

Feb 10th, 12:00 AM - 12:00 AM

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Scholten, Melle, "Complex Global Value Chains and Economic Interdependence: A New Look at the Opportunity Costs Argument" (2023). *Graduate Research Conference (GSIS)*. 3.
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Complex Global Value Chains and Economic Interdependence: A New Look at the Opportunity Costs Argument

Prepared for the Graduate Research Conference of Old Dominion University, February 10, 2023

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February 1, 2023

Abstract

The classical economic interdependence argument states that trade and investment between countries make conflict less likely, because they increase the opportunity costs of war. War means that trade and investment will dry up, to the detriment of society as a whole. The increased opportunity costs of war (vis-à-vis peace) means war will be less likely to occur between interdependent states. Certain strands of realism have challenged this assertion. They argue that expectations that trade will decline in future can be a strong incentive for initiating conflict. Given increasing political and economic tensions between the world's superpowers – the USA and the PRC – the question of whether interdependence leads to peace or conflict is more relevant than ever. I add to this literature by unpacking international trade flows in a world of complex global value chains (GVCs). I argue that both the classical and revisionist accounts fail to consider that it does not just matter how much you trade: exactly what goods you trade is important as well. Specifically, I introduce a new variable to help explain under what conditions economic interdependence can induce peace or conflict: internationally sourced inputs of traded goods.

1 Introduction

The optimism about international relations that typified the post-Cold War era can be said to be well and truly over. Between the war in Ukraine and rising tensions between the United States (USA) and China (PRC) over Taiwan, it is clear that the unipolar moment has passed. Great Power competition is back with a vengeance. Despite the acknowledgment that today's world is more dangerous than yesterday's, international security theorists are divided on the question of just how likely great power conflict between China and the United States really is. Neorealists are generally pessimistic, given the changes in the balance of power. Various strands of neorealist theory would predict either that the USA – the established hegemon – would launch a war against the PRC – the rising power – (Copeland, 1996b), or that the rising power will challenge the hegemon in order to establish regional hegemony (Mearsheimer, 2014). By contrast, liberal scholars, particularly those working in the economic interdependence paradigm, are more skeptical about the imminence of Great Power conflict (Weede, 2010).

In line with more recent work that shows that interdependence does not work under any and all circumstances (Dorussen, 2006; Morelli & Sonno, 2017; Spaniel & Malone, 2019; Tanaka, Tago, & Gleditsch, 2017), I develop a theory that incorporates the logic of Global Value Chains (GVCs) into the opportunity costs of war argument. Specifically, I will show that GVCs lower the probability of conflict by providing strategically manipulable choke points for certain key intermediate goods. Secondly, I show that this deterrent effect is strongest if the choke point is also a “bottleneck”: it is not just the scarcity of traded goods that matters for the deterrent effect of interdependence, but also the scarcity of intermediate inputs at earlier points of the global supply chain of said traded goods. If anything, such linkages should be *more* deterrent than scarcity in bilateral trade, because scarcity in bilateral trade gives an incentive to initiate war in order to capture strategic resources (Førland, 1991)¹.

¹Note that the obvious argument against the trade pessimist position in this vein is that it is not the trade in scarce resources, but rather their existence in a geographically proximate country that provides an incentive for conflict. Controlling for the existence of scarce resources, the existence of bilateral trade

These insights are incredibly important for global politics in the modern era. While the world is more interconnected than ever in economic terms, recent threats to the global trade regime have caused some commentators to adopt the terms “slowbalization” (Linsi, 2021) and “friendshoring” (Maihold, 2022). If these commentators are correct, and the world is indeed becoming less interdependent and globalized, it could have quite disastrous consequences when combined with the rise of a new Great Power, as realists have argued (Copeland, 1996b). In the rest of this article, I lay out how my theory fits with the logic of the classical liberal opportunity costs argument, and illustrate its applicability with both statistical tests and qualitative case studies.

2 A Theory of GVCs and Opportunity Costs

The classical conception of the opportunity costs argument to interdependence and conflict goes as follows. War and conflict are started with the goal of achieving certain gains, be they security (as generally argued by realists), wealth (in Neo-Marxist theory), or some intangible factor like status. However, there are also opportunity costs to war: these are the beneficial effects of peace that states forego when they engage in conflict. Among the most obvious of these beneficial effects are the economic efficiency gains arising from international economic liberalization. When violence erupts, trade and investment will fall, leading to increased opportunity costs for starting the conflict. While this would not make war fully absent – when the prospective gains from war outweigh the prospective opportunity costs, war is still the “rational” choice – it should decrease the probability of war occurring (Hegre, Oneal, & Russett, 2010; Maoz, 2009).

Some neorealist scholars, such as Copeland (1996a; 2014), argue states consider expected future changes to the trade relation, as well as current levels of trade. If states anticipate a decline in future trade volumes, they will be more likely to start a war in order to stave off the decline that results from declined wealth, or at least preempt a

should not move the needle towards an increased probability of conflict.

potential conflict while they are still relatively powerful vis-à-vis their adversary. Such a theory is not necessarily in conflict with the core logic of opportunity costs. After all, future expectations of trade relations – in terms of both needs and flows (Copeland, 2023, fig. 1.2) – allow leaders to update their expectations of the opportunity costs of war in the future. If the leader believes that her country will gain less from trade in the future, then that will allow her to adjust her estimate of opportunity costs downward. Copeland does draw our attention to how the opportunity cost argument may function when we expand the informational basis of decision makers from the state of affairs in the here and now to how they believe relations will develop in the short to medium run. Like him, I also adopt the perspective that policy makers consider strategically and rationally how their actions will affect their countries in the short- to medium-run future as well as the present.

As noted succinctly and eloquently by Dorussen (2006, p.104) “not all trade is the same”²: when separating trade flows between non-manufactured and manufactured goods, it is only the latter that have a statistically significant pacifying effect. This is because, Dorussen argues, manufactured goods are produced mainly in advanced industrial societies as opposed to agrarian or developing societies. Even if a country could conquer such an advanced adversary, which will already be more difficult due to its more advanced military, it would be difficult to attain the collaboration of highly skilled workers necessary to produce the commodities previously traded (ibid, p.93). Such workers, anticipating imminent conquest, could decide to emigrate. Even if they decide to stay, it would be difficult to coerce them into producing such complex goods. By contrast, if a state were to conquer a producer of primary goods, it would be fairly straightforward to appropriate the products in question.

My contribution is very similar to that of Dorussen (2006), however I add a more recent development in the global economy as a variable that can help explain under what circumstances goods are more or less appropriable: Global Value Chains (GVCs).

²On this point, see also Li and Reuveny (2009).

GVCs refer to the international fragmentation of production processes, whereby a finished product will have its base materials sourced, partially assembled, and finally assembled in different countries. According to estimates of the United Nations, international production networks account for no less than 80% of global trade, and “some 28% of gross exports consist of value added that is first imported by countries only to be incorporated in products or services that are then exported again” (UNCTAD, 2013, p.ii). As scholars from a variety of disciplines have noted since the COVID-19 pandemic and the onset of the 2022 Russian invasion of Ukraine, GVCs are vulnerable due to the existence of bottlenecks in production: necessary steps in the value chain for which no or very few alternatives exist (Carvalho, Elliott, & Spray, 2020; Farrell & Newman, 2022; Orhan, 2022).

Although situated squarely within the classical liberal logic of opportunity costs, my theory adds insights from other authors as well as my own. I argue that states are sensitive to the extent to which they could appropriate key strategic resources after invading (Dorussen, 2006), and that they consider expected future changes in the foreign policies of other states (Copeland, 2014, 2023). GVC bottlenecks tie together these insights from the literature. Suppose we have a generic dyad with countries A and B. Country A trades some strategically important good with country B. Since the goods traded are of strategic importance to country B, and B is unable to produce them itself, it has a very strong incentive to invade and appropriate the production process of country A. This effect will be even stronger if B suspects A may stop exports. Suppose now that a third country, creatively named C, is an ally of country A, and supplies A with machines (or some other input of key importance) necessary for the production of its strategic exports to B. Under this scenario, even if B were to successfully occupy A, it would not be able to benefit from the appropriation of the latter’s production of the strategic good. Under this scenario, country C would cease exports of machines necessary for the production of the good, thus negating the incentive B had to start the war with A in the first place. This leads me to my first hypothesis:

Hypothesis 1. *Conflict is less likely between countries that trade goods with prior inputs from global value chains.*

Note that this effect should be strongest if C is a bottleneck in the production of the strategic good. If C is the only producer of these machines (or has a near monopoly), then it will become near impossible for B to benefit from the appropriation of the industry in A. By contrast, if C is one of several existing producers of these machines, then the effect should be less pronounced. C can still decide to cease its exports of machines in order to penalize B for its invasion of A. However, if other producers of the machines exist, then the only result of such export controls will be a rise in the costs of the machine per the laws of supply and demand. This may represent a total increase in the costs of acquiring the strategic good for B, such that the prospective gains in acquiring the good are no longer sufficient to induce it towards escalating conflict with A. Nevertheless, the deterrent effect should logically be expected to be smaller than if C were a bottleneck in the GVC.

Hypothesis 2. *The pacifying effect of trade in goods with inputs from global value chains will be stronger if there is a bottleneck at an earlier stage of production.*

This argument is similar to that of Brooks (1999, 2005), who argues that “the globalization of production has led to shifts in the structures of the most advanced states that would prevent a conqueror from effectively extracting economic gains from vanquished territory” (Brooks, 2005, p.161). However, his theory of how multinational corporations (MNCs) affect the probability of interstate conflict is premised on how invasion deters *future* decisions over foreign direct investment (FDI) by firms. In contrast, I argue that the globalization of production can deter conflict by the strategic manipulation of GVCs. To clarify: both dynamics can and likely do operate simultaneously. However, the logic of incentives is slightly different in the theories. Brooks uses a model that assumes that conquerors are looking for extraction of economic resources. My model, while having

implications for economic incentives, also considers the appropriation of key strategic resources.

3 Data Sources and Empirical Evidence

I use data on GVC trade from the World Integrated Trade Solutions (WITS) platform (Borin, Mancini, & Taglioni, 2021). This data set has as a major advantages that it decomposes trade in GVCs in three fashions: pure backward (the exporting sector is engaged close to the end of the chain), pure forward (the exporting sector is engaged close to the origin of the chain), and mixed participation (the exporting sector is located in a central position of the chain). This distinction matters, because the theory articulated above predicts that it is inputs from GVCs (captured by pure backward or mixed participation), rather than outputs (pure forward participation), which should be most associated with a decreased probability of conflict. Buyers of rare base products are plentiful, sellers are uncommon. The WITS platform provides the appropriately aggregated data to test this proposition. The unit of observation is export/import dyad-exporting sector-year, and temporal coverage is 1990 to 2019. All data are measured in millions of US dollars. However, the data is additive at any level of aggregation, and thus it is feasible to measure GVC participation at the desired level of aggregation, which is the dyad-year.

Data on conflict initiation are taken from the Militarized Interstate Disputes (MIDs) dyadic data 4.02 (which was last updated 06-18-2021), the temporal coverage of which is 1816 to 2014 (Maoz, Johnson, Kaplan, Ogunkoya, & Shreve, 2019). Due to overlap with the WITS, I will only use MID data between 1990 and 2014. Although this time frame is dictated by the availability of the data, it is sensible to focus on the post-Cold War world from an analytical perspective as well: it puts aside inferential concerns about the so-called “long peace” between Great Powers during the era of the American

led Western liberal order. While I recognize that the MID data is far from perfect³, comparable databases lack its temporal scope, which make it the obvious choice for the statistical component of the research. Additional data sources for the control variables are detailed in the appendix.

3.1 Statistical Evidence

Because a militarized interstate dispute is an extremely rare event (out of over 800,000 total observations in the data, only 2,856 experience an MID: an incidence rate of less than 0.0035), I use King and Zeng’s rare events estimator (King & Zeng, 2001a, 2001b). Furthermore, rather than incorporating as many explanatory variables as possible in a so-called “Garbage-Can” model (Achen, 2005), I have only included those variables, which could validly be called potential prior common causes of both the explanatory and response variables (Brady, 2008). These include common membership in alliance communities (Haim, 2016), power asymmetries (Gartzke & Westerwinter, 2016), FDI (Gartzke, 2007; Rosecrance & Thompson, 2003), mutual democracy (Oneal & Russett, 1997), and non-GVC forms of trade (Dorussen, 2006; Maoz, 2009). Separate justifications for each of these are provided in the appendix. I also include two-way fixed effects to capture potential confounders that either vary temporally, but are spatially consistent (e.g. global economic recessions or pandemics), or vary spatially but are temporally consistent (e.g. geographic distance, thus capturing the baseline gravity model of trade, see Kabir and coauthors (2017)).

3.2 Qualitative Evidence

It is important to consider potential forms of endogeneity, which may bias the results presented above (see Morrow, 1999 or Timpone, 2009 for a deeper discussion). Some authors have presented evidence that suggests that conflict, or even the threat of conflict

³In fact, the 4.02 update admitted that several mistakes from the original 3.0 release had to be cleaned up.

(Long, 2008), decreases aggregate trade and investment flows through the imposition of tariffs (Kim & Margalit, 2021), changes in consumer behavior (Pandya & Venkatesan, 2016), and the launching of legal investigations into firms operating in geopolitical rivals (Tomashevskiy, 2021)⁴. In other words, states faced with geopolitical or security pressures to initiate conflict can strategically limit their integration into GVCs prior to conflict onset, thus inducing a spurious negative correlation between GVC trade and the probability of militarized dispute initiation. To address these valid concerns and illustrate the causal logic of my theory, I compare two instances of trade in strategic goods between international rivals. These are the USA and Japan prior to the Second World War, and the PRC and Taiwan and its Great Power allies today. In both cases, two countries that are potential adversaries trade in goods with significant security implications. However, in the former case this product was crude oil, the value chain of which was virtually non-existent. In the latter case, the product is semiconductor chips, the production process of which is incredibly complex, and is broken up across several parts of the world.

3.2.1 USA-Japan Trade before World War 2

3.2.2 China-Taiwan Trade Today

Even though Taiwan and TSMC have the capacity to replace China's lost access to trade chips, the entire GVC of semiconductors and microchips are not captured within Taiwanese borders. Like many other countries, it imports extreme ultraviolet (EUV) lithography machines in order to make its most advanced semiconductors, and these machines are exclusively produced in the Netherlands, which is an ally of the United States, by the firm ASML. The Dutch government previously buckled to American pressure not to allow exports of EUV machines to China (Alper, Sterling, & Nellis, 2020). In early 2023, export controls were extended by both the Netherlands and Japan to the previous generation of deep ultraviolet (DUV) lithography machines (Leonard, 2023). It seems highly

⁴See Davis and Meunier (2011) for two counterexamples.

plausible that a Chinese invasion of Taiwan would result in a stop of exports to Taiwan as well. Without this key item from the semiconductor supply chain, it would be impossible for Beijing to appropriate Taiwanese production, even setting aside the concerns of Dorussen (2006) about inducing compliance among laborers. Given the importance of these products for future Chinese expansion, Beijing faces a formidable deterrent to its goals of bringing Taiwan under mainland control.

4 Conclusion

The findings presented in this paper have significant ramifications for several recent developments in US-China relations and the geopolitics of global economic relations. Broadly speaking, the results presented in this paper suggest that so-called “re-shoring” and “friend-shoring” – meant to make GVCs more resilient to political shock events by moving production back home or to committed allies (Maihold, 2022) – may have unintended negative effects for international security. If GVCs become fully included in the territory of geopolitical allies, it takes away an important deterrent to the escalation of conflict. The exclusivity of certain goods can mitigate this for a while, as it forces one power to acquiesce to the interests of the power that holds exclusive access to such goods. However, in the long run, this strategy will fail. As soon as both powers have access to the same technologies and goods, and have set up their supply chains at home or among allies, there will be no clear deterrent effect from GVCs.

More specifically, my analysis suggests that recent moves by Washington to try and stop Beijing from accessing semiconductor chips (Kharpal, 2022; Leonard, 2023; Nellis, Freifeld, & Alper, 2022), while dangerous, is unlikely to lead to an imminent Chinese invasion and occupation of Taiwan. A thorough qualitative investigation of this assertion was provided in the paper’s qualitative analysis. While semiconductor chips are the most obvious and glaring example of the theory discussed in this paper, it is certainly not the only case of supply chain bottlenecks in the global economy. Another example would

be rare earth elements, which are necessary components of various forms of military technology, and have been used as a political bargaining chip several times over the past two decades (Seligman, 2022).

More work undoubtedly remains to be done on this topic, possibly revivifying the economic interdependence debate after a small decade or so of stagnation⁵. The paper's second hypothesis, concerned with the existence of bottlenecks in GVCs is hard to get at with quantitative data, the smallest aggregation of which is at the sectoral, rather than the product level. The qualitative component of the paper did speak to the bottleneck component of the theory by examining the role of EUV lithography machine exports from the Netherlands in deterring conflict between China and Taiwan. However, more rigorous quantitative tests are necessary to judge the external validity of this case.

⁵Certain exceptions like Copeland (2023) notwithstanding.

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