

Merger Policy in a Quantitative Model of International Trade*

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Abstract

In a two-country international trade model with oligopolistic competition, we study the conditions on market structure and trade costs under which a merger policy designed to benefit domestic consumers is too tough or too lenient from the viewpoint of the foreign country. We calibrate the model to match industry-level data in the U.S. and Canada. Our results suggest that at present levels of trade costs, merger policy is too tough in the vast majority of sectors. We also quantify the resulting externalities and study the impact of different regimes of coordinating merger policies at varying levels of trade costs.

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Journal of Economic Literature Classification: F12, F13, L13, L44

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1 Introduction

Because of cross-border demand and supply linkages, merger approval decisions of national antitrust authorities have important effects on other jurisdictions. This implies that for a given objective function (such as domestic consumer surplus, which is by and large current practice in the United States, the EU, and many other jurisdictions), conflicts between national authorities can arise. In particular, the efficiency gains induced by a merger might be sufficient to outweigh its anti-competitive effect in one country but not in another country, leading to diverging decisions of national merger authorities.

The past two decades have indeed seen a number of high-profile competition cases that illustrate this potential for conflict. Prominent examples include the proposed merger between the two U.S.-based firms General Electric and Honeywell in 2001, the proposed merger of the South African platinum interests of Gencor and Lonrho in 1996, and the attempted joint acquisition of the British-based BOC Group by the French company Air Liquide and the U.S.-based firm Air Products in 2000. In the first two cases, the merger was cleared by the firms' domestic antitrust authority but blocked by the EU Commission; in the third case, the merger was cleared by the authorities in the EU, Canada and Australia, but effectively blocked by the U.S. Federal Trade Commission. A more recent example is the planned acquisition of the Italian company Metlac by the Dutch company Akzo Nobel, which was cleared by several European antitrust authorities but blocked by the UK Competition Commission in 2012.

In this paper, we propose a quantitative framework that can be used to understand the determinants of conflict between merger authorities, to analyze which types of conflicts are likely to arise in practice, and to provide a sense of the economic importance of these conflicts. We use these insights to derive implications for the coordination of national merger and trade policies. As we explain in detail below, trade policy, and trade costs more generally, play an important role in determining the type and scope of conflicts between antitrust authorities, and are a key part of our framework and analysis.

In the first part of the paper, we develop a two-country model of international trade, where in each country there is a population of heterogeneous firms which produce a homogeneous good and compete in a Cournot fashion. While all firms produce in their home country, they can sell not only at home but also export to the other country. Exports do incur standard iceberg-type variable trade costs, however, implying that the sets of firms active in the two countries will in general be different.

Consider a merger between two firms located in the same country and exporting to the

other country. In both the home and foreign country, that merger has opposing effects on domestic consumer surplus: On the one hand, the merger gives rise to a market power effect (which is due to the internalization of competitive externalities post merger); on the other hand, the merger gives rise to an efficiency effect (which is due to merger-specific synergies). The resulting net effect depends on the characteristics of the merger, market conditions and trade costs. As the merger may raise consumer surplus in one country but reduce it in the other, the approval incentives of the national authorities are not fully aligned.

Whether merger control based on domestic consumer surplus is too tough or too lenient from the viewpoint of foreign consumers is shown to depend solely on an industry-level ‘conflict statistic.’ That conflict statistic for mergers among firms in a given industry and country is equal to the ratio of domestic to foreign pre-merger prices, adjusted for trade costs from the home to the foreign country. If the value of the statistic is larger than one, any pair of merger partners has more market power at home than abroad, no matter what their pre-merger marginal costs. This implies that if the merger benefits domestic consumers it must also benefit foreign consumers, while the reverse is not true. In this case, merger control based on domestic consumer surplus is a *too-tough-for-thy-neighbor policy* as it involves blocking some mergers that would benefit consumers in the foreign country. Conversely, if the value of the statistic is smaller than one, merger control based on domestic consumer surplus is a *too-lenient-for-thy-neighbor policy* as it involves approving some mergers that hurt consumers in the foreign country. Generically, the value of the statistic is not equal to one, so there will always be one of these two types of conflict. We also show that any (unilateral or multilateral) reduction in trade costs reduces the value of the conflict statistic in both countries.

Our theoretical results are derived for general demand functions and arbitrary firm heterogeneity. To say more about which types of conflict are likely to be relevant in practice, we calibrate our model in the second part of the paper. Since we are interested in merger policy and not in the impact of an isolated merger, such an exercise requires data that cover a broad range of industries. Ideally, one would like to define industries at a very disaggregated level, fine-tune our model to the details of each industry, and calibrate parameters using firm-level data. Unfortunately, such data are not available for a broad range of industries and even if they were, such an approach would be infeasible due to time and computational limitations. Instead, we use data for Canada and the U.S. at the 5-digit industry level, which is the most disaggregated level at which Canadian and U.S. industry definitions coincide. These data cover a broad range of tradable-goods industries (160 sectors) for the year 2002.

To conduct this calibration exercise requires two types of assumptions. First, we have

to specify a demand function. In the baseline, we focus on the textbook linear demand case.¹ However, to investigate the robustness of our results, we also consider CES demand in a model of price competition with differentiated products. Second, we have to specify a distribution from which firms' productivities are drawn. Here, we follow many recent papers in the trade literature by assuming that productivities are Pareto-distributed.² Importantly, the industry-level conflict statistics can be computed without explicitly modeling mergers. This means that we do not have to take a stance on potential merger-specific synergies nor on the merger formation process.

Our results suggest that at the present levels of trade costs (i.e., the levels obtained in the calibration), domestic merger policy is of the too-tough-for-thy-neighbor type in the vast majority of sectors in the U.S. The picture is even more extreme for Canadian mergers—here, too-tough-for-thy-neighbor policies appear to be the *only* type of conflict. Intuitively, Canada is the smaller and less competitive market in our calibration, in the sense of a higher equilibrium price in a large majority of sectors. Given the presence of positive trade costs, any domestic merger cleared in Canada will also benefit consumers in the U.S. The opposite is not necessarily true: given that the U.S. market is more competitive in most sectors, some mergers cleared there might have anti-competitive effects in Canada despite the presence of trade costs. Still, even in the U.S., too-lenient-for-thy-neighbor policies arise only in a small minority of sectors. Hence, our results suggest that whether or not national authorities have effective veto rights over mergers involving foreign firms appears to matter surprisingly little at current levels of trade costs.³

When we reduce the trade cost parameters in our calibrated model, veto rights over foreign mergers become more valuable. Lower trade costs imply lower prices so that domestic authorities are more likely to approve domestic mergers. At the same time, lower trade costs mean higher market shares and market power of domestic firms in the foreign market and greater anticompetitive effects there. As trade costs fall, we thus see a switch from

¹Neary (2007), one of the very few trade papers on mergers with oligopolistic competition, also considers a Cournot model with linear demand.

²Prominent recent trade papers assuming a Pareto distribution for firms' productivity draws include Helpman, Melitz, and Yeaple (2004), Chaney (2008), Melitz and Ottaviano (2008), Eaton, Kortum, and Kramarz (2011), and Mayer, Melitz, and Ottaviano (2014).

³There is considerable disagreement over the extent to which national authorities have effective veto rights over mergers involving only foreign firms. *De jure*, many countries have adopted the 'effects doctrine' in international competition law, according to which national authorities may assert jurisdiction over any foreign firm whose activity affects the domestic market (see, e.g., Griffin, 1999). In practice, however, the degree to which the effects doctrine is implemented varies substantially across countries, with most antitrust authorities not exercising the implied veto rights over foreign mergers. For example, we are not aware of any U.S. merger authorized by the U.S. but blocked by Canadian antitrust authorities.

conflicts where the domestic authority wants to block a given domestic merger and the foreign authority wants to clear it, to conflicts in which the domestic authority wants to clear the merger and the foreign authority wants to block it. In our counterfactual simulations, this switch occurs for trade cost reductions that do not appear large from a historical perspective.

Our results appear robust to a number of alternative modeling assumptions and data sources used for the calibration. For example, our findings are qualitatively similar if we explicitly model a competitive fringe or imports from the rest of the world. They also hold under Bertrand competition with differentiated products and are robust to assuming additive rather than multiplicative trade costs. The general intuition that trade costs and initial market structures create cross-country differences in the market power enjoyed by the merging firms carries through in all of these settings; it is these differences that are the driving force behind our findings.

In the paper's third and final part, we quantify the importance of conflicts between authorities and analyze counterfactual scenarios for the international coordination of merger control. This requires much stronger assumptions. In particular, we have to model explicitly an endogenous merger formation process and take a stance on the strength of merger-specific synergies. In the absence of a consensus in the existing literature on these topics, our modeling choices are mostly motivated by simplicity and computational feasibility.^{4,5} This part of the paper is therefore more exploratory in nature.

We consider two ways of coordinating national merger policies. We first quantify the impact of granting veto rights over foreign mergers. In line with the results from the first set of calibrations, we find that this policy change only has minor effects. The U.S. does not benefit at all from gaining veto rights; Canada sees small increases in domestic consumer surplus but this comes at the cost of reducing U.S. consumer surplus. This is because, in this counterfactual, Canada now blocks U.S. mergers that increase prices in Canada but reduce them in the U.S.

In the second counterfactual, we introduce a North-American merger authority which maximizes the sum of Canadian and U.S. consumer surplus. This authority internalizes cross-

⁴In general, implementation of the merger formation process involves finding the outcome of a multi-player bargaining process with externalities. (Multiple mergers may obtain in each industry and externalities arise because firms compete in the same market.) Unfortunately, the literature on bargaining does not yet provide a widely accepted solution to such bargaining processes, forcing us to adopt a simpler approach. Papers such as Jehiel and Moldovanu (1995a, b), Gomes (2005), and Gomes and Jehiel (2005) provide only partial characterization results.

⁵Very little is known empirically about merger-specific synergies, despite them being at the heart of the Williamson (1968) trade-off between market power and efficiency effects of mergers. See the discussion at the beginning of Section 5.2 for an overview of the literature.

border effects of mergers and is thus also able to eliminate consumer surplus losses arising from domestic merger policies that are too restrictive from the point of view of foreign consumers. As a consequence, we find much larger gains from this second policy change. Interestingly, however, this comes at the price of hurting Canadian consumers whose average consumer surplus change is negative. Put simply, the new merger authority gives much more weight to the larger U.S. market and tends to ‘ignore’ Canada.

In these counterfactual scenarios, changes in trade costs again modify the gains from national merger policy coordination in important ways. As trade costs increase from current levels, gains from coordination rapidly dissipate. With lower trade costs, however, more complex effects arise. Obtaining veto rights becomes now much more valuable for national antitrust authorities, especially for Canada as the smaller, less competitive market. As trade costs fall from current levels, the focus of a North American antitrust authority also shifts from preventing domestic policies that are too tough to preventing policies that are too lenient. Thus, the effects of introducing such an authority increasingly comes to resemble those of introducing veto rights and Canada also starts to benefit from this form of coordination.

Again, we carry out a number of modifications to this second calibration to examine the robustness of our findings. For example, we experiment with different levels of cost synergies, allow for multinational enterprises and cross-border mergers in addition to purely domestic mergers, and carry out the baseline calibration under the assumption that merger authorities have veto rights over foreign mergers to begin with. We find that the qualitative pattern of our results remains intact throughout.

Our paper relates to several strands in the literature. First, we contribute to the theoretical literature on optimal horizontal merger policy (e.g., Williamson, 1968; Farrell and Shapiro, 1990; Nocke and Whinston, 2010, 2013). While we study the conditions under which different national merger authorities would come to different conclusions regarding the desirability of a given merger, this literature focuses almost exclusively on closed economy settings. An exception are Barros and Cabral (1994) who extend the analysis in Farrell and Shapiro (1990) on the ‘external effect’ of a merger (defined as the merger’s effect on the sum of consumer surplus and non-participant firms’ profits) by allowing some of the firms to be foreign-owned. They find that conflicts between national competition authorities are driven by international imbalances in consumption and production.⁶ Since we are focusing on consumer surplus, which is by and large the standard that most antitrust authorities have

⁶Head and Ries (1997) obtain similar results focusing on the aggregate surplus effects of mergers. Neven and Röller (2000, 2003) study the determinants of conflict between antitrust authorities in a model in which national authorities follow mechanical rules based on market definition and market dominance tests.

adopted, those considerations are absent in our framework. Instead, in our model, conflicts arise because both the efficiency and market power effects of a merger are likely to be different in the foreign and domestic markets. The efficiency effect is different because any cost savings that the firms enjoy abroad are mediated by trade costs. The market power effect is different both because of trade costs and because of differences in market structure.

Second, we contribute to a relatively small literature that looks at the interaction of merger and trade policies (e.g., Horn and Levinsohn, 2001; Rysman, 2001; De Stefano and Rysman, 2010). In this literature, merger policy is akin to industrial policy. For instance, in Horn and Levinsohn (2001) and Rysman (2001), countries directly set the number of symmetric firms; in De Stefano and Rysman (2010), each country partitions an exogenously given set of products into a set of firms. Apart from explicitly modeling mergers, we also consider a richer and more general framework, and provide necessary and sufficient conditions on primitives under which different types of conflicts between national antitrust authorities arise. Moreover, we operationalize our framework for the quantitative analysis of such issues, provide a sense of the magnitude of cross-border externalities, and conduct counterfactual policy experiments.

We also contribute to the international trade literature concerned with the causes and consequences of domestic and cross-border mergers (e.g., Neary, 2007; Nocke and Yeaple, 2007, 2008; di Giovanni, 2005; Breinlich, 2008) and with strategic aspects of firm behavior and trade policy in open economy settings (e.g., Brander and Spencer, 1985; Brander, 1995; Bagwell, Bown, and Staiger, 2016). While competition policy is not the focus of this literature, we use comparable modeling frameworks. We also share common interests such as the consequences of introducing mergers and strategic interactions into models of international trade, or the interaction between trade and domestic policies. As only a few papers in this literature use quantitative frameworks (Ossa (2014) is a recent exception), the techniques we introduce to calibrate our model should also be helpful with a quantification of some of the insights from this earlier literature.

The rest of this paper is organized as follows. In Section 2, we introduce a simple two-country model of oligopolistic competition. In Section 3, we use this model to analyze the domestic and foreign price effects of mergers and to characterize the types of conflict which can arise between national antitrust authorities. In Section 4, we calibrate this model on data for the year 2002 for 160 manufacturing sectors in the U.S. and Canada. We analyze the prevalent types of conflicts for the calibrated parameter values and for counterfactual scenarios in which we lower or raise trade costs. In Section 5, we extend the calibration by

incorporating an endogenous merger formation process, and look at counterfactual scenarios in which we change the antitrust authorities' objective functions at different levels of trade costs. Finally, Section 6 concludes. All the proofs are contained in an Online Appendix, as are the details of our extensions and robustness checks.⁷

2 The Baseline Model

We consider a setting with two possibly asymmetric countries ($i, j = 1, 2$), S manufacturing sectors and an outside sector.⁸ Country i is endowed with L^i units of labor. Labor markets are perfectly competitive; there is perfect labor mobility across sectors and no labor mobility across countries.

In country i , the representative consumer's utility function is given by:

$$U^i(Q_0^i, \mathbf{Q}^i) = Q_0^i + \sum_{s=1}^S u_s^i(Q_s^i),$$

where Q_0^i is the consumption of the outside good, u_s^i is a well-behaved sub-utility function, and Q_s^i is the consumption of manufacturing good s . The consumer's budget constraint is: $P_0^i Q_0^i + \sum_{s=1}^S P_s^i Q_s^i \leq I^i$, where P_0^i is the price of the outside good and P_s^i the price of good s in country i . We assume that parameter values are such that consumer income I^i (which is equal to the sum of wage income $w^i L^i$ and profits) is sufficiently large so that a positive quantity of the outside good is consumed. Since we are focusing on consumer surplus, and income effects are absent (due to quasi-linear preferences), the ownership structure of domestic and foreign firms is irrelevant for the subsequent analysis.

The outside good is produced under perfect competition using a constant-returns-to-scale technology with labor as the only factor of production. One unit of labor generates α^i units of output. We assume that the outside good is freely traded, which implies that its price is the same in both countries. We also assume parameter values such that the outside sector produces positive amounts in both countries. We further use the price of the outside good as the *numéraire* ($P_0^1 = P_0^2 = 1$). This pins down the wage rate in country i at $w^i = \alpha^i$.⁹

⁷The Online Appendix can be found at <http://www.volkernocke.com>.

⁸The model can easily be extended to an arbitrary number of countries. See the discussion at the end of Section 3.

⁹The assumption that the outside good is freely traded and produced under constant returns to scale is made for tractability: As the equilibrium wage rate is pinned down by the labor productivity in this sector, a separate modeling of the labor market is not required. This is a common assumption in the international trade literature (see, e.g., Melitz and Ottaviano, 2008). Trade papers that have allowed for wage responses

Given these assumptions, the inverse demand function for good s in country i is given by $P_s^i(Q_s^i) = \max\{u_s^{ii}(Q_s^i), 0\}$.

In each country i , there is a set \mathcal{N}_s^i of firms manufacturing good s . Each firm $k \in \mathcal{N}_s^i$ produces only in its home country i , so that $\mathcal{N}_s^1 \cap \mathcal{N}_s^2 = \emptyset$, but can sell at home and also export to the foreign country j .¹⁰ Exports are subject to iceberg-type trade costs: For one unit of good s to arrive in country j , a firm located in country i has to ship τ_s^{ij} units of the good, where $\tau_s^{ij} = 1$ if $i = j$.¹¹

In each country and manufacturing sector, firms compete *à la* Cournot, being able to segment markets perfectly. Manufacturing firms combine labor and the outside good (as an intermediate input), using a constant-returns-to-scale technology. The production function is specified further in Section 4.1 below. For now, we simply denote c_k the firm's marginal (and unit) cost of *producing* one unit of good s . Because of trade costs, this is different from the firm's marginal cost of *selling* one unit of the good in country j , $c_k^j \equiv \tau_s^{ij} c_k$.

Let $N_s^i \equiv |\mathcal{N}_s^i|$ denote the number of (potentially active) manufacturing firms in sector s that are located in country i . Denoting q_k^j firm k 's output in country j , we say that firm k is *active* in country j and sector s if $q_k^j > 0$ in equilibrium.

As is well known (see, e.g., Vives, 2000), the following standard assumption on demands and thus, implicitly, on the sub-utility functions u_s^i , implies that there exists a unique and stable Nash equilibrium in each sector and country:

Assumption 1. *For any country i and sector s , $\lim_{Q \rightarrow \infty} P_s^i(Q) = 0$ and $P_s^i(Q) > \min_{k \in \mathcal{N}_s^i} c_k$ for $Q > 0$ sufficiently small. Moreover, for any aggregate output $Q > 0$ such that $P_s^i(Q) > 0$, $P_s^{ii}(Q) < 0$ and $P_s^{ii}(Q) + Q P_s^{iii}(Q) < 0$.*

Lemma 1. *There exists a unique Nash equilibrium. The Cournot equilibrium price in each country i and sector s , P_s^{i*} , is weakly increasing in firm k 's marginal cost of selling in country i , c_k^i , and strictly so if the firm is active in that country.*

In equilibrium, firm $k \in \mathcal{N}_s^j$ is not active in country i if and only if $\tau_s^{ji} c_k \geq P_s^{i*}$. Even though we have abstracted from fixed exports costs, the equilibrium may thus have the feature that some firms export while others do not. In particular, firm $k \in \mathcal{N}_s^j$ sells only in its home country j if and only if $P_s^{i*} / \tau_s^{ji} \leq c_k < P_s^{j*}$.

have typically found that they are quantitatively unimportant (e.g., Breinlich and Cuñat, 2016).

¹⁰In Section 5.4, we also allow for cross-border mergers and thus multinational enterprises.

¹¹The model and the empirical analysis can alternatively feature additive rather than multiplicative trade costs. See the discussion at the end of Section 3 and the quantitative robustness check in Section 4.4.

3 Domestic and Foreign Price Effects of Mergers

In this section, we study the effects of a merger between two domestic firms on domestic and foreign prices and, thus, on domestic and foreign consumer surplus. The focus on consumer surplus rather than total surplus is in line with antitrust laws and practice in the U.S., the EU and many other jurisdictions.¹² In the following, we characterize what types of conflicts may arise (and when) between national authorities.

Consider merger $M_s = \{k, l\}$ between firms $k \in \mathcal{N}_s^j$ and $l \in \mathcal{N}_s^j$, both of which produce good s in country j . Dropping the subscript s from now on for notational ease, let \bar{c}_M denote the merged entity's post-merger marginal cost. Denote the Cournot equilibrium price in country i (which may or may not be equal to j) before the merger by P^{i*} , and after the merger by \bar{P}^{i*} . Since products are homogeneous, the consumer surplus (CS) effect of the merger in country i has the same sign as $P^{i*} - \bar{P}^{i*}$. We say that merger M is *CS-neutral* in country i if $\bar{P}^{i*} = P^{i*}$, *CS-decreasing* if $\bar{P}^{i*} > P^{i*}$, *CS-increasing* if $\bar{P}^{i*} < P^{i*}$, *CS-nonincreasing* if $\bar{P}^{i*} \geq P^{i*}$, and *CS-nondecreasing* if $\bar{P}^{i*} \leq P^{i*}$.

From Lemma 1 it follows that the CS-effect of a merger is the larger (i.e., the more positive or the less negative), the lower is the merged firm's post-merger marginal cost. The following lemma, which is an extension of the results in Farrell and Shapiro (1990) to a two-country world, characterizes the sign of the effect of merger M on consumer surplus in country i :

Lemma 2. *Consider merger $M = \{k, l\}$ between firms $k \in \mathcal{N}^j$ and $l \in \mathcal{N}^j$, both of which are located in country j , and let*

$$\mu^i = \max\left(\frac{P^{i*}}{\tau^{ji}} - \bar{c}_M, 0\right) - \max\left(\frac{P^{i*}}{\tau^{ji}} - c_k, 0\right) - \max\left(\frac{P^{i*}}{\tau^{ji}} - c_l, 0\right).$$

The merger is CS-increasing in country i if $\mu^i > 0$, CS-neutral if $\mu^i = 0$, and CS-decreasing if $\mu^i < 0$.

Moreover, if both merger partners are active in country i pre-merger, then there exists a unique cutoff \hat{c}_M^i such that the merger is CS-neutral in country i if $\bar{c}_M = \hat{c}_M^i$, CS-decreasing

¹²For instance, Whinston (2007) summarizes the perceived wisdom on merger authorities' objective function as follows: "[...] enforcement practice in most countries (including the U.S. and the E.U.) is closest to a consumer surplus standard." Indeed, the U.S. Horizontal Merger Guidelines state: "the Agencies normally evaluate mergers based on their impact on customers [...] the Agencies consider whether cognizable efficiencies likely would be sufficient to reverse the mergers potential to harm customers in the relevant market, e.g., by preventing price increases in that market." Similarly, the EU Horizontal Merger Guidelines state: "The relevant benchmark in assessing efficiency claims is that consumers will not be worse off as a result of the merger."

if $\bar{c}_M > \hat{c}_M^i$ and CS-increasing if $\bar{c}_M < \hat{c}_M^i$.¹³ This cutoff is given by

$$\hat{c}_M^i \equiv c_k + c_l - \frac{P^{i*}}{\tau^{ji}}.$$

In words, for the merger to be CS-increasing, it has to be the case that the profit margin of the merged firm evaluated at the pre-merger price strictly exceeds the sum of the pre-merger profit margins of the merger partners. An immediate implication is that the merger must involve synergies in that $\bar{c}_M < \min(c_k, c_l)$. When both firms k and l are active pre-merger, Lemma 2 shows that the threshold value of post-merger marginal cost, \hat{c}_M^i , below which merger M is CS-increasing in country i , is decreasing in the pre-merger equilibrium price in country i . Intuitively, this is because a reduction in the pre-merger equilibrium price does not affect the efficiency effect of the merger (which can be thought of as the merger-induced reduction in the cost of producing the marginal unit of output) but reduces the market power effect of the merger (which is due to the internalization of the competitive externality post merger) as each merger partner's pre-merger output is decreasing in the pre-merger price.

According to Lemma 2, when firms k and l are active at home and abroad before the merger, the domestic and the foreign antitrust authority would both want to block the merger if $\bar{c}_M > \max\{\hat{c}_M^1, \hat{c}_M^2\}$ and approve it if $\bar{c}_M < \min\{\hat{c}_M^1, \hat{c}_M^2\}$. If $\min\{\hat{c}_M^1, \hat{c}_M^2\} < \bar{c}_M < \max\{\hat{c}_M^1, \hat{c}_M^2\}$, however, the interests of the two authorities conflict with each other as the consumers in one country would be better off with the merger and the consumers in the other country without. Generically, $\hat{c}_M^1 \neq \hat{c}_M^2$, implying that there is always the potential of such conflicts of interest.

The exact nature of the conflict between CS-focused authorities depends on whether merger M can be blocked not only by the domestic (here, country j 's) authority but also by the foreign (here, country i 's, $i \neq j$) authority. As discussed in the introduction (see Footnote 3), two views are possible here. *De jure*, antitrust authorities and courts in many countries have adopted the 'effects doctrine' according to which domestic competition laws apply also to foreign firms insofar as the actions of these firms have significant effects on the domestic market (see, e.g., Griffin, 1999). *De facto*, however, in many countries such extra-territorial jurisdiction seems to be applied only to a very limited extent.

In light of this discussion, we propose the following taxonomy of conflicts which accommodates both a 'veto-rights' case (foreign mergers can be blocked) and a 'no-veto-rights'

¹³In addition, it follows immediately from Lemma 1 in Nocke and Whinston (2010) that if the merger is CS-nondecreasing (i.e., either CS-neutral or CS-increasing) in country i , then it raises the merger partners' joint profit from selling in that country. See Online Appendix Section A.2.

case (foreign mergers cannot be blocked). For country- j mergers, country j 's CS-standard is a *too-tough-for-thy-neighbor policy* if there exists a country- j merger that is CS-decreasing in country j and CS-increasing in country i , and if every country- j merger that is CS-nondecreasing in country j is also CS-nondecreasing in country i . By contrast, if there exists a country- j merger that is CS-nondecreasing in country j and CS-decreasing in country i , and if every country- j merger that is CS-decreasing in country j is also CS-decreasing in country i , then country j 's CS-standard is a *too-lenient-for-thy-neighbor policy* in the no-veto-rights case, and country i 's CS-standard is a *too-tough-for-thy-neighbor policy on foreign mergers* in the veto-rights case. In the following, we state our results within the ‘no-veto-rights’ framework to ease the exposition. Results in the ‘veto-rights’ framework can be obtained by simply replacing *too-lenient-for-thy-neighbor policy* by *too-tough-for-thy-neighbor policy on foreign mergers*.

In principle, one may expect that, for some pre-merger market conditions, there exist country- j mergers that benefit country- j consumers and harm country- i consumers, and country- j mergers that harm country- j consumers and benefit country- i consumers. If so, country j 's CS-standard would be neither a too-tough-for-thy-neighbor policy nor a too-lenient-for-thy-neighbor policy. The following proposition, which follows from Lemma 2, shows that, generically, country j 's CS-standard is either a too-tough-for-thy-neighbor policy or a too-lenient-for-thy-neighbor policy:

Proposition 1. *Suppose that at least two country- j firms are active at home and abroad. The domestic CS-standard for merger approval in the home country j is a too-tough-for-thy-neighbor policy if $\rho^{j*} > 1$ and a too-lenient-for-thy-neighbor policy if $\rho^{j*} < 1$, where*

$$\rho^{j*} \equiv \tau^{ji} \frac{P^{j*}}{P^{i*}}, \quad i \neq j.$$

Proposition 1 shows that the potential for conflict in merger policy depends solely on a market-level “sufficient statistic”, ρ^{j*} , which summarizes the relative competitiveness of the two markets, adjusting for trade costs faced by the merging firms. We call ρ^{j*} the “conflict statistic” for country- j mergers. If $\rho^{j*} > 1$, then whenever consumers in the home country j would benefit from a domestic merger, so would consumers in the foreign country, but not the reverse. If $\rho^{j*} < 1$, then some domestic mergers that benefit consumers in the home country j would hurt consumers in the foreign country (whereas any merger that is CS-increasing in the

foreign country is necessarily also CS-increasing in the firms' home country).^{14,15} Intuitively, if trade costs are high ($\tau^{ji} > 1$) or if the foreign market is more competitive than the domestic market ($P^{i*} < P^{j*}$), so that $\rho^{j*} > 1$, domestic firms tend to have lower market shares abroad than they do at home. The market power effect of the merger is therefore more likely to dominate the efficiency effect at home than abroad, and the nature of the potential conflict on domestic mergers tends to be of the too-tough-for-thy-neighbor type.

These conflict statistics involve endogenous prices. This raises the question: Under what conditions on primitives is one type more likely to arise than the other? In the simple case where the two countries are identical, $\tau^{12} = \tau^{21} \equiv \tau$ and $P^{1*} = P^{2*}$, both conflict statistics are equal to τ , and the domestic CS-standard for merger approval is a too-tough-for-thy-neighbor policy if $\tau > 1$, and a too-lenient-for-thy-neighbor policy if $\tau < 1$. To the extent that one would expect the iceberg-type trade cost τ to be larger than one, this suggests that conflict is likely to be of the too-tough-for-thy-neighbor type when countries are similar.

When countries are not identical, conflict statistics depend both on trade costs and on the ratio of pre-merger equilibrium prices. The following proposition shows that the general idea that conflict is more likely to be of the too-tough-for-thy-neighbor type when trade costs are high extends to the case of asymmetric countries:¹⁶

Proposition 2. *An increase in the trade cost from country j to country $i \neq j$, τ^{ji} , induces an increase in the conflict statistics for mergers in both countries, ρ^{1*} and ρ^{2*} .*

More than two countries. For simplicity of exposition, we have restricted attention to two countries. However, none of our results relies on that assumption: Lemma 2 and therefore Proposition 1 would hold for an arbitrary number of countries, as would the statement of Proposition 2. Whether a merger between two firms producing in country i is CS-increasing or CS-decreasing in country j depends only on the pre-merger price in country j , P^{j*} , and

¹⁴By construction, $\rho^{1*}\rho^{2*} = \tau^{12}\tau^{21}$. So, while one type of conflict may prevail for mergers taking place in one country, the same or another type of conflict may prevail for mergers in the other country (in particular, $\rho^{j*} > 1$ is consistent with both $\rho^{i*} < 1$ and $\rho^{i*} > 1$).

¹⁵Following the 'reciprocal dumping' literature (e.g., Brander and Krugman, 1983) and much of the subsequent literature on oligopolies in international trade, we have assumed that manufacturers can perfectly segment domestic and foreign markets. If we were to make the polar opposite assumption that perfectly competitive arbitrageurs were subject to the same trade costs as manufacturers, then this would impose the following constraints on relative prices: $1 \leq \rho^{j*} \leq \tau^{12}\tau^{21}$. In that extreme case, only one type of conflict can arise, namely that the home country is too tough. As at most one of the no-arbitrage inequalities can generically be binding, at least one of the two countries must be too tough (from the viewpoint of foreign consumers) on domestic mergers in each industry. Whenever there is imperfect competition among arbitrageurs, or arbitrageurs are subject to larger trade costs than manufacturers, both types of conflict can arise.

¹⁶In the Online Appendix (Section A.5), we also study the impact of demand and supply conditions on our conflict statistics.

on the merger partners' marginal costs of selling in country j , both pre- and post-merger. Changes in the openness of country j to imports from third countries affect the sign of the merger's consumer surplus effect only through their impact on P^{j*} . Because the pre-merger price in country j continues to be a sufficient statistic for the degree of competitiveness in that country, the definition of our conflict statistic ρ^{i*} remains unchanged.

Additive trade costs. As is standard in the international trade literature, we have assumed iceberg-type (i.e., multiplicative) trade costs. In recent work, Irarrazabal, Moxnes, and Opromolla (2015) point out that important parts of trade costs are best thought of as being additive rather than multiplicative (e.g., due to freight rates being quoted per unit). Under additive trade costs, the cutoff type defined in Lemma 2 can easily be shown to be equal to

$$\widehat{c}_M^i \equiv c_k + c_l + \tau^{ji} - P^{i*}.$$

This implies that the conflict statistics ρ^{j*} should be redefined as

$$\rho^{j*} = P^{j*} - P^{i*} + \tau^{ji}. \tag{1}$$

In this case, country j is too tough (resp. too lenient) if $\rho^{j*} > 0$ (resp. $\rho^{j*} < 0$). The proof of Proposition 2 can be adapted to show that ρ^{j*} is increasing in both τ^{ij} and τ^{ji} .

4 Model Calibration without Mergers

In this section, we calibrate the model to sector-level data from the U.S. and Canada for 2002. The goal of this first set of calibrations is to evaluate which types of conflicts are likely to be relevant in practice, and how this changes as trade costs evolve. A calibration approach is helpful in this context because it imposes some discipline on the parameter values governing the prevalence of the two types of conflict. In particular, it allows us to obtain model-consistent estimates of bilateral trade costs and permits the analysis of counterfactual changes in these costs.¹⁷

We acknowledge that such a cross-industry calibration brings a number of problems with

¹⁷Note that our conflict statistic, ρ^{j*} , depends on prices and trade costs only. While the former are in principle observable, the latter are not. This is because we require a wide definition of trade costs which includes any factor making selling abroad more costly than at home. Backing out trade costs as a residual from a theoretical model is the preferred way of doing this in the trade literature (e.g., Anderson and van Wincoop, 2004). When we vary trade costs, we also need to compute counterfactual price changes which will depend on all model parameters, requiring a full-scale calibration in the first place.

it. First, while we work at a relatively disaggregated level (160 manufacturing industries) this approach might still group firms that do not compete very much against each other.¹⁸ Second, we will use the same demand system and competition model for all our sectors, albeit with parameters calibrated separately for each industry.

As discussed in the introduction, these simplifications are necessary to make the analysis feasible. Because we are interested in national merger policy and not in the impact of isolated mergers, we need our calibration to cover a broad range of tradable-goods industries. While ideally, one would like to define industries at a very disaggregated level, fine-tune our model to the details of each industry and calibrate parameters using firm-level information, data and time constraints make such an approach infeasible in practice. In addition, as will become clear in the following, our key results will be driven by differences in initial market structure and the presence of substantial trade costs, factors that are likely to be present across a wide range of possible model specifications.

4.1 Model Operationalization: Preferences and Technologies

We assume that the sub-utility $u_s^i(\cdot)$ introduced in Section 2 is now given by $u_s^i(Q_s^i) = a_s^i Q_s^i - \frac{1}{2} b_s^i (Q_s^i)^2$, where s indexes sectors and i countries. This quadratic functional form generates a linear inverse demand function: $P_s^i(Q_s^i) = \max(a_s^i - b_s^i Q_s^i, 0)$. The production function of firm k in sector s and country i is given by

$$q_k = \frac{1}{(\eta_s^i)^{\eta_s^i} (1 - \eta_s^i)^{1 - \eta_s^i}} z_k l_k^{\eta_s^i} q_{0,k}^{1 - \eta_s^i},$$

where l_k and $q_{0,k}$ denote firm k 's consumption of labor and intermediate goods (i.e., the outside good), η_s^i is the labor input share in sector s and country i , and z_k is the productivity of firm k . Firm k 's productivity in sector s and country i , z_k , is drawn from a Pareto distribution with scale parameter x_s^i and shape parameter ζ_s^i . The implied marginal and unit cost of firm k is given by

$$c_k = \frac{1}{z_k} (w^i)^{\eta_s^i} (P_0^i)^{(1 - \eta_s^i)} = \frac{1}{z_k} (\alpha^i)^{\eta_s^i},$$

¹⁸An example of a problematic sector is cement manufacturing (NAICS 32731), which, due to high transport costs, is comprised of many small geographical submarkets. Other sectors (e.g., breakfast cereal manufacturing, NAICS 31123) seem to be more in line with market definition in antitrust.

where the last step follows from our choice of the outside good as *numéraire* and the resulting wage rate of $w^i = \alpha^i$.¹⁹

There are initially N_s^i potentially active manufacturing firms in sector s and country i . We solve the Cournot competition game with linear demand in the Online Appendix. With the equilibrium price and number of firms at hand, we can compute the theoretical moments of interest which will be matched to our data (see below).

4.2 Calibration

Parameters to be calibrated. We calibrate our model by matching key features of U.S. and Canadian data at the industry level. From now on, we relabel country 1 as the U.S. and country 2 as Canada. We calibrate our model separately for each sector. The calibration requires, for each sector, parameter values for a^{US} and a^{CAN} (the intercepts of the inverse demand functions), b^{US} and b^{CAN} (the slopes of the inverse demand functions), N^{US} and N^{CAN} (the numbers of potentially active firms), $\tau^{US,CAN}$ and $\tau^{CAN,US}$ (the trade costs), x^{US} and x^{CAN} (the scale parameters of the productivity distributions), ζ^{US} and ζ^{CAN} (the shape parameters of the productivity distributions), and η^{US} and η^{CAN} (the labor shares). We also require parameter values for α^{US} and α^{CAN} (the productivities of the outside sectors).

We choose units of the numéraire so that $\alpha^{US} = 1$, and set α^{CAN} equal to the ratio of Canadian to U.S. wages in the data. Consistent with our Cobb-Douglas specification of firms' production functions and our assumption of perfectly competitive labor and outside good markets, η^{US} and η^{CAN} are set equal to the ratio of the wage bill to total costs in each sector. In every sector, we use the normalization $a^{US} = 25$, which also amounts to a choice of units.

We set N^{US} and N^{CAN} equal to the number of firms in each sector, which we observe in the data. Note, however, that not all of these firms will end up being active due to homogeneous-goods Cournot competition with heterogeneous firms.²⁰ In Section 4.4, we address this issue in two extensions. First, we introduce a competitive fringe of price-taking firms which co-exist with a small number of oligopolists. Second, we analyze a differentiated-goods Bertrand

¹⁹The substantial assumptions we are making are that there are constant returns to scale and the inverse of unit costs are Pareto distributed. Since a Pareto distribution is scale-free (in that a left-truncation of a Pareto distribution does not affect its shape), mis-calibrating α or η (or misspecifying the production function altogether) only affects the resulting value of the scale parameter x in the calibration, while leaving other parameters in the calibration as well as the calibrated distribution of unit costs unchanged.

²⁰In the real world, most firms are likely to have little market power. To generate this in a homogeneous-goods Cournot model would require having little dispersion in productivity, and many firms having marginal costs just below the equilibrium market price.

model where, due to CES demand, all firms remain active.

We are left with a nine-dimensional vector of parameters to calibrate in every sector:

$$\Gamma = (a^{CAN}, b^{US}, b^{CAN}, \tau^{US,CAN}, \tau^{CAN,US}, x^{US}, x^{CAN}, \zeta^{US}, \zeta^{CAN}).$$

The value of Γ is chosen so as to match the following nine empirical moments in each sector: the ratio of U.S. to Canadian prices, domestic sales, the value of U.S. and Canadian bilateral exports, production-based Herfindahl-Hirschman concentration indices (HHI), and total costs in both countries. Note that the number of elements in Γ equals the number of empirical moments, so that the parameters are exactly identified.

Data sources. Data on U.S. and Canadian industry-level sales, total costs, labor cost shares, number of firms and Herfindahl indices are from the U.S. Census Bureau and Statistics Canada. Data on bilateral trade between the U.S. and Canada are from the NBER website (see Feenstra, Romalis, and Schott, 2002), and relative prices are constructed from purchasing power parity data from Inklaar and Timmer (2014). Throughout, we work at the five-digit level of the North American Industry Classification System (NAICS) which is the most disaggregated level at which Canadian and U.S. industry definitions are identical. This yields a total of 160 manufacturing industries in the year 2002 for which we have data for all required variables. Appendix A provides more details on the construction of our dataset.

Table 1 shows descriptive statistics for our empirical moments. On average, U.S. industries are over ten times larger in terms of total sales. They are also significantly less concentrated in terms of production, as can be seen from the average HHIs (1281 in Canada vs. 601 in the U.S.). In the average sector, the Canadian prices are 7% higher than U.S. prices (11% in the median sector). Finally, we note that, in 2002, Canada ran a substantial trade surplus in manufactured goods with the U.S.

Calibration algorithm. We approximate our theoretical moments using Monte Carlo integration. For a given vector of parameter values Γ , we draw R realizations of the productivity vectors, where $R = 1000$. For each realization, we compute the model's equilibrium and calculate our nine theoretical moments. We take the simple averages of each theoretical moment across the R realizations and compare it to the corresponding empirical moments.²¹

²¹In each sector, we observe one realization of domestic sales, exports, etc. The assumption we are making is that those observations provide good approximations for mean domestic sales, mean exports, etc. We then adjust parameter values so that our theoretical means match those empirical means. Since we do not have a sample, we cannot compute standard errors for our calibrated parameters.

Table 1: Empirical Moments - Summary Statistics

Empirical Moment	Mean	Median	Standard Deviation	P10	P90
# Mergers US	2.18	1.09	4.00	0.10	4.22
# Mergers CAN	0.16	0.06	0.26	0.00	0.47
P^{CAN}/P^{US}	1.07	1.11	0.15	0.86	1.21
Shipments US	22205621	12473479	31082770	3408354	43858147
Shipments CAN	1593020	877455	2541084	177964	3482581
Exports US	527450	201771	1065915	25483	1203514
Exports CAN	758595	190372	2631997	31796	1665297
HHI US	601	417	561	106	1332
HHI CAN	1281	859	1184	194	2899
Total Cost US	16132940	9140820	23804465	2350389	33070284
Total Cost CAN	1784190	854798	3628505	175275	3703720
Observations	160	160	160	160	160

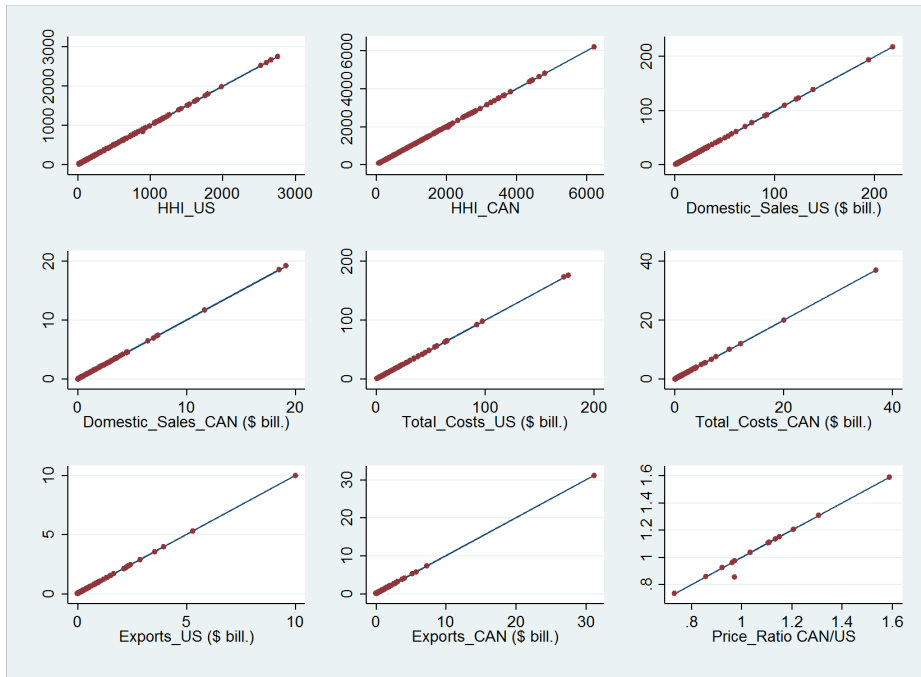
All data are at the 5-digit NAICS level for the year 2002. All value entries (shipments, exports, costs) are in 000s of current USD.

We iterate over parameter values Γ using standard derivative-based methods until we achieve a perfect fit.²²

Identification. Each of our empirical moments has a natural parameter counterpart, which allows a straightforward illustration of how the parameters in Γ are identified. Parameter α^{CAN} governs the price elasticity of demand in Canada, which pins down the ratio of Canadian to U.S. prices, P^{CAN}/P^{US} . The ratio of country i 's imports (Export ji) to country i 's domestic sales (Sales i) is monotonically decreasing in τ^{ji} , and Export ji and Sales i are both proportional to $1/b^i$. This pins down b^i and τ^{ji} . The Herfindahl-Hirschman indices we are targeting are based on the value of production of domestic firms destined for both the domestic and foreign export markets (rather than on the sales by domestic firms and foreign exporters in the domestic market). Thus, ζ^i has a strong and positive impact on country i 's HHI, and a much weaker one on country j 's HHI. Similarly, the scale parameter of the productivity distribution of firms located in country i , x^i , has a direct impact on total costs in country i but only an indirect and much weaker impact on costs in country j . Hence, ζ^i is determined by country i 's HHI and x^i by its total costs.

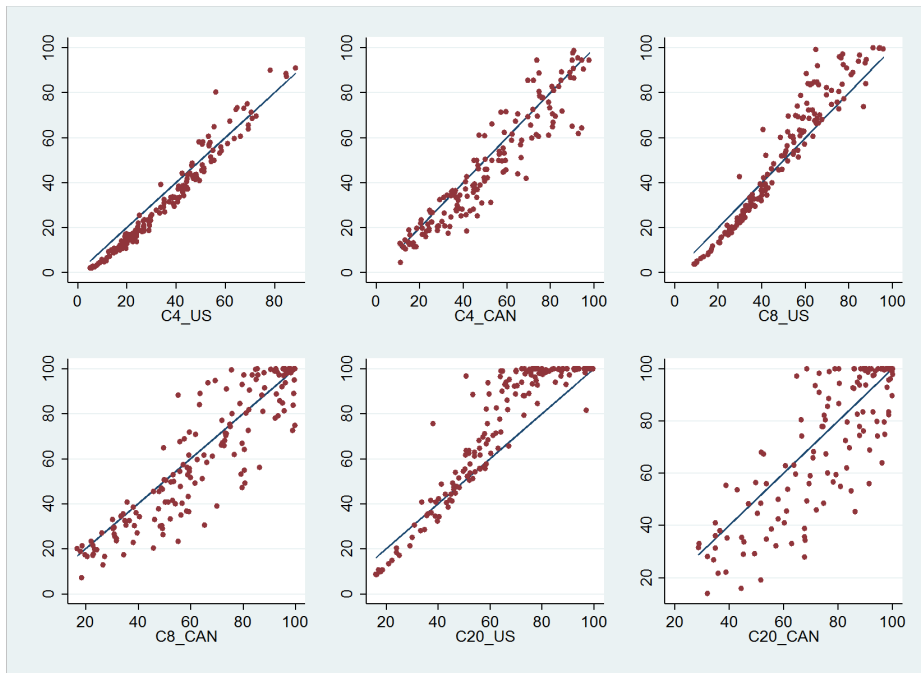
²²In practice, we minimize the sum of the squared residuals, where following Davis, Haltiwanger, and Schuh (1996), the residual is defined as the difference between the theoretical and empirical moments, divided by the arithmetic average of the theoretical and empirical moments. This residual converges to the percentage deviation when the theoretical moment tends to the empirical moment. Using this residual definition improves the convergence properties of our algorithm relative to using standard percentage deviations because residuals behave symmetrically (equal punishment for negative and positive deviations) and always remain bounded.

Figure 1: Theoretical vs. Empirical Moments (targeted moments)



Figures plot theoretical moments (vertical axis) against empirical moments (horizontal axis). Each dot represents a sector. The straight line is the 45-degree line.

Figure 2: Theoretical vs. Empirical Moments (moments not targeted)



Figures plot theoretical moments (vertical axis) against empirical moments (horizontal axis). Each dot represents a sector. The straight line is the 45-degree line.

Goodness-of-fit and parameter values. Figure 1 plots the model fit for our nine targeted moments in all 160 sectors. As can be seen graphically, we match our empirical moments almost perfectly in all sectors. As a cross-validation check, Figure 2 plots the model fit for six moments that were not directly targeted in the calibration: the 4-, 8- and 20-firm concentration ratios in both countries. Our calibrated model does a reasonably good job at predicting these moments as well.

Panel A of Table 2 reports summary statistics on the parameters we take directly from the data. The U.S. is about one third more productive than Canada in the outside sector, and the average manufacturing sector in the U.S. has about six times as many firms as in Canada.

Panel B of Table 2 reports summary statistics on the calibrated parameters. In the median sector, a^{CAN} is very close to a^{US} , meaning that demand elasticities in the U.S. and Canada are quite similar.²³ In the median sector, $1/b^{US}$ is about 13 times higher than $1/b^{CAN}$, which, if we interpret $1/b$ as a market size parameter, is roughly consistent with the ratio of median U.S. to median Canadian industry sales (see Table 1).^{24,25}

Trade costs (τ) from the U.S. to Canada and from Canada to the U.S. are of comparable magnitude in both the average and the median sector. In the median sector, our calibrated τ 's give rise to a tariff equivalent of around 50%, which is close to the 47% reported by Anderson and van Wincoop (2004, pp. 716–717).²⁶ While the τ 's are larger than one in most sectors, there are a few sectors in which they are smaller than one, which seems to be at

²³Things appear to be different in the average sector, where a^{CAN} is almost three times as high as in the U.S. We interpret these findings as follows. As we discuss in Appendix A, Canadian prices are higher than U.S. prices in the average and median sectors. Part of the reason for this is that Canada has fewer firms than the U.S., which suffices to rationalize the U.S.-Canada price ratio in the median sector. However, in a significant number of sectors, this price ratio is so high that differences in numbers of firms alone do not suffice, and the model needs to make Canadian consumers much less price-elastic than U.S. ones. This seems to be driving the average a^{CAN} .

²⁴Again, things look different in the average sector, where the gap between $1/b^{US}$ and $1/b^{CAN}$ shrinks significantly, but one should keep in mind that it is more difficult to think of $1/b$ as a market size parameter when the a 's are allowed to vary (recall that $a^{CAN} \simeq a^{US}$ in the median sector but $a^{CAN} \gg a^{US}$ in the average sector).

²⁵We obtain that $x^{US} < x^{CAN}$ in the average and median sectors. At the same time, there is more dispersion in productivity in the U.S. than in Canada ($\zeta^{US} < \zeta^{CAN}$). This result is driven by the fact that the U.S. has many more firms, which, for a given level of productivity dispersion, should imply much lower U.S. HHIs. While U.S. HHIs are indeed lower than Canadian ones in our data, the model still requires more productivity dispersion in the U.S. in order not to underpredict U.S. HHIs.

²⁶Although the U.S. and Canada are part of a free-trade agreement, there are good reasons to expect trade costs between those two countries to remain significant. For instance, Anderson and van Wincoop (2004) report that border-related barriers such as tariffs only account for 25% of overall trade costs on average, with the rest being accounted for by other factors such as transportation costs or the time value of goods in transit. Note that, due to those other factors, there is no particular reason why $\tau^{US,CAN}$ should necessarily be the same as $\tau^{CAN,US}$.

odds with the conventional interpretation of iceberg trade costs. This could be due to the fact that, in some sectors, a significant fraction of the U.S. industry is located close to the Canadian border. In such sectors, it may therefore be more costly for a U.S. firm to supply the average American consumer than it is to supply the average Canadian consumer. Put differently, it does not seem implausible that international trade costs would occasionally be lower than *intra-national* ones, which we have normalized to 1 in our calibration.²⁷

Table 2: Parameter Values - Summary Statistics (Calibration without Mergers)

A) Parameters from Data	Mean	Median	Standard Deviation	P10	P90
α^{US}	1	1	0	1	1
α^{CAN}	0.750	0.750	0	0.750	0.750
N^{US}	1605.825	705	3147.181	134	3783.5
N^{CAN}	269.788	131.5	423.494	27.5	637.5
η^{US}	0.288	0.277	0.099	0.165	0.417
η^{CAN}	0.26	0.259	0.096	0.118	0.378
B) Calibrated Parameters	Mean	Median	Standard Deviation	P10	P90
a^{US}	25	25	0	25	25
a^{CAN}	69.279	23.699	122.487	7.077	180.666
$1/b^{US}$	18490.707	6343.944	46070.990	1155.054	40278.848
$1/b^{CAN}$	4992.182	475.525	28828.759	32.401	6383.334
$\tau^{CAN,US}$	1.758	1.453	1.149	1.164	2.456
$\tau^{US,CAN}$	1.854	1.506	1.341	0.810	3.103
ζ^{US}	5.414	4.987	2.958	2.568	8.251
ζ^{CAN}	11.585	8.328	9.545	4.611	24.179
x^{US}	0.376	0.183	0.635	0.051	0.690
x^{CAN}	0.488	0.270	0.699	0.086	1.114
Observations	160	160	160	160	160

We compute all parameters reported in the Table separately for each 5-digit NAICS industry. The Table reports summary statistics calculated across all industries.

4.3 Counterfactual Experiments

Using our calibrated model, we now compute our conflict statistics ρ^{US} and ρ^{CAN} to look at which types of conflicts are most frequent, both at current trade costs (i.e., at our calibrated values for $\tau^{US,CAN}$ and $\tau^{CAN,US}$) and at higher and lower levels of trade costs. Figures 3 and 4

²⁷An alternative explanation for trade costs below one could be that, in a given sector, products sold in the U.S. market are not the same as those sold in the Canadian market. This could explain why a U.S. firm may find it cheaper to serve the Canadian market than its own domestic market. We carry out a robustness check in which the τ 's are restricted to be no less than 1 in Section 4.4.

show how ρ^{US} and ρ^{CAN} change as trade costs vary. We consider uniform percentage changes in both $\tau^{US,CAN}$ and $\tau^{CAN,US}$ by multiplying the originally calibrated τ 's by the same factor in all sectors. We recompute the model equilibrium with the new trade cost parameters but keep all other calibrated parameters constant. This leads to new equilibrium prices (P^{US} , P^{CAN}) which we use to compute ρ^{US} and ρ^{CAN} for each sector. Figure 3 plots percentiles of the distribution of ρ^{US} across sectors for different percentage trade cost changes, and Figure 4 does the same for ρ^{CAN} .

According to our calibration results, at the original level of trade costs (0% change), U.S. merger policy is too tough on Canada in the majority of sectors; in only around 20% of sectors we have $\rho^{US} < 1$. As Figure 4 shows, the situation is different in Canada. There are no sectors in which Canadian policy is too lenient according to our potential conflict statistic (ρ). Instead, Canada is always too tough on its own domestic mergers from the point of view of U.S. consumers. The intuition behind this difference is straightforward. The U.S. market is more competitive than the Canadian market, which is reflected in a lower relative price P^{US}/P^{CAN} . Even though iceberg trade costs are larger than one on average and in the vast majority of sectors, this sometimes leads to $\rho^{US} < 1$. By contrast, both $\tau^{CAN,US}$ and P^{CAN}/P^{US} are usually larger than unity, leading to $\rho^{CAN} > 1$ in all sectors in our data.

As implied by Proposition 2, the quantiles of ρ^{US} and ρ^{CAN} are increasing in trade costs. In addition, we find that for trade cost reductions of 25%-30%, ρ^{US} and ρ^{CAN} decrease below one in the median sector, meaning that conflict of the too-lenient-for-thy-neighbor type becomes the most prevalent form of conflict.

These results suggest that even if countries do have veto rights over foreign mergers, they may only use them infrequently at present levels of trade costs. This is particularly true for large, competitive economies such as the U.S. Hence, high-profile cases such as GE/Honeywell and Gencor/Lonrho, where the merger was approved by the domestic authority but blocked by a foreign authority, are likely to be the exception rather than the rule, even if national authorities do claim jurisdiction over foreign mergers. However, our calibration results suggest that veto rights become much more important as trade costs fall. Indeed, in our numerical simulations, too-lenient-for-thy-neighbor policies emerge as the dominant source of conflict for trade cost reductions that do not appear large from a historical perspective.²⁸ In Section 5, we impose more structure to put a monetary value on the costs and benefits of veto rights at different levels of trade costs.

²⁸See Jacks, Meissner, and Novy (2008) for estimates of trade cost changes over the period 1870 to 2000.

Figure 3: Potential Conflicts Arising from U.S. Mergers

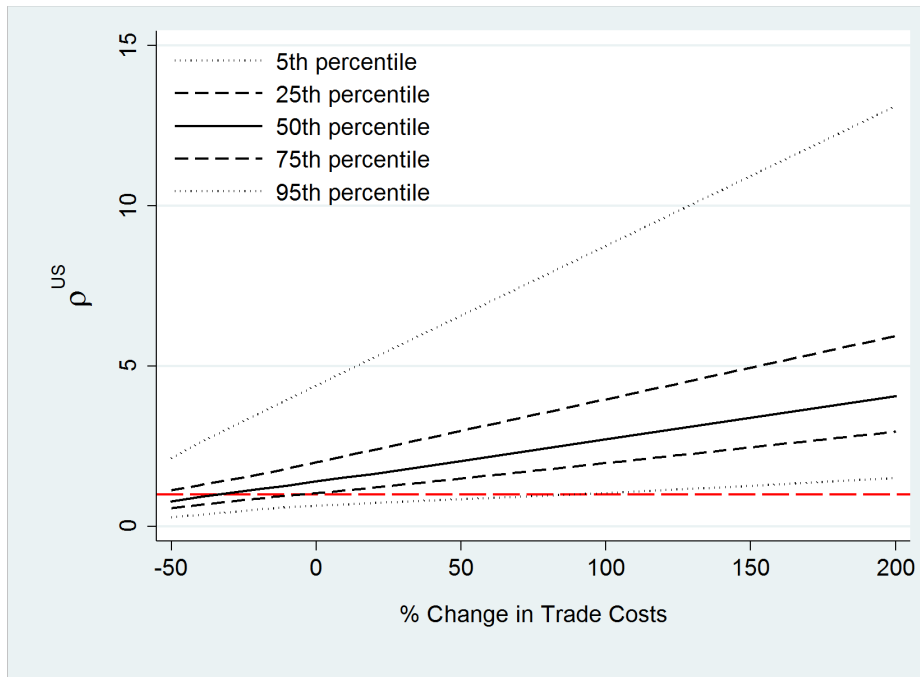


Figure shows percentiles of the distribution of ρ^{US} across sectors for different trade cost changes.

Figure 4: Potential Conflicts Arising from Canadian Mergers

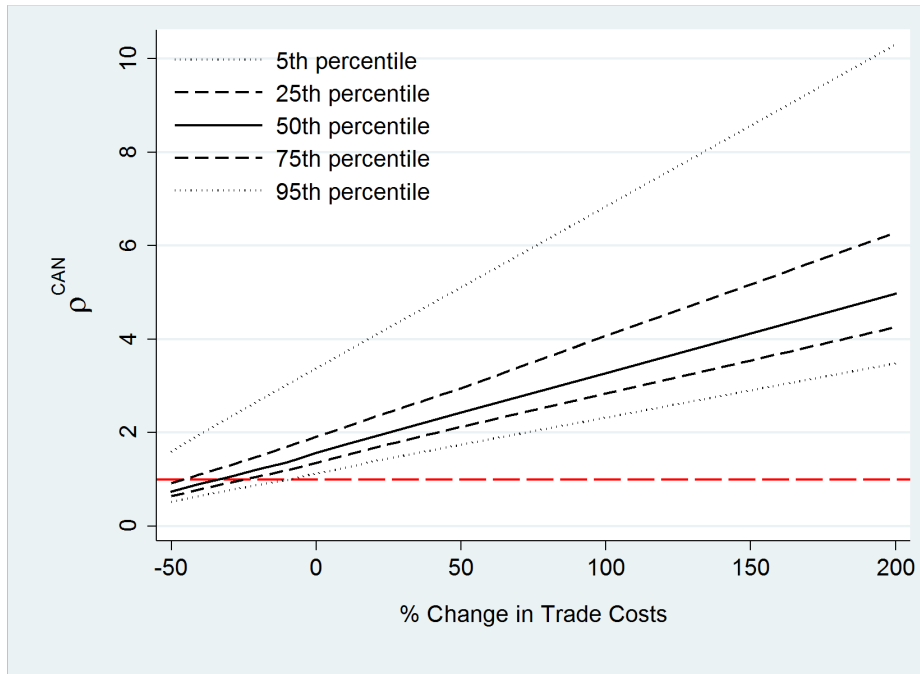


Figure shows percentiles of the distribution of ρ^{CAN} across sectors for different trade cost changes.

4.4 Robustness Checks

We now present a number of robustness checks which investigate how sensitive our findings are to changes in the data and modeling frameworks used. For conciseness, we only provide a brief discussion in this section and refer the reader to the Online Appendix for additional details.

Unit-value-based relative price data. As a first robustness check, we compute relative prices using unit values constructed from our sector-level trade data. While unit values tend to be imprecisely measured and sometimes result in implausibly large price differences between the U.S. and Canada, they have the advantage of allowing the computation of relative prices at a finer level of aggregation than the PPP data (see Appendix A for details). Using unit-value-based relative price data leads to more dispersion in relative prices and slightly changes parameter values. However, the calibrated levels of trade costs are very similar to before and the U.S. continues to be the more competitive market in the sense of having a lower price. Our conflict statistics, ρ^{US} and ρ^{CAN} , are also very similar to before, both at the current level and at lower and higher values of trade costs.²⁹

Competitive fringe. For our second robustness check, we explicitly model a competitive fringe. We assume that out of the total N domestic firms in each sector, N_o behave oligopolistically whereas the remaining $N - N_o$ firms belong to a competitive fringe that takes the market price as given. In the absence of detailed information about the likely number of oligopolists in each sector, we set N_o to the number of the largest firms that jointly account for 80% of total sectoral sales in the data. The parameter values for this competitive fringe extension are broadly similar to the baseline calibration and the evolution of our conflict statistics is almost identical to the one reported in Figures 3 and 4.³⁰

Third-country imports. In our baseline calibration, we have ignored imports from the rest of the world. We explicitly model such imports in our third robustness check. Specifically, we assume that, in every sector, there are n^i identical third-country firms selling in country $i \in \{US, CAN\}$ with a constant unit cost of γ^i . We use information from the World Bank's Exporter Dynamics Database to construct a proxy for n^i and calibrate γ^i to match aggregate imports by country i from third countries, taken from the United Nations'

²⁹See Online Appendix Tables H.1.1 and H.1.2, and Figures H.1.1–H.1.4.

³⁰See Online Appendix Section C.

Comtrade database. The parameter values and the evolution of our conflict statistics are broadly similar to the baseline calibration.³¹

Additive trade costs. As already mentioned at the end of Section 3, some important parts of trade costs are best thought of as being additive rather than multiplicative. In our fourth robustness check, we replace iceberg-type trade costs by additive trade costs. The parameter values (excluding trade costs) for this extension are almost identical to those in the baseline calibration. Using the conflict statistics for additive trade costs defined in equation (1), we find that at present levels of trade costs, both countries continue to be too tough in a majority of sectors, with the U.S. being too lenient in a minority of sectors.³²

Constraining τ to be no smaller than 1. Our baseline calibration delivers values of the iceberg-type trade cost that are strictly less than 1 in some sectors. As mentioned in Section 4.2, such values of τ can be rationalized in several ways, so we do not view this finding as problematic per se. Nevertheless, trade costs below unity could be an issue as trade costs enter directly into our conflict statistics. In particular, one may worry that artificially low trade costs are driving one of our results, that U.S. merger policy is too lenient in a significant minority of sectors. To show that this is not the case, we carry out a fifth robustness check in which the values of τ are constrained to be no less than 1. In sectors in which the constraint is binding, we can no longer expect to match all moments perfectly—we therefore minimize the sum of the squared deviations between theoretical and empirical moments. The fit of the calibration remains good and the parameter values we obtain are broadly similar to those in the baseline calibration. The values of our conflict statistics at current as well as higher and lower values of trade costs are also very similar to before.³³

CES-differentiated Bertrand competition. Our last robustness check undertakes a more substantial modification of our baseline model. Building on Nocke and Schutz (2018a, b), we now work with a CES demand system and assume that firms produce differentiated products and compete *à la* Bertrand. We first show that Proposition 1 extends word for word to the case of price competition with CES demands if we replace P^{i*} and P^{j*} by the equilibrium CES price indices in countries i and j in the definition of conflict statistic ρ^{j*} . Next, we calibrate the model and show that, at current trade costs levels, ρ^{US} and ρ^{CAN} are larger than one in all sectors, which is consistent with the results obtained in the baseline. As trade

³¹See Online Appendix Section D.

³²See Online Appendix Table H.4.1 and H.4.2, and Figures H.4.1 and H.4.2.

³³See Online Appendix Table H.5.1 and Figures H.5.1–H.5.4.

costs decrease, some of the ρ 's decrease below one, which indicates that domestic merger policies are likely to become too lenient for foreign consumers in a number of sectors.³⁴

5 Model Calibration with Mergers

Thus far, we have used our calibrated model to identify the dominant form of conflict between national authorities at different levels of trade costs. In this section, we go one step further and try to put a monetary value on the costs and benefits of alternative ways of coordinating national merger policies. This requires much stronger assumptions. In particular, we have to model explicitly an endogenous merger formation process and take a stance on the strength of merger-specific synergies, on merger authorities' objective functions, and on whether the U.S. and Canada can veto each others' mergers.

We proceed in the following way. We again start out with N_s^i potentially active manufacturing firms in sector s and country i . Firms are then allowed to merge, leading to a new market structure in each country. We compute our theoretical moments at the end of the merger process and compare them to the same empirical moments described above. In addition, we also keep track of the number of mergers taking place during the merger process and match them to the actual number of mergers observed in the data in a given sector.

5.1 Merger Formation Process

We take a simple and tractable dynamic random matching approach to operationalize the merger formation process. In sector s , firms play a dynamic game with $T_s^1 + T_s^2 + 1$ periods, where $T_s^1 \geq 0$ and $T_s^2 \geq 0$ are parameters. Nature randomly and uniformly draws T_s^1 periods in $\{1, \dots, T_s^1 + T_s^2\}$ in which country 1 will receive merger opportunities, and the complementary T_s^2 periods in $\{1, \dots, T_s^1 + T_s^2\}$ in which country 2 will receive merger opportunities.³⁵ From now on, we drop sector subscripts for ease of notation.

Whenever two firms merge, the productivity of the merged entity becomes:

$$\bar{z}_M = (z_1^\delta + z_2^\delta)^{\frac{1}{\delta}}, \quad (2)$$

³⁴See Online Appendix Section E.

³⁵We view T^1 and T^2 as parameters capturing frictions in the market for firm ownership. A low T^i means that these frictions are strong, so that few mergers are feasible. Conversely, a high T^i means that almost every merger is feasible, albeit not necessarily profitable or approvable. To improve the model's fit to the data, it is useful to allow T^1 and T^2 to take non-integer values. This is done as follows: the number of merger opportunities received by country i is equal to the integer part of T^i plus a Bernoulli random variable, which takes value 1 with a probability equal to the fractional part of T^i . These random variables are realized in period 0, before the game starts.

where parameter δ governs the strength of synergies. Note that $\bar{z}_M > \max(z_1, z_2)$ for any $\delta \in (0, \infty)$, and that \bar{z}_M is decreasing in δ . In the limit as $\delta \rightarrow \infty$, we have $\bar{z}_M = \max(z_1, z_2)$, which corresponds to the case of no synergies in the sense of Farrell and Shapiro (1990).³⁶ In the following, we assume that synergies are random and merger-specific, i.e., the δ associated with a merger between firms k and l is drawn from a log-normal distribution with mean parameter $\ln(\beta_s^i) - \frac{1}{2}$ and variance parameter 1, where β_s^i is a parameter of the model.

Now consider period $t \in \{1, \dots, T^1 + T^2\}$, and suppose country i receives a merger opportunity in this period. The timing within period t is as follows. 1) Nature randomly and uniformly draws two merger partners in country i : the acquirer and the target. Nature also draws a synergy parameter δ for this merger. 2) The acquirer can make a take-it-or-leave-it offer to the target. 3) If an offer has been made, then the target accepts or rejects it. 4) If a merger proposal has been made and accepted, then the antitrust authority in the country where the merger is proposed decides whether to approve it. 5) Firms decide whether to stay in the industry. If a firm exits, then it receives a positive but arbitrarily small scrap value. 6) Firms compete in quantities in both manufacturing markets.

Period $t = 0$ is special in that no country receives a merger opportunity in that period. This allows us to accommodate sectors in which there are no mergers. The timing within period 0 is the same as within period $t > 0$, except that sub-stages 1 through 4 are dropped.

We assume that all players have discount factors equal to zero. This means that firms evaluate the profitability of mergers and make their exit decisions given the current market structure. This assumption is necessary to make our approach tractable, given the potentially large numbers of firms and periods we have to deal with. In conjunction with our earlier assumptions, it implies that only those mergers will be proposed to the antitrust authority where the profit of the merged entity at the current post-merger market structure is strictly larger than the sum of the pre-merger profits of the merger partners. Similarly, due to the strictly positive scrap value, firms that do not produce in the current period will exit the market, ensuring that mergers will take place only between active firms (which is what we observe in our data).

As mentioned above, we also need to take a stance on the merger authorities' objective functions. While the U.S., the EU and most other important jurisdictions have adopted something close to a consumer surplus standard in merger control, Canada has long been

³⁶Also note the following two properties of \bar{z}_M . For a merger between two symmetric firms with pre-merger productivity z , equation (2) implies that the merger-induced fractional change in productivity is independent of z . Moreover, a mean-preserving spread of the merger partners' pre-merger productivities induces a larger post-merger productivity: for $\Delta > 0$, $((z + \Delta)^\delta + (z - \Delta)^\delta)^{1/\delta}$ is increasing in Δ .

thought of as having adopted a total surplus standard. However, in the last twenty years or so, the Canadian merger authority has been pushed towards putting a greater weight on consumer surplus: “As a result of [...] extensive litigation, it appears that the total surplus standard no longer serves as the basis for merger evaluation in Canada” (Gifford and Kudrle, 2005). For simplicity, we assume here that both the U.S. and Canadian authorities have a consumer surplus standard. In conjunction with the impatience assumption, this implies that antitrust authorities follow a simple rule, whereby they block a merger if and only if this merger lowers domestic consumer surplus given the current market structure.³⁷ Under these assumptions, it is straightforward to show that our merger game has a unique subgame-perfect equilibrium. Given equilibrium strategies, we compute our theoretical moments at the end of stage $T^1 + T^2 + 1$.

5.2 Calibration Procedure and Results

Introducing a merger formation process into our calibration necessitates a number of changes. First, we now also have to calibrate T^1 and T^2 . We choose T^1 and T^2 such that the number of mergers taking place during the merger formation process equals the actual average annual number of mergers in each sector over the period 1993-2002.³⁸ Second, we now calculate the theoretical moments at the end of the merger game, which means that the calibrated values of our other parameters will also change. Finally, we need to take a stance on the strength of synergies as captured by the β -parameters. Unfortunately, the existing literature does not provide reliable estimates for a broad range of industries. Most papers in the merger simulation literature use arbitrary levels of synergies to simulate the price effect of a merger (Hausman, Leonard, and Zona, 1994; Werden and Froeb, 1994; Nevo, 2000).³⁹ A large empirical literature investigates the causes and consequences of mergers and acquisitions (Lichtenberg and Siegel, 1987; McGuckin and Nguyen, 1995; Maksimovic, 2001; Schoar, 2002). Due to data limitations, these papers use revenue productivity instead of physical productivity to measure economic efficiency. This is problematic, since mergers that increase

³⁷Given the current legal frameworks in most countries, it would be difficult for an antitrust authority to clear (or block) a merger on the grounds that this merger is likely to lead to more (or fewer) mergers in the future.

³⁸The source of our merger data is Thomson SDC Platinum. See Appendix A for details.

³⁹A few papers use post-merger data to assess the accuracy of merger simulations and investigate the discrepancy between simulated and realized price effects (Peters, 2006; Weinberg and Hosken, 2013; Björnerstedt and Verboven, 2016). These papers typically do not attempt to disentangle changes in post-merger marginal costs from other supply side phenomena, such as a change in industry conduct triggered by the merger. A recent exception is Miller and Weinberg (2017), who find that the 2008 MillerCoors joint venture reduced marginal costs by 13.6% on average.

market power tend to raise output prices and hence revenue productivity.⁴⁰

Given this state of affairs, we simply set β^{US} and β^{CAN} equal to 50 in all sectors. As we show below, these parameter values (along with the other calibrated parameters we obtain) imply that, on average, an approved merger reduces the marginal costs of the merging parties by about 7% in the median sector. We also present robustness checks assuming different values for β in Section 5.4.

The fit of the new calibration remains very good.⁴¹ There are only four out of 160 sectors in which we are unable to match merger activity in the data. We drop these sectors in the following although the results are similar if we include them.⁴²

For each sector, the augmented calibration procedure also yields average price and marginal cost reductions induced by mergers during the merger formation process. Tables 3 and 4 show summary statistics on the distribution across sectors of these price and costs effects. For each sector, we calculate average price and marginal cost reductions as follows. Using our calibrated parameter values, we recompute the model's equilibrium R times (where R is the number of iterations used in our Monte Carlo integration). For each iteration, we observe a number of mergers of which each will entail marginal cost reductions as well as price changes in the domestic and/or the foreign market. We compute marginal cost reductions (synergies) as the percentage decline in marginal costs of the merged entity as compared to the most efficient of the two merging firms.⁴³ We compute the average cost and price reductions over all mergers for a given iteration, and then take the mean of these averages across all R iterations.

As seen in Table 3, mergers have larger effects on domestic prices than on foreign prices in both the mean and the median sector. There is also a large degree of heterogeneity in terms of the magnitude of effects, with price reductions reaching from 0% to close to -2% in a few sectors. Because each country has a veto right over domestic mergers, domestic price effects are all non-positive by construction. While cross-border price effects are also negative on average, U.S. mergers lead to price increases in a few Canadian sectors. Table 4 shows

⁴⁰A recent exception is Braguinsky, Ohyama, Okazaki, and Syverson (2015), who use detailed data from the Japanese cotton spinning industry at the turn of the twentieth century, and find that acquired plants experienced productivity increases of around 13%.

⁴¹See Online Appendix Figures H.7.1 and H.7.2 which replicate Figures 1 and 2, augmented with plots for predicted and actual merger activity.

⁴²Table H.7.2 in the Online Appendix shows the new parameter values for the remaining 156 sectors. The estimates of our parameters already present in the first calibration are broadly similar to before, so we do not comment on these further. Regarding our new merger opportunities parameters, we find that T^{US} is significantly higher than T^{CAN} in the median and average sectors. This is consistent with the fact that the number of domestic U.S. mergers is over ten times as high as in Canada in the data (see Table 1).

⁴³This is consistent with the notion of synergies in Farrell and Shapiro (1990).

that the average cost reductions implied by mergers is around 7% in the median sectors in both countries (9% in the average sector). These numbers do not appear unreasonably large compared to the estimates we found in the existing literature (see Footnotes 39 and 40).

Table 3: Simulated Domestic and Cross-Border Price Effects of Mergers

Price Effect	Mean	Median	Standard Deviation	P10	P90
US merger, US price	-0.11%	-0.06%	0.12%	-0.26%	-0.01%
US merger, CAN price	-0.03%	-0.01%	0.09%	-0.09%	0.01%
CAN merger, CAN price	-0.14%	-0.07%	0.18%	-0.32%	-0.01%
CAN merger, US price	-0.08%	-0.01%	0.22%	-0.30%	0.00%

We compute the domestic and cross-border price effects of mergers separately for each 5-digit industry. The Table reports summary statistics calculated across all industries. Industries without merger opportunities are dropped.

5.3 Counterfactual Policy Regimes

Trade costs and the scope for conflicts. The evolution of our conflict statistics with changes in trade cost is nearly identical to that shown earlier in Figures 3 and 4.⁴⁴ As before, these results inform us only about the *potential* for conflicts. For a given realization of synergies, no merger might fall in the zone between \hat{c}_M^{US} and \hat{c}_M^{CAN} , so that no *actual* conflict may arise. The new calibration now also allows us to look at *actual* conflicts, i.e., the fraction of profitable mergers for which the two antitrust authorities reach conflicting decisions in our simulations, as shown in Figures 5 and 6.

These figures show that actual conflicts track potential conflicts closely. Again, the dominant conflict is that merger authorities block too many domestic mergers from the point of view of foreign consumers.⁴⁵ At the present level of trade cost, there are no merger opportunities for which the Canadian authorities are too lenient and only a minority of cases (14%

⁴⁴See Online Appendix Figures H.7.3 and H.7.4.

⁴⁵Note that the fact that a merger is blocked by a merger authority in our model does not necessarily imply that we would observe the same merger getting blocked in the real world. If the merging parties are reasonably confident that their merger will not be allowed to go through by competition authorities, then they will simply not propose it in the first place.

Table 4: Synergy Effects

MC Reduction	Mean	Median	Standard Deviation	P10	P90
US mergers	-7.1%	-6.8%	2.8%	-10.0%	-3.2%
Canadian mergers	-11.1%	-7.2%	9.6%	-24.5%	-5.6%

We compute the synergy effects of mergers separately for each 5-digit industry. The Table reports summary statistics calculated across all industries. Industries without merger opportunities are dropped.

Figure 5: Actual Conflicts, % of all profitable merger opportunities (U.S. mergers)

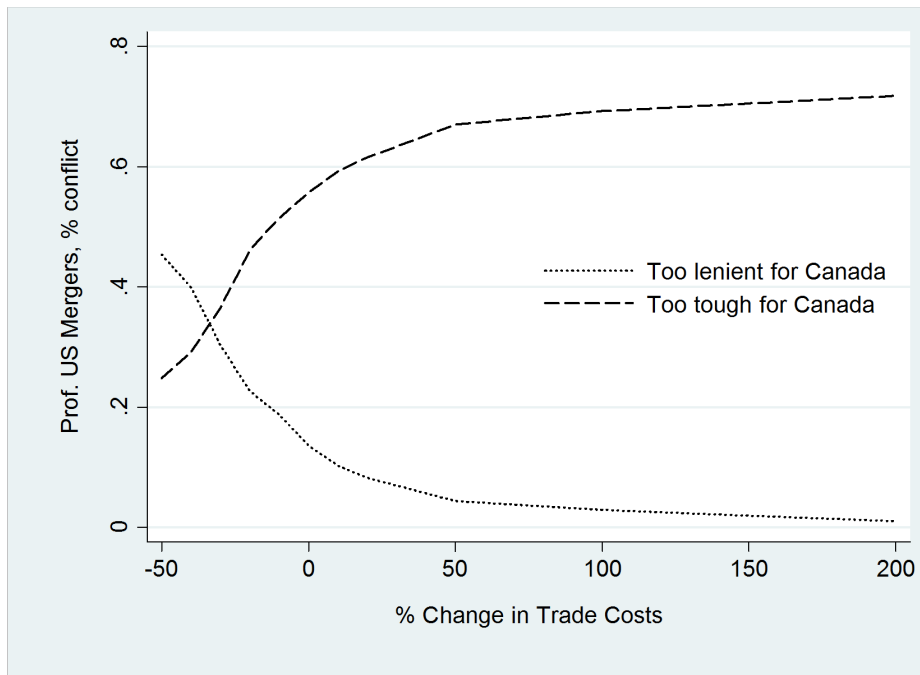


Figure shows means across sectors of the fraction of profitable mergers where a conflict arose. “Too lenient for Canada” means that the U.S. authorized a merger which lowered consumer surplus in Canada; “Too tough for Canada” means that the U.S. blocked a merger which would have increased Canadian consumer surplus. If there are no merger opportunities in a sector, the sector is dropped.

Figure 6: Actual Conflicts, % of all profitable merger opportunities (Canadian mergers)

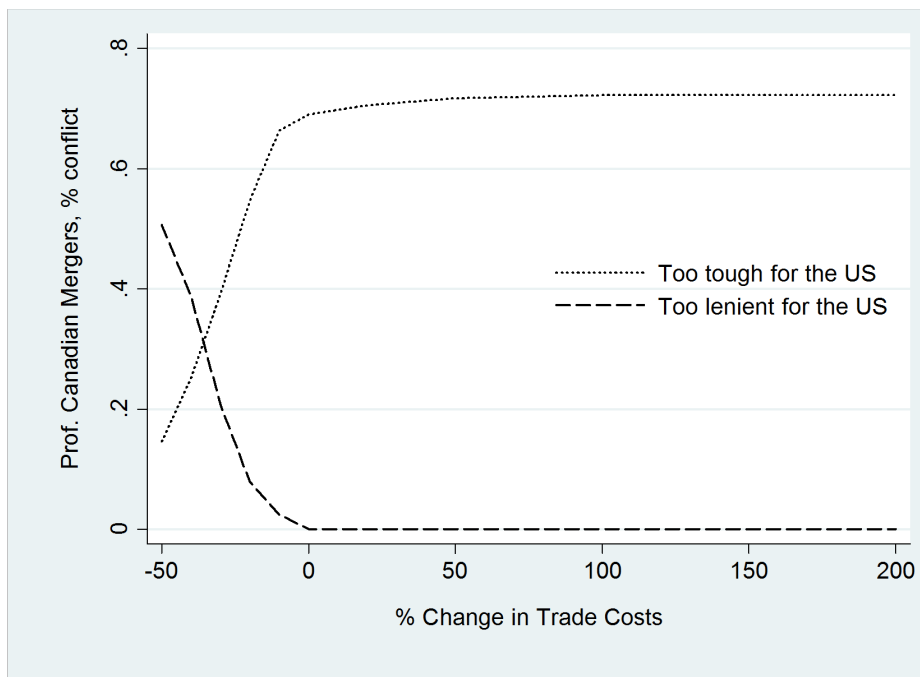


Figure shows means across sectors of the fraction of profitable mergers where a conflict arose. “Too lenient for the U.S.” means that Canada authorized a merger which lowered consumer surplus in the U.S.; “Too tough for the U.S.” means that Canada blocked a merger which would have increased U.S. consumer surplus. If there are no merger opportunities in a sector, the sector is dropped.

of all profitable merger opportunities) where the U.S. authorities approve mergers leading to consumer surplus losses in Canada. As trade costs fall, changes in actual conflict patterns again closely resemble changes in potential conflict patterns, with anti-competitive effects of foreign mergers becoming the most important source of conflict at trade cost declines of about 30%.

Introducing veto rights. One possible way of eliminating too-lenient-for-thy-neighbor policies involves granting veto rights over foreign mergers. Each country can only benefit from having such veto rights. However, the effects from the introduction of bilateral veto rights are, in general, ambiguous. On the one hand, country i benefits from its antitrust authority being able to block CS-decreasing mergers taking place among country- j firms. On the other hand, however, country i suffers from the antitrust authority in country j being able to block CS-increasing mergers among country- i firms.

We use our augmented calibration to quantify the costs and benefits for consumers of granting such bilateral veto rights. To do this, we modify stage 4 in the merger game by assuming that a proposed merger must receive approval from both the U.S. *and* Canadian authorities.⁴⁶ As before, we compute the model’s equilibrium after the merger game, using the parameter values from our calibration with mergers described above.⁴⁷

Table 5 shows that, at the present level of trade costs, the introduction of bilateral veto rights in our simulations reduces consumer surplus in the U.S. by USD 1.6 million in the average sector, and slightly increases Canadian consumer surplus, resulting in a reduction in total North American consumer surplus of USD 230 million across all 156 manufacturing sectors. In the median sector, this policy change has no effect on consumer surplus in either country. These findings are in line with our previous results. At the present level of trade costs, merger policy in Canada is of the too-tough-for-thy-neighbor type in all sectors, implying that U.S. consumers can only lose from the introduction of bilateral veto rights.⁴⁸

⁴⁶Under veto rights, we assume that the domestic antitrust authority makes its approval decision before the foreign one. Sequentiality eliminates undesirable equilibria which rely on a coordination problem between antitrust authorities. Under simultaneous timing, there always exists an equilibrium in which country i blocks a CS-increasing merger because it expects country j to block it, and vice versa. It does not matter who moves first: we could assume that the foreign antitrust authority makes its decision before the domestic one, or that the first mover is drawn randomly, and obtain the same results.

⁴⁷Note that we reset the seed values of our random number generator ahead of each counterfactual, so that we obtain the same realizations of all random variables.

⁴⁸There are three sectors in which U.S. consumer surplus increases slightly which might seem puzzling at first. The explanation is that the introduction of bilateral veto rights prevents some U.S. mergers from taking place which would have increased prices in Canada. As a consequence of the lower equilibrium price, additional mergers can now take place in Canada which increase consumer surplus in both Canada and the United States. The consumer surplus effects of these additional mergers overcompensate the negative effects

Moreover, merger policy in the U.S. is of the too-lenient-for-thy-neighbor type in a minority of sectors, implying that Canadian consumers in those sectors, and only in those sectors, benefit from their authority being able to block U.S. mergers.

Table 5: Introducing Veto Rights

Change in Outcome (000s USD)	Mean	Median	Standard Deviation	P10	P90
Total Consumer Surplus US+Canada	-1486.5	0	8505.5	-1056.2	0
Consumer Surplus US	-1618.7	0	9221	-1302.7	0
Consumer Surplus Canada	132.3	0	746.2	0	110.5

We compute the consumer surplus effects of introducing veto rights separately for each 5-digit industry. The Table reports summary statistics calculated across all industries.

Next, we explore how the effects on Canadian, U.S. and total North-American consumer surplus from the introduction of bilateral veto rights change with trade costs. As Figure 7 shows, as trade costs fall from current levels, Canadian consumers gain increasingly while the effects on U.S. consumers are non-monotonic. To understand these findings, recall that as trade costs fall, conflicts increasingly turn into the too-lenient-for-thy-neighbor type, implying that countries tend to gain more from being able to block foreign mergers. This is exactly what is happening for Canada, which remains the less competitive market and thus has more to gain from the introduction of bilateral veto rights than the U.S. in our simulations. The flip side of Canada remaining the less competitive market is, however, that it blocks many U.S. mergers that would have benefited U.S. consumers. The interaction of these countervailing effects results in the non-monotonic impact in the U.S.

For trade cost reductions of 50%, the total Canadian consumer surplus gain from introducing bilateral veto rights increases to over USD 3 billion, while the total U.S. consumer surplus loss is less than USD 160 million. Overall, these results suggest that veto rights become more important as an “insurance” against price-increasing foreign mergers as trade costs fall, especially for smaller, less competitive countries.

Introducing a North-American merger authority An alternative way of coordinating merger policies involves the creation of a supra-national merger authority that blocks a merger

on the U.S. of the merger initially blocked by Canada.

Figure 7: Consumer surplus change, No-Veto to Veto Case

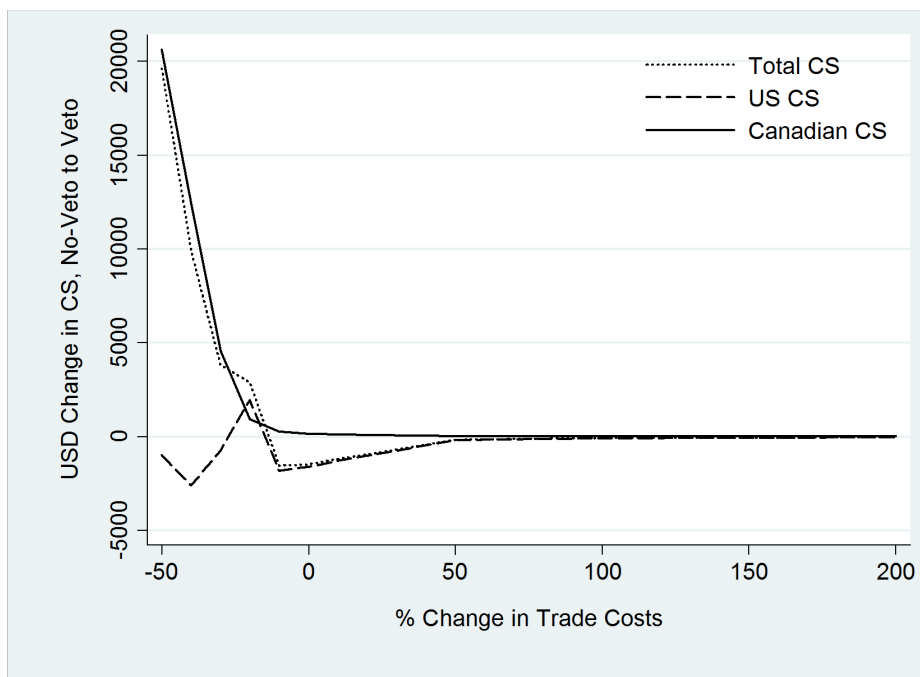


Figure shows the mean USD change in consumer surplus (in 000s of USD) induced by a move from no-veto rights to veto rights for different levels of trade cost changes.

if and only if it decreases the sum of U.S. and Canadian consumer surplus.^{49,50} Like bilateral veto rights, such a supra-national authority mitigates the problem of too-lenient-for-thy-neighbor policies. In contrast to bilateral veto rights, however, it also addresses the problem of too-tough-for-thy-neighbor policies. We use our augmented calibration to quantify the consumer surplus effects of such a hypothetical North-American merger authority.

As can be seen in Table 6, we find a large positive impact on aggregate North American consumer surplus of around USD one billion.⁵¹ This overall gain comes at the expense of

⁴⁹However, there may be an enforcement problem if countries do not give up their own jurisdiction. See Cabral (2005) for an analysis of how the problem may be solved in an infinitely repeated game in which each country has veto power over both domestic and foreign mergers but, in equilibrium, uses this only selectively.

⁵⁰The European Commission is the only real-world example of a supra-national antitrust authority. The European Commission has exclusive jurisdiction over mergers that have an “EU dimension,” which is the case when the merger partners have sufficiently high EU-wide turnover and do not achieve more than two-thirds of that turnover in one of the member states. Our reading of the merger regulation is that the Commission would not approve (without remedies) a merger that raises prices in one of the member states but lowers them in other member states—thus, the behavior of the Commission seems to be best approximated by our veto-rights counterfactual policy regime.

⁵¹There are a few sectors where total North American consumer surplus goes down. This is a consequence of the myopic behavior of the antitrust authority. By authorizing a number of U.S. mergers which increase total consumer surplus but lower consumer surplus in Canada, the joint authority changes the set of future permissible mergers in Canada, some of which would have increased North American consumer surplus. While such dynamic effects are usually dominated by the first-order effects of maximizing joint consumer surplus, there are a few sectors where the total consumer surplus change is negative.

Canada which sees a total drop in consumer surplus of USD 86 million. To understand why, note that the total North American consumer surplus effects of a given merger tend to be dominated by changes in U.S. consumer surplus because of the substantial market size advantage of the U.S. Accordingly, the new antitrust authority bases its decision mainly on U.S. consumer surplus effects. This is detrimental to Canadian consumer surplus because Canadian merger policy was initially too tough on domestic mergers from the point of view of U.S. consumers. The new authority now authorizes a number of domestic Canadian mergers which increase North-American consumer surplus but were previously blocked by Canada because they would have increased prices there.

Table 6: North-American Competition Authority

Change in Outcome (000s USD)	Mean	Median	Standard Deviation	P10	P90
Total Consumer Surplus US+Canada	7043	11.6	39422.8	0	2391.5
Consumer Surplus US	7593.2	0	44433.4	-31.3	1537.4
Consumer Surplus Canada	-550.3	2.4	5626.6	-51.4	153.6

We compute the consumer surplus effects of creating a North-American competition authority separately for each 5-digit industry. The Table reports summary statistics calculated across all industries.

Figure 8 looks at the consumer surplus changes induced by a supra-national authority at different levels of trade costs. Recall that as trade costs fall from current levels, the dominant type of conflict changes and domestic merger authorities tend to become too lenient on domestic mergers. Because it maximizes total consumer surplus, a North American merger authority needs to address this too-lenient-for-thy-neighbor conflict. As we saw previously, it is now Canada which benefits more from its resolution. This explains why the consumer surplus change in Canada (compared to the baseline scenario of no veto rights) becomes increasingly positive and starts to resemble the one from the introduction of bilateral veto rights (see Figure 7). The same effects again have more ambiguous consequences for the U.S., where the gains from preventing CS-decreasing Canadian mergers are balanced by a decrease in CS-increasing domestic merger activity. However, even for large trade cost reductions there remains a substantial fraction of Canadian mergers on which the Canadian authority would be too tough (see Figure 6). The joint merger authority will continue to authorize some of these mergers, so that overall U.S. gains from its introduction remain positive.

As discussed, these results are based on strong assumptions. However, taken at face value, they demonstrate a couple of additional important points about the interconnection of trade and merger policy. First, the level of trade costs determines the predominant type of conflict

Figure 8: Consumer surplus change, No-Veto to North-American Competition Authority

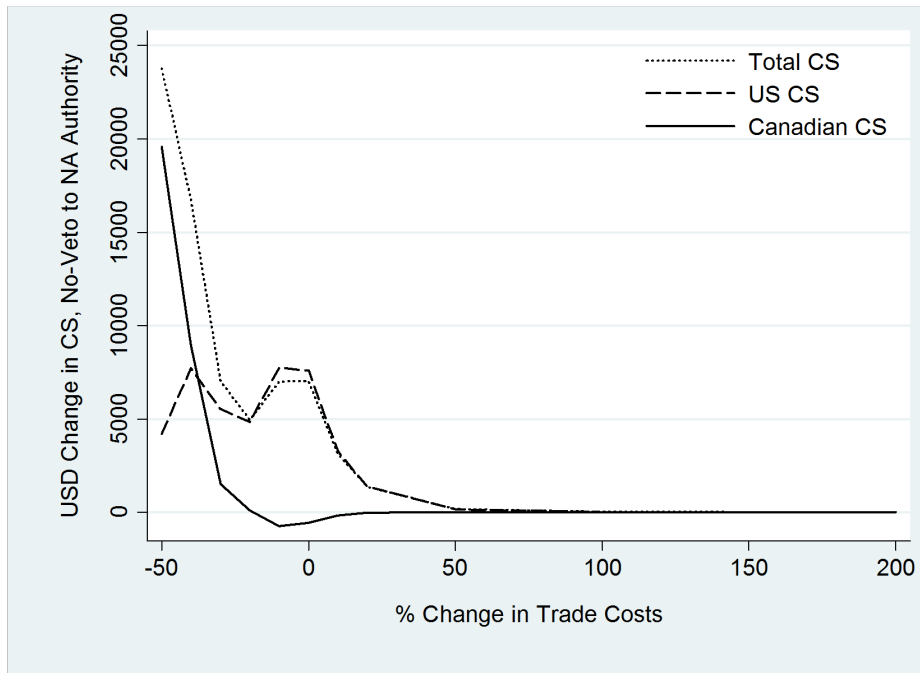


Figure shows the mean USD change in consumer surplus (in 000s of USD) induced by a move from the no-veto-rights case to a North-American merger authority for different trade cost changes.

arising from domestic mergers and thus the distribution of gains from the introduction of a supranational merger authority. Second, at least in our calibration, the overall gains for the larger country remain positive throughout but change signs for the smaller country. This raises the possibility that the political feasibility of merger policy coordination may depend crucially on the level of trade costs between countries and thus on trade policy. Only if trade costs are sufficiently low does it become worthwhile for the smaller country to agree to a merger approval standard aiming at maximizing joint consumer surplus.

5.4 Robustness Checks

In this section, we consider a number of additional robustness checks which are relevant for the calibration procedure with mergers, but not for our earlier baseline calibration without mergers. To preserve space, we again only briefly discuss our findings here and present more detailed results in the Online Appendix.

Different strength of synergies. We start by varying the strength of merger-induced synergies, considering both stronger ($\beta = 30$) and weaker synergies ($\beta = 70$). In both cases, the fit of the calibration continues to be very good. Allowing for stronger synergies

generates more mergers which are profitable and permitted by the antitrust authorities, resulting in lower values for the merger opportunity parameters T^{US} and T^{CAN} . Conversely, weakening the strength of synergies increases the calibrated values for T^{US} and T^{CAN} as more opportunities are needed to match the number of mergers observed in the data. This adjustment of T to the strength of synergies explains why our counterfactual policy changes lead to *stronger* quantitative consumer surplus effects as we increase β (weaker synergies). While each individual merger now has smaller consumer surplus effects, the change in the number of merger opportunities is now larger as we start from a higher base value for T . The latter effect overcompensates the former, leading to slightly stronger consumer surplus effects in the case of weaker synergies, and less pronounced consumer surplus effects in the case of stronger synergies. Qualitatively, however, all results are similar to before and our previous conclusions are not affected by varying the strength of synergies.⁵²

Cross-border mergers. The second modification we consider is to allow for cross-border mergers in addition to domestic mergers. Cross-border mergers are not directly relevant for this paper’s central question as by choice our interest is in the conflicts resulting from domestic mergers only. Moreover, recall that the international ownership structure of firms does not matter for our analysis, given the focus on consumer surplus and the absence of income effects. Nevertheless, given that cross-border mergers are an important feature of overall North American merger activity, incorporating them into our calibration might change parameter values and thus indirectly affect our results.⁵³

We model cross-border mergers by introducing a third merger opportunity parameter (T^{Cross}). Initially, there are only domestic firms. A share $T^{Cross} / (T^{Cross} + T^{US} + T^{CAN})$ of merger opportunities is now of the cross-border type, i.e., one of the merger partners is a U.S. firm while the other is a Canadian firm. A merger thus results in a multinational enterprise (MNE) with production facilities in both countries. This MNE chooses the location of production for serving each market such that the costs of doing so are minimized. This triggers changes in production and trade patterns compared to the baseline calibration with domestic mergers only, which in turn affects other parameter values. However, the resulting changes are relatively minor and our counterfactual experiments lead to qualitatively similar results to before.⁵⁴

⁵²See Online Appendix Sections H.8 and H.9.

⁵³Between 1993 and 2002, we observe an annual average of approximately 0.15 U.S.-Canada cross-border mergers per sector in our data, which is similar to the number of domestic Canadian mergers (see Appendix Table H.10.1).

⁵⁴See Online Appendix Section F. We adjust T^{Cross} to match the number of cross-border mergers in the

Veto-rights baseline. In our final robustness check, we start from an initial situation in which countries have veto rights over foreign mergers. That is, we match the same moments using the same set of parameters as before, but now we assume from the beginning that antitrust authorities have the power to block foreign mergers if they decrease consumer surplus in the authority’s domestic market.

All of the results and all parameters values, except T^{US} , are very similar to the no-veto-rights baseline, as discussed in more detail in the Online Appendix. The one more substantial difference is that the overall effect of having a North-American merger authority on Canada is negative not only at present levels of trade costs but throughout the range of trade cost we analyze. While exactly the same forces are at work as before, Canada is now able to block all of the CS-decreasing U.S. mergers in the baseline. In the no-veto-rights baseline, the reason why Canada started to gain from a North-American merger authority was precisely because the joint authority addressed some of the too-lenient-for-thy-neighbor type conflict arising at lower trade costs. This source of gain for Canada is absent in the new veto-rights baseline.⁵⁵ In conclusion, the forces at work in our model are robust to a different interpretation of the current legal regime concerning veto rights.

6 Conclusion

Because of cross-border demand and supply linkages, merger approval decisions of national antitrust authorities can have important externalities on other jurisdictions. To analyze the resulting conflicts of interest between merger authorities, we analyze a two-country model of international trade with oligopolistic competition. Within this model, we identify the conditions under which merger control based on a domestic consumer surplus standard is too tough or too lenient from the viewpoint of foreign consumers. We show that the type of conflict depends only on the value of an industry-level sufficient statistic which summarizes the relative competitiveness of the home and foreign markets, adjusting for trade costs. A key result is that, unless trade costs and market asymmetries happen to exactly offset each other, the interests of the national authorities are never fully aligned, so conflicts can be expected to be frequent.

To judge what type of conflict is most prevalent in practice, we calibrate our model to data. Note that the overall fit of the model deteriorates slightly, as we now have to match an additional moment. We now have to drop seven sectors (rather than four in the baseline calibration with mergers) for which we are unable to match our empirical moments.

⁵⁵See Online Appendix Section G.

match industry-level data for 160 U.S. and Canadian manufacturing sectors in the year 2002. Our results suggest that the majority of these conflicts are ‘hidden’, in the sense that they do not show in high-profile cases in which domestic authorities block foreign mergers. This is because, at current levels of trade costs, the main issue for the international coordination of merger policy is *not* that domestic authorities clear too many mergers from the point of view of foreign consumers. Rather, foreign consumers would like to see *more* mergers taking place abroad in the vast majority of sectors. According to our analysis, veto rights are thus a relatively inefficient tool when coordinating national merger policies. They cannot address the problem that domestic consumers mostly would like to see more, rather than fewer foreign mergers.

Our calibration results suggest that this situation might change dramatically as trade costs decrease, however. For trade cost reductions that do not appear large from a historical perspective (around 25-30%), conflicts arising from the consumer-surplus-decreasing effects of mergers taking place abroad become the dominant type of conflict. This indicates that merger policy and trade policy (or trade costs more generally) interact in an important sense. In our simulations, further reductions in trade costs make it more important for domestic authorities to be able to veto mergers taking place abroad.

We have shown that the above-mentioned calibration results hold across a range of standard assumptions on market structure (Cournot with linear demand, with and without a competitive fringe; Bertrand with CES demand). More generally, we believe that the main driving forces behind our results are differences in initial market structure and the presence of substantial trade costs, irrespective of the particular specification used. The finding that trade costs are still high despite decades of trade liberalization and reductions in transportation costs is not specific to our calibration, but has been shown in a wide variety of contexts and using different methodologies (e.g., Anderson and van Wincoop, 2004).

To get a better understanding of the quantitative importance of conflicts between merger authorities, we have also provided a second set of calibration results. These require much stronger assumptions (e.g., a specification of a merger formation process) but allow us to assign monetary values to the costs and benefits of international coordination of merger control at different levels of trade costs. These results are in line with the idea that veto rights are not important at current levels of trade costs. In contrast, establishing a supra-national merger authority results in sizeable consumer surplus gains in our simulations because such an authority can address the conflict caused by too-tough-for-thy-neighbor policies. Perhaps surprisingly, these gains are highly asymmetric across countries, with Canadian consumers

being worse off, suggesting that such a supra-national authority may be difficult to establish politically. However, the picture changes as trade costs fall. In our simulations, veto rights become much more valuable quantitatively, in particular for Canada as the smaller and less competitive country. As a consequence, a supranational merger authority increasingly addresses conflicts arising from too-lenient-for-thy-neighbor policies. This benefits Canada, making agreement on such an authority more likely.

In addition to providing a theoretical and quantitative analysis of international aspects of merger policy, the paper also makes a methodological contribution. It showcases how industry-level data can be used to put discipline on parameter values in international trade models with heterogeneous firms and oligopolistic competition. The techniques we introduce to calibrate our model may be helpful to quantify some of the more qualitative insights from existing work in the area of international trade, such as those from the literature on strategic trade policy.

We see our paper as a first step for the quantitative study of the interactions between merger policy and trade policy. An exciting avenue for future research would be to endogenize those policies and study to what extent trade and merger policies are (strategic) complements or substitutes. A natural way of doing so would be to extend our framework by introducing strategic governments that choose, either non-cooperatively or through bilateral or multilateral bargaining, not only import tariffs but also merger policies.⁵⁶ An agreement over a merger policy could, for instance, be modeled as pinning down the respective weights the antitrust authority assigns to domestic consumer and producer surplus. One difficulty with bargaining over merger policies rather than tariffs is that agreements are much harder to enforce: While it is relatively straightforward to assess whether an agreed-upon tariff has been applied or not, it appears difficult to determine whether an individual merger should be approved or not given the agreed-upon objective function.

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⁵⁶See Bagwell, Staiger, and Yurukoglu (2017) for a recent example of an international trade model that features bilateral bargaining over tariffs in a multi-country world.

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A Data Appendix

For the calibration procedure described in Section 4, we require data on industry sales, total costs, labor cost shares, the number of firms, bilateral trade flows, relative prices, and production-based Herfindahl indices for each industry in Canada and the U.S. For the out-of-sample model validation we also need Canadian and U.S. concentration ratios (sales shares of the 4, 8, and 20 largest firms in each industry). Finally, to calibrate the model extension with merger activity in Section 5, we require data on the number of mergers per industry.

We work at the five-digit level of the North American Industry Classification System (NAICS). This is the most disaggregated level at which Canadian and U.S. industry definitions are identical and for which we can thus compare Herfindahl indices across the two countries. We obtain a total of 160 manufacturing industries in the year 2002 for which we have data for all required variables.

Data on U.S. and Canadian industry-level sales, total costs, labor cost shares, the number of firms, production-based Herfindahl indices and sales-based concentration ratios are from the U.S. Census Bureau and Statistics Canada, respectively. Total costs are measured as the sum of an industry’s wage bill and intermediate input expenditures. Labor cost shares are calculated as an industry’s wage bill divided by its total costs.

Data on the number of mergers are from Thomson SDC Platinum. In accordance with our model, we focus on domestic horizontal mergers, i.e., mergers in which both acquirer and

target have the same primary industry classification and are both incorporated in either the U.S. or Canada.

Data on U.S. exports to, and imports from, Canada are from the NBER website (see Feenstra, Romalis, and Schott, 2002) and report trade values and quantities at the ten-digit level of the harmonized system (HS). We use the concordance by Pierce and Schott (2012) to map these data from HS into NAICS.

Relative price data are obtained from Inklaar and Timmer (2014) who compute industry-level output prices from purchasing power parities (PPP) collected for the 2005 International Comparisons Program. Inklaar and Timmer report relative Canadian-U.S. prices for 14 aggregate manufacturing industries in the year 2005. This implies that our price data only varies at a more aggregate level than our other data sources. As a robustness check (see Section 4.4), we also calculate relative export prices from trade unit values, using the NBER data described above. We again use the concordance by Pierce and Schott (2012) to map these data from HS into NAICS, and then compute unit values as the ratio of NAICS-level trade value to quantity.⁵⁷ Because unit value data are notoriously noisy, we average each industry's unit values over the period 1998-2006 and winsorize all data below the 10th percentile and above the 90th percentile of the distribution of unit values across industries before computing relative prices. Still, even the cleaned unit value data yield relative prices ranging from 0.5 to close to 3, implying persistent price differences of up to 200% in relatively narrowly defined industries (see Online Appendix Table H.1.1).⁵⁸ We thus prefer to work with the more aggregated Inklaar and Timmer data for our baseline calibration, which yield more plausible price differences (see Table 1). As seen in Section 4.4, however, both types of relative price data yield very similar conclusions regarding the types of merger policy conflicts.

We convert all value entries into U.S. dollars using the average U.S.-Canadian dollar exchange rate over the period 1997-2007.⁵⁹ In accordance with our choice of units and numéraire, we further normalize value entries by the average U.S. wage rate for the year 2002. We calculate U.S. and Canadian wage rates by dividing the economy-wide wage bill

⁵⁷Using one U.S. data source for bilateral U.S. and Canadian exports (where the latter are proxied by U.S. imports from Canada) has the advantage of greater comparability of collection methods and data cleaning procedures when compared to the alternative of using separate export data from U.S. and Canadian sources. The NBER data are also a standard source of trade values and quantities in the literature. Note that the U.S. export and import data we use are both valued on a free-alongside-ship basis and are thus directly comparable.

⁵⁸Prior to winsorizing, we find a maximum relative Canadian-U.S. price of 75 and a minimum of 0.09.

⁵⁹We use this 11-year average rather than the 2002 exchange rate because the latter is a clear outlier (1.57 CND/USD as opposed to the 11-year average of 1.37 CND/USD).

by the number of persons in employment. This yields an average wage for the U.S. of USD 36,510 and an average wage rate for Canada of USD 27,386 in 2002.⁶⁰

⁶⁰Data are again from the U.S. Census Bureau and Statistics Canada. We count both employees and self-employed persons. For the latter, we use total receipts (i.e., sales) as a proxy for the wage bill. This will overestimate wages of the self-employed, although dropping the self-employed does not change average wages by much.