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The welfare consequences of import tariffs: A quantitative perspective☆

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ABSTRACT

The quantitative trade literature often does not distinguish between tariffs and iceberg trade costs. This paper explores qualitatively and quantitatively how this distinction matters for the gains from trade. Most obviously, tariffs generate government revenues, while icebergs do not. In models of monopolistic competition, they may also affect entry. Finally, depending on whether they are modeled as cost or demand shifters, tariffs may have different implications on profits, entry, and, in turn, on the elasticity of trade flows and welfare. We show that the welfare formula by Arkolakis, Costinot, and Rodriguez-Clare (2012) requires qualification, even in the simple single-sector case. We find that the quantitative welfare consequences of cost- versus demand-shifting tariffs can be important.

1. Introduction

In a very influential recent paper, Arkolakis, Costinot, and Rodriguez-Clare (2012, henceforth ACR) derive a simple formula that allows computing the welfare gains relative to autarky based on a single statistic, the observed share of a country's trade with itself, and on a single parameter, the trade flow elasticity obtained from a gravity equation. This result holds in a class of popular one-sector trade models which differ with respect to assumptions about microeconomic structure.[1] ACR's main conclusion is that the novel features stressed in the recent theoretical literature—imperfect competition and the presence of an extensive margin—have no extra role to play for the ex-post analysis of trade liberalization scenarios. So, the richer micro-level detail contained in new trade models "has not added much" to the gains from trade.

However, a limitation of this equivalence result is that it has been derived under the assumption that trade costs take the iceberg form only. Indeed, ACR acknowledge that their "… *main welfare formula would need to be modified to cover the case of tariffs. In particular, the results*

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[1] The frameworks include the perfect competition Armington (1969) model, the Krugman (1980) model of monopolistic competition and free entry, the stochastic Ricardian model of Eaton and Kortum (2002), and the Melitz (2003) extension of the Krugman model to heterogeneous firms.

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derived … ignore changes in tariff revenues, which may affect real income both directly and indirectly (through the entry and exit of firms)."[2]

In this paper, we explore the distinction between tariffs and iceberg trade costs for the equivalence result in ACR, both qualitatively and quantitatively. There are three considerations which increase in their degree of subtlety. First and most obviously, tariffs generate government revenues, while iceberg trade costs do not. This has direct implications for aggregate income and welfare. Second, tariff revenues may affect entry in models of monopolistic competition, which has an indirect effect on welfare. And, third, depending on whether tariffs are modeled as cost or demand shifters, they may have different implications on profits, entry, and, in turn, on the elasticity of trade flows and welfare. We build on recent work by Costinot and Rodriguez-Clare (2014, henceforth CR) who offer an excellent survey of recent methodological advances in quantitative trade modeling. They also introduce tariffs into the ACR framework. However, they base their simulations on the assumption that tariffs are imposed *before* the mark-up (if any) on marginal costs is charged. Then, tariffs shift the costs of producers as iceberg trade costs do; i.e., they act as cost shifters. Other trade policy papers, e.g., Brander and Spencer (1984), assume that tariffs are imposed *after* the mark-up is charged. Then, tariffs shift demand in the profit function of the foreign monopolist.[3]

Evidence on the empirical relevance of the two different modeling approaches is rare. Regulations of the World Trade Organization (WTO) say that "*[t]he customs value of imported goods shall be the transaction value, that is the price actually paid or payable for the goods when sold for export to the country of importation.*"[4] We sense that in monopolistic competition models the theoretical counterpart to the "price actually paid" is the price inclusive of the mark-up, but matters may look different if trade relationships involve related parties.

In the light of the vague definition, our analysis allows for both types of tariffs at the same time. Moreover, we analytically discuss both perfect and monopolistic competition models, highlighting the role of firm entry. To carve out the main mechanisms, we focus on single-sector versions of all models.

We report the following main results. First, ACR's main result requires qualification. Conditional on a country's observed trade share and tariff revenue share in GDP, the welfare gains from trade associated with moving to autarky are the same across models only in models without firm selection. This is the case in the Armington (1969), Krugman (1980) and Eaton and Kortum (2002) models. In contrast, the Melitz (2003) model features an entry effect. Hence, the presence of this entry effect combined with monopolistic competition matters for the gains from trade from tariff reductions. Moreover, in all models considered, tariffs change the welfare formula and therefore also affect the magnitude of gains from trade.

For the quantitative exercise, besides the iceberg trade cost elasticity, one also requires an estimate of the degree of heterogeneity, and, besides the trade share, one also requires the share of tariff revenue in total GDP. We find that the ACR formula underestimates the gains from trade relative to autarky for countries with positive tariffs, simply because it does not account for tariff revenue. Note that this result does not hinge on the modeling assumptions about tariffs.

Second, across models, micro-structure matters for policy evaluation. To illustrate this point, compare the Krugman model with cost-shifting tariffs to perfect competition models. Conditional on observed trade flows, tariff revenue is smaller in the Krugman case by the inverse of the mark-up.[5] This result is perfectly in line with CR; see their Eq. (20) in the online Appendix.

Third, complementing the analysis of CR, we analytically show that given changes in cost- and demand-shifting tariffs affect the domestic expenditure share differently. The reason is that tariffs imposed before or after mark-ups have differential effects on firm and tariff revenue. We find that the quantitative welfare consequences of cost- versus demand-shifting tariffs can be important. Consider, for example, the effects of unilateral 40% US import tariff on all trading partners. For the US, the Krugman model predicts a slight welfare loss of 0.01% with cost-shifting tariffs and a modest welfare gain of about 0.21% with demand-shifting tariffs. In the Melitz model, the same pattern arises. Hence, the entry effect induced by firm selection in the Melitz (2003) model modifies the gains from trade from tariff reductions qualitatively, but hardly matters quantitatively.[6,7]

The fact that iceberg trade costs and tariffs may have quite different effects on outcomes has been discussed in various papers but, to the best of our knowledge, only CR offer a comparative quantitative perspective à la ACR. Besedes and Cole (2013) use the framework of Chaney (2008) to show that the trade flow elasticity of tariffs is larger than that of iceberg trade costs. They argue that estimates derived from variables such as distance may underestimate the trade-enhancing effects of tariff reforms. We show that the different welfare effects derive more from the fact that tariffs generate revenue rather than from differences in elasticities.

Balistreri, Hillberry, and Rutherford (2011) point out that "*[revenue-generating tariffs rather than iceberg trade costs] can generate differences in the Melitz formulation relative to a perfect competition model*" (p. 96). Summarizing Balistreri and Markusen (2009), they furthermore argue that "*removing rent-generating tariffs have different effects in monopolistic competition* versus *Armington models, because optimal tariffs are different*" (p. 96). These findings are based on simulations. On the qualitative side, we provide an analytical proof that the first assertion holds and shows why it does so. It entirely depends on the difference between the iceberg trade costs and the tariff elasticities in the Melitz (2003) model. The second assertion, in contrast, is not generally true, since, for example, the Krugman (1980) and the Armington (1969) models do admit identical welfare expressions. On the quantitative side, Balistreri, Hillberry, and Rutherford (2011) report that adding firm heterogeneity to a standard computational equilibrium model increases gains from tariff liberalization by a multiple of four. Our quantitative analysis does not even closely come to this order of magnitude. However, their model is not straight-forward to compare with ours: they employ a multiple-sector model with input–output linkages, and they use another liberalization scenario and a different calibration strategy. We conjecture that the quantitative importance of tariffs goes up in the presence of a multi-sector structure.

ACR have triggered substantial further quantitative work on the gains from trade. CR present an excellent synthesis. One debate relates to the role of *procompetitive gains* from trade. Arkolakis, Costinot, Donaldson, and Rodriguez-Clare (2012) show for a single-sector Melitz (2003) model with Pareto distributed productivities and variable markups that pro-competitive gains from trade are negative. Edmond,

[2] See ACR (2012, footnote 33). Moreover, in their analysis of tariff reform in Costa Rica, Arkolakis, Costinot, and Rodriguez-Clare (2008) model trade reform as lower iceberg trade costs.

[3] CR discuss the way of modeling tariffs in a footnote and provide more analysis in a chapter of an online Appendix. They conclude that modeling of tariffs does not affect welfare conditional on the trade elasticity, the degree of heterogeneity across varieties, the change in the domestic expenditure share and tariff revenue raised in the initial situation (p. 13 of the online Appendix).

[4] See Article 1 of the WTO Agreement on Implementation of Article VII of the General Agreement on Tariffs and Trade 1994.

[5] The mark-up appears when conditioning tariff revenue on trade flows.

[6] Other extensions have larger welfare implications. Going from one-sector models to multi-sector models without intermediates and to multi-sector models with intermediates leads to substantially larger effects both within the class of perfect competition models (with average gains from trade ranging from 4.4% to 15.3% to 26.9%, respectively, as reported in Table 1 in CR), as well as between the Krugman and the Melitz model (average gains from trade in the Krugman model of 32.3% as compared to 40% in the Melitz model, as reported in Table 1 in CR).

[7] We also explore whether modeling fixed exporting costs in terms of source or destination labor matter. We find that the choice does not make a difference in scenarios that involve moving to autarky. In the evaluation of less extreme trade policy scenarios, the distinction matters from an analytical point of view, but the difference is of minor quantitative importance.