Differentiated Products, Divided Industries: A Theory of Firm Preferences over Trade Liberalization*

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Abstract

What firms support trade liberalization and when? The dominant approaches to trade politics imply that industries are united in support or opposition to trade. These approaches are based on an incomplete account of trade, however, which ignores two key features of modern international commerce: firm heterogeneity in export performance and intra-industry trade. This paper explores the implications of these features for trade politics. Contrary to existing theories, industries are divided between firms that favor freer trade and firms which oppose it. Firms which serve only the domestic market will generally oppose trade liberalization, even in export-competing industries. Not all exporting firms will be supporters of trade, however. For example, the largest exporters may oppose trade liberalization in their export markets due to increased competition from compatriot firms. Industry-wide coalitions on trade therefore face previously unrecognized challenges, and disagreement among associations representing firms producing the same products is predicted. In particular, industries will be more divided when product differentiation is high, and when the parties to trade liberalization are similar in size and competitiveness.

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Introduction

American manufacturers of textiles were deeply divided over CAFTA-DR, a free trade agreement between the United States, the Dominican Republic and five Central American trade partners. These divisions were most visible in the competing and contradictory assessments of CAFTA given by the industry’s trade associations. The anti-CAFTA associations argued that the agreement was “loaded with provisions that will allow Chinese and other non-regional fabrics to enter the U.S. in garment form” and would “make it easier for U.S. companies to outsource highpaying manufacturing and service sector jobs”. The textile associations supporting the agreement felt it would create “a permanent duty-free platform to ship billions of dollars worth of yarns and fabric” and “protect textile jobs” in the United States.¹

The terms of this debate echoed a similar split among textile manufacturers over NAFTA, 12 years earlier. In that dispute, opponents in the textile industry had emphasized threats to US manufacturing and jobs from imports and outsourcing. Supporters of NAFTA had touted the opportunities to increase textile exports to Mexico, to be made into apparel. Who was right? Both, as it turns out. Textile exports to Mexico and Canada expanded 223% from 1993 to 2000 while US textile imports from these countries increased 264%.

These kinds of intra-industry divisions over trade are a recurrent feature of debates on trade policy, but the dominant models of trade politics predict that firms in the same industry will share the same preferences. Export-competing industries should favor multilateral liberalization of trade, while import-competing industries should be united in opposition. Recent empirical and theoretical developments in the study of the export performance of firms call this simple picture of attitudes toward trade into question, providing a new explanation for these divisions.

The literature on firm performance finds that most industries are divided between firms which are capable of profitably exporting and firms which serve the domestic market only. I argue here that in industries where products are differentiated, so that countries are both importers and exporters of varieties of the same good, firm heterogeneity in export performance creates intra-industry disagreements over trade. Non-exporters see in trade liberalization only costs, due to intensified competition in the home market from foreign-based producers. Exporters see both threats to domestic market share and opportunities in foreign markets as consequences of trade liberalization. They will support free trade if the latter outweigh the former.

This paper develops this basic insight into a series of original propositions about the preferences of firms, and then aggregates these preferences into measures of overall industry support and opposition. Two major claims about preferences are developed. First, industries which feature product differentiation will generally have a set of firms that favor freer trade and a set of firms which oppose it. These divisions can exist in industries at a comparative advantage and disadvantage, although the balance between supporters and opponents will of course differ. There are also
instances – where a trade deal’s terms are too unequal or foreign firms are too competitive – where industries will be united in opposition to trade liberalization.

Second, firm productivity is the crucial determinant of both export opportunities and support or opposition to free trade, but exporting and support for free trade are not synonymous. The least productive exporters will oppose trade liberalization because the increases in profit from exporting do not fully compensate losses incurred in the domestic market. More surprisingly, the most productive exporters are generally not the greatest beneficiaries from trade liberalization, and they may even oppose liberalization due to increased competition in foreign markets from compatriot.

With a model of firm’s preferences over trade liberalization in hand, a series of comparative statics are derived which establish the conditions under which industries will be divided over trade. Differences in technology play a crucial role in determining the level of support for trade. As the distribution of firm productivities shifts toward higher costs, more firms will oppose trade liberalization. Country size, a non-technological source of comparative advantage, also plays a key role. In most instances, the benefits of gaining access to larger markets will be exceeded by the costs of competing with industries from big countries, which have more firms and are more efficient.

The extent of product differentiation is also important. Under a plausible set of conditions described in the paper, industries at a comparative disadvantage in the production of a differentiated product become more in favor of trade liberalization as product differentiation increases; industries at a comparative advantage become more opposed to trade liberalization. Product differentiation therefore fractures the united opposition to trade of import-competing industries, because some producers will be able to find a market for their good abroad even if it is relatively expensive.

The final section of the paper discusses the implications of these findings in considerable detail. For now, the contribution to the literature on trade politics can be summarized in several points. Most fundamentally, this paper develops a theory of preferences over trade policy which is better matched to the empirical patterns of modern international trade. A complete account of preferences over trade requires a precise description of the distributional impact of trade liberalization. Extant models do not consider two widespread features of trade – firm heterogeneity and intra-industry trade – which significantly alter our picture of preferences over trade.

The impact of bilateral trade liberalization, and the patterns of support and opposition, are strikingly different in industries producing homogeneous commodities and industries producing differentiated products. All firms producing a commodity share the same preferences over trade liberalization. They win or lose together. Firms producing a differentiated product face very different effects from trade liberalization depending on their ability to export, and will frequently be divided over trade. Still, there are circumstances where all firms will share the same preferences over trade, as noted above. The paper therefore provides a theory for when intra-industry disagreements over trade are likely to occur.
It is also argued that intra-industry divisions over trade will strongly impact the organizational dimension of trade politics. Industry associations play a fundamental role in organizing and representing firms’ interests on trade. Effective organization faces two previously unrecognized impediments, however. Firms in the same industry may disagree over whether to support or oppose multilateral trade liberalization, even as the collective action problem remains unresolved. Moreover, attitudes are situational – they depend on the features of the trade partner and the terms of the trade deal – so firms’ preferences may be inconsistent over time and across trade liberalizations. Broad industry-wide coalitions on trade are therefore not predicted for industries producing differentiated products.

The paper proposes a new alternative in the long-running debate on factor specificity and trade politics. In the standard approaches, whether capital is completely mobile within an economy or stuck in a particular industry determines whether owners of capital will share attitudes toward trade as a class or will disagree based on their industry’s comparative advantage. Here it is assumed that capital is immobile even within industries and that international competitiveness has roots in factoral-, industrial- and firm-based determinants. Of course, this suggests an extra unit of analysis – the firm – and that the appropriate area to look for coalitional boundaries over trade lies within both factors and industries.

Finally, the paper provides new explanations for two puzzling features of the post-war international trading regime. First is the apparent ease of multilateral liberalization in differentiated products compared to homogeneous products, such as agricultural goods. It is argued that the internal divisions and organizational difficulties faced by industries producing differentiated products provide one explanation for this pattern. Second is the enormous popularity and success of bilateral and regional trade agreements compared to potentially more significant multilateral agreements. The approach here focuses on market size-induced productivity improvements in large countries producing differentiated products. Regional agreements enable governments to expand choice for consumers by growing trade with smaller and less efficient countries, while avoiding widespread opposition from firms caused by liberalization with the largest and most efficient countries.

Existing literature

This research is among a small but growing number of papers in international political economy which build off of the literature on variation in firm performance in export markets. At least

1 These quotes were taken from the following sources, respectively: National Textile Association (2005), Shuster (2005), National Council of Textile Organizations (2005b) and National Council of Textile Organizations (2005a). The data in the succeeding paragraph was taken from the International Trade Administration’s TradeStats Express™, available at http://tse.export.gov/TSE/.

2 For papers using models of firm heterogeneity to explore tariff setting, see Abel-Koch (2010), Chang and Willmann (2006) and Ossa (2010). Plouffe (2011) provides evidence linking productivity to support for
since Melitz (2003) there has been a sense that the ‘new, new’ trade theory’s focus on variation among firms in export performance could contribute to understanding trade politics. This paper advances this broad research agenda in several ways. First, it clearly lays out the set of conditions under which intra-industry divisions are likely to occur. A key argument of this paper is that firm heterogeneity in exporting on its own is insufficient to generate intra-industry divisions over trade. Product differentiation is a crucial extra condition because it leads to intra-industry trade, and generates systematic price differences among firms. In addition to product differentiation and firm heterogeneity in productivity, three additional factors are emphasized: firm-specific capital; short- or medium-term time horizons; and, the absence of variety specific protection. Second, it shows that even when these conditions are met, industries may still be united on trade. Third, it systematically examines the impact of trade liberalization in already partially-open economies.

Firm-level explanations of trade preferences have played an important role in the trade literature in discussions of multinational corporations and trade policy (Gilpin, 1971; Chase, 2004). Firms with foreign plants naturally have a very different perspective on trade barriers in their home market than firms which produce domestically. This intra-firm trade then provides an explanation for intra-industry divisions over trade (Milner, 1988). This paper develops a separate argument for intra-industry divisions over trade, in which firms producing domestically agree on the value of protection at home, but disagree on whether to sacrifice that protection to gain access to markets abroad.

This research also revisits an earlier literature in political science on trade politics with intra-industry trade flows. When the ubiquity of two-way trade in the same product was first noted, it was argued that trade politics in industries with significant intra-industry trade might be less divisive. If two countries can mutually export the same good to one another, then perhaps both industries – as well as consumers – can end up as supporters of trade, and trade politics will be more harmonious. Integrating the now well-established facts on firm heterogeneity in export performance with intra-industry trade helps to clarify in what sense this is true. Far from creating consensus over trade, intra-industry trade and firm heterogeneity create divisions within industries as well as between.

Outline

The rest of the paper proceeds as follows. The first section introduces the model of the economy which underlies all of the subsequent results which follow. The model was first developed in Melitz and Ottaviano (2008). The presentation in this section is mostly non-technical, focusing on

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Walter (2010) discusses this literature in the context of workers’ support and opposition to globalization. 3 See, for example, Krugman (1981) and Alt et al. (1996). See also Gilligan (1997) and Bombardini and Trebbi (2012) for an alternative perspective, which emphasizes the search for firm- or variety-specific protection.
on the parts of the model which are crucial to understand the results which follow. In particular, firm heterogeneity in productivity, product differentiation, and intra-industry trade are described in some detail. Appendix A provides a complete treatment of the model, demonstrating how to solve the model, which originally featured a variable cost-of-trade, with an *ad valorem* tariff. This extension permits exploration of both tariff and non-tariff barriers, both of which are prevalent as barriers to trade.

The second section provides a definition of support and opposition to trade, and briefly discusses some of the key issues associated with translating the literature on firm heterogeneity into a model of preferences over trade policy. The third section describes the patterns of support and opposition to trade which occur when countries move from autarky to trade, and when trade barriers are reduced in already partially open markets. In each case, the focus will be on three questions: What firm gains the most from trade liberalization, if any? Under what circumstances will no firms gain from bilateral trade liberalization? Which firms will favor and which firms will oppose trade liberalization, and how does their support depend on their productivity? As will be shown, the answers to these questions depend crucially on whether the pre-liberalization equilibrium is autarkic or not.

The fourth section derives or simulates a number of comparative statics which connect key features of the countries or industries to the overall rate of support or opposition to a given trade deal. It is shown that Ricardian and non-Ricardian sources of comparative advantage play an important role in determining the extent of support for trade liberalization. The role of product differentiation is also explored. These comparative statics are then applied to several outstanding empirical questions in trade politics. In the conclusion, the paper sums up the implications of firm heterogeneity, and the results derived here, for the politics of trade.

**The Model of the Economy**

This section provides a summary of the key features of the economic model which underlies all of the subsequent results. Two features of the economy are emphasized. First, consumers have a taste for variety, preferring an assortment of differentiated types to a homogeneous product. This generates the possibility of intra-industry trade because consumers will willingly pay for even relatively expensive foreign varieties in order to diversify their consumption. Second, producers differ in their costs of production. In other words, some firms are more productive than others. If trade is costly, because of either shipping costs or trade barriers, only a subset of lower-cost firms will generally be able to export because there will be no demand for the most expensive varieties abroad net of trade costs. It is argued that both of these features apply to a wide variety of industries.
A complete formal treatment of the model is provided in Appendix A, which demonstrates how to derive all of the model solutions for the case of a tariff. The original version of the model, in Melitz and Ottaviano (2008), employed a variable cost of trade, that is, firms must pay additional costs to export their products. These costs are treated here as a type of non-tariff barrier to trade. This paper explores firm preferences over trade policy for both tariffs and non-tariff trade barriers, so readers wishing to see derivations of the model solutions using the variable cost of trade should refer to the original paper. All of the results on trade preferences which follow this section are original to this paper, unless noted.

Two key features of contemporary trade: intra-industry trade and firm heterogeneity

Before describing the model, it is useful to introduce the literatures on intra-industry trade and on firm heterogeneity in exporting. These two features of modern international trade play a crucial role in developing the model and in understanding the results that follow.

Intra-industry trade occurs when a country both exports and imports the same product. This two-way trade in the same types of goods accounts for a significant portion of global trade flows although its extent varies from industry to industry. Intra-industry trade is usually defined as the overlap between import sales and export sales of the same good in a particular country (Grubel and Lloyd, 1971). Estimates vary based on data source and definition, but generally it is believed that roughly 25 to 50% of global trade is intra-industry and that this share has increased over time (OECD, 2002; Brülhart, 2009). This kind of estimate understates the analytic importance of intra-industry trade, however, because even asymmetric intra-industry trade flows will generate very different patterns for trade politics than uni-directional trade.

In the trade literature, intra-industry trade is generally explained as the consequence of an inherent desire for product diversity among consumers. This consumer ‘love of variety’ has several consequences. First, it gives rise to product differentiation, where firms specialize in niche varieties of a product in order to exploit the demand for variety among consumers. If firms are monopolists of their particular variety, as will be assumed here, they are capable of earning rents from this monopoly although they are still in competition with producers of other (imperfect) substitutes. Greater product differentiation also means that less efficient firms are more likely to survive the competition in their industry and remain profitable. Consumers will happily pay more for certain products if they value variety.

Relatedly, product differentiation changes the possibilities for firms engaged in international competition. If consumers place no value on differentiation, international trade is simply arbitrage, as goods travel from low-price locations to high-price locations. Trade between two countries in any given good flows in only one direction and countries are either import-competing or export-competing. With love of variety, trade can flow in both directions as countries can both import
and export varieties of the same good. Even if a country is at a comparative disadvantage in the production of the differentiated product, foreign consumers may be willing to pay for its relatively expensive products to diversify their consumption.

The literature on firm heterogeneity in exporting is more recent, but has been linked with product differentiation from the start. The literature is now quite substantial, but three well-established empirical patterns identified in this literature play an important role in the model and the analysis that follows. First, almost all manufacturing industries have some exporting firms, including import-competing industries, while no industry is composed solely of exporters. Less than 50% of firms export in most export-competing industries (Bernard et al., 2007; Aw, Chung and Roberts, 2000; Delgado, Farinas and Ruano, 2002; Mayer and Ottaviano, 2008). Despite the fact that virtually all industries export a non-negligible proportion of output, variation in exporting is of course still linked to the traditional determinants of comparative advantage, notably relative labor-intensity and differences in technology (Bernard et al., 2007).

Second, firms which export have noticeably higher labor and total factor productivity and are consequently larger than non-exporters. This observation is the essential foundation of all of the major models of firm heterogeneity in international trade, but it of course raises the question of order of causation. The first generation of research on this question found strong support for self-selection into exporting by the most productive firms and relatively little evidence for learning-by-exporting (Clerides, Lach and Tybout, 1998; Bernard and Jensen, 1999; Aw, Chung and Roberts, 2000). 4

Third, substantial reductions in tariffs at home and abroad are usually followed by considerable reallocations of production from less productive to more productive firms, partly because the latter grow larger due to increased export opportunities and partly because the former shrink or exit altogether due to more intense competition in the domestic market (Pavcnik, 2002; Tybout, 2003). The focus of economists has been on the welfare implications of reallocations of production to more productive firms, but from the perspective of trade politics, the most interesting implication is that trade liberalization has previously unrecognized distributional effects within industries.

With these two key concepts established, we can now turn to an outline of the model. Again, to facilitate the presentation and keep the focus on original material, the model is presented below in mostly non-technical terms. Readers who wish to see complete solutions to the model should

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4 Subsequent research suggests that there may be a noticeable positive effect of exporting on productivity, but still finds very strong self-selection into exporting, confirming that self-selection is the most important explanation (De Loecker, 2007; Van Biesebroeck, 2005; Lileeva and Trefler, 2007). At a more general level, there is a question here about the determinants of productivity differentials and the extent to which they are exogenous or endogenous to firm decision-making. For instance, it could be that in anticipation of entering the export market, firms invest heavily in capital and technology, while also ‘trimming the fat’, generating the empirical association between exporting and productivity. However, as long as the ability to do this differs across firms, the possibility of intra-industry divisions over trade remains plausible.
refer to Appendix A or Melitz and Ottaviano (2008).

Consumers and love of variety

The economy in this model is comprised of two sectors. One sector features a group of firms each producing a distinct variety of a differentiated product. The varieties of the differentiated good are imperfect substitutes and consumers value diversified consumption. Production of any given variety is a global monopoly for a single firm but firms compete on price with one another to maximize profits. The second sector is a single homogeneous good which serves a primarily technical role (to fix wages at unity) and will not be a focus of analysis.

Each country is endowed with $L$ units of labor, and these workers are also the only consumers in the economy. Each worker consumes $q^c_i$ units of each differentiated good among the continuous measure of varieties indexed by $i \in \Omega$. Their total consumption of the differentiated good is therefore $Q^c = \int_{\Omega} q^c_i \, di$. There is also a homogeneous numeraire represented by $q^0$. Utility from consumption is defined as:

$$U = q^0 + \alpha Q^c - \frac{1}{2} \eta Q^c - \frac{1}{2} \gamma \int_{\Omega} (q^c_i)^2 \, di.$$ 

The parameters $\alpha$ and $\eta$ determine how much weight consumers place on the differentiated good relative to the numeraire. Of particular interest here is the final term, which penalizes over-consumption of any single variety and therefore leads consumers to spread their consumption across multiple varieties. The parameter $\gamma$ therefore determines the extent of consumer love of variety. When love of variety is equal to zero, consumers place no value on consuming a differentiated basket of goods and care only about price. As love of variety increases consumers increasingly stress consumption of a broad array of varieties which allows relatively less efficient firms to survive despite their higher prices. In the model, love of variety also leads to intra-industry trade.

The utility function defined above is used to determine consumer demand for both domestic varieties and imports as a function of price. One important feature of the demand system is worth noting because it plays an important role in the next section. For each variety, there is a ‘choke price’ at which demand goes to zero. The least productive firms which enter the market will be forced to close up shop before they produce anything because there is no demand for their variety even if priced at marginal cost. Similarly, the least productive producers for the domestic market will not be able to export their variety abroad because there will be no demand for their variety once trade costs are factored into the price.
Producers and productivity

The productivity differences which the empirical literature identifies as the key explanation for variation in export performance are operationalized in this model as exogenous variation in each firm’s constant marginal cost of production, \( c \). Firms learn their productivity after they pay a fixed cost of entry, \( f_E \), common to all firms in the same country. The marginal cost of production is assumed to be randomly drawn from a cumulative distribution function \( G \) with support on \([0, m]\). \( m \) is therefore the marginal cost of the least productive potential producer. It is assumed that \( m \) is sufficiently high so that some high cost firms will not be able to profitably produce for either the domestic or export market, and so will produce nothing in equilibrium.

It is now useful to begin superscripting parameters and endogenous variables to allow asymmetries between two countries \( l \) and \( h \). All assumptions and results will be written in terms of \( l \), and the analogous forms for \( h \) will be omitted to preserve space. I will allow the countries to vary by size \( (L^l) \), the distribution of productivities \( (G^l) \), their fixed costs of entry \( (f_E^l) \), and their trade policies.

Two policy instruments are explored here: an ad valorem tariff \( \tau \) and a non-tariff trade barrier \( \nu \). For example, \( \nu^l \) is a variable cost of trade paid for by a firm exporting from \( h \) to \( l \). The cost of one unit of production exported from \( h \) to \( l \) is \( \nu^l c \), so more productive firms have lower trade costs. This cost-of-trade will be referred to as a non-tariff barrier to trade throughout. \( \tau^l \) is a tariff paid by consumers importing a good from \( h \) to \( l \). It is multiplicative of the price set by foreign producers, so if the firm sets the price at \( p_f^l \) then consumers in \( h \) must pay \( \tau^h p_f^l \). These two trade instruments will be referred to jointly as ‘trade barriers’.

As noted previously, the demand system leads to a ‘choke price’ above which there is no demand for a given variety. In the domestic market, there will be a marginal cost above which no firm is able to profitably sell their good at home. This domestic productivity cutoff is also the choke price in the domestic market, and is represented by \( c^l_D \). Any firm in \( l \) whose marginal cost is greater than this cutoff will find no demand for their variety, even if it is priced at unit cost, and will drop out of the market. Firms which wish to export to \( l \) will face the same choke price, but note that they face additional barriers to entry in the form of tariff or non-tariff barriers. For this reason, the export productivity cutoff for firms in \( h \) is \( c^h_X \equiv \frac{c^l_D}{\tau^l} \). Any firm with a marginal cost of production higher than the export productivity cutoff will not be able to export abroad. Note that these cutoffs are still undetermined at this point.

The cutoffs end up playing a fundamental role in the analysis of the model. Prices, sales and profits in both the domestic and export markets are a function of the firm’s marginal cost and the cutoffs:

\[\text{This equivalency is not obvious, but is proven for both the tariff and NTB case in Appendix A.}\]
For a firm with marginal cost equal to the cutoff, the domestic price is equal to marginal cost and sales are equal to zero. Prices are lower, and sales and profits are greater for more productive firms. This replicates the observed pattern that more productive firms are larger, more profitable and export more.\(^6\)

It is also worth commenting on the crucial role that the cutoffs \(c^l_D\) and \(c^h_D\) play as indicators of the extent of competition. Melitz and Ottaviano (2008) show that an economy with a lower cutoff has lower average prices, lower average markups over cost, and lower profits per firm. The domestic cutoff is therefore closely tied to the idea of the ‘competitiveness’ of the differentiated sector, and throughout, lower cutoffs are considered synonymous with greater competition. Relatedly, we will make use of the average price in autarky as closely akin to the concept of comparative advantage. Because the homogeneous good is a numeraire, if \(l\) has a lower average price in autarky, which is equivalent to \(c^l_D < c^h_D\), then it will be more competitive when the economies open up to trade. Although these average price ratios are not exactly in line with the orthodox definition of comparative advantage, I will refer to them as comparative advantages because of the very close analogy and to economize on language.

**Short and Long-run Equilibria**

All that remains is to find solutions for the productivity cutoffs and determine the number of firms serving each market. In order to do this, it is necessary to choose a time horizon for an equilibrium. This paper uses both long- and short-run equilibria, but in a specific way. Long-run equilibria, which feature a complete process of firm entry, are used to establish the productivity range and number of firms serving each market before any policy change. Transitions to short-run equilibria, with this set of firms, are then used to determine firms’ preferences over trade policy. The reasons for this choice are described in the next section.

Determining analytic solutions for the cutoffs also requires specifying a distribution of firm productivities. Following much of the literature on firm heterogeneity and the original model, it is assumed that costs are distributed Pareto i.e. that \(G^l(c) = \left( \frac{c}{m^l} \right)^k\) for \(c \in [0, m^l]\). For the moment, I also assume that \(k^l = k^h = k\) while permitting \(m^l\) and \(m^h\) to differ. The Pareto distribution

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\(^6\) Note also that \(p^l_X\) represents the price paid by the consumer and firms only earn \(p^l_X = \frac{\tau_h c^l_X}{\tau_h}\) in the tariff case.
has been shown repeatedly to be a reasonable approximation of the empirical distribution of firm productivities within specific industries (Gatto, Mion and Ottaviano, 2006; Luttmer, 2007). It is also analytically convenient, generating straightforward solutions for the key productivity cutoffs. Appendix A provides a complete description of the explicit solutions for the cutoffs and for the number of firms entering and serving each market.

This section has introduced the model of the economy upon which all of the results in the next few sections are based. Two key features of the model were highlighted. Consumers value consuming a variegated set of product varieties. Because of this, countries generally import and export the same good, leading to intra-industry trade. Not all firms are equally adept at exporting, however. More productive firms have lower prices, and so are more equipped to find positive demand abroad, once costs of trade are factored in. Firms with higher costs must charge higher prices to earn a profit, and may face no demand for their variety abroad. The next section explains how this model can be used to develop a theory of firm preferences over trade.

**Evaluating Preferences at the Firm Level: When Does the Theory Apply?**

With the model of firm heterogeneity developed by Melitz and Ottaviano (2008) in hand, it is now possible to develop a series of claims about preferences over trade liberalization at the firm level. Before getting to these results, however, it is important to define some terms and explain the conditions under which the theory is expected to apply. In particular, this section makes the case for an alternative to the Ricardo-Viner and Stolper-Samuelson approaches to trade politics by discussing firm-specific capital, the appropriate time horizons for analysis, and the question of firm-specific protection.

First, some definitions: a bilateral trade liberalization is defined as some change in tariffs \( \{\tau^l_0, \tau^h_0\} \rightarrow \{\tau^l_1, \tau^h_1\} \) for which \( \tau^l_0 < \tau^l_1 \) and \( \tau^h_0 < \tau^h_1 \). It is assumed that a firm’s productivity remains constant over time. In the special case of the move from autarky to (costly) trade, which heuristically we can denote \( \{\tau^l_0 = \infty, \tau^h_0 = \infty\} \rightarrow \{\tau^l_1, \tau^h_1\} \), I will generally omit the subscript and refer to the post-liberalization tariffs as \( \{\tau^l, \tau^h\} \).

**Definition 1** A supporter of a given trade liberalization is any firm for whom

\( \pi(\tau^l_1, \tau^h_1) > \pi(\tau^l_0, \tau^h_0) \), that is, any firm whose profits are greater in the equilibrium which prevails after the policy change than in the pre-policy change equilibrium. Opponents are those whose profits decrease after the change in trade policy.\(^7\)

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\(^7\) This definition has been phrased in terms of tariff reductions but the definition of a supporter of reductions in trade costs, \( \{\nu^l_0, \nu^h_0\} \), is equivalent.
The owners of firms are not treated as consumers and their welfare is evaluated solely based on changes in profits.\(^8\)

A number of conceptual and definitional issues arise in trying to apply models of trade with firm differentiation to the study of trade politics:

**Firm-specific capital**  Definition 1 raises the question of asset specificity, an issue which has been at the center of the trade politics literature (Rogowski, 1989; Frieden, 1991; Hiscox, 2001). In standard trade models, whether assets are tied to their current industry of occupation or are freely mobile determines whether divisions over trade policy will occur between industries (as in the Ricardo-Viner model) or between broader coalitions of factor owners (as implied by the Stolper-Samuelson theorem). The approach here diverges from both of these perspectives by assuming that assets are firm-specific, and immobile even within the same industry. Within the context of the model, firm-specific capital is a sunk cost, a ticket to see one’s productivity draw only and so completely immovable and unrecoverable.

This approach builds off much of the literature in industrial organization on firm entry and exit, which emphasizes the extent of unrecoverable investments. These may include: labor force training; product and production process development; advertising and branding; and, product-specific capital (Mata, 1991; Clark and Wrigley, 1995). These sunk costs may be especially important in industries producing differentiated products. Partially recoverable investments also take time to repurpose or sell, and these endeavors require additional expenditure (Albuquerque and Rebelo, 2000). The model presented here is therefore most applicable for the short- or medium-term or over longer time horizons when capital is truly a sunk cost.

**The short-run**  The long-run version of the model involves a complete process of firm entry in which firms only learn their productivity after the trade policy has been determined. While firms may, *ex post* the revelation of their productivity, wish that a different trade policy had been instituted, that information is of little use *ex ante* when the trade policy is still up for debate. This paper therefore concentrates on transitions from long-run to short-run equilibria. This ensures that the extant set of firms is fully endogenized and that the process by which those firms reason about preferred policies is well-posed. Nonetheless, most of the results in the paper are also applicable to transitions to long-run equilibria. Where significant differences arise, they will be footnoted.

**No variety-specific protection**  Another key issue raised by this literature concerns whether trade protection is available to specific firms or varieties, or whether it remains a public good for all firms in the industry (Gilligan, 1997). The model used here, and indeed most of the models in this literature, assume that firms monopolize a single variety and no other firms at home or abroad produce

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\(^8\) This assumption is becoming a standard simplification. See Abel-Koch (2010), who notes a similar approach in Bombardini (2008).
exactly the same variety. This means that any trade barrier to a specific foreign variety benefits all domestic firms (and one domestic firm’s benefit from the trade barrier does not preclude another firm from benefitting) so trade protection is similar to a public good. Bombardini and Trebbi (2012) also assumes that firms can lobby for variety-specific protection, and provides evidence that this mode of lobbying may be more prevalent in industries producing differentiated products. At this point it remains an open question whether the public- or private-good view of trade protection is a more accurate picture for industries producing differentiated products and there is a need for more research on this question.

Product differentiation A key conjecture of this paper is that firm heterogeneity in exporting, even when combined with firm-specific capital, is not sufficient to generate intra-industry divisions over trade liberalization. In a competitive market for a homogeneous product, a firm’s production (and profits) are determined by the price of their product, factor prices and the firm’s production function. As long as all firms in an export-oriented industry use similar factor proportions, then all firms face the same forces after a reduction in tariffs in the export market. Costs change (but they pay the same prices because they all produce domestically, and use similar factor proportions) and the price of their good changes (but they all earn the same world price, regardless of whether they export, because its a homogeneous good). All firms either gain or lose profits together, then, depending on the balance of these changes. Product differentiation is the crucial extra factor for two reasons. First, it permits heterogeneity in pricing across firms which determines export status. Second, it generates intra-industry trade, which generally increases competition in both markets, ensuring that domestic-only firms lose from trade liberalization.

Firm Preferences over Trade Liberalization

What firms support trade liberalization and under what circumstances? This question is examined under two different scenarios. The first explores the preferences of firms over a bilateral, although not necessarily equal, trade liberalization in an economy which is completely closed off to international trade. The second examines situations when economies are already partially open to trade and a mutual reduction in trade barriers or tariffs is proposed.

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9 For a trade model with a different perspective, see Bernard et al. (2003), which features Bertrand competition at the global level among firms who each have potential competitors in other countries producing the exact same variety. Because firms are also competing with the other varieties for market share, trade policy has both excludable and non-excludable aspects.

10 If, however, we alter the assumption that firms use the same factor proportions then it might be possible to generate intra-industry divisions over trade liberalization. Note however that any reallocations have nothing to do with whether the output is exported or not. For this reason, it is also argued that firm heterogeneity is not necessary for intra-industry divisions over trade.
Each of these cases requires careful attention to the distributional implications of trade liberalization. The first step in either cases is to pin down patterns of exporting, domestic production and exit. Three propositions are then presented which answer the following questions: Which firm gains the most from trade liberalization, if any? Under what circumstances will no firms support trade liberalization? What set of firms supports trade liberalization and how does their support depend on their productivity? Important differences emerge in the answers to these questions depending on whether the pre-liberalization environment is autarkic or partially open.

**Autarky to Free Trade Case**

**Intra-Industry Divisions**

In this section, transitions from a complete lack of international trade to an open economy are examined, for both the tariff and non-tariff barrier cases. The first step in exploring the distributional implications of opening the economy to trade is determining which firms will export, which will produce only for the domestic economy and which will drop out. All of the results which follow are proven in Appendix A1.

In a setting with intra-industry trade, it is intuitive that opening up the economy to trade should increase competition in the domestic market. In terms of the cutoffs, this increased competition is synonymous with \( c_{D} < c_{A} \). Still, we might wonder how robust this intuition is to highly asymmetric trade liberalizations, or trade liberalizations between countries of vastly different sizes or productivity distributions. It turns out to be completely robust to any country asymmetries. The next question is whether exporters will be only a subset of the complete range of producers for the domestic market after liberalization, replicating the observed pattern in the real world. In terms of cutoffs, this means that \( c_{X} < c_{D} \). This relationship will hold as long as both countries have a positive level of trade barriers after liberalization has occurred.

We can therefore specify the complete ordering of cutoffs in both countries without making any restrictions on the set of possible liberalizations:

\[
0 < c_{X} < c_{D} < c_{A}.
\]

Opening up the economy to trade thus has two major effects. First, it increases competition in the home market. The least productive firms whose marginal cost exceeds the domestic productivity cutoff after liberalization are forced to drop out. There is no demand for their high-priced products now that consumers have access to cheaper foreign varieties. All firms which remain in the market face reduced profits from domestic sales relative to autarky.\(^{11}\)

\(^{11}\)This holds because \( c_{D} < c_{A} \), and therefore \( \pi_{D}(c) - \pi_{A}(c) = \frac{L_{1}}{4\gamma}(c_{D} - c)^{2} - \frac{L_{1}}{4\gamma}(c_{A} - c)^{2} < 0 \) for any \( c \).
cost below the exporting productivity cutoff are now capable of profitably exporting. They in turn displace inefficient domestic producers in their export market. Note that both countries will have firms which export.

We earlier defined opponents of trade liberalization as firms whose profits are reduced after liberalization. At this point, then, we can clearly identify as opponents of the move to trade all non-exporters. Establishing the existence of intra-industry divisions over trade policy also requires identifying a range of productivities that have increased profits after liberalization. Doing so will be facilitated by the following proposition:

**Proposition 1a** On the range \([0, c_L^X]\), the percentage change in profits relative to autarky is decreasing in \(c\). If any firm benefits from opening the economy to trade, the absolute change in profits is greatest for the most productive firm and \(\Delta \pi^l(c)\) is decreasing in \(c\) near \(c = 0\).

This proposition, which is proven in Appendix A2, has practical and substantive interest. Substantively, it demonstrates that the largest, most productive firms are the greatest beneficiaries from trade liberalization in both percentage and absolute terms. This provides a clear indication of the distributive consequences of trade liberalization when an economy is opened to trade for the first time. It also suggests that the ‘intensity’ of support for trade liberalization will vary systematically with firm productivity. The biggest firms have the most to gain, and so should push the hardest for trade liberalization.

At a practical level, this proposition implies that if we are looking for a winner from trade liberalization, than we should examine the exporters at the most productive end of the distribution of marginal costs.\(^{12}\) Will there always be a supporter of trade liberalization, no matter how different the countries or unequal the trade concessions? Unsurprisingly, the answer to this question is no. However, examination of a wide range of cases using numerical simulation suggests that intra-industry divisions are the rule rather than the exception, occurring in more than 94% of simulations across a wide grid of parameter values featuring significant asymmetries between the countries. These simulations are described in more detail in Appendix B1.

Under what circumstances will all firms in \(l\) oppose trade liberalization? Several results are available. First, the profits of \(l\)’s firms are diminishing in their trade barriers after liberalization. Pushing down these barriers sufficiently may ensure that no firms benefit from trade liberalization, although there is no guarantee because there are still gains abroad for exporters. As \(h\)’s tariffs

\(^{12}\) It will prove useful throughout to focus on a firm with productivity \(c = 0\). This may seem odd, because the Pareto density equals zero at \(c = 0\). However, if we can demonstrate that the change in profits for a firm with \(c = 0\) (symbolically, \(\Delta \pi(0)\)) is strictly greater than zero, than there must be some range of productivities \(c \in (0, \hat{c})\) as \(\hat{c} \to 0\) for whom \(\Delta \pi(c) > 0\). This is so because the function \(\Delta \pi(c) = \pi^l_X(c) + \pi^D(c) - \pi^A(c)\) is continuous and defined everywhere on \(c \in [0, c^X_L]\).
increase, l’s exporters lose profits in their export market, and this will suffice to ensure that no firms support trade. Second, if either the Ricardian comparative advantage of h’s firms is high enough or the fixed costs of entry in h are low enough, then it is possible that no firm in l will benefit from trade. Either of these conditions makes l’s firms more competitive as exporters, and the foreign market harder to break into.

These ideas form Proposition 2a and are proven in Appendix A3.

**Proposition 2a** If h’s tariffs are sufficiently high then no firm in l supports trade liberalization. Likewise, if h’s firms are sufficiently efficient or their costs of entry sufficiently low. Reductions in l’s non-tariff barriers or tariffs also reduce the profits of all of its firms, and so may lead to no firm in l supporting trade. Finally, if h’s market is sufficiently large, no firm in l supports trade liberalization.

This result provides some important clues for how to interpret the significance of firm heterogeneity in exporting for trade politics. Divisions over trade are common, but they are not guaranteed to occur. Industries can be united on trade, even if some firms export and some do not. The traditional determinants of competitiveness, like technology differences and barriers to entry, still play an important role in shaping the industry’s stance toward trade. Firms will be united in opposition if the trade partner is too competitive or if their country concedes too much in trade negotiations without gaining sufficient access abroad.

Does the productivity of l’s firms have an impact on whether there will be a supporter of trade? Yes, but not in a straightforward manner. Consider two cases involving tariffs. If l makes significant reductions in tariffs and h relatively small reductions, then l’s firms strongly oppose trade liberalization if they are unproductive. They would prefer to operate in the uncompetitive autarkic environment. The likelihood of no supporters is therefore increasing in ‘uncompetitiveness’. If, however, h makes substantial cuts in tariffs and l reduces tariffs very little then l’s firms continue to operate in a quasi-autarkic environment at home. A reduction in competitiveness is therefore a good thing. What happens in the export market? Recall that because of Proposition 1a, we only need to consider the most productive firm. They might actually benefit from less competition from their compatriot firms in the export market and so the likelihood of no supporters can actually be increasing in domestic competitiveness. This result highlights, not for the last time, the special care which is required to understand the preferences of high-productivity exporters.\(^\text{13}\)

A similar interaction occurs between the productivity of l’s firms and the productivity of h’s firms. If h’s firms are extremely productive on average, then the change in profits of the most productive firm brought about by trade liberalization is increasing in home country productivity. Intuitively, with significant competition abroad, the losses associated with opening up to trade are greatest when domestic competition in autarky is weak. In contrast, if h’s firms are extremely

\(^{13}\)This argument, and the discussion in the next paragraph, are formalized in Appendix A3.
unproductive, the change in profits of the most productive firm is decreasing in home country productivity. When foreign producers are extremely inefficient, the main impact of trade liberalization is that it provides access to a new market abroad. Highly productive firms gain the most from this new access when the other firms in their country are relatively inefficient.

Finally, note that there are differences between the tariff and non-tariff barrier case. The reasons relate to the argument just made: that highly productive producers can benefit from a small level of NTB’s which block out compatriot firms. This will be discussed in depth in the next section.

Which Firms Support an Open Economy?

We can now identify which firms will support and which firms will oppose a given trade liberalization. First, recall that because trade liberalization enhances competition in the domestic market, a subset of firms which produced in autarky is forced to drop out once the economy opens up to trade. Because these firms had positive profits in the autarkic equilibrium, they are naturally opponents of any trade liberalization which pushes their profits to zero. Similarly, firms which service only the domestic market will oppose trade liberalization because an open economy is more competitive, and these firms are not able to take advantage of export opportunities abroad to compensate for market share lost at home. Therefore, we must look to exporters to find the complete range of supporters of free trade.

It must be the case that the marginal exporter \( c = c^l_X \) opposes opening the economy to trade: they only just earn positive profits from exporting, while they of course lose market share at home. Moreover, there will be a range of exporters who earn positive profits from exporting who are opposed to trade liberalization. These will be the least productive exporters who cannot find a large enough market for their variety abroad to compensate for their losses in the domestic market. Of course, we also know that the most productive exporters will gain from opening up the economy to trade, if any firm does, so we need to determine the number and locations of the ‘breaks’ in the productivity distribution which separate supporters and opponents of trade. Appendix A4 contains a proof that there is one (and only one) division between supporters and opponents of trade. This means there is a clear dividing line between winners and losers from trade in the range \((0, c^l_X)\). We can define it implicitly as follows:

**Definition 2** The pro-trade productivity cutoff is the productivity \( c^l_{PT} \) such that

\[
\pi^l(c^l_{PT}, \tau^l, \tau^h) - \pi^l(c_{PT}, \infty, \infty) = 0.
\]

Any firm with \( c < c^l_{PT} \) supports the trade liberalization; any firm with \( c > c^l_{PT} \) opposes the trade liberalization. If there are no supporters of the trade liberalization, then \( c^l_{PT} \) is not defined.

This division of the industry into pro- and anti-trade blocs is summarized in Claim 3a.
**Proposition 3a** The following ranges of supporters are possible:

1. All firms in the range \((0, c_{PT}^l)\) where \(c_{PT}^l < c_X^l\).
2. No firms support trade liberalization.

At this point, it is worth mentioning an important consequence of unpacking the industry to look at the firm: most firms are neither intrinsic supporters nor opponents of trade. As was already shown, no firm will support trade liberalization if its own country makes concessions that are too steep or if its competitors are too efficient. Moreover, the dividing line between supporters and opponents, defined by \(c_{PT}^l\), is a function of the parameters. Later on it will be shown that \(c_{PT}^l\) is increasing in home country trade barriers and decreasing in foreign country competitiveness. It is therefore possible that the same firm will change opinions on a trade deal if their country is forced to make extra concessions. It is also possible that a firm will support a trade deal with one country and not with another, even if it is capable of exporting to both.

All of the results so far are summarized in Figure 1, which plots profit as a function of marginal cost both in autarky and after a trade liberalization, as well as the difference between the two. In the example on the left, an economy moves from autarky to costly trade, and there is a continuous range of supporters of trade among the most productive exporters. The most productive firms have the greatest gains from trade, too. The second example on the right shows a situation in which no firm benefits from opening up to trade. In order to generate this example, I reduced the country’s tariffs post-liberalization and increased its trade partner’s average productivity.

This section has proven three results on firm attitudes toward trade when two economies open up to trade with one another for the first time. The economy is generally split between a group of productive exporters who support trade and a group composed of unproductive exporters and domestic-only firms which oppose trade. The greatest beneficiary from trade liberalization is also the largest, most productive firm. However, if trade concessions are too asymmetric or foreign competitors too competitive, it may be that no firms support trade liberalization. Turning to the case of trade liberalization between two countries who already engage in some trade, the first two of these results will be sharply different.

**Restricted to Freer Trade Case**

I now turn to the case of proposed trade liberalizations in an already partially open economy. The equilibrium before the policy is change is represented symbolically as a 0 subscript, while the equilibrium after trade barriers are reduced is represented with a 1. The section develops three claims which closely parallel those presented in the autarky-to-trade case. The firm which gains the most from trade liberalization will be identified first, and then the circumstances under which no firms benefit from trade liberalization will be outlined. Finally, the possible patterns of support
Figure 1: Some trade liberalizations will feature intra-industry divisions over trade, particularly those which are relatively equal. Others will feature complete opposition from the country, especially if its relative concessions are too great or if the other country has a significant comparative advantage in the production of the differentiated good. Both examples feature completely equal parameterizations between the two countries except for the productivity distribution and the trade policy. On the left, $m^l = m^h = 1.5$ (the profits of $l$’s firms are shown) and $\tau^l = \tau^h = 1.2$. For the right, $m^l = 1.5, m^h = 1.2, \tau^l = 1.2$ and $\tau^h = 2$. 
and opposition to trade liberalization will be presented. The first and the last of these results will diverge from those in the autarky-to-trade case, illustrating the importance of a close examination of the distributional effects of trade.

**Intra-Industry Divisions**

Will the industry producing the differentiated product be divided over trade liberalization as before, with the most productive exporters supporting trade? Will the most productive exporters be the greatest winners from trade? Before answering these questions it will be useful to again order all of the cutoffs in country $l$ to clarify the distributional stakes. We already know that any reduction in trade barriers increases competition in the domestic market, and it has already been shown that only the most productive firms export. Appendix A1 contains a proof that exporting becomes easier in the foreign market for any liberalization, completely ordering the cutoffs:

$$0 < c^l_{X0} < c^l_{X1} < c^l_{D1} < c^l_{D0}.$$ 

This ordering is nearly assumption free, requiring only that consumers in both countries consume both the differentiated good and the numeraire.$^{14}$

This ordering summarizes the major effects of a reduction in trade barriers in an already open economy. Competition increases in the domestic market. A group of the least competitive firms are forced out of the market completely while all other firms which continue to produce face a tougher domestic market. However, a mutual reduction in trade barriers also implies that a greater range of producers will be able to export post-liberalization, while all extant exporters will continue to serve the foreign market.

With this ordering we can return to the question of the existence of intra-industry divisions over trade. As in the case of moving from autarky to the open economy, it is easy to identify opponents to trade liberalization: any firm which produces solely for the domestic market will oppose trade liberalization because it enhances competition in the domestic market.

We will look again at the the most productive firm which has marginal cost equal to zero, but Claim 1b immediately makes clear that this may not lead to a reliable set of supporters of trade liberalization.

$^{14}$Will this same ordering hold in the long run? Appendix A1 shows that it will except for an important set of exceptions. Extremely asymmetric liberalizations (such as a unilateral liberalization) can lead to a change in cutoffs such that $c^l_{D1} > c^l_{D0}$, as originally show in Melitz and Ottaviano (2008). The logic here is that if one country lowers trade barriers unilaterally, firms have a new incentive to relocate to the non-liberalizing country. They can then produce for that market, and export back to the now relatively more open economy. The appendix also interprets the condition that $c^l_{D1} < c^l_{D0}$ for the long run case, showing that it assumes either negotiated reductions in trade barriers, or country productivities, aren’t ‘too asymmetric’.
Claim 1b  Among the firms which export post-liberalization, the firm with the greatest increase (or smallest decrease) in profits from trade liberalization is not the most productive firm, and $\Delta \pi'(c)$ is increasing in $c$ near $c = 0$.

If any firm benefits from trade liberalization, the greatest percentage increase in profits does not accrue to the most productive firm, and the percentage increase in profits is increasing in $c$ near $c = 0$.

See Appendix A2 for a proof. Note that the most productive firm is also the largest firm and the greatest exporter pre-liberalization, so this result challenges the instinct that big, successful exporters are the greatest beneficiaries of trade liberalization. This also contrasts sharply with the autarky-to-trade case discussed in Claim 1a where the largest, most productive firm was the most intense supporter of trade liberalization. Exploring the NTB and tariff case in turn makes clear what is going on.

Unlike in the autarky-to-trade case, the most productive firms are opponents of reductions in non-tariff trade costs under all conditions. Consider the forces unleashed by trade liberalization for highly productive firms when costs of trade vary with productivity. On one hand, trade liberalization lowers the profit-maximizing price of the exporter’s variety in the foreign market via a reduction in costs paid by the firm. On its own, this reduction in costs would increase profits as sales grow in the foreign market and a greater share of the price is pocketed by the firm per unit sold. However, trade liberalization also enhances competition in both of the markets in which the exporter sells. In the home market, more foreign varieties are available which intensifies competition and reduces domestic profits. In the foreign market, an extant exporter faces greater competition from its compatriot firms who now have greater access abroad. For the lowest cost firms, the benefits of reduced trade costs are exceeded by losses due to intensified competition at home and abroad.

Examination of the tariff case makes clear that this logic is not just a feature of the variable cost-of-trade. Appendix A5 derives a set of conditions under which the most productive firms will not favor reduced tariffs. For example, the most productive firms will oppose a bilateral reduction in tariffs if their own country’s post-liberalization tariffs are too low relative to their pre-liberalization tariffs. The change in profits for this firm is:

$$\Delta \pi'(0) = \frac{L^h}{4\gamma} (\nu^h_1)^2(c_{X1}^h)^2 + \frac{L^l}{4\gamma} (\nu^l_1)^2(c_{X0}^l)^2 - \frac{L^h}{4\gamma} (\nu^h_0)^2(c_{X0}^h)^2 - \frac{L^l}{4\gamma} (\nu^l_0)^2(c_{X0}^l)^2$$

$$= \frac{L^h}{4\gamma} (c_{D1}^h)^2 - \frac{L^h}{4\gamma} (c_{D0}^h)^2 + \frac{L^l}{4\gamma} (c_{D1}^l)^2 - \frac{L^l}{4\gamma} (c_{D0}^l)^2$$

$$< 0$$

Note that if the inequality is strict, this implies that there are some highly productive firms with positive marginal cost of production who also lose from trade liberalization.
tariffs. Symmetrically, they will oppose any trade liberalization for which their trade partner’s reductions in tariffs are not great enough. They will also oppose freer trade if their own country’s firms are sufficiently inefficient compared to the firms in their competitor.

Why would the most productive firms, in particular, gain less from reductions in tariffs? This occurs because the most productive firms have the lowest prices, and so the reduction in \textit{ad valorem} tariffs creates a lower total decrease in prices (and a lower increase in quantity sold) than for a less productive firm within this model’s linear demand system. At the same time, the most productive firms are the most exposed to the foreign market and so take a greater hit from enhanced competition in that market. As the outlines of the trade liberalization become more unfavorable to \( l \), the firms at the low end of the cost distribution are therefore the first big exporting firms to be submerged into losses from the reductions in trade barriers.

The next step is to examine whether there will be supporters of trade liberalization (we already know that domestic-only firms and the least productive exporters will oppose trade liberalization). As in the autarky-to-trade case, there will be conditions under which no firms benefit from trade liberalization. If either tariffs or NTBs are reduced too much in the home market, no firm will benefit from trade liberalization. If tariffs aren’t reduced sufficiently in the foreign market, no firm will benefit from trade liberalization (but no clear analytic result is available for the NTB case). Note also that even if a liberalization has no supporters in some country, there will still be firms which are profitably exporting. The gains in the foreign market simply aren’t great enough to compensate for the losses at home.

These ideas are all proven in Appendix A3 and lead to Proposition 2b.

\textbf{Proposition 2b} If \( h \)’s post-liberalization tariffs are sufficiently high, then no firm in \( l \) supports trade liberalization. Reductions in \( l \)’s non-tariff barriers or tariffs post-liberalization barriers also reduce the profits of all of its firms, and so may lead to no firm in \( l \) supporting trade liberalization.

This is a relatively spare set of results, but with good reason. Most of the parameters affect the level of competition in both markets, and both before and after liberalization. For example, an increase in the competitiveness of \( h \)’s firms reduces cutoffs in both countries before and after liberalization. For any given firm, this means that both the pre-liberalization and post-liberalization environments are less appealing. The exact effect of changes in competitiveness therefore depends crucially on the matrix of trade policies which characterize the environment before and after liberalization.

\textbf{Which Firms Support Trade Liberalization?}

We have already established that all non-exporters after liberalization are opponents of greater trade. So we can focus on the range of post-liberalization exporters to look for supporters of trade.
We also know that there will be instances where the most productive firms support trade liberalization, and instances where they oppose it. The key question is whether the range of supporters, if it exists, will be continuous. Appendix A4 contains a proof that it is, and this allows us to define the pro-trade productivity cutoffs and make Claim 3b.

**Definition 3** The pro-trade productivity cutoffs (restricted trade to liberalized trade case) are the productivities $c_{PT}^l$ and $c_{PT}^t$ (with $c_{PT}^l < c_{PT}^t$) such that

$$
\pi_1^l(c_{PT}^l, \tau_1^l, \tau_1^h) - \pi_0^l(c_{PT}^l, \tau_0^l, \tau_0^h) = 0
$$

and

$$
\pi_1^l(c_{PT}^t, \tau_1^l, \tau_1^h) - \pi_0^l(c_{PT}^t, \tau_0^l, \tau_0^h) = 0
$$

If $c = 0$ supports the trade liberalization, than $c_{PT}^l = 0$, and if no firms support the liberalization than the pro-trade cutoffs are undefined.

**Proposition 3b** The following ranges of supporters are possible for each trade instrument:

1. A reduction in non-tariff barriers: either $0 < c_{PT}^l$ and $c_{PT}^l < c_{X1}^l$; or, no firms support trade liberalization.
2. A reduction in tariffs: either of the patterns from 1; or, if the terms of the liberalization are sufficiently favorable, $c_{PT}^l = 0$ and $c_{PT}^t < c_{X1}^l$.

The most noteworthy feature here is the non-monotonic relationship between productivity and support for trade liberalization. Because the most productive firms can benefit from increases in trade barriers, given the right circumstances, they may find themselves sharing the interests of the least productive firms which have no ability to export whatsoever. The contrast with the autarky-to-trade case, where the most productive exporters usually have an interest in greater liberalization, is also striking and points toward several broader points.

First, opening the black box of the industry reveals complex dynamics associated with trade liberalization at the firm-level, and non-obvious conclusions about the likely preferences of firms over trade. Second, firms which are better equipped at jumping over trade barriers may not have an interest in reducing those trade barriers. Competitors from their home country may benefit more and even displace them in foreign markets. The simple equation of exporting with an interest in freer trade is not supported in this context. Finally, extant exporters start to take on the attributes of firms actually located in their export market. As a simple case, consider a one-time only adjustment cost for exporting to a country. Extant exporters, having already paid that cost, have no interest in it being lowered for anyone else.
Finally, claims 1b, 2b and 3b are summarized graphically in Figure 2, which plots the profit functions before and after trade liberalization for a hypothetical country moving from restricted to freer trade across a number of scenarios.

**Exporters and Unilateral Increases in Trade Barriers**

The focus on firm opposition to trade liberalization at the highest end of the productivity spectrum in the previous section naturally implies that such firms can benefit from a mutual increase in trade barriers or tariffs by both countries. But it turns out that in the case of non-tariff barriers to trade we can make a much stronger statement: the most productive exporters can actually benefit from a unilateral increase in non-tariff barriers in their export market, as long as the market remains at least partially open to trade. Over the short run, a unilateral increase in non-tariff barriers has two effects on firms exporting to that market. It makes it harder for firms to export to the market because their products will be more expensive, but it also reduces the overall level of competition in the market. For the lowest cost firms, the benefits of the latter outweigh the former and they actually gain from an increase in trade barriers in their export market. At the same time some of the least productive exporters will be forced to drop out of the export market, while some less productive exporters will continue exporting but earn reduced profits.\(^{16}\)

Are there circumstances in which highly productive firms can gain from an increase in tariffs in their export markets? No, and to see the difference between the cases, consider a highly productive firm which has a very low marginal cost. An increase in the variable cost-of-trade has relatively little negative affect on this producer. It only slightly increases their marginal costs per unit exported because more productive firms are assumed to be more adept at negotiating trade barriers. Other less productive producers are harmed significantly more, however, leading to sharply reduced competition in the export market. In the case of a tariff, the most productive firms still charge reasonably high prices in order to maximize their profits, so an increase in the *ad valorem* tariff has a substantial affect. The crucial difference is therefore that while costs of production and trade are one, potentially very small part of the pricing decision, tariffs bluntly reduce the bottom line of any firm by pushing prices and sales down.

This section has focused on attitudes towards trade liberalization at the firm level, describing how the preferences are likely to vary with firm productivity. The answers depend strongly on whether the economy is autarkic or open to trade, on the trade instrument which is under discussion, and on the characteristics of the productivity distribution. The section also developed some propositions

\(^{16}\) Appendix A6 contains a proof of all claims in this section. This result is reminiscent of Abel-Koch (2010) which demonstrates that the most efficient producers may favor a non-zero level of government-imposed costs of production, applying to all firms domestic and foreign. The logic in both results is that such barriers harm the least productive firms more than proportionally.
Figure 2: All long-run equilibria feature a range of supporters and opponents to trade, as shown in the two left-most examples. In the tariff case, it is possible that either the most productive exporters favor or oppose trade liberalization, while in the NTB case they always oppose. In any case, note that the greatest benefits of trade do not accrue to the largest or most productive firm. As in the move from autarky to trade, some short-term equilibria feature no supporters of trade, as on the right. This can occur, for example, if a country agrees to lower its tariffs or trade barriers too sharply. On the left, \( m^l = m^h = 1.5 \) (\( l \)'s firms are shown) and \( \nu^l = \nu^h = 1.2 \). The two countries are equal in size. In the middle, the values are identical except that a tariff is used and \( l \) is much smaller than \( h \) (\( L^l = 170 \) and \( L^h = 400 \)). On the right, all of the parameters are again equal except \( \tau^l = 1.15 \) and \( \tau^h = 1.8 \). This highly unequal liberalization generates no winners in \( l \).
about the circumstances under which no firms will support trade liberalization. The next section follows up on these claims, examining how the proportion of firms in favor of and opposed to trade change with the characteristics of the trade liberalization, of the country, and of the product.

## Overall Industry Orientation

This section uses the results developed so far on firm preferences to explain why some industries are mostly united on questions of trade while others are deeply divided. The previous section concluded that intra-industry differences over trade are commonplace but of course the relative weight of the supporting and opposing camps will differ considerably depending on the contours of the trade agreement and the relative competitiveness of the two countries. In this section, I pursue the implications of this fact. Comparative statics are derived which show how the proportion of firms supporting a given trade liberalization varies with the terms of the trade deal, country size, and Ricardian comparative advantage. It is also shown that product differentiation – the crucial concept for understanding intra-industry trade – is closely linked to the extent of intra-industry disagreement over trade.

In order to simplify the analysis that follows, I will focus only on the case of moving from autarky to trade, while still considering reductions in both tariffs and non-tariff barriers. Examination of numerical examples suggests that most of the results which follow are similar in the case of moving from restricted to more liberal trade, but the notation is unwieldy and the derivations less tractable. Let’s define two measures of the proportion of firms supporting the move from autarky to trade liberalization:

**Definition 3** The proportion of active firms in autarky which support a given trade liberalization is equal to

\[
\frac{G_l(c^l_{pt})}{G_l(c^l_A)} \equiv p^l_{PT}.
\]

Similarly, the proportion of profits located in firms which support a given trade liberalization is equal to

\[
\frac{G_l(c^l_{pt})N^l_E \left( \int_0^{c^l_{PT}} \pi^l(c) \frac{m^l}{c_{PT}} \right)^k}{G_l(c^l_A)N^l_E \left( \int_0^{c^l_A} \pi^l(c) \frac{m^l}{c_A} \right)^k} = \frac{1}{f_E} \int_0^{c^l_{PT}} \pi^l(c) \frac{m^l}{c_{PT}} \right)^k \equiv p^l_{PT}.
\]

The first two results below summarize all of the key comparative statics relating the trade agreement and Ricardian comparative advantage factors to the percentage of firms (and percentage of profits) supporting the trade liberalization. Some of the comparative statics are derived analyti-
cally; others require conditions which are then examined across a set of parameter values to provide some sense of their generality.

**Comparative Static 1** The proportion of firms, and firms weighted by profits, who support trade liberalization are:

1. Increasing in domestic tariff and non-tariffs barriers.
2. Decreasing in foreign tariffs.
3. Decreasing in foreign non-tariff barriers as long as the marginal supporter of the trade liberalization would not benefit from higher NTBs in their export market.

These results are proven in Appendices B2 and B3. Recall that the most productive firms always benefit from higher non-tariff barriers in their export market, so the condition in part three cannot be assumed to hold. Due to the complex form of the pro-trade cutoff, it cannot be evaluated analytically but it did hold across every simulated economy.

These results demonstrate that the overall level of opposition to trade agreements depends on the agreed reductions. Agreements which reduce home tariffs less, and foreign tariffs more, find greater support from the differentiated product industry. Again, this highlights that attitudes are circumstantial. A supporter of one trade deal can be a strong opponent of another if the terms are less favorable. Turning to the differences in the productivity distributions between the countries, the results are similarly straightforward.

**Comparative Static 2** The proportion of firms, and firms weighted by profits, who support trade liberalization are decreasing in foreign average productivity and increasing in foreign costs of entry.

The proportion of firms who support trade liberalization is increasing in domestic average productivity and decreasing in domestic costs of entry, as long as the elasticity of the pro-trade cutoff with respect to the domestic autarky cutoff is less than one.

The condition at the end may seem a little opaque, but it has a straightforward intuitive interpretation. First, recall that we argued that the domestic autarky cutoff is a reasonable proxy for comparative advantage in the differentiated product. This condition then requires that if the comparative advantage of the home country deteriorates by a certain percentage, then the pro-trade cutoff should not increase or at least not increase by a greater percentage. Checking the numerical simulations, this condition held across every simulated economy.\(^\text{17}\)

\(^{17}\)Note also that every simulation across the grid indicated that \(\partial p_{PT}^l / \partial m^l\) and \(\partial p_{PT}^l / \partial f_{E}^l\) were negative, but there is no straightforward sufficient condition to include in the comparative static.
Interpreting this result is straightforward. As a country’s firms in the differentiated sector become more productive on average, they become relatively better at producing the differentiated product compared to the homogeneous good. Differences in the productivity distributions are therefore a source of Ricardian comparative advantage.\(^{18}\) This technological source of comparative advantage feeds predictably into the overall level of support for opening to trade. The logic behind the entry cost result is similar. Countries which facilitate the entry of more firms, by lowering the costs of starting a business or by supporting research, for example, have more varieties and are more competitive. This leads to greater support for trade liberalization.

**Country Size and Support for Trade**

What is the impact of country size on support or opposition to trade? To address this question it helps to decompose the effects of country size into two effects.

**Comparative Static 3** The impact of changes in country size on producers can be decomposed into two effects:

1. A *market size effect*: whereby firms earn greater profits in larger markets.
2. A *firm entry effect*: whereby larger countries have greater entry, and are more competitive, all other things being equal.

For a more formal explication of this argument, see Appendix A7. To see these effects in action, consider an increase in the export market’s size for a firm in \(l\). One obvious impact of an increase in \(h\)’s size is that there are more consumers for \(l\)’s products in the export market. Absent any other changes, this will increase the profits of \(l\)’s exporting firms. But an increase in the size of \(h\) also increases entry by firms in that country, making their industry both larger and more efficient. Put another way, comparative advantage in the differentiated product is increasing in home country size.\(^{19}\) The exact balance of these two forces is not clear analytically.

A similar story can be told about home country size. The first effect of increasing home country size is to make firms prefer a more closed economy. If they have a larger market, then why would they want to share it with foreign competitors? But the other effect of a larger market size is that it makes firms more competitive. The environment in autarky will be very competitive if the country

\(^{18}\)Note that \(\frac{\partial c_A^l}{\partial m^l} > 0\), indicating that a country with less productive firms are less competitive and therefore their average price in autarky is higher. This reduces their comparative advantage, or exacerbates their comparative disadvantage, in the differentiated product.

\(^{19}\)In autarky, the average price of the extant varieties in \(l\) is \(\bar{p}^l = \frac{2k+1}{2k+2} c_A^l\), and \(l\) has a comparative advantage in the differentiated product if \(c_A^l < c_A^h\). Because \(\frac{\partial c_A^l}{\partial L^l} < 0\) the extent of \(l\)'s comparative advantage in the differentiated product is increasing in \(L^l\) (or alternatively, \(h\)'s comparative advantage in the differentiated product is diminishing in \(L^l\)).
is large, so more firms will be incentivized to break out into new markets where they are now relatively more efficient.

In both cases, these effects work at cross purposes with one another. There are advantages and disadvantages associated with any change in market size, at home or abroad. Which effects will dominate? The following numerical simulations, which examines the question across a large set of parameter values as described in Appendix B, gives some indication.

**Numerical Simulation 1** Across the set of simulated economies, the proportion of firms, and firms weighted by profits, supporting trade liberalization are generally increasing in own country size and decreasing in foreign country size. The exact proportion of cases consistent with these patterns are given in the table below.

<table>
<thead>
<tr>
<th>Tariff Case</th>
<th>$\partial p_{PT}^l / \partial L^l &gt; 0$</th>
<th>$\partial p_{PT}^d / \partial L^l &gt; 0$</th>
<th>$\partial p_{PT}^l / \partial L^h &lt; 0$</th>
<th>$\partial p_{PT}^d / \partial L^h &lt; 0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>.96</td>
<td>.99</td>
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<td>.96</td>
<td>.96</td>
</tr>
<tr>
<td>NTB Case</td>
<td>.96</td>
<td>.99</td>
<td>.96</td>
<td>.96</td>
</tr>
</tbody>
</table>

Although the pattern is not absolute, the vast majority of simulations suggest that the impact of country size on competitiveness is stronger than the market size effect. Firms may prefer to export to a larger market, but larger markets have more competitive firms and the latter effect generally outweighs the former. Similarly, as own country size increases, firms may benefit more from keeping their home market closed but operating in a larger market leads to a more competitive environment. The firms which remain will be fitter and eager to compete abroad.

**Product Differentiation and Industry Support**

Product differentiation plays a central role in generating intra-industry trade, so the question naturally arises of how variation in product differentiation across industries affects the scope of support or opposition to trade liberalization. This section again relies on simulation to show that product differentiation interacts with the skewness of the productivity distribution to generate changes in support for trade.

Up to this point, we have assumed that the two countries had equal skewness parameters ($k^l = k^h = k$) in the distribution of marginal costs ($C^l = (c_m^l)^k$). Under this assumption, the overall percentage of firms supporting trade liberalization is unaffected by changes in product differentiation.\(^{20}\) To see why, consider an increase in consumer love of variety. This will increase the number of firms which are able to produce domestically, because consumers will purchase more

\(^{20}\)This is proven, but only for the case of moving to long-run equilibria, in Appendix B4. In the short-run, this property does not hold and the proportion of firms supporting trade liberalization can increase or decrease with $\gamma$. Numerical examples suggest that the size of this effect is modest and is swamped by the changes in comparative advantage when $k^l \neq k^h$ so I focus only on the long-run here.
high-priced varieties. For similar reasons, it will also increase the number of firms that can export abroad, and the number of firms which benefit from trade liberalization. When the skewnesses are equal across countries, all of these changes occur proportionally leaving the overall percentage of firms which support trade liberalization unchanged.

If we relax the assumption of equal skewnesses then the proportionality of cutoffs as love of variety changes is broken, and the extent of love of variety starts to play an important role in determining the shape of opposition. First note that a lower \( k \) implies a cost distribution more skewed towards low cost draws. Therefore, if \( k^l < k^h \) and \( m^l = m^h \), \( l \)'s firms will be more productive on average. There are obviously a number of forces at play when love of variety changes, but intuitively we might expect that if \( k^l < k^h \), reductions in love of variety would be more than proportionally harmful for firms in \( h \) because the viable extent of firms gets pushed into the lower tails of the productivity distributions where firms in \( h \) become relatively less populous compared to firms in \( l \). This intuition forms Numerical Simulation 2.

**Numerical Simulation 2** Across the set of simulated economies, if \( k^l < k^h \), then the proportion of firms which support trade liberalization in \( l \) is decreasing in consumer love of variety; and, the proportion of firms which support trade liberalization in \( h \) is increasing in love of variety.

A strategy for the numerical simulations is outlined in Appendix B4, which also explains why simulation is required. Also note that this only applies to transitions to long-run equilibria. The results with short-run equilibria are similar but not always consistent with this pattern.

Expressed in words, Numerical Simulation 2 suggests that the skewness of the productivity distribution is the decisive source of firm attitudes toward trade, and trumps all other sources of relative competitiveness, as love of variety diminishes. When love of variety is high, country size and the support of the productivity distribution express themselves equally with the skewness parameter. When love of variety is low, the skewness of the productivity distribution is the dominant influence on the attitude of the industry towards trade.

Through what channels do changes in product differentiation affect the level of support for trade among firms? A change in product differentiation alters the comparative advantages of the trade partners in the differentiated product. For example, as product differentiation decreases, the comparative advantage of the country with the lower skewness parameter improves. To see this, recall that we argued before that the average price in autarky (denoted by \( \bar{p}_A \)) is a good proxy for competitiveness in the differentiated product. Using the autarky solutions for the cutoffs, the ratio of the average prices in autarky has the following proportionality:

\[
\frac{\bar{p}^l_A}{\bar{p}^h_A} \propto \gamma \left( \frac{1}{k^{l+2}} - \frac{1}{k^{h+2}} \right).
\]
Figure 3: This figure provides one set of numerical simulations to illustrate Numerical Simulation 2. The proportion of both firms and profits which support an equal bilateral trade liberalization are decreasing with love of variety in the country with a more productive distribution of firms. They are increasing in the country with a less productive firms, who become more capable of exporting as consumers value product diversity more greatly. The darker lines represent a simulation from a long-term equilibrium and the lighter lines from a short-term equilibrium.

If \( k^l < k^h \), then \( \frac{\gamma^l}{\gamma^h} \) gets larger as \( \gamma \) decreases, meaning that a decrease in \( \gamma \) creates a relatively more competitive environment in \( l \) in autarky.

We can now consider a set of cases which illustrate the types of dynamics to which Numerical Simulation 2 gives rise. Let’s assume that \( l \) is unambiguously superior in the production of the differentiated good i.e. \( k^l < k^h \), \( m^l \leq m^h \) and \( L^l \geq L^h \), and the proposed trade liberalization entails equal tariff rates. When love of variety is relatively low, the differentiated product industry in \( l \) will be strongly in favor of trade liberalization. This is because free trade permits its firms to access the market in \( h \), knowing they will face only minimal competition from the generally less productive firms in \( h \). This is of course also the point at which \( l \)’s comparative advantage is greatest. For similar reasons, the firms in \( h \) will strongly resist trade liberalization knowing it entails significantly tougher competition in their home market with few opportunities for export abroad.

As love of variety increases, the differentiated sectors in each country will become ‘more divided’ in the sense that the relative unanimity on whether trade is good or bad breaks down. In \( h \), a growing number of firms will be able to export abroad as \( l \)’s comparative advantage is eroded. \( l \)’s firms now face intensified competition from abroad, and increased love of variety also means more relatively unproductive firms – who are likely non-exporters – will survive in autarky and
then oppose trade liberalization. There are obviously a complex set of forces at play here, but overall, a smaller proportion of l’s firms benefit from trade liberalization in this market than would if love of variety were lower. This class of examples is illustrated in Figure 3.

When are industries divided over trade?

Jointly, these comparative statics suggest the circumstances under which intra-industry divisions over trade will be significant, and when they will be muted. Trade agreements which make substantial concessions in exchange for only limited improvements in access abroad will be broadly opposed. Trade liberalizations with much more competitive countries will also face widespread resistance. Conversely, relatively equal trade liberalizations between countries which are equally competitive in the production of the differentiated good are likely to witness substantial intra-industry disagreements over trade. Put another way, intra-industry trade between countries with similar endowments and technology doesn’t eliminate competition over trade policy, it simply moves that competition from between industries to within industries.

A similar story can be told about country size, although, as noted above, the impact of changes in country size are ambiguous in theory. Still, the overwhelming majority of numerical simulations suggested that the level of support for a given trade liberalization is increasing in own country size and decreasing in export market size. This suggests that trade liberalization with significantly larger countries will face stiff resistance from producers, whereas liberalizations with much smaller countries will usually feature a strong level of support. Intra-industry divisions are predicted when countries are similar in size and competitiveness.

Finally, product differentiation plays an important role in determining the level of intra-industry divisions. It was argued that, under a reasonable set of conditions, comparative advantage industries become more opposed to trade as differentiation increases. Comparative disadvantage industries feature more support for trade. This suggests that industries producing relatively differentiated products are ‘more divided’ over trade. Put another way, industries with substantial intra-industry trade are likely to be the most divided over trade liberalization. The next section makes use of these comparative statics to explore two perennial questions in the study of trade politics.

Applications of the Comparative Statics

The comparative statics described above explain when industries will be united or divided over trade. This section applies these ideas to two long-running debates in trade politics: the popularity of preferential trade agreements; and, the apparent ease of trade liberalization in manufactured goods among the most developed countries. In order to make use of these comparative statics, it
is necessary to first sketch out a model of trade politics.

Rather than setting out a complete political economy, which I pursue in a separate paper, I instead simply assume that governments are cross-pressured when it comes to setting trade policies and making trade agreements, but that policymakers are especially sensitive to high levels of opposition from producers. Pressure from multilateral liberalization comes from consumers and firms capable of benefitting from increased exports; opposition to free trade comes from less productive firms and some subset of new and extant exporters. As shown above, trade deals which make too many concessions or which make equal concessions with more competitive trade partners – especially in industries producing homogeneous products – will provoke overwhelming opposition from producers.

This perspective – that the proportion of firms in a given industry which support or oppose a given trade liberalization matters – seems sensible on its face, but it is at odds with the approach in much of the trade literature which focuses on broad movements in aggregates with a government trading off between consumer and producer utility. For example, I demonstrate in a separate dissertation paper, which develops a complete model of trade policy determination, that larger and more efficient industries generally secure more protection than smaller, inefficient ones. This is because they have more to gain in absolute terms from protection, so governments take greater account of their interests relative to consumers. The model defined here would suggest that smaller and more inefficient sectors should secure more protection, because they will be united in opposition to any substantial decrease in the trade barriers which preserve their profits, even if the overall levels of profit at stake are insubstantial.

**Country size and regional free trade agreements**

The comparative statics in Numerical Simulation 1 showed that with free entry, the proportion of firms supporting a given trade liberalization is usually increasing in own country size and decreasing in trade partner size. This was because country size is a source of comparative advantage in the production of the differentiated goods. Larger countries have lower domestic productivity cutoffs, lower average prices in autarky, and more varieties of the differentiated product. They are therefore a greater source of competition for the home industry when trade liberalization is contemplated.

This result suggests a new perspective on a long-standing puzzle in the literature on trade policy and politics: why do countries form regional or bilateral trading blocs rather than pursue the broadest possible multilateral reductions in trade barriers? The starting point of the literature on regionalism and preferential trading agreements is the observation that, across a wide variety of trade models, free trade is welfare maximizing for both consumers and GDP (Bhagwati, 1999; Sager, 1997). In general, the gains from trade will be smaller among smaller trading blocs, espe-
cially if the countries are similar in their endowments and product specialities. At the same time, regional trade agreements still have distributional implications and some may lose from reductions in trade barriers. Any explanation of regional trade agreements rooted in domestic interests must therefore explain why producers (or owners of the scarce factor of production) oppose global or broad multilateral trade liberalization but favor regional or bilateral liberalizations (Mansfield and Milner, 1999).  

Preferential trade agreements within the WTO system, which are often regional in nature, entail smaller numbers of states, which may have similar factor endowments, agreeing on greater reductions in trade barriers than those extended to all other members under the usual principle of ‘most-favored nation’ treatment. The focus on country size and levels of opposition can help explain each of these features.

First, trade agreements among smaller groups of states will, all else equal, feature less resistance from producers. Consider the simple case of a complete liberalization of the economy and the choice of doing so with a small group of neighbors or with a much larger bloc of states. Further assume that all countries share identical technology and no country has any advantage in labor costs. The free trade agreement with the larger group of states will nonetheless face considerably more opposition from producers than the agreement with the smaller group of states. This is despite the fact that producers in the larger group have no a priori advantage in productivity or factor costs.

Second, rates of trade protection will be lower for preferential trading agreements than for broader multilateral agreements if governments seek to avoid widespread opposition from producers. When a country enters into a free trade agreement with a similarly sized and competitive trade partner, both will feature only moderate opposition to even total liberalization. In contrast, a complete liberalization of trade with a much larger group of countries will generate overwhelming opposition in the smaller country. The only way to compensate for this is by limiting concessions made by the smaller country. Within the GATT/WTO system, these types of differences were of course the entire reason for preferential trade agreements in the first place, but the focus on country size explains why such agreements generally secure greater reductions in trade barriers and...

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21 Eichengreen and Frankel (1995) and Mansfield and Milner (1999) provide extensive reviews of the political and economic arguments for regionalism. In political science, Mansfield and Reinhardt (2003) argue that preferential trade agreements enhance bargaining power in multilateral negotiations, for example, by ensuring access to important export markets or imported resources whether or not multilateral negotiations succeed, or by joining states as negotiating blocs. Milner (1997) and Chase (2003) focus on economic interests at the domestic level, arguing that bilateral or regional trade agreements may allow relatively uncompetitive industries, especially in smaller countries, to exploit economies of scale in production at the regional level, while avoiding the most intense competition at the global level. The explanation here differs in emphasizing country and trade bloc size as a source of comparative advantage, the importance of monopolistic competition rather than monopoly, and intra-industry trade. The latter two explain why two countries producing the same good may both have firms supporting trade liberalization.
are a popular alternative to broader agreements.

Third, intra-industry trade combined with firm heterogeneity helps explain why there is an active constituency for regional trade agreements among both consumers and producers, even in countries with similar endowments. It has already been argued that in homogeneous product industries, firms are united in support or opposition to freer trade. If one country has a significant comparative disadvantage in production of a homogeneous good, then trade liberalization will provoke sharp and united resistance. If, however, the two countries are equally competitive there will be little resistance from producers but no real gains from trade for consumers or producers, either. There is no reason to trade with another country which produces a similar set of homogeneous goods sold at similar prices.

Industries which produce differentiated products, on the other hand, combine significant gains for consumers from liberalization with a base of support among producers. This is even true if the countries produce similar goods in similar proportions. On the producer side, the most efficient firms in both countries form a core constituency for freer trade, especially if the two countries have similar factor endowments and inter-industry allocations of production occurring because of liberalization will be limited. Consumers also gain from greater trade, even if changes in prices are relatively muted because the countries specialize in similar products, due to increases in product variety.

This reasoning can also be applied to bilateral trade agreements, which often feature huge size asymmetries between countries. The theory presented here predicts that among these agreements, the concessions made by the larger country will be greater in order to compensate the firms in the smaller country with the greatest possible access to foreign markets. Unequal reductions in tariff or trade barriers serve to equalize levels of support among producers between countries with differences in competitiveness in the production of the differentiated good.22

One final point: when bilateral FTAs and other free trade agreements are signed between large and small countries, much is often made of the significant opportunities for expansion for firms located in the smaller country. The model presented here suggests that not all market access is the same, however. In industries without substantial intra-industry trade, cost advantages for an industry in the smaller country would generally imply gains from trade, because greater trade raises the price of their product. Larger foreign markets also mean greater increases in the price of goods in which they hold a comparative advantage. In industries with substantial product differentiation, however, smaller industries can be swamped by a flood of foreign varieties from a much larger competitor – even if they have cost advantages in factors of production or superior technology –

22GATT Article XXIV requires that preferential trade agreements generally be complete free trade agreements. The reality has generally been asymmetric reductions in tariffs and trade barriers depending on size and level of development, as well as comparative advantage (Grossman and Helpman, 1995; Wonnacott and Lutz, 1989).
due to size-induced productivity improvements in the larger country. Understanding the implications of market size for potential exporters therefore requires understanding the types of trade patterns that will result from liberalization.

**The challenges of liberalization with homogeneous goods**

The trade politics literature has emphasized the relative ease of trade liberalization in markets for differentiated products among the wealthiest nations, when compared to the more homogeneous products traded between the developing and developed world (Hufbauer and Chilas, 1974; Marvel and Ray, 1987). For example, the pre-1994 GATT rounds featured enormous, if not continuous, reductions in tariffs and non-tariff barriers on manufactures among the OECD countries, with the sole exception of textiles and apparel (Irwin, 1995). In contrast, agricultural goods and other commodities have remained far more protected (Kee, Nicita and Olarreaga, 2009). The role of product differentiation is seemingly crucial in explaining this long-term trend for two reasons. First, manufactured goods tend to feature greater differentiation then more-protected tradeables sectors like minerals and agriculture. Second, product differentiation provides a motivation for trade liberalization among similarly capital-rich countries.

Krugman (1981) and Alt et al. (1996) provide theoretical underpinnings for this pattern. In an economy with multiple endowments, changes in real factor incomes are relatively muted when two similarly-endowed countries liberalize and mutually export differentiated products. Product differentiation also offers additional gains from trade for consumers, including expanded variety and improvements in firm productivity, which may help to overcome losses in nominal earnings for owners of relatively scarce factors (Bernard, Redding and Schott, 2008). Opportunities for export for both sides also are likely to mute inter-industry reallocations of production, and in a model without firm heterogeneity raise the possibility that all producers might benefit from trade liberalization or at least not be harmed too greatly.

This paper has taken a different tack by emphasizing firms’ preferences and including firm heterogeneity in productivity, but points toward the same conclusion: trade liberalization should be easier and less antagonistic in industries with significant product differentiation. This contention arises naturally as an intrinsic feature of the model, as described in Numerical Simulation 2. It also is available extrinsically, when this model is compared to the standard approaches to trade with a homogeneous product.

First, consider the comparison of the model presented here and the standard trade model, which features a single good in a perfectly competitive market, and no intra-industry trade. As demonstrated in Propositions 1-3, the combination of product differentiation and firm heterogeneity leads to intra-industry divisions over trade across a wide variety of circumstances. For an industry producing a non-homogeneous product at a comparative disadvantage, opposition to trade
is both lower in the aggregate then it would be if the product were completely homogeneous and internally contradicted by productive exporters who have the possibility of gaining from trade. Policymakers attempting to read the industry’s views will receive mixed signals from firms depending on their productivity and ability to export. And to the extent that larger firms are better able to communicate their interests, policymakers will receive a biased impression of the extent of support for trade (Sadrieh and Annavarjula, 2005; Drope and Hansen, 2006). No such differences of opinion will exist in industries producing homogeneous products, and the largest firms will have the same preferences as their smaller domestic competitors.

Effective organization for trade protection is also likely to be more difficult in industries with product differentiation and firm heterogeneity. Differences of opinion on trade policy are ubiquitous in this model, obviating any rationale for working together among competing groups in the industry even as the collective action problem still applies. Note also that attitudes toward trade are fluid and situational, depending on a firm productivity itself (which might change over time), whether the liberalization is a move from autarky or partial trade, and on the specific terms of the trade deal. In these circumstances, firms may not have solidly developed attitudes towards trade liberalization and so may be unwilling to invest heavily in political organization when clashes with their fellow firms are in the offing. This insight provides an alternative gloss on Bombardini and Trebbi (2012)’s finding that firms in industries producing differentiated products are less likely to lobby as a trade association than those producing homogeneous products. Rather than a consequence of firms seeking variety-specific protection, it may be that internal divisions and unclear preferences over trade, as a general proposition, lead firms to pursue lawmakers individually as the circumstances of the particular trade deal warrant.

Comparing industries with different levels of product differentiation interior to the model suggests a similar story. Numerical Simulation 2 suggested that the impact of product differentiation on support for trade depends crucially on the skewness of the productivity distribution. The implications of this are more clear if one assumes that these differences in skewness, which absent other asymmetries make the country more skewed towards lower costs draws more competitive, are the only source of comparative advantage. More generally, one can assume that the other sources of comparative advantage are consonant with the difference in skewness. Either way, it then follows that the industry in the country at a comparative disadvantage in the differentiated product becomes less opposed to trade as product differentiation increases. At the same time, more firms in the industry oppose trade liberalization in the country at a comparative advantage in the differentiated product.

Increasing love of variety thus erodes the level of opposition to trade liberalization among firms in the country at a comparative disadvantage, who usually are the greatest stumbling block to freer trade. If governments seek to avoid overwhelming opposition among firms to trade liberalization, then greater love of variety makes trade liberalization easier to accomplish. Moreover, in a hypo-
theoretical move from relatively limited or autarkic levels of trade to greater liberalization, these new proponents of trade are likely to be among the larger and more productive firms, who are plausibly more influential in the determination of trade policy. Of course, the flip side of this is that as product differentiation increases the country at a comparative advantage will now have more opponents to trade liberalization. Still, if the proposed trade liberalization is reasonably equal, there will be fewer opponents than in the country at a comparative disadvantage so opposition will remain relatively weak and concentrated among the smallest firms.

The organizational considerations described above also point in the same direction. When goods are relatively homogeneous in this model, industry attitudes toward trade are, too. Fewer divisions in attitudes don’t overcome the collective action problem, but they at least ensure shared objectives and more widespread gains assuming that the industry does overcome impediments to organization. In addition, the uncertainties associated with interests over trade, in particular, how interests will depend on the exact terms of the trade deal, are minimized. All of these obstacles to organization are heightened as the good becomes more differentiated, and may offer a plausible account for why trade liberalization has been easier with differentiated products than in industries producing homogeneous products.

Finally, this focus on firms and product differentiation may help explain the broad, global movement towards steadily decreasing trade barriers since the creation of the GATT in 1994. Intra-industry trade has increased steadily over time, which is indicative that product differentiation has as well (Brülhart, 2009). Because these two concepts are so closely linked to the intra-industry divisions over trade in this model, and so many new tradeable goods are highly differentiated consumer products, it may be that a gradual increase in product differentiation is implicated in the steady erosion of trade barriers and the globalization of the world economy.

Conclusion

To conclude, I expand the discussion of the contribution of the paper to the literature on international trade in political science. Four themes are emphasized. First, incorporating firm heterogeneity and intra-industry trade into models of trade politics is important in its own right, because political economic models of trade politics should match patterns of trade (Rodrik, 1995). Second, incorporating these features into our understanding of trade politics leads to significant and non-obvious conclusions about who supports and opposes trade. Third, understanding trade preferences at the firm level helps us understand patterns of organization and opposition at the industry- or economy-wide level. Fourth, a firm-level approach helps explain several puzzling features of trade politics, including the existence of intra-industry divisions over trade and the broad movement towards freer trade in the post-war era.
Matching theories of trade politics to trade patterns

The basic contribution of this paper is to develop a theory of preferences over trade which incorporates two recent developments in the economics of international trade. Understanding the economic motivations behind preferences over trade policy starts with understanding how trade impacts the incomes of factor owners. The most commonly used models of trade politics are based on an incomplete picture of trade patterns, however. Two developments in the understanding of international trade are absent from the traditional approaches. First, the majority of industries feature *intra-industry trade*, that is, countries are both importers and exporters of varieties of essentially the same good. Second, only a minority of firms generally export, even in industries which are highly competitive in export markets.

The implications of incorporating these features into our models of trade politics are substantial. Most fundamentally, trade liberalization has significant redistributive effects within industries, shrinking or closing down certain firms even as others expand. Understanding the impact of an increase in trade therefore requires careful consideration not just of an industry’s place in the world but of each constituent firm’s place in their industry. Identifying winners and losers from trade is not as simple as dividing exporters from non-exporters, however. An original contribution of this work is to show that when trade liberalization occurs in already partially open markets, the largest extant exporters do not make the greatest gains in profits. In fact, they may lose profits from increased access to their export markets because of greater competition from compatriot firms.

It is argued that intra-industry reallocations of production and the resultant changes in profits determine firms’ preferences over trade liberalization. This paper therefore suggests an alternative to the class- and industry-based approaches to trade politics which have prevailed in political economy. Just as the debate between these theories focused on the specificity of factors of production, this model is based on the assumption that capital is firm specific, essentially a sunk cost. This is a strong assumption, but one which may be quite suitable for the short-term and has strong empirical grounding in the literature on firm entry in industrial organization.

Variation in attitudes toward trade at the firm level also complicates the organizational dimension of trade politics. On one hand, industries are internally divided over trade between those who can and cannot benefit from greater export opportunities. Under these circumstances, pre-existing organizations may be fractured and competing organizations may develop. On the other hand, one of the major themes of this paper is that attitudes toward trade are highly contingent and depend on existing trade patterns, industry features at home and abroad, and the terms of the trade liberalization. The exact borders between supporters and opponents of trade liberalization are likely to change over time and from agreement to agreement, making it harder to form durable, coherent organizations to influence policy.

An additional organizational implication of this research is that inter-industry coalitions orga-
nizing on trade issues are likely to divide industries. In a Heckscher-Ohlin economy, coalitions on trade cross all industries, uniting factor owners who share a common interest in trade liberalization. In a Ricardo-Viner economy, inter-industry coalitions link up industries with similar comparative advantages, and divide factors. These coalitions are based only on a shared orientation towards free trade, rather than a shared interest in particular policies, however. In the model proposed here, inter-industry coalitions on trade combine these features. All firms which are capable of profiting from trade liberalization, including firms from industries at a disadvantage, may band together to support trade liberalization. Firms which are harmed by trade may also work together to resist trade liberalization. Coalitions are therefore broad, although only based on a common preference for freer trade.

The extent of intra-industry division

The model developed here suggests that industries producing a differentiated product are often divided over trade. However, the balance of power between pro- and anti-trade firms varies considerably depending on the relative competitiveness and size of the trade partners, and the agreed reductions in trade barriers. There are also circumstances, generally requiring some significant disparity in the liberalizing countries’ comparative advantages or agreed reductions in trade barriers, when industries will be unanimously opposed to trade liberalization. These comparative statics therefore provide a theory of when industries will be mostly united, or sharply divided, over trade.

Differences in technology play a predictable role: as the average productivity of firms in the differentiated product industry decrease, more of those firms will lose profits in the wake of trade liberalization. Industries which are extremely uncompetitive relative to their trade partners are therefore likely to be mostly opposed to trade liberalization. It is possible that no firms will benefit from trade liberalization if the competing firms abroad are significantly more productive, although some firms will nonetheless continue to produce and even export.

Country size, which here indicates the endowment of labor and number of consumers, also plays a fundamental role because larger countries can support a larger number of firms. With a richer set of available varieties, consumers in larger countries drop the least competitive firms and those that remain when it comes time to compete globally are more productive. Trade liberalization between countries with extreme size differences is therefore likely to provoke relatively unanimous support in the larger country and opposition in the smaller country. Similarly sized economies will generally feature more pronounced divisions within industries over trade. Note also that the greater competitiveness of firms in larger countries generally swamps any benefit to foreign producers of gaining access to larger markets, again emphasizing how intra-industry trade alters the received wisdom on trade politics. In this setting, larger markets are not more desirable export targets because they can export back.
The role of product differentiation is also crucial for understanding the extent of divisions over trade. Consumer love of variety is a fundamental primitive for an industry with significant implications for firm behavior, market structure and trade patterns. Its role in trade politics is not well understood, however. This paper makes headway on this problem, demonstrating that the level of product differentiation strongly impacts the extent of intra-industry division. Under a plausible set of circumstances, which are described in the paper, a clear result emerges. Industries at a comparative disadvantage in the production of a differentiated product become more in favor of trade liberalization as product differentiation increases; industries at a comparative advantage become more opposed to trade liberalization.

Empirical applications

These ideas shed light on several empirical patterns in the politics of trade. Most importantly, the theory predicts that intra-industry divisions over trade are likely to be widespread. These divisions were first systematically documented in Milner (1988) and are a recurring feature of disputes over trade although they have received relatively little attention in the scholarly literature. In apparent contradiction to standard approaches, firms publicly express divergent preferences over trade agreements and trade disputes. Journalistic accounts in trade publications and mass media emphasize splits within industries over pending trade legislation. Separate trade associations representing the same industry contradict one another in USITC testimony and ITA reports, and issue competing press releases.

Of course, a sensible first instinct is that these divisions occur because the industries are truly producing separate products, and intra-industry trade is simply a poorly measured construct concealing trade in entirely different goods. Intra-industry divisions could also be the result of variation in the multinationalization of production, with firms who outsource production supporting trade liberalization in their own industry. I argue in a separate dissertation paper that while these arguments are certainly valid in some instances, the ideas presented here provide the best explanation for the origins of intra-industry disputes over trade in a great number of other instances. This argument is pursued using case studies from trade agreements and trade disputes involving the United States over the past two decades.

The comparative statics described above also shed light on two striking empirical regularities in the study of international trade. The first of these is that there has been a steady reduction in trade barriers over the past 70 years, especially among the wealthiest countries and for manufactured goods (rather than agricultural products, for example). While this is obviously a complex

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23 Hathaway (1998) also describes several instances of intra-industry divisions over trade in segments of the textile and apparel sectors. Schattschneider (1974) discusses divisions within industries extensively, but only in the context of unilateral trade policy determination.

24 Although, Goldstein and Gulotty (2011) and Kono (2009) suggest that this narrative may be too pat.
historical process with many explanations, it is suggested that the rise of differentiated products may have played a role because it fractured industry-based coalitions against trade liberalization. A second striking feature of post-war liberalization is the rise of regional and bilateral preferential trading agreements. It was argued here that these agreements provide a way for countries to expand product variety and export opportunities for producers, while avoiding the fiercest competition from large trading blocs.

**Further questions for the study of trade**

The model presented above suggests several avenues for future research on the politics of trade. First, because the contrast between the standard trade model, which features no product differentiation, and the model presented above is so striking, it seems natural to focus on product differentiation and intra-industry trade as crucial areas for future research. This is all the more true because intra-industry trade accounts for such a large volume of trade flows, and because the extent of product differentiation differs sharply across industries. The result presented in Numerical Simulation 2 only makes a start on this tricky set of questions. There is a need for more theorizing and more empirical analysis to disentangle the key role played by the extent of product differentiation in trade politics.

Second is the question of whether firm-specific protection is available as an alternative to broader industry-wide barriers to trade. If so, increases in product differentiation may have a far less salubrious effect on the health of the international trading regime. Many have suggested that the highly specific categories of tariff schedules or the availability of anti-dumping and countervailing duties as trade remedies, both of which can be initiated by firms, are indicative of firm-specific protection. This may be so, but there is a need for more systematic research on this question.

There is also a need for more careful empirical work, at the industry level, on attitudes towards trade of business owners and their employees. Industries vary considerably in market structure, product characteristics, competitiveness, firm structure, trade protection, international integration, sources of inputs, and much else. While I believe the ideas presented here have some general applicability, every industry’s story on trade is a little different. Understanding how these details affect the very broad story told here is an interesting area for further research, which I am in part pursuing in a separate dissertation chapter on case studies in intra-industry divisions.

Finally, the literature on firm heterogeneity in international trade is now very rich, and there are many possible new applications for political economy. One major question is how patterns of outsourcing and multinationalization affect attitudes towards trade policy and other economic policies. A major finding in this literature has been that only a very few productive firms are capable of taking advantage of opportunities to outsource, echoing the similar findings on trade which motivated this paper. Second, how does variation in the impact of trade at the firm level
impact the attitudes of workers over trade within the same industry? This paper suggests some tentative answers to these questions, if workers interests are aligned with their employers. Of course, the conditions under which that will be the case need careful explication. Overall, there is a vast array of opportunities for an improved understanding of the politics of globalization based on the literature on firm heterogeneity.
Appendix A

This appendix has two purposes. First, to reintroduce the model developed in Melitz and Ottaviano (2008), highlighting the features of the model which are most important for understanding firm preferences over trade. Second, to present an amended version of the model which uses an ad valorem tariff rather than the variable cost of trade employed in the original paper. This change leads to a few relatively straightforward changes in the model solutions.

As in Melitz (2003), and most of the subsequent literature on firm heterogeneity in export performance, firms engage in monopolistic competition. An endogenously determined set of varieties of a differentiated product are produced. Each variety is indexed by \( i \in \Omega \). Each firm monopolizes production of a single variety, producing \( q_i \) units. There are \( L \) workers/consumers in the economy who each consume \( q_i^c = \frac{q_i}{L} \) units of variety \( i \). Varieties of the differentiated good are imperfect substitutes, therefore consumers value diversified consumption. Consumer utility is given by

\[
U = q_i^0 + \alpha \int_\Omega q_i^c \, di - \frac{1}{2} \gamma \int_\Omega (q_i^c)^2 \, di - \frac{1}{2} \eta \left( \int_\Omega q_i^c \, di \right)^2.
\]

\( q_i^0 \) represents a single consumer’s consumption of a homogeneous numeraire good, an addition to the model which under certain assumptions holds wages across sectors at unity.\(^{25}\) \( \alpha \) and \( \eta \) alter relative demand for the differentiated product. \( \gamma \) determines consumer love of variety. As \( \gamma \to 0 \), the varieties become perfect substitutes and consumers care only about total consumption \( Q^c \equiv \int_\Omega q_i^c \, di \).

As originally shown in Ottaviano, Tabuchi and Thisse (2002), consumer inverse demand takes on an appealingly simple form,

\[
p_i = \alpha - \gamma q_i^c - \eta Q^c
\]

where \( p_i \) represents the price paid by the consumer, which will differ from the amount earned by exporting firms when there are tariffs. Given \( L \) total consumers, aggregate demand for variety \( i \) is

\[
q_i = \frac{L}{\gamma} (\alpha - p_i - \eta Q^c) = \frac{L \alpha}{\eta N + \gamma} - \frac{L}{\gamma} p_i + \frac{\eta N}{\eta N + \gamma} \bar{p}
\]

where \( N \) is the measure of varieties consumed, and \( \bar{p} \) is their average price.\(^{26}\) Demand turns negative at a choke price defined by \( p_i = \alpha - \eta Q^c = \frac{1}{\eta N + \gamma} (\gamma \alpha + \eta N \bar{p}) \), a feature of the demand system which in an open economy with costly trade precludes high price firms from exporting.

Within the differentiated sector, firms are assumed to differ in their constant marginal cost of production, \( c \). All firms simultaneously pay \( f_E \), a fixed cost of entry, in order to learn their cost of production. For the moment, assume \( c \) is drawn from a distribution \( G \) with support on \([0, m]\). Two countries will be denoted by the superscripts \( l \) and \( h \). All assumptions and results will be phrased in terms of \( l \). Countries can vary

\(^{25}\) These are: the numeraire is produced at constant cost equal to 1 in a competitive market; and, all labor is employed at all times. It is also assumed that \( q_0 \geq 0 \) in equilibrium.

\(^{26}\) To see that the two expressions for \( q_i \) are equivalent, integrate the expression for inverse aggregate demand over the measure of varieties, solve for \( Q^c \), and substitute into the first expression for \( q_i \).
by number of workers/consumers ($L'$), distribution of firm marginal costs ($G'$), and trade policies. Two policy instruments are explored: an *ad valorem* tariff $\tau'$ and a variable cost-of-trade, which will be referred to as a non-tariff barrier, $\nu'$. The variable cost-of-trade is multiplicative of the marginal cost $c$. Note than an exporter in $h$ earns $p_{i}^{f_{\text{firm}}} = pr_i$ for every unit sold to $l$'s consumers, who pay $p_i = \tau'p_i$ and the government earns $(\tau' - 1)p_i$ in tariff revenue for each unit sold. From here on out the analysis will focus on the tariff case, because the variable cost-of-trade case is presented in Melitz and Ottaviano (2008).

Profits for a firm in $l$ producing for the domestic and export markets are respectively

$$\pi_D(c) = [(\alpha - \frac{\gamma}{L}q_D(c) - \eta Q^c) - c]q_D(c)$$

and

$$\pi_X(c) = \left[\frac{1}{\tau_h}(\alpha - \frac{\gamma}{L}q_X(c) - \eta Q^{ch}) - c\right]q_X(c)$$

Maximization of profits domestically, as long as $q_D(c) \geq 0$, yields the following optimal production for the domestic market: $q_D(c) = \frac{L't}{\tau_l} (\alpha - \eta Q^c - c)$. Note that if $c > \alpha - \eta Q^c$ then $q_D(c)$ is negative.\(^{27}\) $\alpha - \eta Q^c$ thus represents a threshold in the support of the productivity distribution which divides firms between those who continue to produce after learning their cost draw, and those who cease to serve the domestic market. We thus define $c_D = \alpha - \eta Q^c$ as the zero-profit domestic productivity cutoff for firms both operating and selling in $l$. Upon paying their fixed cost of entry, any firm in $l$ for whom $c > c_D$ will find no demand for their variety in $l$ and so will desist in selling in $l$.

Maximization of profits in the export market generates an analogous expression for optimal production for the foreign market: $q_X(c) = \frac{L't}{\tau_h} (\alpha - \frac{\eta}{L}q_X(c) - \eta Q^{ch})$. The firm therefore has no market for its goods abroad if $c > \frac{\alpha - \eta Q^{ch}}{\tau_h}$, and so we define $c_X = \frac{\alpha - \eta Q^{ch}}{\tau_h}$ as the zero-profit export productivity cutoff. Note that the definition of $c_D$ is embedded in $c_X$, giving the relationship $c_X = \frac{\tau_h}{\tau_l} c_D$.\(^{28}\)

With these cutoffs defined we can return to the equations for sales ($q_i$), price ($p_i$), and profits ($\pi$) and fashion some more useful expressions:

$$p_{i}^{D}(c) = \frac{1}{2}(c_D' + c) \quad p_{i}^{X}(c) = \frac{\tau_h}{2}(c_X' + c)$$

$$q_{D}(c) = \frac{L'}{2\gamma}(c_D' - c) \quad q_{X}(c) = \frac{L}{2\gamma}(\tau_h c_X' - c)$$

$$\pi_{D}(c) = \frac{L'}{4\gamma}(c_D' - c)^2 \quad \pi_{X}(c) = \frac{L}{4\gamma}(\tau_h c_X' - c)^2.$$ 

\(^{27}\)The complete Kuhn-Tucker conditions for the domestic sales problem are:

$$[\alpha - \frac{2\gamma}{L}q(c) - \eta Q^c - c]q(c) = 0$$

where

$$[\alpha - \frac{2\gamma}{L}q(c) - \eta Q^c - c] \leq 0 \text{ and } q(c) \geq 0.$$ 

The conditions for the exporting problem are analogous.

\(^{28}\)Note that the same relationship between the domestic cutoff in $l$ and the exporting cutoff in $h$ holds for the case of a variable cost of trade, i.e. $c_X = \frac{\tau_h}{\tau_l} c_D'$. 

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Note in the export case the divergence between prices paid by consumers \((p^e_X)\) and those earned by firms \((p^h_X = \frac{\phi^h_X(c)}{\tau_l})\) which determine the amount of profits.\(^{29}\)

Recall that before production begins, potential producers pay a fixed cost \(f_E\) to learn their marginal cost of production, \(c\). Free entry implies that expected profits net of the fixed entry cost are pushed to zero, as long as a non-zero mass of entrants choose to enter the market. Let’s define \(N^l_E\) as the number of firms entering in \(l\). Of these, \(G^l(c^l_D)N^l_E\) produce for the domestic market and \(G^h(c^h_D)N^h_E\) export to \(h\). To solve for all cutoffs, we assume that \(N^l_E > 0\), which then implies:

\[
0 = E[\pi(c)] - f_E
\]

\[
0 = \int_0^{c^l_D} \pi^l_D(c)g^l(c) \, dc + \int_{c^k}^{c^l_K} \pi^l_X(c)g^l(c) \, dc - f_E
\]

\[
0 = \int_0^{c^l_D} \frac{L^l}{4\gamma}(c^l_D - c)^2g^l(c) \, dc + \int_{c^k}^{c^l_K} \frac{L^l}{4\gamma}r^h(c^h_X - c)^2g^l(c) \, dc - f_E
\]

The equivalent condition holds for \(h\), giving us two equations to pin down all cutoffs. Substituting in the relations \(c^l_X = \frac{\phi^l_X}{\phi^l_D}\) and \(c^h_X = \frac{\phi^h_X}{\phi^h_D}\), we can solve for all four cutoffs.

In order to find explicit solutions for all cutoffs, we must now specify a distribution for \(G^l(c)\). I follow Melitz and Ottaviano (2008) and assume that costs are distributed Pareto, \(G^l(c) = (\frac{\alpha}{m^l})^{k'}\) for \(c \in [0, m^l]\). I further assume that \(k^l = k^h = k\) and while \(m^l\) and \(m^h\) can differ. Using this distribution we can now solve for the domestic productivity cutoffs, and by extension, the exporting cutoffs:

\[
c^l_D = \left(\frac{\gamma \phi^l_D - \rho^h \phi^h}{L^l \cdot \frac{\phi^h}{\phi^l}}\right)^{\frac{1}{1+\gamma}}
\]

where \(\phi^l = 2(k + 1)(k + 2)(m^l)^k f^l_E\), \(\rho^l = (\tau^l)^{-k-1}\), and \(\phi^h\) and \(\rho^h\) are defined analogously.\(^{30}\)

With the cutoff solutions from above, the equation for aggregate demand of variety \(i\) is used to solve for the number of firms serving in each economy \((N^l\) and \(N^h)\).\(^{31}\) The following identities,

\[
N^l = N^l_E G^l(c^l_D) + N^h_E G^h(c^h_X)
\]

\[\text{29For the case with a variable cost of trade, } p^l_X(c) = p^h_X(c) = \frac{\phi^h_X(c) + c}{\tau} \text{ and profits are } \frac{L^l}{4\gamma} (\phi^h)^2(c^h_X - c)^2.\]

\[\text{30Note that this solution differs slightly from the case with a variable cost of trade, which is} \]

\[
c^l_D = \left(\frac{\gamma \phi^l - \sigma^h \phi^h}{L^l \cdot \frac{\phi^h}{\phi^l}}\right)^{\frac{1}{1+\gamma}}
\]

where \(\sigma^l = (\nu^l)^{-k}\).

\[\text{31Doing so involves a few steps. First, recall that aggregate demand for each variety in } l \text{ is given by } q_l = \frac{L^l \cdot \alpha}{\eta N^l + \gamma} - \frac{L^l}{\gamma} p_l + \frac{\eta N^l}{\eta N^l + \gamma} \frac{L^l}{\gamma} \bar{p}^l. \text{ Second, } q^l = 0 \text{ where } p^l = c^l_D \text{ which allows us to simplify this expression and solve for } N^l. \text{ Third, } \bar{p}^l, \text{ the average variety price faced by consumers in } l, \text{ is easily solvable in terms of parameters and cutoffs because the distribution of productivities of the firms in market } l \text{ is the same for both domestic production and imports. As in Melitz and Ottaviano (2008), this is } \bar{p}^l = \frac{2(k+1)\gamma}{2k+2} \frac{c^l_D}{c^l_D}. \text{ After some simplification, } N^l = \frac{2(k+1)\gamma}{\eta} \frac{\alpha - c^l_D}{c^l_D}.\]

47
\[ N^h = N^h_E G^h(c^h_D) + N^h_E G^l(c^l_X). \]

determine the number of entrants in each economy \( (N^l_E \text{ and } N^h_E) \) The derivations are given in greater detail in Melitz and Ottaviano (2008), but the end result is that

\[ N^l_E = \frac{2(k + 1)\gamma}{\eta (1 - (\tau^h \tau^l)^{-k})(m^l)^{-k}} \left( \frac{\alpha - c^l_D}{(c^l_D)^{k+1}} - (\tau^l)^{-k} \frac{\alpha - c^h_D}{(c^h_D)^{k+1}} \right). \]

We have now collected a couple of assumptions, which it is useful to summarize because they play an important role in the analysis. The restrictions placed on cutoffs, and the requirement that entry be positive are presented together in Assumption 1.

**Assumption 1:** All long-run equilibria in \( l \) feature:

1. \( N^l_E > 0 \) (Positive Entry)
2. \( c^l_D < m^l \) (Dropout)
3. \( q^l_D > 0 \) (No specialization)

Parts 2 and 3 of Assumption 1 are mainly technical assumptions to ensure that the model is solved as presented above. However, they both have a substantive interpretation. Part 2 means that at least some firms which enter the market quit without producing anything. Part 3 means that no country ends up specializing in only the differentiated good. This fixes wages across the economy at 1 and greatly simplifies treatment of the labor market.

In contrast, Part 1 is an assumption with considerable implications [See Appendix A for formal proofs]. First, positive entry guarantees that \( c^l_D < c^l_X \), i.e. that only a subset of those who produce for the domestic market will also export their variety. This reflects a now well-established finding in the literature on firm participation in trade: across a wide variety of industries and countries, only a subset of firms which produce domestically are also exporters. Moreover, very few or no firms export without also producing domestically. Positive entry also implies that \( c^l_D > 0 \).

Finally, Melitz and Ottaviano (2008) also present a short-run version of the model which features a set of extant firms \( N^l_D \) serving the domestic market with a productivity distribution truncated by a previous round of exit lying on \( [0, \tilde{m}^l] \). The short run version of the model has no closed form analytic solutions for the cutoffs. A complete derivation of the implicit solutions for the cutoffs (which in turn determine all other endogenous variables) is provided in Melitz and Ottaviano (2008), but briefly, the zero-profit conditions used to solve for the number of firms serving each market above are re-deployed this time using the fixed number of entrants to determine the new cutoffs. So long as \( c^l_D < \tilde{m}^l \) and \( c^l_X < \tilde{m}^l \) then we can use the following to solve for \( c^l_D \) in the short term:

\[ \frac{\alpha - c^l_D}{(c^l_D)^{k+1}} = \frac{\eta}{2(k + 1)\gamma} \left( \frac{N^l_D}{(\tilde{m}^l)^k} + (\tau^l)^{-k} \frac{N^h_D}{(\tilde{m}^h)^k} \right). \]

All short-run equilibria used in this paper will be transitions away from long-run equilibria. For example, in the section on moving from autarky to an open economy, I will assume that \( \tilde{N}^l_D = N^l_A \) and \( \tilde{m}^l = c^l_A \). In the section on moving from more to less restricted trade, the starting point will again be a long-term equilibrium with costly trade. This is done to ensure comparability with the long-run results, which feature
moves from one long-run equilibria to another, and to start out with a defensible and theoretically grounded
distribution of entrants, rather than arbitrary numbers.

Short-run equilibria of this type allow us to dispense with the first two elements of Assumption 1, giving
a refined Assumption 2 for short-term equilibria. First, entry will always be positive when \( N_{iD} > 0 \). Second, \( c_{iD} < m_i \) when \( m_i \) is the domestic cutoff from a long-run equilibrium. Third, and most usefully, \( c_{X} < c_{D} \) for any short-run equilibrium based on an existing long-run equilibrium. As noted above, this ordering
of the cutoffs is well-established empirically and simplifies the analysis of the model without any extra
assumptions. Proof of these latter two contentions are contained in Appendix A1.

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**Assumption 2:** All short-run equilibria in \( l \) feature:

1. \( q_{i0} > 0 \) (No specialization)

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### A1: Ordering all Cutoffs

This section of the appendix is devoted to establishing two patterns in the cutoffs. First, that in the case of
moving from autarky to trade,

\[
0 < c_{X} < c_{D} < c_{A}.
\]

Second, that in the case of moving from less trade to more trade

\[
0 < c_{X0} < c_{X1} < c_{D1} < c_{D0}.
\]

These orderings are done for transitions from long-run equilibria to both short- and long-run equilibria, to
provide some sense of the generality of the results. I make use of Assumptions 1 and 2 throughout, as well
as that \( \tau_1 < \tau_0 \) for both countries. This section (A1) includes results form Melitz and Ottaviano (2008) which
if repeated are referenced, and new results.

All cutoffs are positive: First, we check for the long-run. Positive entry implies that average expected profits
net of fixed costs are zero, so in \( l \), \( E[\pi|l] = f_E > 0 \). At this point, we only assume that \( c_{D} \geq 0 \) and \( c_{X} \geq 0 \)
(a negative cutoff is non-sensical). Firm willingness to pay the cost of entry implies that either \( c_{D} \) or \( c_{X} \) are
positive. Let’s suppose that \( c_{X} \) is positive. This also means that \( c_{D} \) is positive which implies that the second
term in the expression for \( N_{E} \) is negative. This is so because \( c_{D} > 0 \) implies a positive number of firms
serving \( h \) (\( N^{h} > 0 \)) which implies \( \alpha - c_{D} > 0 \). Positivity of \( N_{E} \) then requires that \( c_{D} \) be strictly greater than
zero. The alternative is that \( c_{D} > 0 \) but \( c_{X} \) (and therefore \( c_{D} \)) might be zero. If \( c_{D} > 0 \), the second term in
\( N_{E} \) will be negative, so positivity of \( N_{E} \) requires that \( c_{D} > 0 \). Using the fact that \( \tau_1 \) and \( \tau_0 \geq 1 \) and \( c_{X} = \frac{c_{D}}{\tau_0} \),
this shows that the exporting cutoffs are also positive.

For transitions to the short-run, the domestic productivity cutoff is defined by:

\[
\frac{\alpha - c_{D1}}{(c_{D})^{k+1}} = \frac{\eta}{2(k + 1)\gamma} \left( \frac{N_{E0}^{l}}{(m_{l})^{k}} + (\tau_{1})^{-k} \frac{N_{E0}^{h}}{(m_{h})^{k}} \right).
\]

When \( \tau_{1} = \tau_{0} \) then \( c_{D1} = c_{D0} > 0 \). Reductions in \( \tau_1 \) reduce \( c_{D1} \) continuously but it is never pushed below
zero, because an arbitrarily large right hand side can be accommodated by a small, but positive, \( c_{D1} \). For
example, a firm will always produce after any trade liberalization after autarky with any size country. As above, it is also the case that \( c_{X_1}^l \) must be greater than zero.

\( c_{X}^l < c_{D}^l < m^l \): For the long-run case, positive entry in \( l \) implies \( c_{X}^h < c_{D}^h \). This proof is replicated from Melitz and Ottaviano (2008).

\[
\begin{align*}
0 &< N_k^l \\
0 &< \frac{2(k+1)\gamma}{\eta(1-(\tau^l)^{-k})(m^l)^{-k}} \left( \frac{\alpha - c_{D}^l}{(c_{D}^l)^{k+1}} - \frac{\alpha - c_{D}^h}{(c_{D}^h)^{k+1}} \right) \\
0 &< \frac{\alpha - c_{D}^l}{(c_{D}^l)^{k+1}} - (\tau^l)^{-k} \frac{\alpha - c_{D}^h}{(c_{D}^h)^{k+1}} \\
0 &< \frac{\alpha - c_{X}^l}{(c_{X}^l)^{k+1}} - (\tau^l)^{-k} \frac{\alpha - c_{D}^h}{(c_{D}^h)^{k+1}}
\end{align*}
\]

This inequality can only hold if \( c_{D}^l \) is strictly greater than \( c_{X}^l \). Note that the proof is identical for the case of a variable cost-of-trade \( \nu^l \).

For the long run case, it must be assumed that \( c_{D}^l < m^l \) (see Assumption 1). We will shortly show that \( c_{D1}^l < c_{D0}^l \) for the short-run case, which then implies that \( c_{D1}^l < m^l \).

To show that \( c_{X1}^l < c_{D1}^l \) for the short-run, we can manipulate the expression for \( c_{D1}^l = \tau_1^l c_{X1}^l \).

\[
\begin{align*}
\frac{\alpha - \tau_1^h c_{X1}^l}{(\tau_1^h c_{X1}^l)^{k+1}} &< \frac{\eta}{2(k+1)\gamma} \left( \frac{N^h_{D0}}{(c^h_{D0})^k} + (\tau_1^h)^{-k} \frac{N^l_{D0}}{(c^l_{D0})^k} \right) \\
\frac{\alpha - \tau_1^h c_{X1}^l}{(\tau_1^h c_{X1}^l)^{k+1}} &< \frac{\eta}{2(k+1)\gamma} \left( \frac{(\tau_1^h)^k N^h_{D0}}{(c^h_{D0})^k} + \frac{N^l_{D0}}{(c^l_{D0})^k} \right) \\
\frac{\alpha - c_{D1}^l}{(c_{D1}^l)^{k+1}} &< \frac{\eta}{2(k+1)\gamma} \left( \frac{N^l_{D0}}{(c^l_{D0})^k} + (\tau_1^h)^k \frac{N^h_{D0}}{(c^h_{D0})^k} \right)
\end{align*}
\]

Comparing this implicit solution for \( c_{X1}^l \) to the solution to \( c_{D1}^l \) above, there are only two differences. First, the right side is larger because \( (\tau_1^h)^k > (\tau_1^l)^{-k} \), and both \( \tau_1^h \) and \( \tau_1^l \) are greater than one. Second, \( \alpha > \frac{\alpha^l}{\alpha^h} \).

On inspection, both of these differences ensure that \( c_{X1}^l < c_{D1}^l \). Note that an identical proof holds for trade costs if \( \nu \) is substituted for \( \tau \) everywhere.

\( c_{D1}^l < c_{D0}^l \): As originally shown in Melitz and Ottaviano (2008), this is not necessarily the case in the long-run. This will be addressed below. For now, we consider the case of \( c_{D}^l < c_{A}^l \) in the long-run. The structure of the proof is as follows: \( \{N_k^l > 0, N_E^h > 0\} \rightarrow \{0 < c_{D}^l, 0 < c_{D}^h\} \leftrightarrow \{\rho^h < \frac{\phi^l}{\phi^h}, \rho^l < \frac{\phi^h}{\phi^l}\} \leftrightarrow \{c_{D}^l < c_{A}^l, c_{D}^h < c_{A}^l\} \).

The first part of this chain of reasoning (positive entry implies positive cutoffs) was proven already. Now let’s examine the assumption that \( 0 < c_{D}^l \). Writing out the full solution for \( c_{D}^l \) reveals:

\[
\begin{align*}
0 &< c_{D}^l \\
0 &< \left( \frac{\gamma \phi^l - \rho^h \phi^h}{\phi^l - \rho^h \phi^h} \right) \frac{1}{\tau^l} \\
\rho^h &< \frac{\phi^l}{\phi^h}
\end{align*}
\]
Note that because \(1 - \rho L, L^I, L^0\) and \(\gamma\) are all positive, this inequality is a necessary and sufficient condition for \(0 < c^I_D\). In addition, \(0 < c^I_D \leftrightarrow \rho^L < \frac{\phi^h}{\phi^L}^\gamma\).

Finally, let’s examine the assumption that \(c^I_D < c^I_A\). Writing out the full forms of the cutoffs and simplifying yields the following:

\[
\begin{align*}
\left(\frac{\gamma \phi^I - \rho^L \phi^h}{L^I \left(1 - \rho^L \phi^h\right)}\right)^{\frac{1}{\gamma + 2}} & < \left(\frac{\gamma \phi^I}{L^I}\right)^{\frac{1}{\gamma + 2}} \\
\rho^L \phi^L & < \rho^h \phi^h \\
\phi^h & < \frac{\phi^L}{\phi^L}^\gamma
\end{align*}
\]

This is again a necessary and sufficient condition for \(c^I_D < c^I_A\). Similarly, \(c^h_D < c^h_A \leftrightarrow \frac{\phi^h}{\rho} < \rho^h\). Therefore, \(0 < c^h_D\) and \(0 < c^h_D\) jointly guarantee \(c^h_D < c^h_A\) and \(c^h_D < c^h_A\).

A similar chain of reasoning can be used to show that \(c^I_D < c^I_A\) in the case of a non-tariff variable trade cost by replacing \(\rho^L\) with \(\sigma^I\) in the proof above. We already demonstrated that \(c^I_D < c^I_A\) in the short-run case in Appendix A2.

For the short-run case, note that we have \(\tilde{m}^I = c^I_D\), the long-run cutoff pre-liberalization, while \(\tilde{c}^I_D\) is the short-run cutoff post-liberalization. Tariffs go from \(\tau^I_0\) to \(\tau^I_1 < \tau^I_0\). (Moving from autarky to trade is simply a special case of reducing trade barriers in an already open economy.)

The equilibrium condition which determines \(\tilde{c}^I_D\) is then:

\[
\frac{\alpha - \tilde{c}^I_D}{(\tilde{c}^I_D)^{k+1}} = \frac{\eta}{2(k + 1)\gamma} \left(\frac{N^h_D}{(\tilde{c}^I_D)^k} + (\tau^I_1 - k) \frac{N^h_D}{(c^I_D)^k}\right)
\]

If \(\tau^I_1 = \tau^I_0\) then the distribution and number of entrants is consistent with the original long-run equilibrium and therefore \(\tilde{c}^I_D = c^I_D\). However, if \(\tau^I_1 < \tau^I_0\) the right side of this expression becomes larger and therefore \(\tilde{c}^I_D < c^I_D\). This is simply a special case of the fact that all short-run reductions in trade barriers reduce the domestic productivity cutoff, which is shown in the original paper.

\(c^h_{X0} < c^h_{X1}\): For the long-run case, we have:

\[
\begin{align*}
\frac{1}{\tau^I_0} \left(\frac{\gamma \phi^I - \rho^h \phi^h}{L^I \left(1 - \rho^h \phi^h\right)}\right)^{\frac{1}{\gamma + 2}} & < \frac{1}{\tau^I_1} \left(\frac{\gamma \phi^I}{L^I \left(1 - \rho^h \phi^h\right)}\right)^{\frac{1}{\gamma + 2}} \\
1 - \rho^h \phi^h \left(1 - \rho^h \phi^h\right)^k & < \frac{1 - \rho^h \phi^h}{\rho^h \phi^h} \frac{\phi^h}{\rho^h \phi^h} \left(\frac{\tau^I_0}{\tau^I_1}\right)^{k+2}
\end{align*}
\]

Recall from earlier that positive entry in \(h\) implies \(\rho^h \phi^h < 1\). Using this, and the fact that \(\tau^I_0 > \tau^I_1\) it is clear...
that the presumed inequality holds. An analogous proof holds for the case of NTBs.

For the short-term case we can start with the expression for $c_{X1}$:

$$\frac{\alpha - \tau_h c_{X1}^l}{(\tau_h c_{X1}^l)^{k+1}} = \frac{\eta}{2(k+1)\gamma} \left( \frac{N_{D0}^h}{(c_{D0}^l)^k} + (\tau_h - k \frac{N_{D0}^h}{(c_{D0}^l)^k}) \right)$$

$c_{X1}^l$ is a function of $\tau_h$, and we have a sequence of pairs ranging between $\{\tau_0^h, c_{X0}\}$ and $\{\tau_1^h, c_{X1}\}$. We want to check that a generic $c_{X}$ is increasing for every tariff rate $\tau_h$ between $\tau_0^h$ and $\tau_1^h$. Using the implicit function theorem, we have:

$$\frac{dc_{X}^l}{d\tau_h} = -\frac{c_{X}^l}{(\tau_h c_{X}^l)^{k+1} + (k+1)\tau_h c_{X}^l - k(\tau_h - k \frac{N_{D0}^h}{(c_{D0}^l)^k})}$$

$$= -\frac{c_{X}^l}{(\tau_h c_{X}^l)^{k+1} + (k+1)\tau_h c_{X}^l - k(\tau_h - k \frac{N_{D0}^h}{(c_{D0}^l)^k})}$$

This will be negative as long as $\alpha - \tau_h c_{X}^l$ is positive, which means that $c_{X}^l$ increases as $\tau_h$ decreases. Using the equilibrium condition for $c_{X}^l$ in the short-term, it is clear that $\alpha - \tau_h c_{X}^l$ must be positive because the right-hand side is positive for all $\tau_h \in [\tau_0^h, \tau_1^h]$. Therefore, $c_{X1}^l > c_{X0}^l$.

Examining unilateral and asymmetric liberalization in the long-run: First, let’s consider the case of a firm in $l$ in the range $(c_{X}^l, c_{D}^l)$. I’ll differentiate their profits with respect to $\rho^l$, so if profits are decreasing in $\rho^l$ they will be increasing in $\tau^l$.

$$\frac{d\pi^l(c)}{d\rho^l} = -\frac{L^l}{2\gamma} (c_{D}^l - c) \frac{dc_{D}^l}{d\rho^l} \frac{\partial c_{D}^l}{\partial \rho^l}$$

Because $c < c_{D}^l$ this is positive. An increase in $\rho^l$ is equivalent to a decrease in $\tau^l$ therefore profits for any firms with $c \in (c_{X}^l, c_{D}^l)$ are increasing in small reductions in $\tau^l$, holding $\tau_h$ constant.

Now we consider a firm with $c$ in the range $(0, c_{X}^l)$.

$$\frac{d\pi^l(c)}{d\rho^l} = -\frac{L^h}{2\gamma} \tau_h (c_{X}^l - c) \frac{dc_{X}^l}{d\rho^l} - \frac{L^l}{2\gamma} (c_{D}^l - c) \frac{dc_{D}^l}{d\rho^l}$$

where

$$\frac{dc_{X}^l}{d\rho^l} = (c_{D}^l)^{-k-1} (c_{D}^l)^{k+2} \frac{1}{\tau_h L^h} \frac{1}{k+2}$$

Plugging the latter expression along with the explicit form of $\frac{dc_{D}^l}{d\rho^l}$, and then simplifying extensively, we get...
the following necessary and sufficient condition for \( \frac{\partial \pi'(c)}{\partial \rho} > 0 \):

\[
\left( \frac{c_D}{c_X} \right)^{k+1} < \rho_h \frac{c_D - c}{c_X - c}
\]

This condition will always be met for \( c = c_X \) (and other \( c \) to the left of this point), however because \( \rho_h \) is less than zero it cannot be met for \( c = 0 \). The equivalent condition for the NTB case replaces \( \rho_h \) with \( \sigma_h \).

What if we were to artificially restrict attention to long-run liberalizations in which \( c_D^1 < c_D^0 \)? After some simplification, this implies the following:

\[
\left( \frac{m^1}{m^n} \right)^k - \rho_0^1 \left( \frac{m^1}{m^n} \right)^k - \rho_0^h \frac{1 - \rho_1^h \rho_1^l}{1 - \rho_0^h \rho_0^l}
\]

Recall that \( \rho^l = (\tau^l)^{-k-1} \) is a measure of the freeness of trade in \( l \). \( \rho^l \) is replaced with \( \sigma^l = (\nu^l)^{-k} \) for the case of non-tariff barriers, but the same argument holds. This restriction then requires that \( \tau^l_1 \) not be too low or \( \tau^l_0 \) too high. In words, there is a breaking point at which country \( l \) lowers its trade barriers too much relative to the status quo leading to the relocation effect in \( h \) described above. Similarly, if \( \tau^h_1 \) is not sufficiently lower than \( \tau^h_0 \), then the pressures for firms to locate in \( h \) will lead to reduced competition in \( l \), and greater profits for \( l \)’s domestic-only producers. Finally, note that if \( \frac{m^1}{m^n} \) becomes larger (indicating that \( l \)’s firms are relatively less productive on average), \( l \)’s trade concessions must be higher to ensure that this condition holds. All of these conditions boil down to the requirement that the proposed trade liberalization not be ‘too unequal’ conditional on the comparative advantage of the two sides.

**A2: The percentage change in profits as a function of \( c \)**

We wish to show that near \( c = 0 \), the percentage and absolute change in profits is decreasing in \( c \) for the autarky-to-trade case, and increasing in \( c \) for the restricted-to-freer-trade case.

**Autarky to trade case:** The percentage change in profits relative to autarky is \( \frac{\Delta \pi(c)}{\pi_A(c)} \), and we need to search in the range \((0, c_X^1)\) where

\[
\frac{\Delta \pi(c)}{\pi_A(c)} = \frac{L^h}{L^l} \tau_h^h (c_X^1 - c)^2 + \frac{L^l}{L^l} (c_D^1 - c)^2 - \frac{L^l}{L^l} (c_A^1 - c)^2
\]

\[
= \frac{L^h}{L^l} \tau_h^h (c_X^1 - c)^2 + \frac{(c_D^1 - c)^2}{(c_A^1 - c)^2} - 1
\]

Taking the derivative of both sides and then multiplying by \((c_A^1 - c)^3\) (which is positive in the range \([0, c_X^1]\)) we get the following condition for \( \frac{\Delta \pi(c)}{\pi_A(c)} \) to be decreasing in \( c \):

\[
\frac{L^h}{L^l} \tau_h^h (-2(c_X^1 - c)(c_A^1 - c) + 2(c_X^1 - c)^2) + (-2(c_D^1 - c)(c_A^1 - c) + 2(c_D^1 - c)^2) < 0.
\]
Because \( c_A^l > c_X^l \) and \( c_A^h > c_Y^h \), both terms will be negative for any value of \( c \in [0, c_X^l] \). Because the percentage increase in profits is decreasing over the admissible range, it must be maximized at 0. Hence, more productive firms in the range \( (0, c_X^l) \) gain more as a proportion of pre-liberalization profits from trade liberalization. The same proof holds for the case of NTBs, in which case \( \tau^h \) is replaced with \( (\nu^h)^2 \).

To see that the greatest increase in profits goes to the firm \( c = 0 \), if any firm benefits from trade, note that the second derivative of \( \Delta \pi^l(c) \) on the range \( [0, c_X^l] \) for the tariff case is

\[
\frac{\partial^2 \Delta \pi^l(c)}{\partial c^2} = \frac{L^h}{2\gamma} \tau^h > 0.
\]

(For the NTB case replace \( \tau^h \) with \( (\nu^l)^2 \).) Because \( \Delta \pi^l(c) \) is a quadratic function, this implies that it has no interior maximum so we look at the endpoints for a maximum. \( \Delta \pi^l(c_X^l) < 0 \), so it must be the case that \( c = 0 \) benefits from trade, if any firm does. Also, \( \frac{\partial \Delta \pi^l(c)}{\partial c} > 0 \) at \( c_X^l \) so all of the proceeding facts require that \( \frac{\partial \Delta \pi^l(c)}{\partial c} < 0 \) in the neighborhood of \( c = 0 \) if any firm benefits from trade.

**Restricted-to-freer-trade case:** I will start with the tariff case. We wish to show that \( \lim_{c \to +0} \frac{\partial \Delta \pi^l(0)}{\partial c} > 0. \)

\[
\lim_{c \to +0} \frac{\partial \Delta \pi^l(0)}{\partial c} = -\frac{L^h}{2\gamma} \tau^h (c_{X1}^l - c) + \frac{L^h}{2\gamma} \tau^h (c_{X0}^l - c) - \frac{L^l}{2\gamma} (c_{D1}^l - c) + \frac{L^l}{2\gamma} (c_{D0}^l - c)
\]

This will be positive, because of the ordering of domestic cutoffs which has already been demonstrated.

The equivalent condition for the NTB case is:

\[
\lim_{c \to +0} \frac{\partial \Delta \pi^l(0)}{\partial c} = -\frac{L^h}{2\gamma} (\nu^h)^2 (c_{X1}^l - c) + \frac{L^h}{2\gamma} (\nu^h)^2 (c_{X0}^l - c) - \frac{L^l}{2\gamma} (c_{D1}^l - c) + \frac{L^l}{2\gamma} (c_{D0}^l - c)
\]

The second half will always be positive, but the sign on the first half is ambiguous. A sufficient condition for the overall expression to be positive is \( -\nu^h c_{D1}^l + \nu^h c_{D0}^l > 0 \). This provides an analytically tractable expression for the short-run case. First, note that when \( \nu^h = \nu^l = 0 \), \( -\nu^h c_{D1}^l + \nu^h c_{D0}^l = 0 \), and that as \( \nu^h \) decreases the second term will not change. We can examine the sign of \( \frac{d(-\nu^h c_{D1}^l)}{d\nu^h} \) to see if our sufficient condition will be met. It will be if \( \frac{d(-\nu^h c_{D1}^l)}{d\nu^h} < 0 \). We will check the sign of this derivative across a range of liberalizations going from \( \{\nu^l, c_{X0}^l\} \) to \( \{\nu^l, c_{X1}^l\} \) and show that it is negative everywhere. We will phrase the derivative in terms of a generic \( \{\nu^h, c_X^l\} \) pair that lies in this range.

\[
\frac{\partial(-\nu^h c_{D1}^l)}{\partial \nu^h} = -c_{D1}^l - \nu^h \frac{\partial c_{D1}^l}{\partial \nu^h}
\]

\[
= -c_{D1}^l - \nu^h \frac{\eta}{2(k+1)\gamma} \left( \frac{N_{D1}^h}{c_{D1}^h} \right)^k \left( \nu^h \right)^{-k-1} k
\]

\[
= -c_{D1}^l - \nu^h \frac{1}{(c_{D1}^h)^{k+1}} \left( k + 1 \right) \frac{a}{c_{D1}^h} \left( c_{D1}^h \right)^{k+2}
\]

\[
= -c_{D1}^l \left( k + 1 \right) \frac{a}{c_{D1}^h} \left( c_{D1}^h \right)^{k+2} - k \left( \frac{a}{c_{D1}^h} \right)^{k+3} - \frac{\eta}{2(k+1)\gamma} \left( \frac{N_{D1}^h}{c_{D1}^h} \right)^k
\]

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This expression is negative everywhere and so we can confirm that in the case of short-run decreases in NTBs, $\Delta\pi^l(c) = \text{increasing in } c$ in the neighborhood of $c = 0$.

Now examining percentage changes in profits: profits in the pre-liberalization equilibrium are decreasing in $c$, so $c = 0$ is the most profitable firm. If $c = 0$ has positive gains from the trade liberalization and $c = 0$’s gains are not the greatest in absolute terms (as shown above) then it must be the case the $c = 0$’s percentage gains from liberalization are not the greatest.

**A3: Circumstances under which no firms support trade liberalization**

**Autarky-to-trade case:** Because of Claim 1a, we can focus on the profits of the most productive firm which are given by

$$\Delta\pi^l(c) = \frac{L^h}{4\gamma} \tau^h (c^l_X - c)^2 + \frac{L^l}{4\gamma} (c^l_D - c)^2 - \frac{L^l}{4\gamma} (c^l_A - c)^2.$$

From the implicit solutions of the cutoffs, its clear that the only impact of a reduction in domestic trade barriers is to decrease $c^l_D$. Reducing $\tau^l$ or $\nu^l$ therefore lowers the profits of all firms. At some point, this may push every firm in $l$ into losses from the trade liberalization, although it may not because there are still gains from an increase in exports.

Appendix A6 contains a proof that in the tariff case, an increase in $\tau^h$ reduces every exporting firm’s profits in the foreign market. A sufficiently large increase will push all of $l$’s firms into losses, because domestic profits always decrease in the wake of trade liberalization and increasing $\tau^h$ arbitrarily pushes exporting profits to zero. The equivalent result does not hold for the NTB case.

A drop in either $m^h$ or $f^h_E$ reduces both $c^l_X$ and $c^l_D$, via the term $\frac{N_h}{(c^l_D)^k} \propto \frac{\alpha - c^h}{(c^l_A)^{k+1}}$. This is because the autarky cutoff, $c^h_A = \frac{\gamma \phi^h}{L^h}$, is decreasing in $m^h$ and $f^h_E$. Because $m^h$ and $f^h_E$ can be pushed to zero (which pushes the cutoff $c^h_A$ to zero and increases entries), reductions in these parameters are sufficient to ensure that no firm in $l$ benefits from trade.

We can now consider $m^l$ and $f^l_E$ but they are have slightly trickier effects. To treat both at the same time, let’s consider an increase in $\phi^l = 2(k + 1)(k + 2)(m^l)^h f^l_E$. This makes $l$’s firms less competitive. Again focusing on the most productive firm, the change in profits associated with an increase in $\phi^l$ is:

$$\frac{\partial\Delta\pi^l(c = 0)}{\partial\phi^l} = \frac{L^h}{2\gamma} \tau^h (c^l_X) \frac{\partial c^l_X}{\partial\phi^l} + \frac{L^l}{2\gamma} (c^l_D) \frac{\partial c^l_D}{\partial\phi^l} - \frac{L^l}{2\gamma} (c^l_A) \frac{\partial c^l_A}{\partial\phi^l}.$$

This is potentially ambiguous, because each of the partial derivatives is positive. For example, a reduction in $l$’s competitiveness might not be such a bad thing if the economy is still heavily protected after liberalization but it could be disastrous if the economy is heavily exposed to foreign competition. We can consider changes in the trade policy to find some extreme cases where the results are clear.

First, consider a reduction in $l$’s own trade barriers. This affects only the term $\frac{L^l}{2\gamma} (c^l_D) \frac{\partial c^l_D}{\partial\phi^l}$. This term is proportional to

$$c^l_D \frac{\partial c^l_D}{\partial\phi^l} = \frac{1}{(c^l_D)^k} + \frac{\alpha - c^l_A}{(c^l_D)^{k+1}} \frac{\partial c^l_A}{\partial\phi^l}.$$

Because a reduction in $\tau^l$ will decrease $c^l_D$, this term will be decreasing in $\tau^l$. 55
Similarly, we can consider an increase in $h$’s trade barriers. This affects only the first term, which is proportional to
\[
\tau^h c_D \frac{\partial c_D^h}{\partial \phi^l} = (\tau^h)^{-k+1} \left( \frac{1}{(c_A^h)^{k+1}} + \frac{(\alpha - c_A^h)(k+1)}{(c_A^h)^{k+2}} \right) \frac{\partial c_A^h}{\partial \phi^l}.
\]
This expression is not necessarily decreasing in $\tau^h$, but it converges to zero as $\tau^h \to \infty$ because $c_D^h$ is always positive. Finally, note that
\[
c_D^h \frac{\partial c_D^h}{\partial \phi^l} < c_A^h \frac{\partial c_A^h}{\partial \phi^l}
\]
because $c_D^h < c_A^h$. This means the final two terms are always negative. A sufficiently large increase in $\tau^h$ will therefore ensure that the most productive firm’s profits are decreasing in $\phi^l$.

Finally, we can consider the interaction of $\phi^l$ and $\phi^h$. As $\phi^h \to 0$, meaning that $h$’s firms get more efficient, $c_D^l \frac{\partial c_D^l}{\partial \phi^l}$ and $\tau^h c_D \frac{\partial c_D^h}{\partial \phi^l}$ both limit out at 0. Because the final term of $\frac{\partial \Delta \pi(c=0)}{\partial \phi^l}$ does not vary with $\phi^h$ and is negative, $\frac{\partial \Delta \pi(c=0)}{\partial \phi^l}$ is negative in the limit.

In contrast, as $\phi^l$ increases arbitrarily, $c_A^h$ will be pushed to its limit at $\alpha$, at which point there will be no entry in $h$. This in turn implies that $c_D^h = c_A^h$, so the second and third cancel. Note, furthermore, that $c_D^l$ will still be positive, therefore $\frac{\partial \Delta \pi(c=0)}{\partial \phi^l}$ will be positive as well.

Now consider increasing $L^h$ arbitrarily.
\[
\lim_{L^h \to \infty} \left( \Delta \pi^h(c = 0) \right) = \lim_{L^h \to \infty} \left( \frac{L^h}{4\gamma} \tau^h (c_A^h)^2 + \frac{L^l}{4\gamma} (c_D^l)^2 - \frac{L^l}{4\gamma} (c_A^h)^2 \right)
\]
\[
= \lim_{L^h \to \infty} \frac{L^h}{4\gamma} \tau^h (c_D^l)^2 + 0 - \frac{L^l}{4\gamma} (c_A^h)^2
\]
The first term’s sign isn’t clear because $\lim_{L^h \to \infty} c_D^h = 0$. Using L’Hopital’s rule
\[
\lim_{L^h \to \infty} \frac{L^h}{(c_D^h)^2} = \lim_{L^h \to \infty} -2(c_D^h)^3 \frac{\partial c_D^h}{\partial L^h}
\]
\[
= \lim_{L^h \to \infty} \left( 2(c_D^h)^3 \frac{1}{(c_D^h)^{k+1}} + \frac{(\alpha - c_A^h)(k+1)}{(c_A^h)^{k+2}} \right) \frac{c_A^h}{k+2 L^h} \frac{1}{L^h}
\]
\[
= \lim_{L^h \to \infty} \left( 2(c_D^h)^3 \frac{k+2}{c_A^h} \frac{\alpha k + \alpha - c_A^h k}{\alpha k + \alpha - c_D^h k} \frac{1}{k+2 L^h} \right)
\]
The expression is 0 in the limit, because $c_A^h > c_D^h$, so the second and third chunks don’t diverge; and because $c_D^h$, $c_A^h$ and $\frac{1}{L^h}$ are all zero in the limit.

Restricted-to-freer-trade case: The change in profits from trade liberalization for an exporter is
\[
\Delta \pi^l(c) = \frac{L^h}{4\gamma} \tau^h (c_A^h)^2 + \frac{L^l}{4\gamma} (c_D^l)^2 - \frac{L^h}{4\gamma} \tau^h (c_A^h)^2 - \frac{L^l}{4\gamma} (c_D^l)^2
\]
Note that $c_D^l$ alone is increasing in $\tau^l$, so $\Delta \pi^l(c)$ decreases for all firms as $\tau^l$ decreases. Some exporters may still benefit from an increase in access abroad, so reductions in $\tau^l$ are not necessarily sufficient to ensure
that no firm supports trade liberalization.

Increasing \( \tau^h \) leads to a reduction in profits for all exporters, although only in the tariffs case. This proof is left until Appendix A6. Because exports are the only source of increased profits, such a change will be sufficient to ensure that no firm support trade liberalization (e.g. if \( \tau^h \) is only slightly lower than \( \tau^h \)).

A4: Only one dividing line between trade coalitions

Autarky-to-trade case: There are two cases two consider. First, if \( \Delta \pi^l(0) > 0 \). We also know that \( \Delta \pi^l(c^l_X) < 0 \). \( \Delta \pi^l \) is a quadratic function of \( c \) in the range \([0, c^l_X]\), and is therefore continuous. Appealing to the intermediate value theorem, then, there must be at least one \( \tilde{c} \in [0, c^l_X] \) such that \( \Delta \pi^l(\tilde{c}) = 0 \). To see that there is only one such \( \tilde{c} \) note that an even number of crossings is ruled out by the relative values of these functions at their endpoints, and 3 or more crossings of these functions would require inflection points (which a quadratic does not have). The second case is if \( \Delta \pi^l(0) \leq 0 \). Note that \( \Delta \pi^l(c) \) is decreasing in \( c \) near \( c = 0 \). We still have \( \Delta \pi^l(c^l_X) < 0 \), and the lack of inflection points in a quadratic function imply that \( \Delta \pi^l(c) \) cannot decrease near \( c = 0 \), rise above the zero line, and then decrease again to \( \Delta \pi^l(c^l_X) \). So if \( c = 0 \) does not support the liberalization, there are no supporters.

Restricted-to-freer trade case: We are going to examine \( \Delta \pi^l(c) \) in the range \([0, c^l_{X1}]\) to establish that this function has at most two roots on this domain, which is sufficient to show that the range of supporters is continuous. First, I focus on the range \((c^l_{X0}, c^l_{X1})\). The derivative \( \Delta \pi^l(c) \) at \( c^l_{X1} \) is

\[
\frac{\partial \Delta \pi^l(c)}{\partial c} = -\frac{L^H}{2\gamma} \tau^l(c^l_{X1} - c) - \frac{L^L}{2\gamma} (c^l_{D1} - c) + \frac{L^l}{2\gamma} (c^l_{D0} - c)
\]

which is positive because \( c^l_{D0} > c^l_{D0} \). We also know that \( \Delta \pi^l(c^l_{X1}) < 0 \). Owing to the quadratic shape of the piecewise function \( \Delta \pi^l(c) \) on \((c^l_{X0}, c^l_{X1})\), there can be at most one root on this range.

There are two cases to examine on the range \((0, c^l_{X0})\): \( \Delta \pi^l(0) < 0 \) and \( \Delta \pi^l(0) > 0 \). If \( \Delta \pi^l(0) < 0 \), then there can be up to two roots on the range \((0, c^l_{X0})\). However, the signs for \( \Delta \pi(0) \) at the endpoints of the range \((0, c^l_{X0})\) indicate that there must be an even number of roots. Therefore, there is either one root in the range \((0, c^l_{X0})\) and one in \((c^l_{X0}, c^l_{X1})\) or two roots in the range \((0, c^l_{X0})\). Either way the range of supporters is continuous.

If \( \Delta \pi^l(0) > 0 \), then we use the fact that \( \frac{\partial \Delta \pi^l(c)}{\partial c} > 0 \) at \( c = 0 \) which was demonstrated in Appendix A4. This implies that there is at most one root on the range \((0, c^l_{X0})\). Using the signs of the endpoints of the range, there can be only one root in \((0, c^l_{X1})\). The range of supporters is continuous between 0 and this one root.
A5: Conditions for the Most Productive Firms to Oppose Tariff Liberalization

For a reduction in tariffs, the change in profits induced by a trade liberalization for the most productive firm is:

$$\Delta \pi^l(0) = \frac{L^h}{4\gamma} \tau^h h (c_{X1})^2 + \frac{L^l}{4\gamma} (c_{D1})^2 - \frac{L^h}{4\gamma} \tau^0 (c_{X1})^2 - \frac{L^l}{4\gamma} (c_{D0})^2$$

$$= \frac{1}{\tau^h} \frac{L^h}{4\gamma} (c_{D1})^2 - \frac{1}{\tau^0} \frac{L^h}{4\gamma} (c_{D0})^2 + \frac{L^l}{4\gamma} (c_{D1})^2 - \frac{L^l}{4\gamma} (c_{D0})^2$$

Because $\tau^h > \tau^0$, $\Delta \pi^l(0)$ may be positive or negative. A sufficient, but not necessary, condition for the most productive firm to oppose a bilateral reduction in tariffs is $\frac{(c_{D1})^2}{\tau^h} < \frac{(c_{D0})^2}{\tau^0}$.

After simplifying and rearranging, the condition is equivalent to:

$$\left( \frac{\tau^h}{\tau^0} \right) \left( \frac{1 - \rho^h \rho^l}{1 - \rho^0 \rho^l} \right) \frac{\rho^h}{\rho^0} > \left( \frac{m^h}{m^l} \right)^k - \rho^l$$

Clearly, this condition will be met if $\tau^0$ is sufficiently small or $\tau^h$ sufficiently big. Recall that Appendix A3 demonstrated that $\rho^h < \left( \frac{m^l}{m^h} \right)^k$ therefore this condition will be met if $\tau^l$ is sufficiently small and $\tau^0$ is sufficiently big. The condition can also be met increasing $m^l$ and by decreasing $m^h$.

In the short term, this condition has no closed form to permit analysis. However, it is clear that if $\tau^l$ (which affects an l exporter’s bottom line only by reducing $c_{D1}$) is too low, than it is possible to make $c = 0$ not profit from trade liberalization.

A6: Exporters may support NTBs in their export market

The exporting profits of a firm in $l$ which sells in $h$ are given by $L^h (\nu^h)^2 (c_X - c)^2$ and the change induced by a small increase in $\nu^l$ is

$$\frac{\partial \pi^l}{\partial \nu^l} = c^h \frac{\partial c^h}{\partial \nu^l} - c^h c - \nu^l c \frac{\partial c^h}{\partial \nu^l} + 2\nu^l c^2.$$

Clearly as $c \to 0$ this will equal $\frac{\partial c^h}{\partial \nu^l}$, which is strictly positive because the short-term domestic productivity cutoff is increasing in home-country trade barriers. Strict positivity and continuity guarantee that there is a range of productive firms whose profits from exporting increase. At the same time, there is no change in domestic profits so these firms support a unilateral increase in profits in their export market.

To see that lower productivity firms will oppose a unilateral increase in trade barriers in their export market, consider the firms in the range $c \in [c_{X1}, c_{X0}]$ where time one represents the equilibrium after the increase in trade barriers. All of these firms will lose out from the growth in trade barriers. The firm with $c = c_{X1}$ will have a strictly negative change in profits. Again appealing to continuity of $\Delta \pi(c)$ there will be some firms which continue to export who oppose the increase in trade barriers.

Now turning to the tariff case, the profits for an exporter from $l$ to $h$ from exporting are $L^h (\tau^h (c_X - c))^2$. Then, $\frac{\partial \pi^l}{\partial \tau^h} \propto (c_X)^2 + 2\tau^h c_X \frac{\partial c_X}{\partial \tau^h} - 2c_X c - 2\tau^h c \frac{\partial c_X}{\partial \tau^h} + c^2$. It is therefore possible that $\frac{\partial \pi^l}{\partial \tau^h}$ is decreasing in $c$ entirely, decreasing and then increasing in $c$, or increasing in $c$ entirely (because it is quadratic in $c$). We
therefore must check the signs at its endpoints 0 and \( c_X \): if they are both negative then no firm gains from an increase in tariffs.

Firms in the vicinity of \( c_X \) must lose from an increase in tariff barriers because a small increase in tariffs reduces \( c_X \) slightly leading to a reduction in profits. For example, at time one a firm with \( c = c_{X1} \) clearly faces a loss in profits because it was earning positive profits when the cutoff was \( c_{X0} > c_{X1} \). Again relying on continuity, a firm an epsilon to the left of this firm in the cost distribution must also lose from greater tariffs, therefore \( \frac{\partial \pi}{\partial \tau} \) is negative near \( c = 0 \).

Next, we’ll examine the change in profits for the firm at \( c = 0 \). I will look at the derivative of this firm’s profits with respect to \( c_D^h \), which is equivalent to an increase in \( \tau^h \) and slightly easier to handle. Note that \( \tau^h \) is an explicit function determined by \( c_D^h \).

\[
\frac{\partial \pi_X(c = 0)}{\partial c_D^h} = -\frac{L^h}{4\gamma}(c_X^h)^2 \frac{\partial \tau^h}{\partial c_D^h} + \frac{2L^h}{4\gamma} c_X^h
\]

\[
\propto \frac{1}{4}(\tau^h)^{k+1} \left( \frac{(m^l)^h}{N_D} \right)^{2(k+1)\gamma} \left( \frac{c_D^h}{(c_D^h)^{k+2}} + (k+1) \frac{\alpha - c_D^h}{(c_D^h)^{k+2}} \right) + \frac{1}{2} \frac{c_D^h}{(c_D^h)^{k+2}}
\]

A sufficient condition for this to be negative is \((k - 2)(c_D^h - \alpha) - \alpha < 0\). We know from the definition of \( c_D^h \) that \( c_D^h - \alpha < 0 \), so we only need to consider cases where \( k < 2 \). We have assumed that \( k \geq 1 \) and this expression at \( k = 1 \), where it is minimized, is \(-c_D^h < 0 \). Therefore, the most productive exporter in \( l \) does not benefit from an increase in tariffs in \( h \). Increasing \( \tau^l \) therefore amounts to a downward shift of the endpoints of the function \( \pi_X^l(c) \).

A7: Decomposing the impact of changes in market size

For an exporting firm moving from autarky to trade, the change in profits from liberalization changes with an increase in \( L^l \):

\[
\frac{\partial \Delta \pi^l(c)}{\partial L^l} = \frac{L^h}{2\gamma} \tau^h (c_X^l - c) \frac{\partial c_X^l}{\partial L^l} + \frac{1}{4\gamma} (c_D^l - c)^2 + \frac{L^l}{2\gamma} (c_D^l - c) \frac{\partial c_D^l}{\partial L^l} - \frac{1}{4\gamma} (c_A^l - c)^2 - \frac{L^l}{2\gamma} (c_A^l - c) \frac{\partial c_A^l}{\partial L^l}.
\]

The second and fourth terms represent the change in profits brought about by an increase in market size, assuming that all cutoffs remain unchanged. This is the ‘market size effect’.

The other terms represent the consequences of changes in the cutoffs (note that each of the partial derivatives is negative). At root, they are all functions of the change in the autarky cutoff.

\[
\frac{\partial c_X^l}{\partial L^l} = (\tau^h)^{-k+1} \left( \frac{1}{(c_A^l)^{k+2}} + \frac{\alpha - c_A^l}{(c_D^l)^{k+2}} \right) \frac{\partial c_A^l}{\partial L^l}.
\]

The form of \( \frac{\partial c_A^l}{\partial L^l} \) is analogous. Recall that firm entry is not a function of \( L^l \) except via \( c_A^l \) so I refer to this latter effect as the firm entry or competitiveness effect. Increasing \( L^l \) decreases \( c_A^l \) which increases \( N_A^l \).

A similar decomposition can be undertaken for changes in \( L^h \).
A8: Implications of Equal Export Volumes

Total exports of \(l\) in a short-term equilibrium, which I will denote \(\Pi_X\), are equal to \(\frac{L^l}{\gamma_l} N^l_D (\nu^h)^{-k} (c^h_D)^{k+2}\). To maintain simplicity, I will assume that \(N^l_D\) is determined exogenously, although an identical proof works if we assume \(N^l_D = N_A\). Equality of exports combined with the fact that \(\frac{N^l_D}{(m^h)^\nu} > \frac{N^l_A}{(m^h)^\nu}\), which is the condition for \(l\) to have a comparative advantage in the short-run, jointly imply that \((\nu^h)^{-k} (c^h_D)^{k+2} < (\nu^l)^{-k} (c^l_D)^{k+2}\) which on inspection implies that \(\nu^h > \nu^l\). A similar set of steps is available to prove the tariff case.
Appendix B

Outline of Numerical Simulations

In order to search over a reasonable portion of the parameter space, it is necessary to cut down on the number of parameters. A number of restrictions can be made without loss of generality for the long-run case. First, the parameters $\alpha$ and $\eta$ affect only the mass of entrants, not any of the cutoffs or proportions which are of interest. I therefore set $\alpha = 2$ and $\eta = 3$ for all simulations. Second, in the long-run, the parameters $\gamma$ and $f_E$ affect both the cutoffs and mass of entrants, but the proportionality of all cutoffs is preserved, so the nature of the results will be the same no matter what value is chosen. This is not true in the short-run because the cutoff solutions are less flexible but to limit the problem these parameters are not varied in the short-run. For these simulations, I set $\gamma = .5$ and $f_E = 1$.

For the case of moving from autarky to trade, this leaves only the six parameters which are permitted to differ between countries, $(L^l, L^h, m^l, m^h, \tau^l, \tau^h)$ and $k$. I search over a grid constructed with the following ranges and number of points for each parameter.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Grid Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>$L^l$</td>
<td>[400, 2000]</td>
<td>5</td>
</tr>
<tr>
<td>$L^h$</td>
<td>[400, 2000]</td>
<td>5</td>
</tr>
<tr>
<td>$m^l$</td>
<td>[2, 4]</td>
<td>5</td>
</tr>
<tr>
<td>$m^h$</td>
<td>[2, 4]</td>
<td>5</td>
</tr>
<tr>
<td>$\tau^l$</td>
<td>[1.2, 3]</td>
<td>5</td>
</tr>
<tr>
<td>$\tau^h$</td>
<td>[1.2, 3]</td>
<td>5</td>
</tr>
<tr>
<td>$k$</td>
<td>[2, 4]</td>
<td>5</td>
</tr>
</tbody>
</table>

This grid thus evaluates the model at $5^7 = 78125$ points, although of course some of these violate Assumptions 1 or 2 and so any claims which rest on these assumptions are validated on a smaller number of points.

B1: Is there a supporter of trade liberalization?

To check that $c = 0$ supports opening the economy in the case of autarky-to-trade, I calculated the cutoffs at each point on the grid, and then checked if $\Delta \pi^l(c) > 0$. This was true in 94.3% of the simulated cases using non-tariff barriers and 91.7% of the cases using tariffs. The substantial difference between the two is likely because high productivity firms can benefit from trade barrier increases (See Appendix A6).

B2: Proportion of Supporters Comparative Statics

We are interested in how $p_{PT}^l \equiv \left(\frac{c_{PT}}{c_A}\right)^k$ varies with the main parameters. The strategy here involves three steps. First, differentiate $p_{PT}^l$ with respect to a parameter $c$, and develop a condition in terms of the sign of $\frac{\partial c_{PT}}{\partial c}$, in order to avoid directly working with the explicit solution of $c_{PT}$, which is analytically intractable. Second, use the implicit function theorem to develop a sufficient condition for the sign of $\frac{\partial c_{PT}}{\partial c}$. Third, and if necessary, evaluate this condition across an extensive grid of admissible parameter values generated in the same manner described at the beginning of Appendix B. Computational evaluation of these necessary...
conditions is required in most of these cases, but where analytical evaluation is possible, a complete proof will be given.

The term
\[ \chi = \frac{L_h}{2\gamma} \tau^h (c'_{h} - c'_{PT}) + \frac{L_l}{2\gamma} (c'_{D} - c'_{PT}) - \frac{L_l}{2\gamma} (c'_{A} - c'_{PT}) \]

appears in the denominator of every derivative \( \frac{\partial c_{PT}}{\partial \tau} \). Note that it is equal to \( -\frac{\partial \Delta \pi}{\partial c} \) evaluated at the point \( c_{PT} \), which is precisely where the change in profits moves from positive to negative territory. It is therefore positive. The equivalent term for the NTB case substitutes \( (\nu_{h})^2 \) in place of \( \tau_{h} \), but is still positive.

\[ \tau_{l} : \text{First, we need a statement of how the proportion of supporters varies with } \tau_{l}. \]
\[ \frac{\partial p_{l}}{\partial \tau_{l}} = k \frac{c_{l} A}{c_{l} A} \left( \frac{c_{l} P_{T}}{c_{l} A} \right)^{k-1} \frac{\partial c_{PT}}{\partial \tau_{l}}. \]

If \( \frac{\partial c_{PT}}{\partial \tau_{l}} \) is negative, as expected, than \( \frac{\partial p_{l}}{\partial \tau_{l}} \) will be as well. After differentiating the implicit solution for \( c_{PT} \), given in Definition 2, and rearranging terms we get the following solution for the tariff case:
\[ \frac{\partial c_{PT}}{\partial \tau_{l}} = \frac{L_h}{2\gamma} (\tau^h) (c'_{h} - c'_{PT}) \frac{\partial c_{h}}{\partial \tau_{l}} + \frac{L_l}{2\gamma} (c'_{D} - c'_{PT}) \frac{\partial c_{D}}{\partial \tau_{l}}. \]

In the short-term, \( \frac{\partial c_{h}}{\partial \tau_{l}} = 0 \) so we only need to check \( \frac{\partial c_{D}}{\partial \tau_{l}} \). This is equal to
\[ \frac{k(\tau^l)^{-k-1}}{(c_{D}^l)^{k+1}} \left\{ \frac{1}{(c_{D}^l)^{k+1}} + \frac{(k+1)\alpha - c_{D}^l}{(c_{D}^l)^{k+2}} \right\}. \]

This clearly positive, so the proportion of firms supporting a move to trade is increasing in home country tariffs. The same proof applies to the NTB case.

\[ \tau_{h} : \]
\[ \frac{\partial p_{l}}{\partial \tau_{h}} = k \frac{c_{l} A}{c_{l} A} \left( \frac{c_{l} P_{T}}{c_{l} A} \right)^{k-1} \frac{\partial c_{PT}}{\partial \tau_{h}}. \]

If \( \frac{\partial c_{PT}}{\partial \tau_{h}} \) is positive, as expected, than \( \frac{\partial p_{l}}{\partial \tau_{h}} \) will be as well. After differentiating the implicit solution for \( c_{PT} \), and noting that \( c_{D} \) is not a function of \( \tau_{h} \), we get the following solution:
\[ \frac{\partial c_{PT}}{\partial \tau_{h}} = \frac{L_h}{2\gamma} (c'_{h} - c'_{PT})^2 + \frac{L_h}{2\gamma} (\tau^h) (c'_{h} - c'_{PT}) \frac{\partial c_{h}}{\partial \tau_{h}}. \]

Note that the numerator here represents the change in profits resulting from an increase in \( \tau_{h} \) for a firm with productivity \( c = c_{PT} \). There are cross-cutting forces here because higher tariffs reduce competition in \( h \) but also raise a firm’s price. However, we already showed in Appendix A6 that no firm benefits from an increase in tariffs, and this is a specific instance of that.

No such result exists for the NTB case, but we can state an intuitive requirement: the lowest productivity supporter of a trade agreement must not benefit from greater non-tariffs barriers in their export market. This
seems like it should be easy to confirm, but the explicit solution of \( c_{PT} \) is too complex to employ. In any event, the condition held across 100% of the simulations described above.

\( m^l \) and \( f^l_E \): To simplify, all derivatives are taken with respect to \( \phi^l \). Any function increasing in \( \phi^l \) will also be increasing in \( m^l \) and \( f^l_E \).

\[
\frac{\partial p^l_{PT}}{\partial \phi^l} = k \left( \frac{c_{PT}^l}{c_A^l} \right)^{k-1} \left( \frac{1}{c_A^l} \frac{\partial c_{PT}^l}{\partial \phi^l} - \frac{c_{PT}^l}{(c_A^l)^2} \frac{\partial c_A^l}{\partial \phi^l} \right).
\]

On inspection both \( \frac{\partial c_A^l}{\partial \phi^l} \) and \( \frac{\partial c_{PT}^l}{\partial \phi^l} \) are positive so the sign here is indeterminate. The following expression is a sufficient condition for \( \frac{\partial p^l_{PT}}{\partial \phi^l} \) to be negative:

\[
\frac{\partial c_{PT}^l}{\partial c_A^l} \frac{c_A^l}{c_{PT}^l} < 1.
\]

Note that we made use of the fact that \( \frac{\partial c_A^l}{\partial \phi^l} = \frac{1}{\nu + 2} \frac{1}{\nu} c_A^l > 0 \). This is the elasticity of \( c_{PT} \) with respect to \( c_A^l \). If this elasticity is less than one than the proportion of supporters is decreasing in \( \phi^l \). Intuitively, if the comparative advantage of the country decreases, then the pro-trade cutoff should either increase, or at least not decrease too much. Examining across the grid, this condition held in every case.

\( m^h \) and \( f^h_E \): All derivatives are taken with respect to \( \phi^h \).

\[
\frac{\partial p^l_{PT}}{\partial \phi^h} = k \left( \frac{c_{PT}^l}{c_A^l} \right)^{k-1} \left( \frac{1}{c_A^l} \frac{\partial c_{PT}^l}{\partial \phi^h} \right).
\]

So we can focus on \( \frac{\partial c_{PT}^l}{\partial \phi^h} \) to determine the sign of \( \frac{\partial p^l_{PT}}{\partial \phi^h} \).

\[
\frac{\partial c_{PT}^l}{\partial \phi^h} = \frac{L^h}{27} (\tau^h)^2 (c_A^l - c_{PT}^l) \frac{\partial c_A^h}{\partial \phi^h} + \frac{L^l}{27} (c_D^l - c_{PT}^l) \frac{\partial c_A^l}{\partial \phi^l}.
\]

In the short term, \( \frac{\partial c_A^h}{\partial \phi^h} \) and \( \frac{\partial c_A^l}{\partial \phi^l} \) are both positive.

\( L^l \):

\[
\frac{\partial p^l_{PT}}{\partial L^l} = k \left( \frac{c_{PT}^l}{c_A^l} \right)^{k-1} \left( \frac{1}{c_A^l} \frac{\partial c_{PT}^l}{\partial L^l} - \frac{c_{PT}^l}{(c_A^l)^2} \frac{\partial c_A^l}{\partial L^l} \right).
\]

\( \frac{\partial c_{PT}^l}{\partial L^l} = -\frac{1}{L^l} \frac{1}{\nu + 2} \tau^l \) is negative. Upon examination, \( \frac{\partial p^l_{PT}}{\partial L^l} \) also turns out to be negative, so we need to evaluate \( \frac{\partial p^l_{PT}}{\partial L^l} \) itself at every point on the grid. To do so, we again differentiate the implicit solution for \( c_{PT}^l \) with respect to \( L^l \) and solve for \( \frac{\partial c_{PT}^l}{\partial L^l} \). This is:

\[
\frac{L^h}{27} (c_A^l - c_{PT}^l) \frac{\partial c_A^h}{\partial L^l} + \frac{1}{47} (c_D^l - c_{PT}^l)^2 + \frac{L^l}{27} (c_D^l - c_{PT}^l) \frac{\partial c_A^l}{\partial L^l} - \frac{1}{47} (c_A^l - c_{PT}^l)^2 - \frac{L^l}{27} (c_A^l - c_{PT}^l) \frac{\partial c_A^l}{\partial L^l}.
\]

\( \tau^h \) is replaced with \((\nu^h)^2\) for the NTB case. Note that \( \frac{\partial c_A^l}{\partial L^l} = 0 \) in the long-run case. In the short-run the sign
of both \( \frac{\partial p}{\partial L} \) and \( \frac{\partial c}{\partial L} \) are indeterminate, although generally positive as described in Numerical Simulation 1.

\[ L^h: \]
\[ \frac{\partial p}{\partial L^h} = k \left( \frac{c_{PT}}{c_A} \right)^{k-1} \frac{1}{c_A} \frac{\partial c}{\partial L^h}. \]

Therefore, the sign of \( \frac{\partial c}{\partial L^h} \) determines the sign of \( \frac{\partial p}{\partial L^h} \).

\[ \frac{\partial c}{\partial L^h} = \frac{1}{45} \tau^h (c_A - c_{PT})^2 + \frac{L^h}{27} \tau^h (c_A - c_{PT}) \frac{\partial c}{\partial L^h} + \frac{L^l}{27} (c_D - c_{PT}) \frac{\partial c}{\partial L^l}. \]

\( \tau^h \) is replaced with \( (\nu^h)^2 \) for the NTB case. Both \( \frac{\partial p}{\partial L^l} \) and \( \frac{\partial c}{\partial L^l} \) are indeterminate, although generally negative as described in Numerical Simulation 1.

**B3: Proportion of Profits Comparative Statics**

\[ p_{PT}^l = \frac{1}{fE} \int_{0}^{c_{PT}} \pi^l(c) dG^l(c) \]
\[ = \frac{1}{fE} \frac{L^l}{47} \int_{0}^{c_{PT}} ((c_A)^2 - 2c_A c + c^2) \left( \frac{c}{m} \right)^{k-1} \frac{k}{m} dc \]
\[ = \frac{1}{fE} \frac{L^l}{47} \frac{k}{(m^l)^k} \left( \frac{c_A}{k} \right)^2 \left( \frac{c_{PT}}{k} \right)^{k+1} + \frac{\left( \frac{c_{PT}}{k} \right)^{k+2}}{k+2} \]

Three pieces are worth exploring. First, some of the comparative statics involve parameters in the group \( \frac{1}{fE} \frac{L^l}{47} \frac{k}{(m^l)^k} \), so we define

\[ \left( \frac{(c_A)^2 (c_{PT})^k}{k} - 2c_A \left( \frac{c_{PT}}{k} \right)^{k+1} + \frac{(c_{PT})^{k+2}}{k+2} \right) \equiv \chi_1. \]

The following sufficient condition must be positive for \( \chi_1 \) to be positive:

\[ (c_A)^2 (k^2 + 2k) - 2c_A c_{PT} (k^2 + 2k) + (c_{PT})^2 (k^2 + 2k) > 0. \]

Each step uses the fact that \( c_A > c_{PT} \).

Second, some of the parameters will affect \( c_A \) so we define

\[ \left( 2c_A \left( \frac{c_{PT}}{k} \right)^{k+1} - 2 \left( \frac{c_{PT}}{k+1} \right)^{k+2} \right) \equiv \chi_2. \]

Again, \( \chi_2 \) is positive because \( c_A > c_{PT} \).
Third, all of the parameters will affect $c_{PT}$ so we need the sign of

$$((c_{PT}^A)^2(c_{PT})^{k-1} - 2c_{PT}(c_{PT})^k + (c_{PT})^{k+1}) = \chi_3.$$

Factorization as above shows that $\chi_3$ is positive. We can now examine each comparative static.

\(\tau^i\):

$$\frac{\partial p_{\tau^i}}{\partial \tau^i} = \frac{1}{f_E} \frac{L^i}{4\gamma (m^i)^k} \frac{\partial c_{\tau^i}}{\partial \tau^i}$$

because $\frac{\partial c_{\tau^i}}{\partial \tau^i} = 0$. We showed in Appendix B2 that $\frac{\partial c_{\tau^i}}{\partial \tau^i} > 0$, so $p_{\tau^i}$ is increasing in $\tau^i$.

\(\tau^h\):

$$\frac{\partial p_{\tau^i}}{\partial \tau^h} = \frac{1}{f_E} \frac{L^i}{4\gamma (m^i)^k} \frac{\partial c_{\tau^i}}{\partial \tau^h}$$

because $\frac{\partial c_{\tau^i}}{\partial \tau^h} = 0$. We showed in Appendix B2 that $\frac{\partial c_{\tau^i}}{\partial \tau^h} < 0$ in the tariff case (and generally will be in non-tariff barrier case), so $p_{\tau^i}$ is decreasing in $\tau^h$.

\(m^i\) and $f_E^i$:

$$\frac{\partial p_{\tau^i}}{\partial m^i} = -\frac{1}{f_E} \frac{L^i}{4\gamma (m^i)^k} \chi_1 + \frac{1}{f_E} \frac{L^i}{4\gamma (m^i)^k} \left( \chi_2 \frac{\partial c_{D}}{\partial m^i} + \chi_3 \frac{\partial c_{PT}}{\partial m^i} \right).$$

This case is similar in that the sign of $\frac{\partial p_{\tau^i}}{\partial m^i}$ is indeterminate because the first term is negative, and the second term is positive because $\frac{\partial c_{D}}{\partial m^i}$ and $\frac{\partial c_{PT}}{\partial m^i}$ are both positive. At every evaluated point in the parameter space it was found that $\frac{\partial p_{\tau^i}}{\partial m^i} < 0$.

\(m^h\) and $f_E^h$:

$$\frac{\partial p_{\tau^i}}{\partial m^h} = \chi_3 \frac{\partial c_{PT}}{\partial m^h}$$

because $\frac{\partial c_{\tau^i}}{\partial m^h}$ is zero. $\frac{\partial c_{\tau^i}}{\partial m^h} > 0$ so $p_{\tau^i}$ is increasing in $m^h$.

\(L^i\):

$$\frac{\partial p_{\tau^i}}{\partial L^i} = \frac{1}{f_E} \frac{1}{4\gamma (m^i)^k} \chi_1 + \frac{1}{f_E} \frac{L^i}{4\gamma (m^i)^k} \left( \chi_2 \frac{\partial c_{D}}{\partial L^i} + \chi_3 \frac{\partial c_{PT}}{\partial L^i} \right).$$

The first term is positive and the second term is negative, because $\frac{\partial c_{D}}{\partial L^i}$ and $\frac{\partial c_{PT}}{\partial L^i}$ are both negative (see Appendix B2). Therefore, this entire expression must be evaluated at every point along the grid. Doing so reveals that in the long-run $\frac{\partial p_{\tau^i}}{\partial L^i} > 0$. In the short-run, the sign of the change can be positive or negative, however in the numerical simulations conducted it was generally positive.

\(L^h\):

$$\frac{\partial p_{\tau^i}}{\partial L^h} = \chi_3 \frac{\partial c_{PT}}{\partial L^h}$$

because $\frac{\partial c_{\tau^i}}{\partial L^h}$ is zero. In the long-run case $\frac{\partial c_{\tau^i}}{\partial L^h} < 0$ so $p_{\tau^i}$ is decreasing in $L^h$. In the short run, the sign of $\frac{\partial c_{\tau^i}}{\partial L^h}$ was indeterminate although generally negative across the grid of numerical simulations.
B4: Solving the Model when $k^l \neq k^h$

Before presenting the revised model, it will be demonstrated that for the long-run case, $p_{PT}$ does not vary with $\gamma$ when $k^l = k^h$. First, note that each of the long-run cutoffs $c^l_A$, $c^l_D$ and $c^l_X$ is homogeneous of degree $\frac{1}{k^l+2}$ in $\gamma$. Examining the explicit solution for the $c^l_{PT}$ [omitted here] it is clear that $c^l_{PT}$ is homogeneous of degree one in $c^l_A$, $c^l_D$ and $c^l_X$ and is only a function of $\gamma$ via these cutoffs. It then follows that $c^l_{PT}$ is homogeneous of degree $\frac{1}{k^l+2}$ in $\gamma$. Moreover, because $p_{PT} = \left( \frac{c^l_{PT}}{c^l_A} \right)^k$, $p_{PT}$ is homogeneous of degree zero in $\gamma$.

For the proportion $\hat{p}_{PT}$, note that

$$\hat{p}_{PT} = \frac{1}{f_E} \frac{L^l}{4\gamma (m^l)^k} \left( (c^l_A)^2 \left( \frac{c^l_D}{\tau^h} \right)^{k^l+2} \right) \left( \frac{c^l_{PT}}{\tau^h} \right)^{k^l+2} = 2\gamma (k^l+1)(k^l+2)(m^l)^k f_E$$

and

$$\hat{p}_{PT} = \frac{1}{f_E} \frac{L^h}{4\gamma (m^h)^k} \left( (c^h_A)^2 \left( \frac{c^h_D}{\tau^l} \right)^{k^h+2} \right) \left( \frac{c^h_{PT}}{\tau^l} \right)^{k^h+2} = 2\gamma (k^h+1)(k^h+2)(m^h)^k f_E.$$

Because $k^l \neq k^h$, there is generally no analytic solution for the cutoffs, and so these must be solved numerically. We continue to assume that Assumption 1 holds in order to ensure that both countries have a differentiated product sector post-liberalization.32

Solving for the number of firms with trade also requires numerical evaluation, but we first need to build up a set of equations from more primitive quantities. I will concentrate on solving for the number of entrants in each country, $N_E$. The average price of a variety produced by $l$’s firms and sold domestically is $\bar{p}^l_D = \frac{c^l_A (2k^l+1)}{2k^l+1}$, while the average price of a variety exported by $l$’s firms is $\bar{p}^l_X = \frac{c^l_A (2k^l+1)}{2k^l+1}$. The average prices for $h$’s varieties are defined analogously. The number of firms serving the market in $l$ is $N^l = \left( \frac{\bar{p}^l_D}{\bar{p}^l_X} \right)^{k^l} N^l_E + \left( \frac{\bar{p}^l_X}{\bar{p}^l_X} \right)^{k^h} N^l_h$. $N^h$ is defined similarly. The average price of all varieties, foreign and domestic, sold in $l$ is then

$$\bar{p} = \frac{\bar{p}^l_D \left( \frac{\bar{p}^l_X}{\bar{p}^l_X} \right)^{k^l} N^l_E}{N^l} + \frac{\bar{p}^l_X \left( \frac{\bar{p}^l_X}{\bar{p}^l_X} \right)^{k^h} N^l_h}{N^l},$$

and similarly for $h$. Finally, we use the zero-demand or ‘choke price’ equations for each country to determine the number of entrants. These equations are

32Note that for NTBs, the above equations have a squared NTB value in front of each of the second terms. The rest of the equations (which are all in terms of consumers’ demand functions) are the same except they replace $\tau$’s with $\nu$’s.
\[
\frac{1}{\eta N^l + \gamma} (\gamma \alpha + \eta N^l \bar{p}^l) = c^l_D
\]

and

\[
\frac{1}{\eta N^h + \gamma} (\gamma \alpha + \eta N^h \bar{p}^h) = c^h_D.
\]

Note that these final two equations are all in terms of parameters, cutoffs (which we have solved) and \(N_E^l\) and \(N_E^h\) which are the two unknowns.

Numerical Simulation 2 is checked for the long-term only (because it does not hold strictly in the short-term) on the grid below. To save on dimensions, \(k^h\) was set to 3. I use a relatively large number of points for \(\gamma\) to ensure that the extreme ends of its values are thoroughly explored. \(k^l\) varies relatively little because even moderate differences in \(k\) between countries tend to result in no entry in the high-\(k\) country.

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<tr>
<td>(\gamma)</td>
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<td>8</td>
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References


Kim, I. 2012. “A Theory of Open Trade with Heterogeneous Firms.” *In progress*.


