Merger Policy in a Quantitative Model of International Trade*

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Abstract

In a globalizing world, the decisions of national merger authorities impose externalities on foreign jurisdictions. In a two-country international trade model with oligopolistic competition, we study the potential conflicts between national merger authorities and provide conditions under which they arise. When deciding whether to block a proposed merger to prevent harm on domestic consumers, each authority faces a trade-off between the market power effect of the merger and its efficiency effect. Because of trade costs and asymmetries between countries, the same merger may be good for consumers in one country but bad for consumers in the other. Endogenizing the merger formation process and explicitly modeling the authorities' decisions, we calibrate the model to match industry-level data for 160 sectors in the U.S. and Canada. We use the calibrated model to study the impact of different policy regimes such as introducing or abolishing veto rights on foreign mergers, or the establishment of a North American competition authority. We also look at the interaction of merger and trade policy by studying how the changes in consumer surplus resulting from these policy changes vary with the level of trade costs.

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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 arising from 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 which illustrate this potential for conflict. Two prominent examples are the proposed mergers between the two U.S.-based firms General Electric and Honeywell in 2001, and the proposed merger in 1999 between the South African firms Gencor and Lonrho. In both cases, the merger was cleared by the firms' domestic antitrust authority but blocked by the EU Commission due to concerns about the mergers' anticompetitive effect in Europe.

In this paper, we propose a quantitative framework which can be used to understand the determinants of conflict between merger authorities, to analyze which type 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 will be 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 competing 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.

A merger between two firms has opposing effects on consumer surplus in each ountry: 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. We characterize the conditions under which merger control based solely on domestic consumer surplus is a *too-tough-for-thy-neighbor policy* (by

blocking mergers that would benefit consumers in the foreign country) or a *too-lenient-for-thy-neighbor policy* (by approving mergers that hurt consumers in the foreign country). We show that with identical countries and positive symmetric trade costs, a domestic merger will always have weaker anti-competitive effects abroad, because exporters will have lower initial market shares (i.e., less market power) there than a home. In this case, domestic merger authorities will tend to block too many mergers from the point of view of the foreign competition authority and foreign consumers. If the countries are characterized by different initial market structures (summarized by the relative equilibrium price in our Cournot model) this effect can be overturned. An important result from our model is that, apart from special cases in which differences in initial market structure and trade costs exactly cancel each other out, there will always be one of these two types of conflict.

Most of our initial theoretical results rely on only very weak assumptions about demand and cost structures. In order to be able to say more about which types of conflict are likely to be relevant in practice, and to get a better understanding of their economic importance, we impose more structure and calibrate the model to sectoral level data in the second part of the paper. This involves operationalizing the model by incorporating an endogenous merger formation process and an explicit modeling of the antitrust authorities' objective functions (which we take to be domestic consumer surplus). Using industry-level data for the year 2002 from 160 sectors in the United States and Canada, we choose parameters to match relevant empirical moments, including industry sales, concentration ratios, relative export prices, the yearly number of mergers, and trade flows.

We perform this calibration separately for two opposing assumptions about the reach of national competition policy. De jure, most 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. In practice, however, the degree to which the effects doctrine is implemented varies substantially across countries, with most competition authorities not exercising the implied veto rights over foreign mergers.[1] Thus, our baseline calibration assumes the absence of veto rights of domestic competition authorities over foreign mergers ('no veto rights' case). In our robustness checks, we also explore the implications of calibrating the model with veto rights ('veto rights' case).

In the paper's third and final part, we use the calibrated model to study the prevalence of the different types of conflicts for the calibrated parameter values, and to analyze counterfac-

[1]For example, we are not aware of any U.S. merger authorized by the U.S. but blocked by Canadian competition authorities. The European Commission generally tends to be more assertive but is not part of our empirical implementation.

tual scenarios. We find that at the present level of trade costs (i.e., the level obtained in the calibration), domestic merger authorities block too many mergers from the point of view of the foreign consumers. That is, for a large majority of sectors, domestic competition policy is too "tough" rather than too "lenient" for foreign consumers. This is particularly true for Canadian mergers, which always increase U.S. consumer surplus in our baseline calibration, provided they have been cleared by domestic authorities. By contrast, there is a large number of Canadian mergers which are blocked by the Canadian merger authority even though they would have increased U.S. consumer surplus. The picture is more nuanced regarding U.S. mergers. While U.S. merger authorities are also too tough on domestic mergers, there is a significant minority of sectors where permitted U.S. mergers hurt Canadian consumers. The intuition for this difference is that Canada is the smaller and less competitive market in our calibration, in the sense of a higher equilibrium price. Given the presence of positive trade costs, any domestic merger cleared in Canada will always be even less anti-competitive in the U.S. and will thus benefit consumers there. The opposite is not necessarily true: given that the U.S. market is more competitive, some mergers cleared there might have anti-competitive effects in Canada despite the presence of trade costs.

Against this background, we look at two ways of coordinating national merger policies, starting from an initial situation of no veto rights. We first introduce veto rights over foreign mergers by allowing domestic authorities to block mergers taking part in the other country. Given that domestic competition policy is mostly too tough, 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 as Canada now blocks a significant number of U.S. mergers which increase prices in Canada but reduce them in the U.S.

In the second counterfactual, we introduce a North-American competition authority which maximizes the sum of Canadian and American consumer surplus. This authority internalizes cross-border effects of mergers and is thus able to also eliminate consumer surplus losses arising from domestic competition policies which 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 'ignores' Canada.[2]

[2]When we start from a 'veto-rights' baseline in our robustness checks (Section 7.2.3), the counterfactual scenarios we can analyze are of course different. But the relative importance of the two types of conflicts described above is very similar. When we remove veto rights, average Canadian consumer surplus falls and

Given the crucial role of trade costs in our analysis, we also study the interaction of trade and merger policy. We do so by analyzing the scope for conflicts at both higher and lower levels of trade costs than the current ones. We also repeat our two counterfactual policy experiments for different levels of trade costs and study how the gains from coordination change as trade costs evolve. With prohibitively high trade costs, cross-border price effects converge to zero and conflicts between the authorities disappear. As trade costs fall, however, two effects emerge. On the one hand, lower trade costs imply lower prices so that domestic authorities are more likely to approve domestic mergers. On the other hand, 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 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 which seem relatively small from a historical perspective (around 25-30%).

These trade-cost induced changes modfiy 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 competition authorities, especially for Canada as the smaller, less competitive market. For the U.S., the picture is more nuanced as gains from being able to block consumer surplus decreasing Canadian mergers are offset by consumer surplus losses due to the fact that Canada blocks many more U.S. mergers which were consumer surplus increasing at home. As trade costs fall from current levels, the focus of a North American competition authority also shifts from preventing domestic policies which are too tough to preventing policies which are too lenient. Thus, the effects of introducing such an authority increasingly comes to resemble those of introducing veto rights and Canada starts to also benefit from this form of coordination.

We believe that these results have important implications for the coordination of merger and trade policy. First, conflicts between competition authorities can be expected to be frequent; they arise unless trade costs and market asymmetries happen to exactly offset each other. Second, the majority of these conflicts will be 'hidden', in the sense that they will not show in high-profile cases in which domestic authorities block foreign mergers (such as the cases mentioned in the beginning of this introduction). This is because, at current

average U.S. consumer surplus rises. Introducing a North American competition policy again increases overall consumer surplus substantially but hurts Canadian consumers.

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. This means that veto rights are 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. This issue can only be resolved by the introduction of a supranational authority evaluating the global (or regional) consumer surplus effects of mergers. Given the likely asymmetric impact on the consumer surplus of different countries, however, this approach is unlikely to be acceptable to all participating countries.

This situation changes dramatically as trade costs decrease from current levels. For relatively small trade cost reductions, conflicts arising from the consumer surplus decreasing effects of mergers taking place abroad become the dominant type of conflict. This clearly shows that merger and trade policy interact in an important sense. Further trade liberalisation will make it more important for domestic authorities to exercise control over mergers taking place abroad. More optimistically, reductions of trade barriers might also make it easier to coordinate merger policy. As the role of a supranational merger authority increasingly becomes to address conflicts arising from domestic policies which are too lenient, the benefits of such coordination to smaller, less competitive economies increase, making agreement between countries more likely.

The rest of this paper is organized as follows. Section 2 discusses the related literature. In Section 3, we introduce a simple two-country model of imperfect competition. In Section 4, 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 Sections 5 and 6, we calibrate this model on data for the year 2002 for 160 manufacturing sectors in the U.S. and Canada. In Section 7, we describe the results of our calibration and use the calibrated model for counterfactual analysis. Section 8 concludes.

2 Related Literature

Our paper relates to several strands in the literature. First, we contribute to the literature regarding the optimal design of merger policy (e.g., Williamson (1968), Farrell and Shapiro (1990), Nocke and Whinston (2010; 2013)). This literature focuses almost exclusively on closed economy settings, which, as we argue, abstracts from some important cross juris-

dictional aspects of merger policy on which we concentrate here. Examining competition policy in open economy settings also allows for possible interactions between competition and trade policy, which is another aspect of our analysis. Another key difference is that the above-mentioned literature characterizes the optimal merger approval policy whereas our paper *quantifies* the positive and normative effects of changes in merger policy (as well as of changes in structural parameters for a given merger policy).

More closely related to our paper is a relatively small literature which also looks at aspects of competition policy in open economy settings, and possible interactions of competition and trade policy (e.g., Head and Ries (1997), Horn and Levinsohn (2001)). One of our contributions compared to this literature is that we consider a richer and more general framework, and provide necessary and sufficient conditions on primitives under which different types of conflicts between national competition authorities arise. Perhaps the main contribution, however, is that we operationalize our framework for the quantitative analysis of such issues. We provide a sense of the magnitude of cross-border externalities, and conduct counterfactual simulations to analyze the effects of different competition or trade policy regimes. Calibrating our model to match important cross-sectional moments in the data also imposes some discipline on parameter values and functional forms. We think that this is important given the lack of general results in the literature (see, for example, Horn and Levinsohn (2001)). Finally, we also provide a more realistic modeling approach to merger formation by allowing for endogenous merger formation, rather than simply setting the number of firms in each country as Horn and Levinsohn (2001) do.

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)). While competition policy is not usually the focus of this literature, we share an interest in the consequences of introducing mergers and strategic interactions into models of international trade, and use comparable modeling frameworks. The techniques we introduce to calibrate our model should also be applicable to a quantification of some of the insights from this earlier literature.

Finally, our paper draws on the parts of the industrial organization literature related to merger incentives and endogenous merger formation (e.g., Salant, Switzer and Reynold (1983), Perry and Porter (1985), Deneckere and Davidson (1985), Kamien and Zang (1990), Pesendorfer (2005)) and to closed-economy merger simulations (e.g., Nevo (2000)). We show

how to adapt the insights from this literature to open economy settings and, regarding our model's calibration, how to make do with the more limited amount of information available for the parameterization of our framework.

3 The Baseline Model

We consider a setting with two possibly asymmetric countries ($i, j = 1, 2$), S manufacturing sectors and an outside sector. 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:

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

where Q_0 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.[3]

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 also assume that the outside good is freely traded, and that parameters are 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 $w^i = \alpha^i$. Given these assumptions, the inverse demand function for good s in country i is given by $P_s^i\left(Q_s^i\right) = \max\left\{u_s^{i\prime}\left(Q_s^i\right), 0\right\}$.

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

[3] An implication of this assumption is that the ownership structure of domestic and foreign firms is irrelevant for the subsequent analysis.

export to the foreign country j. 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 $i = j$.

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 5 below. For now, we simply denote $c_{k,s}$ 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, $c_{k,s}^j \equiv \tau^{ij} c_{k,s}$.

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 $q_{k,s}^j$ firm k's output in country j, we say that firm k is *active* in country j and sector s if $q_{k,s}^j > 0$ in equilibrium.

We impose the following standard assumption on demand and thus, implicitly, on the sub-utility function u_s^i [see, e.g., Vives (2001)]:

Assumption 1. *For any country i and sector s, $P_s^i(Q) > \min_{k \in \mathcal{N}_s^i} c_{k,s}$ for $Q > 0$ sufficiently small. Moreover, for any aggregate output $Q > 0$ such that $P_s^i(Q) > 0$:*

(i) $P_s^{i\prime}(Q) < 0$,

(ii) $P_s^{i\prime}(Q) + QP_s^{i\prime\prime}(Q) < 0$,

(iii) $\lim_{Q \to \infty} P_s^i(Q) = 0$.

As is well known, this assumption implies that there exists a unique and stable Nash equilibrium in each sector and country [see, e.g., Vives (2001)]:

Lemma 1. *There exists a unique Nash equilibrium. The aggregate equilibrium output in each country i and sector s, Q_s^{i*}, is strictly positive, and is weakly decreasing in firm k's marginal cost of selling in country i, $c_{k,s}^i$, and strictly so if the firm is active in that country.*

Proof. See Appendix. ∎

4 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. In line with antitrust laws in the U.S., the EU and many other jurisdictions, we assume that each national authority

approves a proposed merger if and only if it does not decrease domestic consumer surplus (CS).[4] 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 $2 \in \mathcal{N}_s^j$, both of which produce good s in country j. Dropping the subscript s from now on for notational ease, let $\overline{c}_M$ denote the merged entity's post-merger marginal cost. Denote aggregate output in country i (which may or may not be equal to j) before the merger by Q^{i*}, and after the merger by $\overline{Q}^{i*}$. The induced change in consumer surplus in country i is

$$\Delta CS^i(M) = -\int_{Q^{i*}}^{\overline{Q}^{i*}} QP^{i\prime}(Q)dQ,$$

which is positive if and only if $\overline{Q}^{i*} > Q^{i*}$. We say that merger M is *CS-neutral* in country i if $\Delta CS^i(M) = 0$, *CS-decreasing* if $\Delta CS^i(M) < 0$, and *CS-increasing* if $\Delta CS^i(M) > 0$.

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) and Nocke and Whinston (2010) to a two-country world, fully characterizes the effect of merger M on consumer surplus in country i:

Lemma 2. *Consider merger $M = \{k, l\}$ between firms $k \in N^j$ and $l \in N^j$, both of which are located in country j. Assuming that both firms are active in country i pre-merger, the merger is CS-neutral in country i if $\overline{c}_M = \widehat{c}_M^i$, CS-decreasing if $\overline{c}_M > \widehat{c}_M^i$ and CS-increasing if $\overline{c}_M < \widehat{c}_M^i$, where*

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

If the merger is CS-nondecreasing (i.e., either CS-neutral or CS-increasing) in country i, it raises the merger partners' joint profit from selling in that country.

Proof. See Appendix. ∎

Lemma 2 shows that the threshold value of post-merger marginal cost, $\widehat{c}_M^i$, 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

[4]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."

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, both the domestic and the foreign antitrust authority would want to block the merger if $\overline{c}_M > \max\{\widehat{c}_M^1, \widehat{c}_M^2\}$ and approve the merger if $\overline{c}_M < \min\{\widehat{c}_M^1, \widehat{c}_M^2\}$. If $\min\{\widehat{c}_M^1, \widehat{c}_M^2\} < \overline{c}_M < \max\{\widehat{c}_M^1, \widehat{c}_M^2\}$, 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, $\widehat{c}_M^1 \neq \widehat{c}_M^2$, implying that there is always the potential of such conflicts of interest.

The exact nature of the conflict 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 $-j$'s) authority. As discussed in the introduction, 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. *De facto*, however, such extra-territorial jurisdiction only seems to be applied to a very limited extent.

In the 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' case (foreign mergers cannot be blocked). For merger M taking place in country j, country j's CS-standard is a *too-tough-for-thy-neighbor policy* if $\widehat{c}_M^j < \widehat{c}_M^{-j}$, and, provided country $-j$ does not have jurisdiction over country-j mergers, a *too-lenient-for-thy-neighbor policy* if $\widehat{c}_M^j > \widehat{c}_M^{-j}$. If country $-j$ does have veto power over country-j mergers, then the latter type of conflict cannot arise. However, when $\widehat{c}_M^j > \widehat{c}_M^{-j}$, country $-j$ may end up blocking a merger that country j would have wanted to go through. In this case, we say that country $-j$'s CS-standard is a *too-tough-for-thy-neighbor policy on foreign mergers*.

While the cost threshold $\widehat{c}_M^j$ is specific to the characteristics of the merger M under consideration, the following proposition shows that the type of potential conflict is the same for any merger between firms located in the same country (and sector):

Proposition 1. *Consider a merger M between firms located in country j. 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, if the foreign country $i \neq j$ does not have veto power over the merger, a*

too-lenient-for-thy-neighbor policy *if* $\rho^{j*} < 1$*, where*

$$\rho^{j*} \equiv \frac{\tau^{ji} P^j(Q^{j*})}{P^i(Q^{i*})},\ i \neq j,$$

is the ratio between domestic and foreign prices, adjusting for trade costs. If country $i \neq j$ *does have veto power over merger* M*, then its policy is a* too-tough-for-thy-neighbor policy on foreign mergers *whenever country* j*'s policy would be too lenient otherwise, i.e., if* $\rho^{j*} < 1$*.*

Proof. This is an immediate implication of Lemma 2. ∎

Proposition 1 shows that the potential for conflict in merger policy depends on a market-level "sufficient statistic", ρ^j, which is independent of the merger under consideration, and summarizes the relative competitiveness of the two markets, adjusting for trade costs faced by the merging firms. If $\rho^j > 1$, then whenever consumers in the home country j would benefit from a domestic merger, then so would consumers in the foreign country as well, 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). Note also that, by construction, $\rho^i \rho^j = \tau^{12}\tau^{21}$. 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 $\rho^i > 1$).[5]

The conditions for the different types of potential conflict, as stated in Proposition 1, involve endogenous prices. This raises the question: Under what conditions on primitives is one type more likely to arise than the other? The following Corollary is an immediate implication of Proposition 1:

Corollary 1. *Suppose the two countries are identical, i.e.,* $P^1(\cdot) = P^2(\cdot)$*,* $\tau^{12} = \tau^{21} \equiv \tau$*,* $N^1 = N^2$ *and* $(c_k^2)_{k\in\mathcal{N}^2}$ *is a permutation of* $(c_k^1)_{k\in\mathcal{N}^1}$*. Then, the domestic CS-standard for*

[5]Note that following 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.

merger approval is:

- *a* too-tough-for-thy-neighbor policy *by the home country if* $\tau > 1$,
- *and, if countries have (resp., do not have) veto power over foreign mergers, a* too-tough-for-thy-neighbor policy *by the foreign country (resp.* too-lenient-for-thy-neighbor policy *by the home country) if* $\tau < 1$.

The corollary hints at what type of conflict is more likely to arise if countries are similar: to the extent that one would expect the iceberg-type trade cost τ to be larger than one, the merger partners' home country is more likely to block the merger than the foreign country. If so, whether or not authorities have veto power over foreign mergers would not affect the outcome.

The following proposition provides comparative statics of the potential conflict measure for mergers between firms located in country j, ρ^{j*}.

Proposition 2. *The potential for conflict between national authorities varies with trade costs, demand conditions, and production costs as follows:*

1. *An increase in the trade cost from country* j *to country* $i \neq j$, τ^{ji}, *induces an increase in the potential conflict measure for mergers in both countries,* ρ^{1^*} *and* ρ^{2*}.
2. *Suppose that* $\partial_2 P^j(Q^j, a^j) > 0$ *and* $\partial^2_{12} P^j(Q^j, a^j) \leq 0$ *for all* $Q^j > 0$ *such that* $P^j(Q^j, a^j) > 0$, *where* a^j *is a demand shifter in country* $j \in \{1, 2\}$. *Then, an increase in the country-*j *demand level* a^j *induces an increase in* ρ^{j*} *and a decrease in* ρ^{i*}, $i \neq j$.
3. *Suppose demand is linear and the number of active firms in both countries is the same. Then, an increase in the marginal production cost of a country-*j *firm that is active in both countries decreases* ρ^{j*} *and increases* ρ^{i*}, $i \neq j$, *if* $\rho^{j*} > 1$, *and has the reverse effects if* $\rho^{j*} < 1$.

Proof. See Appendix. ∎

The first part of the proposition reveals that a mulitilateral trade liberalization (a decrease in both τ^{12} and τ^{11}) makes it more likely that merger policy based on a domestic consumer surplus standard is a too-lenient-for-thy-neighbor policy on domestic mergers (if domestic mergers cannot be vetoed by the foreign authority) or, equivalently, a too-tough-for-thy-neighbor policy on foreign mergers (if the domestic authority has veto power on foreign mergers). The second part of the proposition shows that a positive demand shock in country j

makes it more likely that domestic merger policy is a too-tough-for-thy-neighbor on domestic mergers (and, if the country has veto power over foreign mergers, on foreign mergers as well). The third part of the proposition implies that productivity improvements in country j make it more likely that country j's CS-based merger policy is too lenient for the other country (and more likely that the other country's merger policy is too tough on its own mergers from the viewpoint of country j).

5 Model Operationalization

In this section, we put more structure on preferences and technologies and define a merger formation process. This will allow us to take our model to the data in the next section.

5.1 Preferences and Technologies

In sector s and country i, sub-utility $u_s^i(.)$ introduced in Section 3 is given by $u_s^i(Q_s^i) = a_s^i Q_s^i - \frac{1}{2} b_s^i \left(Q_s^i\right)^2$. This quadratic functional form generates a linear inverse demand function for sector s's product in country i:

$$P_s^i\left(Q_s^i\right) = \max\left(a_s^i - b_s^i Q_s^i, 0\right),$$

We solve the Cournot competition game with linear demand in Appendix B.

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 industry i, and z_k is the productivity of firm k. The implied marginal and unit cost of firm k is given by

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

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

There are initially N_s^i potentially active manufacturing firms in sector s and country i. Firm k's productivity in sector s and country i, z_k, is initially drawn from a Pareto distribution with scale parameter x_s^i and shape parameter ζ_s^i. When two firms merge, synergies can

affect their original productivities. We assume that if firm k merges with firm l in sector s and country i, then the productivity of the merged firm becomes:[6]

$$\overline{z}_M = \left(z_1^\delta + z_2^\delta\right)^{\frac{1}{\delta}}, \tag{1}$$

where parameter δ governs the strength of synergies. Note that $\overline{z}_M > \max(z_1, z_2)$ for any $\delta \in (0, \infty)$, and that $\overline{z}_M$ is decreasing in δ. In the limit as $\delta \to \infty$, we have $\overline{z}_M = \max(z_1, z_2)$, which corresponds to the case of no synergies in the sense of Farrell and Shapiro (1990). For a merger between two symmetric firms with pre-merger productivity z, equation (1) 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.

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.[7]

5.2 Merger Formation Process

We allow firms to merge horizontally, subject to two conditions. First, mergers must be profitable for the merger partners. That is, the profits of the joint entity must be strictly larger than the sum of the initial profits of the merger partners. Second, mergers must not decrease consumer surplus (i.e., not increase price). This is, by and large, current practice of most merger authorities, including the United States and the European Union. Note that for our baseline calibration, we assume that national antitrust authorities can block any domestic merger under consideration, but not mergers involving foreign firms.

We take a simple and tractable dynamic random matching approach to operationalize the merger formation process.[8] 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. Out of these $T_s^1 + T_s^2$ periods, nature randomly

[6] In line with the closed-economy merger policy literature, we focus on domestic mergers and do not allow for cross-border mergers. We also abstract from conglomerate mergers, in the sense that a firm in sector s cannot merge with a firm in sector s'.

[7] The $-1/2$ term in the distribution of δ ensures that the mean δ is equal to β_s^i.

[8] In 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 industries 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; 1995b), Gomes (2005), Gomes and Jehiel (2005)) provide only partial characterization results.)

and uniformly draws T_s^1 periods in $\{1, \ldots, T_s^1 + T_s^2\}$ in which country 1 will receive merger opportunities, and the complementary T_s^2 periods in in $\{1, \ldots, T_s^1 + T_s^2\}$ in which country 2 will receive merger opportunities.[9] From now on, we drop sector subscripts for ease of notation.

Consider period $t \in \{1, \ldots, T^1 + T^2\}$, 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.[10]

6. Firms compete in quantities in both manufacturing markets.

Period 0 is special, in that no country receives a merger opportunity in this period. This allows us to accommodate sectors in which there are no merger opportunities. 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. This impatience assumption also implies that antitrust authorities follow a simple rule, whereby they block a merger if and only if this merger lowers their (static) welfare criterion (here: domestic consumer surplus)

[9] We view T^1 and T^2 as parameters capturing frictions in the market for firms' 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: denote by n^i and r^i the integer and fractional parts of T^i, respectively. Then, country i receives n^i merger opportunities with probability r^i and $n^i + 1$ merger opportunities with probability $1 - r^i$. These random variables are realized in period 0, before the game starts.

[10] This assumption ensures that inactive firms exit the industry, and allows us to focus on mergers involving active firms, which is what we observe in our data (see Section 6 below).

given the current market structure. We do not view this feature as problematic, as we believe it adequately captures current practice in most countries: it would be difficult for an antitrust authority to clear (or block) on the grounds that this merger is likely to lead to more (or fewer) mergers in the future.

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 $T^1 + T^2$.

6 Calibration

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), η^{US} and η^{CAN} (the labor shares), β^{US} and β^{CAN} (the strength of synergies), and T^{US} and T^{CAN} (the numbers of merger opportunities). We also require parameter values for α^{US} and α^{CAN} (the productivities of the outside sectors).

Parameters calibrated outside the model. 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 set a^{US} equal to 25, which also amounts to a choice of units.

We set β^{US} and β^{CAN} equal to 50 in all sectors. As we will see in Section 7.1, these parameter values (along with the 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.

In the absence of comprehensive sectoral data on the number of firms likely to behave oligopolistically, we set N^{US} and N^{CAN} equal to the number of firms in each sector which we observe in the data. At first sight, this choice seems to be a poor proxy for the actual number of oligopoly players. Note, however, that N^{US} and N^{CAN} only capture the number

of *potentially* active firms which will, in general, be substantially higher than the number of firms active in equilibrium. Indeed, we show below that only a fraction of firms will be active in all sectors. For selected sectors for which we have better information on the number of oligopoly players, we also show that our model's prediction for the number of such players is reasonably close to the data. Finally, in Section 7.2.4, we formally model a competitive fringe of price-taking firms which co-exists with a small number of oligopolists.

Parameters calibrated within the model. This leaves us with an eleven-dimensional vector of parameters to calibrate in every sector:

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

The value of Γ is chosen so as to match the following eleven 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), total costs and merger activity 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. Our data sources are the U.S. Census Bureau, Statistics Canada, the NBER website [see Feenstra, Romalis and Schott (2002)], Thomson SDC Platinum and Inklaar and Timmer (2012). 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 for the year 2002 for which we have data for all required variables. Appendix D provides more details on the construction of our dataset.

Calibration Algorithm and Identification. We approximate our theoretical moments using Monte Carlo integration. For a given vector of parameter values Γ, we draw M realizations of productivity vectors and merger opportunities, where $M = 1000$. For each realization, we play the merger game, compute the final equilibrium, and calculate our eleven theoretical moments at the final equilibrium. We take the simple averages of each theoretical moment across the M realizations and compare it to the corresponding empirical moments. We iterate over parameter values Γ until we achieve a perfect fit.

Each of our empirical moments has a natural parameter counterpart which allows a straightforward illustration of how the parameters in Γ are identified. Parameter a^{CAN} gov-

erns the price elasticity of demand in Canada, which pins down the ratio of Canadian to U.S. prices, P^{CAN}/P^{US}. As shown in Appendix B, 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. Total costs in country i are pinned down by x^i. Finally, T^i has a direct, strong and positive effect on merger activity in country i.

7 Results

In this section, we present the results of our calibration exercise. We first present descriptive statistics for our empirical moments and analyze the fit of the model with these moment (both in-sample and out-of-sample). We also discuss the calibrated parameter values and the implied marginal cost reductions and price effects of mergers. We then move on to a number of counterfactual analyses which will shed light on the empirical relevance of the different types of conflicts discussed in Section 4.

7.1 Calibration Results

Empirical moments and model fit. Table 1 shows descriptive statistics for our empirical moments. On average, U.S. industries are over ten times larger in terms of sales, and average M&A activity is about 10 times higher than in Canada. U.S. industries are also significantly less concentrated in terms of production, as can be seen from the average HHIs (1306 in Canada vs. 609 in the U.S.). In the average sector, the Canadian prices are 7% percent higher than U.S. prices (11% in the median sector). Finally, we note that Canada ran a substantial trade surplus in manufactured goods with the U.S. in 2002.

Figure 1 plots the model fit for our 11 targeted moments in all 160 sectors. Each dot represents a sector. The horizontal coordinate is the value of the empirical moment in this sector; the vertical coordinate is the value of the predicted theoretical moment. If the dot lies on the 45-degree line, then we have a perfect fit in this sector for the moment under consideration. As can be seen graphically, we match our empirical moments exactly in all but 4 sectors.[11]

[11] We drop these four sectors in the rest of the analysis. Including them does not qualitatively affect any

As a cross-validation check, Figure 2 plots the model fit for 6 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.

Parameter values. 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. The average sector in the U.S. has about six times as many firms as in Canada. As also reported in Panel A, only a fraction of firms are active in our model. Thus, the number of active Cournot players is much smaller than the number of potential players which we take directly from the data. As already discussed, we chose not to match the number of active oligopoly players because there is no reliable information available in the data about this number for all 160 sectors. While this also makes evaluating the model's performance on this dimension difficult, the number of active firms in selected U.S. sectors seems to be broadly in line with sector-level studies in the Industrial Organization literature. For example, for NAICS 33611 (Automobiles, Light Trucks, Utility Vehicles) and NAICS 31123 (Breakfast Cereal Manufacturing), we have eleven and six active oligopoly players, respectively.

Panel B of Table 2 reports summary statistics on the calibrated parameters. We 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 American HHIs. While American 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 American HHIs.

Trade costs (τ) from the U.S. to Canada are about 5% higher than trade costs from Canada to the U.S. in both the average and the median sector. This is driven by the fact that the U.S. was running a trade deficit with Canada in 2002. While τ's are higher than one in most sectors, there are a few sectors in which they are smaller than one, which seems to be at odd with the conventional interpretation of iceberg transportation costs. One possible explanation is 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 it could be cheaper for a U.S. firm to serve the Canadian market than its own domestic market. One could also imagine that, in some sectors, a significant fraction of the U.S. industry could be located close to the

of the following results.

Canadian border. When this is the case, it can be more costly for a U.S. firm to supply the average American consumer than it is to supply the average Canadian consumer.

Next, we discuss preference 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. Things 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 D, 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 seems to be enough 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 are not enough, 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}. 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 Panel A of Table 1). 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.)

Finally, T^{US} is significantly higher than T^{CAN} in the median and average sectors, which is consistent with the fact that the U.S. had a much higher level of merger activity in the data.

Implied price effects and marginal cost reductions of mergers. Tables 3 and 4 show summary statistics on the distribution across sectors of the average price and marginal cost reductions induced by mergers in our calibrated model. For each sector, we calculate average price and marginal cost reductions as follows. Using our calibrated parameter values, we recompute the model's equilibrium M times (where M is the number of iterations used in our Monte Carlo integration).[12] 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. Following Farrell and Shapiro (1990), 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. Note that because each country has a veto right over domestic mergers, only mergers which do not increase prices at home will be permitted

[12] We reset the seed values of our random number generator ahead of these computations. Thus, we obtain the same theoretical moments and fit to the data as reported for our baseline calibration in Table 2 and Figures 1 and 2.

and domestic price effects are thus all (weakly) negative. Given that we do not allow for veto rights over foreign mergers in our baseline calibration, this is not true for cross-border price effects. 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 M 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. By construction, domestic price effects are all zero or negative. 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 that the average cost reductions implied by mergers is around 7% in the median sectors in both countries (9% in the average sector). While we are not aware of comparable estimates of synergies in the literature, cost reductions of this magnitude do not seem unreasonably large.

7.2 Counterfactual Experiments

Using our calibrated model, we now perform a number of counterfactual experiments. We begin by looking at how the scope for conflicts changes with changing trade costs. This is useful to understand the effect of policy coordination, to which we turn next. We first grant countries veto rights over foreign mergers. In the second counterfactual, we introduce a North-American merger authority which maximizes the sum of Canadian and American consumer surplus. We carry out these counterfactual policy changes at both the current level of trade cost (i.e., at the values of τ calibrated in the last section) and at both higher and lower trade costs.

7.2.1 Trade Costs and the Scope for Conflicts

To see how the scope for conflicts evolve as trade costs change, it is useful to define the following statistics:

$$\rho^{US} = \tau^{US,CAN} \times \frac{P^{US}}{P^{CAN}}$$

$$\rho^{CAN} = \tau^{CAN,US} \times \frac{P^{CAN}}{P^{US}}$$

Recall from our earlier discussion that if $\rho^{US} > 1$, we have that $\widehat{c}^{US}_{M_{US}} < \widehat{c}^{CAN}_{M_{US}}$. That is, U.S. merger policy is too tough on domestic mergers from the point of view of Canadian

consumers. If $\rho^{US} < 1$, U.S. merger policy is too lenient. Similarly, $\rho^{CAN} > 1$ and $\rho^{CAN} < 1$ imply that Canadian policy is too tough or too lenient on domestic mergers, respectively.

Figures 3 and 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 replay the merger game with the new trade cost parameters but keep all other calibrated parameters constant. This leads to new prices (P^{US}, P^{CAN}) which we use to compute ρ^{US} and ρ^{CAN} for each sector.[13] 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}.

At the original level of trade costs (0% change), U.S. merger policy is too tough on Canada in the majority of sectors. However, in a significant minority of sectors (around 20%) we have $\rho^{US} < 1$, meaning that U.S. merger policy is too lenient. 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 trade costs are positive 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.

Figures 3 and 4 also tell us how the potential for conflict evolves as trade costs change. As trade costs increase, both ρ^{US} and ρ^{CAN} rise as well. This means that the number of sectors in which merger policy is too lenient on domestic mergers decreases. Intuitively, if trade costs are very high, the anti-competitive effects of foreign mergers on the domestic market are negligible and domestic consumers always benefit. As trade costs come down, however, foreign firms gain market shares in the domestic market and the anti-competitive effects of any merger between those firms becomes more important. Thus, there will be more sectors in which domestic merger policy is too lenient from the point of view of foreign consumers.

The above results only tell us about the *potential* for conflicts. For a given realisation of synergies, no merger might fall in the zone between $\widehat{c}_M^{US}$ and $\widehat{c}_M^{CAN}$, and so that no *actual* conflict arises. To get a clearer picture of how often conflicts actually arise, we look at *(i)*

[13]Note that prices change after each merger in the merger game. We compute ρ as an average across all price realizations during the game. As before, we repeat the merger game $M = 1000$ times and take the average across the realized ρ. This average ρ is what is reported in Figures 3 and 4. Also note that we reset the seed values of our random number generator before computing the new equilibrium price path. Thus, any changes in relative prices are due to changes in trade costs rather than to different realizations of randomness.

the number of profitable merger opportunities which are blocked by domestic authorities but would have benefited foreign consumers, and *(ii)* the number of profitable merger opportunities which are permitted by domestic authorities but hurt foreign consumers. Note that if a merger raises consumer surplus in both countries, or decreases it in both countries, no conflict arises. Given that trade cost changes also influence profitability, we express the number of blocked mergers as a fraction of all profitable merger opportunities in a given sector.[14]

Figure 5 plots the average of this fraction across sectors against the percentage change in trade costs for U.S. mergers.[15] Consistent with the earlier figures on potential conflicts, the most common type of conflict is that the U.S. blocks its own domestic mergers, whereas situations in which the U.S. authorizes mergers which hurt Canadian consumers are much rarer, although such cases still arise in 14% of all profitable merger opportunities across sectors. When we look at Canadian mergers (Figure 6), we also find that a large number of such mergers are blocked by the Canadian merger authority which would have benefited U.S. consumers at current trade cost levels (around 70%).[16] In contrast, the second type of conflict – U.S. consumer surplus decreases due to Canadian mergers – never occurs. Again, the intuition is that Canada is the less competitive market. So if Canada clears a domestic merger, the presence of trade costs and the more competitive nature of the U.S. market mean that it is very likely to increase consumer surplus in the U.S. as well. The opposite does not necessarily hold, given that a U.S. merger might take place in a very competitive domestic market, but that the same market in Canada is much less competitive (implying a high P^{CAN}/P^{US}).

As trade costs increase, changes in actual conflict patterns resemble changes in potential conflict patterns closely. Domestic mergers which would increase foreign consumer surplus but are blocked by the domestic authority increase as a fraction of all profitable mergers. The reason for this is that higher trade costs increase prices on the domestic market, so that domestic merger authorities become less likely to clear domestic mergers. At the same time, rising trade costs mean that the merging firms see their market shares abroad shrink, and are

[14] An additional reason for why we need to look at actual conflicts is that we calculate ρ^{US} and ρ^{CAN} based on average price realisations during the merger process (see footnote 13). This means that even if ρ is larger than unity, there may have been situations during the merger process in which prices were such that the domestic authority permitted domestic mergers which decreased foreign consumer surplus.

[15] We calculate this average across sectors with positive merger activity only (i.e., where T_{US} or T_{CAN} are positive). In sectors without merger opportunities, the ratio of mergers leading to conflicts relative to all profitable merger opportunities is of course not defined.

[16] The fact that a merger is blocked by the Canadian competition 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.

thus less likely to raise prices by merging. Indeed, as trade costs become prohibitively high, foreign firms are no longer active in the domestic market and their merger decisions become irrelevant for domestic consumer surplus. The opposite is true as trade costs fall below the initially calibrated level. Falling domestic prices mean that the domestic merger authority is now more likely to clear mergers. By contrast, lower trade costs imply more significant anti-competitive effects of foreign mergers. This leads to a reversal of the relative likelihood of the two types of conflicts. Negative cross-border consumer surplus effects arising from domestic mergers cleared by the domestic now become the most frequent type of conflict.

7.2.2 Counterfactual Policy Regimes

In our no-veto rights baseline calibration two types of conflict can arise. Domestic authorities can be either too tough or too lenient on domestic mergers from the point of view of foreign consumers. We now consider counterfactual policy regimes which address one or both types of conflicts and see what the resulting consumer surplus changes are.[17][18]

Introducing Veto Rights We first introduce veto rights for each country in turn and calculate changes in consumer surplus in each sector for both countries. This will allow us to judge the importance of eliminating conflicts resulting from domestic authorities being too lenient on domestic mergers. Thus, we would expect that the granting of veto rights to the foreign merger authority should decrease consumer surplus at home and increase it abroad, with the overall welfare effects being unclear a priori.

We compute the model's equilibrium as before, using the calibrated parameter values from Table 2. This time, however, we change the rules governing whether a merger is permissible or not. For example, when we introduce a Canadian veto over U.S. mergers, a proposed U.S. merger will take place if it is profitable and does not increase prices in both the U.S. *and* Canada. We first look at the effects of removing veto rights for the present level of trade costs (Table 5). We then analyze how these effects change as trade costs increase or decrease (Figure 7).

[17]Note that at first sight there seems to be a contradiction between finding actual conflicts (albeit for only 0.2% of profitable merger opportunities) and our earlier finding that there were no sectors with potential conflicts at all. The reason for this is that the potential conflicts measure is computed using average price realisations during the merger game, whereas actual conflicts can happen at any point during the game (see the discussion in footnote 13).

[18]Again, there is a small number of Canadian sectors in which consumer surplus increases. This is again due to newly permissible U.S. mergers changing the set of feasible subsequent U.S. mergers (compare the previous footnote).

Panel A of Table 5 shows that consumer surplus in both countries is not affected by introducing U.S. veto rights. This is of course consistent with our earlier results that there were no cases in which the U.S. wanted to block Canadian mergers authorized by Canada at current trade cost levels (Figure 6).[19] Panel B looks at the consequences of introducing Canadian veto rights over mergers taking place in the U.S. The effects of this change are more substantial. This is again consistent with the result reported in Figure 5 that Canada wanted to block a significant number of U.S. mergers which had been previously authorized by the U.S. Thus, as Canadian veto rights are introduced, overall U.S. merger activity decreases by around 10%, leading to consumer surplus losses in the U.S. and gains in Canada.[20] Consumer surplus in the average U.S. sector decreases by 1.6 million USD or 250 million dollars across all 156 U.S. manufacturing sectors.[21] While Canadian consumer surplus increases slightly in the average Canadian sector, total North American consumer surplus goes down by around 230 million USD. A more striking result is that veto rights does not change consumer surplus at all in the majority of sectors. In these sectors, domestic competition policy was too tough on domestic mergers from the point of view of foreign consumers. Introducing veto rights does nothing to address this type of conflict. Panel C shows the effects of introducing bilateral veto rights. Given that the introduction of U.S. veto rights did not change consumer surplus in either country, these are identical to the effects of introducing veto rights for Canada only.

How do changes in trade costs influence the above results? In Figure 7, we plot changes in Canadian, U.S. and total consumer surplus resulting from the introduction of bilateral veto rights against the change in trade costs. As trade costs increase, both U.S. losses and Canadian gains decline in absolute terms. This is consistent with our earlier results that higher trade costs reduce cross-border price effects of mergers and the number of conflicts in which foreign authorities want to block domestic mergers. If such conflicts become less severe, U.S. losses from introducing Canadian veto rights shrink, and Canadian consumers benefit less. Of course, introducing U.S. veto rights did already not have an impact at present levels of trade costs which remains the case as trade costs rise.

[19] Note that we set the percentage change in merger activity to 0% rather than missing if no mergers took place in the data (and thus the baseline calibration). This is to ensure that we have an equal number of observations underlying each row in Tables 5 and 6.

[20] The total change and merger activity is calculated as the ratio of the count of mergers across sectors before and after the counterfactual.

[21] There are three sectors in which U.S. consumer surplus increases slightly which might seem puzzling at first. The explanation is that the introduction of Canadian 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 on the U.S. of the merger initially blocked by Canada.

The situation is more complicated when we reduce trade costs. On the one hand, the number of U.S. mergers which raise prices in Canada goes up, and Canada would like to block more of these mergers. Because many of these mergers would have raised consumer surplus at home, the introduction of Canadian veto rights is increasingly detrimental to U.S. consumers. On the other hand, there are now more and more Canadian mergers which raise prices in the U.S. (see Figure 6), and the price impact of these mergers becomes stronger with lower trade costs. Introducing veto rights allows the U.S. to block such mergers and to increase domestic consumer surplus. These two second effects interact to create the non-monotonic impact on total U.S. consumer surplus see in Figure 7.[22] Both effects are also present for Canada. Here, however, the consumer-surplus increases from being able to block U.S. mergers always overcompensate the negative effects from not being able to implement some domestic mergers, and increasingly so for lower levels of trade costs. For trade cost reductions of 50%, the total Canadian consumer surplus gain from introducing veto rights increases to over three billion USD. 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 In the second counterfactual scenario we consider, the two countries form a joint merger authority that blocks a merger if and only if it decreases the sum of U.S. and Canadian consumer surplus. Given that this new authority internalizes cross-border effects of mergers, it is not surprising that we find a large positive impact on aggregate North American consumer surplus of around one billion USD (Table 6).[23]

Less expected is the fact that this overall gain comes at the expense of Canada which sees a total drop in consumer surplus. To understand why this is the case, note that the total North American consumer surplus effects of a given merger are 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

[22]There is also an additional effect which arises from the fact that reductions in U.S. merger activity due to Canadian veto rights lead to lower equilibrium prices and increased Canadian M&A activity in some sectors (compare the previous footnote). For trade costs which are not too low, these additional mergers mostly increase consumer surplus in the U.S., partially offsetting the effect of lower domestic M&A activity.

[23]There are a few sectors where total North American consumer surplus goes down. This is a consequence of the myopic behaviour 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.

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 – recall from Figure 6 that around 70% of profitable merger opportunities were blocked by Canada even though they would have decreased U.S. prices. Most of these mergers are now authorized, leading to a strong increase in total Canadian M&A activity of around 250% and a corresponding drop in Canadian consumer surplus.

These results show that the initial blocking of domestic mergers by the Canadian authorities created a form of price externality which can only be addressed through the introduction of a joint merger authority. Granting veto rights on Canadian mergers to the U.S. authority does not help U.S. consumers. The problem is that too few Canadian mergers take place in Canada, not too many. We believe that this is important insight which is absent from most policy discussions on a possible international coordination of merger regimes.

Finally, U.S. merger activity remains basically unchanged. A first reason for this is again that overall consumer surplus effects are dominated by their U.S. component. Because in our no-veto rights baseline calibration, the U.S. authority was using this component as the basis for its decisions, most decisions on U.S. mergers remain unchanged when Canadian consumer surplus is taken into account. Secondly, the effect of U.S. mergers on Canadian consumers is more nuanced. While Figure 5 showed that the U.S. was also mostly too tough on its domestic mergers, there was a significant minority of sectors where U.S. mergers hurt Canadian consumers.

Figure 8 looks at the consumer surplus changes induced by a joint merger authority for different levels of trade costs. As before, higher trade costs imply weaker cross-border price effects and cause gains from policy coordination to disappear rapidly. For trade cost increases of 50%, the overall consumer surplus increase from introducing a North American merger authority is already only 2.5% of the original gains reported in Table 6.

As trade costs fall from such high levels, however, firms merging at home have higher market shares abroad and the merger's price and consumer surplus effects become noticeable there. Initially, the dominant type of conflict is one where domestic authorities are too tough on domestic mergers from the point of view of foreign consumers (see Figures 5-6). As discussed above, this is particularly true for Canadian mergers, and the introduction of a joint much authority leads to strong increases in Canadian M&A activity and a resulting drop in Canadian consumer surplus. As trade costs continue to fall, however, the dominant type of conflict changes and domestic merger authorities tend to be too lenient on domestic mergers. Because it maximizes total consumer surplus, a North American merger authority does of

course also address this too-lenient-for-thy-neighbour conflict. But 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 veto rights (see Figure 7).

The same effects again have more ambiguous consequences for the U.S., where the gains from preventing consumer-surplus decreasing Canadian mergers are balanced by a decrease in consumer surplus increasing domestic M&A activity. However, even for large trade cost reductions there remains a substantial fraction of Canadian mergers on which the Canadian authority was too tough (see Figure 6). The joint merger authority will continue to authorise some of these mergers, so that overall U.S. gains from its introduction remain positive.

These results demonstrate a couple of additional important results about the interconnection of trade and merger policy. First, the level of trade costs determines the predominant type of conflict arising from domestic mergers and thus the distribution of gains from the introduction of a supranational merger authority. At intermediate levels of trade costs, domestic merger authorities tend to be too tough on domestic mergers. This is particularly true for smaller countries with high equilibrium prices, such as Canada in our calibration. As trade costs fall, domestic merger authorities become too lenient on their own mergers which in turns hurts smaller countries relatively more. Accordingly, introducing a supranational merger authority at intermediate levels of trade costs leads to overall gains but benefits larger countries at the expense of smaller countries. This effect is reversed for lower levels of trade cost, when the primary effect of a joint merger authority is the elimination of too-lenient-for-thy-neighbor policies.

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 competition policy standard aiming at maximising joint consumer surplus.

7.2.3 Using a Veto-Rights Baseline

We calibrated our model under the assumption that countries do not have veto rights on mergers taking place abroad. As discussed, we believe that this is the best description of the *actual* merger policy of the countries in our calibration. However, from a purely legal point of view, most countries claim extra-territorial jurisdiction, even if such claims are rarely put

into practice. In this section, we examine how our results change if we calibrate the model under the assumption that 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 competition authorities have the power to block foreign mergers if they decrease consumer surplus in the authority's domestic market.

In terms of the merger process described in Section 5.2, this means that if a merger proposal has been made by the acquirer and accepted by the target, then the antitrust authorities in *both* countries decide whether to approve it. The merger can only take place if it is approved by both authorities.We assume that the domestic antitrust authority makes its approval decision before the foreign one.[24]

Given the different structure of the merger process, we would expect to obtain different parameter values for this recalibration. In practice, differences are only minor. The only exception is the number of U.S. merger opportunities (T^{US}) which are around 50% higher than before in the median sector (see Table A1 in the Appendix).[25] Intuitively, because mergers now need to clear two hurdles instead of one, we need more merger opportunities to match the same number of mergers observed in the data. This is mainly relevant for T^{US}, because the U.S. merger authority does not want to block Canadian mergers for a calibrated level of trade costs (see below).

Given the similarity between the two sets of parameter estimates, we keep the following discussion brief and only highlight the main differences.[26] We again start by looking at how the scope for conflicts changes with changing trade costs. As is evident from Figures A.3-A.6 in the appendix, the relative importance of our two main types of conflict is very similar to the earlier no-veto rights calibration. At the calibrated level of trade costs, Canada blocks around 70% of profitable domestic merger opportunities while the U.S. almost never blocks Canadian mergers. By contrast, a substantial fraction (14%) of profitable U.S. merger opportunities are now blocked by the Canadian merger authority. This is still smaller than the fraction of profitable U.S. merger opportunities blocked by the U.S. authorities, however,

[24]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.

[25]We use the same 156 sectors as in the baseline calibration for comparability.

[26]We again achieve an almost perfect fit to the target and moments and match the additional concentration ratios reasonably well (see Appendix Figures A.1 and A.2). Given that we now have veto rights, we no longer observe positive cross-border price effects of mergers but otherwise the magnitude of the price effects are very similar (Appendix Table A.2). The marginal cost reductions implied by our choice of the synergy parameters $\beta_{US} = \beta_{CAN} = 50$ are also almost exactly identical (Appendix Table A.3).

which now stands at 55%.

The types of counterfactuals we can look at in this veto-rights baseline are of course different than before. We start by removing veto rights from the U.S. and Canada, first unilaterally and then bilaterally. The results are a mirror image of our earlier counterfactuals where we introduced veto rights. At the calibrated level of trade costs, removing veto rights from the U.S. does not change Canadian consumer surplus. Removing Canadian veto rights has a larger impact, with a total increase in consumer surplus in the U.S. of around US$1 billion, and a drop in total Canadian consumer surplus of around US$100 million. Removing both veto rights at the same time is again similar to the removal of Canadian veto rights only. The main difference to our no-veto rights calibration is that the effects are quantitatively large than before. The explanation for this is that the number of merger opportunities in the U.S. (T_{US}) is now higher, so that a removal of Canadian veto rights leads to a larger absolute increase in the number of mergers taking place in the U.S. (recall that in both baselines, Canada wants to block around 14% of U.S. mergers). Changes in trade costs also create effects mirroring the ones from our baseline with no veto rights (see Table A.7). As trade costs increase, consumer surplus changes converge towards zero. As they fall, the abolition of veto rights increasingly hurts Canadian consumers. By contrast, the effect on U.S. consumers is again more ambiguous, reflecting the trade off between more consumer surplus increasing domestic mergers and more consumer surplus decreasing Canadian mergers being allowed to take place.

Our second counterfactual is the introduction of a North American merger authority. As before, this leads to a drop in Canadian consumer surplus, and an increase in U.S. consumer surplus. The main difference to our baseline calibration is that the effects are again larger. Intuitively, with a veto rights baseline, moving to a North American merger authority creates two effects which are beneficial for U.S. consumers. First, Canadian M&A activity increases because Canadian merger policy was initially too tough on domestic mergers from the point of view of the U.S. This is similar to our baseline counterfactuals. Second, the new authority also permits a number of U.S. mergers which used to be blocked by Canada because the overall consumer surplus effect is positive, even though the effect on Canada is negative. This effect was absent from our no-veto-rights baseline. Indeed, the number of U.S. Mergers now increases by around 15% with the introduction of a North American merger authority, whereas before the change was close to zero. (Canadian merger activity again increases by over 200%.)

As trade costs fall, mergers have a more detrimental effect on foreign consumer surplus,

and the new merger authority increasingly blocks them. In our baseline calibration, this was particularly beneficial for Canadian consumers who benefited from a North American merger authority at lower levels of trade cost. In the present situation, where we already start out with veto rights, this effect is absent. Compared to a situation with veto rights, the new merger authority continues to permit more mergers even at lower levels of trade cost. While the dominant type of conflict is now the domestic merger policy is too lenient, this was already addressed by the presence of veto rights. At the same time, Figure A.6 showed that around 15% of Canadian mergers were blocked by Canada even though there were consumer surplus increasing in the U.S. Many of these mergers will now be permitted and lead to increases in U.S. consumer surplus and decreases in Canadian consumer surplus. Finally, some U.S. mergers which used to be blocked by Canada with veto rights continue to be permitted by the new authority because the overall consumer surplus increase is positive. Taken together, these effects explain why the overall effect of having a North American merger authority on Canada is negative throughout the range of trade cost we analyse, whereas it is positive for the U.S. We note that while this result is different from our baseline without veto rights, this is merely due to the changed baseline, rather than to a radically different set of parameter values. Put differently, the forces at work in our model are robust to a different interpretation of the current legal regime concerning veto rights. We also note that we think it highly unlikely that Canada has effective veto rights over U.S. mergers, casting doubt on the results driven by this assumption.[27]

7.2.4 A Competitive Fringe

For our second robustness check, we switch back to the no-veto rights baseline but now 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 which takes the market price is given. In the absence of detailed information about the number of likely oligopolists in each sector, we set N_o to the number of firms which have at least a 1% market share or, if this is larger, the number of the largest firms which jointly account for 80% of total sectoral sales in the data. We describe this competitive fringe model and the corresponding calibration procedure in more detail in Appendix A.3.

Overall, the parameter values for this competitive fringe baseline are broadly similar to the no-veto-rights baseline (Table A.6). The main difference is that the number of merger

[27] In private correspondence with the Canadian competition authority, we were advised that no US merger had been blocked by the Canadians over the past two decades, although remedies were imposed in a few cases.

opportunities (T) is 50% higher in the U.S. and twice as large in Canada. Intuitively, the set of firms from which we draw acquirers and targets is now smaller and more homogeneous. In the median sector, only 10% of firms are classified as oligopolists in the U.S. (20% in Canada), and we do not allow competitive fringe firms to participate in the merger game. This implies smaller marginal cost differences between potential merger parties, reducing the scope for synergies (see equation (1) in Section 5.1). Thus, we require more opportunities to obtain a number of permissible mergers which matches the number of mergers observed in the data.[28] Despite the larger values for T, the model's ability to match the number of mergers in the data deteriorates. We now have 15 sectors where we are unable to match the empirical moments, compared to just four in the no-veto-rights and veto-rights baseline calibration. In the following, we drop these 15 sectors.

Turning to our counterfactual simulations, we obtain results which are qualitatively similar to the no-veto-rights baseline. This is true for the consumer surplus effects at the calibrated level of trade costs, and for their evolution as the level of trade costs changes. Canadian consumers gain from the imposition of veto rights, and more so for lower levels of trade cost (Table A.9 and Figure A.15). They also lose from the introduction of a North American merger authority at the calibrated level of trade costs, but gain once trade costs have fallen sufficiently. U.S. consumer surplus decreases for most trade costs levels when veto rights are introduced, but gain throughout from a North American merger authority.

7.2.5 Differentiated Goods and Price Competition

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8 Conclusion

Because of cross-border demand and supply linkages, merger approval decisions of national antitrust authorities have important effects on other jurisdictions. In this paper, we have provided a quantitative framework to analyze the resulting conflicts between consumer-surplus maximizing merger authorities. For very general demand and cost structures, we have shown that the relevant factors influencing the type and likelihood of conflict are initial market structures and the trade cost between markets. To judge which situations are prevalent in

[28] This is also evident from Table A.8 where we show the calibrated synergy effects, measured as before as the reduction in marginal costs of merged firm relative to merger party with the lowest marginal costs. Because the marginal cost of the merging parties are now relatively similar, we require a stronger reduction in the minimum marginal costs for the merger to be permissible.

practice, and to get an idea of the magnitude of the economic consequences of conflict, we have calibrated our model to match sectoral data for 160 U.S. and Canadian manufacturing sectors for 2002.

Our first key results is that conflicts between competition authorities can be expected to be frequent; they arise unless trade costs and market asymmetries happen to exactly offset each other. Second, the majority of these conflicts will be 'hidden', in the sense that they will 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. This means that veto rights are 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. This issue can only be resolved by the introduction of a supranational authority evaluating the global (or regional) consumer surplus effects of mergers. Given the likely asymmetric impact on the consumer surplus of different countries, however, this approach is unlikely to be acceptable to all participating countries.

This situation changes dramatically as trade costs decrease, however. For trade cost reductions which seem relatively small 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 clearly shows that merger and trade policy interact in an important sense. Further trade liberalisation will make it more important for domestic authorities to exercise control over mergers taking place abroad. More optimistically, reductions of trade barriers might also make it easier to coordinate merger policy. As the role of a supranational merger authority increasingly becomes to address conflicts arising from domestic policies which are too lenient, the benefits of such coordination to smaller, less competitive economies increase, making agreement between countries more likely.

While our quantitative results were derived under very specific assumptions regarding demand and cost structures, we believe that our findings will appear in a variety of different settings. What is important are differences in initial market structure and the presence of substantial trade costs, irrespective of the particular framework 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). But our results

also show that even relatively small additional decreases in trade costs might have important implications for the interaction between trade and merger policy.

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A Proofs

A.1 Proof of Lemma 1

Because firms are able to segment markets perfectly, we can focus on a single sector s and country i. Dropping the sector index for notational convenience, firm k's profit-maximizing output in country i, conditional on aggregate output Q^i, is given by the fitting-in function

$$h(Q^i; c_k^i) = \max\left\{0, -\frac{P^i(Q^i) - c_k^i}{P^{i\prime}(Q^i)}\right\}.$$

Assumption 1 ensures that there is at least one firm k such that $h(Q^i; c_k^i) > 0$ for Q^i sufficiently small, and that, for every k, $h(Q^i; c_k^i) = 0$ for Q^i sufficiently large. Let

$$\Gamma(Q^i; (c_k^i)_{k\in\mathcal{N}^1\cup\mathcal{N}^2}) \equiv \sum_{k\in\mathcal{N}^1\cup\mathcal{N}^2} h(Q^i; c_k^i) - Q^i.$$

The properties of the fitting-in function imply that $\Gamma(Q^i; (c_k^i))$ is strictly positive for Q^i sufficiently small and strictly negative for Q^i sufficiently large. By continuity, there exists an equilibrium level of aggregate output, denoted Q^{i*}, such that $\Gamma(Q^{i*}; (c_k^i)) = 0$. Notice also that $P(Q^{i*}) > c_k^i$ for some k.

Next, we establish uniqueness of this equilibrium aggregate output level. Suppose $\tilde{Q}^i$ is such that $\Gamma(\tilde{Q}^i; (c_k^i))=0$, and let $k \in \mathcal{N}^1 \cup \mathcal{N}^2$. If $P^i(\tilde{Q}^i) > c_k^i$, then:

$$\begin{aligned}
\partial_1 h(\tilde{Q}^i; c_k^i) &= -\frac{(P^{i\prime})^2(\tilde{Q}^i) - \left(P^i(\tilde{Q}^i) - c_k^i\right) P^{i\prime\prime}(\tilde{Q}^i)}{\left(P^{i\prime}(\tilde{Q}^i)\right)^2}, \\
&= \frac{1}{-P^{i\prime}(\tilde{Q}^i)}\left(P^{i\prime}(\tilde{Q}^i) + h(\tilde{Q}^i; c_k^i) P^{i\prime\prime}(\tilde{Q}^i)\right),
\end{aligned}$$

which is strictly negative by Assumption 1.[29] If $P^i(\tilde{Q}^i) < c_k^i$, then $\partial_1 h(\tilde{Q}^i; c_k^i) = 0$. Finally, if $P^i(\tilde{Q}^i) = c_k^i$, then $h(.; c_k^i)$ has a strictly negative left derivative and a right derivative equal to zero. Combining these findings, we conclude that $\Gamma(.; (c_k^i))$ is strictly decreasing in the neighborhood of $\tilde{Q}^i$. By continuity, it follows that $\Gamma(.; (c_k^i))$ intersects the horizontal axis once and only once.

Finally, we prove that Q^{i*} is weakly decreasing in c_k^i, and strictly so if $q_k^{i*} > 0$. Let $c_k^{i\prime} > c_k^i$ and $c_l^{i\prime} = c_l^i$ for all $l \neq k$. Suppose first that $q_k^{i*} = 0$. Then,

$$\Gamma(Q^{i*}; (c_k^{i\prime})) = \Gamma(Q^{i*}; (c_k^i)) = 0,$$

so the equilibrium aggregate output is not affected by an increase in c_k^i. Conversely, suppose $q_k^{i*} > 0$. Clearly, $h(Q^{i*}; c_k^i) > h(Q^{i*}; c_k^{i\prime})$, and

$$\Gamma(Q^{i*}; (c_k^{i\prime})) < \Gamma(Q^{i*}; (c_k^i)) = 0.$$

It follows that the equilibrium aggregate output is strictly decreasing in c_k^i.

A.2 Proof of Lemma 2

Merger M is CS-neutral in country i if, conditional on the pre-merger aggregate output Q^{i*}, the merged firm wants to produce exactly as much output as the merger partners did before the merger. Using the same notation as in the proof of Lemma 1, this means that $\Delta CS^i(M) = 0$ if

$$h(Q^{i*}; \overline{c}_M^i) = h(Q^{i*}; c_1^i) + h(Q^{i*}; c_2^i)$$

or, rewriting,

$$P^i(Q^{i*}) - \overline{c}_M^i = [P^i(Q^{i*}) - c_1^i] + [P^i(Q^{i*}) - c_2^i].$$

Solving for $\overline{c}_M^i = \tau^{1i}\overline{c}_M$, we obtain

$$\overline{c}_M = c_1 + c_2 - \frac{P^i(Q^{i*})}{\tau^{1i}} \equiv \widehat{c}_M^i.$$

[29] If $P^{i\prime\prime}(\tilde{Q}^i) \leq 0$, then this is trivial. If $P^{i\prime\prime}(\tilde{Q}^i) > 0$, then

$$\begin{aligned} P^{i\prime}(\tilde{Q}^i) + h(\tilde{Q}^i; c_k^i) P^{i\prime\prime}(\tilde{Q}^i) &\leq P^{i\prime}(\tilde{Q}^i) + \tilde{Q}^i P^{i\prime\prime}(\tilde{Q}^i), \\ &< 0, \end{aligned}$$

where the first line follows from the fact that $\tilde{Q}^i \geq h(\tilde{Q}^i; c_k^i)$ (since $\Gamma(\tilde{Q}^i; (c_k^i)) = 0$) and the second line follows from Assumption 1.

As a decrease in $\overline{c}_M$ raises aggregate output by Lemma 1, it follows that merger M is CS-increasing in country i if $\overline{c}_M < \widehat{c}_M^i$, and is CS-decreasing if the inequality is reversed.

To see that merger M is profitable in country i if it is CS-neutral in that country, note that (i) the price remains unchanged after the merger, (ii) the merged firm produces the same output as the merger partners did jointly before the merger, but (iii) the output is produced at lower costs after the merger as $\widehat{c}_M^i < \min\{c_1^i, c_2^i\}$. To see that a CS-increasing merger is profitable, note that it involves lower post-merger cost than a CS-neutral merger and that the joint output of the firms not involved in the merger is lower as well (as the fitting-in function $h(Q;c)$ is decreasing in Q).

A.3 Proof of Proposition 2

For $i, j \in \{1,2\}$, let

$$\overline{\mathcal{N}}^{ij} \equiv \left\{k \in \mathcal{N}^i : \ P^{j*} > c_k^j\right\}$$

denote the set of firms located in country i that are active in country j. In the following, we assume for simplicity that taking derivatives does not affect this set (which, indeed, it does not generically).[30]

Part 1. Let $i \neq j \in \{1,2\}$. Applying the implicit function theorem to equation $\Gamma(Q^i;(c_k^i)) = 0$, we obtain:

$$\begin{aligned}
\frac{dP^{i*}}{d\tau^{ji}} &= P^{i\prime}(Q^{i*})\frac{dQ^{i*}}{d\tau^{ji}} \\
&= \frac{P^{i\prime}(Q^{i*})}{\tau^{ji}} \frac{\sum_{k\in\overline{\mathcal{N}}^{ji}} c_k^i}{\left(|\overline{\mathcal{N}}^{ii}| + |\overline{\mathcal{N}}^{ji}| + 1\right) P^{i\prime}(Q^{i*}) + Q^{i*}P^{i\prime\prime}(Q^{i*})} \\
&< \frac{\sum_{k\in\overline{\mathcal{N}}^{ji+}} c_k^i}{\tau^{ji}\left(|\overline{\mathcal{N}}^{ii}| + |\overline{\mathcal{N}}^{ji}|\right)} \\
&\leq \frac{P^{i*}}{\tau^{ji}},
\end{aligned}$$

where the first inequality follows from Assumption 1, and the second as $\left(|\overline{\mathcal{N}}^{ii}| + |\overline{\mathcal{N}}^{ji}|\right) P^{i*} - \sum_{k\in\overline{\mathcal{N}}^{ji}} c_k^i \geq \sum_{k\in\overline{\mathcal{N}}^{ji}} (P^{i*} - c_k^i) \geq 0$. It follows that the ratio τ^{ji}/P^{i*} is increasing in τ^{ji}. As P^{j*} is independent of τ^{ji}, this implies that $\rho^{j*} \equiv \tau^{ji}P^{j*}/P^{i*}$ is increasing in τ^{ji}. Moreover, as P^{i*} is increasing in τ^{ji}, $\rho^{i*} \equiv \tau^{ij}P^{i*}/P^{j*}$ is increasing in τ^{ji}.

[30] To account for the non-generic case in which infinitesimal changes of parameters do change the set of active firms, the derivatives in the proof would have to be replaced by one-sided partial derivatives; the results would remain unchanged.

Part 2. Adapting our notation for the demand shift parameter a^j, the equilibrium output level in country $j \in \{1,2\}$ is given by the unique solution to

$$\Gamma(Q^{j*};(c_k^j);a^j) \equiv \sum_{k\in\mathcal{N}^1\cup\mathcal{N}^2} \max\left(0, -\frac{P^j(Q^{j*};a^j)-c_k^j}{\partial_1 P^j(Q^{j*};a^j)}\right) - Q^{j^*} = 0.$$

Applying the implicit function theorem to this equation, yields:

$$\begin{aligned}\frac{dQ^{j*}}{da^j} &= -\frac{\left(|\overline{\mathcal{N}}^{1j}|+|\overline{\mathcal{N}}^{2j}|\right)\partial_2 P^j(Q^{j*};a^j)+Q^{j*}\partial_{12}^2 P^j(Q^{j*};a^j)}{\left(|\overline{\mathcal{N}}^{1j}|+|\overline{\mathcal{N}}^{2j}|+1\right)\partial_1 P^j(Q^{j*};a^j)+Q^{j*}\partial_{11}^2 P(Q^{j*};a^j)},\\ &< -\frac{\partial_2 P^j(Q^{j*};a^j)}{\partial_1 P^j(Q^{j*};a^j)},\end{aligned}$$

where the first line follows as $-\left[P^j(Q^{j*};a^j)-c_k^j\right]/\partial_1 P^j(Q^{j*};a^j) = q_k^{j*}$ if $k \in \overline{\mathcal{N}}^{1j}\cup\overline{\mathcal{N}}^{2j}$, and the second line from Assumption 1, $\partial_2 P^j(Q^{j*};a^j)>0$ and $\partial_{12}^2 P^j(Q^{j*};a^j)\leq 0$. We thus obtain:

$$\begin{aligned}\frac{dP^j(Q^{j*};a^j)}{da^j} &= \partial_1 P^j(Q^{j*};a^j)\frac{dQ^{j*}}{da^j}+\partial_2 P^j(Q^{j*};a^j)\\ &> 0.\end{aligned}$$

The assertion on the effect of a^j on ρ^{j*} and ρ^{i*}, then follows by observing that $dP^i(Q^{i*};a^i)/da^j = 0$ for $i \neq j$.

Part 3. Consider firm $k \in \mathcal{N}^i$. By assumption, firm k is active in both countries, i.e., $k \in \overline{\mathcal{N}}^{i1}\cap\overline{\mathcal{N}}^{i2}$. Applying the implicit function theorem to the equilibrium condition $\Gamma(Q^{j*};(c_k^j)_{k\in\mathcal{N}^1\cup\mathcal{N}^2})=0$, where j may or may not be equal to i, we obtain:

$$\begin{aligned}\frac{dQ^{j*}}{dc_k} &= \frac{\tau^{ij}}{\left(|\overline{\mathcal{N}}^{1j}|+|\overline{\mathcal{N}}^{2j}|+1\right)P^{j\prime}(Q^{j*})+Q^{j*}P^{j\prime\prime}(Q^{j*})}\\ &= -\frac{\tau^{ij}}{\left(|\overline{\mathcal{N}}^{1j}|+|\overline{\mathcal{N}}^{2j}|+1\right)b^j},\end{aligned}$$

where, by the assumption of linear demand, $P''(\cdot)\equiv 0$, and $P^{j\prime}(\cdot)\equiv -b^j$. For $j\neq i$, we have $d\rho^{j*}/dc_k > 0$ if and only if

$$-b^j\frac{dQ^{j*}}{dc_k}P^{i*} > -b^i\frac{dQ^{i*}}{dc_k}P^{j*},$$

or, equivalently,

$$\frac{\tau^{ij}}{\left(|\overline{\mathcal{N}}^{1j}|+|\overline{\mathcal{N}}^{2j}|+1\right)}\frac{\left(|\overline{\mathcal{N}}^{1j}|+|\overline{\mathcal{N}}^{2j}|+1\right)}{\tau^{ii}}\frac{P^{i*}}{P^{j*}}>1.$$

As $\tau^{ii}=1$, and the number of active firms is the same in both countries, i.e., $|\overline{\mathcal{N}}^{11}|+|\overline{\mathcal{N}}^{21}|=|\overline{\mathcal{N}}^{12}|+|\overline{\mathcal{N}}^{22}|$, this inequality can be rewritten as

$$\rho^{i*}\equiv\frac{\tau^{ij}P^{i*}}{P^{j*}}>1.$$

Similarly, we obtain $d\rho^{i*}/dc_k>0$ if and only if $\rho^{i*}<1$.

B Solution of the Cournot Game with Linear Demand

As each firm can sell its good at home and abroad, the number of potentially active firms in sector s is $N_s=N_s^1+N_s^2$ in both countries. However, because a firm can profitably sell in a market only if its unit cost is less than the market price it faces (net of iceberg transportation costs), the number of *active* firms can vary across countries. We drop sector subscripts from now on to ease notation.

Consider the manufacturing market in country i. We relabel firms such that $c_1^i\leq c_2^i\leq\ldots\leq c_N^i$, i.e., adjusting for trade costs, firms are ranked from the most productive to the least productive.

Consider an equilibrium candidate in which the first K firms are active. For $1\leq k\leq K$, the profit of firm k in country i is given by $\pi_k^i=\left(a^i-b^i(q_k^i+Q_{-k}^i)-c_k^i\right)q_k^i$, where $Q_{-k}^i=\sum_{l\neq k}q_l^i$ is the total output of firm k's rivals. This yields the usual first-order condition: $a^i-b^iQ_{-k}^i-c_k^i-2b^iq_k^i=0$. Denoting by $C_M^i=\sum_{k=1}^K c_k^i$ the sum of the marginal costs of the first K firms, and summing over the active firms' first-order conditions, we obtain the market price in country i in this equilibrium candidate:

$$P^i=\frac{a+C_K^i}{K+1}.$$

It follows from usual stability arguments (e.g., Vives, 2001) that there exists a unique $\overline{K}\in\{0,1,\ldots,N\}$ such that

$$\begin{aligned}&\tfrac{a^i+C_K^i}{K+1}>c_K^i \quad \text{for all } 1\leq K\leq\overline{K},\\ \text{and}\quad &\tfrac{a^i+C_K^i}{K+1}\leq c_K^i \quad \text{for all } \overline{K}+1\leq K\leq N.\end{aligned}$$

Therefore, at the unique Nash equilibrium, only the first $\overline{K}$ firms are active, and

$$\begin{aligned} P^i &= \frac{a^i + C^i_{\overline{K}}}{\overline{K}+1}, \\ q^i_k &= \frac{\max(P^i - c^i_k, 0)}{b^i}, \quad 1 \leq k \leq N, \\ \pi^i_k &= \frac{\max(P^i - c^i_k, 0)^2}{b^i}, \quad 1 \leq k \leq N. \end{aligned}$$

C A Competitive Fringe Model

This appendix provides additional details on the setup and calibration of the competitive fringe model from Section 7.2.4.

As in the no-veto-rights calibration, we start by drawing N^i_s productivity levels (z) from a Pareto distribution with scale parameter x^i_s and shape parameter ζ^i_s. The $N^i_{o,s}$ most productive firms are assumed to behave oligopolistically whereas the remaining $N^i_s - N^i_{o,s}$ firms belong to the competitive fringe. $N^i_{o,s}$ is a parameter which is directly determine from the data (see below). The cost function of the oligopoly player k is as before $C(q_k) = \frac{1}{z_k}(w^i)^{\eta^i_s}(P^i_0)^{(1-\eta^i_s)}q_k$. We assume that a fringe firm's l costs are $C_f(q_l) = \frac{1}{z_l}(w^i)^{\eta^i_s}(P^i_0)^{(1-\eta^i_s)}(q_l)^2$ which implise increasing marginal costs and insures fringe firms are always active.

Cournot players move first and set quantities q_k. Fringe firms observe the aggregate output of Cournot players and decide how much to produce. Fringe firms are price takers and choose quantities such that marginal cost equals the equilibrium price (P). This yields fringe firm's f supply functions as $S_k(p) = \frac{1}{2}\frac{z_k}{(w^i)^{\eta^i_s}(P^i_0)^{(1-\eta^i_s)}}P$. Total fringe supply will be $Q^F = \gamma P$ where $\gamma = \frac{\phi_1}{2}\sum_{k=1}^{N_f}\frac{z_k}{(w^i)^{\eta^i_s}(P^i_0)^{(1-\eta^i_s)}}$ is constant for a given realisation of productivity draws.

The equilibrium price P now depends on the total quantity supplied by Cournot players (Q) as well as on the output produced by the fringe (Q^F):

$$P = a - \frac{1}{b}(Q + \gamma P),$$

i.e.,

$$P = \frac{ab}{b+\gamma} - \frac{1}{b+\gamma}Q.$$

This defines the new inverse demand function that Cournot players are facing. We can now simply define $\hat{a} \equiv \frac{ab}{b+\gamma}$ and $\frac{1}{\hat{b}} = \frac{1}{b+\gamma}$ and compute the equilibrium quantities and prices for Cournot players as a function of $\hat{a}$ and $\hat{b}$ as described in the previous appendix. When

computing our theoretical moments, we now take into account the presence of competitive fringe firms. That is, domestic sales now include the competitive fringe's sales, total costs include costs incurred by the competitive fringe firms, and the theoretical HHI is computed using the market shares of both Cournot players and competitive fringe firms. We assume that competitive fringe firms cannot export, so that the value of exports is calculated as before.

The calibration of the competitive fringe model requires one additional parameter, $N^i_{o,s}$, which we calibrate directly from our data on concentration ratios as follows. For each sector and each country, we first fit a fractional polynomial function to match the concentration ratios for which we have data.[31] This yields an imputed relationship between the number of the N largest firms and the total share of sales in a sector these firms account for.[32] In a second step, we use this relationship to compute two numbers, the number of firms which jointly account for 80% of total sales, N_1, and the number of firms which each have at least a 1% market share, N_2. We then set $N^i_{o,s} = \max(N_1, N_2)$.

We have also experimented with different calibration procedures, such as setting $N^i_{o,s} = N_1$ or $N^i_{o,s} = N_2$, or using market share cut-off higher than 1%. For the sectors for which we can match our empirical moments, the qualitative results of our counterfactual experiments for each of these different calibrations were similar to the results presented in section X.X. For the reasons explained there, however, the quality of the match between the theoretical and empirical moments deteriorated as the number of oligopoly firms declined.

D Data Appendix

For the calibration procedure described in Section 6, we require data on the number of mergers per industry, industry sales, total costs, labor cost shares, 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 in Section 7.1 we also need Canadian and U.S. concentration ratios (sales shares of the 4, 8, and 20 largest firms in each 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 defi-

[31] We have CR4, CR8, CR20 and CR50 for the US. For Canada, we also have data for CR12 and CR16. For sectors with more than 20 firms, we use polynomials with three fractional powers and for sectors with between 10 and 20 firms, we use two fractional powers. (10 is the minimum number of firms we observe in our data.)

[32] Note that our concentration ratio data are production based and do not include the sales of foreign firms in the domestic market. That is, sales shares are calculated as a fraction of sales for all domestic firms.

nitions are identical and for which we can thus compare Herfindahl indices across the two countries. We obtain a total of 160 manufacturing industries for the year 2002 for which we have data for all required variables.[33]

Data on U.S. and Canadian industry-level sales, total costs, labor cost shares, 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 at the ten-digit level of the harmonized system (HS). We use the concordance by Pierce and Schott (2009) to map these data from HS into NAICS.

Relative price data are obtained from Inklaar and Timmer (2012) who computed 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, we have also calculated relative export prices from trade unit values, using the NBER data described above.[34] While trade unit values allow the computation of relative prices at the 5-digit industry level, they also tend to be very imprecisely measured and often result in implausibly large price differences between the U.S. and Canada. For example, after averaging over each industry's unit values over the period 1998-2006, we find a maximum relative Canadian-U.S. price of 75 and a mimimun of 0.09. Even after winsorizing all data below the 10th percentile

[33]We later drop four sectors in which our model does not match the empirical moments well; see Section 7.1.

[34]We again used the concordance by Pierce and Schott (2009) to map these data from HS into NAICS, and then compute unit values as the ratio of NAICS-level trade value to quantity. If the HS products mapping into a given NAICS code contain multiple types of units (e.g., kg and square metres), we use the unit appearing most frequently. Using 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.

and above the 90th percentile of the distribution of unit values across industries, we still obtain relative prices ranging from 0.5 to close to 3, implying persistent price differences of up to 200% in relatively narrowly defined industries. Thus, we prefer to work with the more aggregated Inklaar and Timmer data, which yield more plausible price differences (see Table 1). In unreported robustness checks, we show that using the windsorized export price data yields qualitatively similar results to the once reported here, although some of the implied parameter estimates are less plausible.

We convert all value entries into U.S. dollars using the average U.S.-Canadian dollar exchange rate over the period 1997-2007.[35] 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 by the number of persons in employment. This yields an average wage for the U.S. of 36,510 USD and an average wage rate for Canada of 27,386 USD in 2002.[36]

[35]We 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).

[36]Data 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.

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

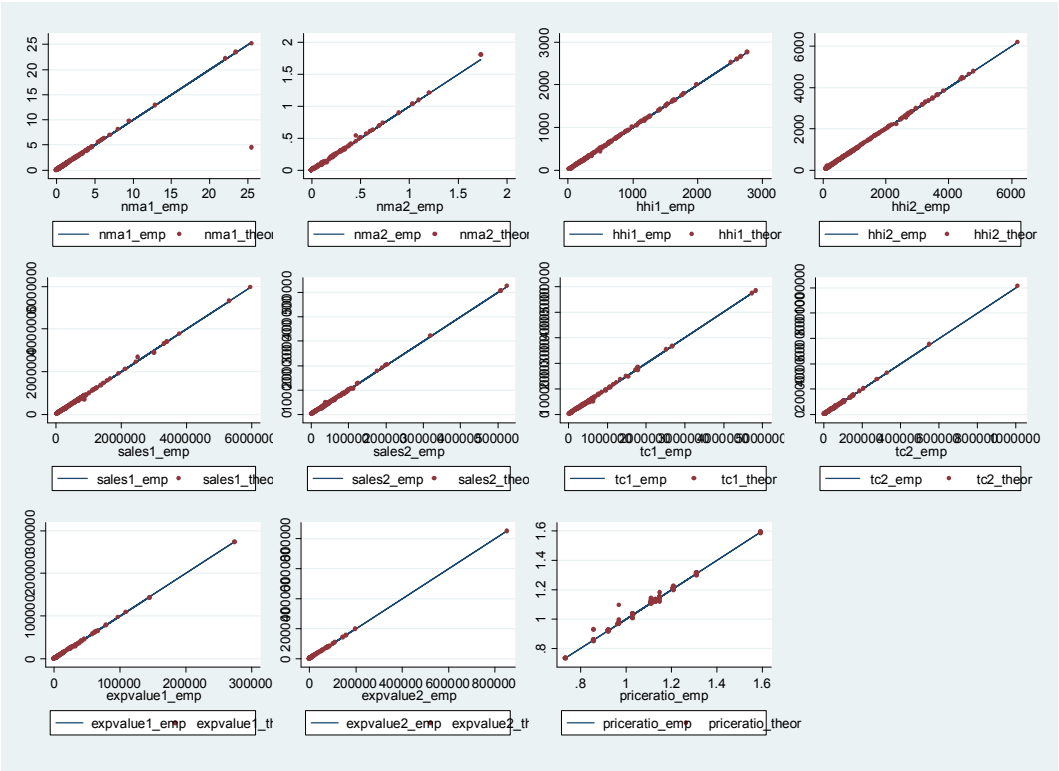


Figure 2: Theoretical vs. Empirical Moments (moments not targeted)

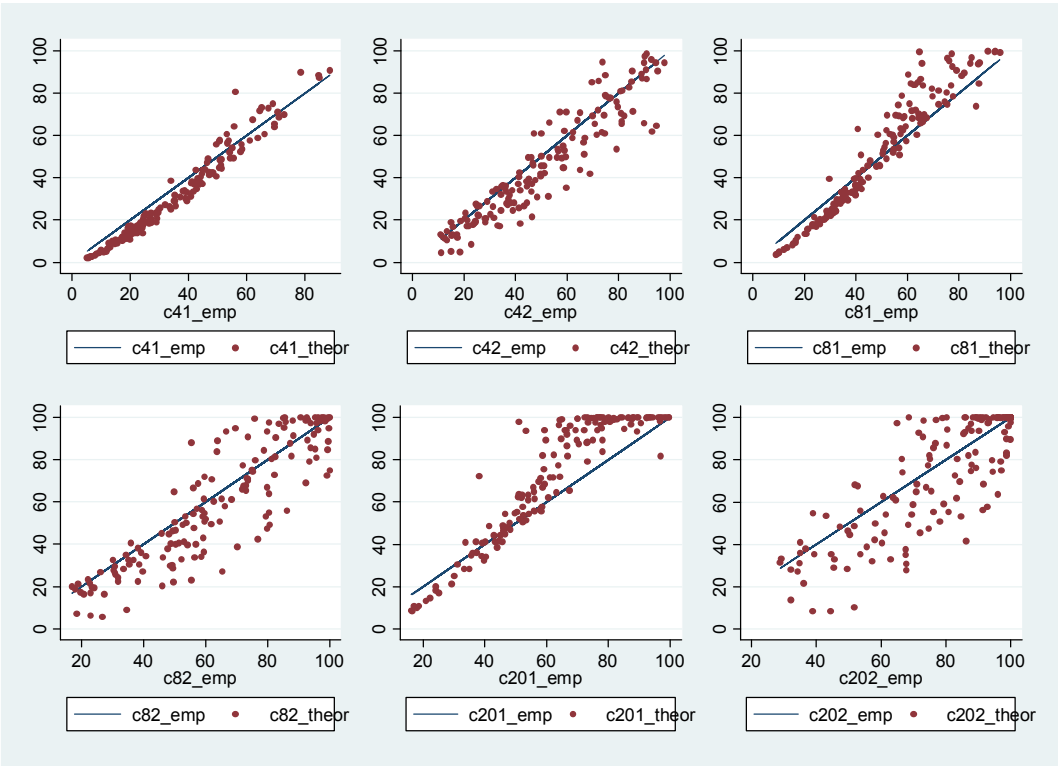
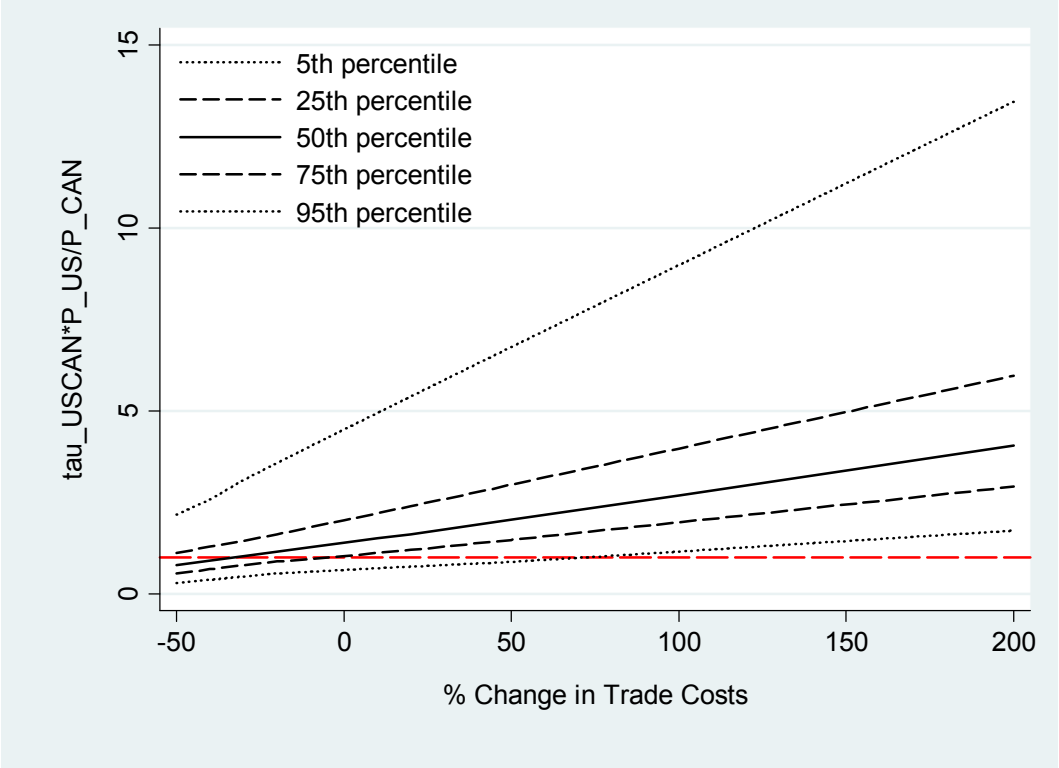
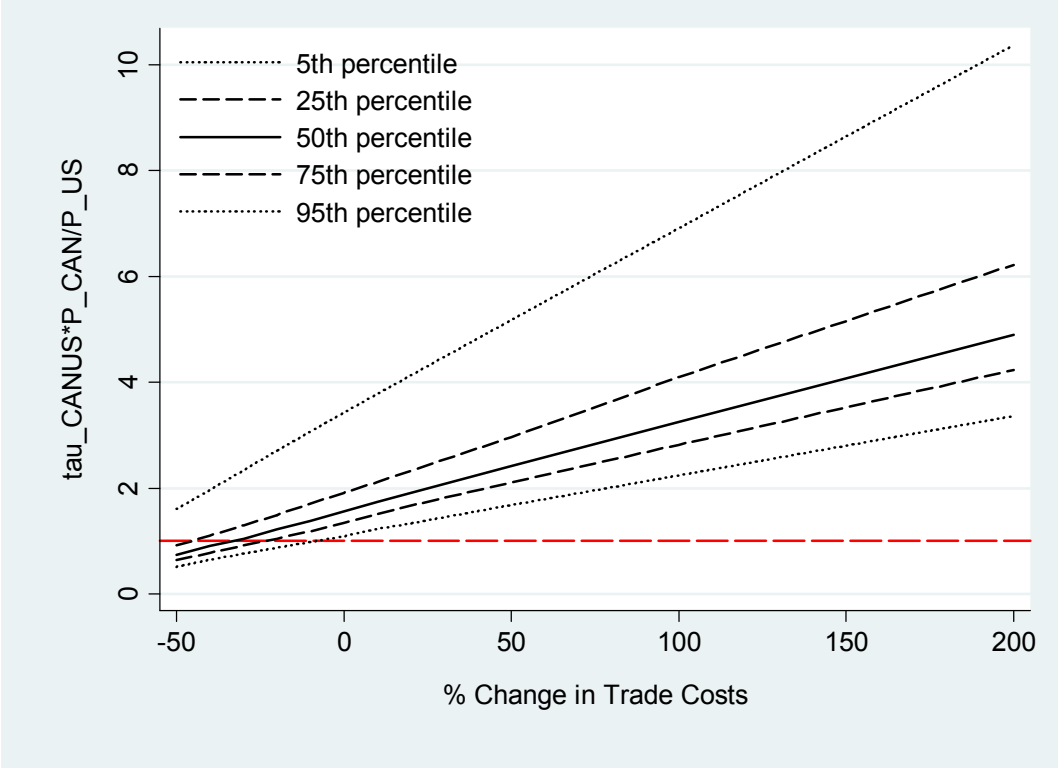


Figure 3: Potential Conflicts arising from U.S. Mergers (No-Veto-Rights Baseline)



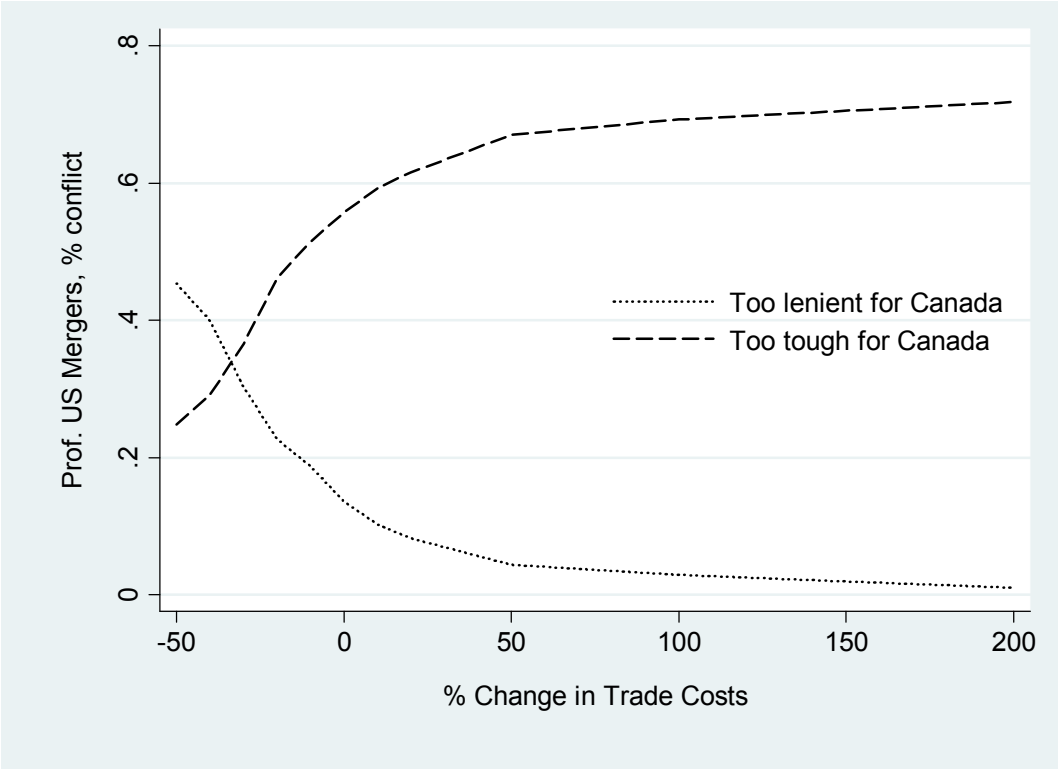
Notes: Figure shows percentiles of the distribution of τ_{USCAN}*P_{US}/P_{CAN} across sectors for different trade cost changes. Values larger than 1 indicate U.S. merger control (over U.S. mergers) will be too tough for Canadian consumers. Values larger than 1 indicate U.S. merger control (over U.S. mergers) will be too lenient for Canada consumers.

Figure 4: Potential Conflicts arising from Canadian Mergers (No-Veto-Rights Baseline)



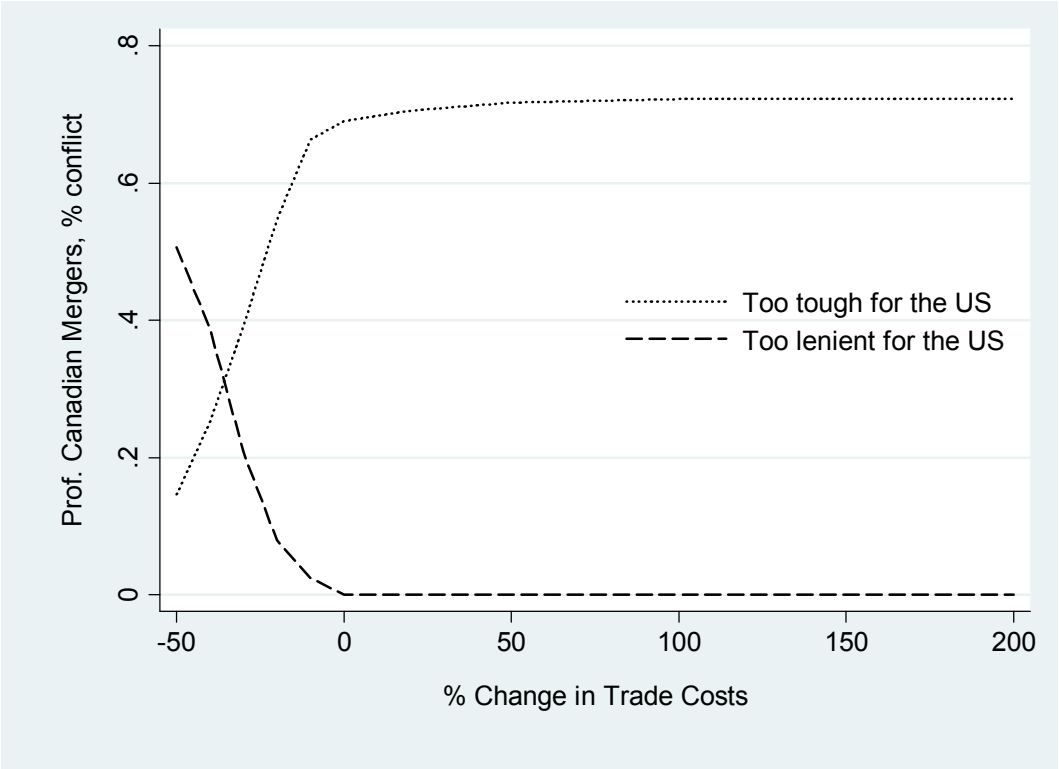
Notes: Figure shows percentiles of the distribution of τ_{CANUS}*P_{CAN}/P_{US} across sectors for different trade cost changes. Values larger than 1 indicate Canadian merger control (over Canadian mergers) will be too tough for the U.S. Values smaller than 1 indicate U.S. merger control is too tough for Canada.

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



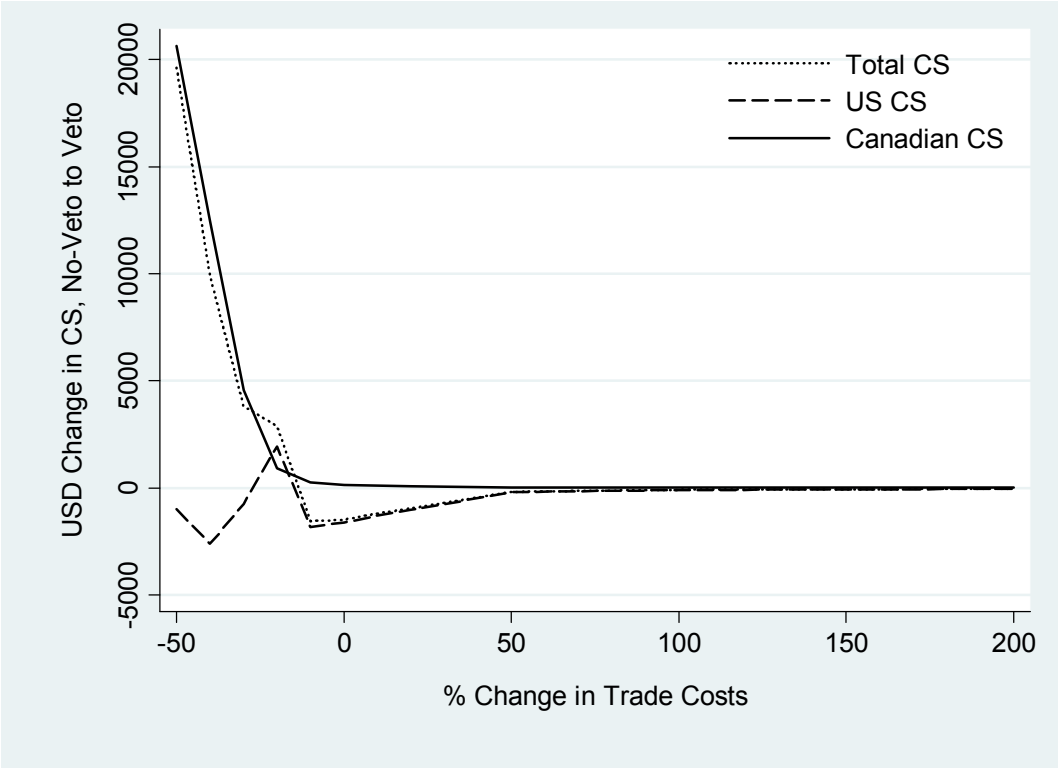
Notes: Figure shows means across sectors of the fraction of profitable mergers where a conflict arose (calculated as a fraction of all profitable merger opportunities for each sector). "Too lenient for Canada" means that the U.S. authorised a merger which lowered consumer surplus in Canada; "Too tough for Canada" means that the US 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, only sectors with merger opportunities (Canadian mergers)



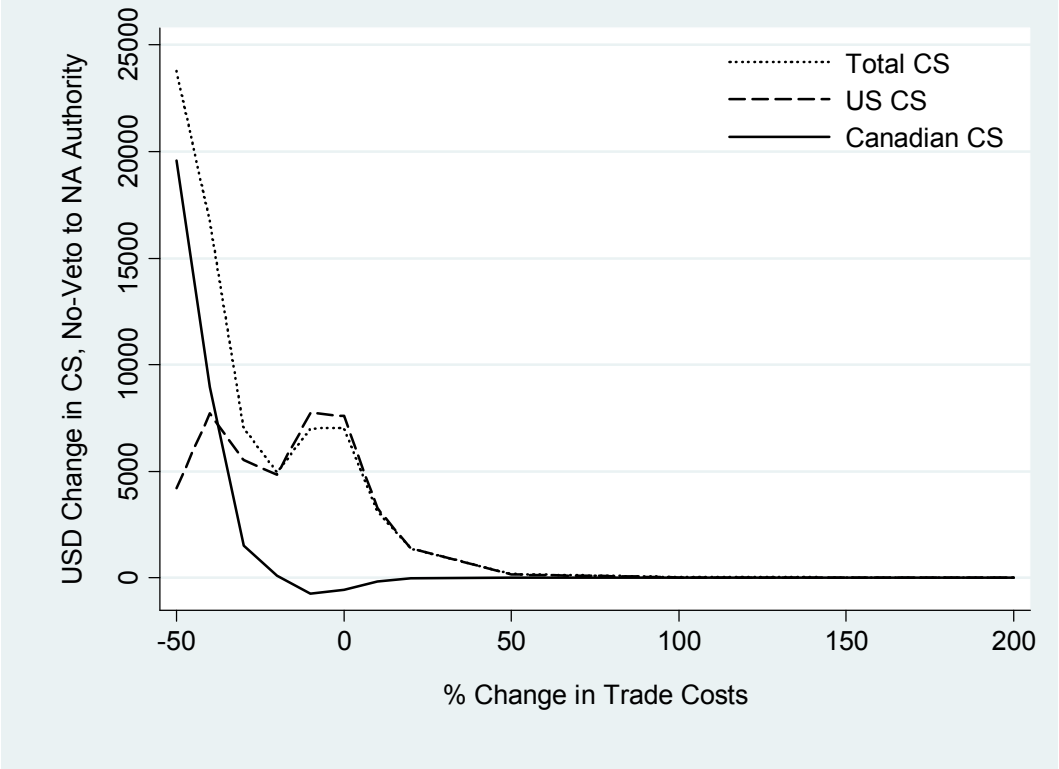
Notes: Figure shows means across sectors of the fraction of profitable mergers where a conflict arose (calculated as a fraction of all profitable merger opportunities for each sector). "Too lenient for the US" means that Canada authorised a merger which lowered consumer surplus in the U.S.; "Too tough for the US" 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.

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



Notes: The figure shows the USD change in consumer surplus induced by a move from veto rights to no-veto rights for different levels of trade cost changes.

Figure 8: Consumer surplus change, move from Veto-Rights Case to North-American Competition Authority



Notes: The figure shows the USD change in consumer surplus induced by a move from the veto-rights case to a North-American competition authority for different levels of trade cost changes.

Table 1: Empirical Moments – Summary Statistics

Empirical Moment	Mean	Median	Standard Deviation	Minimum	Maximum
# M&As US	1.89	1.03	3.2	0	25.5
# M&As CAN	0.15	0.05	0.23	0	1.2
Export Price Ratio CAN/US	1.07	1.11	0.15	0.73	1.59
Shipments US ('000 USD)	20914894	11847495	29481158	978468	2.18E+08
Shipments CAN ('000 USD)	1580744	852509	2563169	23257	19167750
Exports US ('000 USD)	503553	186566	1064862	2318	10003740
Exports CAN ('000 USD)	756379	177074	2666532	104	31143030
HHI US (%)	609	431	565	19	2760
HHI CAN (%)	1306	882	1189	77	6200
Total Cost US ('000 USD)	15491544	8853675	23554262	664482	1.76E+08
Total Cost CAN ('000 USD)	1775104	817824	3668129	40161	36875100
Observations	156	156	156	156	156

Notes: 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.

Table 2: Parameter Values – Summary Statistics

A) Parameters from Data	Mean	Median	Standard Deviation	Minimum	Maximum
α^{US}	1	1	1	1	1
α^{CAN}	0.750	0.750	0.750	0.750	0.750
N^{US}	1574.006	655	3173.156	21	32800
- of which active	13.4%	9.2%	16.2%	0.3%	99.9%
N^{CAN}	263.686	126.5	425.8	10	3840
- of which active	47.4%	33.6%	35.2%	2.5%	100.2%
β^{US}	50	50	0	50	50
β^{CAN}	50	50	0	50	50
η^{US}	0.286	0.274	0.099	0.034	0.53
η^{CAN}	0.258	0.258	0.096	0.017	0.488
B) Calibrated Parameters	**Mean**	**Median**	**Standard Deviation**	**Minimum**	**Maximum**
T^{US}	71.017	9.615	279.863	0	2000
T^{CAN}	4.88	0.607	25.281	0	301
a^{US}	25	25	0	25	25
a^{CAN}	65.407	23.25	119.912	1.59	780
$1/b^{US}$	17529.46	6205	46191.56	219	460000
$1/b^{CAN}$	5080.603	496.5	29392.53	3.72	354000
$\tau^{CAN,US}$	1.758	1.445	1.159	0.837	12.8
$\tau^{US,CAN}$	1.861	1.515	1.3	0.052	8.5
ζ^{US}	5.593	5.105	3.135	0.943	27.8
ζ^{CAN}	22.972	8.255	138.879	2.46	1740
x^{US}	0.381	0.178	0.643	0.005	3.81
x^{CAN}	0.481	0.269	0.707	0.037	4.8
Observations	156	156	156	156	156

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

Table 3: Simulated Domestic and Cross-Border Price Effects of Mergers between Active Firms (Baseline: Veto Rights)

Price Effect	Mean	Median	Standard Deviation	Minimum	Maximum
US merger, US price	-0.11%	-0.06%	0.12%	-0.78%	0.00%
US merger, Canadian price	-0.03%	-0.01%	0.09%	-0.77%	0.32%
Canadian merger, Canadian price	-0.14%	-0.07%	0.18%	-1.00%	0.00%
Canadian merger, US price	-0.08%	-0.01%	0.22%	-1.74%	0.00%

Table 4: Synergy Effects for Baseline Case (reduction in marginal costs of merged firm relative to merger party with the lowest marginal costs)

MC Reduction	Mean	Median	Standard Deviation	Minimum	Maximum
US mergers	-7.1%	-6.8%	2.8%	-19.6%	-1.8%
Canadian mergers	-11.1%	-7.2%	9.6%	-52.2%	-3.5%

Table 5: Introducing Veto Rights

Change in Outcome (000s USD)	Mean	Median	Standard Deviation	Minimum	Maximum
Panel A: U.S. Veto over Canadian Mergers					
Total Consumer Surplus US+Canada	0	0	0	0	0
Consumer Surplus US	0	0	0	0	0
Consumer Surplus Canada	0	0	0	0	0
Panel B: Canadian Veto over U.S. Mergers					
Total Consumer Surplus US+Canada	-1486.5	0	8505.5	-75872.5	185
Consumer Surplus US	-1618.7	0	9221	-80714.2	163.4
Consumer Surplus Canada	132.3	0	746.2	0	5788.2
Panel C: Bilateral Veto Rights					
Total Consumer Surplus US+Canada	-1486.5	0	8505.5	-75872.5	185
Consumer Surplus US	-1618.7	0	9221	-80714.2	163.4
Consumer Surplus Canada	132.3	0	746.2	0	5788.2

Table 6: Only Accept Mergers which Increase Total Consumer Surplus ("North American Competition Authority")

Change in Outcome (000s USD)	Mean	Median	Standard Deviation	Minimum	Maximum
Total Consumer Surplus US+Canada	7043	11.6	39422.8	-14953.9	304897.9
Consumer Surplus US	7593.2	0	44433.4	-15664.1	363737.2
Consumer Surplus Canada	-550.3	2.4	5626.6	-58839.3	13790.6

Figure A.1: Theoretical vs. Empirical Moments, Veto Rights (targeted moments)

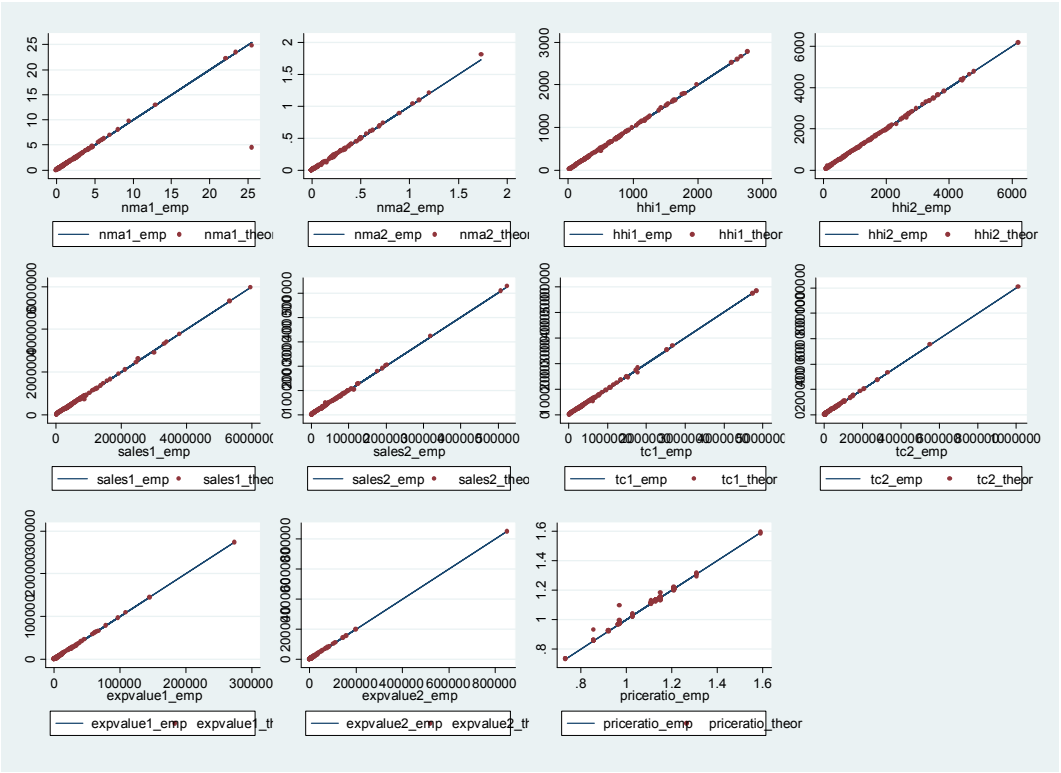


Figure A.2: Theoretical vs. Empirical Moments, Veto Rights (moments not targeted)

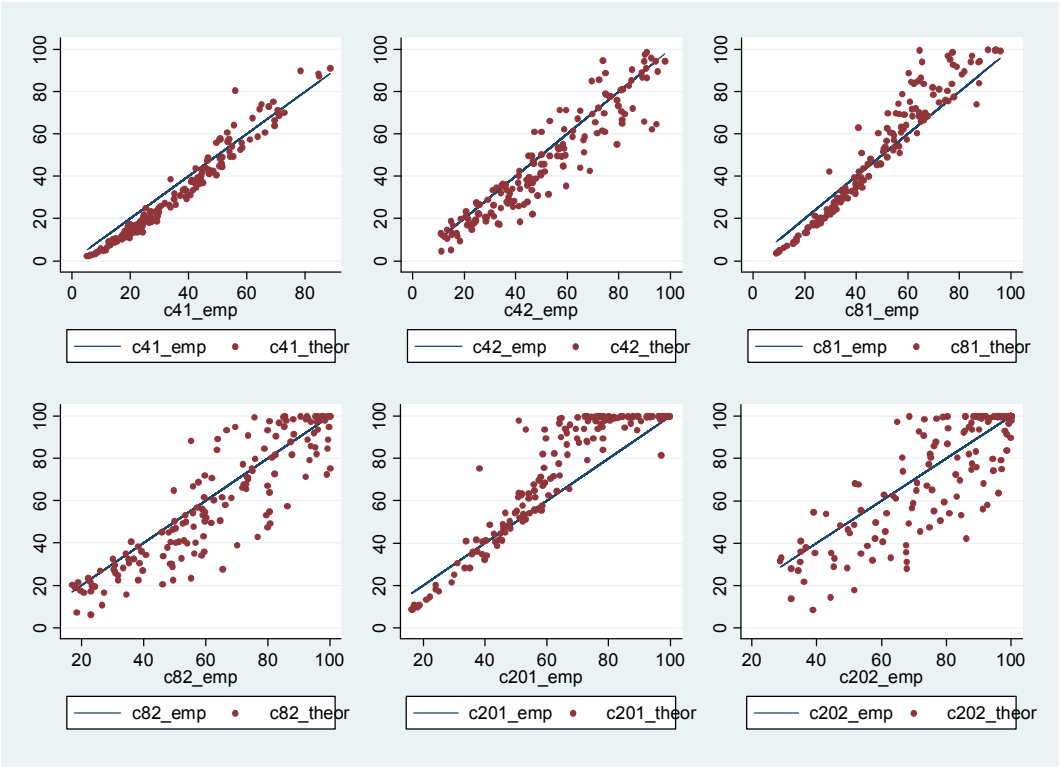
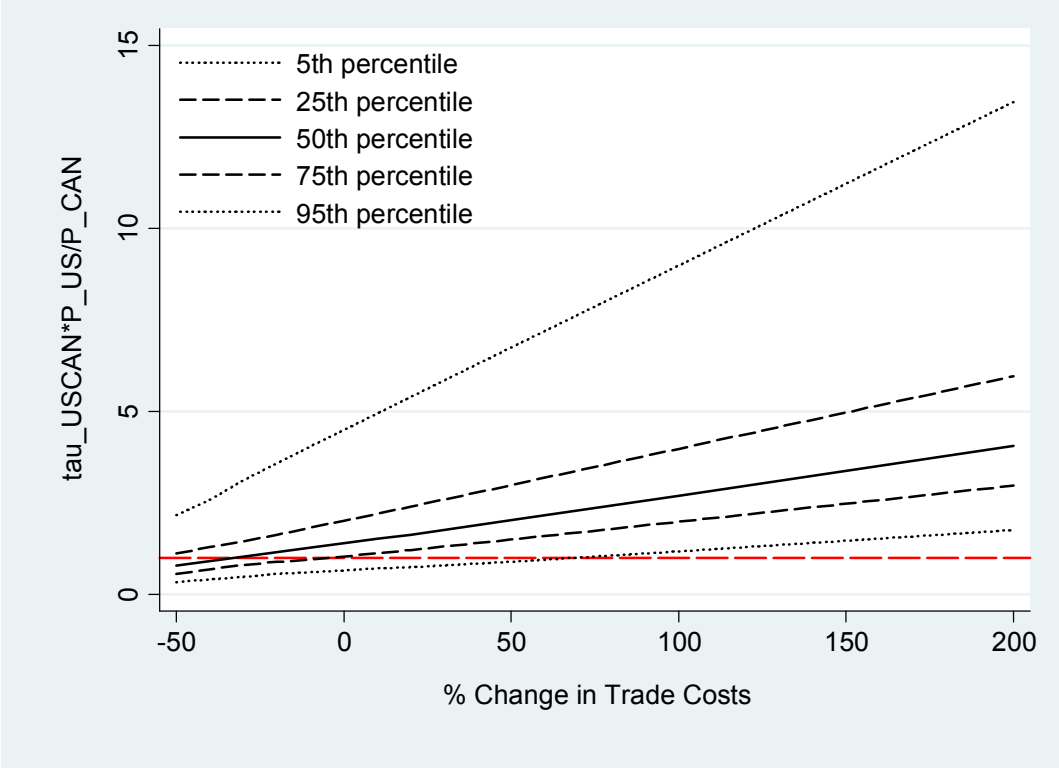
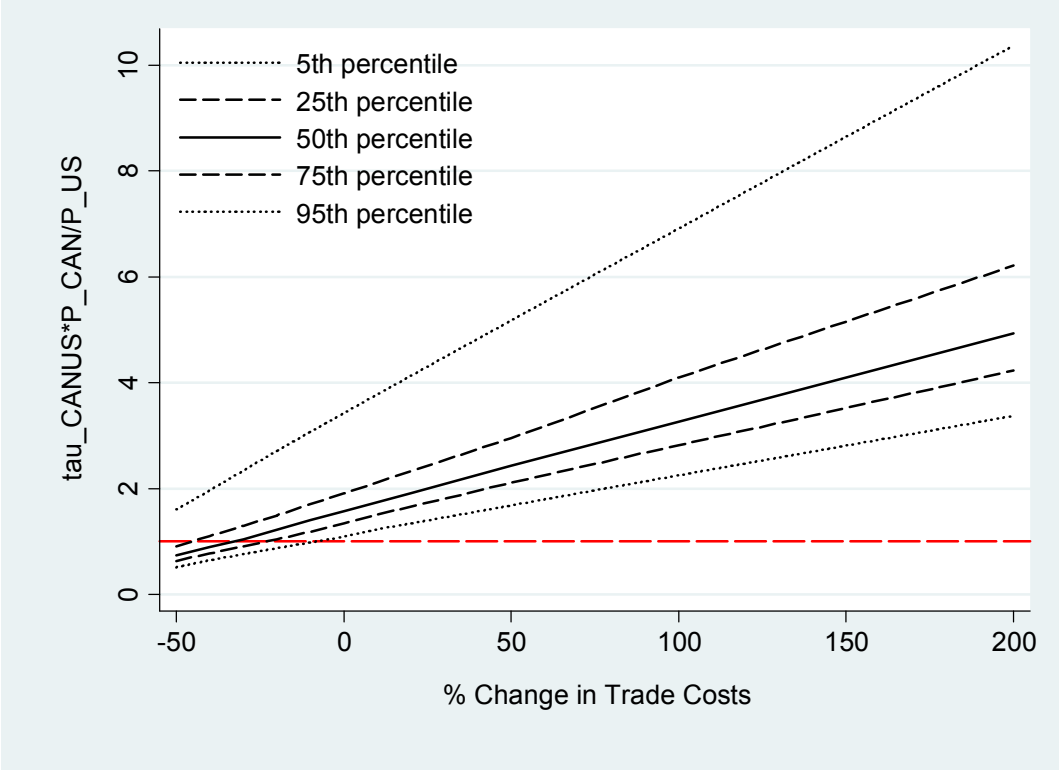


Figure A.3: Potential Conflicts arising from U.S. Mergers (Veto-Rights Baseline)



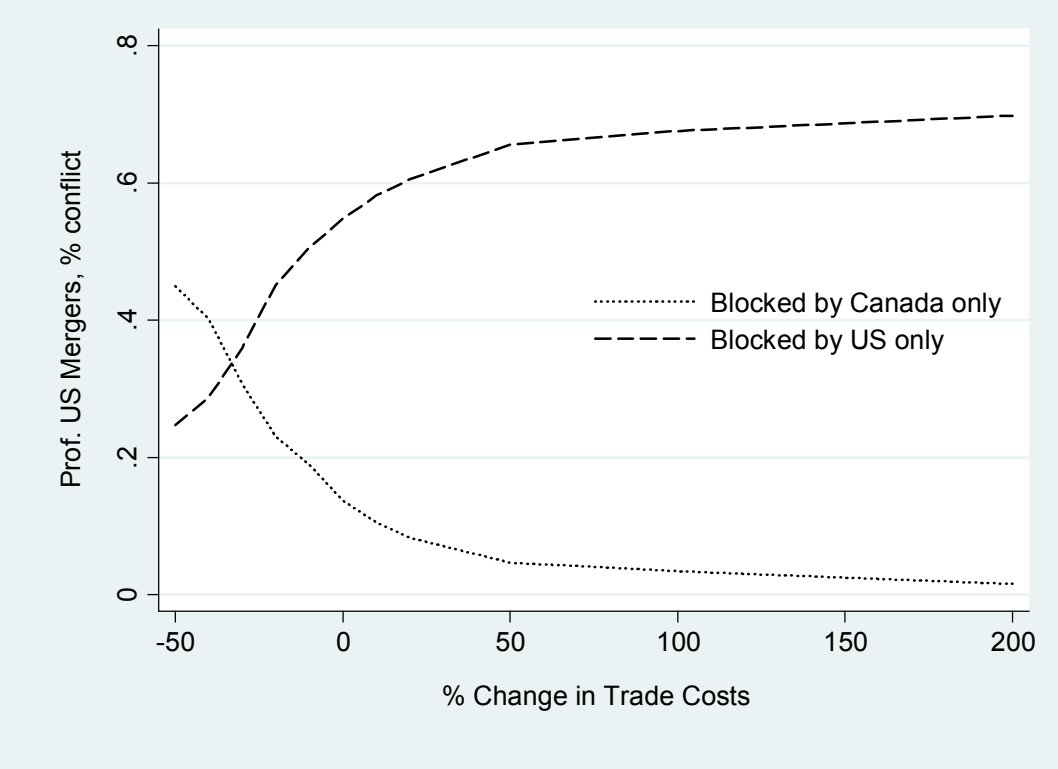
Notes: Figure shows percentiles of the distribution of τ_{USCAN}*P_{US}/P_{CAN} across sectors for different trade cost changes. Values larger than 1 indicate U.S. merger control (over U.S. mergers) will be too tough for Canada. Values smaller than 1 indicate Canadian merger control is too tough for the U.S.

Figure A.4: Potential Conflicts arising from Canadian Mergers (Veto-Rights Baseline)



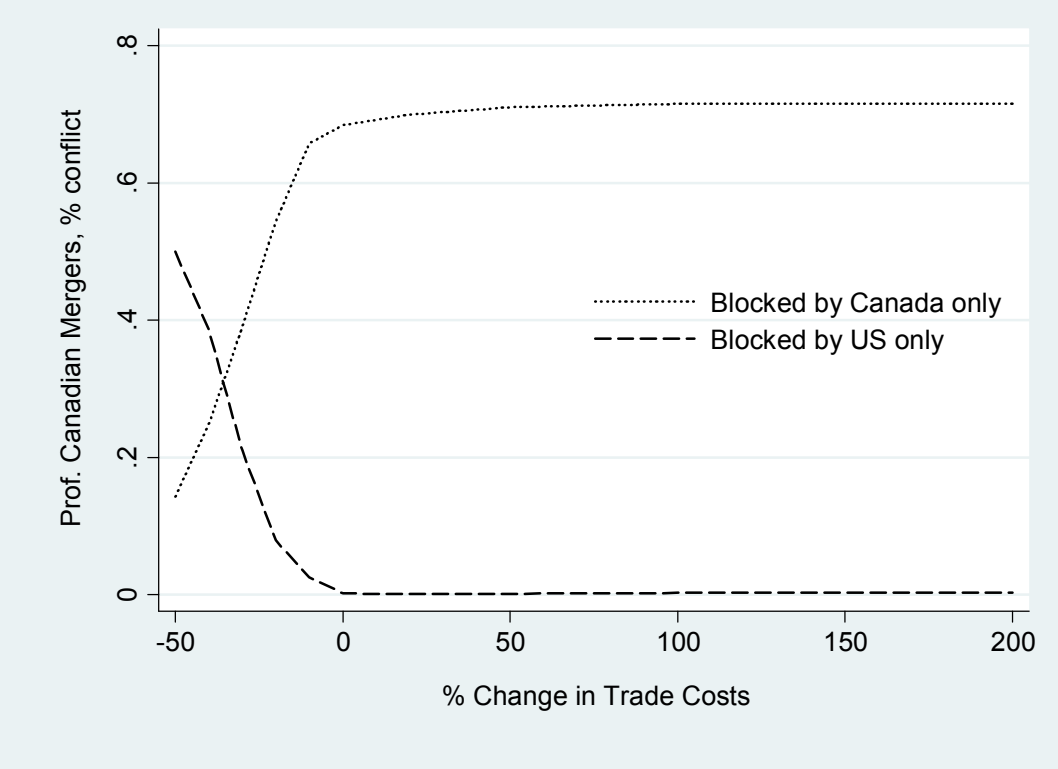
Notes: Figure shows percentiles of the distribution of τ_{CANUS}*P_{CAN}/P_{US} across sectors for different trade cost changes. Values larger than 1 indicate Canadian merger control (over Canadian mergers) will be too tough for the U.S. Values smaller than 1 indicate U.S. merger control is too tough for Canada.

Figure A.5: Actual Conflicts, % of all profitable merger opportunities, only sectors with merger opportunities (U.S. mergers, Veto-Rights Baseline)



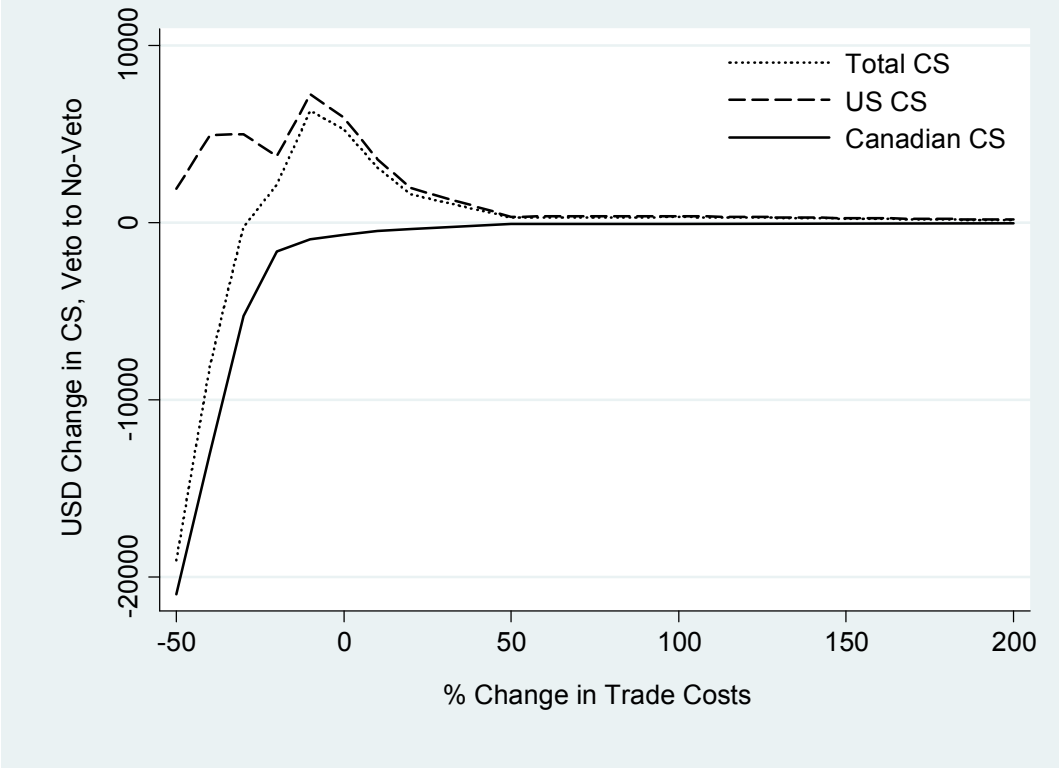
Notes: Figure shows means across sectors of the fraction of profitable mergers where a conflict arose (calculated as a fraction of all profitable merger opportunities for each sector). "Blocked by Canada only" means that the U.S. authorised the merger but Canada blocked it; "blocked by US only" means that Canada authorised the merger but the US blocked it. If there are no merger opportunities in a sector, the sector is dropped.

Figure A.6: Actual Conflicts, % of all profitable merger opportunities, only sectors with merger opportunities (Canadian mergers, Veto-Rights Baseline)



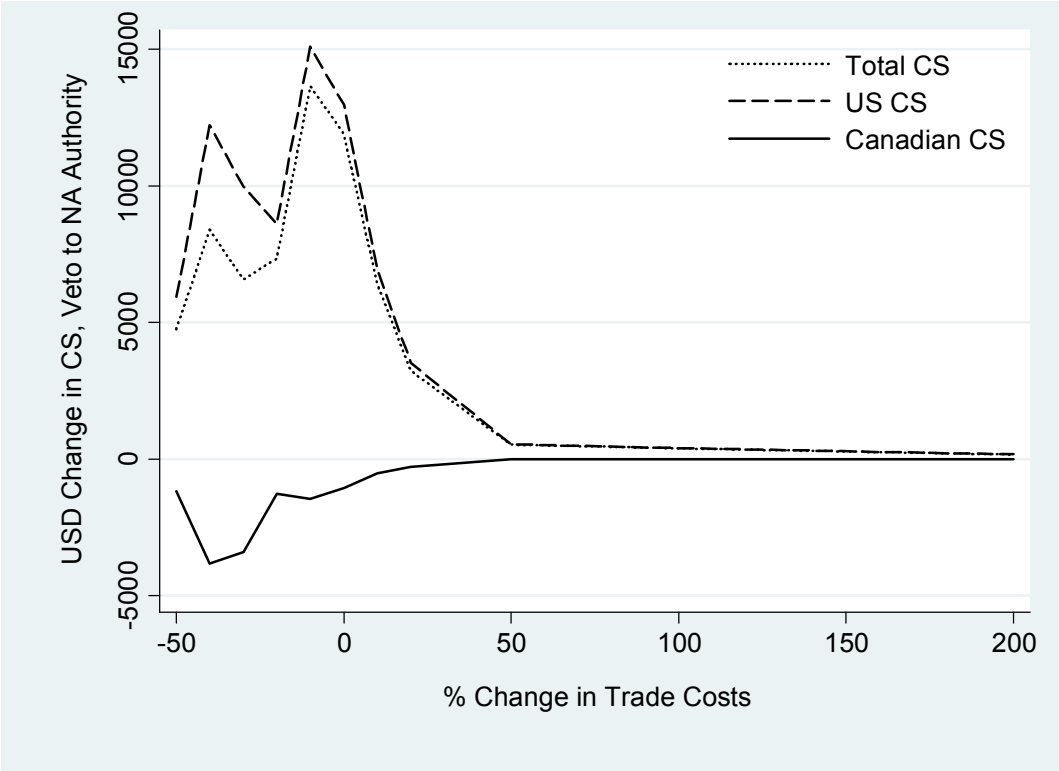
Notes: Figure shows means across sectors of the fraction of profitable mergers where a conflict arose (calculated as a fraction of all profitable merger opportunities for each sector). "Blocked by Canada only" means that the U.S. authorised the merger but Canada blocked it; "Blocked by US only" means that Canada authorised the merger but the US blocked it. If there are no merger opportunities in a sector, the sector is dropped.

Figure A.7: Consumer surplus change, move from Veto to No-Veto Case (Veto Rights Baseline)



Notes: The figure shows the USD change in consumer surplus induced by a move from veto rights to no-veto rights for different levels of trade cost changes.

Figure A.8: Consumer surplus change, move from Veto-Rights Case to North-American Competition Authority



Notes: The figure shows the USD change in consumer surplus induced by a move from the veto-rights case to a North-American competition authority for different levels of trade cost changes.

Figure A.9: Theoretical vs. Empirical Moments - Targeted Moments (Competitive Fringe Model)

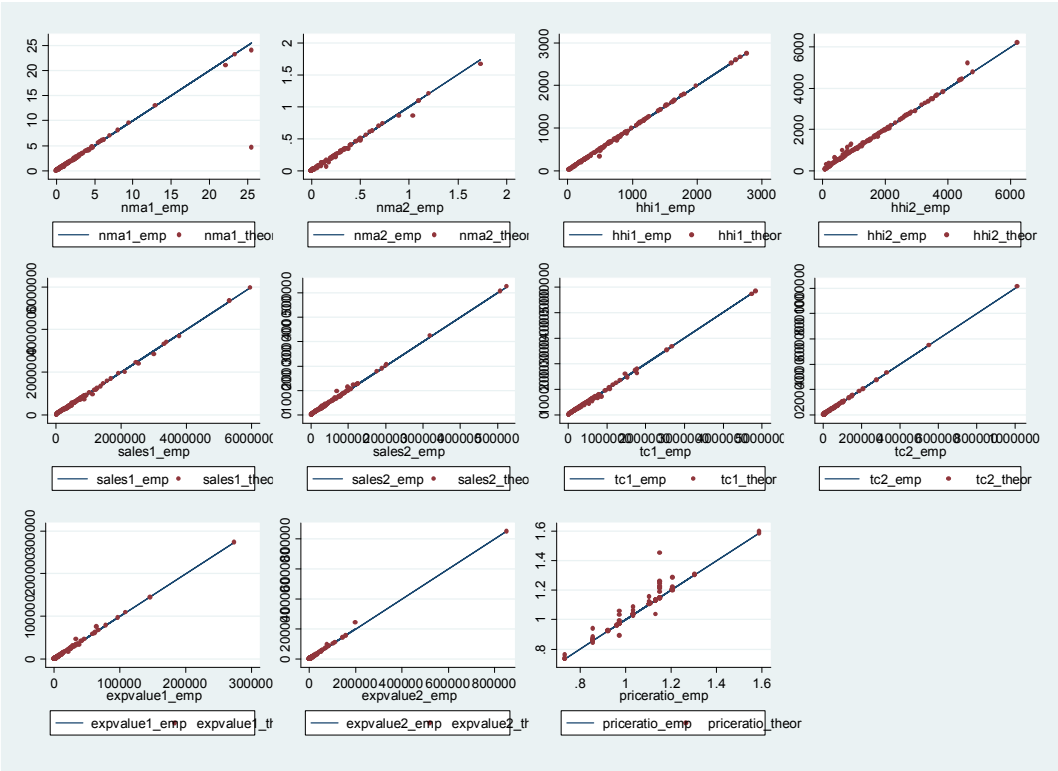


Figure A.10: Theoretical vs. Empirical Moments – Moments Not Targeted (Competitive Fringe Model)

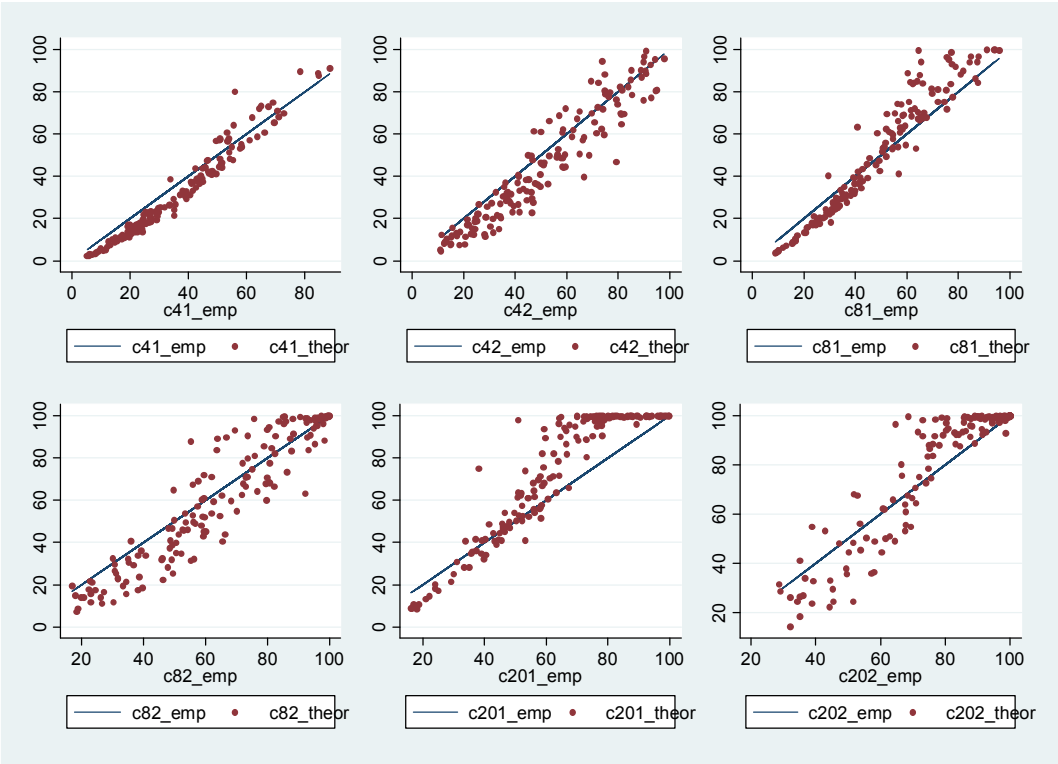
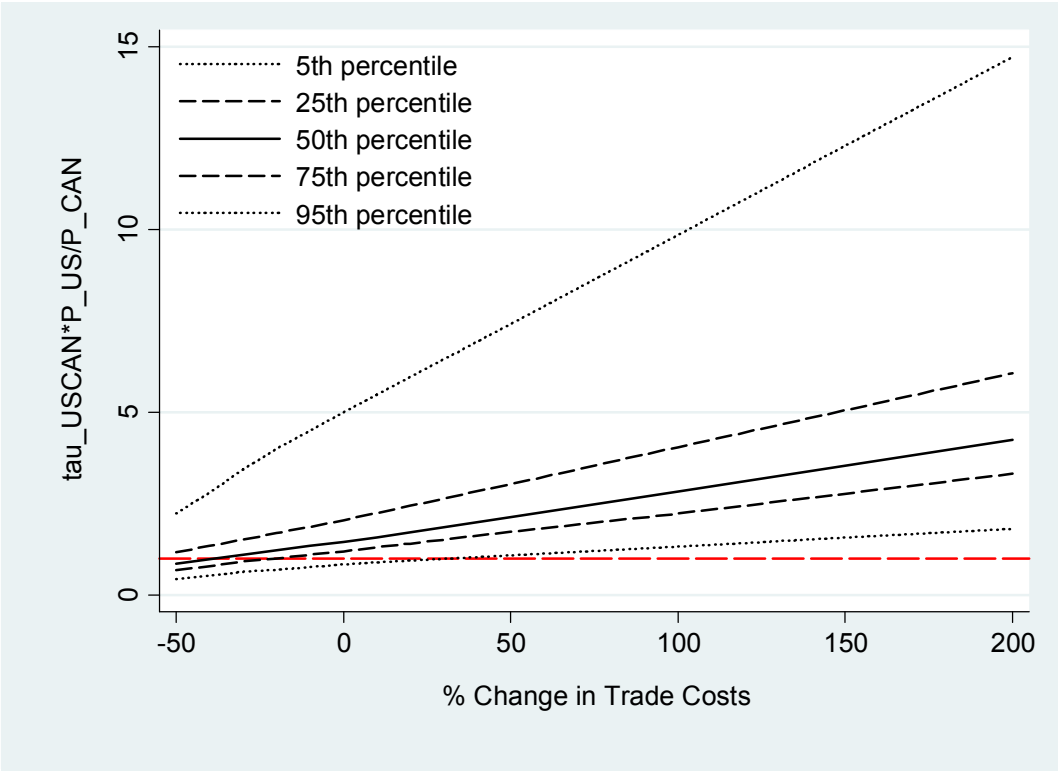
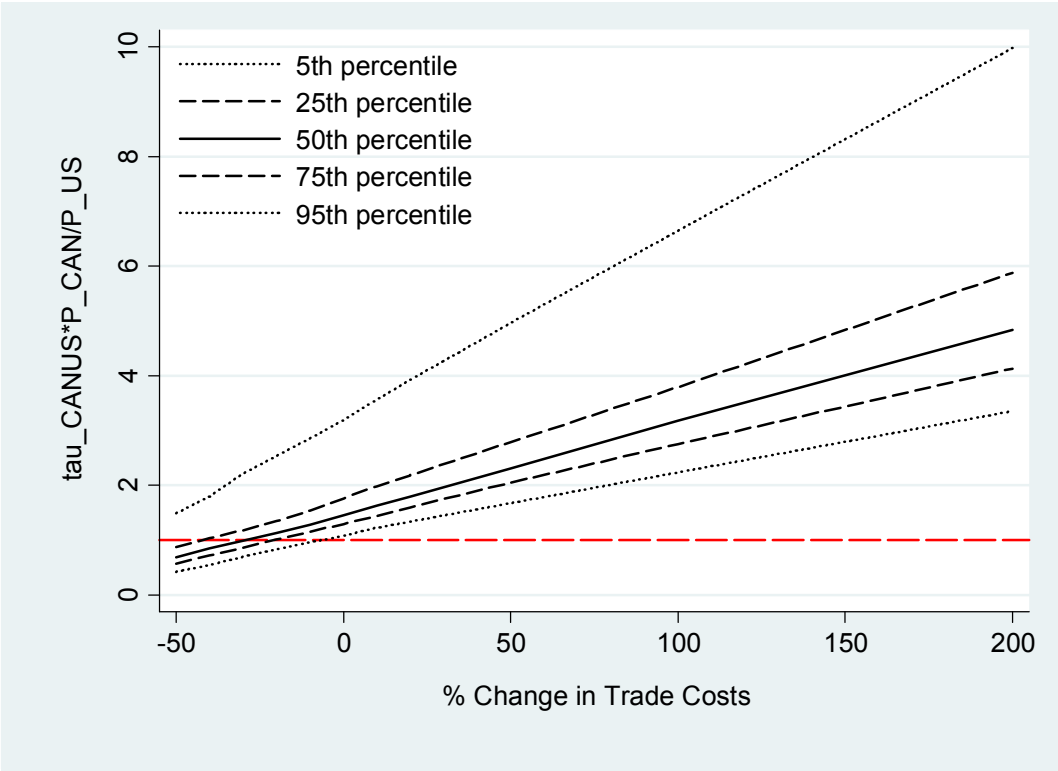


Figure A.11: Potential Conflicts arising from U.S. Mergers (Competitive Fringe Baseline)



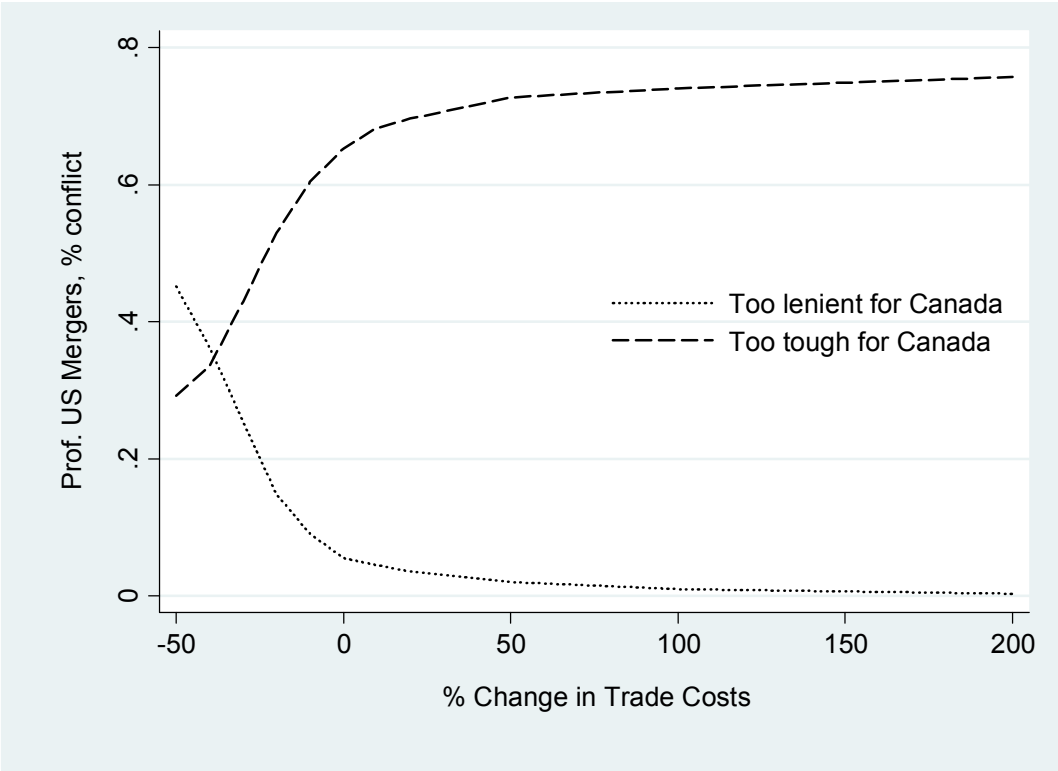
Notes: Figure shows percentiles of the distribution of τ_{USCAN}*P_{US}/P_{CAN} across sectors for different trade cost changes. Values larger than 1 indicate U.S. merger control (over U.S. mergers) will be too tough for Canadian consumers. Values larger than 1 indicate U.S. merger control (over U.S. mergers) will be too lenient for Canada consumers.

Figure A.12: Potential Conflicts arising from Canadian Mergers (Comp. Fringe Baseline)



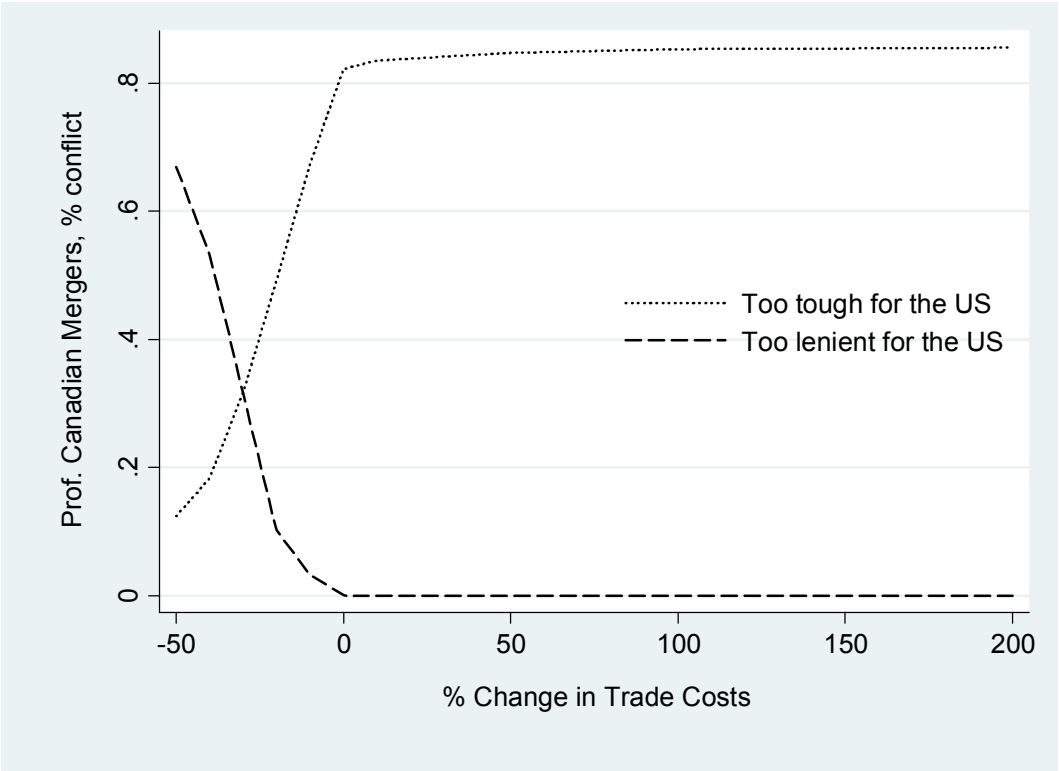
Notes: Figure shows percentiles of the distribution of τ_{CANUS}*P_{CAN}/P_{US} across sectors for different trade cost changes. Values larger than 1 indicate Canadian merger control (over Canadian mergers) will be too tough for the U.S. Values smaller than 1 indicate U.S. merger control is too tough for Canada.

Figure A.13: Actual Conflicts, % of all profitable merger opportunities, only sectors with merger opportunities (U.S. mergers, Competitive Fringe Baseline)



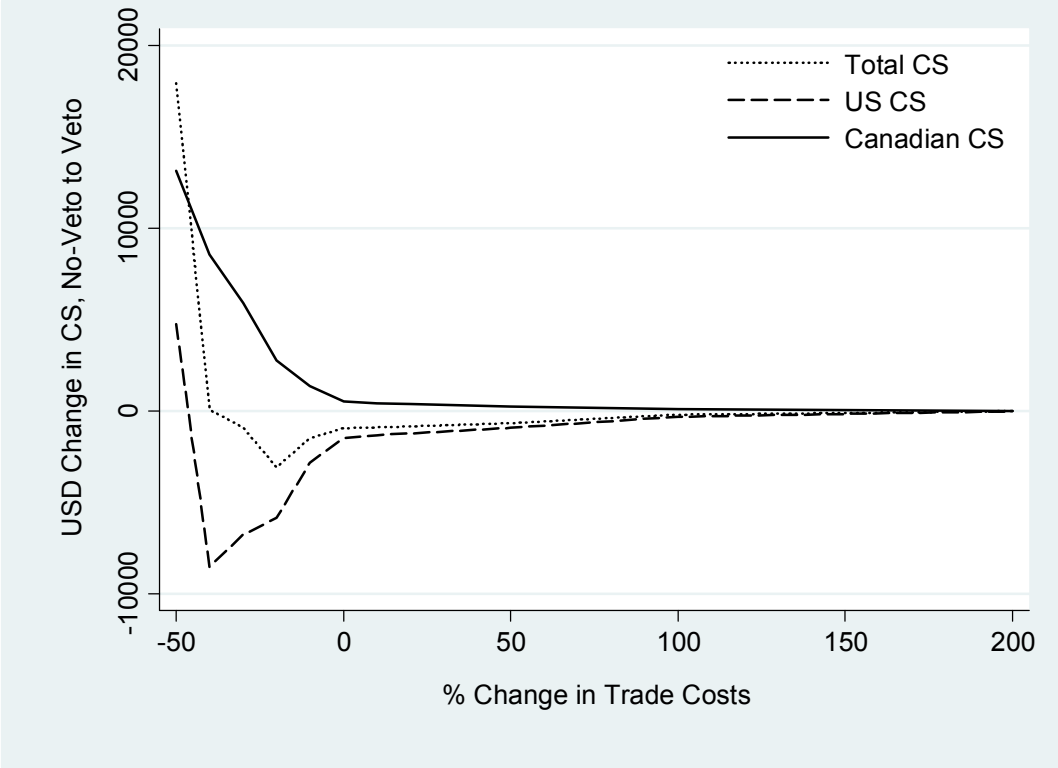
Notes: Figure shows means across sectors of the fraction of profitable mergers where a conflict arose (calculated as a fraction of all profitable merger opportunities for each sector). "Too lenient for Canada" means that the U.S. authorised a merger which lowered consumer surplus in Canada; "Too tough for Canada" means that the US blocked a merger which would have increased Canadian consumer surplus. If there are no merger opportunities in a sector, the sector is dropped.

Figure A.14: Actual Conflicts, % of all profitable merger opportunities, only sectors with merger opportunities (Canadian mergers, Competitive Fringe Baseline)



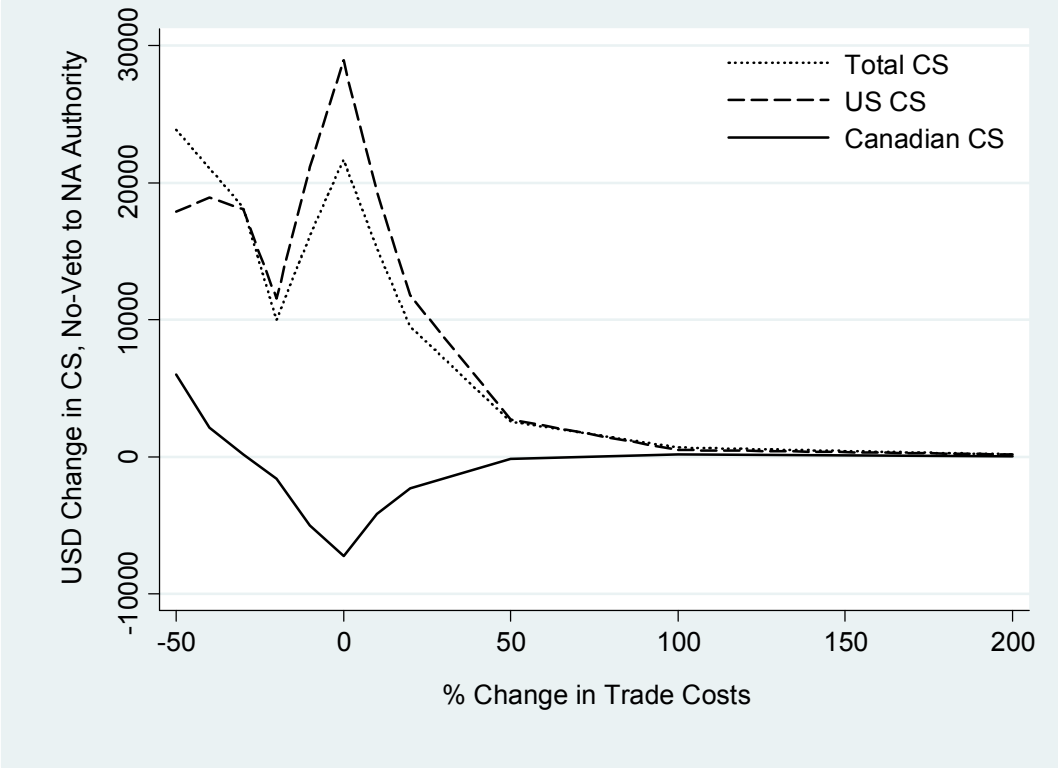
Notes: Figure shows means across sectors of the fraction of profitable mergers where a conflict arose (calculated as a fraction of all profitable merger opportunities for each sector). "Too lenient for the US" means that Canada authorised a merger which lowered consumer surplus in the U.S.; "Too tough for the US" 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.

Figure A.15: Consumer surplus change, move from No-Veto to Veto Case (Competitive Fringe Baseline)



Notes: The figure shows the USD change in consumer surplus induced by a move from veto rights to no-veto rights for different levels of trade cost changes.

Figure A.16: Consumer surplus change, move from Veto-Rights Case to North-American Competition Authority (Competitive Fringe Baseline)



Notes: The figure shows the USD change in consumer surplus induced by a move from the veto-rights case to a North-American competition authority for different levels of trade cost changes.

Table A1: Parameter Values – Summary Statistics (Veto-Rights Calibration)

A) Parameters from Data	Mean	Median	Standard Deviation	Minimum	Maximum
α^{US}	1	1	1	1	1
α^{CAN}	0.750	0.750	0.750	0.750	0.750
N^{US}	1574.006	655	3173.156	21	32800
N^{CAN}	263.686	126.5	425.8	10	3840
β^{US}	50	50	0	50	50
β^{CAN}	50	50	0	50	50
η^{US}	0.286	0.274	0.099	0.034	0.53
η^{CAN}	0.258	0.258	0.096	0.017	0.488
B) Calibrated Parameters	**Mean**	**Median**	**Standard Deviation**	**Minimum**	**Maximum**
T^{US}	78.424	13.05	284.262	0	2000
T^{CAN}	4.763	0.59	25.122	0	300
a^{US}	25	25	0	25	25
a^{CAN}	65.018	23.25	118.738	1.6	761
$1/b^{US}$	17509.88	6205	46192.72	219	460000
$1/b^{CAN}$	5080.737	496.5	29392.25	3.76	354000
$\tau^{CAN,US}$	1.758	1.445	1.158	0.837	12.8
$\tau^{US,CAN}$	1.86	1.515	1.299	0.052	8.5
ζ^{US}	5.603	5.115	3.06	0.943	25.8
ζ^{CAN}	11.806	8.265	10.784	2.46	77.2
x^{US}	0.381	0.178	0.644	0.005	3.81
x^{CAN}	0.48	0.267	0.707	0.037	4.8
Observations	156	156	156	156	156

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

Table A.2: Simulated Domestic and Cross-Border Price Effects of Mergers between Active Firms (Veto Rights Baseline Calibration)

Price Effect	Mean	Median	Standard Deviation	Minimum	Maximum
US merger, US price	-0.13%	-0.07%	0.14%	-0.85%	0.00%
US merger, Canadian price	-0.04%	-0.02%	0.08%	-0.77%	0.00%
Canadian merger, Canadian price	-0.14%	-0.07%	0.18%	-1.00%	0.00%
Canadian merger, US price	-0.08%	-0.01%	0.21%	-1.70%	0.00%

Table A.3: Synergy Effects for Veto-Rights Baseline (reduction in marginal costs of merged firm relative to merger party with the lowest marginal costs)

MC Reduction	Mean	Median	Standard Deviation	Minimum	Maximum
US mergers	-7.9%	-7.3%	2.2%	-19.6%	-5.1%
Canadian mergers	-11.0%	-7.3%	9.3%	-52.1%	-3.5%

Table A.4: Removing Veto Rights (Veto Rights Baseline Calibration)

Change in Outcome (000s USD)	Mean	Median	Standard Deviation	Minimum	Maximum
Panel A: Remove U.S. Veto over Canadian Mergers					
Total Consumer Surplus US+Canada	0	0	0	0	0
Consumer Surplus US	0	0	0	0	0
Consumer Surplus Canada	0	0	0	0	0
Panel B: Remove Canadian Veto over U.S. Mergers					
Total Consumer Surplus US+Canada	5271.9	0	30001.9	-1426	259856.4
Consumer Surplus US	5937.8	0	34029.3	-642.2	294787.9
Consumer Surplus Canada	-665.9	0	4049.6	-34931.5	0
Panel C: Bilateral Removal of Veto Rights					
Total Consumer Surplus US+Canada	5271.9	0	30001.9	-1426	259856.4
Consumer Surplus US	5937.8	0	34029.3	-642.2	294787.9
Consumer Surplus Canada	-665.9	0	4049.6	-34931.5	0

Table A.5: Only Accept Mergers which Increase Total Consumer Surplus ("North American Competition Authority", Veto-Rights Baseline)

Change in Outcome (000s USD)	Mean	Median	Standard Deviation	Minimum	Maximum
Total Consumer Surplus US+Canada	11905.7	24.5	51335.4	-19567.6	338973.8
Consumer Surplus US	12976.1	3.9	57348.6	-20069.5	371821.1
Consumer Surplus Canada	-1070.5	0	6546.3	-60103.2	13790.6

Table A.6: Parameter Values – Summary Statistics (Competitive Fringe Calibration)

A) Parameters from Data	Mean	Median	Standard Deviation	Minimum	Maximum
α^{US}	1	1	1	1	1
α^{CAN}	0.750	0.750	0.750	0.750	0.750
N^{US}	1517.448	619	3171.681	22	32818
Fraction Oligopolists (US)	0.207	0.114	0.267	0.011	1
N^{CAN}	256.531	124	428.102	10	3842
Fraction Oligopolists (CAN)	0.239	0.198	0.166	0.04	1
β^{US}	50	50	0	50	50
β^{CAN}	50	50	0	50	50
η^{US}	0.284	0.273	0.099	0.034	0.53
η^{CAN}	0.254	0.257	0.096	0.017	0.488
B) Calibrated Parameters	**Mean**	**Median**	**Standard Deviation**	**Minimum**	**Maximum**
T^{US}	87.99	13.485	307.285	0	2000
T^{CAN}	58.729	1.501	227.179	0	2000
a^{US}	25	25	0	25	25
a^{CAN}	40.064	20.213	83.581	1.442	812.27
$1/b^{US}$	16981.139	6043.454	39438.338	219.464	295942.99
$1/b^{CAN}$	4452.25	598.309	14922.921	6.667	134906.531
$\tau^{CAN,US}$	1.664	1.359	1.135	0.828	12.231
$\tau^{US,CAN}$	2.168	1.594	2.726	0.614	31.183
ζ^{US}	1.46E+27	5.345	1.76E+28	0.938	2.12E+29
ζ^{CAN}	1.60E+52	11.784	1.93E+53	2.474	2.32E+54
x^{US}	0.436	0.191	0.756	0.014	4.562
x^{CAN}	0.563	0.283	0.847	0.037	5.028
Observations	145	145	145	145	145

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

Table A.7: Simulated Domestic and Cross-Border Price Effects of Mergers between Active Firms (Competitive Fringe Baseline)

Price Effect	Mean	Median	Standard Deviation	Minimum	Maximum
US merger, US price	-0.15%	-0.10%	0.14%	-0.76%	-0.01%
US merger, Canadian price	-0.05%	-0.03%	0.30%	-1.29%	2.10%
Canadian merger, Canadian price	-0.23%	-0.19%	0.21%	-1.32%	-0.01%
Canadian merger, US price	-0.25%	-0.10%	0.37%	-2.02%	0.00%

Table A.8: Synergy Effects for Competitive Fringe Baseline (reduction in marginal costs of merged firm relative to merger party with the lowest marginal costs)

MC Reduction	Mean	Median	Standard Deviation	Minimum	Maximum
US mergers	-10.2%	-8.3%	6.9%	-52.0%	-2.3%
Canadian mergers	-24.0%	-16.3%	19.3%	-86.2%	-3.8%

Table A.9: Introducing Veto Rights (Competitive Fringe Baseline)

Change in Outcome (000s USD)	Mean	Median	Standard Deviation	Minimum	Maximum
Panel A: U.S. Veto over Canadian Mergers					
Total Consumer Surplus US+Canada	0.2	0	1.4	0	13.9
Consumer Surplus US	0.2	0	1.6	0	16.1
Consumer Surplus Canada	0	0	0.2	-2.2	0
Panel B: Canadian Veto over U.S. Mergers					
Total Consumer Surplus US+Canada	-932.9	0	6879.6	-77163.7	3273.9
Consumer Surplus US	-1470.4	0	11084.4	-128630	2404.7
Consumer Surplus Canada	537.5	0	4401.3	0	51466.2
Panel C: Bilateral Veto Rights					
Total Consumer Surplus US+Canada	-932.7	0	6879.7	-77163.7	3273.9
Consumer Surplus US	-1470.3	0	11084.4	-128630	2404.7
Consumer Surplus Canada	537.5	0	4401.3	-2.2	51466.2

Table A.10: Only Accept Mergers which Increase Total Consumer Surplus ("North American Competition Authority", Competitive Fringe Baseline)

Change in Outcome (000s USD)	Mean	Median	Standard Deviation	Minimum	Maximum
Total Consumer Surplus US+Canada	21683	221.7	63239.3	-1912.1	415324.1
Consumer Surplus US	28933.4	53.9	86378.2	-9984.5	543013.6
Consumer Surplus Canada	-7250.4	0	24850.4	-172559	14910.5