The effects of political shocks on international trade: evidence from China and major partners, 1998-2018

Vishesh Agarwal

May 2022

A thesis submitted for the degree of Doctor of Philosophy of The Australian National University

Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university. To the best of the author's knowledge, it contains no material previously published or written by another person, except where due reference is made in the text.

Vishesh Agarwal

Acknowledgements

I am grateful to many friends, colleagues, and generous people in completing this work. I was fortunate and privileged to have had so much support and guidance throughout this exciting and at times trying journey.

This work would not have been possible without my supervisors Professor Ligang Song, Professor Jane Golley and Dr. Yixiao Zhou. Without their generosity in time, guidance and patient support, my PhD experience would not have been as rich and rewarding as it was. I benefited greatly from the care and detail with which my supervisors found time, even in very busy periods, to read over drafts and discuss issues at length.

I am deeply grateful to Professor Ligang Song for believing in me since I took his Issues in Development Policy (IDEC8003) course in 2016 and encouraging and supporting me to apply for the PhD. Along with his academic support, Professor Song kept encouraging me throughout the PhD and advocated for me get other work that helped me financially as I got married and started a family.

Professor Jane Golley spent an immense amount of time carefully reading through my thesis and providing both major and minor comments that helped me polish my work. Through her detailed guidance, I was able to learn the finer aspects of doing research, to develop an attention to detail, and to appreciate the importance of integrity in academic work. Dr. Yixiao Zhou was a crucial pillar of this study as she ensured that I understood and implemented technical aspects of my work as well as possible.

I am also grateful to Professor Stephen Howes and Professor Robert Breunig, for their support during this journey. Under Professor Howes, I tutored the course Government, Market and Global Change (CRWF8000), which allowed me to take my mind of the thesis and not lose sight of the big issues in economics. His initiative of running a discussion group was one of the highlights of my time at Crawford School during which I got to know other students at Crawford much more closely. Professor Breunig was especially important as I wrote my first published paper with him and learnt how to navigate the gruelling publishing process.

I am deeply thankful to my PhD colleagues Tong Zhang, Matthew Woolf and Qiu Tunye who took out the time to be my discussants in the PhD seminars and provided insightful comments that made my work better. I am also grateful to them for being close friends through this journey.

I am also thankful to the Crawford School administration staff Megan Poore and Tracy McRae who have been extremely helpful in advising me through the academic bureaucracy in order to complete all the administration requirements.

This work would not have been possible without my parents, Puneet and Renu Agarwal, who have always encouraged me to follow my dreams, and instilled in me the confidence and diligence required to complete this academic journey. Whether it was emotional or financial support, my parents have always been there and helped me push through the hardest phases of my life.

Last but not least, I would like to thank my wife, Sara Navarro Arnedo, who sacrificed her own career to stay with me in Canberra to support me through the PhD. Earlier this year, she gave me the greatest gift possible with the birth of our daughter, Sophia. I look forward to spending many exciting stages of our life together.

Abstract

The purpose of this study is to examine the effects of political cooperation and conflict between countries on international trade in the context of China's rapid emergence as a global economic and trading power. The study develops a game-theoretical framework in which a bi-directional relationship exists between trade and conflict. The theoretical framework is used as a basis to identify the short- and long-term effects of moderate shocks in political conflict on merchandise goods trade between China and major trading partners between 1998-2018 using vector-auto-regression (VAR) models. The analysis is complemented by an examination of the effects of political shocks on trade disaggregated by product-type. The results suggest that although trade ties are not independent of conflict, they have not been affected by conflict significantly in this period, and the effects of political conflict on trade vary by product-type. The maintenance of a combination of healthy trade and low levels of conflict requires continued rules-based engagement between China and its trading partners to mitigate the extent to which political conflict has spill over consequences on trade ties.

List of Abbreviations

5G	Fifth Generation
ARIMA	Auto Regressive and Integrated Moving Average
AUKUS	Australia, United Kingdom, and United States of America
AUS	Australia
BRI	Belt and Road Initiative
BRICS	Brazil, Russia, India, China, and South Africa
CAMEO	Conflict and Mediation Event Observations
COPDAB	Conflict and Peace Data Bank
CPTPP	Comprehensive and Progressive Trans-Pacific Partnership
DEU	Germany
FRA	France
GBR	Great Britain
GDELT	Global Database of Events, Location and Tone
GDP	Gross Domestic Product
GFC	Global Financial Crisis
GPN	Global Production Network
IDEA	Integrated Data for Events Analysis
IIP	Industrial Index of Production
IND	India
JPN	Japan
KOR	South Korea
MID	Militarised Interstate Disputes
MPIA	Multi-Party Interim Arrangement
OIRs	Orthogonalised Interstate Disputes
PAK	Pakistan
PD	Prisoner’s Dilemma
PRI	Political Relations Index
RUS	Russian Federation
SOE	State Owned Enterprise

TABARI	Textual Analysis by Augmented Replacement Instructions
THAAD	Terminal High Altitude Area Defence
tfPRI	Trade-filtered Political Relations Index
UK	United Kingdom
US/USA	United States
VAR	Vector Auto Regression
WEIS	World Event Interaction Survey
WTO	World Trade Organisation

Table of Contents

List of Tables

Appendix Tables

List of Figures

Appendix Figures

Chapter 1 China and the trade-conflict nexus

Abstract: The effects of shocks in political relations on international trade has been a topic of considerable research across the economics, political science, and international relations literature. This topic has regained significance in the context of China's rise as a global economic and trading power and its alleged use of trade policy as a tool of economic statecraft. This chapter provides a brief introduction to the topic and documents China's rise to becoming a global trading power. The chapter discusses the purpose and scope of the study and provides an outline and summary of its main findings and scholarly contributions.

1 Introduction

China has experienced considerable variation in political relations with several of its major trading partners since becoming a member of the World Trade Organisation (WTO) in 2001. Most significantly, political relations between the United States (US) and China have worsened dramatically since the Global Financial Crisis (GFC) in 2008, with political disputes arising across a range of issues including territorial sovereignty and militarisation in the South and East China Sea, technological and economic competition, and conflicting values regarding democracy and human rights. Worsening US-China relations have had spill-over effects on China's relations with several trading partners, including intensified bilateral disputes with Australia, Japan, India, and South Korea. In the same period, China's political relations with some countries have improved considerably, notably Pakistan and Russia, while remaining steady with others, such as Germany, France, and the United Kingdom (UK).

Despite heterogeneity in political relations and recent setbacks in economic relations, all of the countries mentioned above have experienced a strengthening of mutually beneficial trade ties with China as China's economy has grown rapidly. Between 1998 and 2018, the Chinese real economy grew at an average annual rate of 9 per cent and accounted for approximately 25 per cent of global GDP growth. In this period China's share of global GDP increased three-fold, from 4 per cent to over 13 per cent. Following its entry into the

World Trade Organisation (WTO) in 2001, China's share of world trade also increased three-fold from four per cent 2001 to around 12 per cent in 2018. Most countries discussed above have seen an increase in both the ratio of trade with China to GDP, and an increase in the ratio of China trade to total trade in the new millennium, that is these countries have become more economically integrated with the Chinese economy.

This study investigates the effects of political cooperation and conflict between countries on international trade in the context of China's rapid emergence as a global economic and trading power. Looking at the case of China and major trading partners between 1993-2013, Du et al. (2017) estimate that the effects of moderate shocks in political relations on exports to China were small and short-lived. In a quantitative study of the China-Japan relationship between 1990-2004, Armstrong (2008) comes to a similar conclusion, stating that "[w]hile the economic relationship is not independent from the politics it has not been diminished or disturbed by politics to a significant extent." (Abstract). Analysing China-Japan relations during recent periods of political conflict, Davis and Meunier (2011) also find no significant association between political conflict and trade flows.

What explains the resilience of China's trading relationships to political shocks? Du et al. (2017, p. 212) argue that there are sound theoretical reasons for the effects of moderate shocks in political relations on trade to be small and short-lived. Du et al. (2017) do not provide a formal theoretical model of the trade-conflict relationship but describe the relationship as an infinitely repeated game in which a bi-directional relationship exists between trade and conflict. In this context, a healthy combination of trade and low-conflict constitutes a Pareto-perfect equilibrium, in which countries have no incentive to deviate from the superior cooperation strategy. Moderate political shocks in this framework can be understood as accidental deviations which are quickly resolved through diplomatic negotiations. However, large negative shocks in political relations can reduce trade and result in a vicious downward spiral towards an inferior equilibrium of high conflict and weakened trade ties. Conversely, large positive shocks in political relations can increase trade and result in a virtuous cycle towards a superior equilibrium of low conflict and strengthened trade ties.

Davis and Meunier (2011) argue that multilateral organisations such as the WTO constrain state actors from linking trade-related issues to political conflict by imposing costs for defecting from agreed upon trade rules. Armstrong (2008) also argues that "the multilateral settings in which both [China and Japan] are deeply integrated have been more powerful drivers of trade than the ups and downs of politics" (Abstract). Additionally, private actors may be unresponsive to changes in political relations. For example, multinational firms that are part of regional production networks face costs in searching for and dealing with alternate suppliers and firms that sell to their own foreign affiliates have little incentive to punish their own subsidiaries (Davis and Meunier 2011, p. 631). Consumer boycotts may also be ineffective because of free-rider issues as consumers face information and search costs and may not be able to shift preferences in response to political conflict (ibid.).

The overall resilience of China's trading relationships to political shocks is surprising because several studies suggest that political cooperation and conflict between countries are important determinants of international trade flows, with higher conflict reducing trade between countries (Pollins 1989, Martin et al 2007, Fuchs et al. 2021). This is because the commercial choices of both foreign state and non-state actors may be influenced by political relations. Some studies find evidence that countries which experienced political conflict with China in recent years did experience a reduction in their trade with China. Fuchs and Klann (2013) find that countries which received the Dalai Lama saw a significant decrease in trade with China. Kolstad (2011) finds that Norway experienced a decrease in trade with China after a Norwegian Committee awarded the Nobel Prize to Chinese humans right activist Liu Xiaobo.

Additionally, as China's share in the global economy has grown, so have concerns that China has increasing capacity to use trade as a geoeconomic tool, that is an economic instrument used to achieve foreign policy objectives (Blackwill and Harris 2012, Baru 2013, Medcalf 2020, Laurenceson and Golley 2021, Lim and Ferguson 2021). Recent studies have argued that Chinese State-Owned Enterprises (SOEs) act as a direct mechanism through which states can pursue geoeconomic policy because management decisions are directly controlled by state actors (Blackwill and Harris 2016, Norris 2016). Using firm-level import transaction data for China, Du et al. (2017) finds that sensitivity of imports to political relations is higher for SOEs than for privately-owned firms. Davis et al. (2019) also find that imports of SOEs in China and India show higher sensitivity to political relations relative to private firms.

The rest of this chapter is structured as follows. Section 2 provides definitions of the two key variables in this study: trade interdependence and political relations between countries. Section 3 motivates the study by describing China's rise as a global trading power since 2001 alongside increasingly volatile political relations with major trading partners. Section 4 discusses the purpose and scope of the study by formulating empirically testable hypothesis regarding the effects of political relations on trade. Section 5 provides an outline of the study and summarises its key findings and contributions.

2 Definitions

2.1 Trade interdependence

Gasiorowski (1986) defines 'interdependence' between nations as 'a particular kind of international relationship that emerges when countries are linked by interactions that can be both costly and beneficial' (p. 24). This definition is an extension of Keohane and Nye's (1977) characterization of 'interdependence' between countries which focuses primarily on the cost side of international interactions. Gasiorowski (1986), however, argues that for interactions to constitute 'interdependence' they must have both benefits and costs. This is because unless there are any benefits to be had, countries could 'simply forgo these interactions to avoid paying the costs they entail' (ibid.). In effect, it is the 'combination of costs and benefits [that] produces trade-offs in which countries must try simultaneously to maximize benefits and minimize costs' (ibid.).

Standard trade theory such as the Heckscher-Ohlin theory posits that countries trade because there are 'mutual gains' from trade. When trade is opened, countries can enjoy higher consumption levels, and therefore welfare, by producing those goods that employ their abundant resources more intensively compared to the situation where trade is prohibited. These are often termed as the 'static gains from trade'. Moreover, there are also 'dynamic gains' from trade that arise from shifting comparative advantage as countries develop new capacities (Akamatsu 1962, Vernon 1992, Kojima 2000). Both static and dynamic mutual gains from trade accrue because international trade allows countries to use their resources more efficiently.

New trade theory suggests that all international trade does not represent the exploitation of comparative advantage, and instead stresses the role of increasing returns and imperfect markets as the primary drivers of specialization and international trade (Krugman 1987, p. 132-133). New trade theory implies that nations could gain 'mutual gains' from trade not just from complementary differences in resources, but also through increased scale of production while maintaining or increasing the diversity of goods available (Krugman 1987, p. 134). Although these mutual gains are not guaranteed and could be thwarted by sophisticated government intervention, the difficulty in formulating and implementing such policies means that mutual gains remain a likely outcome of trade interdependence.

Economic interaction through international trade can also have substantial costs for the countries involved (Gasiorowski 1986). Unregulated trade can complicate domestic macroeconomic planning if there are unexpected changes in patterns of trade flows and associated balance of payments issues (ibid.). Countries can also become dependent on others as import sources of certain goods and services, thus becoming vulnerable to embargoes and blockades (ibid.). This might also mean that domestic industries that face strong import competition are not able to sustain themselves. However, domestic export economies that rely on foreign demand are also vulnerable to changes in other countries policies that may disrupt exports.

Within the realm of economic interdependence, interactions involving the trade of goods and services only form part of a broader economic interaction between countries, which can also include capital (both physical and human) and idea flows. However, ideas and human capital flows are difficult to measure, and long, high frequency time-series data on international capital flows and trade in services is unavailable. For these reasons, the empirical analysis in this study is restricted to the interactions involving international trade flows of merchandise goods.

2.2 Political relations

The conceptualisation of political relations between countries presents inherent philosophical questions concerning the nature of political interaction between state and sub-state actors (Gasiorowski 1986). Examples of such questions include what exactly constitutes political cooperation or hostility and how and to whom such activities are directed (Polachek 1980, p. 57).

Conceptually, bilateral political relations should reflect the 'aggregate level of hostility [or cooperation] directed by one country toward another in all foreign policy issue areas' (Gasiorowski 1986, p. 25). That is, bilateral political relations from the perspective of Country A towards Country B are an aggregation of the vast range of cooperative and conflictual interactions directed from Country A towards Country B to 'produce an overall evaluation of the hostile or friendly character of A's relationship with B' (ibid.).

Most quantitative studies of political relations between countries, including this study, primarily consider political relations as constituting interactions between national state actors, that is national executive and military actors. Such a definition discards several types of interactions between countries that are between state and sub-state actors, between state and non-state actors, and between non-state actors.

Three main types of quantitative indicators have been used widely in the trade-conflict literature to measure political relations between state actors. First, several studies concentrate on the occurrence of military confrontation between state actors and associate the degree of political conflict between countries with the longevity of conflict and casualties associated with conflict. The Militarized Interstate Disputes (MID) dataset collates over 2000 such disputes between countries covering a time period between 1816 and 1992 for major powers (Jones et al 1996, cited in Reuveny 2003) with updates provided annually. The unit of analysis is therefore a 'dispute', and for each dispute that is recorded, the dataset contains information about which nations were involved, the beginning and end dates of the dispute, the number of casualties recorded, and the outcome of the dispute (ibid.).

The MID approach to measuring political relations between countries suffers from several drawbacks. By concentrating solely on a particular form of intense, often violent, interaction, the MID approach does not present a full picture of political relations between countries which are better represented as a continuum rather than only such intense negative interactions (Polachek 1980, Davis and Meunier 2011, Du et al. 2017). Moreover, by focusing only on the conflict side of political relations, cooperation in political relations only shows up in the MID data as the absence of militarized conflict between nations (Reuveny 2003, p. 257-258). However, countries often engage in cooperative activities that result in improving political relations, as well as in both conflict and cooperation at the same time (Pollins 1989a, 1989b). Additionally, indicators such as casualties in war are also a function of country size and technology and may not be proportionate to actual hostility (Polachek 1980, p. 57).

A second measure of political relations among countries is the 'distance in foreign policy orientation' between any two countries constructed using United Nations General Assembly (UNGA) voting data. This measure assumes that countries "take very seriously the voting patterns of other countries at the UNGA" (Russett 1967, Richardson 1978; Flores-Macias and Kreps 2013, Ferdinand 2014, Struver 2016, Bailery et al. 2017, Fuchs and Vadlamannati 2013, cited in Davis et al. 2019, p. 12). The UNGA voting data is used to construct a country's 'ideal point distance along a single dimension that captures its position vis-a`-vis a "US-led liberal order"' (ibid.). The resulting values are then differenced to get dyadic measures of the distance between foreign policy orientation for a given pair of states.

However, using voting data to gauge bilateral political relations is problematic for two reasons. First, while voting data may reflect a states' political attitudes, it is not necessary that it reflects actual conflict between countries (Polachek 1980, p. 58). Second, because the ideal point distance is measured relative to the position of a 'US-led liberal order', issues that may be particular to dyads that do not involve the US may not get captured in indicators using UNGA voting data.

A third measure of political relations between countries uses political events data that is sourced through the documentation and categorisation of newspaper reports to measure political relations between countries. The events-data approach as opposed to the MID data captures political events that exist across the continuum of cooperation and conflict rather than focussing solely on intense conflict events. Unlike the UNGA voting indicator, events data allow for a better understanding of bilateral relations between countries without reference to their foreign policy orientation towards the US-led liberal order as summarised in the UNGA voting indicator. Events data are also available at relatively higher frequencies than MID and UNGA voting data, with updated event observations available every fifteen minutes as opposed to MID and UNGA voting data that is updated on an annual basis. For these reasons, this study conducts a quantitative indicator of political relations for China and major trading partners using events-data from the Global Database of Events, Location and Tone (GDELT)[1].

3 China's rise: hot economics, cold politics

The focus on China in this study is motivated by the joint phenomenon of China's rise as a global economic and trading power alongside significant variation in political relations with several of its major trading partners. The significant rise of China's global trade is

[1] Limitations of using events data are discussed in Chapter 3.

shown in Figure 1-1 which shows the evolution of China's trade relationship with ten major partners between 1998-2018.

Figure 1-1 highlights three significant trends. First, on the x-axis is the China share of trade for the partner country, that is the sum of partner country exports and imports to China divided by the sum of partner country exports and imports to the world[2]. Between 1998 and 2018, all countries have seen a right-ward shift, implying an increase in their China share of trade. The largest percentage point increases have been for Australia and South Korea which have seen their China share of trade increase from 4 per cent and 6 per cent in 1998 to over 31 per cent (eight-fold increase) and 26 per cent (four-fold increase) respectively in 2018. The China share of trade for the US has also increased five-fold from just over 3 per cent in 1998 to over 15 per cent in 2018. On average, the increase in China's share of trade for selected countries is about equal (around 6 per cent) for both decades (1998-2008 and 2008-2018).

Second, the y-axis shows the value of China trade as a share of the partner country's GDP, that is the sum of partner country exports and imports to China divided by the partner country's GDP. Both trade and GDP values are in current US dollars. Between 1998 and 2018, most countries have seen an upward shift implying an increase in trade with China as a share of GDP. Australia and South Korea have experienced the largest percentage point increases in China trade to GDP ratios rising from 1 per cent and 6 per cent in 1998 to over 10 per cent (ten-fold increase) and 19 per cent (three-fold increase) respectively in 2018. The China trade to GDP ratio for the US has also increased considerably from just over 0.5 per cent in 1998 to more than 3 per cent in 2018, a six-fold increase.

Third, the size of the partner country bubbles, which reflect the partner country GDP relative to China's GDP, have continually decreased in the past two decades. The significant change in the relative size of Chinese economy is attributable to the faster rate

[2] Trade values for both China and partners are in current US dollars.

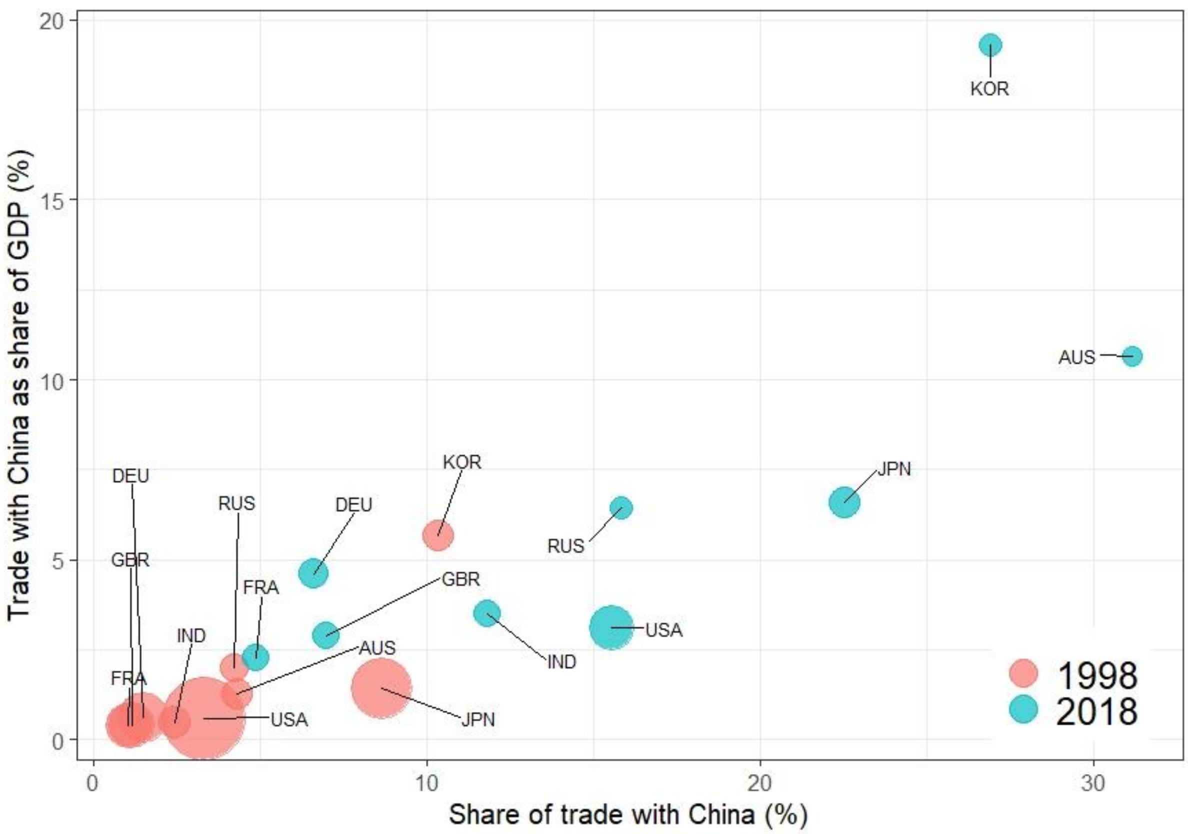


Figure 1-1: China's growing trade relations, 1998-2018

Source: Author's calculations using World Development Indicators and IMF DOTS data

of economic growth in China as compared to other countries as well as the large population size of China. The most dramatic change in relative economic size has been for Japan which has experienced its relative economic size decline from 4 in 1998 to 0.4 (ten-fold decrease) in 2018. The relative size of the US economy has also declined about six-fold from around 9 in 1998 to just over 1.5 in 2018. The decline in relative GDP is lower for emerging economies like India experienced rapid economic growth and have large population sizes. On average, the change in relative economic sizes for India and Russia has been similar in the two decades, a decline of 50 percent relative to 1996.

Alongside rapid integration into the global economy, China has experienced several political disputes with major trading partners since the turn of the century. Political disputes have arisen with the US, China's largest trading partner, due to conflicting strategic interests in the South China Sea and the re-balancing of power in the wider Indo-Pacific region. Several international relations scholars have used the term “Thucydides trap”, that is when a rising power threatens an established power, to describe the current state of US-China relations following China's dramatic rise in relative economic size (Thucydides 1963, Allison 2019). The US under the Trump administration has imposed a range of tariffs on China, which have been met by retaliation, leading to a trade war between the two largest economies in the world. In this context, the current US-China trade war is seen as a manifestation of a larger "great power" struggle that involves not only economic but also national security and foreign policy concerns.

Driven by economic complementarity, China-Australia trade has expanded considerably in the 21st century. However, political relations between China and Australia, while remaining strong in the first decade of the 21st century, have been strained in recent years in part due to worsening US-China relations, given Australia’s deep security relationship with the US. Disputes over bilateral issues between China and Australia have also intensified in this environment, including over the decision by Australian policymakers to restrict Chinese company *Huawei* from participating in the fifth generation (5G) telecommunications industry in Australia. More recently, China has imposed a range of tariffs on Australian products such as beef, barley, wine, and coal in response to Australia’s increasingly close security relationship with the US. Several Australian policymakers and national security analysts have raised concerns over China’ coercive influence in Australia's domestic politics through its large share of trade and investment linkages with the Australian economy, and advocated for diversifying Australia’s trade and economic ties away from China (Medcalf 2020).

China-India relations too have remained volatile in the 21st century, with disagreements on wide-ranging issues including territorial disputes, nuclear proliferation, Chinese political cooperation with Pakistan, and broader power re-balancing in the Indo-Pacific region. China has also experienced volatile political relations in the past two decades with its two East Asian neighbours, South Korea, and Japan. South Korea's political relationship with China has been volatile because of conflicting relationships with North Korea and the deployment of the Terminal High Altitude Area Defence (THAAD), an American antiballistic missile defence system by the South Korea despite Chinese opposition. Similarly, China-Japan relations have remained volatile in the past two decades with a host of issues sparking tensions between the two East Asian neighbours. These include historical disputes such as the issue of war reparations, territorial disputes surrounding islands in the East China Sea, freedom of navigation disputes in the South China Sea and foreign policy issues such as the status of Taiwan.

4 Purpose and scope

The purpose of this study is to examine the effects of political cooperation and conflict on trade in the context of China's rapid emergence as a global economic and trading power. To this end, the study proposes a game-theoretical framework that synthesises several alternative hypotheses regarding the effects of political relations on trade. First, the *terms-of-trade hypothesis* suggests that an increase (decrease) in political conflict has significant long-term negative (positive) effects on trade. This is because political conflict may disrupt trade whereas cooperation may enhance trade due to the actions of foreign state and private actors. Foreign state actors may respond to increasing conflict by the home country by introducing trade barriers such as tariffs, quotas, or outright bans. Conversely, foreign state actors may reduce trade barriers in return for political cooperation by the home country.

Second, the *accidental deviations hypothesis* suggests that an increase (decrease) in political conflict has significant but short-lived negative (positive) effects on trade. The accidental deviations hypothesis is a logical extension of the terms-of-trade hypothesis and theorises a bi-directional relationship between trade and politics. The terms-of-trade hypothesis implies that increasing conflict towards trading partners has trade-related opportunity costs. Assuming this to be true, as trade increases, so should the opportunity costs of conflict. *Ceteris paribus*, higher levels of trade should lead to lower levels of conflict. The argument that trade reduces conflict is often referred to in the international relations literature as the *commercial-peace hypothesis*. Given the bi-directional relationship between trade and conflict, Du et al. (2017) argue that the trade-conflict relationship is best modelled as an infinitely repeated game, that is a combination of the terms-of-trade and commercial-peace hypothesis. Moderate shocks in political shocks in this framework can be understood as accidental deviations which are quickly resolved through diplomatic negotiations.

Third, the *dependency hypothesis* suggests that increasing asymmetric power between trading partners may intensify the negative effects of political conflict on trade by fostering coercive political relationships. According to Hirschmann (1945:1980), dependence reflects a nation's inability to diversify both its exports and imports over many partners, Countries that have several partners are assumed to be less dependent than countries which only have a limited number of trading partners because states that are heavily dependent on a small set of trading partners find it difficult to "alter trading patterns and may become subject to manipulation … [as i]t is the dependent state's fear of losing the gains from trade that enables the less dependent (more powerful) state to enjoy a disproportionate amount of influence in the trading relationship … [and t]his lack of freedom [or choices] thus deprives states of enjoying the gains from free trade stressed by liberal models that do not account for coercive political pressures found in relations of dependence" (Barbieri 2009, p. 30).

Fourth, the *globalisation hypothesis* suggests that political cooperation conflict towards China has no significant effect on exports to China. While Chinese state actors may attempt to use trade as a geoeconomic tool, it is not clear whether they can substantially impact trade outcomes in the presence of other market forces, such as competition from domestic and foreign firms, and various institutional constraints such as WTO rules (discussed below). While SOEs still form a substantial share of China's economy, the share of privately-owned firms in the Chinese economy has risen considerably since the 1980s with "[t]he combination of numbers 60/70/80/90 are frequently used to describe the private sector's contribution to the Chinese economy: they contribute 60 percent of China's GDP, and are responsible for 70 percent of innovation, 80 percent of urban employment and provide 90 percent of new jobs. Private wealth is also responsible for percent of investment and 90 percent of exports" (WEF 2019).

Chinese firms increasingly form part of Global Production Networks (GPNs) and are sensitive to policy uncertainty that arises due to rising political tensions between China and its partners. Such firms are both importers and exporters and any restrictions on trade placed on them due to political tensions are harmful for their profits. Moreover, as a member of the WTO and free-trade agreements with several partners, the Chinese government is constrained by international agreements that prohibit the use of trade as a foreign policy tool and highlight the mutual economic gains that result from greater economic integration.

The study evaluates these alternative hypotheses on the effects of politics on trade by estimating an empirical model based on the gravity model of trade using a Vector Auto-Regression (VAR) framework. VAR frameworks are widely used in the macroeconomics literature and are considered useful statistical devices to evaluate alternative models of the economy (Sims 1980, Cristiano 2012). A VAR framework is useful to estimate the trade-conflict relationship for two reasons. First, a VAR framework allows for the endogenous treatment of trade and political relations by simultaneously estimating both the effects of trade on conflict and the effects of conflict on trade.

Second, the VAR model generates Orthogonalised Impulse Response (OIR) functions that can be used to identify the effects of shocks in political relations on trade between countries. OIRs serve a statistical tool to evaluate three alternative hypotheses regarding the trade-conflict relationship. If we find that political shocks have neither short-term nor long-term effects on trade, this will provide evidence in favour of the globalisation hypothesis. Alternatively, OIRs that show that negative political shocks have only short-term effects on trade would support the accidental deviations hypothesis. The terms-of-trade hypothesis would be supported by evidence of negative political shocks reducing trade in the long-term. Lastly, the dependency hypothesis is supported if we find that the effects of political shocks on trade have been increasing along with China's increasing capacity.

The scope of the study is limited to ten of China's major trade partners namely Australia, India, France, Germany, Japan, Pakistan, Russia, South Korea, UK, and the US between 1998-2018. Together these countries account for more than 80 percent of China's trade in this period and are in themselves major economies and military powers. As discussed earlier, China has significant trading relationships with these major powers alongside a considerable variation in political relations allowing for the empirical investigation of the effects of political relation on trade. A similar study by Du et al. (2017) considers nine of these ten countries (excluding South Korea) between 1993-2013, making the results largely comparable.

5 Contributions and outline

This study makes both theoretical and empirical contributions to the study of the effects of political relations on international trade. On the theoretical front, this study extends a static model of trade and conflict presented in Polachek and Seglie (2007) into a repeated game model, in which a bi-directional relationship exists between trade and political conflict. This theoretical model synthesises several alternative hypotheses regarding the trade-conflict relationship and is used to provide a basis for the causal ordering of variables in the VAR model used to estimate the effects of political shocks on exports for the case of China and major partners.

On the empirical front, this study makes four contributions to the study of trade and political relations. First, the study constructs a quantitative indicator of political relations, the Political Relations Index (PRI), between China and major trading partners using news-events data from the GDELT database. Second, time-series and frequency-domain analysis are conducted on the PRI series to verify that a major proportion of the variation in political relations occurrs at high frequencies, that is at three months or fewer.

Third, this study uses a VAR model to estimate the short- and long-term effects of shocks in political relations on export growth for China and its major trading partners between 1998-2018. Fourth, the study estimated the effects of political shocks on exports for the case of five of China’s trading partners for which political relations were particularly volatile disaggregated at the product-level. For each of these partners, the top five export categories are analysed which together accounted for approximately 80 percent of their exports to China.

The rest of this study is structured as follows. Chapter 2 begins with a discussion of a static microeconomic model presented in Polachek and Seglie (2007) that incorporates three hypotheses on the trade-conflict relationship: the terms-of-trade hypothesis, the commercial-peace hypothesis, and the globalisation hypothesis. In this chapter, I extend the Polachek and Seglie (2007) model to incorporate strategic interaction between countries over time. I demonstrate that the game-theoretic model can reproduce the theoretical results in Polachek and Seglie (2007) and synthesises two additional hypotheses on the relationship: the dependency hypothesis and the accidental deviation hypothesis. I argue that the theoretical model provides a basis for the causal ordering of shocks in the estimation of Vector Auto-Regression (VAR) models of the effects of shocks in conflict on trade.

Chapter 3 discusses issues regarding the quantification of political relations and the frequency at which data should be aggregated in the case of empirical models that use events-based data to measure political relations, that is monthly or annually. Du et al (2017) suggest that data should be aggregated at higher frequencies, that is at the monthly level, because aggregation at the annual level can lead to inconsistent estimates especially if a large amount of variation in political relations occurs at high frequencies. In this chapter, I construct a *Political Relations Index (PRI)* using machine-coded newspaper events data from GDELT. The PRI series considers both cooperative and conflictual events and distinguishes between government and military actors. The series is also normalised to account for increasing media coverage and seasonal variations and filtered to remove out trade-related events to mitigate endogeneity between trade and political relations. Next, using visual, time-series and spectral density analysis I verify that the largest amount of variation in the PRI series is observed at high frequencies.

Chapter 4 estimates the trade-conflict relationship for China and major partners using a VAR framework to identify the effects of moderate shocks in political relations on trade with China for its major partners between 1998-2018. The empirical analysis distinguishes between the effects of shocks in the government versus military PRI series. Overall, the results indicate that although effects vary by trading partner, a general trend across most partners is that the effects of moderate shocks in political relations are small and short-lived, lasting from one to six months. However, there is some evidence to suggest that the effects of political relations on trade have increased over time with some partners such as Australia.

Chapter 5 conducts a product-level disaggregated analysis of the effects of political shocks on trade for Australia, India, Japan, South Korea, and the US. These countries are chosen because they have experienced a significant deterioration in political relations with China. Of these countries, Australia, India, Japan, and the USA have committed to military and economic cooperation in the form a Ministerial level 'Quadrilateral' arrangement to balance China's rapid rise in the Indo-Pacific region. Specifically, the merchandise goods trade data is dis-aggregated at HS1 level which distinguishes between 21 different goods-types. The empirical analysis is conducted for the period between 2001-2018 for all countries. Overall, the findings suggest that the effects of political shocks on trade can differ across both product-types and trading partners. For a given trading partner, some product types may be affected significantly by political shocks but not others, while for a given product type, some partners may see significant effects but not others.

Chapter 6 summarises the main conclusions and contributions of the study. I also highlight the limitations of the study along with avenues for further research. On policy implications, I argue that while trade ties with China have remained largely resilient to political shocks in the first two decades of the 21st century, the maintenance of a healthy combination of trade and peace requires continued rules-based engagement between China and its trading partners to mitigate the extent to which political conflict will have spill over consequences on trade ties in the future.

Chapter 2 A repeated game model of trade and conflict

Abstract: Polachek and Seglie (2007) provide a static microeconomic framework that synthesises three hypotheses regarding the trade-conflict relationship: the ‘terms-of-trade’ hypothesis, the ‘commercial-peace’ hypothesis and the ‘globalisation’ hypothesis. In this chapter, I extend the Polachek and Seglie (2007) framework to incorporate strategic interaction between countries over time. I demonstrate that the game-theoretical model can reproduce the theoretical results in Polachek and Seglie (2007) and synthesises two additional hypotheses on the relationship: the ‘dependency’ hypothesis and the ‘accidental deviation’ hypothesis. I argue that the model provides a theoretical basis for the causal ordering of shocks in the estimation of Vector Auto-Regression (VAR) models of the effects of shocks in conflict on trade.

1 Introduction

Many studies across the economics, political science, and international relations literature have investigated the relationship between international trade and inter-state conflict. Polachek and Seglie (2007) present a static microeconomic framework that incorporates three hypotheses regarding the trade-conflict relationship, the *terms-of-trade hypothesis*, the *commercial-peace hypothesis*, and the *globalisation hypothesis*.

The *terms-of-trade hypothesis* states that political cooperation and conflict among countries is a significant determinant of trade patterns, with higher (lower) conflict leading to lower (higher) trade. This is because the economic choices of both state and private actors are significantly affected by international political relations. Greico (1992), Gowa (1993) and Powell (1993) argue that state actors consider the security externalities of international trade and are more likely to establish stronger trading relationships with political allies (that is countries with low conflict). Several studies suggest that private actors such as firms respond to political risks of international commerce and are less likely to establish commercial ties in foreign countries that have volatile political relations with their home country (Pollins 1989, Armstrong 2008, Fuchs et al. 2013). Consumers too may express political goodwill or lack thereof through purchasing decisions, boycotting goods from countries with which political relations sour (Heilmann 2016).

Arguments that suggest conflict reduces trade through the choices of states and private actors imply in one way or another that initiating conflict towards trading partners has opportunity costs in terms of potential trade-related welfare losses. Polachek and Seglie (2007) model the effects of the choices of state and private actors on trade through changes in the terms-of-trade, that is the ratio of export and import prices. Increasing conflict towards partners leads to a deterioration in the terms-of-trade and a reduction in trade flows because demand from foreign private actors falls and foreign states retaliate through trade policy measures such as tariffs, quotas, and bans. Consequently, a reduction in trade leads to a reduction in consumption and welfare. C*eteris paribus,* countries should reduce conflict towards trading partners to minimise potential trade-related welfare losses.

The co*mmercial-peace hypothesis* considers the opposite relationship, that is, trade as a significant determinant of political cooperation and conflict between countries, with higher (lower) trade leading to lower (higher) conflict. It is important to note that the commercial-peace hypothesis is a logical extension of the terms-of-trade hypothesis, in that it analyses the effects of trade on conflict assuming the terms-of-trade hypothesis to be true. To repeat, the terms-of-trade hypothesis implies that increasing conflict towards trading partners has trade-related opportunity costs. Given this to be true, as trade increases, so should the opportunity costs of conflict. C*eteris paribus*, higher levels of trade lead to lower levels of conflict demanded. Put together, the terms-of-trade and commercial-peace hypotheses suggest that the dynamics of the trade-conflict relationship between countries should involve either virtuous circles that result in a high-trade and low-conflict equilibrium or downward spirals towards a low-trade and high-conflict equilibrium.

Davis and Meunier (2011) contest both the terms-of-trade and the commercial-peace hypotheses stating that these arguments are ‘based on an image of state-society relations that no longer fits the current era of globalization’ (p. 631). Arguments that stress the effects of political conflict on international trade ‘portray the state having substantial control over economic actors’, while arguments that stress the effects of international trade on conflict ‘portrays economic actors with substantial influence over political leaders’ (p, 631). Instead, Davis and Meunier (2011) assert that the linkages between trade interdependence and political relations at the dyad level have weakened in the current era of globalization because of the changing incentives that state and private actors face. However, this *globalisation hypothesis* can be seen as an extreme case scenario in the framework presented by Polachek and Seglie (2007) in which public and private actors have insufficient market power to alter terms-of-trade. As put by Polachek and Seglie (2007), this is a situation when “countries are prices takers in the international market and the cost of trade diversion [due to increasing conflict] is negligible.” (p. 1025) Consequently, trade has no effects on conflict because trade-related opportunity costs of conflict remain negligible with higher trade.

Two additional hypotheses regarding the relationship are prevalent in the literature that are not incorporated within the Polachek and Seglie (2007) framework. First, Hirschmann (1945:80) argues economic dependence between states is an important factor that influences the effects of trade on conflict. . According to Hirschmann (1945:1980), dependence reflects a nation’s inability to diversify both its exports and imports over many partners, Countries that have several partners are assumed to be less dependent than countries which only have a limited number of trading partners because states that are heavily dependent on a small set of trading partners find it difficult to “alter trading patterns and may become subject to manipulation … [as i]t is the dependent state’s fear of losing the gains from trade that enables the less dependent (more powerful) state to enjoy a disproportionate amount of influence in the trading relationship … [and t]his lack of freedom [or choices] thus deprives states of enjoying the gains from free trade stressed by liberal models that do not account for coercive political pressures found in relations of dependence” (Barbieri 2009, p. 30).

Polachek and Seglie (2007) acknowledge that the ability of states to alter terms-of-trade is determined by global market power, writing with respect to import prices that “[th]e smaller either country is, the smaller the impact that conflict will have on prices since the elasticity of demand for imports will be greater” (p. 1025). However, the proposition that trade reduces conflict is derived under conditions that all countries have symmetric market power, that is equal abilities to alter the terms-of-trade.

Second, Du et al (2017) suggest that the dynamics between trade and conflict can be modelled as an infinitely repeated game with an ‘Pareto perfect equilibrium’ (that is none of the players have any incentive to deviate from their strategies) in which bilateral relations consist of a ‘combination of healthy trade and peaceful political relations’ (p. 212). In this context, moderate shocks in political relations are understood as ‘accidental deviations’ from the equilibrium and players have an incentive to settle disputes and return to the earlier Pareto superior combination of trade and peace. Because the Polachek and Seglie (2007) framework is a static one, it does not incorporate the *accidental deviations hypothesis* regarding the short-lived effects of political shocks on trade.

In this chapter, I extend the static framework presented in Polachek and Seglie (2007) to incorporate strategic interaction between countries over time. I demonstrate that the model reproduces the theoretical results in Polachek and Seglie (2007) and incorporates the two additional hypotheses discussed above. Specifically, the two-country, two-good model builds on the micro-foundations in Polachek and Seglie (2007) to derive relative payoffs to countries in an infinitely repeated trade-conflict game. I derive the conditions required for the game to take a Prisoner’s Dilemma (PD) form and the discount factor required for cooperation (low-conflict and high-trade strategy) to emerge as a Nash equilibrium for both countries.

The model incorporates Hirschmann’s *dependency hypothesis* by demonstrating that increasing trade can lead to coercive political relations when trade relations are asymmetric, that is, countries have asymmetric ability to alter export and import prices in response to conflict by trading partners. This is because more trade re-enforces the relative ability of the larger country to alter the terms-of-trade, thereby increasing the potential trade-related welfare losses for the smaller country and reducing the potential trade-related welfare losses for the larger country. Under these conditions, the larger country would prefer a higher level of conflict while the smaller country due to higher potential trade-related costs prefers a lower level of political conflict.

Incorporation of the accidental deviations hypothesis within the framework is discussed but formal treatment is left for future research. The accidental deviations hypothesis suggests that the effects of shocks in political relations on trade should be short-lived. To test this proposition, Du et al. (2017) estimate a vector auto-regression (VAR) model based on the gravity model of trade. The use of a VAR framework allows for the endogenous treatment of trade and political relations and the quantification of dynamic effects of shocks in system variables (Du et al. 2017, p. 218). They find that negative political shocks have only short-term effects on trade providing support for the accidental deviation hypothesis.

However, identification in VAR models requires *apriori* assumptions regarding the causal ordering of shocks in variables (Sims 1980). For a chosen order, the shocks to variables placed first affect all other contemporaneously, while latter variables only affect variables with a lag. Lacking a theoretical framework, Du et al. (2017) use the *Choleski* decomposition method to estimate several alternative variations of the causal order of variables (Du et al 2017, Lee 2018). However, estimates often defer for different orders and it is unclear which results should be preferred. I argue that the model presented in this chapter provides a theoretical basis for the ordering of causal shocks in the estimation of VAR models of the effects of conflict on trade.

The rest of the chapter is structured as follows. Section 2 elaborates on the five hypotheses discussed so far regarding the trade-conflict relationship. Section 3 follows Polachek and Seiglie (2007) and models the trade-conflict nexus as a static optimisation problem. It then expresses the problem as a normal form game and analyses the game in an infinitely repeated setting. Section 4 demonstrates that alternative hypotheses on the trade-conflict relationship emerge as special cases under this general framework.

Section 5 discusses how the theoretical model aids the estimation of VAR models. Section 6 concludes.

2 Theories on the trade-conflict relationship

2.1 The terms-of-trade hypothesis: how conflict reduces trade

Political cooperation and conflict between countries may be significant determinants of trade if they affect the economic choices of state and private actors. Pollins (1989a) contends that conflict can reduce trade because private importers consider political relations between their home country and trading partner in their business decisions. This is because ‘in cases where price and quality are roughly comparable, the buyer could choose a seller from a friendly nation in order to minimize the possibility of economic disruption … [and] importers will behave in ways that will tend to decrease trade with a particular partner when their political relations are becoming more conflictive, and they will tend to increase trade with that partner when political relations become more cooperative’ (p. 741).

Consumer behaviour can also be affected by political relations. Pollins (1989, p. 739-40, cited in Davis and Meunier 2011, p. 630) argues that ‘[c]onsumers express goodwill or solidarity toward those whom they identify as friends, while shunning or punishing those they perceive as foes”. Heilmann (2016, p.2) suggests that as more and more people gain access to the internet, ‘being able to communicate and coordinate their actions online, consumer boycotts enable the public to become a political agent in international relations … [and i]n the case of the Chinese consumer boycott against Japan in 2012 … the internet may have played a crucial role in organizing the boycott, with the Chinese government having limited control over the reaction on the streets’.

State policy regarding international trade may also be affected by current or potential future conflict with trading partners. Greico (1990) argues that a state’s utility function should consider not only its own payoff from trade but also incorporate the gap between its own payoff and that of a partner. In other words, ‘envy [between nations] is a major impediment in the attempt to create lasting institutions’ (Barbieri and Schneider 1999, p. 389). These arguments are based on the implicit assumption (often associated with the realist school of thought in international relations) that nation-states can be treated as unitary, sovereign actors that care about survival in an anarchical system of international relations (ibid.). Although trade leads to an increase in economic efficiency which can be used to increase one’s own military resources, the anarchical nature of the system also means that increased trade can lead to more powerful adversaries (Barbieri and Schneider 1999, p. 392). Therefore, states must be careful about establishing economic relations with other states that could result in future vulnerabilities or strengthen a current or future rival.

A similar argument is put forward by Gowa and Mansfield (1993). In their model, trade leads to welfare gains for both trading partners but also results in security externalities because states could use these gains to harm their trading partners in the future. Their model also assumes that states are more concerned about security externalities when trade is with a political ally than with a political rival. Therefore, inter-state alliances should affect patterns of international trade. Several authors have extended this argument to suggest that shifting international alliances motivate states to use economic statecraft as a tool to meet foreign policy objectives (Mastanduno 1998, Skalnes 2000). A broader generalisation of Gowa and Mansfield’s (1993) argument is that trade is more probable between “like-minded” states even if these states are not formal allies (Gowa 1995, cited in Barbieri and Schneider 1999, p. 393). Some authors build on such frameworks to suggest war-time trade policies should raise trade with friendly and enemy-hostile third parties but reduce trade with hostile and enemy-friendly third parties (Feldman and Sadeh 2018, Garfinkel et al 2020).

This “like-mindedness” between nations has been interpreted in various ways by different authors. Dixon and Moon (1993) argue that nation-states with similar political systems and policy positions on global issues are more likely to trade with each other. They back this claim with evidence from US exports to more than 70 importing nations over an 18-year period. Pollins (1989a, 739 cited in Davis and Meunier 2011, p. 630) also suggests that 'it is not only alignment and open conflict that can affect trade but the broad orientation of states' foreign policies towards one another'. Hirschmann (1945:1980) presents a similar argument by examining 'the cultivation and exploitation of economic ties as instruments in the service of the state's larger foreign policy interests' (Pollins 1989a, p. 741) for the case of Nazi Germany.

Polachek and Seglie (2007) argue that political cooperation and conflict between countries influence terms-of-trade through the choices of both state and private actors. To illustrate, an increase in conflict by the home country towards a foreign country will cause consumers in the foreign country to reduce demand for exports from the home country. *Ceteris paribus*, reduced demand will lead to a decrease in the price of the home country's exports, or a deterioration in the home country's terms-of-trade. State actors in the foreign country might also react to higher conflict by the home country by increasing tariffs on the home country's exports, which would require home country exporters to reduce prices to maintain demand. Placing quotas or bans on the home country's exports can be argued to finally be passed on to consumers through price changes, as contraband goods may be available but at much higher prices that compensate the home country's suppliers for the risk involved. Both tariffs and quotas/bans by the foreign country's public actors both (that is tariffs and quotas) cases will lead to lead to a deterioration in the home country's terms-of-trade. Consequently, a reduction in trade leads to a reduction in consumption and welfare. In this context, *ceteris paribus,* countries should reduce conflict towards trading partners to minimise potential trade-related welfare losses.

One channel through which states may affect terms-of-trade in response to conflict with? trading partners that has received significant attention in the recent literature is through the presence of state-owned enterprises (SOEs). This is because it is hypothesised that the actions of SOEs are controlled directly by the government of the day and their goals may therefore include foreign policy objectives in addition to maximising shareholder profits. As put by Davis et al (2019, pp. 405-406), '[s]tate-owned firms align their behavio[u]r with state interests because of dependence at the level of personnel and finances. Where private firms trade on the basis of business interests, state-owned firms also pursue government interests. As a result, we expect the impact of political relations on trade to be a function of state control'. Recent empirical evidence suggests that the effect of political shocks on imports for the case of China and India vary by firm type, with SOEs' sensitivity to political shocks being higher than that of private firms (Davis et al 2019, Du et al 2017).

2.2 The commercial-peace hypothesis: how trade reduces conflict

The commercial-peace hypothesis has intellectual roots dating back to classical liberals like Francis Montesquieu and Adam Smith who assert that 'economic interdependence creates vested interests opposed to conflict' (Davis and Meunier 2011, p. 630). As put by Montesquieu in his 1748 treatise *The Spirit of Laws*, '[t]he natural effect of commerce is to bring about peace. Two nations which trade together render themselves reciprocally dependent; if the one has an interest in buying and the other has an interest in selling; and all unions are based upon mutual needs" (cited in Armstrong 2009, p. 158). Contemporary liberal arguments also 'link the pacifying elements of trade to economic and sociological factors … [with] an implicit (and at times explicit) assumption that the increased contact that results from trade ties promotes peace and unites states' (Barbieri 2002, p. 22).

The classical models of the trade-conflict relationship within a microeconomic setting are Polachek (1980, 1992) and Polachek and Seiglie (2007). These models provide support for the "commercial-peace hypothesis": that more trade generates greater mutual dependencies between countries and reduces conflict. Country preferences in these models are represented by a welfare function consisting of consumption and the intensity of conflict towards trading partners, with higher consumption providing greater welfare. International trade allows countries to pursue efficiency in production due to comparative advantage, leading to an increase in consumption, and thus welfare.

Increasing conflict towards trading partners has 'non-economic' benefits and 'trade-related' welfare losses. The composition of 'non-economic' welfare gains is not discussed in any detail in these papers but can be interpreted in a narrow or broad manner. Narrowly defined, the non-economic gains from conflict consist of the acquisition of strategic assets that help attain national security or foreign policy related goals. More broadly defined, non-economic gains from conflict can also include an increase in political legitimacy and credibility due to rising domestic nationalist sentiments.

Conflict results in trade-related welfare losses because higher conflict results in a deterioration in the terms-of-trade for the conflict-initiating country, leading to lower trade, consumption, and welfare. That is, to assert that trade reduces conflict, these models first assume the reverse causal relationship exists, that conflict affects trade. As put by Polachek (1980, p. 61), 'the price of being belligerent is an implicit price that increases with the level of trade. Ceteris paribus, the greater the amount of trade, the higher the price of conflict, and the less the amount of conflict that is demanded'.

In such a scenario, Polachek (1980) argues that states attempt to optimize the level of hostility towards other nations keeping in mind the trade-off between gains from hostility and losses from trade-related retaliation. And as trade between countries grows, the opportunity costs of conflict from trade-related retaliation by partners increase proportionally. Thus 'private actors who expect to benefit from continued commerce lobby to restrain the state from engaging in conflict … [and b]usiness pressure is expected to encourage positive relations with economic partners and not just rally against war' (Copeland 1996, Kastner 2007, Mansfield 1994, Papoyouanou 1997, cited in Davis and Meunier 2011, p. 630).

Studies such as those by Gartzke et al (2001) argue that increasing trade ties between countries promotes peace because greater interaction in the economic sphere means that states have additional 'policy tools short of war by which to signal their dissatisfaction with another state and demonstrate their own resolve' (Davis and Meunier 2011, p. 630).

These set of arguments stress the importance of low-intensity political conflict as 'signalling through changes of economic behavio[u]r often occurs below the threshold of militarized conflict' (Gartzke, et al 2001, p. 405, cited in Davis and Meunier 2011, p. 630). The growth of economic ties between nations acting as signals of political dis-satisfaction leads some authors to the conclusion that 'militarized conflict has little impact on trade because economic actors adjust their trading activities before a dispute occurs in response to lower-level changes of political relations' (Li and Sacko 2002; Morrow 1999, p. 488, cited in Davis and Meunier 2011, p. 631).

2.3 The dependency hypothesis: asymmetric trade and economic coercion

Critics of the commercial-peace hypothesis, however, argue that 'not all economic relations are created equal' (Barbieri 2002, p. 27); that is, while it may be true in some cases that deeper trade ties can lead to better political relations, it does not always need to be so. Hirschmann (1945:1980) stresses the importance of "dependence" as a major factor in determining whether trade leads to better or worse political relations.

According to Hirschmann (1945:1980) dependence reflects a nation's inability to diversify both its exports and imports over many partners. Countries that have several partners are assumed to be less dependent than countries which only have a limited number of trading partners. In such a scenario, states that are heavily dependent on a small set of trading partners find it difficult to 'alter trading patterns and may become subject to manipulation … [as i]t is the dependent state's fear of losing the gains from trade that enables the less dependent (more powerful) state to enjoy a disproportionate amount of influence in the trading relationship … [and t]his lack of freedom thus deprives states of enjoying the gains from free trade stressed by liberal models that do not account for 'coercive political pressures found in relations of dependence' (Barbieri 2002, p. 30).

Dependency theorists build on Hirschmann's work to stress that it is not necessarily the case that deepening economic ties between countries are mutually beneficial and result in an improvement in political relations. Kegley and Richardson (1980) suggest that trade dependence can limit state autonomy beyond the economic sphere by arguing ‘that dependent trade partners are subject to the demands of the stronger trade partner when making foreign policy decisions’ (Barbieri 2002, p.32). Several authors in the dependency school of thought are especially sceptical of trade ties between developed and developing nations and argue that the gains from trade are enjoyed exclusively by developed states (Singer 1950), that trading relations between developed and developing nations retard the development process of developing states (Seers 1963), and that trade exacerbates inequalities in the wealth of nations (Myrdal 1957).

While the discussion of trade dependency suggests that increasing trade ties could worsen political relations, this does not necessarily have to be the case. This is because while it is likely that asymmetrical dependence may lead to an increase in hostilities between countries, ‘it is equally plausible that the more powerful state has the ability to suppress conflict before it erupts’ (Barbieri 2002, p. 31).

2.4 The globalisation hypothesis: a separation of trade and conflict

Davis and Meunier (2011) contend that the linkages between trade interdependence and political relations at the dyad level have weakened in the current era of globalization because of the changing incentives that state and private actors face. While governments today still have substantial control over economic actors and retain considerable autonomy over how to respond to market pressures and interest group demands, the ‘development of a global economy with low trade barriers, capital mobility, and multinational firms has constrained the ability of states to direct trade or investment flows to meet national goals’ (p. 631).

Most governments today (or in the period under investigation in this thesis) – including China’s – are also party to the WTO dispute settlement mechanism where they can face potential challenges and retaliation for imposing unilateral trade policies over political

differences. Together, trade rules and capital mobility raise the costs of unilateral government actions to restrict commerce (ibid.). Additionally, as more countries liberalise their economies, governments that are competing for foreign investment must face the prospect of losing the confidence of foreign investors if they are seen to engage in politicised economic policies like impeding trade in response to political conflict (ibid.).
The responsiveness of private firms engaged in international trade to changes in political relations may also be weakened in the current era of globalization. This is because firms' export and import decisions may be influenced significantly by the consideration of 'sunk costs' of engaging in international trade (Baldwin 1988, Dixit 1989, Roberts and Tybout 1997, cited in Davis and Meunier 2011, p. 631). These sunk costs include for the case of both exporting and importing firms the cost of acquiring market information and developing supply chain networks spanning across different countries (ibid.). Once firms have established exports to or imports from a particular market, changing trade partners is not easy because expanding to new partners may involve bearing the sunk costs again (ibid.). Foreign direct investment bears even higher sunk costs because it involves the duplication of facilities (Helpman et al 2004, cited in Davis and Meunier 2011, p. 631).

Firms engaged in intra-industry trade face additional sunk costs of shifting trading partners irrespective of industry adjustment at the national level because they tend to operate in markets that are not perfectly competitive (Helpman and Krugman 1994, p. 141, Gilligan 1997, p. 462, cited in Davis and Meunier 2011, p. 631). Such markets rely on relational contracts rather than market exchanges making it more difficult for firms to switch suppliers. The role of intra-industry trade on the linkages between trade and politics is increasingly relevant as intra-industry trade as a share of global trade has grown substantially in the post-Cold War era. These sunk costs mean that private firms that engage in international trade are discouraged from shifting economic activity to different countries in the event of political changes.

Rather, it might be the case that firms evaluate political stability between their home country and prospective trading partners at the time of the initial investment based on observable characteristics such as alliance relations (Davis and Meunier 2011, p. 631).

However, once the initial investment has been made, '[s]ubsequent events affecting expectations of hostile political climate are discounted given the sunk cost in existing economic relations. Hence, weakening alliance ties or animosity between rivals would not produce a parallel shift in economic ties' (ibid.).

The growth of multinational firms as a share of the global economy may also reduce the likelihood that political changes have a strong impact on economic outcomes such as trade interdependence (Davis and Meunier 2011, p. 632). Multinational firms that are part of global production networks (GPNs) will face costs in searching for and dealing with alternate suppliers of sub-contract components, and firms that sell to their own foreign affiliates have little incentive to punish their own subsidiaries (ibid.). Moreover, GPNs make it difficult for consumers to identify the national origin of different goods as most leading brands around the world are increasingly attached to goods made elsewhere. Firms may also hide the national identification of goods from consumers through the use of manipulative advertisement strategies catered to local tastes and preferences (ibid.).

As discussed earlier, authors like Pollins (1989, 1989a) contend that consumer behaviour can be influenced by political relations between their home country and importing partners. However, Davis and Meunier (2011) argue that consumers too face sunk costs in purchasing decisions and are therefore reluctant to change their behavior[u]r in the face of political tensions' (p.632). Consumers face costs in acquiring information about different products and may develop 'brand loyalty' or 'product attachment', making it less likely for them to participate in consumer boycotts (Kotler 2002, Klein et al 2004, cited in Davis and Meunier p. 632). Collective action problems may also lower the impact of consumers boycotts even if consumers agree with the political message. While some consumers may perceive their actions to be too small a contribution to make any significant difference on foreign policy, others may believe they can free ride on the boycott actions of other consumers (ibid.).

2.5 The accidental deviations hypothesis: let bygones be bygones?

Most studies that investigate the trade-conflict relationship consider the impact of high-intensity conflict episodes that involve military confrontation. However, recent studies have shown that a significant proportion of interaction between state actors is of moderate intensity (Pinker 2011, Heilmann 2016). Du et al. (2017) find that the effects of moderate shocks in political conflict on trade for the case of China and major trading partners between 1993-2013 tend to be short-lived, lasting in the order of months rather than years. Du et al. (2017, p. 212) argue that there are ‘sound theoretical reasons’ to expect that such effects are short-lived, describing the dynamics between trade and conflict as an infinitely repeated game with a Pareto perfect equilibrium (that is none of the players have any incentive to deviate from their strategies) in which bilateral relations consist of a “combination of healthy trade and peaceful political relations”.

In this context, moderate shocks in political relations can be understood as ‘accidental’ deviations from the equilibrium and players have an incentive to re-negotiate and settle disputes to return to the earlier Pareto superior combination of trade and peace. Du et al. (2017) do not present a formal theoretical model of trade and conflict, writing in a footnote that, “[t]he classic reference that analyses the relationship between trade and political conflict within a microeconomic setting is Polachek (1980) … [h]is model, however, is inherently static. We are unaware of a dynamic, game-theoretic version.” (p. 212).

A key assumption of the accidental deviation hypothesis is that countries negotiate during periods of escalating conflict. Re-negotiation implies that in the case that one country was to deviate from cooperation followed by both countries not cooperating thereafter, both countries would have an incentive to negotiate back to the superior cooperation equilibrium. Farrell and Maskin (1987, p.2) argue that when the continuation payoffs from the cooperation are larger than the continuation payoffs from defection, countries have an incentive to ‘let bygones be bygones’ (p.2) are return to a cooperation equilibrium. Van Damme (1989) shows that for prisoner dilemma type games, the grim-trigger strategy is not “re-negotiation proof” because the continuation payoff with both players cooperating dominates the continuation payoff with both players defecting. Instead, a ‘forgiving’ grim-trigger strategy is re-negotiation proof, with the defecting country first returning to a cooperation strategy as a signal for trading partners to follow suit.

3 Theoretical framework

This section builds on Polachek and Seiglie (2007), which models the trade-conflict relationship as a static optimisation problem in which countries maximise welfare subject to certain constraints. The microeconomic framework is extended into a normal-form game to allow for strategic interaction between countries and conditions are derived under which the game resembles a Prisoner's Dilemma (PD) form. The discount factor required to maintain cooperation is derived in an infinitely repeated game setting.

3.1 Setup

Following Polachek and Seiglie (2007), country preferences are represented by an aggregate social welfare function over the consumption of two goods, c_1 and c_2, that are produced in a two-country world, denoted by the home country (subscript h) and the foreign country (subscript f). Both home and foreign countries can initiate conflict towards the opposing country with the level of intensity of conflict denoted by z_h and z_f. Formally, the home country seeks to maximize its welfare,

$$w_h = w_h(c, z), \qquad \ldots (2.1)$$

with $c = \{c_1, c_2\}$ and $z = \{z_h, z_f\}$. Higher consumption of both goods entails greater welfare. Moreover, preferences for the level of conflict to achieve outcomes deemed important by a country generate a derived demand for it. Increased conflict by trading partners is assumed to reduce welfare. That is,

$$\frac{\partial w_h}{\partial c_1} \geq 0; \ \frac{\partial w_h}{\partial c_2} \geq 0; \frac{\partial w_h}{\partial z_h} \geq 0; \frac{\partial w_h}{\partial z_f} \leq 0 \qquad \ldots (2.2)$$

In a one-period world, the budget constraint for the home country is given by,

$$p_1c_1 + p_2c_2 + p_{z_h}z_h = p_1q_1 + p_2q_2 \qquad \ldots \quad (2.3)$$

where p_1, p_2 and $p_{z_h}$are the prices of good 1, good 2 and conflict for the home country, and q_1 and q_2 are the quantities of goods 1 and 2 produced domestically in the home country. The price of conflict p_{z_h} reflects the amount of revenue required to produce 1 unit of conflict and $p_{z_h}z_h$ is the 'direct cost of conflict' for the home country. The home country is assumed to be the natural exporter of good 1 and the natural importer of good 2. Substituting $x_1 = q_1 - c_1$ and $m_2 = q_2 - c_2$ into Equation (2.3) gives,

$$p_1x_1 + p_2m_2 = p_{z_h}z_1 \qquad \ldots \text{ (2.4)}$$

where x_1 is the quantity of exports of good 1 by the home country and m_2 is the quantity of imports of good 2 by the home country. The static optimisation problem for the home country is,

$$L \ = w_h(c_1, z_h, z_f) \ + \ \lambda_1(p_1x_1 + p_2m_2 - p_{z_h}z_h) \qquad \ldots \quad (2.5)$$

That is the home country chooses optimal levels of consumption and conflict towards the foreign country, given levels of trade and conflict by the foreign country towards the home country.

3.2 The terms-of-trade hypothesis

As put by Polachek and Seiglie (2007), 'conflict directed towards the other country reduces or has no impact on the price the country obtains for its export commodity and increases or has no impact on the price the country pays for its imported goods. Greater conflict by the actor towards the target requires the actor to reduce the price of their exports to induce them to purchase the good and leads to them being charged a higher price for the imports from the target country.' (p. 1025).

Pollins (1989, 1989a) justifies this assumption by arguing 'that importers [and exporters] include political as well as economic objectives in their utility functions, and it is these multiple (and possibly conflicting) objectives that they seek to maximize subject to constraints' (Pollins 1989, p. 738). These conflicting objectives lead to import and export decisions being affected by 'purposive attempts by trading partners to alter economic ties in lieu of political objectives, the general foreign policy orientation or political alignment of the importer vis-a-vis the exporter, and the recent status of relations, that is, the climate of friendliness or hostility that exists between the importer and exporter' (ibid, p. 739).

Formally, following Polachek and Seiglie (2007), conflict by both countries is assumed to affect prices as follows,

$$\frac{\partial p_1}{\partial z_h} \leq 0, \frac{\partial p_2}{\partial z_h} \geq 0, \qquad \ldots \text{ (2.6a)}$$

Equation (2.6a) states that an increase in conflict by the home country either decreases (increases) or has no impact on the price of home country exports (imports), that is an increase in conflict by the home country results in a deterioration in the home country's terms-of-trade. While Polachek and Seglie (2007) also present Equation (2.6a), they do not consider the effect of an increase in conflict by the foreign country separately. In this study, an increase in conflict by the foreign country is hypothesised to lead to a deterioration in the foreign country's terms-of-trade. That is,

$$\frac{\partial p_1}{\partial z_f} \geq 0, \frac{\partial p_2}{\partial z_f} \leq 0, \qquad \ldots \text{ (2.6b)}$$

Equation (2.6b) states that an increase in conflict by the foreign country either increases (decreases) or has no impact on the price of home country exports (imports), that is an increase in conflict by the foreign country results in an improvement in the home country's terms-of-trade. For a given level of z_f, the marginal net benefit for the home country due to an increase in the level of conflict (dz_h) is given by,

$$\frac{dL}{dz_h} = \left\{\left(\frac{\partial w_h}{\partial z_h}\right) + \lambda_h\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_h} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_h} - p_{z_h}\right]\right\} dz_h \qquad \ldots \ (2.7)$$

where λ_h is the marginal welfare of income of the home country. The individual components of Equation (2.7) can be interpreted as follows. The first term $\frac{\partial w_h}{\partial z_h}$ is the marginal benefit of conflict to the home country attributable to non-economic factors. The first bracketed term $\lambda_h\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_h}$ is the trade-related marginal cost of conflict for the home country attributable to lower export revenues arising to lower export prices. The greater the ability of the foreign country to reduce export prices in response to higher conflict by the home country, the higher will be the trade-related marginal cost of conflict for the home country.

The trade-related marginal costs of conflict for the home country attributable to lower export revenues in turn has two components. The first term $\lambda_h x_1\left(\frac{\partial p_1}{\partial z_h}\right)$ is the marginal cost attributable to lower export prices, while the second term $\lambda_h p_1\left(\frac{\partial x_1}{\partial p_1}\right)\left(\frac{\partial p_1}{\partial z_h}\right)$ is the marginal benefit attributable to an increase in exports due to a price decrease, where $\frac{\partial x_1}{\partial p_1}$ is the derivative of exports with respect to export prices. A larger derivative exports therefore reduces the export revenue losses for the home country during periods of higher conflict.

The second bracketed term $\lambda_h\left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_h}$ is the indirect marginal cost of conflict for the home country attributable to higher import expenditures arising due to higher import prices. The greater the ability of the foreign country to increase import prices in response to higher conflict by the home country, the higher will be the trade-related marginal cost of conflict for the home country.

The marginal costs of conflict attributable to higher import expenditures in turn has two components. The first term $\lambda_h m_2\left(\frac{\partial p_2}{\partial z_h}\right)$ is the marginal cost of higher conflict attributable to higher import prices, while the second term $\lambda_h p_2 \left(\frac{\partial m_2}{\partial p_2}\right)\left(\frac{\partial p_2}{\partial z_h}\right)$ is the marginal benefit due to a reduction in imports due to price increases, where $\frac{\partial m_2}{\partial p_2}$ is the derivative of imports with respect to import prices. A larger derivative therefore reduces import expenditures for the home country during periods of higher conflict.

Altogether, the latter two bracketed terms $\lambda_h \left(x_1 + p_1 \left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_h}$ and $\lambda_h \left(m_2 + p_2 \left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_h}$ represent the total trade-related marginal cost to the home country of higher conflict. Lastly, the final bracketed term $\lambda_h p_{z_h}$ is the marginal cost of conflict for the home country attributable to the opportunity costs of resources diverted towards conflict from other productive uses.

Similarly, for a given level of z_h , the marginal net benefit for the home country from a marginal increase in the foreign country's level of conflict $\left(dz_f\right)$ is given by,

$$\frac{dL}{dz_f} = \left\{\left(\frac{\partial w_h}{\partial z_f}\right) + \lambda_h \left[\left(x_1 + p_1 \left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_f} + \left(m_2 + p_2 \left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_f}\right]\right\} dz_f \qquad \ldots \; (2.8)$$

The individual components of Equation (2.8) can be interpreted as follows. The first term $\frac{\partial w_1}{\partial z_f}$ is the marginal cost of conflict for the home country due to higher conflict by the foreign country attributable to non-economic factors. The first bracketed term $\lambda_h \left(x_1 + p_1 \left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_f}$ is the indirect marginal benefit of conflict by the foreign country for the home country attributable to higher export revenues arising due to higher export prices. The greater the ability of the home country to increase export prices in response to higher conflict by the foreign country, the greater will be the indirect marginal benefit for the home country due to increased conflict by the foreign country.

The marginal benefits to the home country of higher export prices due to higher conflict by the foreign country has two components. The first term $\lambda_h x_1 \left(\frac{\partial p_1}{\partial z_f}\right)$ is the marginal benefit attributable to higher export prices, while the second term $\lambda_h p_1 \left(\frac{\partial x_1}{\partial p_1}\right)\left(\frac{\partial p_1}{\partial z_f}\right)$ is the marginal cost attributable to a decrease in exports due to a price increase, where $\frac{\partial x_1}{\partial p_1}$ is the derivative of exports with respect to export prices. The larger the derivative, the lower the ability of the home country to realise the welfare gains attributable to higher export prices during periods of higher conflict by the foreign country.

The second bracketed term $\lambda_1\left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_f}$ is the marginal benefit to the home country of higher conflict by the foreign country attributable to lower import expenditures arising due to lower import prices. The greater the ability of the home country to decrease import prices in response to higher conflict by the foreign country, the higher will be this component of marginal benefit for the home country. The marginal benefits of lower import prices due to higher conflict by the foreign country in turn has two components.

The first term $\lambda_1 m_2\left(\frac{\partial p_2}{\partial z_x}\right)$ is the marginal benefit attributable to lower import prices, while the second term $\lambda_1 p_2\left(\frac{\partial m_2}{\partial p_2}\right)\left(\frac{\partial p_2}{\partial z_f}\right)$ is the marginal cost due to a increase in imports due to a price decrease, where $\frac{\partial m_2}{\partial p_2}$ is the derivative of imports with respect to import prices. The larger the derivative, the lesser the ability of the home country to realise the welfare gains attributable to lower import prices. The latter two bracketed terms $\lambda_1\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_f}$ and $\lambda_1\left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_f}$ together represent the trade-related marginal benefits to the home country of higher conflict by the foreign country.

3.3 Payoffs in the stage game

Using the effects of increases in conflict by the home and foreign country, the strategic interaction of countries over time can be expressed as an optimisation problem in a normal-form game. Assume that each of the two countries can play one of two strategies, low conflict (denoted by z_h and z_f for the home and foreign country respectively) or high conflict (denoted by $z_h + dz_\mathrm{h}$ and $z_f + dz_f$). The payoff matrix for the stage game is displayed in Figure 2-1.

Let the payoff to the home for the strategy space $(z_\mathrm{h}, z_\mathrm{f})$, referred to hereafter as the 'low-conflict' equilibrium be given by,

$$\pi_h^* = w_h \qquad \text{… (9)}$$

Using Equations (2.7), (2.8) and (2.9), I express the payoffs as functions of the underlying micro-economic variables. Formally, the payoff to the home country from deviating from the low-conflict equilibrium, that is, into? the strategy space $(z_h + dz_h, z_f)$, is given by,

		Foreign country	
		z_f	$z_f + dz_f$
Home country	z_h	π_h^*, π_f^*	d_h^*, d_f
	$z_h + dz_h$	d_h, d_f^*	π_h, π_f

Figure 2.1: The trade-conflict stage game

$$d_h = w_h + \left\{\left(\frac{\partial w_h}{\partial z_h}\right) + \lambda_h\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_h} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_h} - p_{z_h}\right]\right\} dz_h \qquad \text{… (2.10)}$$

Similarly, the payoffs to the home country for deviating into the remaining strategy spaces (d_h^* and π_h) are,

$$d_h^* = w_h + \left\{\left(\frac{\partial w_h}{\partial z_f}\right) + \lambda_h\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_f} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_f}\right]\right\} dz_f \qquad \text{… (2.11)}$$

$$\pi_h = w_h + \left\{\left(\frac{\partial w_h}{\partial z_h}\right) + \lambda_1\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_h} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_h} - p_{z_h}\right]\right\} dz_h +$$
$$\left\{\left(\frac{\partial w_1}{\partial z_f}\right) + \lambda_h\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_f} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_f}\right]\right\} dz_f \qquad \text{… (2.12)}$$

3.4 Conditions for Prisoner's Dilemma game

For the stage game represented in Figure 2.1 to take the form of a Prisoner's Dilemma (PD) game, the payoffs for the home country must be ordered such that: $d_h > \pi_h^* > \pi_h > d_h^*$. Assuming $dz_h = dz_f$ for the rest of the analysis, the first condition for the game to take a PD form ($d_h > \pi_h^*$) implies,

$$\left(\frac{\partial w_1}{\partial z_h}\right) > -\lambda_h \left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_h} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_h} - p_{z_h}\right] \quad \ldots (2.13)$$

Equation (2.13) states that for the stage game to take a PD form, the marginal benefit to the home country due to higher conflict must be greater than the marginal costs of higher conflict (that is including trade and non-trade related costs). If this condition is not met, the payoff from deviation to the home country is lower than the payoff from a low-conflict equilibrium making low-conflict a dominant strategy for the home country. In this case, the home country would play low conflict regardless of what the foreign country plays.

The second condition for the game to take a PD form ($\pi_h^* > \pi_h$) implies,

$$\left(\frac{\partial w_h}{\partial z_h}\right) + \lambda_h \left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_h} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_h} - p_{z_h}\right] <$$
$$-\left\{\left(\frac{\partial w_h}{\partial z_f}\right) + \lambda_h \left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_f} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_f}\right]\right\} \quad \ldots (2.14)$$

Equation (2.14) states that for the stage game to take a PD form, the net marginal benefit to the home country from deviation has to be less than the net marginal benefit of a high-conflict equilibrium. If this condition is not met, the payoff from a high-conflict equilibrium to the home country is greater than the payoff from a low-conflict equilibrium making high-conflict a dominant strategy for the home country. In this case, the home country would play high conflict regardless of what the foreign country plays.

The third condition for the game to take a PD form ($\mathrm{d}_h > \pi_h$) implies,

$$-\left(\frac{\partial w_1}{\partial z_f}\right) > \lambda_h \left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_f} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_f}\right] \qquad \text{… (2.15)}$$

Equation (2.15) states that for the stage game to take a PD form, the conflict-related marginal cost to the home country due to higher conflict by the foreign country has to be greater than the trade-related marginal benefit. If this condition is not met, the payoff from a high-conflict equilibrium to the home country is greater than the payoff from a low-conflict equilibrium making high-conflict a dominant strategy for the home country. In this case, the home country would play high conflict regardless of what the foreign country plays. The derivations for Equations (2.13)-(2.15) are provided in the Appendix A.1.

3.5 Cooperation in an infinitely repeated PD game

Assuming that countries have some positive probability that the game will continue, we can model the game as one that is infinitely repeated. In an infinitely repeated setting, several Pareto-improving outcomes can be realised even if defection is a dominant strategy in the stage game. Let the welfare accrued by the home country from the infinitely-repeated game be given by,

$$w_h = (1 - \delta_h)\sum_{t=0}^{\infty} \delta_h^t w_{ht} \qquad \text{... (2.16)}$$

where, w_{ht} is the welfare of the home country at time *t* and δ_h is the discount factor of the home country. A grim trigger strategy would constitute a Sub-game Perfect Nash Equilibrium (SPNE) of the game if and only if the equilibrium payoff from cooperation in each stage is at least as large as the payoff from defecting in stage *k* and ever thereafter. That is,

$$\Rightarrow (1-\delta_h)\sum_{t=0}^{\infty}\delta_h^t w_h(c_h, z_h, z_f)$$

$$\geq (1-\delta_h)\left[\sum_{t=0}^{k-1}\delta_h^t w_h(c_h, z_h, z_f) + \delta_h^k w_h(c_h, z_h + dz_h, z_f)\right.$$

$$\left. + \sum_{t=k+1}^{\infty}\delta_h^t w_h(c_h, z_h + dz_h, z_f + dz_f)\right] \qquad \text{... (2.17)}$$

Rearranging to obtain the minimum discount factor,

$$\delta_h \geq \frac{w_h(c_h, z_h + dz_h, z_f) - w_h(c_h, z_h, z_f)}{w_h(c_h, z_h + dz_h, z_f) - w_h(c_h, z_h + dz_h, z_f + dz_f)}$$

$$\Rightarrow \ \delta_h \ \geq \ \frac{d_h - \pi_h^*}{d_h - \pi_h} \qquad \text{… (2.18)}$$

Substituting in expressions for d_h, π_h^*, π_h gives,

$$\delta_h \ \geq \ \frac{w_h + \left\{\left(\frac{\partial w_h}{\partial z_h}\right) + \lambda_h\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_h} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_h} - p_{z_h}\right]\right\}dz_h - w_h}{\begin{array}{c} w_h + \left\{\left(\frac{\partial w_h}{\partial z_h}\right) + \lambda_h\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_h} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_h} - p_{z_h}\right]\right\}dz_h \\ - \left(\begin{array}{c} w_h + \left\{\left(\frac{\partial w_h}{\partial z_h}\right) + \lambda_h\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_h} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_h} - p_{z_h}\right]\right\}dz_h + \\ \left\{\left(\frac{\partial w_h}{\partial z_f}\right) + \lambda_h\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_f} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_f}\right]\right\}dz_f \end{array}\right) \end{array}}$$

$$\therefore \ \delta_h \ \geq \ \frac{\left\{\overbrace{\left(\frac{\partial w_h}{\partial z_h}\right)}^{\substack{\text{Marginal benefit of} \\ \text{higher conflict by the} \\ \text{home country due to} \\ \text{non-economic factors}}} + \lambda_h\left[\overbrace{\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_h}}^{\substack{\text{Marginal cost of higher} \\ \text{conflict by the home} \\ \text{country attributable to} \\ \text{lower export prices}}} + \overbrace{\left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_h}}^{\substack{\text{Marginal cost of higher} \\ \text{conflict by the home} \\ \text{country attributable to} \\ \text{higher import prices}}} \overbrace{- p_{z_h}}^{\substack{\text{Marginal cost of} \\ \text{higher conflict by the} \\ \text{home country due to} \\ \text{re-allocation of} \\ \text{resources to defence}}}\right]\right\}dz_h}{\left\{-\underbrace{\left(\frac{\partial w_1}{\partial z_f}\right)}_{\substack{\text{Marginal cost of higher} \\ \text{conflict by the foreign} \\ \text{country due to non-} \\ \text{economic factors}}} - \lambda_h\left[\underbrace{\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_f}}_{\substack{\text{Marginal benefit of higher} \\ \text{conflict by the foreign} \\ \text{country attributable to} \\ \text{higher export prices}}} + \underbrace{\left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_f}}_{\substack{\text{Marginal benefit of higher} \\ \text{conflict by the foreign} \\ \text{country attributable to lower} \\ \text{import prices}}}\right]\right\}dz_f} \qquad \text{… (2.19)}$$

Equation (2.19) shows the different factors that drive the minimum discount factor required for the home country to sustain cooperation via a grim-trigger strategy. In the numerator are four terms. The first term is the marginal benefit to the home country of higher conflict towards the foreign country attributable to non-economic factors. An increase in this term increases the minimum discount factor required to sustain cooperation for the home country.

The second and third terms in the numerator are the trade-related marginal costs of higher conflict by the home country attributable to lower export revenues and higher imports expenditures, respectively. An increase in these terms reduces the minimum discount factor required to sustain cooperation for the home country. The final term in the numerator is the marginal cost to the home country of higher conflict towards the foreign country attributable to a diversion of resources from other productive uses. An increase in this term reduces the minimum discount factor required to sustain cooperation for the home country.

In the denominator are three terms. The first term is the direct marginal cost to the home country of higher conflict by the foreign country attributable to non-economic factors. An increase in this term reduces the minimum discount factor required to sustain cooperation for the home country. The second and third terms in the numerator are the marginal benefits to the home country of higher conflict by the foreign country attributable to higher export revenues and lower imports expenditures, respectively. An increase in these terms increases the minimum discount factor required to sustain cooperation for the home country.

4 Propositions on the effects of trade on conflict

This section demonstrates that several alternative hypotheses on the effects of trade on conflict emerge as special cases within the conceptual framework discussed so far. Particularly, three alternative hypotheses can be generated by varying the relative ability of countries to alter terms-of-trade in response to conflict by trading partners. It is to be noted that all the propositions are under the assumption that the only way for countries to retaliate to increased conflict by partners is through manipulating the terms-of-trade. First, the ‘globalisation hypothesis’ that trade and conflict are unrelated occurs when countries cannot alter terms-of-trade in response to conflict by trading partners. Second, the ‘commercial-peace hypothesis’ that higher trade flows reduce conflict occurs when trading partners have symmetric abilities to alter terms-of trade in response to conflict. Third, the ‘trade dependency hypothesis’ that higher trade flows increase the likelihood of conflict occurs when countries trading partners have asymmetric abilities to alter the terms-of-trade in response to conflict. Fourth, allowing for re-negotiation between countries during episodes of increasing conflict suggests that the ‘accidental-deviation’ hypothesis, in which the relationship between trade and political conflict is short-lived, can also be accommodated within this framework.

4.1 The globalisation hypothesis

Proposition 1: No relationship exists between trade and political conflict when countries cannot shift terms-of-trade in response to increased conflict by trading partners.

Proof: When countries cannot shift terms-of-trade in response to conflict by trading partner,

$$\frac{\partial p_1}{\partial z_h} = \frac{\partial p_2}{\partial z_h} = \frac{\partial p_1}{\partial z_f} = \frac{\partial p_2}{\partial z_f} = 0 \qquad \ldots (2.20)$$

Setting $dz_h = dz_f$, Equation (2.19) simplifies to,

$$\delta_h \geq \frac{\left(\frac{\partial w_h}{\partial z_h}\right)}{-\left(\frac{\partial w_h}{\partial z_f}\right)} \qquad \ldots (2.21)$$

Equation (2.21) states that the level of trade has no effect on the discount factor required for the home country to stick to the grim-trigger strategy. In other words, when countries have limited ability to alter terms-of-trade in response to partner conflict then rising levels of trade have no effect on conflict. As discussed earlier, the lack of countries' ability to alter terms-of-trade can depend on several factors including existing trade barriers, capital mobility, relationship-specific sunk costs of private firms, and free-rider issues related to consumer boycotts (Davis and Meunier, p. 631).

4.2 The commercial-peace hypothesis

Proposition 2: Higher levels of trade reduce the minimum discount factor required to sustain a cooperative grim-trigger strategy as an SPNE if both countries have symmetric abilities to alter the terms-of-trade in response to higher levels of conflict by trading partners.

Proof: For analytical tractability, assume $\frac{\partial x_1}{\partial p_1} = \frac{\partial m_2}{\partial p_2} = 0$. Setting $dz_h = dz_f$, Equation (2.19) simplifies to,

$$\delta_h \geq \frac{\left(\frac{\partial w_h}{\partial z_h}\right)+\lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_h}\right)+m_2\left(\frac{\partial p_2}{\partial z_h}\right)-p_{z_h}\right]}{-\left(\frac{\partial w_h}{\partial z_f}\right)-\lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_f}\right)+m_2\left(\frac{\partial p_2}{\partial z_f}\right)\right]} \qquad \ldots (2.22)$$

To evaluate the effects of increasing trade on conflict, we need to investigate the first derivative of the discount factor with respect to exports $\left(\frac{\partial \delta_h}{\partial x_1}\right)$. Formally, it can be shown that,

$$\frac{\partial \delta_h}{\partial x_1} = \frac{-\lambda_1\left(\frac{\partial w_h}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right)+\lambda_h^2 m_2\left[\left(\frac{\partial p_2}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right)-\left(\frac{\partial p_2}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right)\right]+\lambda_h\left(\frac{\partial w_h}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right)-\lambda_h^2 p_{z_h}\left(\frac{\partial p_1}{\partial z_f}\right)}{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right)-\lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_f}\right)+m_2\left(\frac{\partial p_2}{\partial z_f}\right)\right]\right\}^2} \qquad \ldots (2.23)$$

Symmetric ability of both countries to alter terms of trade in response to partner conflict implies,

$$\frac{\partial p_1}{\partial z_h} = -\frac{\partial p_1}{\partial z_f}, \frac{\partial p_2}{\partial z_h} = -\frac{\partial p_2}{\partial z_f} \quad \ldots (2.24)$$

Under these set of conditions, $\frac{\partial \delta_h}{\partial x_1}$ simplifies to,

$$\frac{\partial \delta_h}{\partial x_1} = \frac{\lambda_1\left[\left(\frac{\partial w_h}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right) - \left(\frac{\partial w_h}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right)\right] - \lambda_h{}^2\left[p_{z_h}\left(\frac{\partial p_1}{\partial z_f}\right)\right]}{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right) - \lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_f}\right) + m_2\left(\frac{\partial p_2}{\partial z_f}\right)\right]\right\}^2} \quad \ldots (2.25)$$

For increasing exports to reduce the likelihood of conflict, $\frac{\partial \delta_h}{\partial x_1}$ has to be less than zero. In this case Equation (2.25) simplifies to,

$$\left(\frac{\partial w_h}{\partial z_h}\right) - \lambda_h p_{z_h} < \left(-\frac{\partial w_h}{\partial z_f}\right) \quad \ldots (2.26)$$

Equation (2.26) states that in the context of symmetric trade relations, for increasing exports to lead to a decrease in the likelihood of conflict by the home country, the net marginal benefits (that is non-economic benefits minus trade-related costs) from higher conflict by the home country must be less than the non-economic costs of higher conflict by the foreign country. Equation (2.26) is a restricted form of Equation (2.14), which is an initial assumption for the game to take a Prisoner Dilemma (PD) form $(\pi_h^* > \pi_h)$. This implies that Equation (2.26) is always true, completing the proof that increasing exports lead to a decrease in the minimum discount factor for the home country required to sustain cooperation when countries have symmetric abilities to alter the terms of trade in response to higher conflict by trading partners. The derivations for Equations (2.23) and (2.25) are provided in the Appendix A.2.

Similarly, for increasing imports to deter conflict, we need to investigate the first derivative of the discount factor with respect to imports. That is,

$$\frac{\partial\delta_h}{\partial m_2} = \frac{\lambda_h\left[\left(\frac{\partial w_h}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right) - \left(\frac{\partial w_h}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right)\right] - {\lambda_h}^2\left[\left(\frac{\partial p_2}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right) - \left(\frac{\partial p_2}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right)\right]x_1 - {\lambda_h}^2\left[p_{z_h}\left(\frac{\partial p_1}{\partial z_f}\right)\right]}{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right) - \lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_f}\right) + m_2\left(\frac{\partial p_2}{\partial z_f}\right)\right]\right\}^2} \qquad \ldots (2.27)$$

Under symmetric trade relations, $\frac{\partial\delta_h}{\partial m_2}$ simplifies to,

$$\frac{\partial\delta_h}{\partial m_2} = \frac{\lambda_h\left[\left(\frac{\partial w_h}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right) - \left(\frac{\partial w_h}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right)\right] - {\lambda_h}^2\left[p_{z_h}\left(\frac{\partial p_1}{\partial z_f}\right)\right]}{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right) - \lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_f}\right) + m_2\left(\frac{\partial p_2}{\partial z_f}\right)\right]\right\}^2} \qquad \ldots (2.28)$$

For increasing imports to reduce the likelihood of conflict, $\frac{\partial\delta_h}{\partial m_2}$ has to be less than zero. That is,

$$\left(\frac{\partial w_h}{\partial z_h}\right) - \lambda_h p_{z_h} < -\left(\frac{\partial w_h}{\partial z_f}\right) \qquad \ldots (2.29)$$

Equation (2.29) is equivalent to Equation (2.26), which is an initial assumption required for the game to take a PD form. This completes the proof that increasing imports lead to a decrease in the minimum discount factor required for the home country to sustain cooperation when countries have symmetric abilities to alter the terms of trade in response to higher conflict by trading partners. The derivation for Equations (2.27)-(2.29) is provided in the Appendix A.2.

4.3 The dependency hypothesis

Proposition 3: Higher levels of trade increase (decrease) the minimum discount factor required to sustain a cooperative grim-trigger strategy as an SPNE for the dominant (weaker) country if countries have asymmetric abilities to alter the terms-of-trade in response to higher levels of conflict by trading partners.

Proof: Let the home country be the dominant partner and the excess ability of the home country to alter the terms of trade relative to foreign country be some fixed amount (γ_h),

$$\gamma_h = \lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_f}\right) + m_2\left(\frac{\partial p_2}{\partial z_f}\right)\right] - \lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_h}\right) + m_2\left(\frac{\partial p_2}{\partial z_h}\right)\right] > 0 \qquad \text{… (2.30)}$$

Using Equation (2.22), Equation (2.30) can be expressed as,

$$\delta_h \geq \frac{\left(\frac{\partial w_h}{\partial z_h}\right)+\lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_h}\right)+m_2\left(\frac{\partial p_2}{\partial z_h}\right)-p_{z_h}\right]}{-\left(\frac{\partial w_h}{\partial z_f}\right)-\gamma_h+\lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_h}\right)+m_2\left(\frac{\partial p_2}{\partial z_h}\right)\right]} \qquad \text{… (2.31)}$$

For increasing exports to deter conflict, we need to investigate the first derivative of the discount factor with respect to exports $\left(\frac{\partial \delta_h}{\partial x_1}\right)$. Formally, it can be shown that,

$$\frac{\partial \delta_h}{\partial x_1} = \frac{\left(-\left(\frac{\partial w_h}{\partial z_f}\right)-\gamma_h-\left(\frac{\partial w_h}{\partial z_h}\right)+p_{z_h}\right)\left(\lambda_h\left(\frac{\partial p_1}{\partial z_h}\right)\right)}{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right)-\gamma_h+\lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_h}\right)+m_2\left(\frac{\partial p_2}{\partial z_h}\right)\right]\right\}^2} \qquad \text{… (2.32)}$$

For increasing exports to reduce the likelihood of conflict, $\frac{\partial \delta_h}{\partial x_1}$ has to be less than zero. That is,

$$\frac{\partial \delta_h}{\partial x_1} = \frac{\left(-\left(\frac{\partial w_h}{\partial z_f}\right)-\gamma_h-\left(\frac{\partial w_h}{\partial z_h}\right)+p_{z_1}\right)\left(\lambda_1\left(\frac{\partial p_1}{\partial z_h}\right)\right)}{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right)-\gamma_h+\lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_h}\right)+m_2\left(\frac{\partial p_2}{\partial z_h}\right)\right]\right\}^2} < 0 \qquad \text{… (2.33)}$$

Because $\lambda_h\left(\frac{\partial p_1}{\partial z_h}\right)$ is always less than zero, Equation (2.31) can be re-written as,

$$\gamma_h < \left(-\frac{\partial w_h}{\partial z_f}\right) - \left(\frac{\partial w_h}{\partial z_h}\right) + \lambda_h p_{z_h} \qquad \text{… (2.34)}$$

Equation (2.34) is equivalent to Equation (2.26), which is an initial assumption required for the game to take a PD form. This completes the proof that increasing exports lead to an increase in the minimum discount factor required to sustain cooperation for the dominant partner under asymmetric trade relations. The derivation for Equation (2.32)-(2.34) is provided in Appendix A.2. A similar proof can be shown for imports.

4.4 The accidental deviations hypothesis: re-negotiation in repeated games

Du et al (2017, p.212) describe the dynamics between trade and conflict as an infinitely repeated game with a Pareto perfect equilibrium (that is none of the players have any incentive to deviate from their strategies) in which bilateral relations consist of a "combination of healthy trade and peaceful political relation". In this context, Du et al (2017, p.212) assert that moderate shocks in political relations can be understood as 'accidental' deviations from the equilibrium and players have an incentive to re-negotiate and settle disputes to return to the earlier Pareto superior combination of trade and peace.

It is often observed that countries are regularly involved in diplomatic negotiations with each other even during periods of escalating conflict. Re-negotiation implies that in the case that one country was to deviate from cooperation followed by both countries not cooperating thereafter, both countries would have an incentive to return to the cooperation equilibrium. Instead, '[t]hey [countries] might say to each other, [w]hy should we submit to this bleak prospect? Why not 'let bygones be bygones' and return to the original equilibrium path, which gives higher payoffs for us both?' (Farell and Maskin 1987, p.2). Farell and Maskin (1987) define a sub-game perfect Nash equilibrium of an infinitely repeated game as "re-negotiation-proof" if continuation payoffs of the SPNE are not Pareto dominated by other continuation payoffs. Van Damme (1989) shows that for prisoner dilemma type games, the grim-trigger strategy is not re-negotiation proof because the continuation payoff with both players cooperating dominates the continuation payoff with both players defecting.

However, following the "forgiving grim-trigger" strategy by both players is re-negotiation proof such that, "[e]ach player starts with cooperate and continues to play cooperatively as long as the other does so; If player *i* defects in period *t* (and player *j* does not), then player *j* will defect until player *i*, chooses to cooperate. As soon as player *i* has shown repentance by playing cooperate, player *j* forgives the initial defection and also returns to the cooperative mode of play" (Van Damme 1989, p. 211). Allowing for re-negotiation suggests that the relationship between trade and conflict may be short-lived. Higher conflict by one player in this context is met by retaliation though an increase in conflict by trading partners. However, as the aggressor withdraws to low-conflict, the trading partner also returns to a low-conflict strategy. For a formal treatment of re-negotiation in repeated games see Farell and Maskin (1987) and Van Damme (1989).

5 Estimating VAR models of trade and conflict

The theoretical framework constructed in this chapter formulates that the relationship between trade and conflict may run in both directions and depends on at least two other factors: 1) the relative terms-of-trade effects of conflict, and 2) bargaining conditions, particularly the presence of re-negotiation. When countries have insufficient market power to change terms-of-trade in response to conflict, there exists no relationship between trade and conflict; that is, the globalisation hypothesis. When market power is sufficient and equally distributed among countries, trade reduces conflict; that is, the commercial-peace hypothesis. In the presence of re-negotiation, countries have an incentive to return to Pareto-perfect levels of trade and conflict which suggests that the effects of shocks in political relations on trade, and vice vera, should be short-lived.

The question posed in this study is which of the hypotheses discussed is most consistent for the case of China and major trading partners between 1998-2018? Du et al (2017) suggest using a bilateral Vector Auto-Regression (VAR) framework to verify the nature of the trade-conflict relationship for the case of China and major trading partners. Their model is based on the gravity model of trade which posits that bilateral trade is proportional to the size of the two economies and inversely related to the geographical distance. VAR frameworks are widely used in the macroeconomics literature and are considered useful statistical devices to evaluate alternative models of the economy (Sims 1980, Cristiano 2012). A VAR framework is useful to estimate the trade-conflict relationship for two reasons. First, the VAR setup allows for the endogenous treatment of trade and political relations and mitigates reverse causality by simultaneously estimating both the effects of trade on conflict and the effects of conflict on trade.

Second, the VAR model generates Orthogonalised Impulse Response (OIR) functions that can be used to identify the effects of shocks in political relations on trade between countries. OIRs serve a statistical tool to evaluate three alternative hypotheses regarding the trade-conflict relationship. If we find that political shocks have neither short-term nor long-term effects on trade, this will provide evidence in favour of the globalisation hypothesis. Alternatively, OIRs that show that negative political shocks have only short-term term effects on trade would support the accidental deviations hypothesis. The terms-of-trade hypothesis would be supported by evidence of negative political shocks reducing trade in the long-term.

However, generating OIRs requires assumptions regarding the causal order of shocks in system variables. Du et al. (2017) use the *Choleski* decomposition method to order causal variables. The *Choleski* method is problematic because the number of models with valid identification assumptions rises exponentially with the number of variables (an n-variable model has *n!* models with valid identification assumptions) and model parameters are sensitive to these identification assumptions. For the 5-variable model (exports to China, political relations with China, bilateral real exchange rate, China and partner industrial production indices) estimated in Du et al. (2017) with political shocks being assumed as most exogenous, there are 24 alternative models with valid identification assumptions. Lacking a theoretical framework of the trade-politics relationship, Du et al. (2017) argue that their results are robust to alternative model specifications.

The framework presented in this chapter provides a theoretical basis for the following causal ordering of shocks and helps restrict the set of valid models: first, the terms-of-trade hypothesis suggest that an exogenous shock in political relations should result in a deterioration in the terms-of-trade of the conflict-initiating country. This suggests that the real exchange rate used as a proxy for terms-of-trade should be the next variable in the causal chain. Next, changes in terms-of-trade result in changes in trade patterns suggesting the import of export variable used to measure trade to be the next variable in the casual chain. Lastly, changes in trading patterns affect production, measured using industrial production indices, in both trading partners. Imposing this structure on the VAR model leaves only two models with valid identification assumptions, depending on whether China or the trading partners production index is considered most endogenous.

6 Conclusions

This chapter extends the micro-economic framework provided in Polachek and Seiglie (2007) to model the trade-conflict relationship as a two-country, two-good, infinitely repeated Prisoner's Dilemma game. Countries are assumed to maximise expected lifetime welfare and can choose one of two strategies, low-conflict, and high-conflict. When both countries choose low conflict, no country experiences any conflict-related welfare gains or losses and both countries gain from trade. Moving to a high-conflict strategy has both conflict-related welfare benefits and trade-related welfare costs for the conflict-initiating country (assuming the partner remains at a low-conflict strategy). Conversely, when trading partners choose a high-conflict strategy, the conflict-receiving country (with a low-conflict strategy) experiences conflict-related costs and trade-related welfare benefits. When both countries choose a high-conflict strategy, both countries experience conflict-related welfare benefits and costs, and trade-related welfare benefits and costs.

The magnitude of trade-related welfare losses due to higher conflict depends on three factors, First, the current volume and price of traded goods determine the total value of current trade and thus the magnitude of welfare gains that could be reduced due to conflict. *Ceteris paribus,* a higher total value of traded goods results in larger potential welfare losses for the conflict-initiating country. Second, trade-related welfare losses occur due to a deterioration of terms-of-trade changes as trading partners respond to higher conflict. As discussed, terms-of-trade changes can occur due to the actions of both state and private actors. *Ceteris paribus*, the greater the ability of trading partners to alter terms-of-trade in response to higher conflict, the greater the potential trade-related welfare losses for the conflict-initiating country.

Several factors can be argued to affect the ability of actors to alter prices in the global market, such as current market power in global markets, substitutability of goods, changing technologies, and changing demand preferences. However, these factors are assumed to be exogenous and not modelled explicitly. Third, potential trade-related welfare losses are affected by the price elasticity of trade. *Ceteris paribus*, a greater price elasticity of exports would offset the export revenue losses due to decreasing export prices due to higher conflict and thus lower the potential welfare losses. Similarly, a greater price elasticity of imports would offset the higher import expenditures due to import price increases and lower the potential welfare losses due to higher conflict.

In this context, conditions are derived under which the trade-conflict game takes a Prisoner's Dilemma (PD) form. Then, three theoretical propositions on the effects of trade on conflict are presented. First, trade has no effect on conflict when trading partners have limited ability to alter the terms of trade in response to conflict, that is the "globalisation hypothesis". Second, *ceteris paribus,* increasing trade between countries *reduces* the likelihood of conflict when countries have equal abilities to alter the terms of trade in response to conflict by trading partners, that is the "commercial-peace hypothesis". Third, *ceteris paribus,* increasing trade between countries *increases* the likelihood of conflict by the dominant trading partner and reduces the likelihood of conflict by the weaker trading partner when countries have an unequal ability to alter the terms of trade in response to conflict by trading partners, that is the "dependency hypothesis".

It has also been observed that countries are frequently involved in diplomatic negotiations during periods of increasing conflict (Du et al 2017). In the presence of re-negotiation, the trade-conflict relationship may be short-lived, with a forgiving grim-trigger strategy emerging as a Pareto perfect equilibrium (such that no country has an incentive to deviate). In this context, political shocks can be viewed as 'accidental' deviations from the equilibrium which are resolved quickly through diplomatic channels. The chapter provides a brief discussion of game-theoretical frameworks which allow the modelling for re-negotiations between players in repeated games that suggests that the 'accidental deviations hypothesis' can also be accommodated within the conceptual framework.

The conceptual framework constructed in this chapter aids the empirical investigation of the effects of political shocks on trade flows using VAR models. While VAR models can incorporate simultaneous relationships between variables, they require *apriori* assumptions regarding the causal ordering of shocks in variables (Sims 1980). Lacking a theoretical framework, empirical studies of the trade-conflict relationship that rely on VAR models use *Choleski* decomposition methods to estimate several alternative variations of the causal order (Du et al 2017, Lee 2018). However, estimates often defer for different orders and it is unclear which estimation results should be preferred.

The conceptual framework constructed in this chapter suggests the following ordering of variables: an exogenous shock in conflict between countries would have a causal effect on the terms-of-trade through the response of state or private actors. In turn, changes in the terms-of-trade would have a causal effect on trade flows which would affect consumption patterns of both countries. Using this causal ordering, VAR models of the trade-conflict relationship are estimated in later chapters of the thesis.

Chapter 3: Quantifying China's political relations: measurement and frequency

Abstract: This chapter constructs a *Political Relations Index (PRI)* to measure political relations from the perspective of Chinese state actors towards foreign state actors using newspaper events data from the Global Database of Events, Location and Tone (GDELT). The PRI series considers both cooperative and conflictual events and distinguishes between government and military actors. The series is also normalised to account for increasing media coverage and seasonal variations and filtered to remove trade-related events to mitigate the effect of trade negotiations on political relations. Du et al. (2017) suggest that empirical models of the effects of political conflict on trade should be aggregated at higher frequencies (monthly) because aggregation at lower frequencies (annually) can lead to inconsistent estimates especially if a large amount of variation in political relations occurs at high frequencies. Using visual, time-series and spectral density analysis, I verify that the largest amount of variation in the PRI series is observed at high frequencies suggesting that shocks in political relations tend to be short-lived.

1 Introduction

Unlike economic indicators such as trade flows, which are objectively quantifiable, political relations between countries are both difficult to define and measure. As discussed in Chapter 1, quantifying political relations among countries involves philosophical questions regarding the interaction between state and sub-state actors (Gasiorowski 1986). Conceptually, any quantitative indicator of bilateral political relations between countries should reflect the 'aggregate level of hostility [or cooperation] directed by one country toward another in all foreign policy issue areas' (Gasiorowski 1986, p. 25). Three quantitative indicators have been used widely in the literature to measure political cooperation and conflict: military disputes data, United Nations General Assembly (UNGA) voting data, and newspaper events data.

For reasons discussed in Chapter 1, this study uses events data to measure political relations between China and its major trading partners. In this chapter, I construct a Political Relations Index (PRI) for China and ten major trading partners between 1998 and 2018. The partners considered are Australia, France, Germany, Great Britain, India, Japan, Pakistan, Russia, South Korea, and the United States (US). Events data for the indices constructed in this study are sourced from the GDELT Database. The GDELT database extracts text sources from several global news agencies transforms them into event observations using the open-source Textual Analysis by Augmented Replacement Instructions (TABARI) machine-coding system and the Conflict and Mediation Event Observations (CAMEO) coding scheme. It is considered the most comprehensive of its kind (Leetaru and Schrodt 2012).

The underlying events considered in the construction of the PRI series are those events which include actions directed from foreign state actors towards Chinese state actors (Davis et al. 2019). The restriction on the direction of political relations aids the estimation of the effects of actions by foreign state actors towards Chinese state actors on bilateral trading relations. Arguably, including only events which contain state actors further removes pure business events from the PRI series and discards events with a country's non-ruling political opposition or sub-state actors which may not receive any reaction from governments (Davis et al. 2019, p. 11). Then, a trade-filtered PRI series is constructed which removes the effects of trade-related events on the original PRI series and account for nominal effects such as increasing news coverage over time and seasonal fluctuations (Du et al. 2017). To distinguish between types of state actors, separate indices are constructed from the perspective of government and military actors (Davis et al. 2019).

Recent work on the effects of political shocks on bilateral trade has argued that empirical work should be conducted using high-frequency data to account for aggregation bias. Du et al. (2017) demonstrate that aggregating data at the annual level in such work can lead to inappropriate inferences regarding the extent and timing of the effects of political shocks on trade. As they explain it (Du et al. 2017, p. 212), the problem arises because mild to moderate political shocks "tend to be relatively short-lived—coming and going in a matter of months, if not weeks. The data, however, are either aggregated or sampled at lower frequencies (for example, quarterly or annually). Thus, if the natural duration of political shocks is shorter than the frequency with which it is measured, a spurious causality may be imposed on the empirical relationship." This results in the detection of an "instantaneous causality" when none actually exists, a problem referred to as "temporal aggregation" or sampling bias in the time-series econometrics literature.

To verify that a major proportion of the variation in political relations between countries occurs at high rather than low frequencies, this chapter conducts visual, time-series and frequency-domain analysis to understand the dynamic properties of the PRI series. To avoid cherry-picking events for visual analysis, the two case studies outlined in Du et al. (2017) namely, the US bombing of a Chinese embassy in Belgrade and the Senkaku boat collision incident between Japan and China, are explored. An additional case study, the Doklam standoff between China and India between June and August 2017 is also analysed visually. From a time-series perspective, the PRI series is analysed using Auto-Regressive Integrated Moving Average (ARIMA) modelling techniques as outlined in Hyndman (2008). This modelling results helps verify the extent to which current values of the PRI series are correlated with past values and shocks. From a frequency-domain perspective, the Bartlett's test of white noise and cumulative periodogram are used to measure the proportion of variation of the series that occurs at different frequencies.

The rest of this chapter is structured as follows. Section 2 discusses the methodology used to construct a PRI and trade-filtered PRI series for China and major partners. Section 3 provides annual-level time-series plots of the PRI series for all trading partners between 1998-2018 and looks at the three case studies. Section 4 conducts time-series and frequency domain tests respectively, to understand the dynamic properties of the PRI series. Section 5 concludes.

2 Measuring political relations using events data

The use of political events data in the quantification of international relations can be traced back to the early work of McLelland (1976) and Azar (1980) who construct event-based databases such as the Conflict and Peace Data Bank (COPDAB) and World/Event Interaction Survey (WEIS). These datasets relied on human coders to document and categorise diplomatic events reported in newspapers around the world. One of the main reasons these early datasets were discontinued was because of the sheer time-consuming nature of human event coding from paper and microfilm sources (Leetaru and Schrodt 2012, p.1).

More recent event-based datasets such as the King (2003) dataset (Integrated Data for Events Analysis (IDEA)) as well as the Global, Location and Event Database (GDELT) rely on automated coding of media reports. Compared to earlier sources, events-data has been shown to be comparable to human coders and can be argued to become more reliable over time as more sophisticated ways of automated big data gathering are developed that increasingly cover a greater number of news sources (including those other than in English). Moreover, most major media outlets today have a digital presence and with the proliferation of digital media outlets that focus on niche policy areas, events-data tends to capture even subtle aspects of interactions between diverse state and non-state actors.

As described in Reuveny (2003, p. 255), “an event is an action involving an actor and a target. The actor is the unit generating the action, and the target is the unit toward which the action is sent. The description of an event involves an issue, the topic about which the activity revolves and an activity – the action directed by the actor towards the target”. Because we often refer to state actors in this study, the term actor used in the definition is referred to as “sender” hereafter. Reuveny (2003) raises three questions about the use of events data to construct a measure of political relations. First, which type of events should be recorded? Second, who are the relevant actors whose actions need to be observed? And third, how do we aggregate different event types into a single theoretically meaningful measure?

Events data for the indices constructed in this study are sourced from the GDELT Database. The GDELT database extracts text sources from several global news agencies including those from China such as *Xinhua News* and transforms them into event observations based on the actors involved using the open-source TABARI machine-coding system and the Conflict and Mediation Event Observations (CAMEO) coding scheme (Leetaru and Schrodt 2012). While early datasets that relied on human coders only considered a limited range of both event and actor types, the automation of the event-coding process has meant that the GDELT database records events involving a large range of international actors, from governments and international organisations to multinational firms. A wide range of event types are also captured in the GDELT database ranging from extreme conflict such as military cooperation to milder forms of conflict such as condemnations or threat. Similarly, cooperative events also occur across a range, with minor cooperation such as state visits to deeper from of cooperation such as military alliances

The PRI series constructed in this chapter only includes those events in which foreign state actors are the "sender" and Chinese state actors are the "target. As mentioned earlier, the restriction on the direction of the political relations aids the estimation of the effects of actions by foreign state actors towards Chinese state actors on bilateral trading relations. To distinguish between types of state actors, separate indices are constructed from the perspective of government and military actors. A common method of aggregating events-data into a single meaningful measure of political relations in the literature has been to convert events-data into a measure of cooperation and conflict that conveys the tensions implicit in a series of actions of one nation towards another (Goldstein 1992, p. 370).

Early databases such as the COPDAB used officially sanctioned set of weights originally developed by panels of experts to decide the amount of conflict or cooperation present in 16 different event types ranging from extreme to mild conflict (that is verbal criticisms to military conflict) and minor to deeper cooperation (that is to say state vists to military alliances). COPDAB included separate conflict and cooperation scales that could be conceptually joined to give a single measure of ‘net cooperation’ (or conflict depending on the order in which cooperation and conflict are considered) (ibid.). The idea here was that ‘a positive event will to some extent cancel out, or have the opposite effect on, a negative effect’ (Armstrong 2009, p. 165).

Conceptually, aggregating events into a single theoretical measure of conflict-cooperation was much harder for the WEIS dataset. This was because the WEIS dataset was not a ‘scaled’ dataset like COPDAB, but a categorical one which included not just over 60 different event types, but each group had over 20 verb categories such as ‘promise’, ‘accuse’ or ‘threaten’. The IDEA dataset added to the event categories used in WEIS and included codes for non-human events such as natural disasters. As discussed above, the GDELT database has an even larger dictionary of actor and event types making aggregation even more difficult for such data.

To get around the aggregation issue, researchers using the WEIS, IDEA and GDELT datasets all rely on the “Goldstein scale” to weight different event types to construct a measure of net cooperation between two units of interest. The ‘Goldstein Scale’ is based on a study conducted by Goldstein (1992) that derived these weights for the WEIS event types. The study asked a panel of judges comprising of faculty from the School of International Relations at the University of Southern California to place different events along a scale running from extreme conflict or hostility (given a score of -10) at one end to extreme cooperation or friendliness on the other (given a score of 10) (Goldstein 1992, p. 374).

For example, in the case of conflict, the use of military force would be weighted more than expelling a country’s diplomats or verbal criticism, while in the case of cooperation, signing a treaty would be weighted more than diplomatic negotiations. Panellists were explicitly told to keep in mind the linearity involved in assigning weights to different event types, that is an event with a score of 6 had to be twice as cooperative as an event with a score of 3. Panellists were also asked to consider the symmetric nature of conflict and cooperation, that is equally cooperative and conflict events had to have equal absolute values but opposing signs. For each event type, the mean score from the panellists was assigned as the 'Goldstein score'. The code used to extract data from the GDELT database is produced in Appendix B.

Once different events have been weighted, summing up the events can reveal the total amount of cooperation as well as the total amount of conflict for a given period. The GDELT data provide the Goldstein score for each event observations which are used to produce a 'net cooperation' variable between China and its trading partners for any given period of time. To account for nominal effects, the index is normalised by the total event count in the period. Following Du et al. (2017), a 'trade-filtered' version of the PRI (tfPRI) is also constructed using the residuals of the following regression,

$$\log(PRI_{j,t}) = \alpha_0 + \alpha_1 \left(\frac{\#trade_{j,t}}{\#events_{j,t}}\right) + \varepsilon_{j,t} \qquad (3.1)$$

where $PRI_{j,t}$ is the PRI measure of country *j* towards China at time *t*, $\#events_{j,t}$is the total number of events recorded between country *j* and China at time *t*, $\#trade_{j,t}$ is the total number of events in which the term 'trade' appears in the SOURCE URL recorded between country *j* and China at time *t*, and $\varepsilon_{j,t}$ are the residuals for country *j* at time *t*. Overall, the methodology for constructing the PRI in this chapter uses a combination of techniques employed in Davis et al. (2019) and Du et al. (2017). A comparison of the methodologies for constructing the PRI is summarised in Table 3-1.

3 China's political relations with major partners, 1998-2018

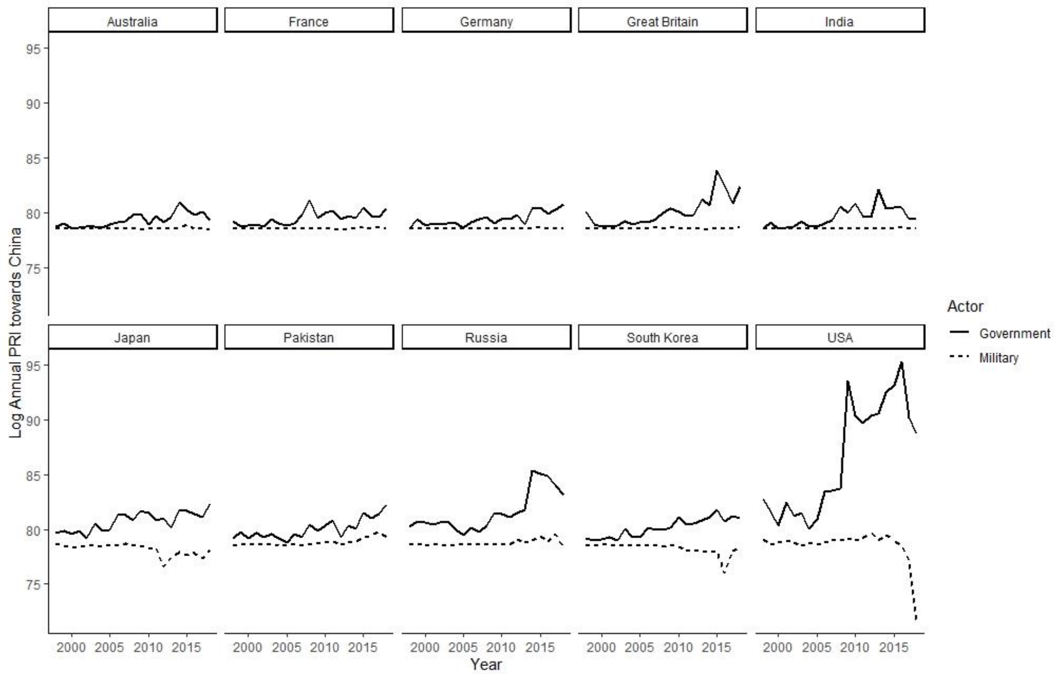
The panels in Figure 3-1 plot the logged PRI and trade-filtered PRI (tfPRI) series for China and major partners between 1998-2018. Two series are presented for each partner, from government and military perspectives. Panel A, which shows the PRI, indicates that all of China's trading partners experienced an increase in the government PRI in the first decade of the 21st century.

Table 3-1: Constructing a Political Relations index: a comparison of methodologies

Characteristic	Davis et al. (2019)	Du et al. (2017)	PRI	tfPRI
Source data	GDELT	*Renmin Ribao, Ministry of Foreign Affairs, China*	GDELT	GDELT
Event types	Conflict only	Cooperation and conflict	Cooperation and conflict	Cooperation and conflict
Actor type distinction (Military/Non-military)	Yes	No	Yes	Yes
Removal of pure business events	Yes	Yes	Yes	Yes
Removal of trade-related events	No	Yes	No	Yes
Index direction	Partners towards China	Not stated	Partners towards China	Partners towards China
Nominal effects	Not normalised	Normalised	Not normalised	Normalised
Frequency	Annual	Monthly	Monthly	Monthly

However, since 2010, there has been more heterogeneity in government PRI towards China with some countries continuing to see the political relations improve, that is Germany, Pakistan, and Russia, while other saw political relations stabilise, such as France, Japan and South Korea, while others saw political relations deteriorate, such as Australia, Great Britain, India, and the US. For these latter countries the deterioration in political relations is particularly significant in the latter half of the second decade of the 21st century. From the military perspective, most countries saw very little variation other than South Korea and the US. The deterioration in military PRI is particularly significant for the US case which saw a large deterioration in military relations since 2016 with the election of President Donald Trump.

A. Unfiltered PRI



B. Trade-filtered PRI

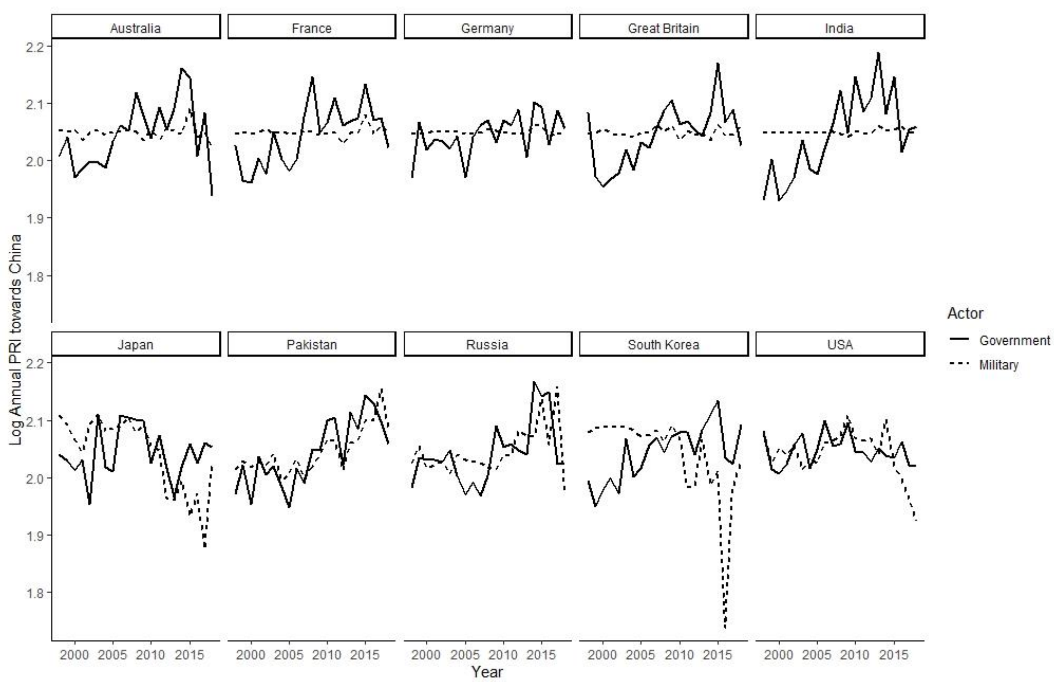


Figure 3-1: Annual trade-filtered PRI towards Chinese state actors, 1998-2018

Source: Author's calculations using GDELT data.

The second panel in Figure 3-1 shows the trade-filtered PRI (tfPRI) for the same trading partners and time period. Compared to the PRI, the tfPRI values are much more volatile and do not show the large increases seen in the PRI, indicating that a large share of improvement in political relations was driven by improved trade ties. From a government perspective, six out of ten countries, that is Australia, France, Great Britain, India, South Korea, and Russia show an inverted U-curve with a turning point in relations towards China between 2012-2014. Of these countries, the largest relative increase in cooperation towards China is seen for India, with relations improving rapidly between 2003-2012 followed by a rapid decline back to 2003 levels by 2018. Of all the countries that show the inverted-U pattern, Great Britain, Russia, and Australia have tfPRI values in 2018 that are lower than those observed in 1998. The only country to see a sustained increase in political relations towards China form the government perspective in Pakistan.

The trade-filtered military PRI shows much less variation that is the case for government relations. While relations are largely stable for the countries shown in the top row (Australia, France, Germany, Great Britain, and India), there is considerable variation for countries in the bottom row. Pakistan shows a considerable improvement in military relations towards China. Japan, South Korea, and the US have seen a rapid deterioration in military relations. For Russia, military relations are in sync with government relations, improving from 1998-2015 but declining rapidly thereafter.

3.1 Case studies

While Figure 3-1 is informative regarding the general pattern of political relations between China and partners over the last two decades, these figures do not provide information regarding the behaviour of the PRI series during specific political incidents (or what may be referred to as political shocks). In this section, I plot the unsmoothed PRI and trade-filtered PRI series for two case studies explored in Du et al. (2017), namely the US bombing of the Chinese embassy in Belgrade in May 1999, and the Senkaku boat collision incident involving Japan and China in September 2010. I also consider an additional event, the Doklam standoff between China and India that occurred between June and August 2017.

3.1.1 Chinese embassy bombing

On May 7th, 1999, the Chinese embassy in Belgrade (now in Serbia) was hit by five laser-guided bombs dropped by U.S planes as part of the North Atlantic Treaty Organisation (NATO) military operation against former Yugoslavia (Dumbaugh 2000). The embassy building was damaged, three embassy employees were killed, and twenty-seven others wounded (ibid.). For months prior to the bombing, Chinese officials and press accounts had been critical of the involvement of NATO and US forces in Yugoslavia, and China along with Russia had voted in favour of a United Nations Security Council (UNSC) resolution in March 1999 calling for an immediate halt to the NATO bombing of Yugoslavia (ibid.). The day after the bombing, the US Secretary of Defense William Cohen, and the US Central Intelligence Agency (CIA) director George Tenet issued a joint statement saying that the US 'deeply regretted the loss of life . . . [and that] the bombing was an error' (ibid., p.2). Three days after the bombing, President Bill Clinton described the bombing as a 'tragedy' and apologized to Chinese President Jiang Zemin (ibid., p.2).

Despite the immediate apology by US government and military actors, the bombing was met with 'unparalleled indignation and sheer anger' from Chinese authorities (Du et al. (2017), p.216). The Chinese Ministry of External Affairs suspended all high-level military negotiations with the US regarding non-proliferation, arms control, and international security matters, as well as all Sino-American dialogues related with human rights (Ibid.). The relatively subdued protests by the Chinese public against the NATO intervention up until the bombing erupted into 'fiery [and] wildly popular demonstrations of Anti-Americanism throughout China' (Moore 2010, p. 28). In a television appearance, Vice President Hu Jintao 'endorsed the protests although warning [that] they must remain in accordance with law' (Ponniah and Marinkovic 2019). Several news reports reported the event as a severe blow to Sino-American relations (Du et al. 2017).

Diplomatic tensions between the US and China, however, dissipated within weeks of the incident. Barely two weeks after the incident, a Chinese trade delegation which included provincial-level ministers visited Washington and stressed dismay at the incident and called for a speedy resolution while stressing the need for continued US-China economic cooperation (Du et al. 2017, p. 216-217). By August, the two countries had agreed on a compensation package to be paid by US authorities for loss of life and injury and by December, further compensation was agreed by US authorities regarding the damage caused to Chinese embassy building in Belgrade and by Chinese authorities for damages caused to US diplomatic facilities in China. High-level meetings between US and Chinese military personnel also resumed by the beginning of the next year with Chinese strategic policymakers visiting Washington in late January 2000 (ibid.).

Figure 3-2 shows the (logged) values of the different PRI indicators for China and the US two years before and after the bombing. The top panel indicates US net government cooperation towards China and clearly shows a drastic drop in May 1999. The second panel shows that negative US government events towards China increased in May 1999, although the rise is not as large as the fall in net cooperation. Together, this means that the fall in government cooperation was largely driven by a decrease in positive events rather than an increase in negative events between the two countries.

The data correlates with anecdotal evidence which highlighted the suspension of several Sino-American cooperation dialogues and negotiations in the aftermath of the bombing. From the military-perspective, net cooperation shows a slight increase in May 1999 and negative military events is higher than average during the period April-June 1999. The military-perspective PRI also reflect increased cooperation by US military actors that quickly acknowledged that the bombing was an accident. Both the government and military PRI highlight the short-run nature of the political shock, with all indices returning back to levels before the bombing in a few months after the incident.

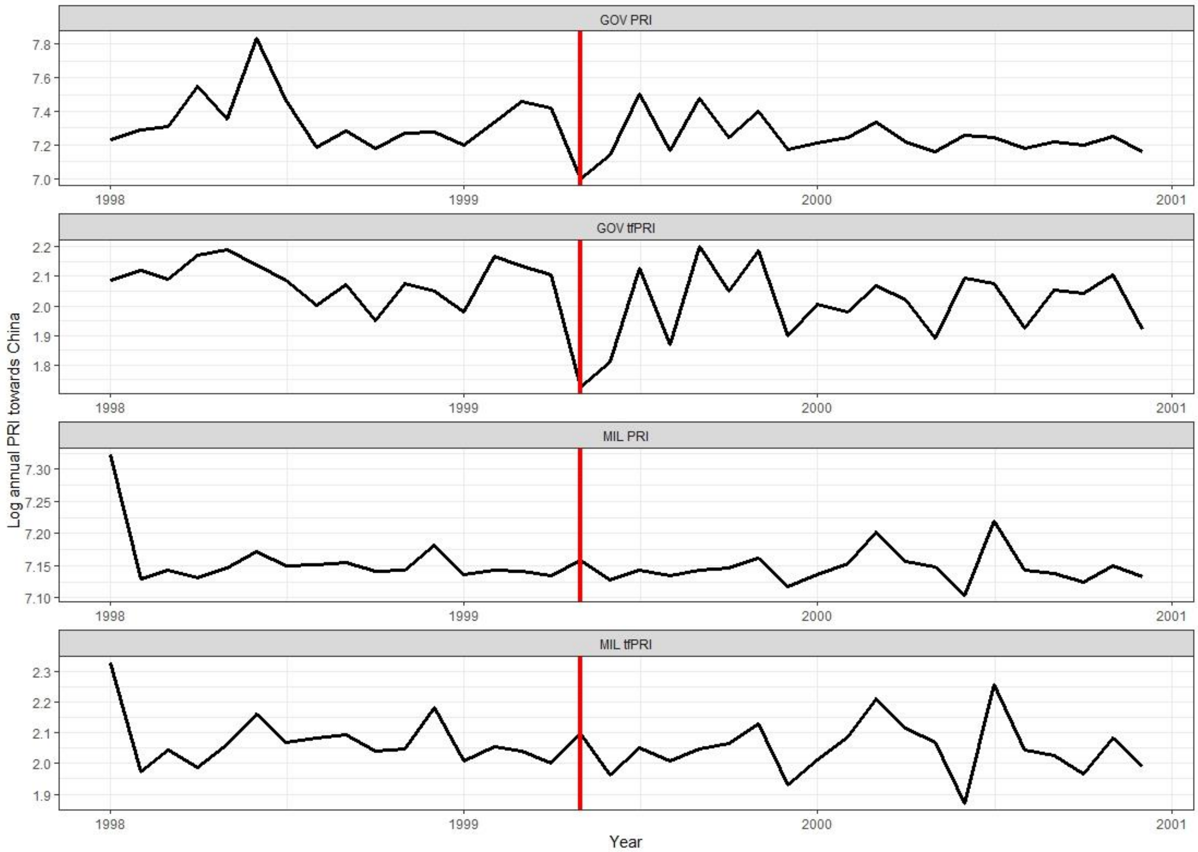


Figure 3-2: Chinese embassy bombing

Source: Author's calculations using GDELT data.

Notes: The red line marks the month of May 1999.

3.1.2 Senkaku boat collision incident

In early September 2010, a Chinese finishing boat collided with several Japanese Coast Guard patrol boats in disputed international waters near the Senkaku (or Diaoyu) islands. The uninhabited islands are located off Mainland China in the East China Sea and both China and Japan have claimed territorial ownership of the islands. Japanese officials arrested the captain of the fishing boat and charged him on the count of "obstructing public officers during the performance of their duties" (Du et al. 2017, 217). Despite calls for an immediate and unconditional release of the captain by Chinese state officials, Japanese authorities insisted that the Senkaku islands were "clearly an inherent territory of Japan" and that the incident would be handled "in accordance with domestic law" (ibid.).

Political relations between China and Japan saw a major downturn throughout September with public protests erupting in China demanding the release of the captain, cancellation of meetings between Chinese and Japanese high-level officials, and action against employees of Japanese firm Fujita Corporation in China under allegations of military espionage (ibid.). On September 23rd, China banned the export of rare earth metals, a natural resource commodity used widely in the manufacture of electronic equipment for which China controls 90 per cent of global supply, to Japan. While Chinese authorities claimed that the export ban was due to environmental concerns, the timing of the ban suggested that the move was in response to rising political tensions between the two countries.

Following China's export ban, Japanese authorities released the captain in an attempt to ease political tensions. Although the release was met by protesters in Japan asserting that the Japanese government had handled the event poorly, tensions eased as Chinese Premier Wen Jiabao met Japanese Prime Minister Naoto Kan in early October during a Asia-Europe summit in Brussels (ibid.). Protests in China dwindled as the government officials discouraged such activities, Fujita employees were released although the export ban on rare earth metals continued to remain and was eventually challenged by Japan in the WTO. While sporadic protests continued in Japan for a few months, political relations between the two countries had returned to normal by the end of the year.

Figure 3.3 shows the logged values of the different PRI indicators for China and Japan two years before and after the Senkaku boat-collision incident in September 2010. The government PRI series shows that relations between the two countries were had deteriorated since a peak in early 2009. However, in the month following the incident, there is a large increase in the PRI series. This suggests that along with the increased conflict towards China, Japanese government actors also communicated cooperative messages toward Chinese government actors. Looking at the trade-filtered government PRI series there is a large decrease in cooperation in September followed by a normalisation of relations in October 2010. However, throughout the course of the following two years, relations between the two countries continue to be volatile.

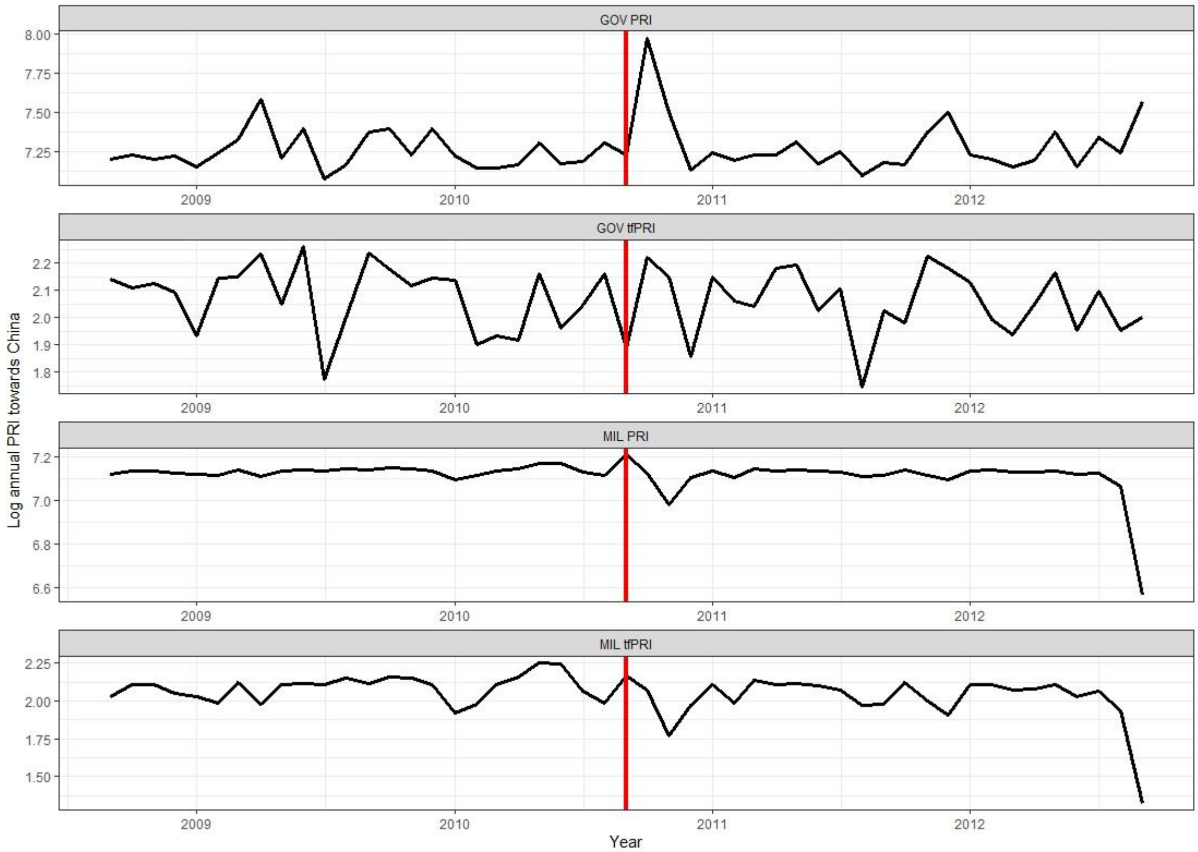


Figure 3-3: Senkaku boat collision incident

Source: Author's calculations using GDELT data.

Notes: The red line marks the month of September 2010.

3.1.3 Doklam standoff

India and China have a long history of border disputes beginning with India gaining independence from British rule in 1947 and the formation of People's Republic of China in 1949. The two countries fought a war in late 1961 due to the 'ill-demarcated frontier along Eastern Ladakh and North-Eastern Frontier Agency (NEFA, which in 1987 became Arunachal Pradesh)' (Roy 2021, p. 83). Following the war, relations between the two countries remained suspended until the late 1980s when India's then Prime Minister visited Beijing in a bid to normalise political relations. Since the early 1990s, there has been much deeper engagement between the two countries particularly in the economic domain, with a large increase in trade and investment ties, while political relations have remained stable with the occasional dispute arising due to unresolved border disputes.

In June 2017, India and China were involved in one of the most significant military standoffs between the two countries in recent years in the disputed region of Doklam, which lies in the Sikkim sector of the India-China border and forms a tri-junction between India, China, and Bhutan (Ratha 2020, pp. 196-197). The conflict began with the construction of a road by the People’s Liberation Army of China (PLA) in the Doklam region which was seen as a security threat by Bhutan and India. The construction was first opposed by the Royal Bhutanese Army which tried to push back the Chinese construction party, failing which Indian troops intervened and a standoff ensued between China and India.

Despite a sharp rise in political tensions in June, by August both countries had agreed to an ‘expeditious disengagement of troops in a disputed border area with matured diplomacy … [as a]ny escalation further could have been heaped enormous cost in terms of economic engagement, political and diplomatic cost, and human casualties, without any valuable gains for both sides.’ (Ratha 2020, p. 208). There was little public support for a continued protraction of the issue in either country alongside pressure from the US to reach a swift diplomatic solution along with the need for a successful BRICS Summit possibly played a role in helping ease tensions between the two Asian powers (ibid.). In 2018, China and India held an informal Summit in Wuhan, China where Chinese President Xi Jinping emphasised ‘the importance of constructing an open and pluralist global economic order in which all countries can take part without restraint to pursue their development’ and reiterated the necessity for India and China to work together given that they had convergent interests in areas of global governance (ibid.).

Figure 3-4 shows the logged values of the different PRI indicators for China and India two years before and after the Doklam standoff in June 2017. The first panel which shows the PRI from the perspective of Indian government actors towards Chinese government actors does not show any variation, other than a sharp increase in the first half of 2016, one year prior to the incident. The second panel which shows the trade-filtered PRI from the perspective of government actors is much more volatile and there is a slight dip in the

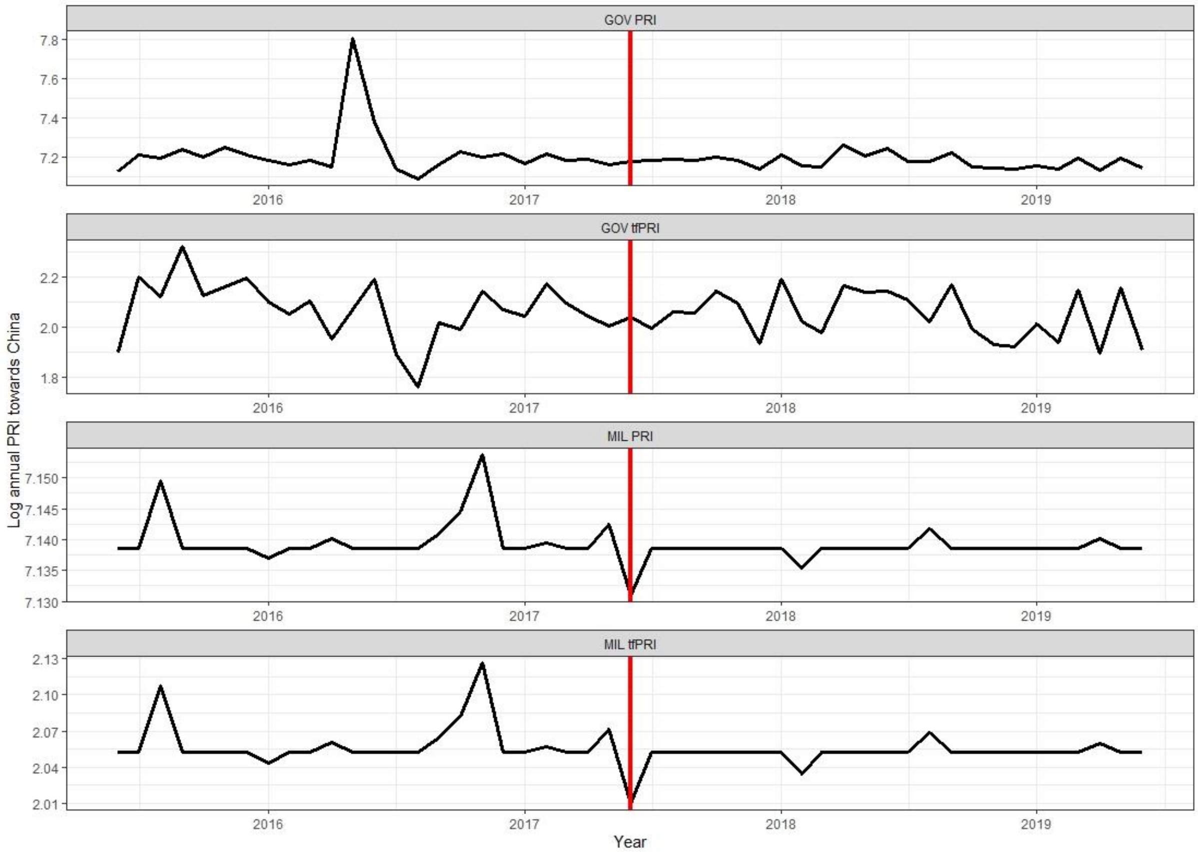


Figure 3-4: Doklam standoff

Source: Author's calculations using GDELT data.

The red line marks the month of June 2017.

PRI in the few months prior to and after the standoff. However, the deterioration in political relations in this period does not stand out when the entire period of two years before and after the incident is considered, with much larger decreases in political relations seen in the latter half of 2016, at the end of 2017, in the second half of 2018, and in the first half of 2019. Overall, these two panels suggest that political relations from the perspective of government actors remained largely stable during the standoff.

The latter two panels of Figure 3-4 show political relations from the perspective of Indian military actors towards Chinese military actors. In both panels we see a sharp decrease in the PRI in the month of June 2017 when the standoff took place, which correlates with the anecdotal evidence that the standoff was largely an event that involved military actors. We can also see that unlike the case for government PRIs where there is a large difference in patterns between the PRI and trade-filtered PRI series, both the PRI and trade-filtered PRI series from the perspective of military actors follow the same patterns, suggesting that trade hardly plays a role when military actors are concerned. Prior to the standoff, we observe an increase in the PRI in the latter half of 2016, followed by the sharp decrease in PRI seen in June. However, in line with the anecdotal evidence which suggests that relations between the countries stabilised soon thereafter as military disengagement took place, the PRIs stabilise in the next two months with relatively smaller dips in political relations seen in early 2018.

4 Frequency issues: monthly versus annual

Recent work on the effects of political shocks on bilateral trade has argued that empirical work should be conducted using high-frequency data to account for aggregation bias. Du et al. (2017) argue that aggregating data at the annual level in such work can lead to inappropriate inferences regarding the extent and timing of the effects of political shocks on trade. As they explain it (Du et al. 2017, p. 212), the problem arises because mild to moderate political shocks "tend to be relatively short-lived—coming and going in a matter of months, if not weeks. The data, however, are either aggregated or sampled at lower frequencies (for example, quarterly or annually). Thus, if the natural duration of political shocks is shorter than the frequency with which it is measured, a spurious causality may be imposed on the empirical relationship." This results in the detection of an "instantaneous causality" when none actually exists, often referred to as the "temporal aggregation problem" or sampling bias. For a formal treatment of the temporal aggregation problem see Du et al. (2017, pp. 223-224).

An additional complication that arises from using annual data is "the aliasing problem, which makes it impossible for the researcher to detect the presence of higher frequency cycles within the aggregated intervals" (ibid.). Du et al. (2017) conduct a combination of visual and statistical tests to identify the time-series and frequency-related properties of their PRI series for China and major trading partners between 1990-2013. Using the Box-Jenkins (1976) methodology, they find that for several partners the monthly PRI series is best modelled as a random walk process, that is with insignificant auto-regressive or moving-average components. For countries that do have significant auto-regressive and moving-average components, these components are generally short lived, lasting for 1-2 months. Using spectral distribution analysis, Du et al. (2017) also report that a large proportion of the variation in the PRI series for most partners occurs at high frequencies, that is three months or shorter. In such cases, aggregation of the PRI series at the annual level results in serial correlation in the constructed annual series and leads to inconsistent estimates of the effects of political relations on trade, and vice versa. This section conducts visual and statistical tests for the PRI series constructed in this chapter for the time period between 1998 and 2018.

4.1 ARIMA modelling

The visual analysis of case studies in the previous section suggests that shocks in political relations between China and major partners tend to be short-lived. Du et al. (2017) model the PRI series using the Box-Jenkins (1976) of model identification and selection methodology. This methodology includes testing the series for presence of stationarity and the use of auto-correlation and partial auto-correlation plots to identify a parsimonious auto-regressive and moving-average of the underlying data-generating process (Du et al. 2017, p. 214). This process results in a parsimonious Auto-Regressive Integrated Moving Average (ARIMA) model that best explains the time-series behaviour of the data (ibid.). Formally, it is assumed that the underlying data-generating process takes the following form,

$$\emptyset(L^p)\Delta^d PRI_t = \theta(L^q)\varepsilon_t \qquad \ldots (3.2)$$

where the underlying PRI_t series are differenced d ($d \geq 0$) times to achieve stationarity, $\emptyset(L)$ and $\theta(L)$ are lag polynomials of degrees p and q respectively, and ε_t is the residual term. The outcome of this methodology returns a parsimonious ARIMA (p,d,q) process that best describes the data-generating process (Du et al. 2017, p. 214). A number of tests (including the standard and augmented Dickey-Fuller tests, the PP test and the

KPSS test) are carried out to determine the order of integration for the PRI series. Largely these tests show that the PRI series for China and most of its partners was nonstationary in levels but stationary in first-differences.

While the Box-Jenkins (1976) methodology is used extensively in the time-series econometrics literature, it has often been criticised because “the order selection process is usually considered subjective and difficult to apply” (Hyndman and Khandakar 2008, p. 8). Building on previous work, Hyndman and Khandakar (2008) develop an algorithm for a step-wise traversing of the model space for different orders which chooses the model with the lowest AIC value. We apply this algorithm to estimate parsimonious auto-regressive models for the PRI series constructed in this chapter.

Table 3-2 presents the results of the optimal ARIMA model selection for China’s PRI and trade-filtered PRI with its partners from the perspective of both government and military actors. In each cell, entry (p,d,q) represents the optimal auto-regressive parameter (p), whether integration was necessary (d = 0 or 1); and the optimal moving average parameter (q). Most of the series can be seen to be non-stationary in levels but stationary in first-differences. The results indicate that China’s PRI (PRI and trade-filtered PRI for the case of both government and military actors) follow low-order ARIMA processes with the auto-regressive component largely being between 0 and 5, and a moving-average component between 0 and 2. The largest autoregressive lag of five months is seen for Japan using the trade-filtered PRI series. These ARIMA modelling results suggest that the PRI series is best characterised as short-lived auto-regressive and moving error processes.

4.2 Spectral density analysis

This section conducts spectral density analysis to understand the relative importance of low- and high-frequency cycles in the PRI series. Spectral density analysis is the decomposition of a time-series into variable frequencies of sine and cosine functions. The analysis is conducted by constructing a spectral distribution and cumulative periodogram

Table 3-2: ARIMA (p,d,q) modelling of PRI series towards China, 1998-2018

Partner	Government actors		Military actors	
	PRI	Trade-filtered PRI	PRI	Trade-filtered PRI
Australia	0,1,1	0,1,2	0,0,0	0,0,0
France	0,1,2	1,1,1	0,0,1	0,0,1
Germany	5,1,1	0,1,1	0,0,0	0,0,0
Great Britain	0,1,1	0,1,1	0,0,1	0,0,1
India	4,1,1	1,0,0	0,1,1	0,1,3
Japan	2,1,1	5,1,2	0,1,4	0,1,1
Pakistan	0,1,1	1,1,2	0,1,1	0,1,1
Russia	1,1,1	2,1,1	0,1,2	0,1,2
South Korea	4,1,3	1,1,1	0,0,0	0,0,0
USA	2,1,1	0,0,0	3,0,3	2,0,0

Source: Author's calculations using GDELT data.

Notes: In each cell, entry (p,d,q) represents the optimal auto-regressive parameter (p), whether integration was necessary (d = 0 or 1); and the optimal moving average parameter (q).

to evaluate the relative prominence of cycles at different frequencies (Du et al. 2017, p. 215, Harvey 2001, p. 260-1, Priestley 1981). The spectral distribution of a time-series is usually used to describe the properties of a time-series in the frequency domain.

Formally, any time-series X_t can be expressed in the frequency domain as, [I don't like the Table where it is, you need the equation to follow this here…

$$X_t = \sum_f [A(f)\cos(2\pi ft) + B(f)\sin(2\pi ft)] \qquad \ldots (3.3)$$

where $A(f)$ and $B(f)$ are the amplitudes of the sine and cosine functions at frequency f, and the subscript t denotes the time variable. Estimation of $A(f)$ and $B(f)$ can be expressed as a multiple linear regression problem: for X_t of length n, X_t is the dependent variable and there are $n-1$ independent variables composed of sine and cosine functions of all possible frequencies. The length of X_t (record length) determines the number of cycles that can be detected and the highest and lowest frequencies that can be detected. For example, if the time- series data is collected weekly for one month (that is 4 data points) then three cycles can be detected, 1) the high-frequency cycle of length two weeks, 2) the low-frequency cycle that of length one month, and 3) the mid-frequency cycle of length three weeks. For even n, the multiple regression problem can be expressed as,

$$X_t = \alpha_0 + \sum_{f=1}^{\frac{n}{2}-1} \left[\alpha_f \cos\left(\frac{2\pi f t}{n}\right) + \beta_f \sin\left(\frac{2\pi f t}{n}\right)\right] + \alpha_{n/2} \cos(\pi t) \quad \ldots (3.4)$$

Combining estimates α_f and β_f for all frequencies produces a periodogram which shows the contributions of the individual frequencies to the time-series regression. That is for any given frequency f (for $f = 1,2, \ldots n/2$), the periodogram value P_f is given by,

$$P_f = \alpha_f^2 + \beta_f^2 \qquad \ldots (3.5)$$

The plot of P_f for all frequencies is also called the Fourier line spectrum and can be interpreted in terms of variance of the data at different frequencies, with a relatively high value of P_f indicating the time-series data is strongly correlated with frequency f. Like cumulative probability functions are derivable from probability density functions, the cumulative periodogram can also be constructed using the spectral density function.

To understand the relative importance of short-term versus long-term variations in the PRI series, we look at three estimates: 1) the “Bartlett’s test of white noise”; based on the series’ spectral cumulative periodogram. A statistically significant test rejects the null of a white noise process (that is all frequencies are equally prevalent), in favour of unevenness in the prevalence of cycles at different frequencies; 2) the “low-frequency share” which reports the cumulative spectral distribution function at “low” frequencies, defined as cycles of 12 months or longer. Thus, a figure of 0.010 for the integrated PRI series for Australia (in Table 3 below) indicates that 1.0 percent of the cycles occur at frequencies of 3 months or shorter, and 3) the “high-frequency share”, which reports the cumulative spectral distribution function at “high” frequencies, defined as cycles of 3 months or shorter. Thus, a figure of 0.633 for the integrated PRI series for Australia indicates that 63.3 percent of the cycles occur at frequencies of 3 months or shorter.

The panels in Table 3-3 present the estimates from the spectral density analysis for government and military actors for the PRI and trade-filtered PRI. For government actors (Panel A), the Bartlett's test of white noise is significant for all countries and PRI series types, indicating that we can reject the null hypothesis of equal prevalence of all frequencies. Other than the US, the Bartlett's test of white noise is significant at the 1 percent level, suggesting that there is a wide difference in the prevalence of different frequencies (for the US it is only significant at the 10 percent level).

This unequal prevalence of frequencies is confirmed by the frequency share estimates, which show that high-frequency shares are much higher than the low-frequency shares, that is, a much larger significance of the variation in political variation occurs at high frequencies. The share of low frequencies is quite small, with an average of 0.012 for the PRI, that is, only 1.2 percent of the cycles occur at frequencies of 12 months or higher, and 0.055 for the trade-filtered PRI, that is, only 5.5 percent of the cycles occur at frequencies of 12 months or higher. Conversely, the high-frequency shares are much higher for all the partners and PRI series type, with an average of 0.595 for the PRI, that is, only 59.5 percent of the cycles occur at frequencies of 12 months or higher, and 0.529 for the trade-filtered PRI, that is, only 52.9 percent of the cycles occur at frequencies of 12 months or higher.

For military actors (Panel B), the Bartlett's test of white noise is significant for India, Japan, Pakistan, Russia, and South Korea at the 1 percent significant level, indicating that we can reject the null hypothesis of equal prevalence of all frequencies (for both the PRI and trade-filtered PRI). For each of these countries the low-frequency shares are much lower than the high-frequency shares, indicating that a higher proportion of the variation in political relations occurs at high frequencies. For the other countries, the Bartlett's test of white noise is significant which indicates that we cannot reject the hypothesis that all frequencies are of equal prevalence. However, looking at the frequency shares, once

Table 3-3: Spectral density estimates, PRI towards China, 1998-2018

A. Government actors

Partner	PRI			Trade-filtered PRI		
	White noise test	Low-frequency share	High-frequency share	White noise test	Low-frequency share	High-frequency share
Australia	**3.920*** **	0.010	0.633	**3.359*** **	0.020	0.588
France	**2.740*** **	0.015	0.483	**2.977*** **	0.013	0.508
Germany	**4.118*** **	0.010	0.611	**3.504*** **	0.008	0.564
Great Britain	**3.371*** **	0.021	0.556	**3.446*** **	0.005	0.630
India	**3.087*** **	0.006	0.613	**3.782*** **	0.317	0.268
Japan	**3.614*** **	0.011	0.566	**3.367*** **	0.010	0.607
Pakistan	**3.727*** **	0.006	0.565	**3.594*** **	0.009	0.508
Russia	**3.308*** **	0.012	0.665	**3.012*** **	0.010	0.511
South Korea	**2.675*** **	0.012	0.587	**4.193*** **	0.011	0.669
USA	**3.874*** **	0.014	0.675	**1.255* **	0.149	0.437
Average		0.012	0.595		0.055	0.529

B. Military actors

Partner	PRI			Trade-filtered PRI		
	White noise test	Low-frequency share	High-frequency share	White noise test	Low-frequency share	High-frequency share
Australia	0.988	0.165	0.252	1.095	0.008	0.478
France	0.832	0.221	0.288	0.856	0.010	0.568
Germany	1.160	0.178	0.258	1.116	0.007	0.511
Great	0.809	0.151	0.330	0.690	0.010	0.604
India	**3.515*** **	0.013	0.602	**3.579*** **	0.037	0.609
Japan	**3.454*** **	0.010	0.620	**3.679*** **	0.008	0.674
Pakistan	**3.915*** **	0.003	0.583	**4.200*** **	0.004	0.614
Russia	**3.656*** **	0.011	0.610	**3.753*** **	0.013	0.620
South Korea	**3.141*** **	0.195	0.434	**2.646*** **	0.017	0.542
USA	0.701	0.014	0.579	0.976	0.013	0.650
Average		0.096	0.456		0.013	0.587

Source: Author's calculations using GDELT data again we find that the share of low frequencies is much lower than the share of high frequencies, which again indicates that a much larger proportion of the variation in political relations (both PRI and tfPRI) occurs at high frequencies. Overall, the spectral density analysis concurs with the visual and time-series analysis that shocks in political relations between China and major trading partners in this period tend to be short-lived.

5 Summary and conclusion

This chapter constructed a political relations indicator to quantify political relations between China and major partners between 1998-2018. Unlike economic indicators, quantifying political relations is not a straightforward task. To construct such a Political Relations Indicator (PRI) this chapter relies on the GDELT database which codifies newspaper events which involve government and military actors of China and trading partners. Using this indicator, the chapter shows the evolution of unfiltered and trade-filtered versions of the PRI for ten of China's trading partners.

To verify the dynamic properties of the PRI series, visual, time-series and spectral density analysis were conducted which showed that the largest amount of variation in the PRI series is observed at high frequencies, suggesting that shocks in political relations tend to be short-lived. As also concluded by Du et al. (2017), this suggests that econometric analysis using the PRI indicator should be conducted with aggregation done at the monthly rather than annual level in order to obtain unbiased and consistent estimates. In the remaining chapters of this study, this PRI series is used to estimate the effects of political relations on trade for China and major trading partners.

Chapter 4 The effects of political shocks on trade

Abstract: Using a vector-autoregression framework, this chapter estimates the effects of shocks in political relations on export growth to China for major trading partners between 1998-2018. While the dynamic pattern of effects varies for countries, overall, we find that that the effects are small and short-lived, with a one standard deviation in political relations resulting in a 1-2 percent change in export growth for two months after the shock. While for most cases there are no long-run effects on export levels two years after the shock, in some cases these effects do persist. These effects are slightly stronger when political relations are measure using government actors as opposed to military actors. Lastly, panel-data regressions at the monthly and annual levels are estimated to confirm that estimating the effects of political shocks on trade are best conducted using monthly-level data to avoid inconsistent estimates.

1 Introduction

In line with its rising power, several authors have suggested that the Chinese government has shown an increased capacity and willingness to use economic tools such as trade policy to achieve its broader foreign policy objectives – that is, to engage in economic statecraft, or what is now commonly referred to as geoeconomics (Blackwill and Harris 2016, Baru 2012, 2013, Medcalf 2020). China will certainly not be the first great power to engage in economic statecraft; it has been a persistent feature of international relations for centuries (Davis et al. 2019). In some cases, trade relations have been based on the premise that trade would prove “a bond of friendship between nations” (Hirschman 1945: p.7), while in others they have been pursued with “dependence, [of] influence, and even [of] domination” in mind (Hirschman 1945, p. 13).

Regardless of whether the stronger relative power in any bilateral relationship exerts that power to ‘win-win’ or ‘win-lose effect’, trade patterns in the past have been shown to closely reflect political relations in a variety of contexts (Long 2008) – for example, rising in times when “bonds of friendship” strengthen and contracting in times of military conflict.

However, recent studies have reported that political shocks may have little or no effects on trade between disputing nations (Davis and Meunier 2011, Heilmann 2016, Du et al. 2017).

This chapter estimates the effects of political shocks on exports to China for major trading partner between 1998-2018 using a vector-autoregression (VAR) framework. A VAR framework allows for the endogenous treatment of trade and political relations given that the theoretical model derived in Chapter 2 of this study suggests that a bi-directional relationship exists between political relations and trade flows at the country dyad-level. The theoretical model also aids the empirical investigation by providing a basis for the causal ordering of shocks in the VAR model.

The PRI series used to measure political relations constructed in Chapter 3 is used as an indicator of political relations, that is, from the perspective of both government and military actors. The analysis in Chapter 3 suggests that most of the variation in political relations between nations in recent decades has been moderate and short lived. Du et al. (2017) show that when this is the case, models which rely on annual instead of monthly-level data may result in inconsistent estimates. For this reason, the empirical models estimated in this chapter are all aggregated at the monthly level. Moreover, to verify this result, panel-data models are also estimated at both the monthly and annual level.

The rest of the chapter is structured as follows. Section 2 provides a brief review of the empirical literature on the effects of political relations on international trade. Section 3 introduces the empirical model and provides the summary statistics. Section 4 estimates the short-run effects of political shocks on export growth to China for major trading partners, while Section 5 estimates the long-run effects over a horizon of two years. Section 6 verifies the importance of monthly-level regressions by estimating panel-data models at both the monthly and annual levels of aggregation. Section 7 concludes.

2 Empirical literature review

Several studies across the economics, political science, and international relations literature investigate the effects of international political relations of international trade. Pollins (1989a, 1989b) is among the first to estimate the effects of political relations on international trade using single-equation cross-sectional analysis. The empirical model in Pollins (1989a, 1989b) is a standard gravity model of trade augmented to include a variable for political relations. Standard trade models attempt to explain bilateral trade flows based on the economic sizes of countries and the geographical distance between them (Bergstrand 1985, Anderson and Wincoop 2003). Larger economies are expected to have higher trade flows while geographical distance is assumed to lower trade. Pollins (1989a, 1989b) measures political relations using a variable that captures cooperation and conflict based on COPDAB data.

The sample investigated by Pollins (1989a, 1989b) includes trade between 25 nations measured over a period of 16 years from 1960 to 1975. Control variables that may explain trade patterns between dyads that are also considered in the models include terms of trade variables and binary variables accounting for economic or political unions that dyads may be part of. On this basis, Pollins (1989a, p. 757) concludes that, '[i]nternational conflict and cooperation affect commerce significantly and continuously, and in a way which directly reflects the security concerns delineated in this study [that is private firms considering the risks arising out of shifts in political relations]'. Pollins (1989b) concludes that 'trade does indeed follow the flag despite the efforts of academics over the past century to consider economics and politics in isolation from one another' (p. 477-478).

A more recent study by Davis and Meunier (2011) also uses political events data in a panel setting to assess the effects of political relations on trade and investment flows for the case of the US and Japan. Examining the time period between 1990 and 2004, Davis and Meunier (2011) use the King and Lowe (2003) IDEA dataset to construct political relations variables for the case of US and Japan with all their trading partners. As in other studies, the Goldstein scale is used to weight events and construct a single measure of political relations that reflects both cooperation and conflict. However, Davis and Meunier (2011) only consider events that have a negative Goldstein score (that is, only the conflict side of political relations) and also do not filter the data to remove pure business events. Unlike Pollins (1989a, 1989b), who reports a significant positive relationship between political relations and trade, Davis and Meunier (2011) find that political relations do not significantly affect either trade or investment flows for the US or Japan for the time period examined. Davis et al. (2019) also estimate panel-data models for the cases of China and India with some major partners. Additionally, they disaggregate the trade data by firm ownership. In effect, their study explores whether sensitivity of imports to political relations is higher for state-owned enterprises as compared to the sensitivity of imports for privately-owned firms.

As discussed earlier, Davis et al. (2019) construct their political relations indicator using GDELT data but only consider negative events. They construct separate indicators for government and military actors and ensure that the indicators control for endogeneity between trade and political relations by removing pure business events. Data are aggregated at the annual level. Their findings suggest that sensitivity of imports of political relations is indeed higher for state-owned enterprises than for private enterprises for both China and India. They also find that imports are more sensitive to political relations for the case of military actors as compared to government actors for both China and India.

While panel-data models help to shed some light on the trade-politics relationship, they have certain limitations. Panel data models assume that there is no reverse causality between trade and political relations and thus fail to provide systematic evidence that establishes trade (political cooperation/conflict) as causally prior to political cooperation/conflict (trade) (Sayrs 1990, cited in Reuveny and Kang 1996, p. 948). In other words, while such models show an association between trade interdependence and political relations, they do not verify the existence and direction of the causal relationship between the two variables of interest. The recognition that causality can run both ways, that is politics affects trade and trade can also affect politics, led to many studies estimating simultaneous equation models (Armstrong 2008, p. 173).

However, the problem with estimating simultaneous equation models using two stage least squares or three stage least squares estimation 'is that exogenous variables are needed to identify the equations' (ibid.), and the exogeneity of these variables is usually hard to justify. For example, Pollins (1999) uses defence expenditure to identify political relations and education levels and highways per capita to identify international trade. However, defence expenditure like MID data which rely on military casualties are only indicative of high-intensity conflict and do not account for lower-intensity conflict such as diplomatic standoffs and non-military aggression. For China's case there have not been any significant military conflict in the last few decades and China's level of trade is much higher than its development indicators would suggest (ibid.). Moreover, most of such studies rely on annual data, and problems with this approach have been discussed in Chapter 3.

Both time-series vector-autoregression (VAR) and single-equation cross-section models have been used to estimate the effects of political shocks on trade. Unlike single-equation panel models, VAR models consider a system of multiple equations which allows for the endogenous treatment of both trade and political relations. By treating both trade and political relations as endogenous, VAR models allow the use of formal 'Granger causality' tests to verify the direction of the causal relationship between trade and political relations. Endogenous treatment of all variables also means that VAR models can be used to quantify the impact of 'shocks' in variables on the dynamics of other system variables.

Another advantage of using VAR models is that they allow for greater flexibility in finding different lag structures among different bilateral relationships. Panel-data models impose a common lag structure on all dyads. However, it is natural to expect different lag structures across countries as there exist important heterogeneities that are not explicitly modelled, such as differences in industrial structure, nature of contracts and so on (Du et. al. 2017, p. 220). Therefore, imposing common lag structures on all dyads may not be congruent with the actual lag structures for different dyads. While panel-data models pool together data from several country-dyads, VAR models consider only one dyad at a time but allow for lagged terms in order to understand the dynamics of the trade-politics relationship. VAR models also generally consider a much longer period of time than panel data models to make up for losses in the number of observations.

Gasiorowski and Polachek (1982) is often credited as the first attempt at using bi-variate VAR models to formally test for Granger causality between bilateral trade interdependence and political relations. Granger’s (1969) definition of “causality” is summarized in Pierce (1977): “Granger's definition is in terms of predictability: a variable X causes another variable Y, with respect to a given universe or information set that includes X and Y; if present Y can be better predicted by using past values of X than by not doing so, all other information available (including past values of Y) being used in either case (Pierce 1977, p.12, cited in Reuveny and Kang, 1996, p.944).

Gasiorowski and Polachek (1982) measure US relations with seven Warsaw Pact countries between 1967 and 1978 using a variety of trade measures and a net conflict variable constructed using the COPDAB event dataset. Data is aggregated at the annual frequency. Based on their empirical findings, Gasiorowski and Polachek (1982) conclude ‘… that causality runs largely from trade to conflict … [and] [t]his result provides strong support for the notion that trade can be used as an instrument to alter another country's behavior[u]r’ (p. 728). They also consider whether the relationship between trade and conflict differs by type of goods and for different country dyads. Gasiorowski and Polachek (1982) report that there is ‘… some indication that the structure of intra-bloc relations and the structures of the Warsaw Pact economies affected the degree to which trade and conflict were related for these countries’ (p. 728).

Reuveny and Kang (1996) extend the study by Gasiorowski and Polachek (1982) by including a larger number of country-dyads in their sample. They also increase the time period of study by combining COPDAB and IDEA datasets. They conclude that the causal relationship between trade and political relations is largely reciprocal (p. 964). They also state that different dyads differ in the lag structures ranging from one to four quarters (p. 964-965). In such scenarios, the use of panel-data models that impose a common lag structure on all dyads may be inappropriate. The relatively short lag structures also lead Reuveny and Kang (1996) to conclude that that the use of low-frequency annual data to study the relationship between trade and political relations may be inadequate (p. 965).

Reuveny and Kang (1998) also use Granger causality tests but additionally disaggregate trade data into ten commodity groups to explore whether the relationship between trade and political relations differs by good type. They consider four country-dyads (USA-USSR, USA-China, Turkey-Greece, and Egypt) using data between 1970-1990 aggregated at the quarterly level, and sixteen dyads using data between 1960-1990 aggregated at the annual level. The political relations variable used is similar to the one used in Reuveny and Kang (1996). Based on their empirical findings, Reuveny and Kang (1998) conclude that 'Granger causality between bilateral trade and conflict/cooperation is generally reciprocal in most goods and dyad dependent, but independent of whether or not two countries are political rivals' (p. 581).

Armstrong (2008) conducts Granger causality tests to verify the direction of causality between trade and political relations for China and Japan and both sensitivity and dependence variables to measure trade and IDEA data to construct a net cooperation variable for the different dyads between 1990 and 2004. The results suggest a reciprocal relationship between trade and political relations. Specifically, greater political cooperation from Japan towards China helps explain an increase in Japanese exports to China between 1990-97 but also growing Chinese trade dependency on Japan helps explain Japan's greater political cooperation towards China between 1998-2004.

Du et al. (2017) use a multi-variable VAR model, but rather than conduct Granger causality tests, they investigate the extent to which political shocks affect bilateral trade using monthly data. They use the VAR model to generate impulse response functions (IRFs) to quantify the effect of political shocks on trade over different time periods. Their empirical findings suggest that political tensions negatively impact exports of partner countries to China, but these effects are both small and short-lived, lasting up to two months. On average, a one standard deviation negative shock to political relations leads to a 0.05

percent decline in exports in the first month following the shock, and an additional decline of 0.06 percent in exports in the second month. By the third month the effects dissipate. Although the dynamic patterns vary for different countries, the magnitude and duration of the effects are generally similar, that is adverse political shocks lead to a short-term decline in exports. The cumulative effects of political shocks on trade are also estimated and shown to be insignificant.

Lee (2018) uses both panel-data and VAR models to examine the relationship between trade and political relations for South Korea and four of its neighbours (China, Japan, Russia and North Korea). The study uses exports and imports data to measure trade and net cooperation and conflict variables based on GDELT data. An additional variable to measure political relations, the ideal point measure based on UNGA voting data is also considered. The empirical findings suggest that South Korea's political relations with its neighbours do affect South Korea's trade with these countries but differs in magnitude and duration for different countries (Lee 2018, p.76-77).

3 Empirical model and data

The empirical approach in this paper follows Du et al. (2017) by situating the gravity model of trade within a vector auto-regression (VAR) framework. As discussed above, the flexible nature of this framework allows for the endogenous treatment of trade and political relations along with the covariates considered (Du et al. 2017, p. 218). Moreover, a VAR framework allows for quantification of the dynamic effects of political shocks on trade, that is short-run effects that last for months, and long-run effects that last for years, enabling inferences to be made about the dynamic impact of the shocks (Du et al. 2017).

Formally, the model estimated is,

$$x_{j.m} = \alpha_0 + \sum_{I=1}^{n} A_{j,i}\left(x_{j.m-i}\right) + e_{j.m} \qquad \dots (4.1)$$

$$where\ x_{j.m} = (\Delta ex_{j,m}, \Delta PRI_{j,m}, \Delta y_{c,m}, \Delta y_{j,m}, \Delta reer_{j,m})' \qquad \ldots (4.2)$$

where the subscript *j* represents partner countries = {Australia, France, Germany, Great Britain, India, Japan, Pakistan, South Korea, Russia, USA}, m represents the month = {January 1998, … December 2018}. The column vector $x_{j,m}$ contains, (i) the percentage change in partner *j*'s seasonally adjusted exports to China at time *m* ($\Delta ex_{j,m}$), (ii) the percentage change in partner *j*'s PRI towards China at time *m* ($\Delta PRI_{j,m}$), (iii) the percentage change in China's industrial production index at time *m* $(\Delta y_{c,m})$, (iv) partner *j*'s Industrial Index of Production (IIP) at time *m* ($\Delta y_{j,m}$) and, (v) the change in the ratio of partner *j*'s real effective exchange rate to China's real effective exchange rate at time m ($\Delta reer_{j,m}$). The trade data is from the IMF Directorate of Trade Statistics (IMF DOTS), the political events data is from the GDELT database as described in the earlier section, the IIP data is from the World Bank General Economic Monitor (WBGEM) and the OECD Statistics Database (OECDStat), and the real exchange rate data is from the Bruegels database. The summary statistics are presented in Table 4-1.

The $A_{j,i}$'s in the model are 5x5 matrices that contain the VAR model coefficients and E(ee'] is the 5x5 variance-covariance matrix of contemporaneous error terms. The lag order *n* is selected using the Schwarz Information Selection Criterion (SC). Estimation of the model in differences is necessary because the PRI series is found to be non-stationary in levels but stationary in first differences for most partners. All other data-series are also found to be first-order integrated and the model is tested for co-integration.

As discussed in Sims (1980), estimation of VAR models requires a-priori assumptions based on the causal ordering of contemporaneous shocks between system variables. Based on the conceptual framework developed in Chapter 2, these shocks are interpreted as follows, respectively: an exogenous moderate political conflict event is initiated by China's partners; with a lag of one month, China retaliates through an attempt to change the terms-of-trade (measured as exchange rates) in its favour; subsequently, the changes in terms-of-trade impact trade flows; which in turn leads to changes in consumption for both countries.

Table 4-1: Summary statistics

Variables	Obs.	Mean	Std. Dev.	Source
Exports (USD Millions)	2520	3944.675	4538.9	IMF DOTS
Log PRI (Government actors)	2520	6.725	0.285	GDELT Database
Log PRI (Military actors)	2520	6.544	0.138	GDELT Database
Log tfPRI (Government actors)	2520	2.044	0.107	GDELT Database
Log tfPRI (Military actors)	2520	2.046	0.089	GDELT Database
China Industrial Index of Production	252	0.564	0.352	WBGEM
Partner Industrial Index of Production	2520	0.902	0.185	WBGEM & OECDStat
Real Effective Exchange Rate	2520	0.899	0.176	Bruegels Database

Source: Author's calculations

The model is estimated using data aggregated at the monthly level rather than at the annual level due to the issues with annual data discussed in Chapter 3. In the analysis, the change in IIP for China is placed before the change in IIP of the partner country, while the opposite configuration is used as a robustness check.

4 Results: the short-lived effects of political shocks on trade

The effects of political shocks on trade can be measured using orthogonalized impulse response (OIR) functions which show the change that occurs over time to the value of one variable in the model as another variable is shocked. Figure 4-1 shows the impulse responses of a one standard deviation positive shock in political relations from the perspective of government actors on export growth to China for the ten partner countries. Figure 4-2 shows the analogous functions using the trade-filtered PRI from the perspective of government actors. The black line in each case shows the OIR estimate

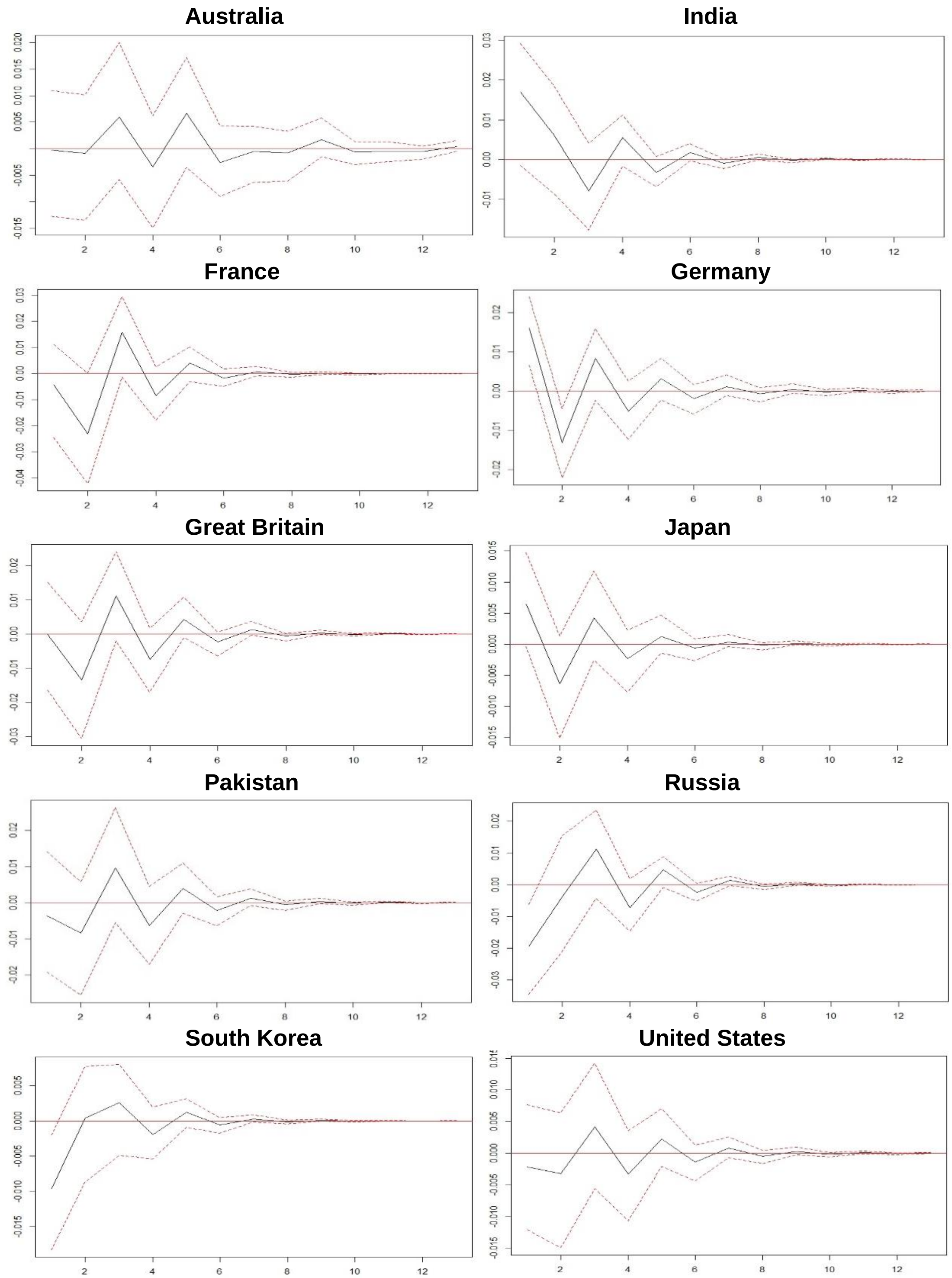


Figure 4-1: Short-run effects of political shocks (Government PRI) on export growth

Source: Author's calculations

Notes: Y-axis is percentage change in exports divided by 100 (i.e., the OIR coefficient). X- axis is months after political shock.

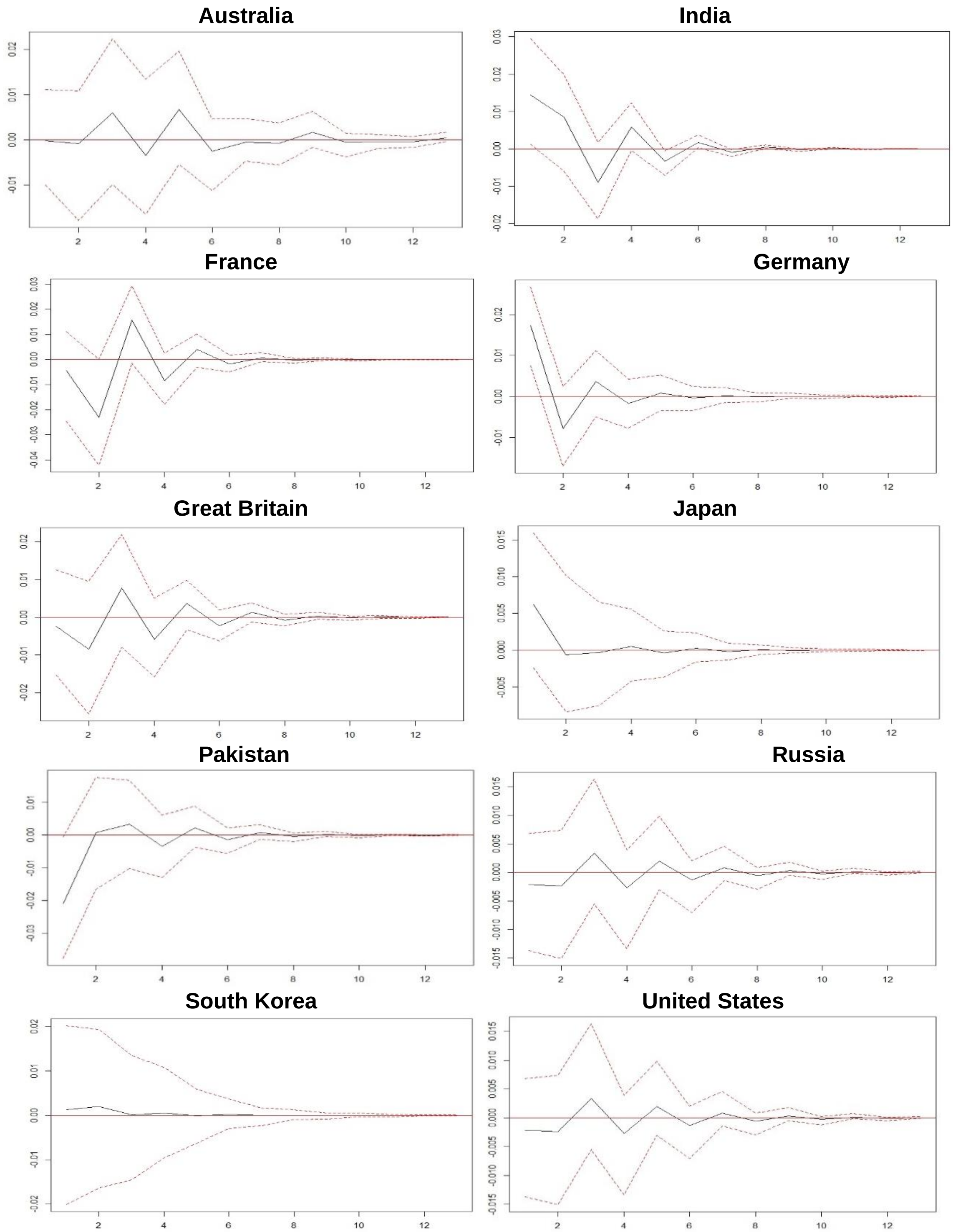


Figure 4-2: Short-run effects of political shocks (Government trade-filtered PRI) on export growth

Source: Author's calculations

Notes: Y-axis is percentage change in exports divided by 100 (i.e., the OIR coefficient). X- axis is months after political shock.

while the red lines show the lower and upper bound estimate at the 90 percent confidence interval using a bootstrap method. Glancing across the figures, it can be seen that for most cases shocks in political relations have no significant effects on export growth to China. Although political relations do affect significantly exports to China for some partners, these effects tend to be short-lived, lasting at most up to 2 months. By 12 months, for each of the partners the effects vanish completely.

When political relations are measured without trade-filtering, Germany, Japan, Russia, and South Korea have a significant effect in the month of the political shock (month 1), but the effects die out from the second month onwards. The overall magnitude of the effects is also quite small for the case when the effects are significant, with a one standard deviation positive shock in political relation increasing export growth by about 1-2 percent for Germany and Japan but reducing export growth by a similar amount for Russia and South Korea.

The results are similar when the trade-filtered PRI is considered, that is, for most cases there is no effect of political shocks on trade, and in the cases where there are effects, these die down by the second month after the political shock. Specifically, using the trade-filtered PRI, India, Germany, and Pakistan have a significant effect in the month of the political shock, but these effects vanish by the second month. The magnitude of the effects is also quite similar, with a one standard deviation shock increasing export growth in month 1 for Germany and India by 1-2 percent and reducing export growth for Pakistan by 2 percent. That significant effects are present for Japan, Russia and South Korea for the trade-unfiltered PRI but not for the trade-filtered PRI suggests that some of the dynamic effects in the trade-unfiltered PRI series are driven by trade-related events, such as negotiations and agreements.

The analogous IORs using military actor PRIs are shown in Figure 4-3 (unfiltered PRI) and Figure 4-4 (trade-filtered PRI). For the unfiltered series, the only country which has any short-run effects of political shocks on export growth is the US. Unlike the earlier cases, this effect is seen to persist through the entire year after the shock. The magnitude

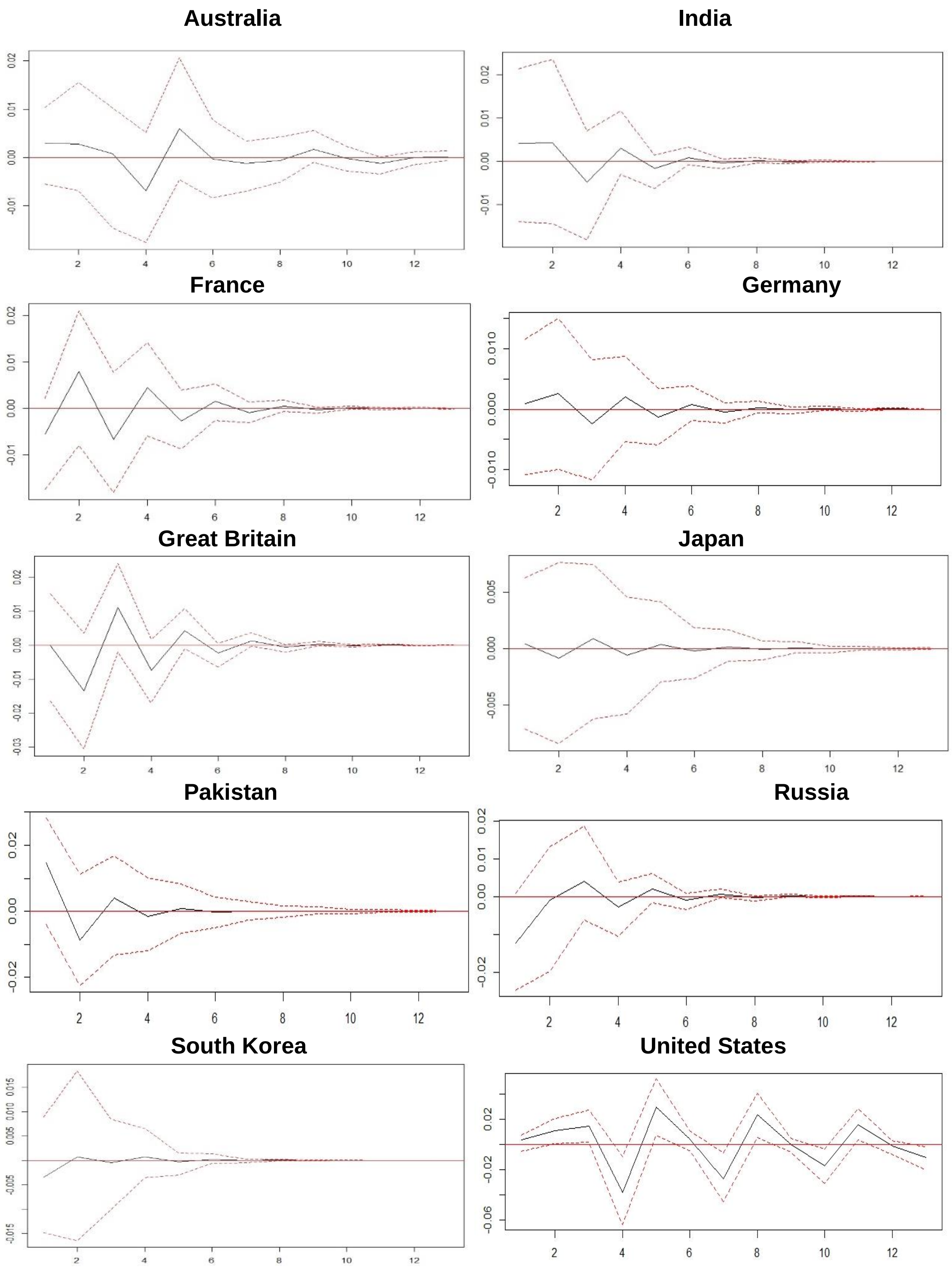


Figure 4-3: Short-run effects of political shocks (Military PRI) on export growth

Source: Author’s calculations

Notes: Y-axis is percentage change in exports divided by 100 (i.e., the OIR coefficient). X- axis is months after political shock.

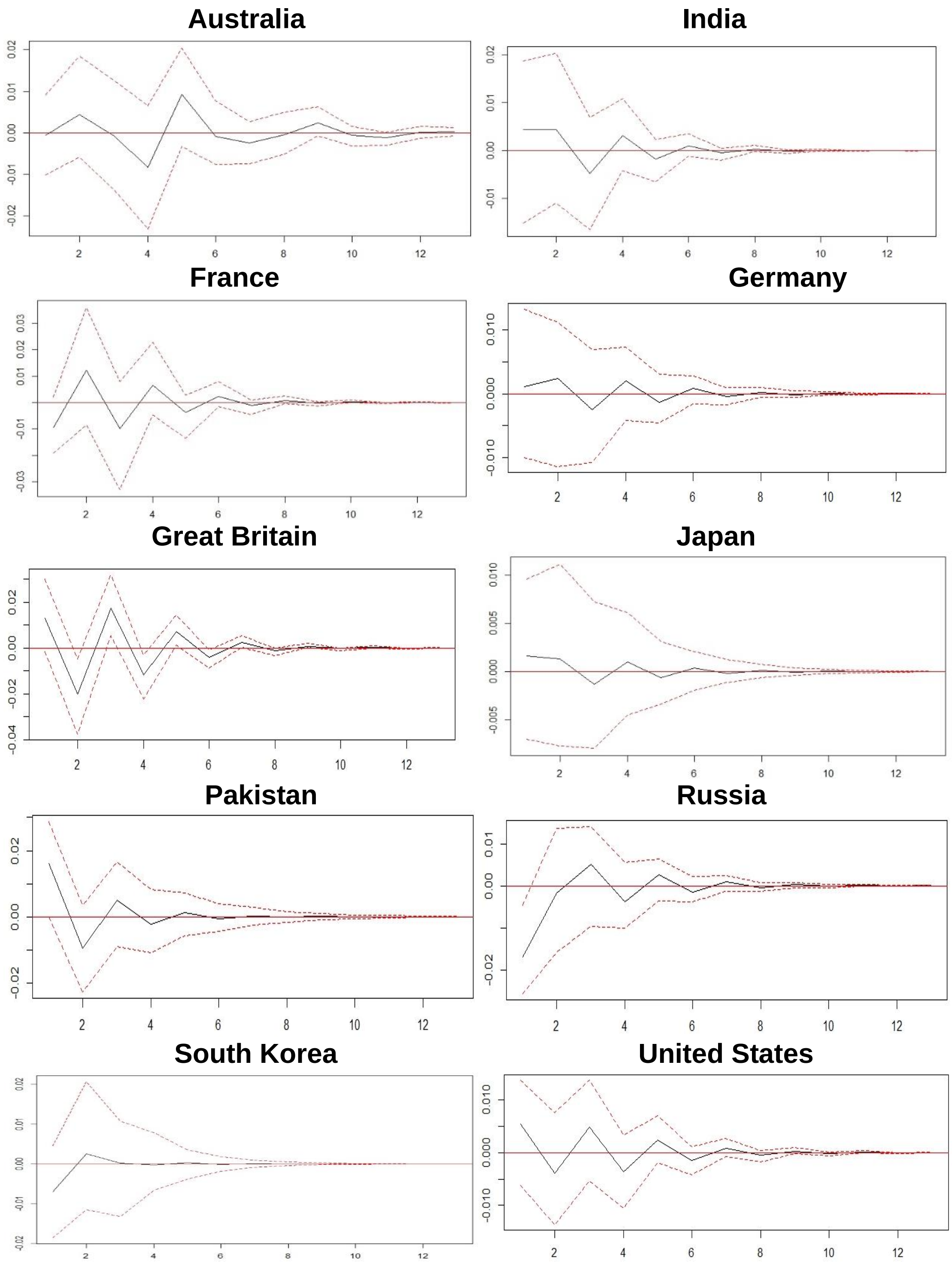


Figure 4-4: Short-run effects of political shocks (Military trade-filtered PRI) on export growth

Source: Author's calculations

Notes: Y-axis is percentage change in exports divided by 100 (i.e., the OIR coefficient). X- axis is months after political shock.

of the shock is largest at the beginning of the shock in the same range (2 percent) as the government PRI series and is seen to reduce over time. The results, however, vary for the trade-filtered series with the effects for the US case disappearing, suggesting that the effects for the unfiltered series are driven by trade-related events. Instead, significant short-term effects are seen for the case of Great Britain, Pakistan, and Russia, with the magnitude of effects being in a similar range. However, once again these short-term effects vanish a month or so after the political shock. Overall, although different countries display slightly different dynamic patterns for the different PRI series, the magnitude and duration of the effects are generally similar. The difference in the dynamic patterns across countries are to be expected, given that several heterogeneities across countries, such as industrial structure, are not explicitly modelled.

5 Results: the long-run effects of political shocks on trade

To further analyse whether the effects of political shocks on trade are transitory, the cumulative effects of political shocks on exports implied by the VAR model are also computed. As put in Du et al. (2017), '[e]xamining the cumulative effect on the changes is a straightforward way of evaluating whether there are long-lasting effects on levels' (p. 221). Put simply, calculating the cumulative effects amounts to summing up the short-run effects over the time period required. Following Du et al. (2017), the cumulative effects are computed over a time horizon of two years.

The results are shown in Table 4-2, with Panel A showing the results for the government PRI series and Panel B showing the results for the military PRI series. For the unfiltered government PRI series, a significant effect on levels is seen for the case of India, France, Russia, and South Korea, and similar results are found using the trade-filtered series except for the case of South Korea (suggesting that for South Korea the results are driven by trade-related events). However, these results are overall small and combined with the short-run results can be seen to be largely due to the effects felt in the first months after the political shock. Overall, the magnitude of the effects is also quite small, with the largest

Table 4.2: Long-run effects of shocks in political relations on export growth

Panel A: Government actors

	Government PRI			Government tfPRI		
	Lower bound	Estimate	Upper bound	Lower bound	Estimate	Upper bound
Australia	-0.9	0.3	1.3	-0.7	0.4	1.5
India	0.4	1.9*	3.3	0.4	1.8*	3.0
Japan	-0.4	0.3	0.9	-0.2	0.6	1.2
France	-3.6	-1.7*	-0.2	-4.4	-2.5*	-1.2
Germany	-0.02	0.8	1.5	0.4	1.2*	1.9
Great	-2.0	-0.7	0.4	-1.8	-0.7	0.6
Pakistan	-2.2	-0.6	0.6	-3.6	-1.9*	-0.5
Russia	-2.9	-1.6*	-0.1	-3.4	-2.0*	-0.1
South Korea	-1.4	-0.8*	-0.005	-1.2	0.4	1.9
USA	-0.3	-1.1	0.3	-0.3	-1.1	0.7

Panel B: Military actors

	Military PRI			Military tfPRI		
	Lower bound	Estimate	Upper bound	Lower bound	Estimate	Upper bound
Australia	-0.7	0.4	1.3	-1.0	1.0	1.2
India	-1.2	0.6	2.1	-0.5	0.6	2.1
Japan	-0.7	0.009	0.6	-0.5	0.2	0.9
France	-1.1	-0.1	0.8	-1.6	-0.3	0.7
Germany	-0.6	0.2	1.1	-0.7	0.2	1.2
Great	-0.7	0.3	1.1	-0.7	-1.0	1.3
Pakistan	-0.9	0.9	2.1	-0.9	0.04	2.0
Russia	-2.4	-1.1	0.1	-3.1	-1.6*	-0.4
South Korea	-1.4	-0.3	1.2	-1.8	-0.4	0.7
USA	0.07	1.1*	1.8	-0.4	0.4	1.2

Source: Author's calculations

Notes: All values are in percentages. * indicates significance at the 10 percent level.

effect seen for India which experiences a 2 percent increase in export growth, two years after a political shock.

Looking at the military PRI series, only for the US case is there a significant long-run effect when the unfiltered PRI series is considered. For all other countries, there is no significant long-run effect on levels of exports when the unfiltered series is considered. However, the significance of the US result disappears when the trade-filtered series is taken, suggesting that the significance was driven by trade-related events. However, there is a significant long-run effect seen for the case of Russia, although once again the magnitude of the effect is small of about 2 percent driven primarily by the first month shock. Overall, these results suggest that compared to the government-related PRI

series, the military-related PRI series have a relatively smaller impact on export growth to China. However, these results may also be driven by the lower volatility in political relations when the PRI series is measured from the perspective of military actors as several partners have little heterogeneity in relations due to the lack of military cooperation or conflict between China and its major trading partners during this period. The tables for the alternative identification in which the change in partner IIP is placed before Chinese IIP are produced in Appendix C and are identical to the tables produced here.

6 Gravity-equation models: monthly versus annual frequencies

The analysis from the last two sections suggests that the effects of political shocks on export growth to China are largely short-lived. This section estimates gravity-equation models at the monthly and annual frequencies to further examine the implication of data aggregation on such estimates. Following Du et al. (2017), the standard gravity equation model augmented by dynamic effects is estimated. Because most of the significant effects in the previous section are for government relations, the analysis is restricted to the trade-filtered PRI from the perspective of government actors.

Formally, the model estimated is,

$$\Delta ex_{j.m} = \alpha_0 + \sum_{k=0}^{n} \gamma_k(\Delta ex_{j.m-k}) + \sum_{k=0}^{n} \theta_k(\Delta tfPRI_{j.m-k}) + \beta_1(\Delta y_{j.m}) + \beta_2(\Delta er_{j.m}) + time + c_j + \eta_{j.m} \quad \ldots (4.3)$$

where subscript "*j*" represents the country = {Australia, Germany, France, India, Japan, Pakistan, Russia, U.K., U.S}, "*m*" represents the month = {Jan. 1998 … Dec. 2018}. The variables are (i) the percentage change in partner *j*'s exports to China at time *m* ($\Delta ex_{j.m}$) (ii) the change in the China–partner *j*'s trade-filtered political relations index at time *m-k* ($\Delta tfPRI_{j.m-k}$); (iii) the percentage change in partner *j*'s Industrial Index of Production (IIP) at time *m* ($\Delta y_{j.m}$); and (iv) the change in the ratio of partner *j*'s real effective exchange rate to China's real effective exchange rate at time *m* ($\Delta er_{j.m}$), *time* represents the time fixed effects, c_j represents the partner fixed effects, and $\eta_{j.m}$ is the error term.

Allowing for time fixed effects means that China's growth rate in output can be dropped from the model which is normally included in standard gravity models. The inclusion of partner fixed effects means that the distance variable that is also included in gravity models can also be dropped. Following Du et al. (2017), up to four lags of the PRI variable (for both monthly and annual regressions) are included to allow for the possibility that political relations affect trade, but not necessarily contemporaneously.

Tables 4-3 and 4-4 display the results for the monthly and annual regressions respectively. The model is estimated using both Pooled OLS estimation which does not include fixed effects along with the fixed-effects estimation. To assess whether temporal aggregation matters, we have to compare the contemporaneous (current) PRI coefficients of the monthly and annual regressions. The coefficients in the annual regression absorb the effects that take place at the monthly level and are a non-linear function of the coefficients in the monthly regression and the auto-regressive process (Du et al. 2017, p. 222). In the absence of temporal aggregation bias, the contemporaneous PRI effect would be the same for both frequencies. Therefore, any differences in these coefficients (contemporaneous PRI variable in the monthly regression, versus the same in the annual

Table 4-3: Gravity equation model regression results: monthly level regression

	Pooled OLS			Fixed effects		
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta ex_{j,t-1}$		**-0.36*** (0.03)**	**-0.49*** (0.03)**		**-0.36*** (0.02)**	**-0.49*** (0.04)**
$\Delta ex_{j,t-2}$			**-0.37*** (0.02)**			-0.37 (0.04)
$\Delta tfPRI_{j,t}$	0.03 (0.03)	0.02 (0.03)	0.03 (0.03)	0.03 (0.03)	0.02 (0.04)	0.03 (0.04)
$\Delta tfPRI_{j,t-1}$		0.00 (0.04)	0.01 (0.04)		0.00 (0.03)	0.01 (0.04)
$\Delta tfPRI_{j,t-2}$		**0.08** (0.03)**	**0.10** (0.04)**		**0.08** (0.04)**	0.10 (0.07)
$\Delta tfPRI_{j,t-3}$			0.04 (0.04)			0.04 (0.06)
$\Delta tfPRI_{j,t-4}$			-0.01 (0.03)			-0.01 (0.04)
$\Delta y_{j,t}$	**1.11** (0.50)**	**1.13** (0.46)**	**1.33*** (0.45)**	**1.11* (0.59)**	1.14 (0.64)	1.34 (0.74)
$\Delta er_{j.t}$	**0.88** (0.37)**	**1.03*** (0.32)**	**1.14*** (0.33)**	**0.88** (0.32)**	**1.03*** (0.30)**	**1.14*** (0.29)**
Constant	**0.01*** (0.00)**	**0.01*** (0.00)**	**0.02*** (0.00)**	**0.01*** (0.00)**	**0.01*** (0.00)**	**0.02*** (0.00)**
R^2	0.10	0.14	0.26	0.10	0.14	0.26
Observations	2,495	2,475	2,455	2,495	2,475	2,455
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes

Source: Author's calculations
Notes: *** p < 0.01, ** p < 0.05, * p < 0.10

regression) 'would be attributable to the inconsistency that the temporal aggregation introduces through the moving average' (Ibid.).

Columns (1) and (4) in Tables 4-3 and 4-4 show the benchmark results without the presence of any auto-regressive or lags of the political relations variables. Columns (2) and (5) in both regressions contain one auto-regressive component of the dependent variable which captures the dynamics of exports over time following a political shock. A negative coefficient here implies that the dynamics of export growth follows a fast-moving, mean-reverting process after the shock takes place. Columns (2) and (5) in the monthly regression also include two lags of the political relations variable which allows for a delayed effect of political shocks on export growth to be captured.

To highlight the temporal aggregation issue, Columns (2) and (5) in the annual regressions do not include any lagged political relations variable, thereby highlighting the importance of the contemporaneous (current) PRI coefficient. Lastly, Columns (3) and (6) contain two autoregressive lags for exports, as well as four lags of the political shocks variable to ensure robustness of the results to number of lags.

Comparing the results of regressions for columns (3) and (6) best illustrates the difference in the dynamics between the monthly and annual effect. The coefficients in Column (3) imply that a one-unit decline in political relations has no effect on exports one month after a political shock but increases export growth by 4 (= -0.49x0.08) units two months after the shock, resulting in a cumulative effect of positive 0.04 units. In Column (6), none of the political relations variables are significant, suggesting that shocks in political relations have no impact on export growth. This timing and observed dynamic pattern are consistent with the one detected in the VAR results which show either short-run effects that last up to two months and negligible or small cumulative impacts of a political relations shock on export growth for several partners.

In contrast, Columns (3) and (6) of the annual level regressions (Table 4.4) indicate that a one-unit decline in political relations have a significant impact on export growth, with export growth declining by 0.24 units in the same year as the political shock, along with a further decline in export growth up to three years after a political shock (although the effects do dampen in the second period). Moreover, as the second lag of exports is insignificant, these results suggest that the effects are persistent, with a 0.38-unit decline in export growth three years after a political shock.

Table 4.4: Gravity equation model regression results: annual level regression

	Pooled OLS			Fixed effects		
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta ex_{j,t-1}$		**-0.17*** (0.08)**	**-0.14** (0.08)**		**-0.166*** (0.057)**	**-0.14*** (0.05)**
$\Delta ex_{j,t-2}$			**-.015*** (0.06)**			**-0.146*** (0.07)**
$\Delta PRI_{j,t}$	**0.17** (0.08)**	**0.15** (0.08)**	**0 .23*** (0.08)**	**0.17* (0.09)**	**0.14* (0.09)**	**0.24*** (0.08)**
$\Delta PRI_{j,t-1}$		-0.01 (0.10)	0.10 (0.12)		-0.02 (0.06)	**0.11* (0.06)**
$\Delta PRI_{j,t-2}$		0.06 (0.08)	**0.32*** (0.10)**		0.06 (0.05	**0.34*** (0.10)**
$\Delta PRI_{j,t-3}$			**0.36*** (0.09)**			**0.38*** (0.08)**
$\Delta PRI_{j,t-4}$			0.14 (0.09)			0.15 (0.10)
$\Delta y_{j,t}$	**4.37*** (0.57)**	**4.38*** (0.62)**	**4.56*** (0.60)**	**4.69*** (0.59)**	**4.68*** (0.62)**	**4.90*** (0.74)**
$\Delta er_{j.t}$	**1.45*** (0.50)**	**1.73*** (0 .42)**	**1.78*** (0.37)**	**1.44*** (0.56)**	**1.73*** (0.60)**	**1.73*** (0.48)**
Constant	**0.01*** (0.00)**	**0.01*** (0.00)**	**0.01*** (0.00)**	**0.01*** (0.00)**	**0.01*** (0.00)**	**0.01*** (0.00)**
R^2	0.26	0.33	0.42	0.26	0.33	0.42
Observations	208	188	168	208	188	168
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes

Source: Author's calculations
Notes: *** p < 0.01, ** p < 0.05, * p < 0.10

Overall, the gravity equation results are very similar to the results found by Du et al. (2017) and similar conclusions can be drawn from them. First, with monthly data, the effect of political relations on export growth for the case of China and major trading partners is insignificant. However, with annual data, there is a significant negative impact of a negative shock in political relations on export growth. Second, using monthly data, the effect of political shocks on export growth is slightly delayed, moderate and transitory, while for the annual data, the effects are contemporaneous, relatively larger, and persistent. The first result highlights that temporal aggregation is a significant issue when estimating the effects of political relations on trade for the case of China and major partners. The second result highlights the aliasing problem, that is, with temporally aggregated data it is not possible to uncover the dynamics of the effects of political shocks on trade.

7 Summary and Conclusion

Building on the theoretical model derived in Chapter 2, and the indicator of political relations constructed in Chapter 3, this chapter estimated the effects of political relations on exports to China for major trading partners between 1998-2018. The analysis in Chapter 3 showed that a large proportion of the variation in the PRI series occurred at high frequencies which increased the chances of inconsistent estimates being found if low-frequency data was used. While the dynamic pattern of effects varies for countries, overall, we find that that the effects are small and short-lived, with a one standard deviation in political relations resulting in a 0.01-0.02 percent change in export growth for two months after the shock. While for most cases there are no long-run effects on export levels two years after the shock, in some cases these effects do persist. These effects are slightly stronger when political relations are measure using government actors as opposed to military actors.

Of the various hypothesis regarding the trade-conflict nexus formulated in Chapter 2, the empirical results in this Chapter tend to support the accidental deviations hypothesis and globalisation hypothesis over the terms-of-trade hypothesis. For a majority of countries, political shocks have short-term effects on trade but have no long-term effects. These results support the accidental-deviation hypothesis suggests that while political shocks can affect trade flows as countries move respond to higher conflict by partners through an increase in conflict themselves, these effects would be short-lived as countries move back to a Pareto superior combination of healthy trade and low conflict. For several cases there are neither short nor long-term effects of political shocks on trade which would support the globalisation hypothesis that political shocks have no effects on trade. Lastly, only for a minority of cases are there long-term effects of political shocks on trade, which would support the terms-of-trade hypothesis that political shocks should have long term effects on trade flows.

Chapter 5 Do good types matter? A product-level disaggregated analysis

Abstract: This chapter extends the empirical analysis by investigating the effects of political shocks on trade disaggregated at the product level for five of China's largest trading partners, Australia, India, Japan, South Korea, and the USA. Overall, the findings suggest that the effects of political shocks on trade can differ across both product-types and trading partners. For a given trading partner, some product types may be affected significantly by political shocks but not others, while for a given product type, some partners may see significant effects but not others. Specifically, the only case for which political shocks have significant short and long-term effects is machinery equipment exports for South Korea. Several good types though have short-term effects including, textiles and live animal products for Australia, base metals and textiles for India, chemical products for Japan, machinery equipment and base metals for South Korea, and machinery, vehicles and transport equipment, optical instruments, and mineral products for the USA.

1 Introduction

The empirical exercises conducted in the last chapter suggested that moderate political shocks had largely short-term impacts on exports to China for several of its major trading partners. However, aggregation of exports lumps together several different types of goods into one variable and does not allow for the distinction between the impact of political shocks across different good types.

Although there are some studies which investigate the impact of political shocks on international trade at the product level, the literature is not significant. In a study of the effects of consumer boycotts motivated by international disputes, Heilmann (2016) finds that "boycotts are most effective for consumer goods, especially highly-branded signature export goods such as Japanese cars, while having at most a temporary effect on intermediates and capital goods" (Abstract). In a study of 20 dyads, Reuveny and Kang (1998) find that political conflict tends to Granger-cause bilateral trade in minerals, iron and steel, fuels, basic manufactures and control and scientific equipment. Fuchs and Klann (2013) and Lin et al. (2019) find that deterioration of political relations with China due to hosting the Dalai Lama has a significantly negative impact on food and live animals as well as machinery equipment, but not other good types. However, each of these studies aggregate data at the annual level, which has been shown to potentially introduce bias in the results and does not allow for the distinction between short and long-term effects.

This chapter extends the analysis by considering the impact of political shocks across different good types using monthly data for five of China's trading partners, Australia, India, Japan, South Korea, and the USA. As in the previous chapter, the choice of these partners is due to their large share of trade with China alongside volatility in political relations which allows for an econometric study of the effects of political shocks on trade. The empirical model used in identical to the VAR model introduced in Chapter 4 (equation 4.1 and 4.2), except that product-level data is used instead of aggregate exports. Only the top five export categories are considered for each of the trading partners, because in most cases these categories together account for more than 80 percent of exports to China for each of the trading partners. The political relations variable is restricted to the trade-filtered PRI from the perspective of government actors as the previous chapter showed that most significant effect are for government rather than military actors. To keep the analysis succinct, only the trade-filtered version of the PRI is used.

Overall, the findings suggest that the effects of political shocks on trade can differ across both product types and trading partners. For example, for the China-South Korea case, political shocks have significant short- and long-term effects on machinery equipment exports, which is South Korea's largest export type to China. However, other goods types such as base metals are only affected by political shocks in the short-term, while vehicles and transport equipment, plastics and mineral products have neither short- nor long-term effects due to political shocks. For Japan though, there are no effects of political shocks on machinery equipment, while for the USA, the effects of political shocks on machinery equipment are only short term. For Australia, India, Japan and the US, there are no long-term effects of political shocks on exports for any of the product categories. The rest of the chapter is structured as follows. Section 2 presents the empirical model and data on the composition of exports to China of the five trading partners. Section 3 provides the results of the disaggregated analysis. Section 4 concludes.

2 Empirical model and data

Table 5-1 shows the composition of exports to China for five of its largest trading partners. For Australia, more than 70 percent of exports to China are mineral products, and another 10 percent of exports are in the precious stones category. The remaining 20 percent of exports are divided among the remaining product types of which the major categories include textiles, base metals and live animal and animal products. Together the five major exports account for more than 90 percent of all Australian exports to China. Exports from India are much more diverse, with chemical products being the largest export category, comprising approximately 20 percent of exports to China. Other major export categories for India include mineral products, base metals, precious stones, and textiles. Together the top five export categories account for 75 percent of all Indian exports to China.

Machinery equipment is the major export to China for Japan (47 percent), South Korea (60 percent), and USA (24 percent), reflecting the comparative advantage in technology-intensive production that these countries have with respect to China. For Japan, other major exports include chemical products, vehicles and transport equipment, optical instruments, and base metals, which together comprise more than 75 percent of all Japanese exports to China. For South Korea, other major export categories include chemical product, vehicles and transport equipment, plastics and rubber articles and base metals, together comprising approximately 90 percent of all exports to China. Lastly, for the USA, other major export categories include vehicles and transport equipment, chemical products, optical instruments, and mineral products, together comprising for approximately 60 percent of all US exports to China. Table 5-2 lists these major export categories for the five trading partners.

Table 5-1: Composition of exports to China for selected countries by product type, 2018

HS 2 Section code	Product description	Australia	India	Japan	South Korea	USA
1	Live Animal; Animal Product	2.7	2.1	0.2	0.1	1.5
2	Vegetable Product	1.9	1.1	0.1	0.0	6.1
3	Animal or Vegetable Fat & Oil & their Cleavage Product; Prepared Edible Fat; Animal or Vegetable Wax	0.1	2.2	0.0	0.0	0.1
4	Prepared Foodstuff; Beverage, Spirit & Vinegar; Tobacco & Manufactured Tobacco Substitute	1.7	0.2	0.3	0.4	1.5
5	Mineral Product	72.9	19.0	1.1	5.6	7.7
6	Chemical or Allied Industry Product	1.2	19.1	11.2	11.2	10.6
7	Plastic & Article thereof; Rubber & Article thereof	0.1	5.9	6.3	6.2	5.3
8	Raw Hide & Skin, Leather, Fur skin & Article thereof; Saddlery & Harness; Travel Goods, Handbag & Similar Container; Article of Animal Gut Other than Silk Worn Gut	0.4	1.6	0.0	0.1	0.6
9	Wood & Article of Wood; Wood Charcoal; Cork & Article of Cork; Manufacture of Straw, of Esparto or Other Plaiting Material; Basket ware & Wickerwork	1.4	0.4	0.1	0.0	2.0
10	Pulp of Wood or Other Fibrous Cellulosic Material; Waste & Scrap of Paper or Paperboard; Paper & Paperboard & Article thereof	0.3	0.6	1.0	0.3	3.2
11	Textile & Textile Article	3.0	10.8	1.5	0.9	1.2
12	Footwear, Headgear, Umbrella, Sun Umbrella, Walking & Seat Stick, Whip, Riding Crop & Part thereof; Prepared Feather & Article Made therewith; Artificial Flower; Article of Human Hair	0.0	1.1	0.0	0.0	0.1
13	Article of Stone, Plaster, Cement, Asbestos, Mica or Similar Material; Ceramic Product; Glass & Glassware	0.0	0.3	1.2	1.1	0.9
14	Natural or Cultured Pearl, Precious Stone or Semi-Precious Stone, Precious Metal, Metal Clad with Precious Metal & Article thereof; Imitation Jewellery; Coin	10.1	15.4	0.8	0.1	2.9
15	Base Metal & Article of Base Metal	3.3	11.5	8.3	4.6	3.7
16	Machinery & Mechanical Appliance; Electrical Eq; Part thereof; Sound Recorder & Reproducer, Television Image & Sound Recorder & Reproducer & Part & Accessory of such Article	0.4	6.9	47.2	60.3	24.6
17	Vehicle, Aircraft, Vessel & Associated Transport Equipment	0.0	0.6	10.4	1.3	19.0
18	Optical, Photographic, Cinematographic, Measuring, Checking, Precision, Medical/Surgical Instrument & Apparatus; Clock & Watch; Musical Instrument; Part & Accessory thereof	0.2	1.0	9.1	7.5	8.6
19	Arm & Ammunition; Part & Accessory	0.0	0.0	0.0	0.0	0.0
20	Miscellaneous Manufactured Article	0.0	0.2	1.1	0.1	0.4
21	Work of Art, Collectors' Piece & Antique	0.0	0.0	0.0	0.0	0.0

Source: CEIC database

Table 5-2: Top 5 exports to China for selected countries, 2018

Partner	Top 5 exports in 2018 (HS2 section)
Australia	1. Mineral Products (5), 2. Natural or Cultured Pearl, Precious Stone or Semi-Precious Stone, Precious Metal, Metal Clad with Precious Metal & Article thereof; Imitation Jewellery; Coin (14), 3. Base Metal & Article of Base Metal (15), 4. Textile & Textile Articles (11), 5. Live Animal; Animal Product (1)
India	1. Chemical or Allied Industry Product (6), 2. Mineral Products (5), 3. Base Metal & Article of Base Metal (15), 4. Natural or Cultured Pearl, Precious Stone or Semi-Precious Stone, Precious Metal, Metal Clad with Precious Metal & Article thereof; Imitation Jewellery; Coin (14), 5. Textile & Textile Articles (11)
Japan	1. Machinery & Mechanical Appliance; Electrical Eq; Part thereof; Sound Recorder & Reproducer, Television Image & Sound Recorder & Reproducer & Part & Accessory of such Article (16), 2. Chemical or Allied Industry Product (6), 3. Vehicle, Aircraft, Vessel & Associated Transport Equipment (17), 4. Optical, Photographic, Cinematographic, Measuring, Checking, Precision, Medical/Surgical Instrument & Apparatus; Clock & Watch; Musical Instrument; Part & Accessory thereof (18), 5. Base Metal & Article of Base Metal (15)
South Korea	1. Machinery & Mechanical Appliance; Electrical Eq; Part thereof; Sound Recorder & Reproducer, Television Image & Sound Recorder & Reproducer & Part & Accessory of such Article (16), 2. Chemical or Allied Industry Product (6), 3. Vehicle, Aircraft, Vessel & Associated Transport Equipment (17) 4. Plastic & Article thereof; Rubber & Article thereof (7), 5. Mineral Products (5)
USA	1. Machinery & Mechanical Appliance; Electrical Eq; Part thereof; Sound Recorder & Reproducer, Television Image & Sound Recorder & Reproducer & Part & Accessory of such Article (16), 2. Vehicle, Aircraft, Vessel & Associated Transport Equipment (17), 3. Chemical or Allied Industry Product (6), 4. Optical, Photographic, Cinematographic, Measuring, Checking, Precision, Medical/Surgical Instrument & Apparatus; Clock & Watch; Musical Instrument; Part & Accessory thereof (18), 5. Mineral Products (5)

Source: CEIC database

The empirical model used to identify the effects of political shocks to exports to China is similar to the VAR model used in Chapter 4. Specifically, the model is,

$$x_{i,j.m} = \alpha_0 + \sum_{l=1}^{n} A_{j,i}\left(x_{i,j.m-i}\right) + e_{i,j.m} \qquad \dots (5.1)$$

$$where\ x_{i,j.m} = (\Delta ex_{i,j,m}, \Delta tfPRI_{j,m}, \Delta y_{c,m}, \Delta y_{j,m}, \Delta reer_{j,m})' \qquad \dots (5.2)$$

where the subscript *i* represents the product categories, *j* represents partner countries = {Australia, France, Germany, Great Britain, India, Japan, Pakistan, South Korea, Russia, USA}, *m* represents the month = {January 1998, … December 2018}. The column vector $x_{j,m}$ contains, (i) the percentage change in partner *j*'s seasonally adjusted exports to China at time m ($\Delta ex_{j,m}$), (ii) the percentage change in partner *j*'s trade-filtered PRI towards China at time m ($\Delta tfPRI_{j,m}$), (iii) the percentage change in China's industrial production index at time m $\left(\Delta y_{c,m}\right)$, (iv) partner *j*'s Industrial Index of Production (IIP) at time m ($\Delta y_{j,m}$) and, (v) the change in the ratio of partner *j*'s real effective exchange rate to China's real effective exchange rate at time m ($\Delta reer_{j,m}$). The trade data is from the IMF Directorate of Trade Statistics (IMF DOTS), the political events data is from the GDELT database as described in the earlier section, the IIP data is from the World Bank General Economic Monitor (WBGEM) and the OECD Statistics Database (OECDStat), and the real exchange rate data is from the Bruegels database.

The $A_{j,i}$'s in the model are 5x5 matrices that contain the VAR model coefficients and E(*ee'*] is the 5x5 variance-covariance matrix of contemporaneous error terms. The lag order *n* is selected using the Schwarz Information Selection Criterion (SC). Estimation of the model in differences is necessary because the PRI series is found to be non-stationary in levels but stationary in first differences for most partners. All other data series are also found to be first-order integrated and the model is tested for co-integration. As discussed in Sims (1980), estimation of VAR models requires a-priori assumptions based on the causal ordering of contemporaneous shocks between system variables. The VAR model is used to estimate OIR functions which measure the impact of a one standard deviation shocks in political relations on export growth to China. Next, the cumulative effects over two years are computed which help evaluate whether there are long-lasting effects on levels.

Based on the conceptual framework developed in Chapter 2, these shocks are interpreted as follows, respectively: an exogenous moderate political conflict event is initiated by China's partners; with a lag of one month, China retaliates through an attempt to change the terms-of-trade (measured as exchange rates) in its favour; subsequently, the changes in terms-of-trade impact trade flows; which in turn leads to changes in consumption for both countries. The model is estimated using data aggregated at the monthly level rather than at the annual level due to the issues with annual data discussed in Chapter 3. In the analysis, the change in IIP for China is placed before the change in IIP of the partner country, while the opposite configuration is used as a robustness check.

3 Results: short and long-term effects of political shocks on export growth

3.1 China-Australia

Tables 5-3 and 5-4 present the short- and long-term effects of a one standard deviation (positive) shock in Australian government cooperation towards China on Australian export growth to China. For mineral products, which comprises more than 70 percent Australian exports to China, there are no significant short-term or long-term effects of political shocks on export growth to China. Similarly, for precious stones, which comprises another 10 percent of Australian exports to China there are neither significant short-term or long-term effects of political shocks on export growth, and similar results are found for base metals.

However, for textile articles there is a significant effect found in the month in which the political shock takes place, but there are no significant short-term effects in any of the following months. Moreover, there are no significant long-terms effects of political shocks for the base metals category. Lastly, for the live animals and animal product category there is a short-term effect of political shocks on export growth in the fifth month after the

Table 5-3: China-Australia short-run effects of political shocks on export growth

HS2 Section	Variable	Months after political shock											
		1	2	3	4	5	6	7	8	9	10	11	12
5	Lower bound	-13.8	-0.7	-12.1	-13.8	-8.5	-5.6	-4.1	-6.2	-1.9	-0.6	-1.6	-2
	Estimate	-5.5	10.7	-1.0	-3.9	0.3	2.5	0.4	-1.6	0.6	0.8	-0.2	-0.6
	Upper bound	4.3	25.1	9.8	6.5	10.2	9.3	5.9	2.3	2.9	2.7	1.1	0.3
14	Lower bound	-2.5	-1.6	-3.2	-3.9	-4.9	-0.7	-0.4	-1.1	-1.4	-0.1	-0.3	-0.4
	Estimate	0.8	0.9	0.9	-0.3	-1.7	0.8	1.0	-0.2	-0.5	0.3	0.1	-0.2
	Upper bound	4.0	4.7	4.8	4.0	1.9	2.5	2.4	0.9	0.5	0.8	0.4	0.1
15	Lower bound	-1.0	-2.1	-0.4	-1.1	-1.5	-1.0	-0.3	-0.5	-0.2	-0.4	-0.2	-0.3
	Estimate	0.2	-0.7	1.5	0.2	0.1	-0.2	0.3	-0.1	0.1	0.1	0.1	-0.1
	Upper bound	1.5	0.8	2.9	1.7	1.2	0.6	0.9	0.4	0.5	0.2	0.2	0.1
11	Lower bound	0.1	-2.7	-1.8	-1/0	-1.0	-2.4	-0.1	-0.6	-0.6	-0.7	-0.1	-0.3
	Estimate	**1.3***	-1.2	-0.3	0.9	0.5	-1.2	0.5	0.1	0.1	-0.2	0.1	-0.1
	Upper bound	2.3	0.5	1.6	2.8	2.3	0.1	1.4	0.8	0.6	0.2	0.4	0.1
1	Lower bound	-0.7	-4.6	-0.5	-1.8	-7.6	-1.2	-1.1	-1.0	-2.4	-0.2	-0.6	-0.3
	Estimate	2.1	-1.6	2.5	1.3	**3.7***	0.8	0.5	0.5	-1.1	0.5	0.1	0.2
	Upper bound	3.9	1.1	5.7	3.9	-0.4	2.7	2.0	2.0	0.1	1.5	0.5	0.9

Notes: This table shows the dynamic effects of a one standard deviation (positive) shock in Australian government cooperation towards China on Australian export growth to China over the following 12 months. All figures are in percentages. * denotes significance at 90 percent level.
Source: Author's calculations.

Table 5-4: China-Australia long-run effects of political shocks on export growth

	HS2 Section	5	14	15	11	1
Variable	Lower bound	-1.2	-0.4	-0.4	-0.2	-0.4
	Estimate	3.0	2.0	1.1	0.5	1.7
	Upper bound	8.7	5.2	2.8	1.2	3.3

Notes: All values are in percentages. Long-run horizon is two years. * denotes significance at 90 percent level.
Source: Author's calculations

shock but no significant effects for any of the preceding or following months. Moreover, no significant long-term effects are found for this product category. The results using the alternative identification causal order is presented in Appendix D and are virtually identical to these results.

3.2 China-India

Tables 5-5 and 5-6 present the short- and long-term effects of a one standard deviation (positive) shock in Indian government cooperation towards China on Indian export growth to China. For chemical products and mineral products, each of which comprise approximately 20 percent of Indian exports to China, there are no significant short- or long-term effects of political shocks on export growth. Similarly, for precious stones exports, which comprise approximately 15 percent of Indian exports to China, there are no significant effects of political shocks on export growth.

However, for the case of base metals, a short-term significant effect is detected in the first month after the political shocks takes place, but no significant effects are detected thereafter. Moreover, there are no long-term significant effects detected for this product category. Lastly, for the case of textile products, which comprise approximately 10 percent of Indian exports to China, there is a significant short-term effect detected eight months after the political shock, but significant effects in the preceding or following months. No significant long-term effects of political shocks are detected for this product category. The results using the alternative identification causal order is presented in Appendix D and are virtually identical to these results.

3.3 China-Japan

Tables 5-7 and 5-8 present the short- and long-term effects of a one standard deviation (positive) shock in Japanese government cooperation towards China on Japanese export growth to China. For machinery equipment, which comprised approximately half of all Japanese exports to China, there are no significant short- or long-term effects of political

Table 5-5: China-India short-run effects of political shocks on export growth

HS2 Section	Variable	Months after political shock											
		1	2	3	4	5	6	7	8	9	10	11	12
6	Lower bound	-1.1	-1.2	-1.4	-0.4	-0.5	-0.1	-0.2	-0.1	0.1	0.1	0.1	0.1
	Estimate	0.1	0.3	-0.4	0.2	-0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Upper bound	1.6	1.7	0.6	0.9	0.2	0.3	0.1	0.1	0.1	0.1	0.1	0.1
5	Lower bound	-8.7	-6.5	-2.5	-4.7	-1.1	-1.9	-0.4	-0.7	-0.2	-0.2	0.1	-0.1
	Estimate	-3.2	-1.7	2.2	-1.8	1.2	-0.7	0.4	-0.2	0.1	-0.1	0.1	0.1
	Upper bound	2.2	2.9	6.4	1.7	3.2	0.6	1.1	0.3	0.4	0.1	0.1	0.1
15	Lower bound	0.5	-2.5	-1.2	-0.7	-0.4	-0.2	-0.1	-0.1	0.1	0.1	0.1	0.1
	Estimate	**2.1***	-0.8	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Upper bound	4.0	1.0	1.3	0.7	0.4	0.2	0.1	0.1	0.1	0.1	0.1	0.1
14	Lower bound	-5.5	-3.5	-7.5	-2.0	-2.5	-0.8	-0.9	-0.2	-0.3	-0.1	-0.1	0.1
	Estimate	-0.9	3.1	-2.4	1.4	-0.8	0.4	-0.2	0.1	-0.1	0.1	0.1	0.1
	Upper bound	5.4	9.5	3.1	4.6	1.2	1.5	0.4	0.5	0.1	0.2	0.1	0.1
11	Lower bound	-2.4	-0.8	-3.6	-0.2	-1.7	-0.1	-0.5	0.1	-0.2	-0.1	0.1	0.1
	Estimate	-0.2	1.3	-1.6	1.2	**0.8***	0.5	-0.3	**0.1***	-0.1	0.1	0.1	0.1
	Upper bound	1.2	3.2	0.3	2.5	0.1	1.0	0.1	0.1	0.1	0.1	0.1	0.1

Source: Author's calculations

Notes: This table shows the dynamic effects of a one standard deviation (positive) shock in Indian government cooperation towards China on Indian export growth to China over the following 12 months. All figures are in percentages. * denotes significance at 90 percent level.

Table 5-6: China-India long-run effects of political shocks on export growth

	HS2 Section	6	5	15	14	11
Variable	Lower bound	-1.3	-7.5	-0.4	-5.5	-1.4
	Estimate	0.2	-3.8	1.4	-0.9	0.2
	Upper bound	1.4	0.1	3.0	5.4	1.7

Source: Author's calculations

Notes: All values are in percentages. Long-run horizon is two years. * denotes significance at 90 percent level.

Table 5-7: China-Japan short-run effects of political shocks on export growth

HS2 Section	Variable	Months after political shock											
		1	2	3	4	5	6	7	8	9	10	11	12
16	Lower bound	-1	-0.3	-0.7	-0.3	-0.3	-0.1	-0.1	-0.1	0.1	0.1	0.1	0.1
	Estimate	-0.4	0.4	-0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Upper bound	0.4	1.0	0.4	0.4	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
6	Lower bound	-2.2	0.1	-1.3	-0.2	-0.5	-0.1	-0.1	-0.1	0.1	0.1	0.1	0.1
	Estimate	**-1.1***	**1.2***	-0.5	0.3	-0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Upper bound	-0.1	2.2	0.2	0.8	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1
17	Lower bound	-2.9	-0.6	-2.7	-0.5	-1.2	-0.2	-0.4	-0.1	-0.1	-0.1	0.1	0.1
	Estimate	-0.8	1.0	-0.7	0.5	-0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1
	Upper bound	1.0	3.2	0.7	1.8	0.4	0.7	0.1	0.1	0.1	0.1	0.1	0.1
18	Lower bound	-0.9	-0.5	-0.8	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Estimate	-0.2	0.3	-0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Upper bound	0.6	1.1	0.6	0.5	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
15	Lower bound	-1.7	-0.3	-1.2	-0.1	-0.4	-0.1	-0.1	0.1	0.1	0.1	0.1	0.1
	Estimate	-0.3	0.9	-0.6	0.3	-0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Upper bound	1.0	1.7	0.3	0.7	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1

Source: Author's calculations
Notes: This table shows the dynamic effects of a one standard deviation (positive) shock in Japanese government cooperation towards China on Japanese export growth to China over the following 12 months. All figures are in percentages. * denotes significance at 90 percent level.

Table 5-8 China-Japan long-run effects of political shocks on export growth

	HS2 Section	16	6	17	18	15
Variable	Lower bound	-0.8	-1.1	-1.9	-0.7	-0.6
	Estimate	-0.1	-0.3	-0.2	0.1	0.2
	Upper bound	0.6	0.9	1.6	1.0	1.3

Source: Author's calculations
Notes: All values are in percentages. Long-run horizon is two years. * denotes significance at 90 percent level.

shocks on export growth. Similarly, no short- or long-term effects are detected for vehicles and transport equipment, optical instruments, or base metals.

However, for the case of chemical products, which comprise 11 percent of Japanese exports to China, significant effects are detected in the first two months following the political shock. However, no short-term effects are detected thereafter, and neither are there any significant long-term effects of political shocks on export growth for this product category. The results using the alternative identification causal order is presented in Appendix D and are virtually identical to these results.

3.4 China-South Korea

Tables 5-9 and 5-10 present the short- and long-term effects of a one standard deviation (positive) shock in South Korean government cooperation towards China on South Korean export growth to China. For machinery equipment, which comprises of approximately 60 percent of South Korean exports to China, significant short-term effects are detected from the second to the eighth month after the political shocks. However, no short-term effects are detected from the eighth month onwards. Moreover, there is a significant long-term effect that is detected for machinery equipment, implying that political shocks have a significant effect on export levels following a political shock.

For the next three product categories, that is chemical products, vehicle and transport equipment, and plastics and rubber material, no significant short- or long-term effects of political shocks on export growth are detected. Lastly, for mineral products, which comprise approximately 6 percent of South Korean exports to China, there are significant short-term effects of political shocks on export growth from the second to the eighth month following a political shock, identical to the effects found for machinery equipment. However, these effects vanish from the ninth month onwards, and there are no significant long-term effects, which suggest that political shocks have no effects on export levels for

Table 5.9 China-South Korea short-run effects of political shocks on export growth

HS2 Section	Variable	Months after political shock											
		1	2	3	4	5	6	7	8	9	10	11	12
16	Lower bound	-2.0	-2.7	0.7	-2.3	0.4	-1.1	0.1	-0.4	0.1	-0.2	0.1	-0.1
	Estimate	-0.7	**-1.6***	**2.0***	**-1.6***	**1.1***	**-0.7***	**0.7***	**-0.2***	0.1	-0.1	0.1	0.1
	Upper bound	0.5	-0.2	3.0	-0.6	1.7	-0.2	0.7	-0.1	0.3	0.1	0.1	0.1
6	Lower bound	-1.1	-1.3	-0.6	-0.9	-0.2	-0.4	0.1	0.1	0.1	-0.1	0.1	0.1
	Estimate	**-1.1***	**1.2***	0.3	-0.2	0.1	-0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Upper bound	1.0	0.8	1.3	0.4	0.6	0.2	0.3	0.1	0.1	0.1	0.1	0.1
17	Lower bound	-1.7	-1.3	-4.0	-0.5	-2.3	-0.2	-1.0	-0.1	-0.4	-0.1	-0.2	0.1
	Estimate	0.6	1.8	-1.9	1.5	-1.0	0.6	-0.4	0.2	-0.1	0.1	0.1	0.1
	Upper bound	3.2	4.3	0.8	3.2	0.3	1.5	0.1	0.6	0.1	0.3	0.1	0.1
7	Lower bound	-0.8	-1.0	-0.2	-0.8	-0.1	-0.3	-0.1	-0.1	0.1	0.1	0.1	0.1
	Estimate	0.1	-0.3	0.6	-0.3	0.2	-0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Upper bound	0.9	0.6	1.2	0.2	0.5	0.1	0.2	0.1	0.1	0.1	0.1	0.1
5	Lower bound	-6.2	2.0	-7.5	0.9	-3.5	0.3	-1.4	0.1	-0.4	-0.1	-0.1	0.1
	Estimate	-3.0	**4.9***	**-4.0***	**2.7***	**-1.7***	**1.0***	**-0.5***	**0.3***	-0.1	0.1	0.1	0.1
	Upper bound	0.3	8.2	-1.4	5.3	-0.6	2.2	-0.1	0.8	0.1	0.2	0.1	0.1

Source: Author's calculations
Notes: This table shows the dynamic effects of a one standard deviation (positive) shock in South Korean government cooperation towards China on South Korean export growth to China over the following 12 months. All figures are in percentages. * denotes significance at 90 percent level.

Table 5.10 China-South Korea long-run effects of political shocks on export growth

	HS2 Section	16	6	17	7	5
Variable	Lower bound	-2.1	-0.9	-0.9	-0.8	-2.4
	Estimate	**-1.2***	0.1	1.4	0.2	-0.4
	Upper bound	-0.1	1.2	3.4	1.1	2.7

Source: Author's calculations.
Notes: All values are in percentages. Long-run horizon is two years. * denotes significance at 90 percent level.

this product category. The results using the alternative identification causal order is presented in Appendix D and are virtually identical to these results.

3.5 China-USA

Tables 5.-11 and 5-12 present the short- and long-term effects of a one standard deviation (positive) shock in US government cooperation towards China on US export growth to China. For machinery equipment, which comprises of approximately 24 percent of US exports to China, significant short-term effects are detected in month two, month four, and month 6 following a political shock. However, there are no significant effects detected from the seventh month onwards and there are also no significant long-term effects, implying no effects on export levels for this product category. For vehicle and transport equipment, which comprise approximately 20 percent of US exports to China, significant short-term exports are detected in the sixth month following a political shock, but no long-term effects are detected.

Similar to machinery equipment, significant effects are detected in month 2, month 4, and month 6 following a political shock for the case of chemical products, which comprise approximately 11 percent of US exports to China. However, no significant short-term effects are detected from month seven onwards and there are also no significant long-term effects. For the case of optical instruments, no significant short- or long-term effects are detected. Lastly, for base metals, significant short-term effects are detected in the month of the political shocks and one month after, but the effects vanish thereafter. No long term-effects are detected for the case of base metals. The results using the alternative identification causal order is presented in Appendix D and are virtually identical to these results.

4 Summary and conclusion

The empirical exercises conducted in Chapter 4 suggested that moderate political shocks had largely short-term impacts on exports to China for several of its major trading partners. However, aggregation of exports collects together several different

Table 5.11 China-USA short-run effects of political shocks on export growth

HS2 Section	Variable	Months after political shock											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
16	Lower bound	-0.3	-1.3	0.1	-0.7	0.1	-0.3	0.1	-0.1	-0.1	0.1	0.1	0.1
	Estimate	0.4	**0.6***	**0.5***	-0.3	**0.2***	-0.1	**0.1***	0.1	0.1	0.1	0.1	0.1
	Upper bound	1	0.1	1.1	0.1	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1
17	Lower bound	-1.3	-1.7	-0.2	-1.4	-0.1	-0.6	0.1	-0.2	0.1	-0.1	-0.1	0.1
	Estimate	-0.1	-0.8	0.8	-0.6	0.4	-0.3	**0.2***	-0.1	0.1	0.1	0.1	0.1
	Upper bound	0.9	0.6	2	0.2	0.9	0.1	0.4	0.1	0.1	0.1	0.1	0.1
6	Lower bound	-1.3	-1.6	0.1	-1.4	0.1	-0.6	0.1	-0.2	0.1	-0.1	0.1	0.1
	Estimate	-0.3	-0.8	0.9*	-0.7	0.5*	-0.3	0.2*	-0.1	0.1*	0.1	0.1	0.1
	Upper bound	0.1	0.1	1.8	0.1	0.9	0.1	0.4	0.1	0.1	0.1	0.1	0.1
18	Lower bound	-0.5	-1.4	-0.3	-0.9	-0.2	-0.3	-0.1	-0.1	-0.1	0.1	0.1	0.1
	Estimate	0.4	-0.5	0.5	-0.3	0.2	-0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Upper bound	1.3	0.4	1.2	0.2	0.5	0.1	0.2	0.1	0.1	0.1	0.1	0.1
5	Lower bound	-8.5	0.2	-5.3	-0.9	-2.6	-0.6	-1.1	-0.3	-0.5	-0.1	-0.2	0.1
	Estimate	-5.4*	3.8*	-2.3	1.5	-0.9	0.5	-0.3	0.2	-0.1	0.1	0.1	0.1
	Upper bound	-1.5	7.1	0.9	3.7	0.8	1.7	0.4	0.7	0.2	0.3	0.1	0.1

Source: Author's calculations
Notes: This table shows the dynamic effects of a one standard deviation (positive) shock in US government cooperation towards China on US export growth to China over the following 12 months. All figures are in percentages. * denotes significance at 90 percent level.

Table 5.12 China-USA long-run effects of political shocks on export growth

	HS2 Section	16	17	6	18	5
Variable	Lower bound	-0.6	-1.4	-1.6	-0.5	-6.1
	Estimate	0.1	-0.4	-0.6	0.2	-2.9
	Upper bound	0.6	0.5	0.03	0.9	1.3

Source: Author's calculations.
Notes: All values are in percentages. Long-run horizon is two years. * denotes significance at 90 percent level.

types of goods into one variable and does not allow for the distinction between the impact of political shocks across different good-types. This chapter extended the analysis by investigating the effects of political shocks on export growth disaggregated at the HS2 product-level using a VAR model.

The results suggest that the only case for which political shocks have significant short- and long-term effects is machinery equipment exports for South Korea. Several good types though have short-term effects including, textiles and live animal products for Australia, base metals and textiles for India, chemical products for Japan, machinery equipment and base metals for South Korea, and machinery, vehicles and transport equipment, optical instruments, and mineral products for the USA. Overall, these results suggest that political shocks can have heterogenous impacts on trade within countries, effecting some product categories but not others, as well as heterogenous impacts on given product-types across countries, effecting some product-categories in some countries but not others.

Similar to Chapter 4, the empirical results in this Chapter tend to support the accidental deviations hypothesis and globalisation hypothesis over the terms-of-trade hypothesis. For a majority of product categories and countries, political shocks have short-term effects on trade but have no long-term effects. These results support the accidental-deviation hypothesis suggests that while political shocks can affect trade flows as countries move respond to higher conflict by partners through an increase in conflict themselves, these effects would be short-lived as countries move back to a Pareto superior combination of healthy trade and low conflict. For several cases there are neither short nor long-term effects of political shocks on trade which would support the globalisation hypothesis that political shocks have no effects on trade. Lastly, only for a minority of cases are there long-term effects of political shocks on trade, which would support the terms-of-trade hypothesis that political shocks should have long term effects on trade flows.

Chapter 6 Conclusion

Abstract: This chapter summarises the contributions made to the trade-conflict literature in this study. On the theoretical front, this study derives a two-country repeated game model of trade and conflict in which a bi-directional relationship exists between trade and political relations. On the empirical front, the study first constructs a quantitative indicator to measure political relations between China and its major trading partners and shows that a significant amount of variation in political relations occurs at high frequencies, that is, three months or fewer. Next, it estimates the effects of shocks in political relations on export growth to China, including a product-level disaggregated analysis. Overall, the results suggest that for the time period analysed, the effects of political shocks on trade differ across product categories but on the whole were largely small and short-lived. However, changing geopolitical circumstances require that continued rules-based engagement between China and its major trading partners continues to mitigate the negative effects of political conflict on international trade.

1 Contributions to the analysis of trade and political relations

A considerable number of studies investigate the relationship between international trade and political relations among countries across the economics, political science, and international relations literature. China's rise as a global economic and trading partner along with continued volatility in political relations, including frequent political disputes regarding a number of issues such as territorial sovereignty, militarisation in the South China Sea, technological and economic competition, and conflicting values regarding democracy and human rights. These simultaneous developments have raised concerns that China has the potential to use trade policy as a tool of foreign policy which has led to an increased attention in this area of research in recent times.

The purpose of this study was to investigate the effects of political shocks on exports to China for its major trading partners in the period between 1998-2018. On the theoretical front, this study extended a static model of trade and conflict presented in Polachek and Seglie (2007) into a repeated game model, in which a bi-directional relationship exists between trade and political conflict. The model presented in Polachek and Seglie (2007) incorporated three major hypothesis on the trade conflict relationship, 1) the terms-of-trade hypothesis: that political conflict results in changes in the terms-of-trade between countries and thereby can lead to changes in trade patterns, 2) the commercial-peace hypothesis: that increasing trade reduces the probability of conflict between countries, and 3) the globalisation hypothesis: that no relationship exists between international trade and political relations.

The model derived in this study extended the static model to consider strategic interaction between countries over time and incorporated two additional hypotheses on the relationship, that is, 1) the dependency hypotheses: that increased trade between countries can lead to increased political conflict; and 2) the accidental deviation hypothesis: that the effects of political shocks on trade may be short-lived as countries re-negotiate towards a Pareto-superior outcome following a political shocks. This theoretical model was then used to provide a basis for the causal ordering of variables in the VAR model used to estimate the effects of political shocks on exports for the case of China and major partners.

On the empirical front, this study made four contributions to the study of trade and political relations. First, the study constructed a quantitative indicator of political relations, the Political Relations Index (PRI), between China and major trading partners using news-events data from the GDELT database. Separate indicators were constructed to measure political relations from the perspective of government and military actors, as well as a trade-filtered version of the indicator which removed the effects of trade-related news events. The validity of this indicator was verified by analysing three case studies of political disputes between China and its trading partners, that is the US bombing of a Chinese embassy in Belgrade in 1999, the Senkaku boat collision incident between China and Japan in 2010, and the Doklam military standoff between China and India in 2017.

Second, time-series and frequency-domain analysis were conducted on the PRI series to verify that a major proportion of the variation in political relations occurred at high frequencies, that is at three months or fewer. As discussed in Du et al. (2017), the large proportion of short-term variation in political relations has implications for the econometric study of the effects of political shocks on trade, with studies that use annual instead of monthly data to estimate these effects likely to produce biased and inconsistent estimates which over-estimate the duration of the effects. Moreover, studies which use annual data do not allow for the distinction between short and long-term effects of political shocks on international trade. For these reasons, the econometric analysis conducted in this study were all carried out using monthly data.

Third, this study used a VAR model to estimate the short- and long-term effects of shocks in political relations on export growth for China and its major trading partners between 1998-2018. The model was estimated using four different versions of the PRI indicator, that is, the government and military-related PRI and the unfiltered and trade-filtered version of the PRI. For each of these indicators, impulse response functions were generated to estimate the effects of a one standard deviation shocks in political relations on export growth in the twelve months following a political shock, as well as the cumulative effect of a one standard deviation shock in political relations two years after a political shock. Moreover, panel-data models were estimated to verify that models which used annual data were likely to over-estimate the duration of the effects of political shocks on export growth to China.

Fourth, the study estimated the effects of political shocks on exports for the case of five of China’s trading partners for which political relations were particularly volatile disaggregated at the product-level. For each of these partners, the top five export categories were analysed which together accounted for approximately 80 percent of their exports to China.

2 Summary of empirical findings

The PRI indicator constructed in the study helped identify the long-term trajectory of political relations of major trading partners towards China. For several of its trading partners, including Australia, India, Japan, South Korea, the United Kingdom and USA, it was shown that political relations improved considerably in the first decade of the new millennium but deteriorated in the second decade. However, for countries such as Germany, political relations improved in the first decade and remained largely stable in the second decade, while for others such as Pakistan, political relations improved through the entire period.

To verify the dynamic properties of the PRI series, visual, time-series and spectral density analysis were conducted which showed that the largest amount of variation in the PRI series to is observed at high frequencies suggesting that shocks in political relations tend to be short-lived. Drawing on Du et al. (2017) this meant that econometric analysis that uses the PRI indicator should be conducted with aggregation done at the monthly rather than annual level in order to obtain unbiased and consistent estimates.

The analysis of the effects of political shocks on export growth using VAR models at the monthly level showed that while the dynamic pattern of effects varies for countries, overall, the effects were largely small and short-lived, with a one standard deviation in political relations resulting in a 0.01-0.02 percent change in export growth for two months after the shock. While for most cases there are no long-run effects on export levels two years after the shock, in some cases these effects do persist. These effects are slightly stronger when political relations are measure using government actors as opposed to military actors. Lastly, panel-data regressions at the monthly and annual levels are estimated to confirm that estimating the effects of political shocks on trade are best conducted using monthly-level data to avoid inconsistent estimates.

The results of the product-level analysis suggested that the only case for which political shocks have significant short- and long-term effects is machinery equipment exports for South Korea. Several good types though have short-term effects including, textiles and live animal products for Australia, base metals and textiles for India, chemical products for Japan, machinery equipment and base metals for South Korea, and machinery, vehicles and transport equipment, optical instruments, and mineral products for the USA. Overall, these results suggest that political shocks can have heterogenous impacts on trade within countries, effecting some product categories but not others, as well as heterogenous impact on given product-types across countries, effecting some product-categories in some countries but not others.

Together, the aggregated and product-disaggregated empirical results in this chapter tend to support the accidental deviations hypothesis and globalisation hypothesis over the terms-of-trade hypothesis. For a majority of product categories and countries, political shocks have short-term effects on trade but have no long-term effects. These results, which support the accidental-deviation hypothesis, suggest that while political shocks can affect trade flows as countries respond to higher conflict by partners through an increase in conflict themselves, these effects would be short lived as countries move back to a Pareto superior combination of healthy trade and low conflict. For several cases there are neither short- nor long-term effects of political shocks on trade which supports the globalisation hypothesis that political shocks have no effects on trade. Lastly, only for a minority of cases are there long-term effects of political shocks on trade, which would support the terms-of-trade hypothesis that political shocks should have long term effects on trade flows.

3 Limitations of the study and areas of future research

While this study extended the study of international trade and political relations on both theoretical and empirical fronts, there remain several limitations and therefore areas for further research. On the theoretical front, the accidental-deviations hypothesis was not derived formally and is one clear area where the study could be extended. Additionally, the model developed in this study was a simple repeated game model which considered only bilateral relations and did not consider the effect of multiple countries in which some countries may be considered allies and others as enemies. A multi-country model would also be able to account for global supply chains in which countries are involved in trade of intermediate goods. Moreover, no distinction was made in the theoretical model between different good types, as some goods may be considered strategic and may result in different implications for how countries may respond to political cooperation and conflict. Lastly, the strategic interaction between countries was analysed in a simultaneous manner and sequential interaction was not analysed.

On the empirical front, the construction of the PRI indicator in this study relied on the use of the GDELT database which codifies political events based on media reports.

However, several interactions between countries, especially those between military actors may not be reported in the media. Next, the empirical analysis of the effects of political shocks on exports was conducted using a parsimonious VAR model in which only a handful of confounding variables were considered. However, this choice of modelling highlights the trade-off between using single-equation cross-section models with several confounding variables, but which do not adequately account for reverse causality between trade and political relations.

The empirical analysis was also restricted to bilateral relationships between China and some of its trading partners, and future research may consider the use of panel-VAR models which can account for several partners simultaneously and thus consider inter-relationships between multiple trading partners. Lastly, while this empirical focus of this study was on the effects of political shocks on trade, the theoretical model also generated hypothesis regarding the effects on international trade on political conflict. Future research could aim to empirically identify these effects.

4 Policy implications

While the results of this study suggest that, during the first two decade of the 20th century, the effects of political shocks on exports to China for its major trading partners were small and short lived, this does not mean this relationship will persist in the future. Rather, as China continues to grow and represent a larger proportion of the global economy, increasing strategic competition between China and the USA is likely to have spill over consequences on their economic relationship. In this context, the trade war initiated by former US president Donald Trump in 2017 can be seen as just one indication that these spill overs started to dominate the bilateral relationship since 2017.

Increased rivalry between the world's two largest economies is also likely to have consequences for other countries and it is not entirely clear how inter-mingled trade and politics will become in the future. Indeed, Australia's experience throughout 2020, in which China used a range of coercive tools to restrict some AUD20 billion worth of Australian exports to China in retaliation for a number of political decisions taken by the Australian government that frustrated Beijing, provides some evidence that this inter-mingling is already happening.

Of the countries selected in this analysis, Australia, India, Japan, and the US in 2017 formed a Ministerial-level cooperation mechanism termed the 'Quadrilateral' arrangement, explicitly aimed at enhancing maritime cooperation in the East and South China Sea with the implicit goal of containing China's hegemony in the Indo-Pacific region. More recently, the US, UK and Australia have formed the AUKUS agreement through which the US and UK will help Australia acquire nuclear-powered submarines. Both the Quadrilateral arrangement and AUKUS have been met with opposition from Chinese state authorities. Relations between China and India have also deteriorated in the last decade with a military standoff along the Eastern border with both countries suffering military casualties for the first time in over three decades.

Despite these changing geopolitical circumstances, the results in this study show that it is not an absolute certainty that moderate increases in political conflict will necessarily have large negative effects on trade flows. Even as China's share in global trade increased substantially between 1998-2018, the effects of political shocks were largely muted during this period. Even as US-China relations deteriorated substantially under the Trump administration, bilateral trade talks between China and the US have resumed and the recent US trade representative Katherine Tai has talked about 'recoupling' between the two economies including a targeted tariff exclusion process. These points were echoed and endorsed in an online meeting between Tai and China's vice premier Liu He.

The globalisation hypothesis suggests that one of the reasons that trade, and political conflict can be independent of each other is because of the significant presence of multinational corporations in global trade and the proliferation of global supply chains which make it difficult for any one country to disrupt trade political for political purposes. However, the COVID-19 pandemic has led to a disruption of global supply chains and it is to be seen whether the pandemic makes governments re-think the trade-offs between efficiency and resilience of global supply chains. So far, while some governments have hinted at boosting domestic production of critical goods, the extent to which this is possible to achieve given resource constraints is unclear.

Another possible reason for the separation of trade and conflict over the last two decades is that institutional arrangements such as the WTO and regional trade agreements constrain countries from explicitly using trade policy as a geo-economic tool. While the WTO Appellate Body became dysfunctional in December 2019 due to non-appointment of judges, the setting up of a WTO multi-party interim appeal arrangement has occurred with the support of several countries including China. Moreover, China has also recently expressed interest in joining the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) which would further involve China in a rules-based arrangement with several countries. In this context, rules-based engagement between China and its major trading partners remains an important avenue to ensure that the negative impacts of geopolitics on trade in the future are mitigated to the maximum extent possible.

References

Akamatsu, K., 1962. “A historical pattern of economic growth in developing countries”, *The developing economies*, 1, pp.3-25.

Aitken, N.D., 1973. “The effect of the EEC and EFTA on European trade: A temporal cross-section analysis”. *The American Economic Review*, *63*(5), pp.881-892.

Alesina, A., Easterly, W. and Matuszeski, J. 2011. “Artificial States.” *Journal of the European Economic Association,* 9(2), pp. 246–77.

Armstrong, S.P., 2009. *The Japan-China economic relationship: distance, institutions and politics*, PhD thesis, Australian National University, Canberra.

Armstrong, S.P., 2010. Interaction between trade, conflict and cooperation: the case of Japan and China. *Crawford School Asia Pacific Economics Paper*, (386).

Armstrong, S.P., 2012. The politics of Japan–China trade and the role of the world trade system. *The World Economy*, *35*(9), pp.1102-1120.

Azar, E.E., 1980. The conflict and peace data bank (COPDAB) project. *Journal of Conflict Resolution*, *24*(1), pp.143-152.

Bailey, M.A., Strezhnev, A. and Voeten, E., 2017. Estimating dynamic state preferences from United Nations voting data. *Journal of Conflict Resolution*, *61*(2), pp.430-456.

Baldwin, D.A., 1985. *Economic statecraft*. Princeton University Press.

Baldwin, R., 1988. “Hysteresis in Import Prices: The Beachhead Effect”, *American Economic*
Review LXXVIII, pp. 773–85.

Baran, P.A., 2019. *The Political Economy of Growth*. NYU Press.

Barbieri, K., 1995., Economic Interdependence and Militarized Interstate Conflict, 1870–1985.” Ph.D. diss., Department of Political Science, State University of New York at Binghamton. ——

—. 1996a. Economic Interdependence: A Path to Peace or a Source of Interstate Conflict?, *Journal of Peace Research,* 33, pp. 29–49.

—. 1996b. Interdependence and the Characteristics of Conflict. Paper presented at the Annual Meeting of the American Political Science Association, San Francisco, August 28–September 1.

—. 1996c. Explaining Discrepant Findings in the Trade-Conflict Literature.” Presented at the Annual Meeting of the International Studies Association, San Diego, April 16–21.

—. 1997. *Risky Business: The Impact of Trade Linkages on Interstate Conflict, 1870–1985.* In *Enforcing Cooperation: ‘Risky’ States and*

Intergovernmental Management of Conflict, ed. Schneider, G. and Weitsman, P.A., pp. 202–31. London: Macmillan.
—. 2009. *The liberal illusion: Does trade promote peace?*. University of Michigan Press.

Barbieri, K. and Levy, J.S., 1999. Sleeping with the enemy: The impact of war on trade. *Journal of peace research*, *36*(4), pp.463-479.

Barbieri, K. and Schneider, G., 1999. “Globalization and peace: Assessing new directions in the study of trade and conflict”. *Journal of Peace Research*, *36*(4), pp.387-404.

Bartlett, M.S., 1950. Periodogram analysis and continuous spectra. *Biometrika*, *37*(1/2), pp.1-16.

Blainey, G. 1973, *The Causes of War*. New York: Free Press.

Blackwill, R.D. & Harris, J.M. 2016, *War by other means: geoeconomics and statecraft,* The Belknap Press of Harvard University Press, Cambridge, Massachusetts.

Blanchard, J.M.F. and Ripsman, N.M., 1994, Peace through economic interdependence? Appeasement in 1936, *Annual meeting of the American Political Science Association*, New York.

Bliss, H., Russett, B., Geeraerts, G. and Stouthuysen, P., 1998. “Democracy and Trade: Ties of Interest and Community”. *Democratic Peace in Europe: Myth or Reality*, pp.107-30.

Blundell, R. and Bond, S., 2000. GMM estimation with persistent panel data: an application to production functions. *Econometric reviews*, *19*(3), pp.321-340.

Box, G.E. and Jenkins, G.M., 1976. *Time series analysis: forecasting and control*. Prentice-Hall, Englewood Cliffs, NJ.

Brada, J.C. and Mendez, J.A., 1983. “Regional economic integration and the volume of intra-regional trade: a comparison of developed and developing country experience”. *Kyklos*, *36*(4), pp.589-603.

Brockwell, P.J., Davis, R.A. and Calder, M.V., 2002. *Introduction to time series and forecasting* (Vol. 2). New York: springer.

Chavis, L. and Leslie, P., 2009. Consumer boycotts: The impact of the Iraq war on French wine sales in the US. *Quantitative Marketing and Economics*, 7(1), pp.37-67.

Copeland, D.C., 1996. "Economic interdependence and war: A theory of trade expectations”. *International security*, *20*(4), pp.5-41.

Davis, C.L. and Meunier, S., 2011. “Business as usual? Economic responses to political tensions”. *American Journal of Political Science*, *55*(3), pp.628-646.

Davis, C.L., Fuchs, A. and Johnson, K., 2019. “State control and the effects of foreign relations on bilateral trade”. *Journal of Conflict Resolution*, *63*(2), pp. 405-438.

Dixit, A., 1989. “Hysteresis, import penetration, and exchange rate pass-through”. *The Quarterly Journal of Economics*, *104*(2), pp. 205-228.

Dixon, W.J. and Moon, B.E., 1993. “Political similarity and American foreign trade patterns”. *Political Research Quarterly*, *46*(1), pp.5-25.

Du, Y., Ju, J., Ramirez, C.D. and Yao, X., 2017. Bilateral trade and shocks in political relations: Evidence from China and some of its major trading partners, 1990–2013. *Journal of International Economics*, *108*, pp.211-225.

Feldman, N. and Sadeh, T., 2018. “War and third-party trade”. *Journal of Conflict Resolution*, *62*(1), pp.119-142.

Ferdinand, P., 2014. Rising powers at the UN: an analysis of the voting behaviour of BRICS in the General Assembly. *Third World Quarterly*, *35*(3), pp.376-391.

Flores-Macías, G.A. and Kreps, S.E., 2013. The foreign policy consequences of trade: China’s commercial relations with Africa and Latin America, 1992–2006. *The Journal of Politics*, *75*(2), pp.357-371.

Fuchs, A. and Klann, N.H., 2013. “Paying a visit: The Dalai Lama effect on international trade”. *Journal of International Economics*, *91*(1), pp.164-177.

Fuchs, A. and Vadlamannati, K.C., 2013. The needy donor: An empirical analysis of India’s aid motives. *World Development*, 44, pp.110-128.

Garfinkel, M.R., Syropoulos, C. and Yotov, Y.V., 2020. “Arming in the global economy: The importance of trade with enemies and friends”. *Journal of International Economics*, *123*, pp.103-295.

Gartzke, E., Li, Q. and Boehmer, C., 2001. “Investing in the peace: Economic interdependence and international conflict”. *International organization*, *55*(2), pp.391-438.

Gasiorowski, M. and Polachek, S.W., 1982. Conflict and interdependence: East-West trade and linkages in the era of detente. *Journal of Conflict Resolution*, *26*(4), pp.709-729.

Gasiorowski, M.J., 1986. “Economic interdependence and international conflict: Some cross-national evidence”. *International Studies Quarterly*, *30*(1), pp.23-38.

Gilligan, M.J., 1997. Lobbying as a private good with intra-industry trade. *International Studies Quarterly*, *41*(3), pp.455-474.

Goldstein, J.S., 1992. A conflict-cooperation scale for WEIS events data. *Journal of Conflict Resolution*, 36(2), pp.369-385.

Gowa, J., 1995. *Allies, adversaries, and international trade*. Princeton University Press.

Gowa, J. and Mansfield, E.D., 1993. Power politics and international trade. *American Political Science Review*, *87*(2), pp.408-420.

-----, 2004. Alliances, imperfect markets, and major-power trade. *International Organization*, *58*(4), pp.775-805.

Granger, C.W., 1969. Investigating causal relations by econometric models and cross-spectral methods. *Econometrica: Journal of the Econometric Society*, pp.424-438.

Granger, C.W., 1980. Testing for causality: a personal viewpoint. *Journal of Economic Dynamics and control*, 2, pp.329-352.

Grieco, J.M., 1990. *Cooperation among nations: Europe, America, and non-tariff barriers to trade*. Cornell University Press.

Guiso, L., Sapienza, P. and Zingales, L. 2009. “Cultural Biases in Economic Exchange”. *Quarterly Journal of Economics*, 124, pp. 1095–1131.

Hannan, E.J. and Rissanen, J., 1982. Recursive estimation of mixed autoregressive-moving average order. *Biometrika*, 69(1), pp.81-94.

Helpman, E., and Krugman, P., 1989. *Trade policy and market structure*. MIT press.

Helpman, E., Melitz, M.J. and Yeaple, S.R., 2004. “Export versus FDI with heterogeneous firms”. *American Economic Review*, 94(1), pp. 300-316.

Heilmann, K., 2016. “Does political conflict hurt trade? Evidence from consumer boycotts”. *Journal of International Economics*, 99, pp.179-191.

Hirschman, A.O., 1945[1980]. *National power and the structure of foreign trade*. Univ of California Press.

Hutchens, G., 2018, ‘Sweeping foreign interference and spying laws pass Senate’, The Guardian, Australia edition – accessed on 20/07/2019 at https://www.theguardian.com/australia-news/2018/jun/29/sweeping-foreign-interference-and-spying-laws-pass-senate

Hufbauer, G.C., Schott, J.J. and Elliott, K.A., 1990. *Economic sanctions reconsidered: History and current policy (Volume 1)*. Peterson Institute.

Hyndman, R.J. and Khandakar, Y., 2007. Automatic time series for forecasting: the forecast package for R (No. 6/07). Clayton VIC, Australia: Monash University, Department of Econometrics and Business Statistics.

Kastner, S.L., 2007. “When do conflicting political relations affect international trade?”. *Journal of Conflict Resolution*, 51(4), pp.664-688.

Richardson, N.R. and Kegley Jr, C.W., 1980. “Trade dependence and foreign policy compliance: A longitudinal analysis”. *International Studies Quarterly*, 24(2), pp.191-222.

Keohane, R.O. and Nye, J.S., 1977. *Power and interdependence: World Politics in Transition*, Boston: Little, Brown.

Keshk, O.M., Pollins, B.M. and Reuveny, R., 2004. Trade still follows the flag: The primacy of politics in a simultaneous model of interdependence and armed conflict. *The Journal of Politics*, 66(4), pp.1155-1179.

King, G. and Lowe, W., 2003. An automated information extraction tool for international conflict data with performance as good as human coders: A rare events evaluation design*.* *International Organization*, 57(3), pp.617-642.

Klein, J.G., Smith, N.C. and John, A., 2004. Why we boycott: Consumer motivations for boycott participation. *Journal of Marketing*, 68(3), pp.92-109.

Kotler, P. 2002. *Marketing Management*. New York: Prentice Hall.

Kojima, K., 2000. “The “flying geese” model of Asian economic development: origin, theoretical extensions, and regional policy implications”. *Journal of Asian Economics*, 11(4), pp.375-401.

Krugman, P.R., 1987. “Is free trade passé?”. *Journal of economic Perspectives*, 1(2), pp. 131-144.

Lan, X. and Li, B.G. 2015. “The economics of nationalism”, *American Economic Journal: Economic Policy,* 7(2), pp. 294-325.

Lee, M., 2018. “Analysis of the Impacts of South Korea's Political Relations on its Bilateral Trade: Focus on South Korea's Political and Trade Relations with China, Japan, Russia, and North Korea”. Master’s Thesis, University of Maine.

Lee, J.W. and Pyun, J.H., 2016. “Does trade integration contribute to peace?”. *Review of Development Economics*, 20(1), pp.327-344.

Leetaru, K. and Schrodt, P.A., 2013. GDELT: Global data on events, location, and tone, 1979–2012. In ISA annual convention (Vol. 2, No. 4, pp. 1-49).

Levy, J.S., 1989. The Causes of War: A Review of Theories and Evidence. in *Behavior, Society, and Nuclear War*, vol. 1, ed. Phillip E. Tetlock, Jo L. Husbands, Robert Jervis, Paul C. Stern, and Charles Tilly, pp. 212–333. New York and Oxford: Oxford University Press.

Li, Q. and Sacko, D.H., 2002. “The (ir) relevance of militarized interstate disputes for international trade”. *International Studies Quarterly*, 46(1), pp.11-43.

Lin, F., Hu, C. and Fuchs, A., 2019. How do firms respond to political tensions? The heterogeneity of the Dalai Lama Effect on trade. *China Economic Review*, 54, pp.73-93.

Liu, L.M., 1989. Identification of seasonal ARIMA models using a filtering method. *Communications in Statistics-Theory and Methods*, 18(6), pp.2279-2288.

Lütkepohl, H., 2005. *New introduction to multiple time series analysis*. Springer Science & Business Media.

Mansfield, E. 1994. *Power, Trade, and War*. Princeton University Press.

Maoz, Z., 2009. The effects of strategic and economic interdependence on international conflict across levels of analysis. *American Journal of Political Science*, 53(1), pp.223-240.

Marcellino, M., 1999. Some consequences of temporal aggregation in empirical analysis. *Journal of Business & Economic Statistics*, 17(1), pp.129-136.

Marinov, N., 2005. “Do economic sanctions destabilize country leaders?”. *American Journal of Political Science*, 49(3), pp.564-576.

Marx, K., 1887:1906, *Capital, a Critique of Political Economy, vol. 1,* Progress Publishers. Reprint, New York: Modern Library, 1906.

Mastanduno, M., 1998. “Economics and security in statecraft and scholarship”. *International Organization*, 52(4), pp.825-854.

McClelland, C.A., 1979. Warnings in the international events flow: EFI and Roz as threat indicators. *International Interactions*, 5(2-3), pp.135-202.

McMillan, S.M., 1997. Interdependence and conflict. *Mershon International Studies Review*, 41(1), pp.33-58.

Medcalf, R., 2020. *Contest for the Indo-Pacific*. La Trobe University Press, Melbourne.

Michaels, G. and Zhi, X., 2010. “Freedom fries”. *American Economic Journal: Applied Economics*, 2(3), pp.256-81.

Morrow, J.D., 1997. When do “relative gains” impede trade?. *Journal of Conflict Resolution*, 41(1), pp.12-37.

Morrow, J.D., 1999. “How could trade affect conflict?”. *Journal of Peace Research*, 36(4), pp.481-489.

Morrow, J.D., Siverson, R.M. and Tabares, T.E., 1998. “The political determinants of international trade: the major powers, 1907–1990”. *American Political Science Review*, 92(3), pp.649-661.

Myrdal, G., 1957. *Economic theory and under-developed regions*. London: G, Duckworth.

Oneal, J.R., Oneal, F.H., Maoz, Z. and Russett, B., 1996. The liberal peace: Interdependence, democracy, and international conflict, 1950-85. *Journal of Peace Research*, 33(1), pp.11-28.

Oneal, J.R. and Russett, B.M., 1997. The classical liberals were right: Democracy, interdependence, and conflict, 1950–1985. *International Studies Quarterly*, 41(2), pp.267-294.
———.1999. The Kantian peace: The pacific benefits of democracy, interdependence, and international organizations, 1885–1992. *World politics*, 52(1), pp.1-37.

Pandya, S.S. and Venkatesan, R., 2016. “French roast: consumer response to international conflict—evidence from supermarket scanner data”. *Review of Economics and Statistics*, 98(1), pp.42-56.

Papayoanou, P.A., 1997. “Economic interdependence and the balance of power”. *International Studies Quarterly*, 41(1), pp.113-140.

Parzen, E., 1961. An approach to time series analysis. *The Annals of Mathematical Statistics*, 32(4), pp.951-989.

Pierce, D.A., 1977. Relationships—and the lack thereof—between economic time series, with special reference to money and interest rates. *Journal of the American Statistical Association*, 72(357), pp.11-22.

Pelzman, J., 1977. “Trade creation and trade diversion in the Council of Mutual Economic Assistance 1954-70”. *The American Economic Review*, 67(4), pp.713-722.

Polachek, S.W., 1980. “Conflict and trade”. *Journal of conflict resolution*, 24(1), pp.55-78.

Polachek, S.W., 1992. “Conflict and trade: An economics approach to political international interactions”. in W Isard and C.H. Anderton (eds), *Economics of arms reduction and the peace process*, North-Holland, pp. 89-120.

Polachek, S.W and Seiglie, C., 2007. “Trade, peace and democracy: an analysis of dyadic dispute”, in T Sandler and K Hartley (eds), *Handbook of Defense Economics, Volume 2*, Elsevier, pp. 1017-1073.

Polachek, S.W., Robst, J. and Chang, Y.C., 1999. Liberalism and interdependence: Extending the trade-conflict model. *Journal of Peace Research*, 36(4), pp.405-422.

Pollins, B.M., 1989. Does trade still follow the flag?. *American Political Science Review*, 83(2), pp.465-480.
--- 1989a. “Conflict, cooperation, and commerce: The effect of international political interactions on bilateral trade flows”. *American Journal of Political Science*, pp.737-761.

Priestley, M.B., 1981. *Spectral analysis and time series*, London: Academic press.

Reuveny, R. and Kang, H., 1996. International trade, political conflict/cooperation, and Granger causality. *American Journal of Political Science*, pp.943-970.

Reuveny, R. and Kang, H., 1998. Bilateral trade and political conflict/cooperation: do goods matter?. *Journal of Peace Research*, 35(5), pp.581-602.

Reuveny, R. 2003. Measuring Conflict and Cooperation: An Assessment, in Mansfield, E.D. and Pollins, B.M. eds., 2009. *Economic interdependence and international conflict: New perspectives on an enduring debate*. University of Michigan Press.

Richardson, N.R. and Kegley Jr, C.W., 1980. Trade dependence and foreign policy compliance: A longitudinal analysis. *International Studies Quarterly*, 24(2), pp.191-222.

Roberts, M., and Tybout. J., 1997. “The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs”, *American Economic Review*, 88, pp. 545–64.

Russett, Bruce M., 1967: *International Regions and the International System: A Study in Political Ecology*, Chicago, IL: Rand McNally.

Sayrs, L.W., 1990. “Expected utility and peace science: An assessment of trade and conflict”. *Conflict Management and Peace Science*, 11(1), pp.17-44.

Seers, D., 1963, “The limitations of the special case”, *Bulletin of the Oxford University Institute of Economics & Statistics*, 25(2), pp.77-98.

Skålnes, L.S., 2000. *Politics, markets, and grand strategy: foreign economic policies as strategic instruments*. University of Michigan Press.

Silvestrini, A. and Veredas, D., 2008. Temporal aggregation of univariate and multivariate time series models: a survey. *Journal of Economic Surveys*, 22(3), pp.458-497.

Sims, C.A., 1980. Macroeconomics and reality. *Econometrica: journal of the Econometric Society*, pp.1-48.

Singer, H.W., 1975. “The distribution of gains between investing and borrowing countries”. in Cairncross, A and M Puri (eds), *The Strategy of International Development*. Palgrave Macmillan, London, pp. 43-57.

Strüver, G., 2016. What friends are made of: Bilateral linkages and domestic drivers of foreign policy alignment with China. *Foreign Policy Analysis*, 12(2), pp.170-191.

Sweezy, P. M., 1942. *The Theory of Capitalist Development: Principles of Marxian Political Economy*. New York: Monthly Review.

Vernon, R., 1992. "International investment and international trade in the product cycle". In J.M. Letiche (ed), *International economic policies and their theoretical foundations*. Academic Press, pp. 415-435.

Waltz, K., 1979. *Theory of International Politics*, New York: Random House.

Wheelwright, S., Makridakis, S. and Hyndman, R.J., 1998. *Forecasting: methods and applications*. John Wiley & Sons.

World Economic Forum, 2011. 'The role of China's state-owned companies explained'. – accessed on 12/10/2021 at https://www.weforum.org/agenda/2019/05/why-chinas-state-owned-companies-still-have-a-key-role-to-play/

WTO, 2018, World Trade Statistical Review.

Xuetong, Y., Fangyin, Z., Haixia, Q., Jin, X., Zhaijiu, M. and Liangzhu, Y., 2010. Zhongwai Guanxi Jianlan, 1950–2005: Zhongguo yu daguo guanxi dingliang hengliang [China's foreign relations with major powers by the numbers 1950–2005]. Beijing: Gaodeng jiaoyu chubanshe.

Appendix A

A.1 Conditions for trade-conflict to take a Prisoner's Dilemma (PD) form.

The first condition for the game to take a PD form ($d_h > \pi_h^*$) implies,

$$w_h + \left\{\left(\frac{\partial w_h}{\partial z_h}\right) + \lambda_h\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_h} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_h} - p_{z_h}\right]\right\}dz_h - w_h > 0$$

$$\left\{\left(\frac{\partial w_h}{\partial z_h}\right) + \lambda_h\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_h} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_h} - p_{z_h}\right]\right\}dz_h > 0$$

$$\left(\frac{\partial w_1}{\partial z_h}\right) > -\lambda_h\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_h} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_h} - p_{z_h}\right] \qquad \ldots (13)$$

The second condition for the game to take a PD form ($\pi_h^* > \pi_h$) implies,

$$w_h - \left(\begin{array}{l} w_h + \left\{\left(\frac{\partial w_h}{\partial z_h}\right) + \lambda_h\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_h} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_h} - p_{z_h}\right]\right\}dz_h \\ \qquad + \left\{\left(\frac{\partial w_h}{\partial z_f}\right) + \lambda_h\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_f} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_f}\right]\right\}dz_f \end{array}\right) > 0$$

$$\left\{\left(\frac{\partial w_h}{\partial z_h}\right) + \lambda_h\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_h} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_h} - p_{z_h}\right]\right\}dz_h$$
$$< -\left\{\left(\frac{\partial w_h}{\partial z_f}\right) + \lambda_h\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_f} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_f}\right]\right\}dz_f \qquad \ldots (14)$$

The third condition for the game to take a PD form ($d_h > \pi_h$) implies,

$$w_h + \left\{\left(\frac{\partial w_h}{\partial z_h}\right) + \lambda_h\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_h} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_h} - p_{z_h}\right]\right\}dz_h$$
$$- \left(\begin{array}{l} w_h + \left\{\left(\frac{\partial w_h}{\partial z_h}\right) + \lambda_h\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_h} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_h} - p_{z_h}\right]\right\}dz_h \\ \qquad + \left\{\left(\frac{\partial w_h}{\partial z_f}\right) + \lambda_h\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_f} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_f}\right]\right\}dz_f \end{array}\right) > 0$$

$$-\left\{\left(\frac{\partial w_h}{\partial z_f}\right) + \lambda_h\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_f} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_f}\right]\right\} > 0$$

$$-\left(\frac{\partial w_h}{\partial z_f}\right) > \lambda_h\left[\left(x_1 + p_1\left(\frac{\partial x_1}{\partial p_1}\right)\right)\frac{\partial p_1}{\partial z_f} + \left(m_2 + p_2\left(\frac{\partial m_2}{\partial p_2}\right)\right)\frac{\partial p_2}{\partial z_f}\right] \qquad \ldots (15)$$

A.2 The effects of trade on the home country's discount factor: symmetric trade relations

The first derivative of the home country's discount factor with respect to higher exports $\frac{\partial \delta_h}{\partial x_1}$ is given by,

$$\frac{\partial \delta_h}{\partial x_1} = \frac{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right)-\lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_f}\right)+m_2\left(\frac{\partial p_2}{\partial z_f}\right)\right]\right\}\left\{\lambda_h\left(\frac{\partial p_1}{\partial z_h}\right)\right\}-\left\{\left(\frac{\partial w_h}{\partial z_h}\right)+\lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_h}\right)+m_2\left(\frac{\partial p_2}{\partial z_h}\right)-p_{z_h}\right]\right\}\left\{-\lambda_h\left(\frac{\partial p_1}{\partial z_f}\right)\right\}}{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right)-\lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_f}\right)+m_2\left(\frac{\partial p_2}{\partial z_f}\right)\right]\right\}^2}$$

$$= \frac{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right)-\lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_f}\right)+m_2\left(\frac{\partial p_2}{\partial z_f}\right)\right]\right\}\left\{\lambda_h\left(\frac{\partial p_1}{\partial z_h}\right)\right\}-\left\{\left(\frac{\partial w_h}{\partial z_h}\right)+\lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_h}\right)+m_2\left(\frac{\partial p_2}{\partial z_h}\right)-p_{z_h}\right]\right\}\left\{-\lambda_h\left(\frac{\partial p_1}{\partial z_f}\right)\right\}}{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right)-\lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_f}\right)+m_2\left(\frac{\partial p_2}{\partial z_f}\right)\right]\right\}^2}$$

$$= \frac{-\lambda_h\left(\frac{\partial w_h}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right)-\lambda_h^2\left[x_1\left(\frac{\partial p_1}{\partial z_f}\right)+m_2\left(\frac{\partial p_2}{\partial z_f}\right)\right]\left(\frac{\partial p_1}{\partial z_h}\right)+\lambda_h\left(\frac{\partial w_h}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right)+\lambda_h^2\left[x_1\left(\frac{\partial p_1}{\partial z_h}\right)+m_2\left(\frac{\partial p_2}{\partial z_h}\right)-p_{z_h}\right]\left(\frac{\partial p_1}{\partial z_f}\right)}{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right)-\lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_f}\right)+m_2\left(\frac{\partial p_2}{\partial z_f}\right)\right]\right\}^2}$$

$$= \frac{-\lambda_h\left(\frac{\partial w_h}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right)-\lambda_h^2 x_1\left(\frac{\partial p_1}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right)-\lambda_h^2 m_2\left(\frac{\partial p_2}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right)+\lambda_h\left(\frac{\partial w_1}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right)+\lambda_h^2 x_1\left(\frac{\partial p_1}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right)+\lambda_h^2 m_2\left(\frac{\partial p_2}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right)-\lambda_1^2 p_{z_h}\left(\frac{\partial p_1}{\partial z_f}\right)}{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right)-\lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_f}\right)+m_2\left(\frac{\partial p_2}{\partial z_f}\right)\right]\right\}^2}$$

$$= \frac{-\lambda_h\left(\frac{\partial w_h}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right)-\lambda_h^2 m_2\left(\frac{\partial p_2}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right)+\lambda_h\left(\frac{\partial w_h}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right)+\lambda_h^2 m_2\left(\frac{\partial p_2}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right)-\lambda_h^2 p_{z_h}\left(\frac{\partial p_1}{\partial z_f}\right)}{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right)-\lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_f}\right)+m_2\left(\frac{\partial p_2}{\partial z_f}\right)\right]\right\}^2}$$

$$= \frac{-\lambda_h\left(\frac{\partial w_h}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right)-\lambda_h^2 m_2\left(\frac{\partial p_2}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right)+\lambda_h^2 m_2\left(\frac{\partial p_2}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right)+\lambda_h\left(\frac{\partial w_h}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right)-\lambda_h^2 p_{z_h}\left(\frac{\partial p_1}{\partial z_f}\right)}{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right)-\lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_f}\right)+m_2\left(\frac{\partial p_2}{\partial z_f}\right)\right]\right\}^2}$$

$$= \frac{-\lambda_h\left(\frac{\partial w_h}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right)+\lambda_h^2 m_2\left[\left(\frac{\partial p_2}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right)-\left(\frac{\partial p_2}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right)\right]+\lambda_h\left(\frac{\partial w_h}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right)-\lambda_h^2 p_{z_h}\left(\frac{\partial p_1}{\partial z_f}\right)}{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right)-\lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_f}\right)+m_2\left(\frac{\partial p_2}{\partial z_f}\right)\right]\right\}^2} \quad \ldots (21)$$

Under symmetric trade relations, $\frac{\partial \delta_h}{\partial x_1} < 0$ implies,

$$\frac{\lambda_h\left[\left(\frac{\partial w_h}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right)-\left(\frac{\partial w_h}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right)\right]-{\lambda_h}^2\left[p_{z_h}\left(\frac{\partial p_1}{\partial z_f}\right)\right]}{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right)-\lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_f}\right)+m_2\left(\frac{\partial p_2}{\partial z_f}\right)\right]\right\}^2} < 0$$

$$-\lambda_h\left(\frac{\partial w_h}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right)+\lambda_h\left(\frac{\partial w_h}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right)-\lambda_h^2 p_{z_h}\left(\frac{\partial p_1}{\partial z_f}\right) < 0$$

$$\left(\frac{\partial w_h}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_f}\right)+\left(\frac{\partial w_h}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right)-\lambda_h p_{z_h}\left(\frac{\partial p_1}{\partial z_f}\right) < 0$$

$$\left(\frac{\partial w_h}{\partial z_h}\right)-\lambda_h p_{z_h} < \left(-\frac{\partial w_h}{\partial z_f}\right) \quad \ldots (24)$$

The first derivative of the home country's discount factor with respect to imports is given by,

$$\frac{\partial \delta_h}{\partial m_2} = \frac{\left(-\left(\frac{\partial w_h}{\partial z_f}\right) - \lambda_h \left[x_1 \left(\frac{\partial p_1}{\partial z_f}\right) + m_2 \left(\frac{\partial p_2}{\partial z_f}\right)\right]\right)\left(\lambda_1 \left(\frac{\partial p_2}{\partial z_h}\right)\right) + \left(\left(\frac{\partial w_h}{\partial z_h}\right) + \lambda_h \left[x_1 \left(\frac{\partial p_1}{\partial z_h}\right) + m_2 \left(\frac{\partial p_2}{\partial z_h}\right) - p_{z_h}\right]\right)\left(\lambda_1 \left(\frac{\partial p_2}{\partial z_f}\right)\right)}{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right) - \lambda_h \left[x_1 \left(\frac{\partial p_1}{\partial z_f}\right) + m_2 \left(\frac{\partial p_2}{\partial z_f}\right)\right]\right\}^2}$$

$$= \frac{\lambda_h\left[\left(\frac{\partial w_h}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right) - \left(\frac{\partial w_h}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right)\right] - {\lambda_h}^2\left[\left(\frac{\partial p_2}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right) - \left(\frac{\partial p_2}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right)\right]x_1 - {\lambda_h}^2\left[p_{z_h}\left(\frac{\partial p_1}{\partial z_f}\right)\right]}{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right) - \lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_f}\right) + m_2\left(\frac{\partial p_2}{\partial z_f}\right)\right]\right\}^2} \quad \ldots (25)$$

For $\frac{\partial \delta_h}{\partial m_2}$ to be less than zero,

$$\frac{\lambda_h\left[\left(\frac{\partial w_h}{\partial z_h}\right)\left(\frac{\partial p_1}{\partial z_f}\right) - \left(\frac{\partial w_h}{\partial z_f}\right)\left(\frac{\partial p_1}{\partial z_h}\right)\right] - {\lambda_h}^2\left[p_{z_h}\left(\frac{\partial p_1}{\partial z_f}\right)\right]}{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right) - \lambda_h\left[x_1\left(\frac{\partial p_1}{\partial z_f}\right) + m_2\left(\frac{\partial p_2}{\partial z_f}\right)\right]\right\}^2} < 0$$

$$\left(\frac{\partial w_h}{\partial z_h}\right) - \lambda_h p_{z_h} < -\left(\frac{\partial w_h}{\partial z_f}\right) \quad \ldots (27)$$

A.2 The effects of trade on the home country's discount factor: asymmetric trade relations

The first derivative of the home country's discount factor with respect to higher exports is given by,

$$\frac{\partial \delta_h}{\partial x_1} = \frac{\left(-\left(\frac{\partial w_h}{\partial z_f}\right) - \gamma_h + \lambda_h \left[x_1 \frac{\partial p_1}{\partial z_h} + m_2 \frac{\partial p_2}{\partial z_h}\right]\right)\left(\lambda_h \left(\frac{\partial p_1}{\partial z_h}\right)\right) - \left(\left(\frac{\partial w_h}{\partial z_h}\right) + \lambda_h \left[x_1 \left(\frac{\partial p_1}{\partial z_h}\right) + m_2 \left(\frac{\partial p_2}{\partial z_h}\right) - p_{z_h}\right]\right)\left(\lambda_h \left(\frac{\partial p_1}{\partial z_f}\right)\right)}{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right) - \gamma_h + \lambda_h \left[x_1 \frac{\partial p_1}{\partial z_h} + m_2 \frac{\partial p_2}{\partial z_h}\right]\right\}^2}$$

$$= \frac{\left(-\left(\frac{\partial w_h}{\partial z_f}\right) - \gamma_h + \lambda_h \left[x_1 \frac{\partial p_1}{\partial z_h} + m_2 \frac{\partial p_2}{\partial z_h}\right]\right)\left(\lambda_h \left(\frac{\partial p_1}{\partial z_h}\right)\right) - \left(\left(\frac{\partial w_h}{\partial z_h}\right) + \lambda_h \left[x_1 \left(\frac{\partial p_1}{\partial z_h}\right) + m_2 \left(\frac{\partial p_2}{\partial z_h}\right) - p_{z_h}\right]\right)\left(\lambda_h \left(\frac{\partial p_1}{\partial z_h}\right)\right)}{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right) - \gamma_h + \lambda_h \left[x_1 \frac{\partial p_1}{\partial z_h} + m_2 \frac{\partial p_2}{\partial z_h}\right]\right\}^2}$$

$$= \frac{\left(-\left(\frac{\partial w_h}{\partial z_f}\right) - \gamma_h - \left(\frac{\partial w_h}{\partial z_h}\right) + p_{z_h}\right)\left(\lambda_h\left(\frac{\partial p_1}{\partial z_h}\right)\right)}{\left\{-\left(\frac{\partial w_h}{\partial z_f}\right) - \gamma_h + \lambda_h\left[x_1\frac{\partial p_1}{\partial z_h} + m_2\frac{\partial p_2}{\partial z_h}\right]\right\}^2} \quad \ldots (28)$$

Appendix B

The SQL code used to extract data from the GDELT database is:

```
SELECT
  *
FROM
  `gdelt-bq.full.events`
WHERE

  (Actor1Type1Code = 'GOV' OR Actor1Type1Code = 'MIL') AND
  (Actor2Type1Code = 'GOV' OR Actor2Type1Code = 'MIL') AND
  Actor2CountryCode = 'CHN'
 )  AND
(
(Actor1CountryCode = 'AUS' AND Actor2CountryCode = ‘CHN) OR
(Actor1CountryCode = 'DEU' AND Actor2CountryCode = ‘CHN) OR
(Actor1CountryCode = 'FRA' AND Actor2CountryCode = ‘CHN) OR
(Actor1CountryCode = 'GBR' AND Actor2CountryCode = ‘CHN) OR
(Actor1CountryCode = 'IND' AND Actor2CountryCode = ‘CHN) OR
(Actor1CountryCode = 'JPN' AND Actor2CountryCode = ‘CHN) OR
(Actor1CountryCode = 'KOR' AND Actor2CountryCode = ‘CHN) OR
(Actor1CountryCode = 'PAK' AND Actor2CountryCode = ‘CHN) OR
(Actor1CountryCode = RUS AND Actor2CountryCode = ‘CHN) OR
(Actor1CountryCode = 'USA' AND Actor2CountryCode = ‘CHN) OR
) ;
```

-10.0	223	Military attack; clash; assault
-9.2	211	Seize position or possessions
-8.7	222	Nonmilitary destruction/injury
-8.3	221	Noninjury destructive action
-7.6	182	Armed force mobilization, exercise, display; military buildup
-7.0	195	Break diplomatic relations
-7.0	173	Threat with force specified
-6.9	174	Ultimatum; threat with negative sanction and time limit
-5.8	172	Threat with specific negative nonmilitary sanction
-5.6	193	Reduce or cut off aid or assistance; act to punish/deprive
-5.2	181	Nonmilitary demonstration, walk out on
-5.0	201	Order person or personnel out of country
-4.9	202	Expel organization or group
-4.9	150	Issue order or command, insist, demand compliance
-4.4	171	Threat without specific negative sanction stated
-4.4	212	Detain or arrest person(s)
-4.1	192	Reduce routine international activity; recall officials
-4.0	112	Refuse; oppose; refuse to allow
-4.0	111	Turn down proposal; reject protest, demand, threat
-3.8	194	Halt negotiation
-3.4	122	Denounce; denigrate; abuse
-3.0	160	Give warning
-2.4	132	Issue formal complaint or protest
-2.2	121	Charge; criticize; blame; disapprove
-2.2	191	Cancel or postpone planned event
-1.9	131	Make complaint (not formal)
-1.1	063	Grant asylum
-1.1	142	Deny an attributed policy, action, role or position
-0.9	141	Deny an accusation
-0.2	023	Comment on situation
-0.1	102	Urge or suggest action or policy
-0.1	021	Explicit decline to comment
-0.1	094	Request action; call for

0.0	025	Explain or state policy; state future position
0.1	091	Ask for information
0.6	011	Surrender, yield to order, submit to arrest
0.6	012	Yield position; retreat; evacuate
1.0	031	Meet with; send note
1.2	095	Entreat; plead; appeal to; beg
1.5	101	Offer proposal
1.8	061	Express regret; apologize
1.9	032	Visit; go to
1.9	066	Release and/or return persons or property
2.0	013	Admit wrongdoing; apologize, retract statement
2.5	062	Give state invitation
2.8	054	Assure; reassure
2.8	033	Receive visit; host
2.9	065	Suspend sanctions; end punishment; call truce
3.0	082	Agree to future action or procedure, to meet or to negotiate
3.4	092	Ask for policy assistance
3.4	093	Ask for material assistance
3.4	041	Praise, hail, applaud, extend condolences
3.6	042	Endorse other's policy or position; give verbal support
4.5	053	Promise other future support
4.5	051	Promise own policy support
5.2	052	Promise material support
5.4	064	Grant privilege; diplomatic recognition; de facto relations
6.5	073	Give other assistance
6.5	081	Make substantive agreement
7.4	071	Extend economic aid; give, buy, sell, loan, borrow
8.3	072	Extend military assistance

Figure B.1. Goldstein Scale

Appendix C

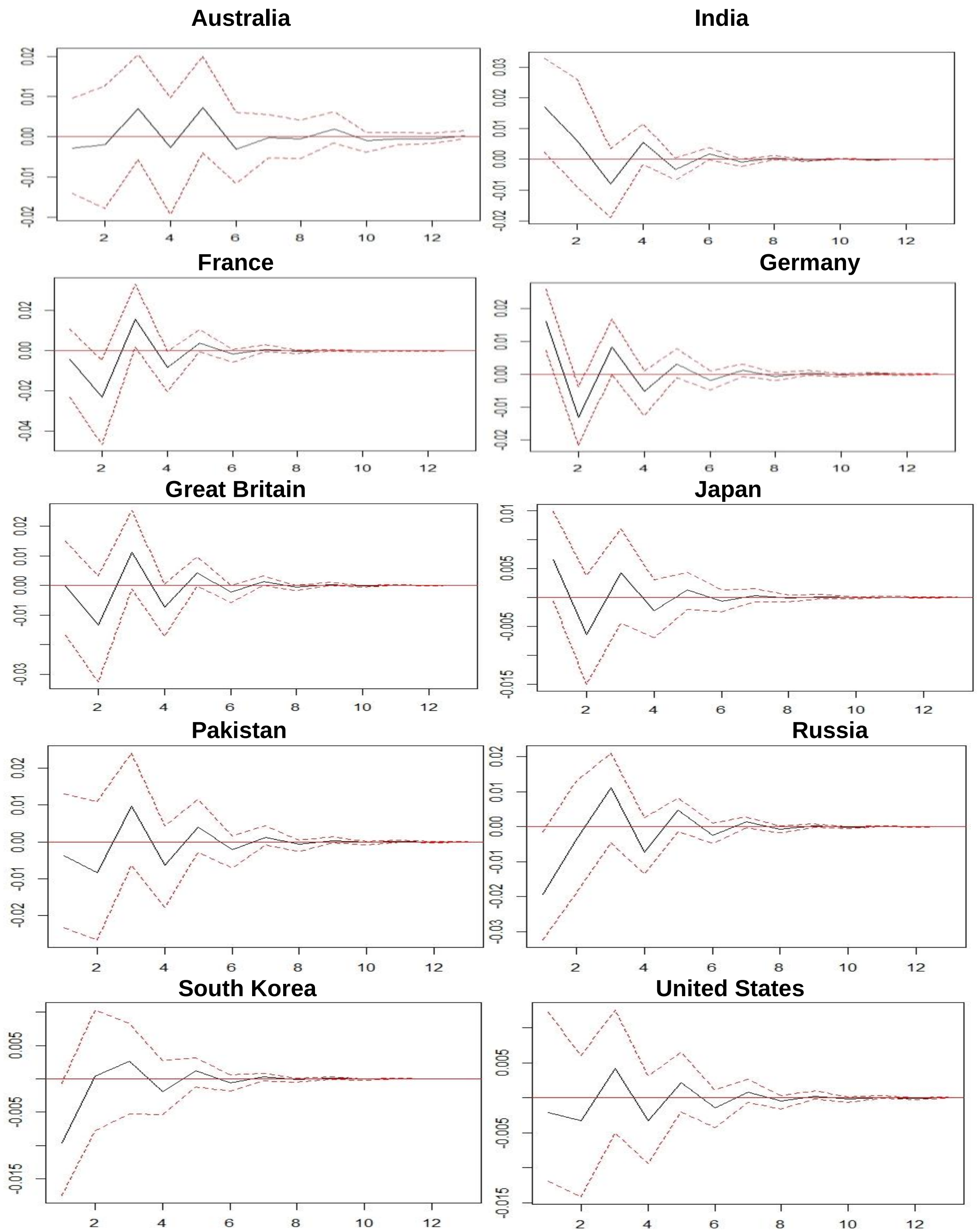


Figure C.1: Short-run effects of political shocks (Government PRI) on exports: alternate identification

Source: Author's calculations

Notes: Y-axis is percentage change in export growth divided by 100 (i.e., the OIR coefficient). X- axis is months after political shock.

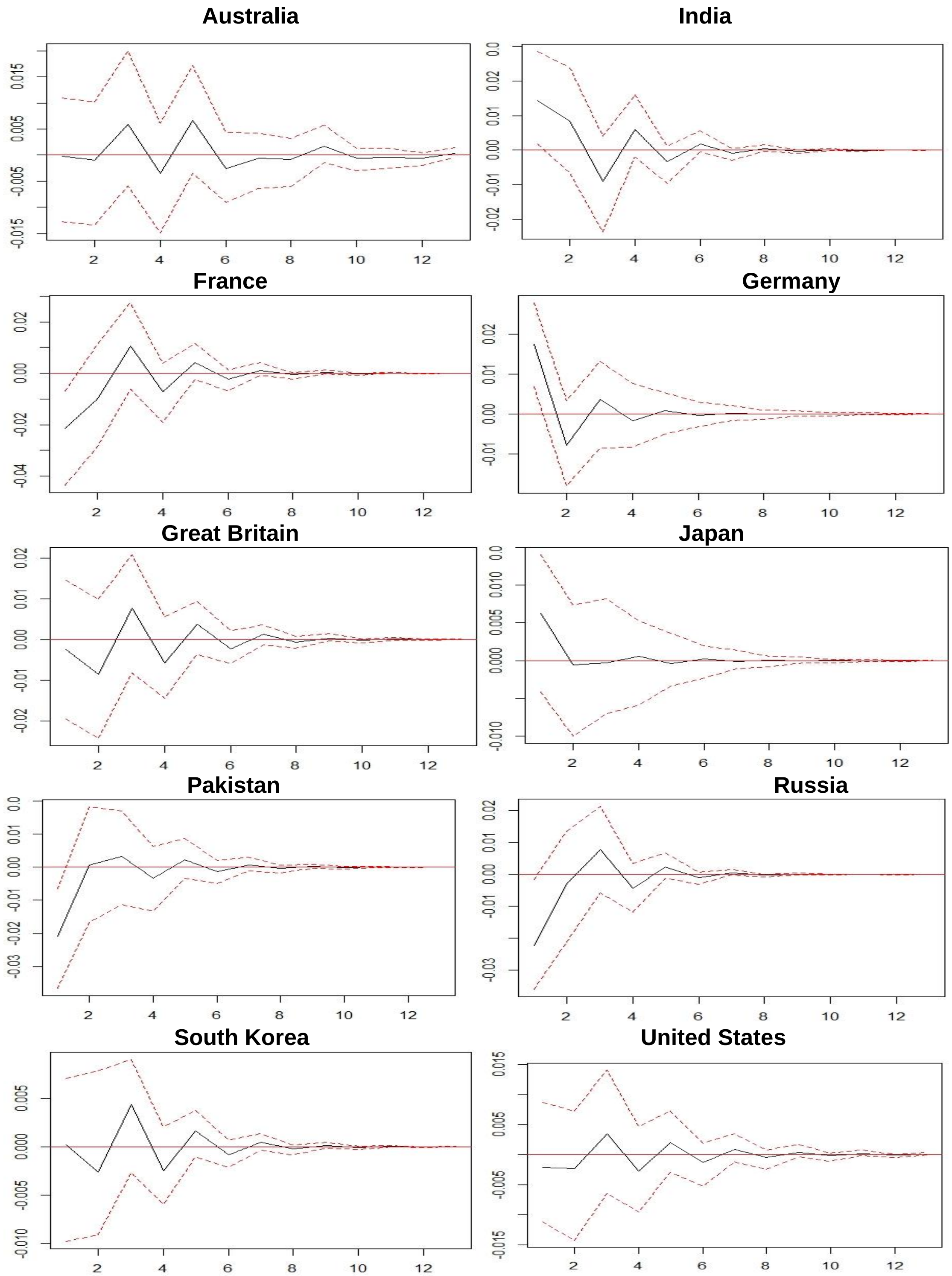


Figure C-2 Short-run effects of political shocks (trade-filtered Government PRI) on exports: alternate identification

Source: Author's calculations.
Notes: Y-axis is percentage change in export growth divided by 100 (i.e., the OIR coefficient). X- axis is months after political shock.

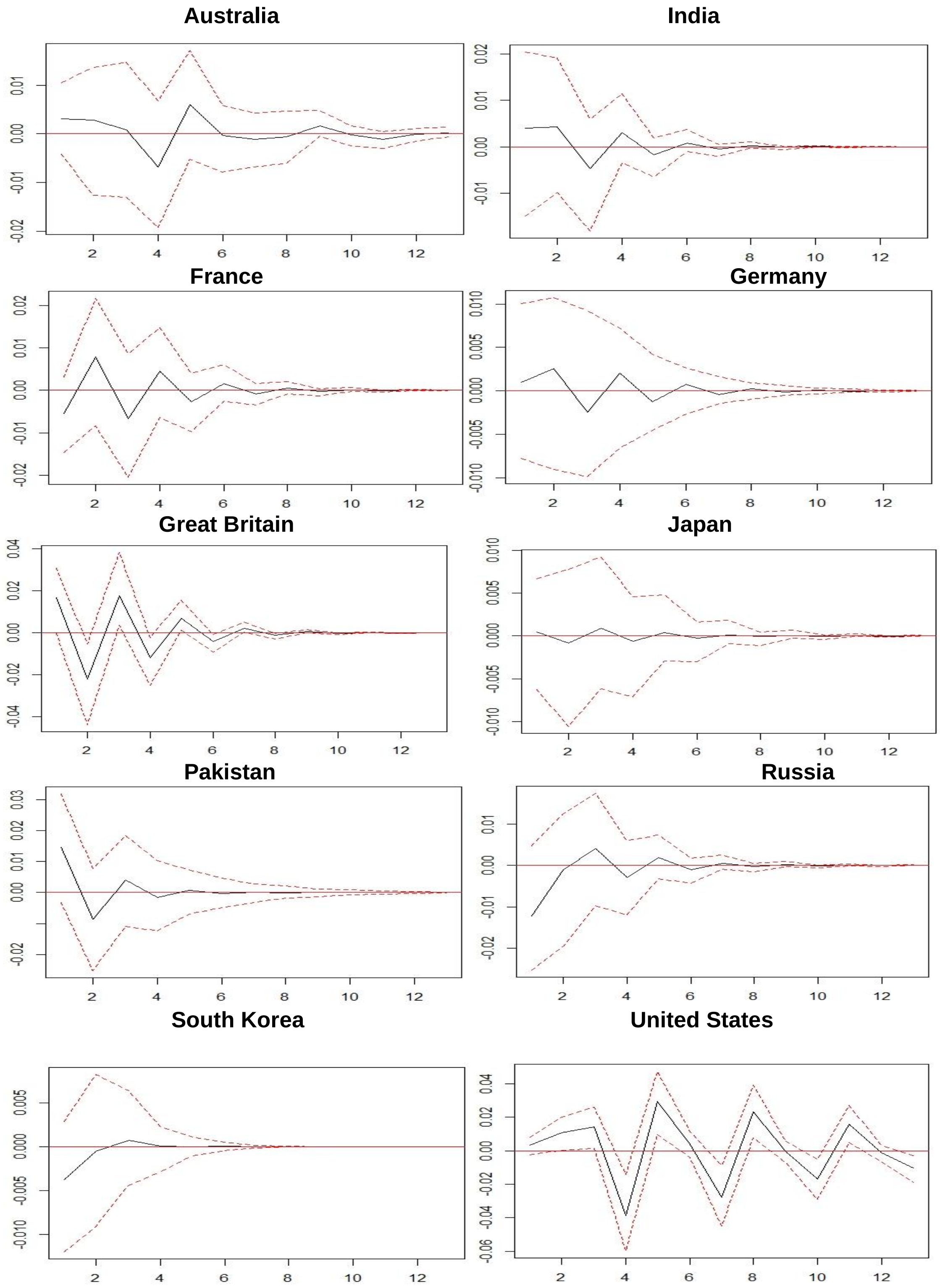


Figure C-3 Short-run effects of political shocks (Military PRI) on exports: alternate identification

Source: Author's calculations.

Notes: Y-axis is percentage change in export growth divided by 100 (i.e., the OIR coefficient). X- axis is months after political shock.

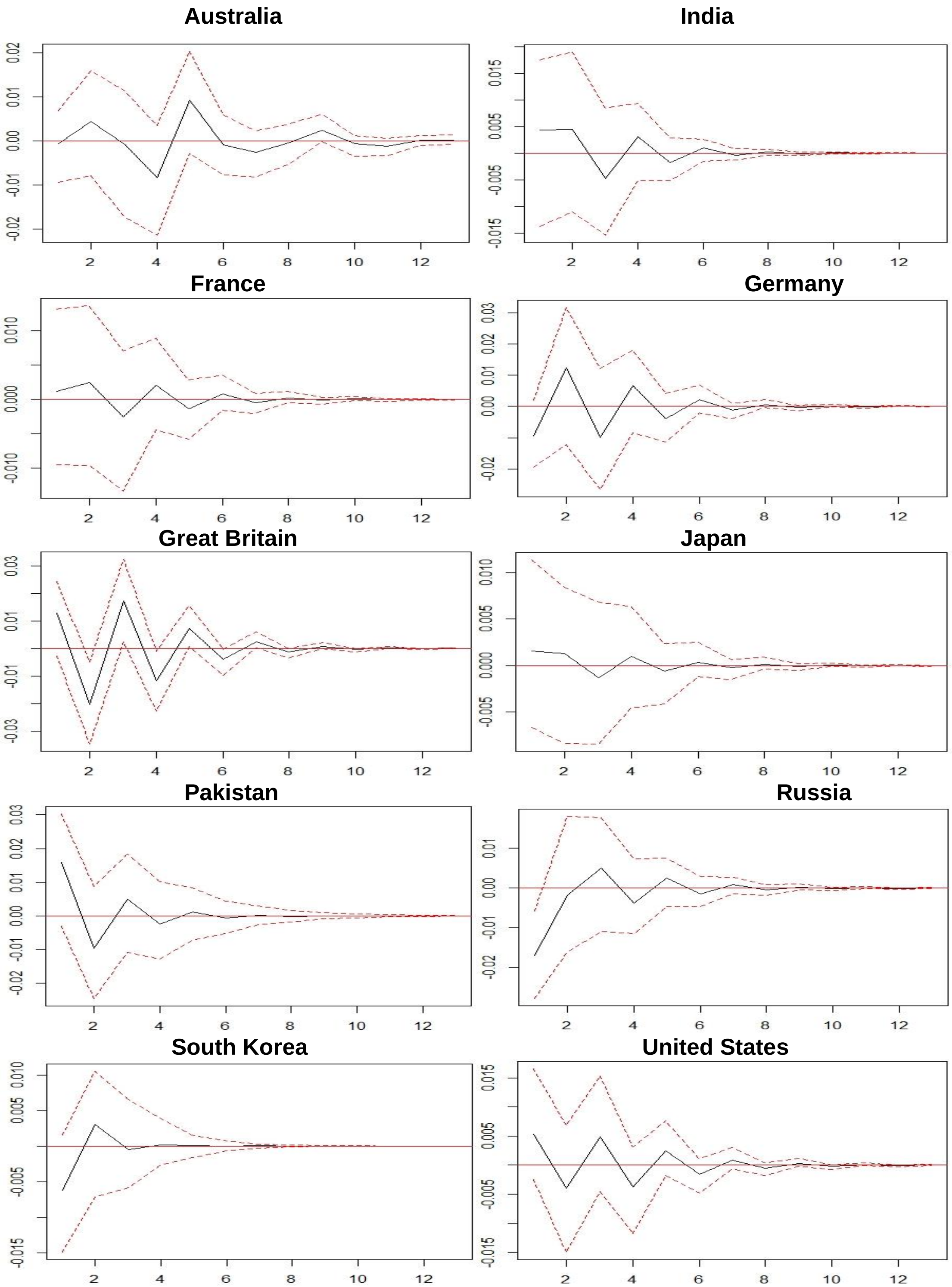


Figure C-4 Short-run effects of political shocks (trade-filtered Military PRI) on exports: alternate identification

Source: Author's calculations

Notes: Y-axis is percentage change in export growth divided by 100 (i.e., the OIR coefficient). X- axis is months after political shock.

Table C 1: Long-run effects of shocks in political relations on export growth: alternative identification

Panel A: Government actors

	Government PRI			Government tfPRI		
	Lower bound	Estimate	Upper bound	Lower bound	Estimate	Upper bound
Australia	-0.8	0.3	1.2	-0.5	0.5	1.9
India	0.6	1.9*	3.4	0.5	1.8*	3.4
Japan	-0.5	0.3	1.2	-0.2	0.6	1.2
France	-3.6	-1.7*	-0.2	-4.2	-2.5*	-1.3
Germany	-0.03	0.8	1.7	0.5	1.2*	2.3
Great	-2.0	-0.7	0.7	-1.8	-0.7	0.6
Pakistan	-2.0	-0.6	0.9	-3.6	-1.9*	-0.9
Russia	-3.1	-1.6*	-0.1	-3.7	-2.0*	-0.3
South Korea	-1.7	-0.8*	-0.003	-0.6	0.06	0.9
United	-1.3	-0.3	0.5	-0.3	-1.1	0.7

Panel B: Military actors

	Military PRI			Military tfPRI		
	Lower bound	Estimate	Upper bound	Lower bound	Estimate	Upper bound
Australia	-0.8	0.4	1.3	-1.0	0.1	1.1
India	-1.2	0.6	1.9	-0.5	0.6	2.1
Japan	-0.7	0.009	0.7	-0.3	0.2	0.9
France	-1.3	-0.1	1.0	-1.1	-0.3	1.0
Germany	-0.6	0.2	1.1	-0.7	0.2	1.2
Great	-0.6	0.5	1.8	-1.0	-0.3	1.3
Pakistan	-0.4	0.9	2.4	-0.3	1.0	2.3
Russia	-2.3	-1.1	0.2	-2.6	-1.6*	-0.3
South	-1.3	-0.4	0.4	-1.2	-0.3	0.2
United	0.04	1.1*	1.8	-0.6	0.4	1.2

Source: Author's calculations.

Notes: All values are in percentages. * indicates significance at the 10 percent level.

Appendix D

Table D-1 China-Australia short-run effects of political shocks on export growth: alternative identification

HS2 Section	Variable	Months after political shock 1	2	3	4	5	6	7	8	9	10	11	12
5	Lower bound	-14.2	-2.9	-11.9	-16.4	-10.2	-5.1	-3.1	-5.3	-2.9	-0.8	-1.4	-1.8
	Estimate	-5.5	10.7	-1.0	-3.9	0.3	2.5	0.4	-1.6	0.6	0.8	-0.2	-0.6
	Upper bound	2.2	22.4	9.6	6.4	10.7	9.9	5.6	0.9	3.1	3.5	1.0	0.5
14	Lower bound	-2.3	-1.9	-2.7	-4.1	-5.1	-0.8	-0.4	-1.2	-1.6	-0.2	-0.3	-0.4
	Estimate	0.8	0.9	0.9	-0.3	-1.7	0.8	1.0	-0.2	-0.5	0.3	0.1	-0.2
	Upper bound	3.6	4.6	4.0	4.0	0.9	2.6	2.1	1.0	0.3	0.7	0.6	0.1
15	Lower bound	-0.8	-2.2	-0.4	-1.1	-1.3	-1.1	-0.3	-0.7	-0.2	-0.4	-0.2	-0.3
	Estimate	0.2	-0.7	1.5	0.2	0.1	-0.2	0.3	-0.1	0.1	0.1	0.1	-0.1
	Upper bound	1.7	1.1	3.0	1.7	1.2	0.6	0.9	0.3	0.4	0.1	0.2	0.1
11	Lower bound	-0.2	-3.3	-2.0	-1.2	-1.5	-2.6	-0.2	-0.8	-0.7	-0.9	-0.2	-0.5
	Estimate	1.3	-1.2	-0.3	0.9	0.5	-1.2	0.5	0.1	0.1	-0.2	0.1	-0.1
	Upper bound	2.4	0.6	2.0	3.2	2.3	0.6	1.5	0.9	0.9	0.4	0.6	0.1
1	Lower bound	-0.5	-4.4	-1.1	-2.1	-7.7	-1.2	-1.1	-1.0	-2.8	-0.4	-0.9	-0.4
	Estimate	2.1	-1.6	2.5	1.3	-3.7	0.8	0.5	0.5	-1.1	0.5	0.1	0.2
	Upper bound	4.0	1.7	5.6	5.0	0.3	3.2	2.2	2.8	0.1	1.9	0.6	1.3

Source: Author's calculations
Notes: This table shows the dynamic effects of a one standard deviation (positive) shock in Australian government cooperation towards China on Australian export growth to China over the following 12 months. All figures are in percentages. * denotes significance at 90 percent level.

Table D-2: China-Australia long-run effects of political shocks on export growth: alternative identification

	HS2 Section	5	14	15	11	1
Variable	Lower bound	-3.2	-0.2	-0.3	-0.2	-0.6
	Estimate	3.0	2.0	1.1	0.5	1.6
	Upper bound	8.5	4.1	2.5	1.2	3.2

Source: Author's calculations
Notes: All values are in percentages. Long-run horizon is two years. * denotes significance at 90 percent levels.

Table D-3: China-India short-run effects of political shocks on export growth: alternative identification

HS2 Section	Variable	Months after political shock											
		1	2	3	4	5	6	7	8	9	10	11	12
6	Lower bound	-1.3	-1.4	-1.5	-0.3	-0.5	-0.1	-0.2	-0.1	0.1	0.1	0.1	0.1
	Estimate	0.1	0.3	-0.4	0.2	-0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Upper bound	1.6	1.7	0.7	0.8	0.2	0.3	0.1	0.1	0.1	0.1	0.1	0.1
5	Lower bound	-7.8	-7.2	-1.1	-4.8	-0.5	-2.1	-0.2	-0.8	-0.1	-0.3	0.1	-0.1
	Estimate	-3.2	-1.7	2.2	-1.8	1.2	-0.7	0.4	-0.2	0.1	-0.1	0.1	0.1
	Upper bound	2.7	2.5	7.0	0.7	3.2	0.3	1.4	0.1	0.5	0.1	0.2	0.1
15	Lower bound	0.2	-2.8	-1.1	-0.8	-0.4	-0.2	-0.1	-0.1	0.1	0.1	0.1	0.1
	Estimate	**2.1***	-0.8	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Upper bound	3.9	0.6	1.4	0.6	0.5	0.2	0.1	0.1	0.1	0.1	0.1	0.1
14	Lower bound	-6.4	-4.2	-7.5	-2.1	-3.0	-0.7	-0.9	-0.2	-0.3	-0.1	-0.1	-0.1
	Estimate	-0.9	3.1	-2.4	1.4	-0.8	0.4	-0.2	0.1	-0.1	0.1	0.1	0.1
	Upper bound	4.1	9.2	3.0	4.9	1.1	1.7	0.4	0.5	0.1	0.2	0.1	0.1
11	Lower bound	-2.1	-0.3	-3.4	-0.1	-1.5	-0.1	-0.6	-0.1	-0.2	-0.1	-0.1	0.1
	Estimate	-0.2	1.3	-1.6	1.2	-0.8	0.5	-0.3	0.1	-0.1	0.1	0.1	0.1
	Upper bound	1.3	3.3	0.2	2.4	0.1	1.0	0.1	0.3	0.1	0.1	0.1	0.1

Source: Author's calculations
Notes: This table shows the dynamic effects of a one standard deviation (positive) shock in Indian government cooperation towards China on Indian export growth to China over the following 12 months. All figures are in percentages. * denotes significance at 90 percent level.

Table D-4: China-India long-run effects of political shocks on export growth: alternative identification

	HS2 Section	6	5	15	14	11
Variable	Lower bound	-1.2	-7.8	-0.3	-6.0	-0.2
	Estimate	0.2	-3.4	1.4	0.7	0.2
	Upper bound	1.6	0.6	3.0	6.1	1.9

Source: Author's calculations
Notes: All values are in percentages. Long-run horizon is two years. * denotes significance at 90 percent levels.

Table D-5: China-Japan short-run effects of political shocks on export growth: alternative identification

HS2 Section	Variable	Months after political shock 1	2	3	4	5	6	7	8	9	10	11	12
16	Lower bound	-1.0	-0.3	-0.6	-0.3	-0.2	-0.1	-0.1	0.1	0.1	0.1	0.1	0.1
	Estimate	-0.4	0.4	-0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Upper bound	0.6	1.0	0.5	0.4	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
6	Lower bound	-2.3	0.1	-1.5	-0.2	-0.5	-0.1	-0.1	0.1	0.1	0.1	0.1	0.1
	Estimate	**-1.1***	**1.2***	-0.5	0.3	-0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Upper bound	-0.2	2.5	0.4	0.9	0.1	0.3	0.1	0.1	0.1	0.1	0.1	0.1
17	Lower bound	-2.8	-1.0	-2.2	-0.6	-0.9	-0.2	-0.4	-0.1	-0.1	-0.1	0.1	0.1
	Estimate	-0.8	1.0	-0.7	0.5	-0.3	0.2	-0.1	0.1	0.1	0.1	0.1	0.1
	Upper bound	1.1	2.9	0.9	1.6	0.4	0.6	0.1	0.2	0.1	0.1	0.1	0.1
18	Lower bound	-1.1	-0.5	-0.8	-0.4	-0.3	-0.1	-0.1	0.1	0.1	0.1	0.1	0.1
	Estimate	-0.2	0.3	-0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Upper bound	0.7	1.3	0.6	0.5	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1
15	Lower bound	-1.5	-0.3	-1.6	-0.2	-0.5	-0.1	-0.1	0.1	0.1	0.1	0.1	0.1
	Estimate	-0.3	0.9	-0.6	0.3	-0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Upper bound	1.2	1.9	0.4	1.0	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1

Source: Author's calculations
Notes: This table shows the dynamic effects of a one standard deviation (positive) shock in Japanese government cooperation towards China on Japanese export growth to China over the following 12 months. All figures are in percentages. * denotes significance at 90 percent level.

Table D-6: China-Japan long-run effects of political shocks on export growth: alternative identification

	HS2 Section	16	6	17	18	15
Variable	Lower bound	-0.7	-1.4	-1.5	-0.8	-0.6
	Estimate	0.1	0.3	-0.2	0.1	0.2
	Upper bound	0.8	0.8	1.2	0.9	1.3

Source: Author's calculations
Notes: All values are in percentages. Long-run horizon is two years. * denotes significance at 90 percent levels.

Table D-7: China-South Korea short-run effects of political shocks on export growth: alternative identification

HS2 Section	Variable	Months after political shock											
		1	2	3	4	5	6	7	8	9	10	11	12
16	Lower bound	-2	-2.7	0.7	-2.6	0.5	-1.3	0.1	-0.5	-0.1	-0.2	0.1	-0.1
	Estimate	-0.7	**-1.6***	**2.0***	**-1.6***	**1.1***	**-0.7***	**0.4***	**-0.2***	0.1	-0.1	0.1	0.1
	Upper bound	0.5	-0.2	3.2	-0.7	2.0	-0.3	0.8	-0.1	0.3	0.1	0.1	0.1
6	Lower bound	-1.1	-1.2	-0.4	-0.7	-0.2	-0.3	-0.1	-0.1	0.1	0.1	0.1	0.1
	Estimate	0.1	-0.1	0.3	-0.2	0.1	-0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Upper bound	1.6	0.7	1.1	0.5	0.5	0.1	0.2	0.1	0.1	0.1	0.1	0.1
17	Lower bound	-2.9	-1.2	-4.8	-0.8	-2.7	-0.3	-1.1	-0.1	-0.4	-0.1	-0.2	0.1
	Estimate	0.6	1.8	-1.9	1.5	-1.0	0.6	-0.4	0.2	-0.1	0.1	0.1	0.1
	Upper bound	3.5	4.7	0.9	3.8	0.5	1.7	0.2	0.7	0.1	0.3	0.1	0.1
7	Lower bound	-0.8	-1.2	-0.3	-0.9	-0.1	-0.3	-0.1	-0.1	-0.1	0.1	0.1	0.1
	Estimate	0.1	-0.3	0.6	-0.3	0.2	-0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Upper bound	1.0	0.6	1.5	0.3	0.5	0.1	0.2	0.1	0.1	0.1	0.1	0.1
5	Lower bound	-6.2	2.1	-7.4	1.0	-3.3	0.3	-1.3	0.1	-0.5	0.1	-0.2	0.1
	Estimate	-3.0	**4.9***	**-0.4***	**2.7***	**-1.7***	**1.0***	**-0.5***	**0.3***	-0.1	0.1	0.1	0.1
	Upper bound	0.1	8.0	-1.7	4.9	-0.5	2.1	-0.1	0.8	0.1	0.3	0.1	0.1

Source: Author's calculations
Notes: This table shows the dynamic effects of a one standard deviation (positive) shock in South Korean government cooperation towards China on South Korean export growth to China over the following 12 months. All figures are in percentages. * denotes significance at 90 percent level.

Table D-8: China-South Korea long-run effects of political shocks on export growth: alternative identification

	HS2 Section	16	6	17	7	5
Variable	Lower bound	-2.3	-0.7	-1.3	-0.8	-2.9
	Estimate	**-1.2***	0.1	1.3	0.2	-0.4
	Upper bound	-0.3	1.2	3.7	1.2	1.5

Source: Author's calculations
Notes: All values are in percentages. Long-run horizon is two years. * denotes significance at 90 percent levels.

Table D-9: China-USA short-run effects of political shocks on export growth: alternative identification

HS2 Section	Variable	Months after political shock												
		1	2	3	4	5	6	7	8	9	10	11	12	12
16	Lower bound	-0.2	-1.3	0.1	-0.7	0.1	-0.3	0.1	-0.1	0.1	0.1	0.1	0.1	-0.2
	Estimate	0.4	**0.6***	**0.5***	**-0.3***	**0.2***	-0.1	**0.1***	0.1	0.1	0.1	0.1	0.1	0.4
	Upper bound	1.1	-0.1	1.0	-0.1	0.4	0.1	0.2	0.1	0.1	0.1	0.1	0.1	1.1
17	Lower bound	-1.2	-1.8	-0.3	-1.3	-0.1	-0.6	0.1	-0.2	0.1	-0.1	0.1	0.1	-1.2
	Estimate	-0.1	-0.8	0.8	-0.6	0.4	-0.3	**0.2***	-0.1	0.1	0.1	0.1	0.1	-0.1
	Upper bound	0.8	0.5	1.8	0.2	0.9	0.1	0.4	0.1	0.2	0.1	0.1	0.1	0.8
6	Lower bound	-1.3	-1.9	0.1	-1.5	0.1	-0.6	0.1	-0.2	-0.1	-0.1	0.1	0.1	-1.3
	Estimate	-0.3	-0.8	**0.9***	-0.7	**0.5***	-0.3	**0,2***	-0.1	0.1	0.1	0.1	0.1	-0.3
	Upper bound	0.5	0.2	1.9	-0.1	1.0	0.1	0.4	0.1	0.2	0.1	0.1	0.1	0.5
18	Lower bound	-0.5	-1.3	-0.2	-0.9	-0.1	-0.4	-0.1	-0.1	-0.1	-0.1	0.1	0.1	-0.5
	Estimate	0.4	-0.5	0.5	-0.3	0.2	-0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4
	Upper bound	1.4	0.3	1.2	0.2	0.6	0.1	0.2	0.1	0.1	0.1	0.1	0.1	1.4
5	Lower bound	-10.7	0.4	-6.0	-0.6	-2.8	-0.4	-1.2	-0.2	-0.5	-0.1	-0.2	0.1	-10.7
	Estimate	**-5.4***	**3.8***	-2.3	1.5	-0.9	0.5	-0.3	0.2	-0.1	0.1	0.1	0.1	**-5.4***
	Upper bound	-1.6	7.9	0.5	4.3	0.6	1.9	0.3	0.8	0.1	0.3	0.1	0.1	-1.6

Source: Author's calculations
Notes: This table shows the dynamic effects of a one standard deviation (positive) shock in US government cooperation towards China on US export growth to China over the following 12 months. All figures are in percentages. * denotes significance at 90 percent level.

Table D-10: China-USA long-run effects of political shocks on export growth: alternative identification

	HS2 Section	16	17	6	18	5
Variable	Lower bound	-0.5	-1.4	-1.4	-0.6	-5.7
	Estimate	0.1	-0.4	-0.6	0.2	-2.9
	Upper bound	0.6	0.7	0.4	1.1	1.1

Source: Author's calculations
Notes: All values are in percentages. Long-run horizon is two years. * denotes significance at 90 percent levels.

END