sectors vary widely. Further, the nature of different sector-wise capital inflows vary with respect to business cycle and the resulting effect of these inflows to sectors can be very different. Aggregate analysis of the effect of capital controls does not provide enough insight about the sector-wise heterogeneity.

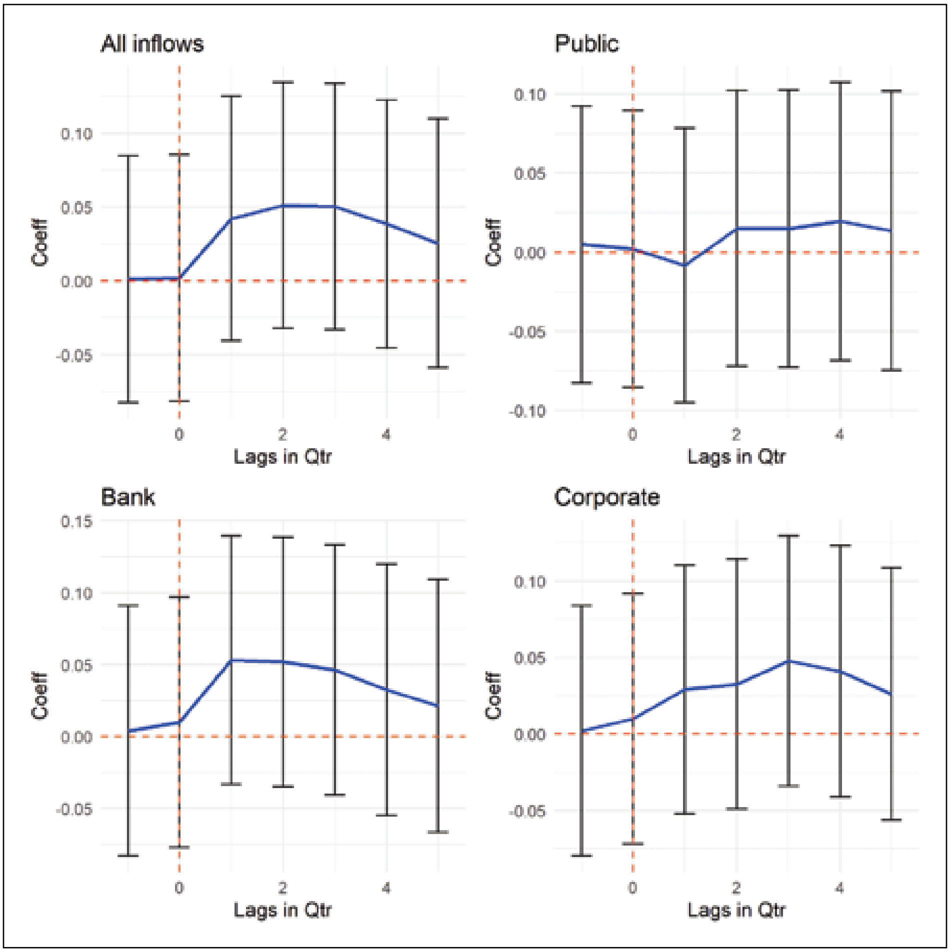
The chapter evaluates the direct and spillover effect of capital controls using a spatial econometric model on quarterly data. The reduced form specifications analyze the direct effect and the spillover effect of capital account restrictions on cross-border gross inflows of portfolio flows and other investment inflows using Spatial Durbin model. The spillover shocks are defined as spatial weighted shocks of capital account restrictions in other countries. The empirical findings indicate possible heterogeneity in the direct effect of capital controls. Inflows to Public sector moderated in response to the own capital account restrictions whereas inflows going to the banks and corporate did not get impacted The findings of the chapter provide valuable in response to capital controls. The spillover effect of capital controls was found to be broad-based as inflows to all sectors increased significantly in response to other country's capital account restrictions. The direct effect was found to be immediate in nature implying almost immediate adjustments of portfolios from public sector bonds in response to capital controls. However, the spillover effect appeared to be gradual in nature and the portfolio re-balancing persisted over 1-3 quarters after the change of capital account restrictions in other countries. The spillover effect was found to be marginally higher in case of inflows to corporate sector.

The chapter, then provides an explanation of heterogeneity in the direct and spillover effect by extending the portfolio choice model in multi-country set up under the assumption of signaling effect. Inspired by the fund managers view about capital controls from Forbes et. al. (2016), the chapter introduces heterogeneous signaling effect of investors about the state of foreign country's economy when the foreign country imposes capital controls measures. Using investor problem and the derived first order conditions, the analytical derivations of comparative statics provided a theoretical justification of the heterogeneity in the capital controls effects as a change in private signal of the investors about the foreign economy. The private signal, derived from the investors' belief given capital controls shock, modulates the wedge between tomorrow's expected return in the mind of the investors. The chapter argues that the investors adjustment about future return from public sector accelerates their portfolio withdrawal from public sector bonds to a greater extent. The spillover effect, on the other hand, is purely driven by the change in private signal and the degree of hedging between two foreign country bonds.

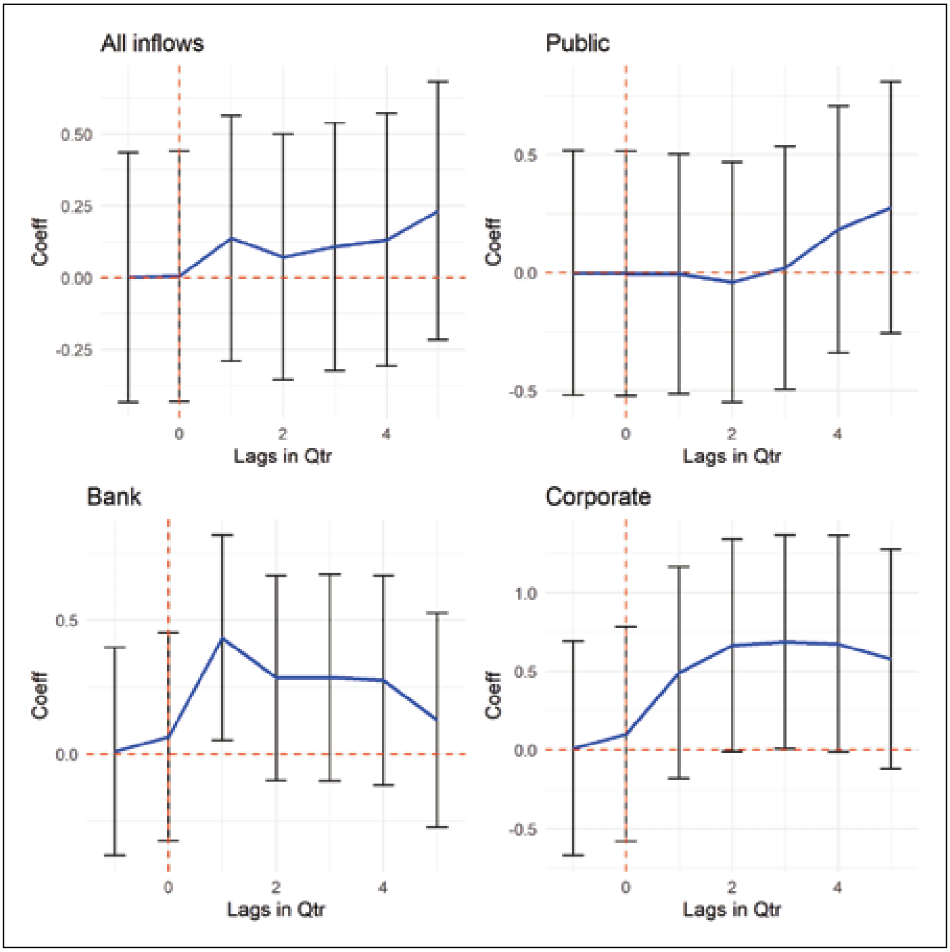
The findings of the chapter provide valuable insight for the policymakers. As capital controls safeguard the domestic economy from foreign capital inflow fluctuations, the signaling effect moderates the investment sentiment of investors away from certain sectors. The portfolio re-balance become greater as the investors change their perception about the future state of economy. The chapter identifies the importance of sector-wise analysis of the effects of capital controls and provides justification towards more targeted policy approach to manage the direct effect and spillover effect of capital controls. The future scope of this research is enormous - the optimal policy design in view of the sectoral heterogeneity and the resultant welfare analysis will provide a greater insight of interest to policymakers.

Appendix

Appendix 1: Direct effect of other investment inflows over lags



Appendix 2: Spillover effect of other investment inflows over lags



Bibliography

[Aguiar and Amador, 2011] Aguiar, M. and Amador, M. (2011). Growth in the Shadow of Expropriation *. The Quarterly Journal of Economics, 126(2):651–697.

[Aihounton and Henningsen, 2019] Aihounton, G. and Henningsen, A. (2019). Units of measurement and the inverse hyperbolic sine transformation. IFRO Working Paper, 2019/10.

[Aihounton and Henningsen, 2020] Aihounton, G. B. D. and Henningsen, A. (2020). Units of measurement and the inverse hyperbolic sine transformation. The Econometrics Journal, 24(2):334–351.

[Altig et al., 2018] Altig, D., Bloom, N., Davis, S., Meyer, B., and Parker, N. (2018). Are tariff worries cutting into business investment? Federal Reserve of Atlanta Blog.

[Amiti et al., 2020] Amiti, M., Kong, S. H., and Weinstein, D. (2020). The effect of the u.s.-china trade war on u.s. investment. NBER Working Paper, 27114.

[Amiti and Konings, 2018] Amiti, M. and Konings, J. (2018). Trade liberalization, intermediate inputs, and productivity: Evidence from indonesia. American Economic Review, 97(1611-1638).

[Amiti et al., 2019] Amiti, M., Redding, S., andWeinstein, D. (2019). The impact of the 2018 trade war on u.s. prices and welfare. CEPR Discussion Paper, 13564.

[Anderson and Wincoop, 2003] Anderson, J. and Wincoop, E. V. (2003). Gravity with gravitas: A solution to the border puzzle. The American Economic Review, 93(1)(170-192).

[Arkolakis, 2010] Arkolakis, C. (2010). Market penetration costs and the new consumers margin in international trade. Journal of Political Economy, 118(1151-1199).

[Arkolakis et al., 2012a] Arkolakis, C., Costinot, A., and Rodriguez-Clare, A. (2012a). New trade models, same old gains? The American Economic Review, 102(94-130).

[Arkolakis et al., 2012b] Arkolakis, C., Costinot, A., and Rodríguez-Clare, A. (2012b). New trade models, same old gains? American Economic Review, 102(1):94–130.

[Atkin and Donaldson, 2015] Atkin, D. and Donaldson, D. (2015). Whos getting globalized? the size and implications of intra-national trade costs. NBER Working Paper 21439.

[Attanasio et al., 2015] Attanasio, O., Goldberg, P. K., and Pavcnik, N. (2015). Trade reforms andwage inequality in colombia. Journal of development Economics, 74(331-366).

[Auer et al., 2018] Auer, R., Bonadio, B., and Levchenko, A. A. (2018). The economics and politics of revoking nafta. Technical report.

[Autor et al., 2013a] Autor, D., Dorn, D., and Hanson, G. H. (2013a). The china syndrome: Local labor market effects of import competition in the united states. American Economic Review, 103(2121-68).

[Autor et al., 2013b] Autor, D., Dorn, D., Hanson, G. H., and Song, J. (2013b). Trade adjustment: Worker-level evidence. The Quarterly Journal of Economics, 129(17991860).

[Avdjiev et al., 2017] Avdjiev, S., Hardy, B., Kalemli-Ozcan, S., and Serven, L. (2017). Gross capital flows by banks, corporates and sovereigns. NBER Working Paper.

[Balassa, 1965] Balassa, B. (1965). Trade liberalisation and revealed comparative advantage. The Manchester School, 33(99-123).

[Balassa, 1989] Balassa, B. (1989). Comparative advantage, trade policy and economic development. Harvester Wheatsheaf, New York.

[Balasubramanyam and Wei, 2015] Balasubramanyam, V. and Wei, Y. (2015). A comparative analysis of the manufacturing sectors in india and china. Review of Development and Change, 20(2):35–58.

[Baqaee and Farhi, 2019] Baqaee, D. and Farhi, E. (2019). Networks, barriers, and trade. Technical report.

[Bartolini and Drazen, 1997a] Bartolini, L. and Drazen, A. (1997a). Capitalaccount liberalization as a signal. The American Economic Review, 87(1):138–154.

[Bartolini and Drazen, 1997b] Bartolini, L. and Drazen, A. (1997b). Capitalaccount liberalization as a signal. American Economic Review, 87(1):138–54.

[Bekkers and Schroeter, 2020] Bekkers, E. and Schroeter, S. (2020). An economic analysis of the us-china trade conflict. WTO Staff Working Papers ERSD-2020-04, World Trade Organization (WTO), Economic Research and Statistics Division.

[Bellora and Fontagné, 2019] Bellora, C. and Fontagné, L. (2019). Shooting oneself in the foot? trade war and global value chains. Working papers, CEPII research center.

[Benguria et al., 2022] Benguria, F., Choi, J., Swenson, D. L., and Xu, M. J. (2022). Anxiety or pain? the impact of tariffs and uncertainty on chinese firms in the trade war. Journal of International Economics, 137:103608.

[Bloom et al., 2015] Bloom, N., Draca, M., and Van Reenen, J. (2015). Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity. The Review of Economic Studies, 83(1):87–117.

[Bolt et al., 2019] Bolt, W., Mavromatis, K., and van Wijnbergen, S. (2019). The global macroeconomics of a trade war. the eagle model on the us-china trade conflict. De Nederlandsche Bank Working Paper No. 623.

[Broda et al., 2008] Broda, C., Limao, N., and Weinstein, D. E. (2008). Optimal tariffs and market power: The evidence. American Economic Review, 98(2032-2065).

[Broda and Weinstein, 2006] Broda, C. and Weinstein, D. E. (2006). Globalization and the Gains From Variety*. The Quarterly Journal of Economics, 121(2):541–585.

[Brown and Zhang, 2019] Brown, C. and Zhang, Y. (2019). Measuring trumps 2018 trade protection: Five takeaways. Technical report.

[Bustos, 2011] Bustos, P. (2011). Trade liberalization, exports, and technology upgrading: Evidence on the impact of mercosur on argentinian firms. Technical Report 304-340.

[Caceres et al., 2019] Caceres, C., Cerdeiro, D. A., and Mano, R. (2019). Trade wars and trade deals: Estimated effects using a multi-sector model. IMF Working Paper.

[Caldara and Iacoviello, 2022] Caldara, D. and Iacoviello, M. (2022). Measuring geopolitical risk. American Economic Review, 112(4):1194–1225.

[Caliendo and Parro, 2014] Caliendo, L. and Parro, F. (2014). Estimates of the Trade and Welfare Effects of NAFTA. The Review of Economic Studies, 82(1):1–44.

[Campbell and Hopenhayn, 2005] Campbell, J. and Hopenhayn, H. (2005). Market size matters. Journal of industrial economics, 53(1)(1-25).

[Carter and Steinbach, 2020] Carter, C. A. and Steinbach, S. (2020). The impact of retaliatory tariffs on agricultural and food trade. NBER Working Paper, 27147.

[Cavallo et al., 2019] Cavallo, A., Gopinath, G., Neiman, B., and Tang, J. (2019). Tariff pass- through at the border and at the store: Evidence from us trade policy. NBER Technical Report, 26396.

[Chaney, 2008] Chaney, T. (2008). Distorted gravity: The intensive and extensive margins of international trade. American Economic Review, 98(1707-21).

[Chauhan, 2020] Chauhan, S. (2020). Understanding the impact of gsp withdrawal on indias top exports to the us. ISSUE BRIEFS AND SPECIAL REPORTS, Observer Research Foundation.

[Chen and Pantelous, 2022] Chen, Y. and Pantelous, A. A. (2022). The u.s.-china trade conflict impacts on the chinese and u.s. stock markets: A network-based approach. Finance Research Letters, 46:102486.

[Chinn and Ito, 2006] Chinn, M. D. and Ito, H. (2006). What matters for financial development? capital controls, institutions, and interactions. Journal of Development Economics, 81(163-192).

[Choi and Nguyen,] Choi, B.-Y. and Nguyen, T. L.

[Coglianese et al., 2017] Coglianese, J., Davis, L. W., Kilian, L., and Stock, J. H. (2017). Anticipation, tax avoidance, and the price elasticity of gasoline demand. Journal of Applied Econometrics, 32(1-15).

[Costinot et al., 2011] Costinot, A., Donaldson, D., and Komunjer, I. (2011). What Goods Do Countries Trade? A Quantitative Exploration of Ricardo's Ideas. The Review of Economic Studies, 79(2):581–608.

[Costinot and Rodríguez-Clare, 2013] Costinot, A. and Rodríguez-Clare, A. (2013). Trade Theory with Numbers: Quantifying the Consequences of Globalization. NBER Working Papers 18896, National Bureau of Economic Research, Inc.

[Dekle et al., 2007] Dekle, R., Eaton, J., and Kortum, S. (2007). Unbalanced trade. American Economic Review, 97(2):351–355.

[Devereux and Sutherland, 2011] Devereux, M. B. and Sutherland, A. (2011). Country portfolios in open economy macro-models. Journal of the European Economic Association, 9(2):337–369.

[di Giovanni et al., 2014a] di Giovanni, J., Levchenko, A. A., and Mejean, I. (2014a). Firms, destinations, and aggregate fluctuations. Econometrica, 82(4):1303–1340.

[di Giovanni et al., 2014b] di Giovanni, J., Levchenko, A. A., and Zhang, J. (2014b). The global welfare impact of china: Trade integration and technological change. American Economic Journal: Macroeconomics, 6(3) (153-83).

[Diamond and Rajan, 2009] Diamond, D. W. and Rajan, R. G. (2009). The credit crisis: Conjectures about causes and remedies. American Economic Review, 99(2):606–10.

[Dix-Carneiro and Kovak, 2017] Dix-Carneiro, R. and Kovak, B. K. (2017). Trade liberalization and regional dynamics. American Economic Review, 107(2908-2946).

[Dixit and Londregan, 1996] Dixit, A. and Londregan, J. (1996). The determinants of success of special interests in redistributive politics. Journal of Politics, 58(1132-1155).

[Dixit and Norman, 1980] Dixit, A. and Norman, V. (1980). Theory of International Trade: A Dual, General Equilibrium Approach.

[Donaldson, 2018] Donaldson, D. (2018). Railroads of the raj: Estimating the impact of transportation infrastructure. American Economic Review, 108(899-934).

[Eaton and Kortum, 2002] Eaton, J. and Kortum, S. (2002). Technology, geography, and trade. Econometrica, 70(5):1741–1779.

[Eaton et al., 2016] Eaton, J., Kortum, S., Neiman, B., and Romalis, J. (2016). Trade and the global recession. American Economic Review, 106(11):3401–38.

[Emter et al., 2021] Emter, L., Killeen, N., and McQuade, P. (2021). Bank and non-bank financial institutions crossborder linkages: New evidence from international banking data. Financial Stability Notes 3/FS/21, Central Bank of Ireland.

[Fajgelbaum et al., 2020] Fajgelbaum, P. D., Kennedy, P. J., Goldberg, P. K., and Khandelwal, A. K. (2020). The return to protectionism. Quarterly Journal of economics, 135(1)(1-55).

[Feenstra, 1989] Feenstra, R. C. (1989). Symmetric pass-through of tariffs and exchange rates under imperfect competition: An empirical test. Journal of International Economics, 27(25-45).

[Feenstra, 1994] Feenstra, R. C. (1994). New product varieties and the measurement of international prices. American Economic Review, 84(157-177).

[Feenstra, 2010] Feenstra, R. C. (2010). Product Variety and the Gains from International Trade. The MIT Press.

[Fernandez et al., 2016] Fernandez, A., Klein, M. W., Rebucci, A., Schindler, M., and Uribe, M. (2016). Capital control measures: A new dataset. IMF Economic Review, 64(3)(548-574).

[Fetzer and Schwarz, 2019] Fetzer, T. and Schwarz, C. (2019). Tariffs and politics: Evidence from trumps trade wars. CEPR Discussion Paper no. DP13579.

[Forbes et al., 2016] Forbes, K., Fratzscher, M., Kostka, T., and Straub, R. (2016). Bubble thy neighbour: Portfolio effects and externalities from capital controls. Journal of International Economics, 99(85-104).

[Freund et al.,] Freund, C., Ferrantino, M., Maliszewska, M., and Ruta, M.

[Fund, 2012] Fund, I. M. (2012). The global village: Connected world drives economic shift.

[Ghosh et al., 2014] Ghosh, A., Qureshi, M., and Sugawara, N. (2014). Regulating capital flows at both ends: Does it work? IMF Working Paper, 14/188.

[Giordani et al., 2016] Giordani, P. E., Rocha, N., and Ruta, M. (2016). Food prices and the multiplier effect of trade policy. Journal of International Economics, 101:102–122.

[Goldberg et al., 2010] Goldberg, P. K., Khandelwal, A. K., Pavcnik, N., and Topalova, P. (2010). Imported intermediate inputs and domestic product growth: Evidence from india. Quarterly Journal of Economics, 125(1727-1767).

[Goldberg and Knetter, 1997] Goldberg, P. K. and Knetter, M. M. (1997). Goods prices and ex- change rates: What have we learned? Journal of Economic Literature, 35(12431272).

[Goldberg and Maggi, 1999] Goldberg, P. K. and Maggi, G. (1999). Protection for sale: An empirical investigation. American Economic Review, 89(11351155).

[Goldberg and Pavcnik, 2016] Goldberg, P. K. and Pavcnik, N. (2016). The effects of trade policy. Hand- book of Commercial Policy, 1(161-206).

[Gopinath et al., 2010] Gopinath, G., Itskhoki, O., and Rigobon, R. (2010). Currency choice and exchange rate pass-through. American Economic Review, 100(304336).

[GOURINCHAS and JEANNE, 2013] GOURINCHAS, P.-O. and JEANNE, O. (2013). Capital flows to developing countries: The allocation puzzle. The Review of Economic Studies, 80(4 (285)):1484–1515.

[Greenaway and Milner, 1993] Greenaway, D. and Milner, C. (1993). Trade and Industrial Policy in Developing Countries: A Manual of Policy Analysis. Number 181-208.

[Grossman and Helpman, 1994] Grossman, G. M. and Helpman, E. (1994). Protection for sale. American Economic Review, 84(833-850).

[Handley et al., 2020] Handley, K., Kamal, F., and Monarch, R. (2020). Rising import tariffs, falling export growth: When modern supply chains meet oldstyle protectionism. NBER Working Paper.

[Hu, 2020] Hu, C. (2020). Industrial specialization matters: A new angle on equity home bias. Journal of International Economics, 126(C):S0022199620300702.

[Hu et al., 2022] Hu, C., Arora, P., and Choo, D. (2022). Spatial consumption risk sharing. SSRN Working Paper.

[Jeanne and Korinek, 2010] Jeanne, O. and Korinek, A. (2010). Excessive volatility in capital flows: A pigouvian taxation approach. American Economic Review, 100(2):403–07.

[Jinjarak et al., 2013] Jinjarak, Y., Noy, I., and Zheng, H. (2013). Capital controls in Brazil Stemming a tide with a signal? Journal of Banking & Finance, 37(8):2938–2952.

[Khandelwal, 2022] Khandelwal, A. (2022). The us-china trade war and indias exports. India Policy Forum, NCAER.

[Korinek and Sandri, 2015] Korinek, A. and Sandri, D. (2015). Capital controls or macroprudential regulation? IMF Working Paper WP 15/218.

[Kren and Lawless, 2022] Kren, J. and Lawless, M. (2022). How Brexit has changed EU-UK trade flows. Technical report.

[Krueger, 1999] Krueger, A. B. (1999). Experimental estimates of education production functions. The Quarterly Journal of Economics, 114(2):497–532.

[Levchenko and Zhang, 2011] Levchenko, A. A. and Zhang, J. (2011). The evolution of comparative advantage: Measure- ment and welfare implications. NBER Working Paper, 16806.

[Li et al., 2019] Li, C., Wang, J., and Whalley, J. (2019). Trade protectionism and us manufacturing employment. NBER Working Paper, 25860.

[Lorenzo et al., 2015] Lorenzo, C., Feenstra, R. C., Romalis, J., and Taylor, A. M. (2015). Tariff reductions, entry, and welfare: Theory and evidence for the last two decades. Technical report.

[Magee, 2008] Magee, C. S. (2008). New measures of trade creation and trade diversion. Journal of International Economics, 75(2):349–362.

[Mattoo et al., 2022] Mattoo, A., Mulabdic, A., and Ruta, M. (2022). Trade creation and trade diversion in deep agreements. Canadian Journal of Economics, 55(3)(1598-1637).

[Melitz, 2003] Melitz, M. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. Econometrica, 71(16951725).

[Melitz and Ottaviano, 2008] Melitz, M. J. and Ottaviano, G. I. P. (2008). Market Size, Trade, and Productivity. The Review of Economic Studies, 75(1):295–316.

[Mukhopadhyay and Sharma, 2020] Mukhopadhyay, A. and Sharma, N. (2020). Us trade realignment: The impact of gsp withdrawal on indias top exports to the united states. Occasional Paper, Observer Research Foundation. [on Trade and Development, 2013] on Trade, U. N. C. and Development (2013).

Key statistics and trends in trade policy. United Nation. [Ongan and Gocer, 2020] Ongan, S. and Gocer, I. (2020). The relationship between interest rates and inflation: Examining the fisher effect in china. Frontiers of Economics in China, 15(2):247–256.

[Pasricha et al., 2015] Pasricha, G., Falagiarda, M., Bijsterbosch, M., and Aizenman, J. (2015). Domestic and multilateral effects of capital controls in emerging markets. NBER Working Paper Series, (20822).

[Pasricha et al., 2018] Pasricha, G. K., Falagiarda, M., Bijsterbosch, M., and Aizenman, J. (2018). Domestic and multilateral effects of capital controls in emerging markets. Journal of International Economics, 115:48–58.

[Rauch, 1999] Rauch, J. E. (1999). Networks versus markets in international trade. Journal of International Economics, (48).

[Reinhart and Rogoff, 2009] Reinhart, C. M. and Rogoff, K. S. (2009). The aftermath of financial crises. American Economic Review, 99(2):466–72.

[Sanyal, 2021] Sanyal, A. (2021). Impact of us-china trade war on indian external trade. Econstor preprints, ZBW - Leibniz Information Centre for Economics.

[Shikher, 2011] Shikher, S. (2011). Capital, technology, and specialization in the neoclassical model. Journal of International Economics, 83(2):229–242.

[Spearot, 2013] Spearot, A. (2013). Variable demand elasticities and tariff liberalization. Journal of International Economics, 89(1)(26-41).

[Spearot and Ahn, 2015] Spearot, A. and Ahn, D. (2015). Us-countervailing measures on certain hot-rolled carbon steel flat products from india: To cumulate or not cumulate products. SSRN Workign Paper.

[Steinberg, 2018a] Steinberg, J. (2018a). Export market penetration dynamics. Working paper, University of Toronto.

[Steinberg, 2018b] Steinberg, J. (2018b). The macroeconomic impact of nafta termination. Meeting Papers 753, Society for Economic Dynamics.

[Tille and van Wincoop, 2010] Tille, C. and van Wincoop, E. (2010). International capital flows. Journal of International Economics, 80(2):157–175.

[Togo and Arikawa, 2002] Togo, K. and Arikawa, Y. (2002). Agglomeration effects versus policy effects: The case of the electronics industry in malaysia. Asian Economic Journal, 16(3):229–245.

[Wang, 2020] Wang, J.-C. (2020). The economic impact analysis of us-china trade war. AGI Working Paper Series 2020-11, Asian Growth Research Institute.

[Waugh, 2019] Waugh, M. E. (2019). The consumption response to trade shocks: Evidence from the us-china trade war. NBER Working Paper, 26353.

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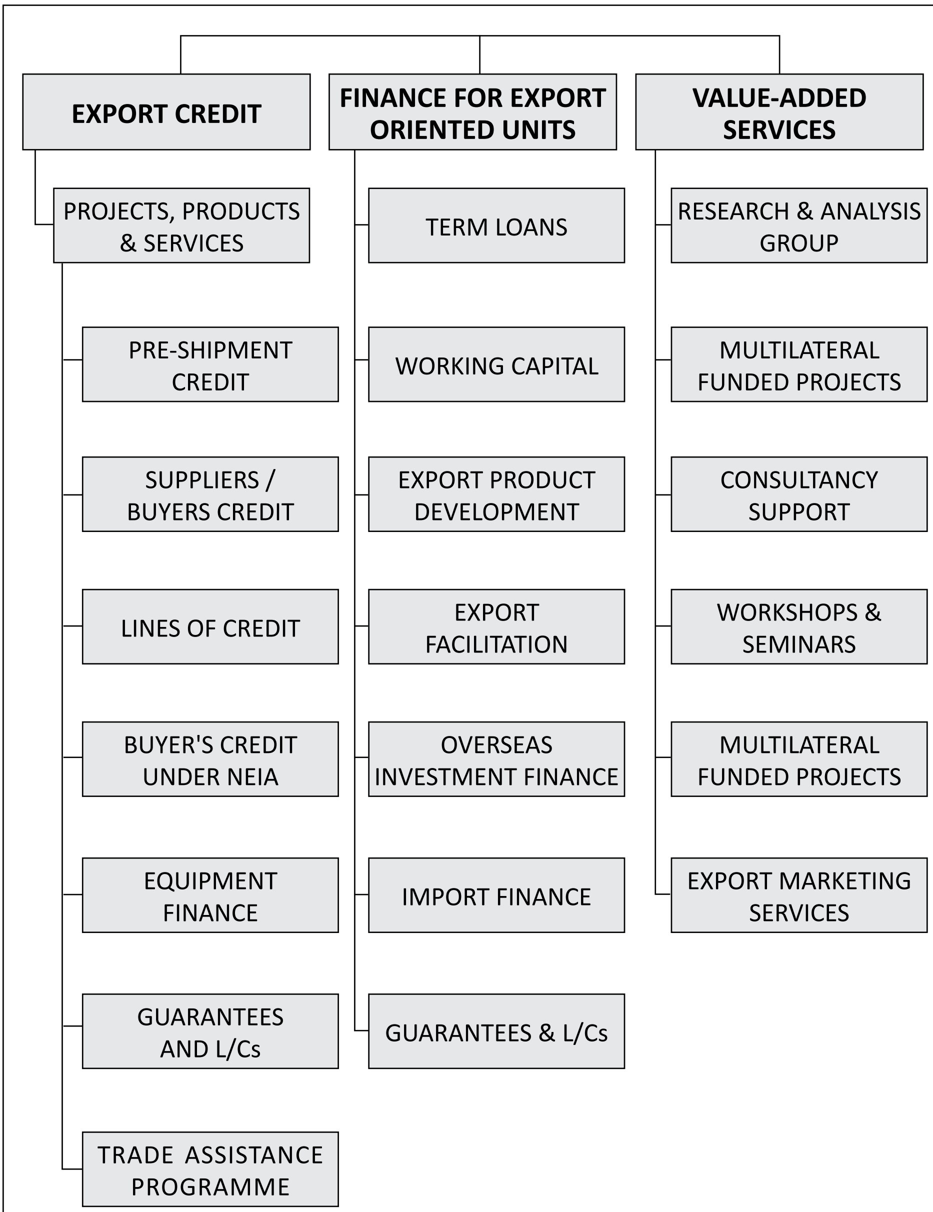

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