Variable demand elasticities and tariff liberalization ☆

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ABSTRACT

This paper examines tariff liberalization within an environment of heterogeneous demand elasticities. Varieties produced at a lower cost (a) are imported at lower absolute demand elasticities and (b) earn higher revenues. By virtue of larger demand elasticities, low revenue varieties benefit the most from tariff liberalization. Further, if varieties are substitutable, low revenue varieties benefit at the expense of high revenue varieties. These predictions are confirmed using a case study of US Uruguay Round ad-valorem tariff cuts, where within exporter-industry groups, low revenue varieties experienced large gains, and high revenue varieties experienced negligible gains. Further, I find evidence suggesting that these effects were also relevant for other trade shocks, such as exchange rates and specific tariffs.

1. Introduction

If one point has been made abundantly clear by the recent theory of international trade, it is that firms and firm heterogeneity have a profound effect on trade patterns. However, despite the significant amount of heterogeneity in firms and varieties across trading partners within narrowly defined products, the rules of the GATT/WTO, on a basic level, seem designed for a more homogenous environment. With regard to tariffs, this point is particularly salient, as outside of special safeguards, retaliatory measures, and all-or-nothing regional agreements, members have very little latitude regarding tariffs applied to different varieties of the same product. One particular guiding principle, "non-discrimination", imposes that all GATT/WTO members receive equal treatment, usually via a common, or "most favored nation" (MFN), tariff. This applies within any product, across all export sources without preferential status, and (obviously) does not discriminate by product characteristics. Further, this equal treatment rule extends to the process of liberalization, and allows for no consideration of which exporters and/or varieties stand to gain more or less from lower tariffs.

As an example, consider imports within the largest passenger vehicle category (HS8 code 87032300) by the United States in 1992. Overall, the US imported varieties within this product category from 13 different countries at an average pre-tariff unit-value of $15,315.67. However, this average varied substantially by country. For example, while the average import from Japan was fairly low price ($8112.04), the average imported vehicle from Germany was substantially more expensive ($25,475.98). Hence, it is unlikely that the average variety from each exporter has the same characteristics. Further, looking *within* imports from Germany across eleven HS10 sub-categories, the average price ranged from $9000 to $44,000. Hence, not only are imports from Germany and Japan quite different, but within Germany, imports across HS10 categories are also quite different. Yet, the WTO mandates that these products are treated equally in setting tariffs, and when liberalizing tariffs.

Overall, there is a clear friction between the precise intent of WTO rules regarding tariffs, and the natural differentiation which occurs in trade flows. Critically, even though the WTO prefers (and arguably promotes) the multilateral process over other preferential or regional schemes, it remains unclear how the effects of MFN liberalization accrue within products that exhibit significant differentiation in varieties. In what way should MFN tariff reductions influence bilateral trade flows? Are certain varieties more likely to gain from MFN liberalization based on their fundamental demand characteristics? Overall,

how are the benefits of additional import market access distributed across *competing* and *differentiated* export suppliers?

This paper answers these questions. Using a simple theoretical model based on Melitz and Ottaviano (2008), I show that the liberalization of a common ad-valorem tariff need not increase bilateral imports of all varieties. In particular, if elasticities vary across varieties, I show that liberalization of a common tariff has a natural disparate effect on the composition of aggregate trade flows. Indeed, within a wide class of demand systems that are consistent with empirical evidence in Campbell and Hopenhayn (2005), Foster et al. (2008), and more recently Feenstra and Weinstein (2010), the liberalization of a common tariff disproportionately increases imports of low revenue varieties, and in some cases, this increase comes at the expense of high revenue varieties. In analyzing the effects of US Uruguay Round tariff cuts, I find robust support for the model. Specifically, using within-exporter-industry variation in import values, I find that tariff elasticities are large, negative, and statistically significant for low revenue varieties and smaller and not statistically different from zero for high revenue varieties. In some cases, imports of high revenue varieties *fall* after tariff liberalization.

The key to the model is the degree to which demand elasticities vary across varieties. First, consider low-cost varieties, which earn relatively large revenues, and for a wide class of demand systems are also sold at relatively low absolute demand elasticities.[1] Given the low demand elasticities for these varieties, changes to tariffs have a fairly small direct effect on the value of bilateral imports. This is in stark contrast with varieties produced at a high cost, where revenues are fairly small but equilibrium demand elasticities are relatively large. Hence, for these varieties, changes to tariffs have a relatively large effect on the value of bilateral imports.

In equilibrium, the effects of changes to a common tariff are aggregated across all varieties, and competition is generally tougher when tariffs fall. That is, when tariffs fall, so does the residual demand for each variety, all else equal. It is the resolution of the tension between this aggregate effect and the effects related to demand elasticities which determine the varieties that benefit from tariff liberalization and to what extent. In particular, I show that the aggregate effect may in fact be larger than the direct effect for some varieties. As detailed above, these are the varieties that earn relatively large revenues before tariffs are cut. Thus, as a novel result, I show that tariff liberalization may in fact decrease imports of varieties that earn large revenues before the tariff cut. In contrast, I show that varieties earning low revenues always benefit from tariff liberalization by virtue of the high demand elasticity at which these varieties are sold. Overall, I show that for a wide class of demand systems, the traditional negative effects of tariffs are amplified for low revenue varieties, and smaller and/or of opposite sign for high revenue varieties.

Empirically, the model is evaluated using a case study of tariff reductions by the United States resulting from Uruguay Round GATT negotiations. Despite being a result of bargaining within the GATT, this case study is sensible on a number of levels. For one, data are available at the Exporter-HS10 level, which provides a useful amount of detail within narrowly defined products.[2] Second, reductions to MFN tariffs were relatively quick, most of which occurring over the period 1995–1999. Third, the evidence suggests that import growth rates before the Uruguay Round agreements were drafted were independent from whether an HS8 product received a tariff cut after the Uruguay Round was completed. Finally, the US HS8 tariff data provides information on whether specific tariffs were present, which provides for an analysis of multiple policy instruments.

Overall, I find evidence which is broadly supportive of the model. Regressing bilateral import growth rates on tariff growth rates and an interaction with initial import values, I find that within exporter-industry pairs, bilateral import elasticities (with respect to tariffs) were large, significant, and negative for varieties with the smallest pre-Uruguay Round import values. In contrast, and consistent with the theory, estimated elasticities are small and, with few exceptions, not significantly different from zero for varieties with the largest pre-Uruguay Round import values. In some cases, the point estimates are *greater* than zero, which is a novel focus of the theoretical models in Sections 2 and 3. These results are sharpened when focusing on products that exhibit higher within-industry substitution (as in Broda and Weinstein (2006)), as the theory predicts. Further, the results suggest that there is a substantial bias in naively assuming that elasticities are invariant to pre-liberalization import values. Precisely, the average true elasticity at the exporter-industry level is roughly one point less elastic than the naively estimated constant elasticity. Relative to the typical constant elasticity of bilateral imports (roughly −2), this bias is substantial. Finally, I evaluate additional policy measures and trade shocks, such as specific tariffs and exchange rates. While these trade shocks tend to be less pronounced over my sample period (especially specific tariffs), both affect trade flows in a manner consistent with the theory.

1.1. Related literature

This paper adds to a number of different areas related to trade, firm heterogeneity, and trade policy. Most notably, it is related to the literature on the role of firm and variety heterogeneity in trade flows.[3] The rather robust response of low revenue varieties is similar to Kehoe and Ruhl's (2009), though documented at a more detailed level. Indeed, motivated in-part by these results, Arkolakis (2010) presents a framework based on endogenous marketing costs that generates a larger response to trade liberalization by low revenue varieties. While similar to the results in my paper, the results are driven by a completely different mechanism. Further, there is one crucial qualitative difference in equilibrium predictions, where the Arkolakis framework guarantees that all firms gain from liberalization, which is not the case in my paper.[4] Indeed, in the forthcoming empirical work, imports from the top 10% of Exporter-HS10 pairs rarely increase after tariff liberalization occurs, and in certain industries, imports tend to fall for these successful varieties.

In allowing for an active extensive margin of trade, this paper is related to Helpman et al. (2008), Manova (2008), and Johnson (2011). Unlike these papers, I do not precisely adjust for sample selection of Exporter-HS10 observations given that good instruments are not available at this level of refinement. To this end, my paper is similar to Trefler's (2004) in that I evaluate the impact of tariff liberalization on import growth within the set of continuing imported varieties. However, I provide a robustness check using an alternate specification that suggests that sample selection is not driving the differential response of tariffs by initial market penetration.

In aggregating firm-level trade to exporter-level trade within each industry, I draw from the recent literature on multi-product firms in Bernard et al. (2011) and Mayer et al. (2011). However, the relationship to these papers is limited to the assumption that firms enter industries and not varieties, which motivates the appropriate use of fixed effects in the empirical specification. My work also extends the trade literature on variable-elasticity demand systems. In particular, the paper is related

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[1] This is in contrast with the CES demand curve, where elasticities do not change with quantity. This results from the elasticity of the marginal revenue curve, which for CES is constant in quantity.

[2] For example, "Grand Pianos" is an HS8 product, and HS10 provides detail such as "containing a case measuring less than 152.40 cm in length".

[3] For example, Hummels and Skiba (2004), Helpman et al. (2008), Manova (2008), Hallak and Sivadasan (2009), Baldwin and Harrigan (2011), and Johnson (2011).

[4] Via a CES demand assumption, all firms in the Arkolakis (2010) framework receive the same percentage demand shock resulting from tariffs. Thus, all firms gain from a reduction in a common iceberg transport cost, but differ in their supply response based on the marginal cost of reaching a larger fraction of consumers.