HETEROGENEOUS FIRMS, INTERNATIONAL TRADE, AND MERGER AND ACQUISITION INCENTIVES

ABSTRACT

In this paper, I study Merger and Acquisition (M&A) incentives in an international environment. I explore two classes of models to find mechanisms linking trade policy and M&A activity: oligopoly models with countable and few firms making Cournot conjectures about their competitors, and monopolistically competitive models with a continuum of firms and a Q-theory of mergers as reallocation. A basic Cournot model predicts a fall in M&A activity with trade liberalization. In oligopoly models with firm heterogeneity, either between domestic firms or between domestic and foreign firms, tariffs shift the reaction functions of firms, changing the profitability and incentives to merge. I study how changes in tariffs affect three merger motives in this context: market power, cost-reductions, and entry deterrence in the presence of synergies and foreign cost advantages. The monopolistically competitive models focus on the effect of changes in tariffs on the allocation of a fixed factor of production between heterogeneous firms. By increasing import competition and expanding the potential market of exporting firms, bilateral trade liberalization drives the least efficient firms out of the market and induces the most efficient firms to expand. M&A is one mode of expansion for acquiring firms and a way for target firms reallocating installed capacity in the process to exit. The reallocation motive for mergers is consistent with the Q-theory of mergers. I test some of the implications of these two classes of models using a new data set of global M&A, tariffs, and free trade agreements between 1965 and 2009 finding a statistically and economically significant increase in M&A activity caused by trade liberalization. Each percentage point fall in tariffs results in an average increase of 1 M&A per year. My identification strategy relies on exogenous changes in tariffs and I find significant effects with M&A increasing as tariffs fall, but only temporarily consistent with a story of M&A as reallocation.

JEL Classification: F13, F14, F15, L11, G34.

1 Introduction

Free Trade Agreements (FTA) have become more prevalent in the world trading scene as multilateral negotiations at the WTO stall [WorldBank, 2004] . Competition authorities have asserted that these trade liberalization programs have lead to increased merger activity (see anecdotal evidence in Globerman [1990]), and detailed analysis of the US-Canada Free Trade Agreement has confirmed this increase and a causal relationship between a fall in tariffs and M&A activity within Canada for this particular FTA [Breinlich, 2008]. These facts are at odds with many oligopoly models that suggest an increase in competition following trade liberalization due to entry by relatively efficient foreign firms would reduce the profit gains from mergers due to their inability to reduce quantities and increase prices. With Cournot conjectures we also know that losses from horizontal mergers due to downward-sloping reaction curves of non-merging firms in quantity space may hinder merger activity and this effect is stronger as the number of firms increases. More recent contributions to merger theory have found that with firm heterogeneity, trade can induce certain types of mergers motivated by cost savings, and the recent trade literature with heterogeneous firms and monopolistic competition and macroeconomic models of restructuring and factor-specificity have suggested that M&A may be driven by profitable reallocation of factors of production between firms [Melitz, 2003, Caballero, 2007]. In the theory section I identify one new incentive to merge in response to trade liberalization: the possibility of deterring foreign entry when foreign firms have cost advantages and domestic horizontal mergers result in synergies.

I first present a literature review of the main oligopoly models linking industry structure and trade policy and the recent trade literature with heterogeneous firms. I suggest a new way of interpreting M&A in the context of the workhorse trade models with monopolistic competition and heterogeneous firms. I argue that a model of M&A as reallocation is compatible with a heterogeneous firm trade model and provides another rationale for M&A even

if the industry is not concentrated. The purpose of this review is to determine the similarities and differences between these models and show how the possibility of trade-induced M&A arises in models with very different market structures and assumptions. The main contribution of the paper is to propose a new rationale for mergers following trade liberalization, review the existing literature on M&A and trade, and suggest how M&A can be interpreted as a mechanism to reallocate scarce factors of production and to test these empirically. I finally test the implications of these two sets of models (oligopoly models and monopolistic competition models) with a large sample of FTA between many different countries. Unlike the existing literature using only a single FTA, this approach makes it possible to generalize the insights from the US-Canada example and identify the factors and characteristics leading to stronger and weaker links between trade and M&A and the type of M&A that arise.

Heterogeneous firm models in the tradition of Melitz [2003], Melitz and Ottaviano [2008] and empirical papers using firm level data have shown that trade induces a reallocation of resources and market shares from less efficient firms towards more efficient firms. This reallocation is an important factor explaining the observed increase in aggregate productivity following trade liberalization. In this paper, I present empirical evidence that shows that trade liberalization induces M&A that serve the purpose of reallocating industry-specific capital between firms of different productivity. Endogenous horizontal M&A in this paper are understood as a mechanism to efficiently reallocate a scarce productive resource between firms of different characteristics in response to a change in the economic environment as suggested by Jovanovic and Rousseau [2002a,b] and empirically documented in Phillips and Maksimovic [1999], Andrade and Stafford [2004], Andrade et al. [2001]. I contrast this framework with oligopoly models of M&A that would predict a reduction in M&A activity rather than an increase following trade liberalization (see for example, Salant et al. [1983]). However, the increase in M&A is consistent with predictions of oligopoly models with heterogeneous firms such as Long and Vousden [1995]. Oligopoly models also identify different

rationales for M&A, such as increasing market power, deterring foreign entry, and reducing costs. The reallocation motivation emphasized in the recent trade literature implies that M&A will be driven by entry into the export market and self-selection of firms on productivity. M&A induced by trade will be different than those not induced by trade.

The data set I construct includes all M&A deals between firms in countries signing free trade agreements (FTA) since 1970. I match the M&A data with firm level accounting data on the acquirer and target firms for each deal, tariffs for the SIC-4 digit industry sector of both firms, including most favored nation (MFN) as well as preferential and effectively applied tariffs, trade flow data between all countries in the data set, and country level data usually used in gravity models of trade. Most of the observed M&A are between firms in the same country which is an indication that the market for corporate control may indeed be a particular mechanism to restructure firms and industrial sectors following a trade shock. Comparing productivity and cost measures of the acquirer and target firms and where they lie on the productivity distribution, as well as changes in trade flow and industry structure parameters such as number of firms in an industry can help us identify the type of M&A occurring: M&A where the acquirer is more productive than the target but the target is not the least productive potential target, in industries with many firms where trade flows change substantially after trade liberalization, are consistent with reallocation M&A as suggested by the monopolistically competitive framework and the Q-theory; M&A between similar firms that result in lower post-merger costs following trade liberalization even if there is no foreign entry are consistent with M&A as entry deterrence in an oligopoly model; observing more M&A between a productive acquirer and a low productivity target after liberalization is consistent with an oligopoly model with heterogeneous firms.

My identification strategy relies on bilateral tariff reductions implemented as part of Free Trade Agreements (FTA). Another possible policy experiment useful to test the implications of the models presented are the unilateral trade liberalization of the 1990s in many developing

countries, particularly in Latinamerica. The main difference between the two experiments is that with bilateral trade liberalization the domestic market becomes more competitive because of import competition but the most productive domestic firms benefit from improved access to the foreign market. There is therefore a competition effect and a market size effect. With unilateral trade liberalization there is only the competition effect. I use tariffs as a plausibly exogenous variable rather than trade volumes following most of the empirical trade literature [see for example Trefler, 2004]. Interestingly, besides finding direct effects of trade on tradeable sectors, also find effects on traditionally non-traded sectors: mergers in all sectors tend to cluster around FTA dates and then level-off, and the characteristics of firms engaging in M&A and the type of M&A also changes with more horizontal M&A ocurring and with acquirers being more productive and targets less productive than for non-trade M&A.

There are several classes of models with predictions of the effect of trade liberalization on parameters of industry structure such as the number of firms and the size of firms. Head and Ries [1999] identify 4 classes of models: segmented-markets cournot models, unified-markets Cournot models, monopolistic competition models and tariff-limit pricing models. All of these models predict a rationalizing effect of tariff cuts in the sense that the number of firms decreases after liberalization although the effect on the scale and output depend on the specific assumptions of the models. These papers, however, do not identify the way this rationalization occurs. This paper documents the role of M&A as a rationalizing force and identifies the mechanisms of this rationalization by identifying the characteristics of merging firms. I explore the monopolistically competitive class of models to find rationales for M&A in a trade liberalization context and compare it to oligopoly models. After reviewing a set of oligopoly models and their predictions, I outline a static version of the Melitz [2003] model following the described mechanism in Breinlich [2008]. The model is a one-factor model with a fixed supply of capital, CES preferences, increasing returns to scale at the firm level, het-

erogeneity in productivity and monopolistic competition. Firm profits are supermodular in production costs and tariffs which leads to sorting of firms into exporting and non-exporting firms as argued in Mrazova and Neary [2011]. Differences between the fixed costs of entering the domestic and the foreign market lead to different cut-off productivity with the most productive firms entering the export market and the least productive firms exiting. The fixed capital supply is allocated between production for the domestic and the foreign market. Changes in tariff levels lead to changes in the two cut-off productivity generating endogenous expansion and contraction of firms and changing the total demand of capital for each sector. Since there is no investment in this model, all expansions and contractions are due to reallocation which I interpret as a measure of M&A activity. The model delivers several empirically testable hypotheses at the industry level: M&A are increasing in the size of the industry as measured by total capital, in the fixed trade costs, in the dispersion of productivity, in the size of the change in tariffs and in the level of the initial tariff. M&A are decreasing in a measure of total trade costs relative to domestic entry costs and follow an inverted U-shape pattern in domestic fixed costs where the threshold is determined by the relative size of trade costs with respect to a dispersion-weighted size of the industry.

Although this model helps understand the reallocation of capital across firms of different productivity and explains the different responses to trade policy across industrial sectors and across countries, since the market for acquisitions is not explicitly modeled it does not allow us to say much about the matching of targets and acquirers in the M&A market. Furthermore, CES preferences and monopolistic competition exclude any meaningful dimension of product market competition, interactions between the factor market and the product market and a clear notion of firm structure and boundaries of the firm. I use the Q-theory of Mergers suggested by Jovanovic and Rousseau [2002a] to complement this model and explain the M&A patterns induced by trade policy.

In the first part of the paper I review the literature and its empirical implications in term

of M&A activity in a trade liberalization context. In the second part I develop in detail the two main types of models, oligopoly models with homogeneous and heterogeneous firms and models with monopolistic competition and heterogeneous firms. I develop a version of the Q-Theory of mergers that together with trade models can rationalize changes in M&A activity. The third and fourth sections describe the database, and results and the final section concludes.

2 Literature

The literature linking M&A activity and trade policy is relatively scarce. In this section I review several styles of models that can be used to understand the relationship between international trade and M&A activity including oligopoly models with Cournot competition, the empirical literature on determinants of M&A, and the growing literature on heterogeneous firms and trade. I briefly review the literature on oligopolies in general equilibrium and how it may help understand M&A facts although this style of models are nor as tractable and popular as the monopolistically competitive models. I argue that monopolistically competitive models of trade with their emphasis on firm level behavior in the presence of trade that have become popular in the field may be useful in understanding some of the empirical facts of M&A in an international context. I show that M&A are a prevalent and understudied feature of the process of restructuring following trade shocks and how the study of M&A and trade contribute to our understanding of the sources of aggregate productivity gains following trade liberalization, the process of industry restructuring in response to asymmetric shocks and the factors that make these processes differ across industries and countries.

Empirical studies of production units have shown that there is a massive amount of heterogeneity in various performance measures across firms, even within very narrowly defined industries. This heterogeneity matters for theoretical and empirical models of trade and I will

argue, also matters for understanding M&A activity. Trade, or trade liberalization induces important reallocation between heterogeneous producers in a sector with the smallest and less productive producers being forced to exit and the more productive producers expanding and becoming exporters. These reallocations generate a new channel for productivity and welfare gains from trade.

There are several empirical regularities that justify the use of models with heterogeneous firms. Firm and plant level studies in many countries have shown substantial heterogeneity across production units even within narrowly defined sectors. For example, in the USA, Bernard et al. [2003] show how for US manufacturing plants in 1992 a plant one standard deviation above the mean plant size is 167% bigger and a plant one standard deviation above the mean productivity level is 75% more productive. These enormous differences are reflected in other performance measures as well and the extent of the heterogeneity does not diminish as we look at more narrowly defined sectors. These measures of heterogeneity are also correlated with firm decisions to engage in international transactions and with the resulting aggregate trade flows: only a few firms engage in international trade and they tend to be larger, more productive, more capital intensive and tend to pay higher wages than the average firm Bernard et al. [2007a].

These sets of facts and correlations beg the question of causality. Many empirical papers including De Loecker [2007] have found that there is a strong selection effect: firms are already more productive prior to entering the export market. Another part of the recent empirical literature has studied the link between export status and productivity when exposure to trade is changing, finding that exposure to trade induces reallocation of market shares and factors of production between exporters and non-exporters (Erdem et al. [2003], Pavcnik [2002]). One of the implications of this reallocation in favor of the more productive firms is an increase in aggregate productivity even without any improvement in productivity at the firm level. Since trade policy changes are frequently done at the same time as other

macroeconomic policies, isolating the effect of trade policy has been a challenge for this literature.

The empirical facts documented in this growing empirical literature cannot be explained by trade models based on representative firms since these assume that trade affects all firms in a similar way. In response to this empirical evidence of heterogeneity and correlation and possible causation with outcomes such as exporting status we have developed two types of theoretical models with firm level heterogeneity: Ricardian models, summarized in Eaton and Kortum [2012], and monopolistic competition models, reviewed in Melitz and Trefler [2012]. In the first class of models, developed by Bernard et al. [2003], Eaton and Kortum [2002], Eaton et al. [2004], there is a fixed number of products that can be produced by competing firms in all countries. A set of firms can produce the same good but with different technologies and consumers in each country buy from the lowest cost producer across all countries. Because of trade costs several firms producing the same product can survive if they are located in different countries, but there is only one supplier to any given destination. The model emphasizes competition in price between firms to be the exclusive supplier. The second style of model developed in Melitz [2003], Melitz and Ottaviano [2008] abstracts from the issue of direct competition between firms by using a monopolistic competition framework: each firm produces its own distinctive good. These models incorporate firm heterogeneity into the one-sector models of intra-industry trade developed by Krugman [1979, 1980]. In this type of model the product variety available to consumers in any given country varies endogenously depending on the characteristics of the country and the trade costs linking it to trading partners. Trade costs affect both the number of varieties produced domestically as well as the number of varieties imported from trading partners. Firms face sunk costs of entry as well as uncertainty regarding their future productivity. Firms learn their productivity instantaneously when they enter and this is modeled as a draw from a known distribution. Due to the sunk nature of entry costs, firms with heterogeneous productivity remain active

in the market. The least productive firms make negative profits and exit and only the most productive firms export as they can cover the fixed costs of exporting.

Both classes of models predict that trade liberalization induces reallocation of market shares from the less towards the most productive firms as the less productive firms exit and contract and the more productive firms expand. This reallocation results in both aggregate productivity and welfare gains. Additionally, both classes of theories predict that differences in aggregate trade flows between countries reflect both an intensive margin (amount of goods traded) and an extensive margin (number of goods traded). Helpman et al. [2007] and Chaney [2008] have shown how to extend the Melitz [2003] framework to derive gravity specifications for bilateral trade flows where trade costs affect both the extensive and intensive margin.

Because of the absence of strategic interactions between firms, the monopolistic competition model in Melitz [2003] provides a convenient framework to model other firm level decisions in an open-economy environment where heterogeneous firms self-select into different types of activities. It has been used to model which firms choose to become multinational and operate foreign affiliates in Helpman et al. [2004]; to integrate with foreign suppliers in Antras and Helpman [2004]; choice of technology as in Acemoglu et al. [2007]; level of investment in innovation as in Atkeson and Burstein [2007]; range of products in multi-product firms as in Bernard et al. [2006]. The structure of Melitz [2003] has also been incorporated into other models that rely on the monopolistic competition model of trade: extensions of the two-sector model of trade with comparative advantage and factor proportion differences in Bernard et al. [2007b]; open economy models of growth in Baldwin and Robert-Nicoud [2005]; and international macro-dynamics as in Ghironi and Melitz [2007], Bilbiie et al. [2007].

There is a large literature on cross-border mergers and acquisitions and trade that relies on the trade-off between proximity and concentration. With trade costs, acquiring a foreign firm is an alternative mechanism for market access allowing the firm to "jump" the tariff at

the cost of incurring a fixed merger cost Mrazova and Neary [2011]. Head and Ries [2008] have considered FDI as limited by a span of control problem that must be compared to the tariff-jumping motive and the implications for competition policy have been explored in Head and Ries [1997]. Other incentives to participate in the global acquisition market include differences in factor prices and off-shoring, selection between greenfield investment, FDI and cross-border mergers because of differences in technology transfer [Bjorvatn, 2004, Brakman et al., 2007, Coeurdacier et al., 2009, Erel et al., 2009, Georgopoulos, 2008, Hijzen et al., 2008, Kim, 2009, Moskalev, 2010, Neary, 2007, 2009b, Nocke and Yeaple, 2007, 2008].

The literature on trade policy and trade costs and domestic mergers is a lot more recent and less voluminous. Breinlich [2008] empirically shows the effect of the Canada-US FTA on domestic mergers showing a significant increase in the Canadian market. Clougherty and Zhang [2005] investigate causality in the other direction: changes in merger policy on trade flows. Most papers investigating the effect of trade policy on M&A rely on partial equilibrium oligopoly models with homogenous goods and Cournot competition. In these models, firms face two different incentives to merge: cost reductions or increasing concentration and monopoly power. In some settings unilateral trade liberalization leads to more concentration mergers and bilateral trade liberalization leads to more cost-reducing mergers as in Gaudet and Kanouni [2004], Lommerud et al. [2006]. The merger literature has suggested that higher anticipated market power increase M&A activity as firms anticipate larger gains from merging. Trade liberalization, by reducing entry barriers and intensifying competition would reduce the incentive to merge as it reduces the possibility of any two firms exercising market power. Trade liberalization can be expected to make anti-competitive horizontal mergers less likely. This intuition has been formalized by Gaudet and Kanouni [2004] who show along the lines of Salant et al. [1983] how tariff reductions that induce entry of foreign firms tend to reduce the gains from horizontal mergers.

In his study on specificity and the macroeconomics of restructuring, Caballero [2007]

shows how M&A have played a key role in industry restructuring in response to technological and organizational revolutions in the US. However, he finds for the US more support for an increase in M&A in good times and when there is an abundance of liquidity rather than in bad times following asset firesales. Trade policy is not a shock considered in Caballero [2007] but it fits well into his narrative of industry-specificity, asymmetric shocks and the process of reallocating these specific assets across firms and industries. However, his findings on M&A would suggest that a reduction in value of assets for firms negatively affected by trade is not the mechanism driving M&A waves in the US but rather the increased liquidity of the firms gaining from trade.

Other rationales for M&A are cost savings and economies of scale. Long and Vousden [1995] show that with Cournot Oligopoly in a two-country world, unilateral trade liberalization encourages mergers motivated by market power and discourage cost saving mergers, but bilateral trade liberalization encourages cost-reducing mergers. Their framework matches the rationales for mergers in the monopolistically competitive framework explored in this paper where the merged firms have access to the technology of the lower cost firm. In their setup, Long and Vousden [1995] introduce heterogeneity by assuming that there are n identical firms and 2 firms with different costs. These two firms are the only ones with an incentive to merge to reduce costs. The gains from the merger are defined as the additional profits from the merger and is given by a parabola as a function of the cost disadvantage of the least efficient firm. The gains from a merger are also a function of tariffs. Unilateral domestic tariff reductions will encourage previously unprofitable domestic horizontal mergers with lower cost savings than those before trade liberalization. Bilateral tariff reductions are found to encourage mergers with high cost savings. A caveat of this approach is that it shuts down entry and the results only hold in the vicinity of free trade ($t = 0$).

A large corporate finance literature has documented how under performing firms with X-inefficiency face stock valuation losses that make them vulnerable to hostile takeovers. There

may be two possible implications of internal inefficiencies and stock valuation in the context of trade liberalization: by negatively impacting less efficient firms, more efficient firms now find it interesting to raid them; or, trade liberalization generates the incentives for internal restructuring. Mitchell and Mulherin [1996], Andrade et al. [2001] have documented how M&A are often the least-cost method of industry restructuring to industry-specific shocks and that merger waves are clustered both in time and by industry. This suggests that trade liberalization can be understood as an industry-specific shock endogenously generating M&A activity before generating large changes in firm level productivity, which is a prediction that matches the assumptions of heterogeneous trade models that will serve as the backbone of this paper. Mitchell and Mulherin [1996] show how the takeover activity of the 1980's clusters disproportionately at the industry level with industries experiencing the greatest fundamental shocks facing more M&A. Clustering can also be driven by the information content of takeovers or M&A: one M&A may provide information to other firms about underlying industry fundamentals. Other strands of the literature on M&A have emphasized macroeconomic variables as the source of takeover activity (e.g. overall stock market performance), reversing value-decreasing acquisitions, returning assets to their core industries, penalizing poor managerial performance, and improving cash flows and other fundamentals. There is also an older literature more closely related to the approach taken in this paper that studies restructuring and takeover activity at the industry level and surveyed in Mitchell and Mulherin [1996], Andrade et al. [2001] .

In his book on corporate finance, Tirole [2006] reviews several models that rationalize takeovers and M&A. In particular, he explains capital reallocation as driven by managerial discipline and pledgeable income concerns when assets are industry-specific as in Shleifer and Vishny [1992]. The resale value of these assets is determined by the presence of other firms in the industry that demand them and that have the financial means to purchase them. In the context of this paper, trade liberalization drives the demand for industry-

specific assets by high-productivity firms and the corresponding supply by low-productivity firms. The relationship between this paper and the corporate finance literature can be traced back to Jensen [1988] arguing that takeovers facilitate exit and cash disgorgement in slow-growth industries. Jovanovic and Rousseau [2002a] have also shown that firms in industries with low Tobin-Q are more likely to be the target of takeovers. The mechanisms underlying the effect of tariffs on M&A through their effect on firm valuation suggests that the value of the merged firm will be higher than the value of the two firms pre-merger. In fact, the literature on the takeover waves of the 1980s in the US does suggest that these takeovers were efficiency enhancing [Tirole, 2006, p.50]. The same mechanisms are at work with trade: increased profit opportunities for efficient firms in foreign markets together with reduced profit opportunities at home for inefficient firms leads to an increase in foregone value because of the misallocation of valuable assets between efficient and inefficient firms creating incentives to reallocate productive assets between firms and within industries. Finally, Tirole [2006, p.52] also suggests a debt mechanism: the costs associated with debt, such as costs of illiquidity, bankruptcy costs and all direct and indirect costs, serve as an additional incentive to find alternatives for the installed assets. If the value of debt to equity in low productivity firms increase these costs, M&As may be an alternative and socially more efficient way to redeploy assets rather than the costly bankruptcy process induced by increased debt.

More recently, an attempt has been made to incorporate oligopoly models into a general equilibrium framework comparable to the models of trade with imperfect competition of the 1980s. These models have not been used to study domestic mergers directly but do have predictions on trade and market structure [Neary, 2009a, 2007, Neary and Tharakan, 2005, Neary, 2003, 2002, 2009c]. Neary [2009c] observes that the two dominant paradigms of trade, the theory of comparative advantage based on perfect competition and the theory of product differentiation and increasing returns to scale based on monopolistic competition, both assume free entry and exit of ex-ante identical firms that are infinitesimal in scale and

that compete non-strategically. The production sector of the economy is hence, constrained efficient and both approaches lead to very similar implications such as the gravity equations of trade. Neary then suggests that casual empiricism shows that large firms are important in many world markets and this dominance has increased rather than diminished. This granularity, or importance and differences between large firms and smaller firms, motivates Neary in his quest to resurrect the new trade theory of the 80's with oligopolistic competition and strategic trade policy as developed in Brander and Krugman [1983]. The shortcoming of this literature was that they were partial equilibrium models and did not allow for the interactions between product and factor markets at the heart of many trade topics. Neary endeavors to overcome the technical difficulties of embedding oligopolies in general equilibrium by assuming a continuum of sectors with large firms within each sector. In this way, firms can be large and behave strategically in their own sector but are still infinitesimal for the economy as a whole. He calls this approach, General Oligopolistic Equilibrium and argues that it helps gain insights that the two other paradigms don't: oligopolistic entry barriers reduce the degree of international specialization, competition effects and comparative advantage can results in counter intuitive results like the increase in share of profits in national income following trade liberalization, potential foreign competition can affect domestic firm behavior even in the absence of large increases in trade flows, and finally, oligopoly models can help understand how market structure changes through cross-border M&A as a response to trade. This new literature suggests developing oligopoly models in general equilibrium, endogenizing entry and exit while at the same time allowing for large firms that behave strategically to understand the nature of competition in globalized markets.

Although oligopoly in general equilibrium models seem like a promising approach to issues such as M&A and trade, in this paper I will contrast the implications of partial equilibrium oligopoly models and monopolistic competition models combined with theories on M&A that can help motivate empirically testable implications and mechanisms to explain

and document increases in M&A during trade liberalization. I choose to remain within the monopolistically competitive model since it has become one of the most popular models to study firm behavior in an international context.

3 Theory

In this section I present two broad classes of models that will suggest empirically testable predictions of the effect of trade on M&A activity and explain the possible mechanisms linking the two. The baseline model is a Cournot model with homogeneous firms and one homogenous product that predicts that M&A will fall following trade liberalization since trade increases foreign entry limiting the ability of domestic firms to monopolize an industry through coalitions. I then follow Long and Vousden [1995] and present a Cournot model of trade with heterogeneous firms and homogeneous products where trade can increase M&A activity as low cost firms merge with high cost firms transferring their cost parameter to the merged entity. In the third section I introduce heterogeneity between domestic and foreign firms in the case of a domestic duopoly and derive conditions showing how domestic mergers can deter foreign entry by a lower cost foreign competitor when tariffs fall thus avoiding domestic exit. These mergers are strategic as they change industry structure to affect the profitability of the foreign firm. Finally, I present a Melitz [2003] model of heterogeneous firms highlighting how trade policy defines a group of potential acquirers and potential targets during the reallocation process following trade liberalization. Finally, I summarize the empirical predictions of the models highlighting their similarities and differences and laying the ground for empirical testing.

3.1 M&A and Trade in Oligopoly Models: Market Power, Cost-Savings and Strategic Mergers

3.1.1 Baseline model: Trade reduces the incentives to merge

A first approach to understanding the link between trade and M&A is to consider the effect of an exogenous change in industry structure on the gains from a merger in a Cournot-Nash equilibrium. Arguably, by opening a country to trade a first order effect is to increase the number of firms selling in a market. However, Salant et al. [1983] show that an increase in the number of firms in an industry reduces the gains from a merger or coalition of given size, or equivalently, increases the minimum size of the coalition required to make the merger profitable. This result relies on the strategic substitutability of quantities in a Cournot game and how non-merging firms increase their quantities in response to a quantity reduction by the merging firms.

Consider an industry with n identical firms and a possible merger of $m+1$ firms where m is an integer between 0 and $n-1$. Denote $\Pi^{NC}(n,m)$ the profits of the merging firms prior to the merger and $\Pi^{C}(n,m)$ the profits of the coalition after the merger. Define $G(n,m)$ as the increase in joint profits following the merger which we will call the Merger Gains Function,

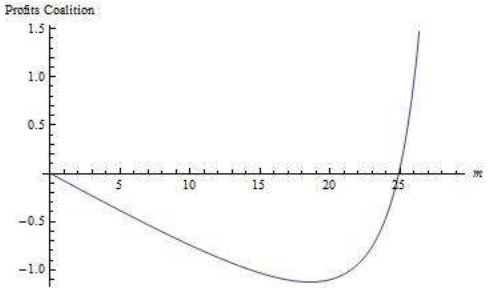
$$G(n,m) = \Pi^{NC}(n,m) - \Pi^{C}(n,m)$$

Consider a Cournot example with constant marginal costs c and linear demand $p = a - bQ$. The results do not depend on the linearity of demand. The equilibrium profit function for each identical firm in an industry of size n is given by

$$\Pi(n) = \left(\frac{a-c}{(n+1)}\right)^2$$

The joint profits prior to the merger and after a merger for a coalition of $m+1$ firms can

Figure 1: Profitability of Cournot Coalitions



be written as

$$\Pi^{NC}(n,m) = (m+1)\Pi(n)$$

and

$$\Pi^{C}(n,m) = \Pi(n-m)$$

Substituting the Cournot equilibrium solution yields the gains function

$$\begin{aligned} G(n,m) &= \Pi(n-m) - (m+1)\Pi(n) \\ &= \left(\frac{a-c}{(n-m+1)}\right)^2 - (m+1)\left(\frac{a-c}{(n+1)}\right)^2 \\ &= (a-c)^2\left\{(n-m+1)^{-2} - (m+1)(n+1)^{-2}\right\} \end{aligned}$$

From this equation, we can see that a merger can create loses when $G(n,m) < 0$. Figure 1 plots this function for a fixed industry size of $n = 30$ and different coalition sizes.

This functions shows several results of interest. Over a range of m the loses are larger the larger the number of firms merging holding the size of the industry fixed; merger to monopoly is always profitable; for any n it is sufficient to be unprofitable that less than 80% of the firms merge and there is an industry size n such that any given fraction of an industry that merges will cause a loss to the coalition and the merger will not be profitable. Figure 2 plots $\frac{\partial G}{\partial n}$ for several values of n and m. Over most ranges the gains fall for an increased

Figure 2: Larger Coalitions Reduce Profits of Mergers

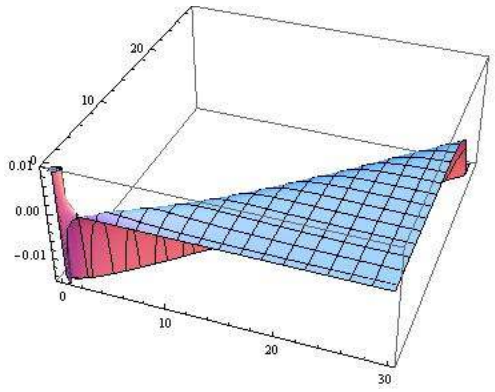
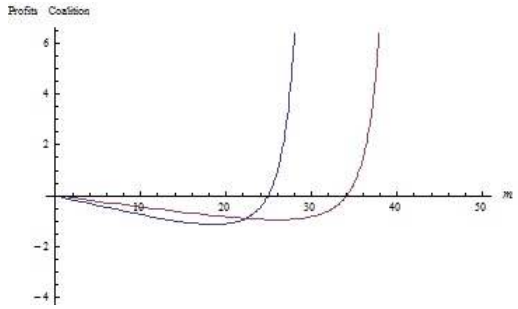


Figure 3: Industry Size and Merger Profitability



number of firms n.

Figure 3 shows the effect of increasing exogenously the number of firms in the industry on the merger gains function. The blue line shows an industry with 30 firms and the red line an industry with 40 firms. Mergers of a given subset of firms become less likely with a larger industry.

The main message of this model is that horizontal mergers can lead to loses and these loses are more likely the larger the number of firms in the industry. Since a first order effect of trade liberalization is allowing more foreign firms into the industry, trade liberalization would make previously profitable mergers unprofitable and we would expect M&A activity to fall. However, this model ignores firm heterogeneity by assuming all firms have the same

marginal cost c and they produce an homogenous product and it ignores entry and exit by domestic firms following trade liberalization. However, the model does capture a common intuition that M&A become less profitable as the number of firms in an industry increases. In what follows I will present variations on this basic Cournot model that can help rationalize the observed effect of trade liberalization on M&A.

3.1.2 Cournot with Heterogeneous firms: market power and cost-saving mergers

Long and Vousden [1995] introduce firm heterogeneity into a cournot set-up in a very simple way: they assume that there are two countries, home and foreign, with $n+2$ domestic firms and m foreign firms. The n domestic firms are identical with marginal cost c and sell quantities x and x^* in the domestic and foreign markets respectively. Asterisks will denote production for the foreign market where the analysis is done from the viewpoint of the country with $n+2$ domestic firms. Firms 1 and 2 have different marginal costs and I assume without loss of generality that $c_1 > c_2$ and sell quantities x_1, x_2 in the domestic market and x_1^*, x_2^* in the foreign market. Foreign firms have marginal cost c_F and sell quantities y and y^*. There is no entry or exit of new firms. In each country demand is linear given by $p = a - bQ$. Tariffs are t per unit so the marginal cost of selling abroad is given by $c^* = c + t$.

Given these assumptions, it is straight forward to write the profit functions for each domestic firm in the home market,

$$\pi_i = \left\{ \begin{array}{ll} x_i \left[a - b\left(x_1 + x_2 + nx + my\right)\right] - c_i x_i, & i = 1, 2 \\ x \left[a - b\left(x_1 + x_2 + nx + my\right)\right] - cx, & i = 3, ..., n+2 \end{array} \right\}$$

and in the foreign market

$$\pi_i^* = \left\{ \begin{array}{ll} x_i^* \left[a - b\left(x_1^* + x_2^* + nx^* + my^*\right)\right] - c_i^* x_i^*, & i = 1, 2 \\ x^* \left[a - b\left(x_1^* + x_2^* + nx^* + my^*\right)\right] - c^* x^*, & i = 3, ..., n+2 \end{array} \right\}$$

For the m identical foreign firms profits in the domestic market are given by

$$\pi_F = y\left[a - b\left(x_1 + x_2 + nx + my\right)\right] - \left(c_F + t\right) y$$

and in the foreign market it is given by,

$$\pi_F^* = y^*\left[a - b\left(x_1^* + x_2^* + nx^* + my^*\right)\right] - c_F y^*$$

The Cournot equilibria in both markets are straight forward to solve for. In particular, for firms 1 and 2 these are given in the domestic and foreign markets by,

$$x_i = \frac{1}{b\left(m+n+3\right)}\left[a + c_i + nc + m(c_F + t) - (m+n+2)c_i\right]$$

$$x_i^* = \frac{1}{b\left(m+n+3\right)}\left[a + c_i^* + nc^* + mc_F - (m+n+2)c_i^*\right]$$

From the above, we see that the lower the marginal cost of serving the foreign market c_i^* the larger the cournot-nash equilibrium quantity produced for the foreign market. The

share of total production shipped to the foreign market is given by,

$$\begin{aligned} s &= \frac{x_i^*}{x_i^* + x_i} \\ &= \frac{\frac{1}{b(m+n+3)}\left[a + c_i^* + nc^* + mc_F - (m+n+2)c_i^*\right]}{\left[\begin{array}{c} \frac{1}{b(m+n+3)}\left[a + c_i^* + nc^* + mc_F - (m+n+2)c_i^*\right] \\ + \frac{1}{b(m+n+3)}\left[a + c_i + nc + m(c_F + t) - (m+n+2)c_i\right] \end{array}\right]} \\ &= \frac{\left[a + c_i^* + nc^* + mc_F - (m+n+2)c_i^*\right]}{\left[\begin{array}{c} \left[a + c_i^* + nc^* + mc_F - (m+n+2)c_i^*\right] \\ + \left[a + c_i + nc + m(c_F + t) - (m+n+2)c_i\right] \end{array}\right]} \end{aligned}$$

If firms 1 and 2 decide to merge the new merged entity will have access to the best technology so the marginal cost for the merged firm is given by

$$c_M = min\left\{c_1, c_2\right\}$$

We can find the post-merger cournot equilibrium:

$$\begin{aligned} X &= \frac{M}{b\left(m+n+2\right)} \\ X^* &= \frac{M^*}{b(m+n+2)} \end{aligned}$$

where $M = [a + nc + m(c_F + t) - (m+n+1)c_M]$and $M^* = [a + nc^* + mc_F^* - (m+n+1)c_M^*]$

The gains from the merger are given by

$$G = \pi_M + \pi_M^* - [\pi_1 + \pi_2] - [\pi_1^* + \pi_2^*]$$

Defining $c_{max} = max\left\{c_1, c_2\right\}$, $z = c_{max} - c_M$, $A = \frac{1}{b(m+n+2)^2(m+n+3)^2}$ we can write the

gains function as

$$G = -2A \begin{bmatrix} (m+n+2)^2\left((m+n+2)^2+1\right)z^2 \\ -2(m+n+2)^2(m+n+1)Mz + ((m+n+1)^2-2)M^2 \end{bmatrix}$$

Inspecting this gains function we can determine its behavior in (G,z) space,

$$\frac{dG}{dz} = 4A(m+n+2)^2 \begin{bmatrix} (m+n+1)\left(a+nc+m(c_F+t)-(m+n+1)c_M\right) \\ -((m+n+2)^2+1)(c_{max}-c_M) \end{bmatrix}$$

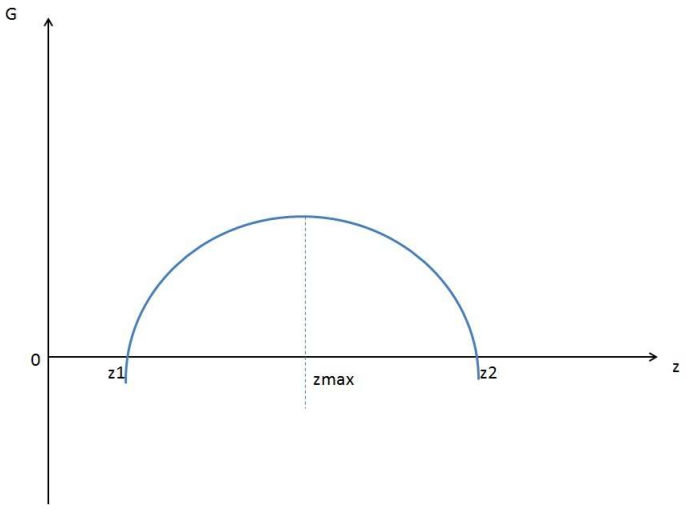
$$\frac{d^2G}{dz^2} = -4A(m+n+2)^2((m+n+2)^2+1) < 0$$

The Gains function reaches a maximum at

$$\begin{aligned} z_{max} &= \frac{M(m+n+1)}{[(m+n+2)^2+1]} \\ &= \frac{[a+nc+m(c_F+t)-(m+n+1)c_M]\,(m+n+1)}{[(m+n+2)^2+1]} \end{aligned}$$

The gains function G is a parabola in (G,z) space as shown in figure 4. The figure shows that for a merger to be profitable there must be a large enough cost difference between the acquiring and target firms so $z_1 > 0$. However, if the cost disadvantage of the high cost firm is large enough ($z > z_2$), it exits the industry and there are no profitable mergers either. If there are no cost savings at all, the gains function is negative but the gains from a merger are not maximal for the most cost savings merger but rather for an intermediate range. The market power motive for mergers in this context is frustrated by the Cournot reactions of non-merging firms as in the Salant et al. [1983] model presented above. The horizontal

Figure 4: The Gains from Merger Function



intercepts are given by

$$\begin{aligned} z_1 &= \frac{M\left[(m+n+1)^2-2\right]}{(m+n+2)\left[(m+n+2)^2+1\right]} \\ z_2 &= \frac{M}{m+n+2} \end{aligned}$$

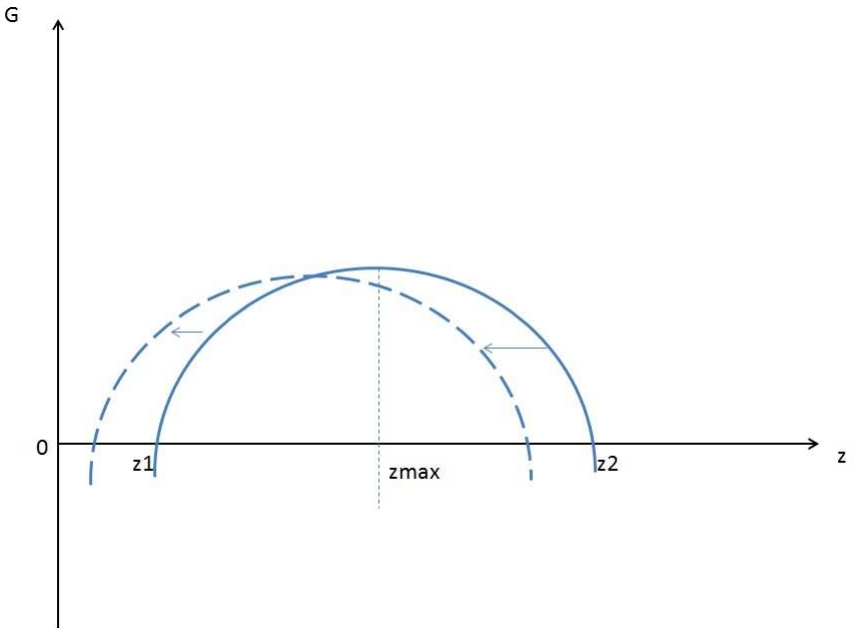
The contraction of quantity supplied post merger is inversely related to the cost reduction z,

$$x_1 + x_2 - X = \frac{m+n+1}{b(m+n+3)}(z_2 - z)$$

Mergers with z close to $z_1$are those with the highest output contraction and the lowest cost savings, those with z close to z_2 are the ones with the highest cost savings and that also tend to expand output. Therefore, we can characterize the former as market power mergers and the latter as cost-saving mergers.

The effect of trade liberalization can be found by investigating the effect of changes in

Figure 5: Unilateral Liberalization and Gains from Merger Function



tariffs on the gains function. The effect of a reduction in domestic tariffs, t, is given by

$$\begin{aligned}
\frac{dG}{dt} &= \frac{dG}{dM}\frac{dM}{dt} \\
&= 2Am\left[(m+n+2)^2(m+n+1)z - M((m+n+1)^2-2\right] \\
&\geqslant 0 \iff z \geqslant \frac{M\left[(m+n+1)^2-2\right]}{(m+n+2)^2(m+n+1)} = z^*
\end{aligned}$$

Since $z^* < z_{max}$ a reduction in domestic tariffs shifts G up for $z < z^*$ and down for $z > z^*$as shown in figure 5. Unilateral tariff reductions induce previously unprofitable domestic horizontal mergers with low cost savings (those with cost savings to the left of z_1) and will discourage horizontal mergers with large cost savings in the vicinity of z_2. Therefore, the M&A that occur following trade liberalization are mergers that primarily concentrate market power.

The more relevant case in the context of Free Trade Agreements is the bilateral tariff

reduction case. In this case, the effect of both countries reducing their tariffs is given by

$$\frac{dG}{dt} = \frac{\partial G}{\partial M}\frac{dM}{dt} + \frac{\partial G}{\partial M^*}\frac{dM^*}{dt}$$

evaluated at $M = M^*$(proximity of free trade).

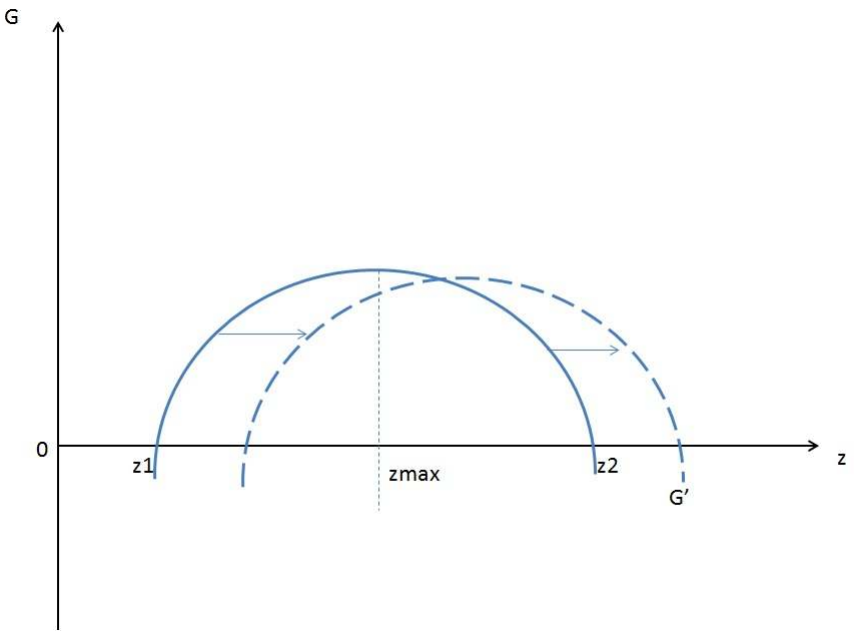
In this case,

$$\frac{dG}{dt} = 2Am\left[M(m+n+1)^2 - 2\right] - (m+n+1)(m+n+2)^2 z > 0 \iff z < z^*$$

This is exactly the opposite than the unilateral liberalization case: the fall in domestic and foreign tariffs shift the gains function to the right making previously unprofitable mergers with high cost savings profitable and mergers with lower cost savings unprofitable. Figure 6 shows the effect of bilateral liberalization on the merger gains function. Now, besides the negative effect on the size of the home market, the fall in foreign tariffs expands the total market. In this expanded market, the loses from the market concentration effect due to expansion of rivals will be larger while the gains from cost-reductions are increased. Bilateral trade liberalization therefore induces high cost savings mergers and disincentivize market concentration mergers (which was the only effect in Salant et al. [1983]).

The merger gains function shows that the main determinant of M&A in this model is the difference in costs between potential merging partners. Since monopolization is thwarted by the cournot response of non-merging firms, there must be a minimum cost disadvantage z_1 to make a merger profitable. If the cost disadvantage is too large, above z_2, the high cost firm will not be an active firm in the market so mergers with cost disadvantages above z_2 will not be feasible either. A low cost firm can choose to merge with one of the homogeneous n firms if their cost difference is such that z approaches z_{max} and maximizes the gains from the merger. The model therefore implies sorting of acquirers and targets with acquirers being lower cost and targets being high cost but with acquirers not buying the highest cost

Figure 6: Bilateral Liberalization and Gains from Merger Function



firm. However, the purpose of this model is not to have a specific prediction of the sorting pattern of M&A but rather to look at how changes in tariffs shift the merger gains function G making previously unprofitable mergers profitable.

Introducing fixed costs of production and fixed costs-savings as a motivation for mergers Gaudet and Kanouni [2004] show in a 3 firm example with Cournot competition and linear demand that the effect of a tariff reduction depends on the level of the tariff that is being abolished. If the tariff is small in the sense that it is not prohibitive, then tariff reductions increase the profitability of domestic mergers. However, tariffs that are prohibitive may stop being so after a domestic merger as prices and profits in the domestic market increase. In the case of tariffs that are prohibitive both before and after the domestic merger, a tariff reduction reduces the profitability of the domestic merger.

3.1.3 Entry Deterrence and Synergies: Trade-induced strategic mergers

The models presented thus far consider cost differences and monopoly power as reasons to merge and how changes in barriers to foreign entry change the profitability of these mergers. In this section I develop a special case of the Cournot model presented above with only 2 domestic firms ($n = 0$) and 1 foreign firm ($m = 1$) to illustrate how merger synergies and heterogeneity between the domestic and foreign firms but not between domestic firms, $c_1 = c_2 = c$, can create an additional rationale for mergers if firms can deter entry by foreign firms through mergers. Trade induces mergers by increasing the opportunity cost for firms not to merge but it also reduces the gains of anti-competitive mergers defined as those that do not result in any efficiencies and the gains from mergers with synergies that do not result in the exclusion of foreign rivals.

Consider, as above, two countries, home and foreign with one foreign firm denoted Firm F and two domestic firms, Firm 1 and Firm 2 selling homogeneous goods and using Cournot conjectures about rivals. Demand in the domestic market is linear with $p = a - bQ$ and costs are linear given by $c(q) = cq$. The foreign firm entering the domestic market has a cost advantage and her costs are given by $c(q) = c_F q$ where $c_F = c - c_f$. When domestic firms merge they enjoy merger synergies that reduce their costs by s. In this way, we incorporate both factors of the Williamson trade-off familiar to IO economists into the analysis of mergers in an international context. This special case of the Long and Vousden [1995] model focuses on heterogeneity between domestic and foreign firms and strategic merger incentives of domestic firms. The three firms in this example play a three-stage game where in a first stage tariffs are reduced and domestic firms decide whether to merge or not to merge. In a second stage the foreign firm decides whether to enter and the domestic firms decide to exit or remain in the market and finally all firms present in the market compete in quantities. The example considers the effect of a tariff reduction where the tariff affects the decisions of firms by shifting the foreign firm reaction function in and the domestic firm

reaction functions out. The question is whether in this strategic setting mergers by domestic firms can affect the entry decision of foreign firms by changing the industry structure as a response to trade liberalization.

Given the demand and cost functions assumed the equations from Long and Vousden [1995] simplify substantially. Domestic firms maximize profits given by,

$$\pi_i = (a - bQ - c)q_i$$

and foreign firms maximize,

$$\pi_F = (a - bQ - c + c_f - t)q_F$$

The Cournot-Nash equilibrium is given by

$$\begin{aligned} q_i^* &= \frac{a-c}{2b} - \frac{a-c+c_F-t}{4b} \\ &= \frac{a-c-c_f+t}{4b} \end{aligned}$$

for the two domestic firms and for the foreign firm,

$$\begin{aligned} q_F^* &= \frac{3(a-c+c_f-t)}{4b} - \frac{2\,(a-c)}{4b} \\ &= \frac{a-c+3(c_f-t)}{4b} \end{aligned}$$

The profit functions are therefore

$$\pi_i = \frac{1}{b}\left(\frac{a-c-c_f+t}{4}\right)^2$$

and for the foreign firm,

$$\pi_F = \frac{1}{b}\left(\frac{a-c+3(c_f-t)}{4}\right)^2$$

The entry condition for the foreign firm under this market structure (domestic duopoly) gives us the threshold tariff that makes trade costs prohibitive,

$$\begin{aligned} \pi_F &> 0 \\ \frac{1}{b}\left(\frac{a-c+3(c_f-t)}{4}\right)^2 &> 0 \\ \left(\frac{a-c+3(c_f-t)}{4}\right) &> 0 \\ t &< t^* \equiv \frac{a-c+3c_f}{3} \end{aligned}$$

To introduce the idea of foreign entry I will consider tariff reductions below the threshold t^*.

Consider a merger between the two domestic firms resulting in marginal cost reductions due to synergies s. The new equilibrium is now a duopoly between one domestic firm and one foreign firm with equilibrium quantities given by

$$q_m^* = \frac{a-c+2s-c_f+t}{3b}$$

for the domestic monopoly and

$$q_F^* = \frac{a-c-s+2c_f-2t}{3b}$$

for the foreign entrant. This equilibrium results in equilibrium profits Π_m for the domestic firm and π_F for the foreign entrant.

Post-liberalization entry by the foreign firm is deterred if $\pi_F < 0$ which gives us a

threshold level of merger synergies, s^* that make entry of the foreign firm unprofitable,

$$\begin{aligned} \frac{1}{b}\left(\frac{a-c-s+2c_f-2t}{3}\right)^2 &< 0 \\ s &> s^* \equiv a-c+2c_f-2t \end{aligned}$$

Since the profits of the foreign firm are decreasing in merger synergies, any exogenous merger synergy above s^*will deter entry given a fall in tariffs t below the entry threshold t^*.

Since profits of the domestic merged firm are decreasing in the cost advantage of the foreign firm there's a threshold cost advantage that induces exit of the domestic firm even if the the two duopolists merge. The threshold is given by the condition $\pi_m < 0$,

$$\begin{aligned} \frac{1}{b}\left(\frac{a-c+2s-c_f+t}{3}\right)^2 &< 0 \\ c_f &> c_f^* \equiv a-c+2s+t \end{aligned}$$

This threshold shows that when the foreign firm has sufficient cost advantages entry will drive both domestic firms out of the market. However, mergers can change the post-liberalization industry structure so liberalization that could induce entry may also induce domestic mergers as a way to both avoid exit and deter entry. These two relationships imply that for merger synergies that are sufficiently high and for cost advantages of the foreign firm sufficiently high to drive both domestic firms out of the market, trade liberalization induces a merger to monopoly of a domestic duopoly. To show that these trade-induced mergers are privately profitable we need to show that the gains from the mergers are positive and how they change with changes in the tariffs.

The first step is to consider the autarky case. The Cournot-Nash equilibrium of a domestic duopoly in autarky is given by

$$q_i^* = \frac{a-c}{3b}$$

with profits given by,

$$\pi_i = \frac{1}{b}\left(\frac{a-c}{3}\right)^2$$

A merger to monopoly with synergies s results in monopoly quantity given by

$$Q^* = \frac{a-c+s}{2b}$$

and profits given by

$$\Pi^* = \frac{1}{b}\left(\frac{a-c+s}{2}\right)^2$$

The gains from a merger in autarky, G^a, are given by the difference in joint profits before and after the merger,

$$\begin{aligned} G^a &= \Pi^* - (\pi_1 + \pi_2) \\ &= \frac{1}{b}\left(\frac{a-c+s}{2}\right)^2 - \frac{2}{b}\left(\frac{a-c}{3}\right)^2 \\ &= \frac{1}{b}\left(\left(\frac{a-c+s}{2}\right)^2 - 2\left(\frac{a-c}{3}\right)^2\right) \end{aligned}$$

Consistent with Salant et al. [1983], mergers to monopoly are profitable even with no cost savings since there are no non-merging firms to offset the reduction in output of the merging firms. Synergies make the merger even more profitable. Above we found the equilibrium in the post-liberalization world, where tariffs fall below t^*. The gains from a merger in a free

trade environment (or with a non-prohibitive tariff $t < t^*$), G^{ft}, are given by

$$\begin{aligned} G^{ft} &= \Pi_m - (\pi_1 + \pi_2) \\ &= \left(\frac{a-c-s-c_f+t}{3}\right)\left(\frac{a-c+2s-c_f+t}{3b}\right) - (\frac{2}{b}\left(\frac{a-c-c_f+t}{4}\right)^2) \\ &= \frac{(a-c-s-c_f+t)}{b}\left[\left(\frac{8a-8c+16s-8c_f+8t}{8*9}\right) - (\frac{9a-9c-9c_f+9t}{8*9})\right] \\ &= \frac{(a-c-s-c_f+t)}{b}\left(\frac{-a+c+16s+c_f-t}{72}\right) \end{aligned}$$

Mergers can be motivated by variable cost savings captured by the synergies s, or by the increase in profits driven by increased concentration (we can add fixed costs f and savings in fixed costs as an additional merger motive, however since this saving is not affected by the trade regime it will not play a significant role in this analysis). We can denote mergers with no cost savings as anti-competitive and those with cost savings as efficiency enhancing. To study the effect of trade liberalization on each type of merger we can define the change in the gains function as

$$\begin{aligned} \Delta G &= G^{ft} - G^a \\ &= \frac{(a-c-s-c_f+t)}{b}\left(\frac{-a+c+16s+c_f-t}{72}\right) - \frac{1}{b}\left(\left(\frac{a-c+s}{2}\right)^2 - 2\left(\frac{a-c}{3}\right)^2\right) \\ &= -\frac{(a-c-s-c_f+t)}{b}\left(\frac{a-c-16s-c_f+t}{72}\right) - \frac{1}{b}\left(\left(\frac{a-c+s}{2}\right)^2 - 2\left(\frac{a-c}{3}\right)^2\right) \end{aligned}$$

and determine whether trade liberalization increases or decreases the gains from a merger of different characteristics.

For a purely anti-competitive merger with $s = 0$ this reduces to

$$\Delta G = -\frac{(a-c-c_f+t)}{b}\left(\frac{a-c-c_f+t}{72}\right) - \frac{1}{b}\left(\left(\frac{a-c}{2}\right)^2 - 2\left(\frac{a-c}{3}\right)^2\right) < 0$$

This results shows that for a reduction in tariffs sufficient to induce entry by a foreign

firm trade liberalization reduces the gains from a purely anti-competitive merger.

With positive synergies $s > 0$ we see that $\Delta G < 0$ for any level of s, so we conclude that trade liberalization also reduces the incentives for cost-reducing mergers. The reason why liberalization reduces both types of merger incentives is that with foreign entry domestic firms are less capable of reducing output and raising prices and cost savings are applicable to lower number of units.

Finally, we need to show using the same apparatus, how mergers to deter entry are also privately profitable. To do so, we need to compare the merger gains under trade liberalization and deterrence, G_d^{ft} (which is the difference in profits between the domestic monopoly outcome and the three firm outcome), with the merger gains before trade liberalization, G^a,

$$\begin{aligned}
\Delta G &= G_d^{ft} - G^a \\
&= \frac{1}{b}\left(\frac{a-c+s}{2}\right)^2 - (\frac{2}{b}\left(\frac{a-c-c_f+t}{4}\right)^2) - (\frac{1}{b}\left(\left(\frac{a-c+s}{2}\right)^2 - 2\left(\frac{a-c}{3}\right)^2\right)) \\
&= \frac{1}{b}\left[2\left(\frac{a-c}{3}\right)^2 - \left(\frac{a-c-c_f+t}{2}\right)\right]
\end{aligned}$$

In the special case where there are no cost advantages of the foreign firm and with completely liberalized trade, $c_f = t = 0$ the difference is strictly positive provided $a - c > \frac{9}{4}$. With foreign firm cost advantages and positive tariffs (although below the threshold for foreign entry), entry deterrence is profitable by merging if

$$(a-c)(a-c-\frac{9}{4}) > -\frac{9}{4}(c_f - t)$$

The left hand side is positive if $a-c > \frac{9}{4}$ and the right hand side is negative provided $c_f > t$. Trade makes deterring mergers more profitable when the cost advantage of the foreign firm is large enough compared with trade barriers. Since cost advantages above c_f^* would induce both domestic firms to exit the industry even if they merged to monopoly we must have $t <$

$c_f < c_f^*$ and $s > s^*$ for a domestic duopoly to choose to merge following trade liberalization and effectively deter entry by the foreign competitor. The same incentives outlined in this section are present for oligopolies with more firms with the thresholds depending on the number of firms.

3.1.4 Summary Oligopoly Models

Table (1) summarizes the predictions of the oligopoly models surveyed and the effect on trade:

Table 1: Summary Oligopoly Models

Model	Effect of Bilateral Tariff Reduction on M&A	Rationale	Drawbacks
Cournot-homogeneous product-homogeneous firms [Salant et al., 1983]	Reduces mergers.	Trade increases the number of firms and makes the minimum number of firms in a profitable coalition larger. Mergers find it harder to monopolize markets.	Exogenous mergers and industry structure. No adjustment of industry in response to competitive effects of trade.
Cournot-homogeneous good-heterogeneous firms [Long and Vousden, 1995]	Increases cost-saving mergers, reduces market power mergers	More competition in domestic market reduces incentive to merge to reduce output and increase prices, but access to foreign market increases gains from cost-savings mergers.	Model doesn't consider the competitive impact of liberalization since it considers only marginal tariff changes and no new entry by foreign firms.
Cournot-homogeneous product-fixed costs-non-marginal tariff changes [Gaudet and Kanouni, 2004]	Effect depends on the size of the initial tariff and the effect on the threshold fixed cost that renders the merger profitable. Only reductions of non-prohibitive tariffs will increase mergers.	Mergers save fixed costs of production. The threshold fixed cost is a function of tariffs.	Model relies on merger to monopoly assumption and applies only to concentrated markets.
Cournot-homogeneous product-heterogeneity between domestic and foreign firms-strategic mergers (new results).	Decreases market power and cost saving mergers. Increases industry-structure changing mergers. Not driven by domestic firm selection into exporting.	Firms merge to deter entry by foreign firm and to prevent exit by domestic firms. Trade induces horizontal mergers. Effect independent of actual increases in trade flows.	Results hold for case of duopoly. Concentrated markets. Mechanisms hold for n-firm industries but effect may not be as strong to explain mergers.

All of the oligopoly models presented above assume that entry is costless and there are no fixed costs of entering markets. Fixed and variable costs models with firm heterogeneity naturally lead to selection and sorting along the expected lines: more productive (lower cost) firms self select into the activity with the high fixed cost. To determine whether there is sorting of firms into domestic and foreign markets I use the results in Mrazova and Neary [2011] who establish necessary and sufficient conditions for there to be sorting and selection with heterogeneous firms. They prove that fixed costs are necessary for selection effects. However, supermodularity of the profit function in production and trade costs is necessary and sufficient for selection. In the context of the Cournot models presented supermodularity requires $\frac{\partial^2 \pi}{\partial c \partial t} \geqslant 0$ which is satisfied. This means that the lower cost firms also benefit more from reductions in tariffs. Intuitively, firms with higher and constant marginal costs optimally choose lower output, so a fall in tariffs will benefit them less than a firm with lower costs and higher output. The first order effect when the profit function is decreasing in marginal costs, $\pi_c < 0$ implies that for any pair of firms with $c_1 > c_2$ there is a threshold marginal cost such that $\pi(c_1, t) < 0 < \pi(c_2, t)$ and firm 2 exports while firm 1 doesn't.

The potential reasons why liberalization reduces incentives to merge include the restricted possibility to increase prices post-merger (the monopolization effect) and the lower volumes over which cost-savings can be spread. On the other hand in the presence of firm heterogeneity and many firms bilateral trade liberalization can increase the profitability of cost-reducing mergers but reduce the profitability of market power mergers. The possibility of deterring entry by a low cost foreign firm that would put domestic firms out of business is also an incentive for an increased number of mergers with synergies that reduce costs.

3.2 A Model of Trade Policy and Aggregate Domestic M&A

Many of the insights from oligopoly models are specific to concentrated industries where merging firms have the ability to reduce industry output and increase prices or to deter

entry by foreign competitors. We also saw that the results are sensitive to the form of competition with many of these results relying on downward sloping reaction functions in quantity space. This was one of the criticisms of the literature linking trade and industrial organization in the 1980s. In this section I will build on the insights of two complementary models, the Melitz [2003] model of trade with heterogeneous firms and the view of mergers as reallocation proposed by Jovanovic and Rousseau [2002b] to provide a rationale for merger activity in response to trade that can be applicable to competitive industries (industries with many firms) where monopolization is not an incentive to merge and the scope for any one merger to deter foreign entry is limited. The mechanism driving mergers in this context is the change in value of firms with heterogeneous productivity following trade liberalization and self-selection of firms into the exporting sector driven by differences in fixed costs of entering domestic and foreign markets and heterogeneity in variable costs of production (this industry structure satisfies all the conditions in Mrazova and Neary [2011] for supermodularity, single crossing and sorting) . Mergers arise as a mechanism for low productivity firms to exit and for high productivity firms to expand as they enter foreign markets. It is in a way analogous to the cost-saving rationale in Long and Vousden [1995] since it is assumed that the productivity parameter of the acquiring firm will be transferred to the assets of the target firm but the incentives to merge come from the factor markets: a fixed supply of capital to be allocated between firms and within firms for the export or the domestic market, increasing returns at the firm level driven by sunk entry costs and the resulting sorting of firms into winners and losers of the liberalization process generate gains from reallocation that contribute to merger activity.

The selection model determines a range of productivity for firms that want to expand or contract along an extensive margin (exit the market/enter the foreign market). Coupled with a Q-theory of mergers that rationalizes the matching of acquirers and targets from these sets, the model provides comparative statics that can be tested with a large database

of trade policy experiments and M&A. Finally, I show how the results are not specific to the demand functions chosen and how a similar framework with variable markups will have the same type of implications.

I modify the framework in Melitz [2003] and Breinlich [2008] where firms discover their productivity before incurring any cost of entering and capital is the only factor of production in fixed supply. This makes reallocation via M&A a transition phenomenon between steady states. The model delivers clear comparative statics for reallocation and suggests bounds on the acquirer and target sets for the M&A model. I first present the general model with a continuum of goods and then I present an example focusing on 3 firms in such an industry.

3.2.1 Consumers

Consumers solve the following problem where Ω is the mass of available varieties, $\sigma > 1$ is the elasticity of substitution between any two varieties and E is aggregate expenditure:

$$\begin{aligned} max_{q(\omega)}\, u(q) &= \left[\int_{\omega \varepsilon \Omega} q(\omega)^{\frac{\sigma-1}{\sigma}} d\omega\right]^{\frac{\sigma}{\sigma-1}} \\ s.t \quad \int_{\omega} & \quad p(\omega)q(\omega)d\omega = E \end{aligned} \tag{1}$$

The solution to this problem leads to iso-elastic demand function

$$q(\omega) = \left(\frac{p(\omega)}{P}\right)^{-\sigma} \frac{E}{P} \tag{2}$$

where,

$$P = \left(\int_{\Omega} p(\omega)^{1-\sigma} d\omega\right)^{\frac{1}{1-\sigma}} \tag{3}$$

is the CES price index.

3.2.2 Production and Pricing

Production takes place under increasing returns to scale as in Krugman [1980] but with the marginal productivity of capital differing across firms. The capital needed to produce q units of output by a firm with productivity ψ is given by

$$k(q, \psi) = f + \frac{q}{\psi} \tag{4}$$

The fixed overhead f has to be paid each period. Denote the price of capital R. The firm's problem is

$$max_{p(\psi)} p(\psi)q(\psi) - R\left(\frac{q(\psi)}{\psi}\right) - f \tag{5}$$

Where we will analyze the problem for each firm of different productivity ψ rather than for each variety. With iso-elastic demand, each monopolist firm charges a constant mark-up over marginal cost

$$p(\psi) = \frac{\sigma}{\sigma - 1}\frac{R}{\psi} \tag{6}$$

Each firm therefore produces,

$$\begin{aligned} q(\psi) &= \left(\frac{\sigma}{\sigma - 1}\frac{R}{\psi}\right)^{-\sigma} \frac{E}{P^{1-\sigma}} \\ &= \left(\frac{\sigma - 1}{\sigma}\frac{\psi}{R}\right)^{\sigma} \frac{E}{P^{1-\sigma}} \end{aligned} \tag{7}$$

and has revenues

$$r(\psi) = p(\psi)q(\psi) = \left(\frac{\sigma}{\sigma - 1}\frac{R}{\psi}\right)^{1-\sigma} \frac{E}{P^{1-\sigma}} \tag{8}$$

Net profits are,

$$\begin{aligned}\pi(\psi) &= \left(\frac{\sigma}{\sigma-1}\frac{R}{\psi}\right)^{1-\sigma}\frac{E}{P^{1-\sigma}} - R\left(\left(\frac{\sigma}{\sigma-1}\frac{R}{\psi}\right)^{-\sigma}\frac{E}{\psi P^{1-\sigma}}\right) - f \\ &= \left(\frac{\sigma}{\sigma-1}\frac{R}{\psi}\right)^{-\sigma}\frac{E}{P^{1-\sigma}}\frac{R}{\psi}\left(\frac{1}{\sigma-1}\right) - f \\ &= \left(\frac{\sigma-1}{\sigma}\frac{\psi}{R}\right)^{\sigma}\frac{E}{P^{1-\sigma}}\frac{R}{\psi}\left(\frac{1}{\sigma-1}\right) - f\end{aligned} \tag{9}$$

Also note that

$$\begin{aligned}\pi(\psi) &= r(\psi) - R\left(\frac{q(\psi)}{\psi}\right) - f \\ &= r(\psi) - f - R\frac{q(\psi)}{\psi} \\ &= \frac{r(\psi)}{\sigma} - f\end{aligned} \tag{10}$$

Demand of capital for domestic production is given by

$$\begin{aligned}k_d(\psi) &= f + \left(\frac{\sigma}{\sigma-1}\frac{R}{\psi}\right)^{-\sigma}\frac{E}{\psi P^{1-\sigma}} \\ &= f + \left(\frac{\sigma-1}{\sigma}\frac{\psi}{R}\right)^{\sigma}\frac{E}{\psi P^{1-\sigma}}\end{aligned} \tag{11}$$

We can establish some initial comparative statics that can be tested empirically,

$$
\begin{aligned}
\frac{\partial p(\psi)}{\partial \psi} &= \frac{\sigma}{1-\sigma}\frac{R}{\psi^2} < 0 \qquad (12)\\
\frac{\partial p(\psi)}{\partial \sigma} &= -\frac{R}{\psi}\frac{1}{(\sigma-1)^2} < 0\\
\frac{\partial p(\psi)}{\partial R} &= \frac{\sigma}{\psi(\sigma-1)} > 0\\
\frac{\partial q(\psi)}{\partial \psi} &= \frac{\sigma-1}{R}\left(\frac{\sigma-1}{\sigma}\frac{\psi}{R}\right)^{\sigma-1}\frac{E}{P^{1-\sigma}} > 0\\
\frac{\partial r(\psi)}{\partial \psi} &= -\frac{(\sigma-1)^2}{\sigma R}\left(\frac{\sigma-1}{\sigma}\frac{\psi}{R}\right)^{\sigma}\frac{E}{P^{1-\sigma}} < 0\\
\frac{\partial \pi(\psi)}{\partial \psi} &= \frac{E}{P^{1-\sigma}}\left(\frac{1}{\sigma-1}\right)\left[\frac{\sigma-1}{R}\left(\frac{\sigma-1}{\sigma}\frac{\psi}{R}\right)^{\sigma-1}\frac{R}{\psi} - \left(\frac{\sigma-1}{\sigma}\frac{\psi}{R}\right)\frac{R}{\psi^2}\right]\\
&= \frac{E}{P^{1-\sigma}}\left(\frac{1}{\sigma-1}\right)\frac{(\sigma-1)}{\psi}\left(\left(\frac{\sigma-1}{\sigma}\frac{\psi}{R}\right)^{\sigma-1} - \frac{1}{\sigma}\right) > 0\\
\frac{\partial k_d(\psi)}{\partial \psi} &= \frac{\sigma-1}{R}\left(\frac{\sigma-1}{\sigma}\frac{\psi}{R}\right)^{\sigma-1}\frac{E}{\psi P^{1-\sigma}} - \left(\frac{\sigma-1}{\sigma}\frac{\psi}{R}\right)^{\sigma}\frac{E}{\psi^2 P^{1-\sigma}}\\
&= \left(\frac{\sigma-1}{\sigma}\frac{\psi}{R}\right)^{\sigma}\frac{E}{\psi^2 P^{1-\sigma}}(\sigma-1) > 0\\
\frac{\partial k_d(\psi)}{\partial R} &= -\left(\frac{\sigma-1}{\sigma}\frac{\psi}{R^2}\right)\frac{E}{\psi P^{1-\sigma}} < 0\\
\frac{\partial k_d(\psi)}{\partial \sigma} &= \frac{E}{\psi}\left(\frac{(\sigma-1)\psi}{\sigma R}\right)^{\sigma}\left(\left(ln\frac{\sigma-1}{\sigma}\frac{\psi}{R}\right) + \frac{1}{\sigma-1}\right) > 0
\end{aligned}
$$

Therefore, more productive firms will charge lower prices, produce more, have higher profits but lower revenues and have more capital. More productive firms will be larger. The price of capital R, is the marginal cost of production in this model so increases in i lead to higher prices and also to lower demand for capital. Finally, the higher the elasticity of substitution between varieties σ, the lower the price but the larger the demand for capital.

In the empirical application I will have several sectors which can differ in how substitutable varieties are within them, the cost of capital in each and productivity. The comparative statics described above can also be useful in the cross-section of sectors.

3.2.3 Firm Entry and Exit

I will look at two cases, a simple case where the entrepreneur discovers his productivity before entering and acquiring the minimal capital f required for production and the case where entrepreneurs discover their productivity only after incurring a fixed entry cost f_e and drawing a productivity parameter ψ from a distribution G over $\mathbb{R}^{+1}$. In the first case, only firms making at least enough to cover the set-up costs will enter. This is given by the following condition which gives the entry productivity threshold ψ^{*E}

$$\begin{aligned} \left(\frac{\sigma-1}{\sigma}\frac{\psi}{R}\right)^{\sigma}\frac{E}{P^{1-\sigma}}\frac{R}{\psi}\left(\frac{1}{\sigma-1}\right)-f &= f_e \\ \psi^{*E} &= \frac{(\sigma R)^{\frac{\sigma}{\sigma-1}}}{(\sigma-1)P}\left(\frac{f_e+f}{ER}\right)^{\frac{1}{\sigma-1}} \end{aligned} \tag{13}$$

Alternatively, we can think of the fixed entry cost being paid each period and contained in the fixed production cost f. In the steady state, this won't make any difference. The entry condition will now be

$$\pi(\psi)=0 \iff \left(\frac{\sigma-1}{\sigma}\frac{\psi}{R}\right)^{\sigma}\frac{E}{\psi P^{1-\sigma}}\left(\frac{1}{\sigma-1}\right)=f \tag{14}$$

Solving for ψ gives us a productivity cut-off, ψ^*, for firms that actually enter the market,

$$\begin{aligned} \psi^* &= \left(\frac{P^{1-\sigma}}{R}(\sigma-1)\left(\frac{R\sigma}{\sigma-1}\right)^{\sigma}f\right)^{\frac{1}{\sigma-1}} \\ &= \left(\frac{R^{\sigma}\sigma^{\sigma}f}{EP(\sigma-1)^{\sigma-1}}\right)^{\frac{1}{\sigma-1}} \end{aligned} \tag{15}$$

The comparative statics are quite intuitive and similar for both formulations,

[1]The Shleifer and Vishny [1992] model of M&A and the equilibrium determination of asset values can be incorporated into this model at this stage.

$$\frac{\partial \psi^*}{\partial R} > 0 \tag{16}$$

$$\frac{\partial \psi^*}{\partial f} > 0 \tag{17}$$

Additionally, the entry cut-off productivity depends on the endogenous price index P. A decrease of the price level following trade liberalization does not affect mark-ups or pricing, but does increase ψ^*.

Entry in this formulation is also fully determined by the observation of the productivity draw previous to incurring any fixed costs.

3.2.4 Trade and Exporting Status

As in Krugman [1980, 1981] exporting requires covering a variable iceberg-type cost; for every unit shipped only $\frac{1}{\tau}$ units arrive. Additionally, firms that export incur a fixed export cost in addition to the cost of entering the domestic market. I will assume for now that this is a per period cost rather than having a one time entry cost as well as a per period fixed export cost f_x. This additional cost can be thought of as the cost of adapting products for the foreign market, establishing distribution channels, complying with foreign regulations, etc. There has been empirical evidence documenting these costs [Das et al., 2007].

The export profit maximizing prices and quantities will be

$$p_x(\psi) = \frac{\sigma}{\sigma - 1} \frac{\tau R}{\psi} \tag{18}$$

$$q_x(\psi) = \left(\frac{\sigma}{\sigma - 1} \frac{\tau R}{\psi} \right)^{-\sigma} P^{\sigma - 1} \tag{19}$$

Accordingly, the capital demand for export production is given by

$$k_x(\psi) = \left(\frac{\sigma}{\sigma-1}R\tau\right)^{-\sigma}\psi^{\sigma-1}P^{\sigma-1} + f_x \tag{20}$$

The demand for capital used in the export sector is decreasing in the tariff. This is only the direct effect without the general equilibrium effects:

$$\frac{\partial k_x(\psi)}{\partial \tau} = -\frac{\sigma^2}{\sigma-1}R\left(\frac{\sigma}{\sigma-1}R\tau\right)^{-\sigma-1}\psi^{\sigma-1}P^{\sigma-1} < 0$$

Also, the direct effect is smaller for the more productive firms. Most of the adjustment happens on the extensive margin with firms entering the export market:

$$\frac{\partial^2 k_x(\psi)}{\partial \tau \partial \psi} = -\sigma^2 R\left(\frac{\sigma}{\sigma-1}R\tau\right)^{-\sigma-1}\psi^{\sigma-2}P^{\sigma-1} < 0$$

The entry condition into the export market will also be determined by a productivity threshold given by

$$\pi_x(\psi) = 0 \tag{21}$$

As before, assuming f_x is the per-period fixed cost of entering a market, and that the productivity is known before entering, this threshold is given by

$$\psi_x^* = \left(\frac{\tau^{\sigma-1}R^\sigma f_x \sigma^\sigma}{P^{\sigma-1}(\sigma-1)^{\sigma-1}}\right)^{\frac{1}{\sigma-1}} \tag{22}$$

The direct effect of a fall in tariffs is to reduce the export threshold and induce entry into the export market of marginal firms.

The ratio of these two thresholds gives a relationship between the productivity of exporting and non-exporting firms

$$\psi_x^* = \left(\frac{f_x}{f}\right)^{\frac{1}{\sigma-1}}\tau\psi^* \tag{23}$$

If firms that export must pay the domestic setup costs as well, then $\psi_x^* \geqslant \psi^*$. Assuming that productivity follows a Pareto distribution allows for closed form solutions to the entry thresholds and the aggregate demand for capital. Assuming a density given by $v(\psi) = a\kappa^a\psi^{-(a-1)}$ with $\kappa > 0, a > \sigma - 1 > 0, \psi \geqslant \kappa$, the two thresholds for entry into the domestic and foreign market are given by

$$\psi^* = \left[\frac{\sigma a \kappa^a}{a-\sigma+1} Rf\right]^{\frac{1}{a}} \left[1 + \tau^{-1}\left(\frac{f_x}{f}\right)^{\frac{\sigma-1-a}{\sigma-1}}\right]^{\frac{1}{a}} \tag{24}$$

and

$$\psi_x^* = \left[\frac{\sigma a \kappa^a}{a-\sigma+1} Rf\right]^{\frac{1}{a}} \left[\left(\frac{f_x}{f}\right)^{\frac{a}{\sigma-1}} \tau^a + \left(\frac{f_x}{f}\right)\right]^{\frac{1}{a}} \tag{25}$$

We can show that

$$\frac{\partial \psi^*}{\partial \tau} = -\frac{1}{\tau^2}\left[\frac{\sigma a \kappa^a}{a-\sigma+1} Rf\right]^{\frac{1}{a}} \frac{1}{a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-1-a}{\sigma-1}} \left[1 + \tau^{-1}\left(\frac{f_x}{f}\right)^{\frac{\sigma-1-a}{\sigma-1}}\right]^{\frac{1-a}{a}} < 0$$

and

$$\frac{\partial \psi_x^*}{\partial \tau} = \left[\frac{\sigma a \kappa^a}{a-\sigma+1} Rf\right]^{\frac{1}{a}} \tau^{a-1}\left(\frac{f_x}{f}\right)^{\frac{a}{\sigma-1}} \left[\left(\frac{f_x}{f}\right)^{\frac{a}{\sigma-1}} \tau^a + \left(\frac{f_x}{f}\right)\right]^{\frac{1-a}{a}} > 0$$

3.2.5 Total demand for capital and trade equilibrium

All active firms, those with $\psi \geqslant \psi^*$, will demand capital for domestic production given by $k_d(\psi)$. All firms with productivity $\psi \geqslant \psi_x^*$will demand additional capital $k_x(\psi)$. I will assume that the capital stock is fixed at K and solve for the capital used in domestic production K_d, the capital used for exporting K_x and the price of capital i, by assuming a specific cumulative distribution of productivity given by the Pareto distribution $V(\psi) = 1 - \left(\frac{\kappa}{\psi}\right)^a$ as in Melitz and Ottaviano [2008] . Given this probability distribution, we can write the

demand for capital for domestic and exporting as a function of the entry threshold ψ^*

$$\begin{aligned} k_d(\psi) &= f + \left(\frac{\sigma-1}{\sigma}\frac{\psi}{R}\right)^{\sigma} \frac{E}{\psi P^{1-\sigma}} = \left(\frac{\sigma}{\sigma-1}R\right)^{-\sigma} \psi^{\sigma-1} P^{\sigma-1} + f \\ &= \left[(\sigma-1)\left(\frac{\psi}{\psi^*}\right)^{\sigma-1} + 1\right] f \end{aligned} \tag{26}$$

where I set total expenditure $E = 1$ without loss of generality. The demand for capital for exporting purposes will be given by,

$$k_x(\psi) = \left(\frac{\sigma}{\sigma-1}R\tau\right)^{-\sigma} \psi^{\sigma-1} P^{\sigma-1} + f_x = \tau^{1-\sigma}(\sigma-1) f \left(\frac{\psi}{\psi^*}\right)^{\sigma-1} + f_x \tag{27}$$

Total demand for capital can be found by integrating over the productivity distribution above the relevant entry threshold,

$$K_d = \int_{\psi=\psi^*}^{\infty} k_d(\psi) d\psi = \frac{1}{R}\left(\frac{a\sigma-\sigma+1}{\sigma a}\right)\left[1 + \tau^{-a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}}\right]^{-1} \tag{28}$$

and

$$K_x = \int_{\psi=\psi_x^*}^{\infty} k_x(\psi) d\psi = \frac{1}{R}\left(\frac{a\sigma-\sigma+1}{\sigma a}\right)\left[1 + \tau^{a}\left(\frac{f_x}{f}\right)^{-\frac{\sigma-a-1}{\sigma-1}}\right]^{-1} \tag{29}$$

Market clearing in the capital market, which will be used to characterize the market for M&A is given by

$$K_x + K_d = K \tag{30}$$

The model can be thought of as a short-run model or a model with very high adjustment costs and long investment lags. The capital clearing condition can be used to solve for the price of capital

$$R = \frac{1}{K}\left(\frac{a\sigma-\sigma+1}{\sigma a}\right) \tag{31}$$

Plugging back into the demand for capital equations, we get

$$K_d = K\left[1+\tau^{-a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}}\right]^{-1} \tag{32}$$

$$K_x = K\left[1+\tau^{a}\left(\frac{f_x}{f}\right)^{-\frac{\sigma-a-1}{\sigma-1}}\right]^{-1} \tag{33}$$

The key parameters driving selection are the fixed costs of entering domestic and foreign markets. The variable cost required to export will determine volumes of trade and changes in the intensive margin rather than the extensive margin. Not that as $\tau \to \infty$, $K_d \to K$ and $K_x \to 0$. This is the case of a closed economy in autarky with no trade. All capital is used for domestic production.

3.2.6 Trade Liberalization and Capital Reallocation

Trade liberalization is understood as a fall in the variable export cost τ. As the variable export cost goes down, we can see from firm profit maximization (19) that the optimal price of exports goes down and the optimal quantity produced for export goes up. From (20) we see that the demand for capital for export purposes increases. Finally, from (24) and (25) we see that the entry threshold for the domestic market increases and the entry threshold for the export market falls. This means that firms that had been producing prior to liberalization will exit as the price they receive for their products falls due to foreign entry and the price of capital increases due to increased demand by expanding exporters as the export threshold falls. On the extensive margin more firms enter the export market and on the intensive margin exporting firms will export more. Both effects increase the demand for capital used in the production of exports as well as the size of exporting firms. From (32) we see that the total demand for capital in the exporting sector increases and the total demand for domestic production falls.

In this model, capital is fixed so the price of capital R remains fixed as well, and any

increase in the export capital has to be offset by an equivalent decrease in the domestic production capital. The amount of reallocation following trade liberalization can be found by differentiating $K_d$with respect to τ

$$\begin{aligned}\frac{\partial K_d}{\partial \tau} &= a\tau^{-a-1}K\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}}\left[1+\tau^{-a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}}\right]^{-2} \\ &= \frac{aK\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}}}{\tau^{a+1}\left[1+\tau^{-a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}}\right]^2} > 0\end{aligned} \tag{34}$$

The total capital transferred because of trade liberalization is therefore given by the absolute value of the transfer (the size of the transfer is the same if we had found the effect of a change in τ on K_x):

$$dK_d = \frac{aK\tau^{-a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}}}{\tau\left[1+\tau^{-a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}}\right]^2}d\tau \tag{35}$$

The transition between stationary states is not modeled and can involve different mechanisms, including M&A, greenfield investment, partial M&A, depreciation. The determinants of M&A activity will therefore include all of the determinants of capital reallocation and M&A specific factors which are unrelated to trade policy.

$$M\&A = \frac{aK\tau^{-a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}}}{\tau\left[1+\tau^{-a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}}\right]^2}d\tau + non-trade\,factors$$

We can simplify the above by defining a measure of the total trade cost. This measure includes the variable and fixed cost of selling on the foreign market.

$$\lambda = \tau^{-a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}} \tag{36}$$

We can re-write the volume of expected M&A as,

$$M\&A = \frac{aK\lambda}{\tau\left[1+\lambda\right]^2}d\tau \tag{37}$$

Besides the effect of the variable trade costs τ the previous result suggests several other comparative statics with respect to the trade-related factors:

$$\begin{aligned}
\frac{\partial M\&A}{\partial K} &> 0 \qquad (38)\\
\frac{\partial M\&A}{\partial f_x} &= \frac{aK\tau^{-a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}}}{\tau\left[1+\tau^{-a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}}\right]^2}|d\tau|\\
&= \frac{\left(\frac{\sigma-a-1}{\sigma-1}\right)\tau^{-a}f_x^{\frac{-a}{\sigma-1}}f^{-2\left(\frac{\sigma-a-1}{\sigma-1}\right)}aK\left[1+\tau^{-a}\left(f_x\right)^{\frac{\sigma-a-1}{\sigma-1}}\left(f^{-\frac{\sigma-a-1}{\sigma-1}}-2\right)\right]}{\left[1+\tau^{-a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}}\right]^3} > 0\\
\frac{\partial M\&A}{\partial f} &= \frac{-\left(\frac{\sigma-a-1}{\sigma-1}\right)aK\tau^{-a}f_x^{\frac{\sigma-a-1}{\sigma-1}}f^{-\frac{\sigma-a-1}{\sigma-1}-\frac{\sigma-1}{\sigma-1}}\tau\left[1+\tau^{-a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}}\right]^2}{\tau\left[1+\tau^{-a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}}\right]^4}\\
&+ \frac{\left(\frac{\sigma-a-1}{\sigma-1}\right)\tau 2\left[1+\tau^{-a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}}\right]\tau^{-a}f_x^{\frac{\sigma-a-1}{\sigma-1}}f^{-\frac{\sigma-a-1}{\sigma-1}-1}}{\tau\left[1+\tau^{-a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}}\right]^4}\\
&= \frac{\left(\frac{\sigma-a-1}{\sigma-1}\right)\tau^{-a}f_x^{\frac{\sigma-a-1}{\sigma-1}}f^{-\frac{2\sigma-a-2}{\sigma-1}}\left[2-aK\left(1+\tau^{-a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}}\right)\right]}{\left[1+\tau^{-a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}}\right]^3} > 0\\
&\quad if\ \frac{2}{aK} > \left(1+\tau^{-a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}}\right) \qquad (39)
\end{aligned}$$

$$\frac{\partial M\&A}{\partial a} = \frac{K\lambda}{\tau(1+\lambda)^2}|d\tau| > 0$$

$$\frac{\partial M\&A}{\partial \tau} = \frac{aK\lambda}{\tau(1+\lambda)^2} > 0$$

$$\begin{aligned}\frac{\partial M\&A}{\partial \lambda} &= \frac{aK\tau\left[1+\lambda\right]^2 - 2\tau\left[1+\lambda\right]aK\lambda}{\tau^2\left[1+\lambda\right]^4}|d\tau| \\ &= \frac{aK\left(1-\lambda\right)}{\tau\left[1+\lambda\right]^3}|d\tau| > 0\, if\, \tau^{-a}\left(\frac{f_x}{f}\right)^{\frac{\sigma-a-1}{\sigma-1}} < 1\end{aligned}$$

$$\frac{\partial M\&A}{\partial (d\tau)} = \frac{aK\lambda}{\tau\left[1+\lambda\right]^2} > 0$$

Equations (38) describe the comparative statics of the model and the empirically testable implications. Most comparative statics are quite intuitive: the larger the sector in terms of the total capital used, the more M&A after trade liberalization. This is because trade protection allows many lower productivity firms to survive in the domestic market and prevents more productive firms from expanding into foreign markets. The larger the size of the sector, the more potential for reallocation. The higher the fixed costs of entering the foreign market, the larger the change in M&A. This is because higher fixed costs induce stronger selection patterns on productivity. Since the profit functions are super modular in tariffs and production costs, the effect of changes in tariffs in sectors with higher fixed trade costs will be larger than in sectors with lower fixed costs. The larger the fixed costs of entering the domestic market the larger the change in M&A, provided total trade costs are not too large. The reason is similar than for fixed export costs: with supermodularity in the profit function between production and trade costs, changes in tariffs have a larger effect on reallocation in sectors with higher fixed entry costs. The larger the dispersion a of productivity, the more scope for reallocation since more firms will be towards the tails of the distribution and be affected by changes in the entry thresholds. Finally, the larger the

change in tariffs and the larger the initial tariff, the larger the change in productivity cutoffs and the larger the reallocation induced through M&A.

The mechanisms linking trade-policy and reallocation and how they can relate to M&A do not depend on the functional forms used. To illustrate, I show in the appendix an example with monopolistic competition and linear demand where all the selection and sorting effects go through.

3.2.7 A Graphical Representation

To illustrate how the model works I use Figure (7) to show two equilibria, before trade liberalization and after trade liberalization, and the corresponding profit functions. Π_d is the profit line for sales in the domestic market as a function of an index of productivity $\left(\frac{1}{\psi}\right)^{1-\sigma}$. The higher the productivity of the firm, the higher the profits it makes in the domestic market. Π_x is the profit function in the foreign market also as a function of the same index. The fixed costs determine the vertical intercept and the selection patterns. The intercept with the horizontal axis determines the zero-profit productivity cut-offs in both markets. The two profit lines are determined by the following equations:

$$\Pi_d(\psi) = \left(\frac{\sigma-1}{\sigma}\frac{\psi}{R_i}\right)^{\sigma} \frac{E_i}{P_i^{1-\sigma}}\frac{R_i}{\psi}\left(\frac{1}{\sigma-1}\right) - f_d = (1-\alpha)\, A_i \left[\frac{R_i}{\alpha\psi}\right]^{1-\sigma} - f_d$$

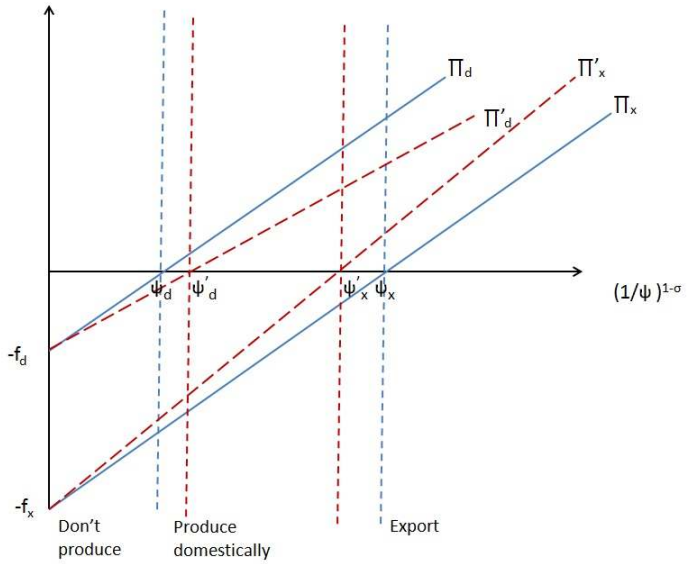
And

$$\Pi_x(\psi) = (1-\alpha)A_k \left[\frac{\tau_{ik}R_i}{\alpha\psi}\right]^{1-\sigma} - f_x$$

The slopes of these equations are determined by the elasticity of substitution, the production and trade costs and the endogenous demand parameter. The exact position of the curves will be determined in general equilibrium. However, following the algorithm in Mrazova and Neary [2011], we can establish their loci without solving the full general equilibrium.

The initial equilibrium is depicted by the profit functions Π_d and Π_x. After a fall in

Figure 7: Capital Reallocation and Trade Liberalization



tariffs, the new profit functions are $\Pi_d^{'}$ and $\Pi_x^{'}$. The domestic zero-profit cutoff increases because of increased competition in the product and factor markets. The main effect is via the factor markets since firms charge a constant mark-up over marginal cost. This forces the marginal firms that were formerly producing to exit the market. There is also a change in the intensive margin with all firms reducing the scale of their operations in the domestic market. The export profit function on the other hand pivots up and the export productivity cutoff decreases as lower productivity firms can enter the foreign market. This induces entry on the extensive margin. Exporting firms also expand on the intensive margin as exporting becomes more profitable.

The evidence on M&A in Phillips and Maksimovic [1999] shows how large expansions are done via M&A and smaller expansions are done via greenfield investment. Jovanovic and Rousseau [2002b] show how M&A are a high fixed cost/low variable expansion mode while greenfield investment is a low fixed cost/high variable cost expansion mode to explain these patterns. I will conjecture that these same pattern must hold for expansions induced

by trade policy with expansions on the extensive margin typically being larger and being implemented by M&A and expansions on the intensive margin typically being smaller and implemented via greenfield investment. Therefore, firms with productivity between the two cut-offs will be adjusting along the extensive margin with the export thresholds determining the set of acquiring firms and the domestic thresholds determining the target firms.

3.2.8 Summary of Empirical Predictions

Table 2: Summary Empirical Predictions Monopolistic Competition Models

Comparative static/model parameter	Effect on M&A following bilateral liberalization	Rationale
Size of industry measured by installed capital	Increases	Correlated with number of firms and possibilities of reallocation.
Fixed cost of exporting	Increases	Supermodularity of the profit function in fixed costs and tariffs means that there is a strong selection effect and liberalization induces more entry into foreign markets.
Fixed cost of entering domestic market	Increases over a certain range	Trade liberalization induces more exit of low productivity firms.
Productivity Dispersion	Increases	With longer tails the number of firms that will want to expand and exit increases
Initial Tariff	Increases	The higher the initial tariff the larger the distortion in terms of domestic firms that survive and that must exit after liberalization.
Composite cost parameter (λ)	Decreases	
Change in tariffs	Increases	Larger tariff falls mean more entry and potential entry by foreign firms and more exit by low productivity domestic firms.
Q of acquirier > Q of Target	Observed M&A	Trade liberalization reduces the value of assets for low productivity firms and increases the value of assets for high productivity firms.
Productivity of merged firm is the same as acquirer firm	Observed M&A	Productivity parameter perfectly transferable.

3.2.9 Differences between Oligopoly Models and Monopolistic Competition Models

The baseline Cournot model by Salant et al. [1983] shows that trade liberalization reduces the profitability of M&A and therefore the incentive for domestic firms to merge by making it harder for domestic firms to monopolize markets through coalitions. Increased entry by foreign firms trumps intents by domestic firms to restrict output and increase prices. By adding cost heterogeneity as in Long and Vousden [1995], we can introduce a second M&A motive that will be affected by trade: the cost-reduction mergers. In this model, trade liberalization reduces the incentive to merge for mergers with very low cost savings but increases the profitability of high cost savings mergers. The fall in low cost savings mergers responds to the same forces as in Salant et al. [1983]: with a more liberalized market subject to foreign entry it is harder to increase profits via output restrictions and monopolization. However, there is more of an incentive to merge if there are cost differences between the merging partners since the gains from reductions to variable costs are applied to more units benefiting from access to the larger foreign market. A special case of this model with two identical domestic firms and a potential foreign entrant with a cost advantage shows that trade liberalization can induce mergers even in the absence of foreign entry and even with no change in trade flows. If the foreign entrant has a cost advantage large enough to drive the domestic firms out of business and there are synergies from merging the domestic firms can reduce the potential profits of the entrant by strategically merging and materializing the synergies preempting entry. These mergers do not require pre-merger cost differences between merging firms, are characterized by post-merger synergies reducing costs below the pre-merger costs of both firms and will occur even in the absence of foreign entry and changes in trade flows.

The Melitz [2003] framework complemented with the Q-theory of mergers and mergers as reallocation of Jovanovic and Rousseau [2002b,a] eliminates all strategic motives for mergers.

With a continuum of firms there is no possibility of influencing prices and output which also eliminates the market power incentive to merge. However, the theory shows how changes in trade policy can lead to reallocation of a fixed and sector-specific factor of production from less efficient firms that are no longer able to compete in the domestic market, towards more efficient firms that can now expand into foreign markets. M&A has been shown to be a cost-effective to expand so in this paper I assume that a fraction of the reallocation will occur via M&A. M&A will be proportional to total reallocation and respond to the same trade-related factors. In this case, M&A will be characterized by acquirers being more productive than targets, increases in trade flows being correlated with M&A as expanding firms start exporting (extensive margin) and domestic firms face more import competition (import flows must increase). Unlike the entry deterrence M&A, these must occur together with changes in trade flows. Additionally, only mergers between firms with different productivity will be rationalized as reallocation mergers. The reallocation mergers are most similar to the cost-saving mergers where firms differ in productivity. However, this theory only allows for positive assortative matching while Long and Vousden [1995] suggest that trade will actually increase the cost disparities between merging partners.

4 Data

The data used in this paper comes from several sources. The list of Free Trade Agreements (FTAs) comes from the WTO, tariff data comes from UNCTADs Trade Analysis and Information System (TRAINS) database via the World Integrated Trade Solutions (WITS) software, exports and imports come from COMTRADE also via WITS, firm level data comes from Worldscope and the M&A data comes from SDC Platinum. The M&A data base provides the names of the parties in the deal, their parent companies, their countries of origin, their sector of economic activity at the SIC 4-digit level, as well as a set of firm identifiers.

There is also some data from firm balance sheets. The tariff data is also at the SIC 4-digit level. First, I construct a database containing the total number of M&As and the value of these deals by industry sector and for each country according to provenance of the target firm. I construct these aggregate number of M&As before and after the entry into force of the relevant FTA and at 4 different aggregation levels. I use the SIC industry codes to match the tariff and the M&A data. I construct two data sets: one with country-pair specific tariffs another one with the average tariff by sector that each country levies on the other members of the FTA. I also calculate the average tariff at higher levels of aggregation and match these tariffs with the individual deals. This allows me to increase the size of the matched database. The underlying hypothesis is that most of the tariff change is set at higher levels of aggregation as these are better able to influence the political process, while more specific sectors do not have the resources to do so. I focus the analysis on domestic deals but present the full data including cross-border deals. I also include indicator variables for the level of development of the countries where the firms come from, limiting this measure to a binary classification, as well as for the type of FTA signed and its scope. The deals are classified as horizontal or non-horizontal based on the SIC-codes.

The predictions developed in the theoretical framework suggest that the effect of changes in trade policy will depend on productivity. In order to test the implications of the model, I match the M&A data with firm level accounting data and calculate different measures of productivity at the firm level. I include all firms including those not engaged in M&A. I calculate several productivity measures and construct the distribution for the economies in my data set.

The firm level model has implications for aggregate trade flows and industry level productivity. While the oligopoly models show cases where changes in trade policy can induce M&A even without changes in trade flows, the monopolistic competition model suggests that reallocation is driven only by firms expanding into the export market. To test these

two alternatives I match trade flow data from Comtrade and aggregate industry productivity data to the M&A data all at the same 4-SIC digits.

Most of the country-specific and trade-block-specific effects are captured by time fixed effects which reflect all changes in factors that are common to all sectors within a country or across countries. However, I will explicitly include country level controls that have been suggested in the M&A literature. In particular, I use data from the Penn World Tables and from the CEPII database. The CEPII data has information on measures of distance, both physical and cultural, between countries, production and trade. The Penn World Tables data and the CEPII data were matched to the M&A and tariff data using the World Bank ISO country datacodes.

4.1 Free Trade Agreements

The list of Free Trade Agreements included comes from the WTO. The WTO gives the coverage of the agreement (goods/services), the type of agreement (FTA/Economic Integration Area), the date of notification and date of entry into force, and the status of the agreement (e.g. in force). There are two classes of agreements notified to the WTO: Regional Trade Agreements and Preferential Trade Agreements. The former are reciprocal agreements whereas the later are unilateral preferences granted to one trading partner to another. In this paper I will use only the bilateral agreements. As can be seen in figure (8), the number of agreements notified to the WTO has increased significantly over the last years. Prior to the 1990's FTAs were a rare instrument in the trade policy landscape. Starting in the 90s the number of FTAs increases with as many as 17 per year in 2008 and 2009. The recent explosion of FTA has been a subject of study specially in the political economy of trade policy literature. The percentage of world trade covered by these agreements has also increased substantially.

Figure 8: Number of FTA per Year

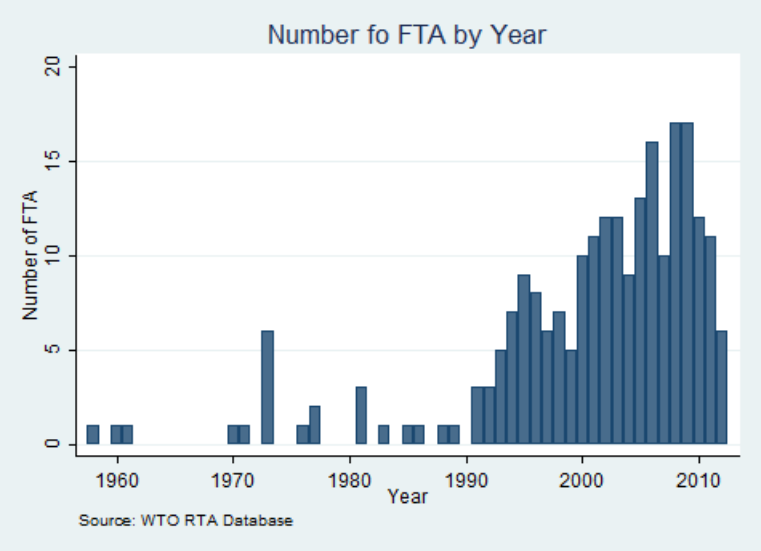


Figure (9) shows the cumulative number of agreements in force since the 1950s and the exponential increase with a total of 232 agreements in force and notified to the WTO as of July 2012.

Out of these agreements, 128 cover only goods, 103 cover goods and services and one is exclusively a service deal. The distribution of FTA by coverage type is shown in Figure (10). The availability of different types of coverage will allow us to control empirically for this dimension in the empirical analysis.

This paper uses a subset of these agreements for which data on tariffs, trade and firms is available. The list of FTAs, signatory countries and dates of entry into force are listed in Tables (3) and (4).

For comparison with the full sample I present the time distribution of the sample used in this paper in Figure (11). We can see that the time pattern is similar and we are using FTA from all periods which will help capture the changing characteristics of these agreements over time.

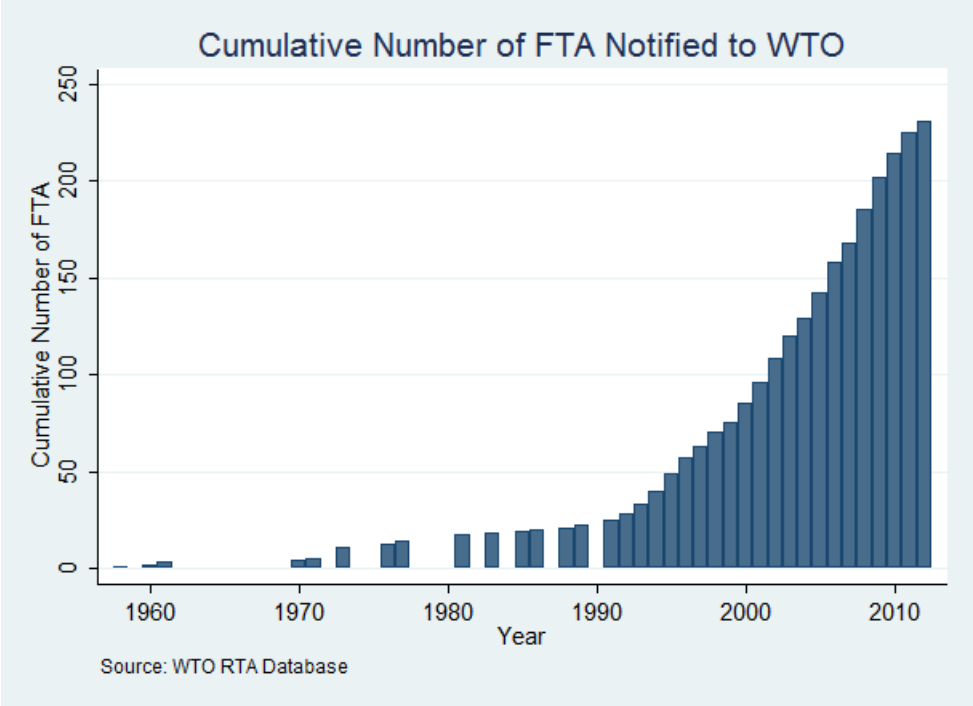
Table 3: Sample of Free Trade Agreements used in this paper I

RTA Name	Coverage	Date of entry into force
ASEAN Free Trade Area (AFTA)	Goods	28-Jan-92
Australia - Chile	Goods & Services	6-Mar-09
Australia - New Zealand (ANZCERTA)	Goods & Services	01-Jan-1983(G) / 01-Jan-1989(S)
Australia - Papua New Guinea (PATCRA)	Goods	1-Feb-77
Brunei Darussalam - Japan	Goods & Services	31-Jul-08
Canada - Chile	Goods & Services	5-Jul-97
Canada - Costa Rica	Goods	1-Nov-02
Canada - Israel	Goods	1-Jan-97
Central European Free Trade Agreement (CEFTA) 2006	Goods	1-May-07
Chile - China	Goods & Services	01-Oct-2006(G) / 01-Aug-2010(S)
Chile - Costa Rica (Chile - Central America)	Goods & Services	15-Feb-02
Chile - El Salvador (Chile - Central America)	Goods & Services	1-Jun-02
Chile - Japan	Goods & Services	3-Sep-07
Chile - Mexico	Goods & Services	1-Aug-99
China - Hong Kong, China	Goods & Services	29-Jun-03
China - Macao, China	Goods & Services	17-Oct-03
Colombia - Mexico	Goods & Services	1-Jan-95
Costa Rica - Mexico	Goods & Services	1-Jan-95
Dominican Republic - Central America - United States Free Trade Agreement (CAFTA-DR)	Goods & Services	1-Mar-06
EC (10) Enlargement	Goods	1-Jan-81
EC (12) Enlargement	Goods	1-Jan-86
EC (15) Ennlargement	Goods & Services	1-Jan-95
EC (25) Enlargement	Goods & Services	1-May-04
EC (27) Enlargement	Goods & Services	1-Jan-07
EC (9) Enlargement	Goods	1-Jan-73
EC Treaty	Goods & Services	1-Jan-58
EFTA - Chile	Goods & Services	1-Dec-04
EFTA - Croatia	Goods	1-Jan-02
EFTA - Israel	Goods	1-Jan-93
EFTA - Mexico	Goods & Services	1-Jul-01
EFTA - Singapore	Goods & Services	1-Jan-03
EU - Mexico	Goods & Services	01-Jul-2000(G) / 01-Oct-2000(S)
European Free Trade Association (EFTA)	Goods & Services	03-May-1960(G) / 01-Jun-2002(S)
India - Bhutan	Goods	29-Jul-06
India - Singapore	Goods & Services	1-Aug-05
India - Sri Lanka	Goods	15-Dec-01
Israel - Mexico	Goods	1-Jul-00
Japan - Indonesia	Goods & Services	1-Jul-08
Japan - Malaysia	Goods & Services	13-Jul-06
Japan - Mexico	Goods & Services	1-Apr-05
Japan - Philippines	Goods & Services	11-Dec-08
Japan - Singapore	Goods & Services	30-Nov-02
Japan - Thailand	Goods & Services	1-Nov-07
Jordan - Singapore	Goods & Services	22-Aug-05
Korea, Republic of - Chile	Goods & Services	1-Apr-04
Korea, Republic of - Singapore	Goods & Services	2-Mar-06
Korea, Republic of - US	Goods & Services	15-Mar-12
Mexico - El Salvador (Mexico - Northern Triangle)	Goods & Services	15-Mar-01
Mexico - Guatemala (Mexico - Northern Triangle)	Goods & Services	15-Mar-01
Mexico - Honduras (Mexico - Northern Triangle)	Goods & Services	1-Jun-01
Mexico - Nicaragua	Goods & Services	1-Jul-98
North American Free Trade Agreement (NAFTA)	Goods & Services	1-Jan-94
Pakistan - China	Goods & Services	01-Jul-2007(G) / 10-Oct-2009(S)
Pakistan - Sri Lanka	Goods	12-Jun-05
Singapore - Australia	Goods & Services	28-Jul-03
South Asian Free Trade Agreement (SAFTA)	Goods	1-Jan-06
Southern Common Market (MERCOSUR)	Goods & Services	29-Nov-1991(G) / 07-Dec-2005(S)
Thailand - Australia	Goods & Services	1-Jan-05
US - Australia	Goods & Services	1-Jan-05
US - Bahrain	Goods & Services	1-Aug-06
US - Chile	Goods & Services	1-Jan-04
US - Israel	Goods	19-Aug-85
US - Jordan	Goods & Services	17-Dec-01
US - Morocco	Goods & Services	1-Jan-06
US - Oman	Goods & Services	1-Jan-09
US - Peru	Goods & Services	1-Feb-09
US - Singapore	Goods & Services	1-Jan-04

Table 4: Sample of Free Trade Agreements used in this paper II

RTA Name	**Coverage**	**Date of entry into force**
Morocco-Agadir	Goods & Services	2007
Tunisia-Agadir	Goods & Services	2007
Egypt-Agadir	Goods & Services	2007
Jordan-Agadir	Goods & Services	2007
Bahrain-Gafta	Goods & Services	2005
Egypt-Gafta	Goods & Services	2005
Irag-Gafta	Goods & Services	2005
Jordan-Gafta	Goods & Services	2005
Kuwait-Gafta	Goods & Services	2005
Lebanon-Gafta	Goods & Services	2005
Libya-Gafta	Goods & Services	2005
Morocco-Gafta	Goods & Services	2005
Oman-Gafta	Goods & Services	2005
State of Palestine-Gafta	Goods & Services	2005
Qatar-Gafta	Goods & Services	2005
Saudi Arabia-Gafta	Goods & Services	2005
Sudan-Gafta	Goods & Services	2005
Syria-Gafta	Goods & Services	2005
Tunisia-Gafta	Goods & Services	2005
UAE-Gafta	Goods & Services	2005
Yemen-Gafta	Goods & Services	2005
Pakistan-China	Goods & Services	2005
Pakistan-Sri Lanka	Goods & Services	2005

Figure 9: Cumulative Number of FTA

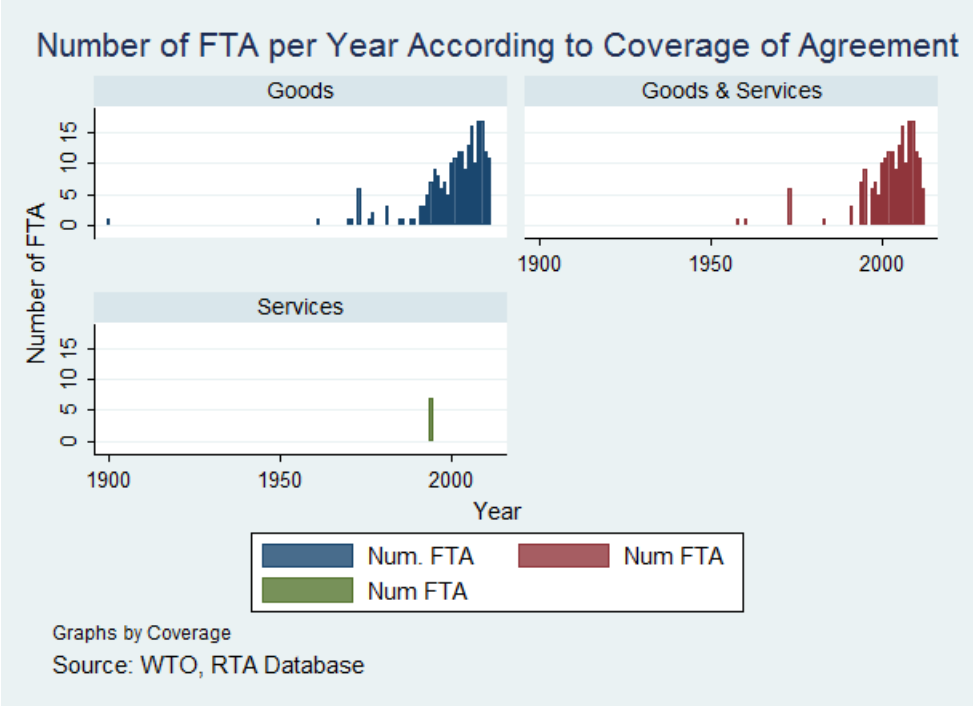


4.2 Merger and Acquisition data

The M&A data comes from Thomson Financial's SDC Platinum Database considered to be the world's most comprehensive M&A database, with US deals dating back to 1979 and other international transactions dating back to 1985. As the database has been updated, new deals going as far as 1965 have been added. SDC M&A data include over 200 English and foreign news sources, SEC filings (and global equivalents), trade press publications, banks surveys and direct contact with the relevant advisers. Institutions involved in league tables are especially diligent when it comes to reporting and maintaining a feed of information for research, primarily to help ensure as high a placement as possible. The premier sources, particularly at the deal initiation stage, are press releases from PR companies acting for companies involved in transactions, and RNS announcements.

I use the entire database containing global M&A including countries signing FTA and

Figure 10: FTA by type of Coverage



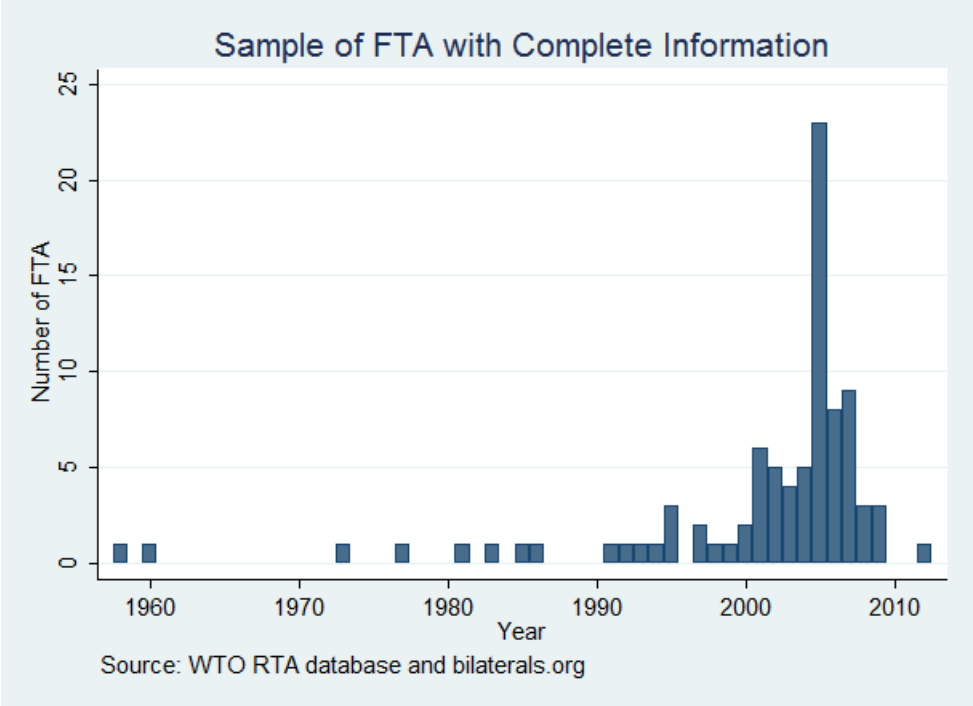
countries not signing FTA. The database includes global M&As from 1965 to 2012 between 226 entities between countries, independent territories, protectorates including 14 industrialized countries and 68 developing countries signing FTAs during this time period. The database contains 612,905 deals announced, however, not all of these deals were completed. Of those announced, 612,373 have a completed deal date. I will infer from missing completed deal dates that these deals were never completed. The number of M&A in each FTA considered is shown in Table (5) where bilateral FTA such as all the FTA signed between the USA and other countries have been grouped for convenience even if they are not multilateral agreements such as NAFTA.

Some of the countries in the sample are signatories of several FTA. In 120,033 cases the countries where firms were involved in M&A deals have no FTA between them or other countries. In 226,896 cases and 249,482 cases they are signatories to one and two FTA

Table 5: Number of M&A in each FTA

Free Trade Agreement	Number of M&A completed
Agadir	848
Asean	17,716
Australia Bilaterals	26,546
US Bilaterals	22,760
Cafta	180,000
Canada Bilaterals	22,078
Cefta	5,668
Chile Bilaterals	13,220
China	14,284
Efta	12,942
EU	170,000
G3	1,793
Gafta	1,571
India Bilaterals	8,321
Japan Bilaterals	18,760
Mercosur	5,405
Mexico Bilaterals	23,936
Nafta	220,000
Safta	5,040
Singapore Bilaterals	7,965
Pakistan Bilaterals	7,971

Figure 11: Sample of FTA Used



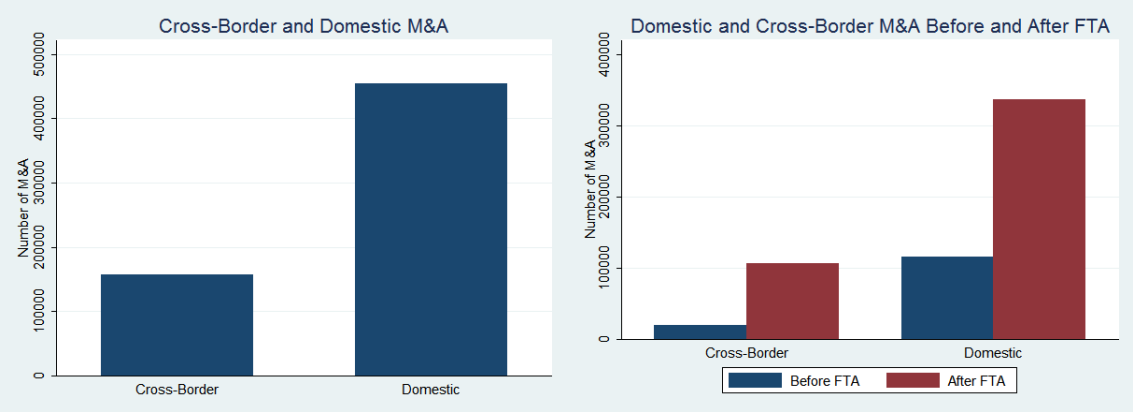
respectively. Acquirer and target nations in 11,183 cases are signatories to three FTA. A minority of countries in the database are signatories to more than 3 FTA. The overlap of FTA will be considered in the empirical section.

Most M&A are domestic with over 450,000 M&A between firms in the same country and slightly over 150,000 between firms in different countries. This is surprising given the emphasis in the literature on cross-border M&A. I will focus mainly on domestic M&A which are the focus of the theory presented and explore their role in reallocating assets between firms within countries and within industries as well as possible strategic motives suggested in the oligopoly models. Figure (12) shows how both types of M&A increased following FTA and the proportionally larger increase in domestic M&A. Domestic M&A are assigned to an FTA depending on the distance of the deal year relative to the FTA year. The data presented covers the entire time period which is biased against my hypothesis since I have

Table 6: Total Number of FTA involving countries in Mergers and Acquisitions

Item	Number	Per cent
No FTA	120,033	20
Single FTA	226,896	37
2 FTA	249,482	41
3 FTA	11,183	2
4 FTA	1,263	0
6 FTA	864	0
7 FTA	3,184	1
Total	612,905	100

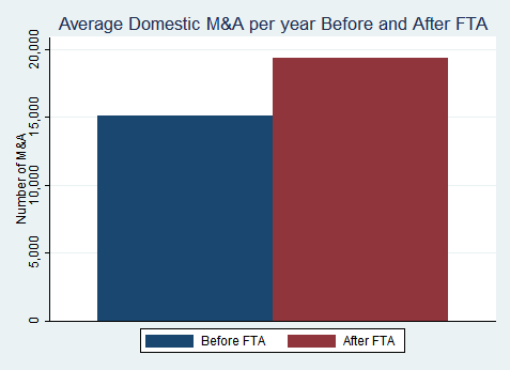
Figure 12: Domestic and Cross-Border M&A



longer time horizons before the signature of most FTA than after.

Since the theory presented provides rationales for domestic M&A, I will focus on those. In that category, not only have the total number of M&A increased after FTA are signed, but also the average number per year has increased as shown in Figure (13). Since this average is calculated for FTA signed at different time periods over the sample time frame and covers all industries, all countries and all types of deals, it shows a very robust first order effect of FTA on M&A activity. The figure shows a non-negligible increase of nearly 15,000 M&A per year for years after FTA are signed and enter into force relative to years before the relevant FTA.

Figure 13: Average Number of Domestic M&A per Year Before/After FTA



The sample is more or less equally divided between developed and developing countries with 301,500 target firms in developed countries, and 309,678 acquirer firms in developed countries as shown in the cross-tabulation of deals following the CIA classification of countries. Mirroring the predominance of domestic M&A in the sample, most deals are between either two firms in developed countries or two firms in developing countries. When there are cross-border mergers, there are more cases of a firm in a developed country acquiring one in a developing country.

Table 7: Distribution of Deals between Developed and Developing Countries

	Target Nation		
Acquiror Nation Developed	Developing	Developed	Total
Developing	267,263	35,964	303,227
Developed	44,142	265,536	309,678
Total	311,405	301,500	612,905

Tables 5 and 6 show the data disaggregated for the time period before and after signing FTAs. The largest proportional increase was for cross-border M&A between an acquirer from a developed country and a target from a developing country, followed by deals between firms in developing countries. The smallest increase was for deals between firms in developed countries.

Table 8: Distribution according to Development Status

	Target Nation		
Acquiror Nation	Developing	Developed	Total
Developing	52,276	13,439	65,715
Developed	7,702	133,148	140,850
Total	59,978	146,587	206,565

Table 9: Distribution according to Development Status

	Target Nation		
Acquiror Nation	Developing	Developed	Total
Developing	191,942	22,478	214,420
Developed	32,606	131,973	164,579
Total	224,548	154,451	378,999

Figure (**??**) shows the distribution of M&A across industries for the entire sample. Most M&A are between manufacturing firms followed by firms in the service sector and in finance. Looking at this data before and after signing an FTA reveals an increase in all sectors after FTA's are signed but specially in the manufacturing, service and finance sectors.

At a more disaggregated level (SIC-2 digits), we confirm the main observation of increases in M&A activity after the FTAs are signed, but we also see that there are a few sectors where the number of FTA falls. Figure (15) shows that the increase is pretty consistent across sectors but also that there is significant variation which will be important for identification in the econometric exercise.

Examining the number of M&A relative to the year an FTA is signed, we can see some evidence of clustering around the year the FTA is signed. Figure (16) shows the number of M&A increasing before the FTA are signed and falling afterward where year 0 is the year the FTA was signed. The figure shows the total number of M&A for each year relative to the corresponding FTA.

Overall, the pattern of M&A over time shows clustering of M&A activity around the time a FTA comes into force. Figure (17) shows clustering for both firms from developing

Figure 14: Number of M&A by Industry

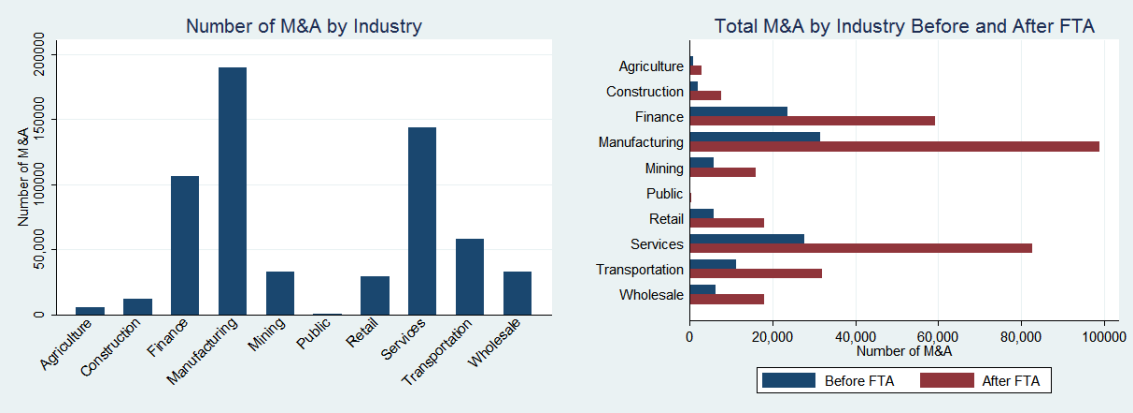


Figure 15: Number of M&A by SIC 2 digits Before and After FTA

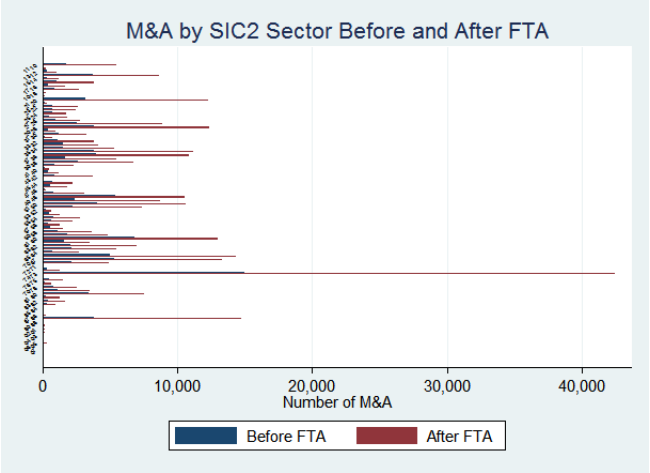


Figure 16: M&A per Year relative to FTA year

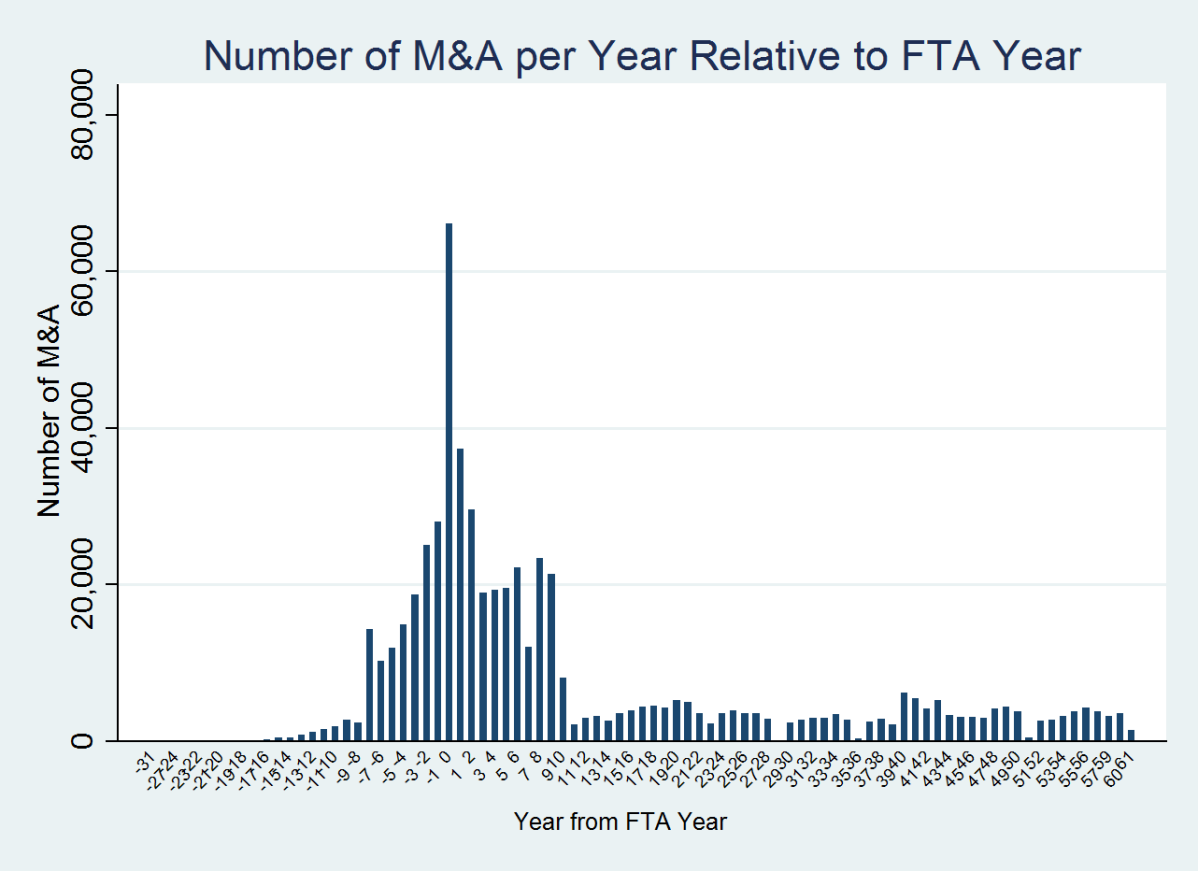
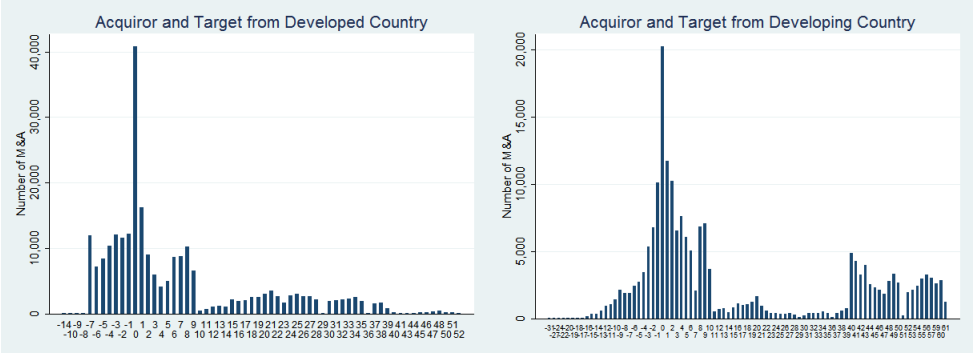


Figure 17: M&A Clustering for Developed and Developing Firms

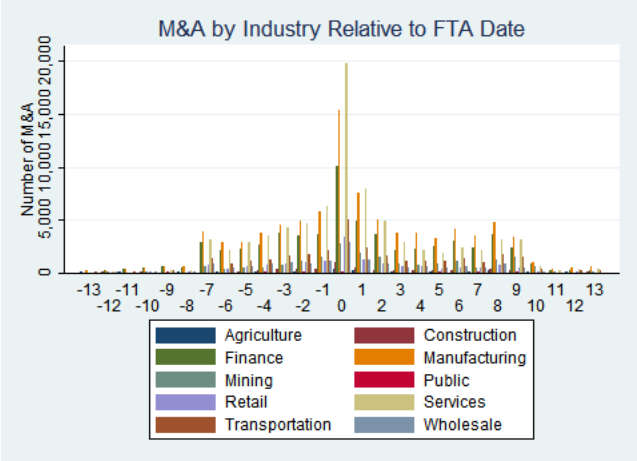


and developed countries. However, the distribution in the case of developed countries is less dispersed than for developing countries which is consistent with faster reallocation via M&A in developed countries relative to developing countries. Similarly, in the case of developed countries theer is a clear concentration of M&A activity during the year the FTA is signed and over the next 2 years. In the case of developing countries there is a more gradual increase during the two previous years and M&A activity does not level-off as fast as in developed countries.

Disagreggating the time pattern over industries as shown in Figure (18) shows the main industries driving the clustering of M&A around the FTA date: services, manufacturing and finance are the three sectors where M&A increase the most around an FTA date. The theory speaks mainly to the trabable sector of the economy and expansion into foreign markets. The data shows how traditionally non-tradeable sectors have become a lot more tradable or how trade in goods also impacts industry structure of supporting service sectors.

The theory of M&A and trade is mainly about horizontal mergers transferring sector-specific assets between firms of different productivities or preemptively changing market structure within an industry. Figure (19) shows how the number of horizontal and non-horizontal M&A changes around the date of an FTA. The distribution shows a significantly larger increase in horizontal mergers (or within-sector mergers) within 2 years of the FTA,

Figure 18: M&A Relative to FTA Date all Industries



and particularly during the FTA year. This stylized fact matches the intuition of the theory and will be a factor to consider in the empirical analysis.

Finally, over the entire time period covered by the database, M&A increased with the characteristic waves of mergers reported in the literture. Figure (20) shows the full database with visible merger-waves and peaks.

4.3 Tariff Data

Tariff data comes from UNCTADs TRAINS database. This database is collected from governmental sources, official journals and circulars and is continually revised to identify changes in trade practices and restrictions. Tariff data is available under different classifications. I use the Standard International Trade Classification (SITC) revision 1 with data from 1962. The database includes detailed information on Trade Control Measures providing Most Favoured Nation (MFN) tariffs, preferential tariffs, bound tariffs and effectively applied tariffs. The entire sample includes bilateral tariff data for countries in all FTAs. Bound tariffs are the maximum tariffs agreed multilaterally in the context of multilateral trade negotiations, the MFN tariff is the tariff applied to all trading partners under GATT rules and can be at

Figure 19: Horizontal and Non-Horizontal M&A

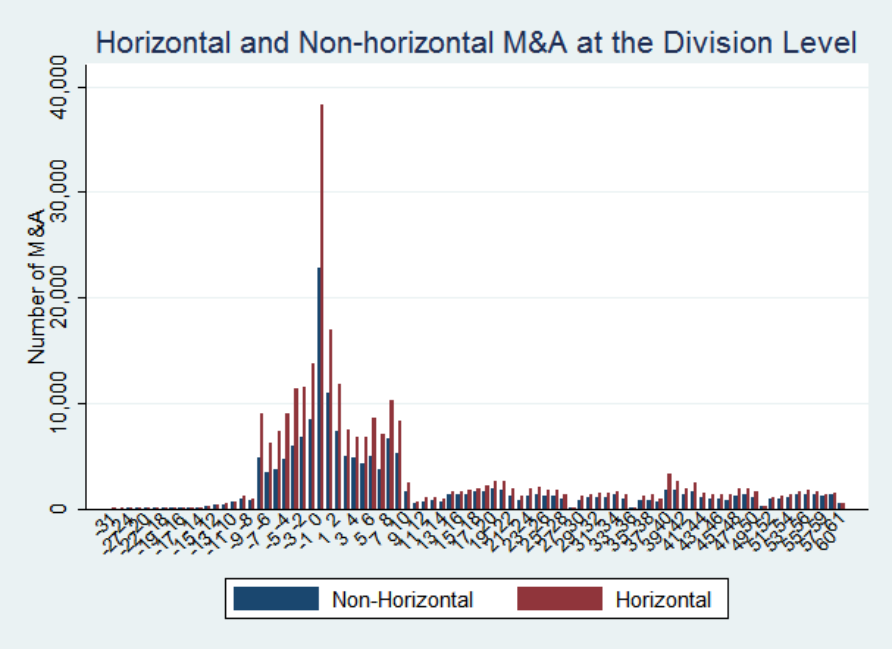
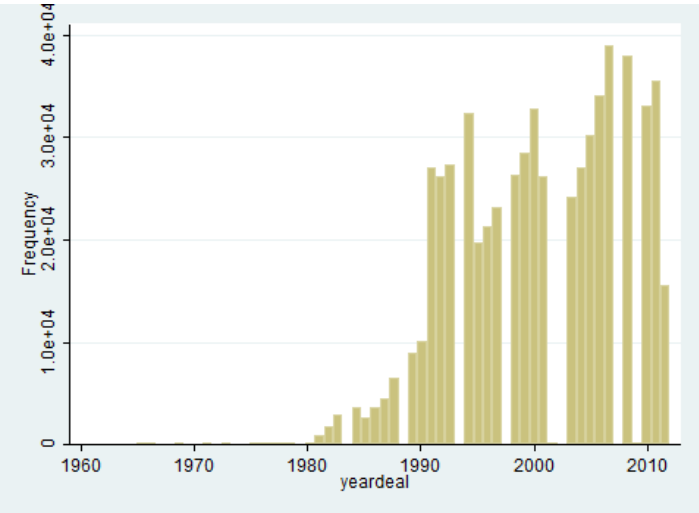


Figure 20: M&A by Year



most equal to the bound tariff. Preferential tariffs are those allowed under the rules for FTA which do not have to be extended to all trading partners. Finally, the effectively applied tariff is the lowest of the MFN and the preferential tariff.

Using the full tariff data base, I calculate the change in average tariffs before the signature of the FTA and after the signature of the FTA. This is a fairly adverse measure for my test. A more generous metric to test the effect of reductions of tariffs on trade in an environment where tariffs have been falling consistently would be to compare the max tariff before the FTA and the minimum once the implementation schedule has ran its course.

I calculate the difference in effectively applied, weighted tariffs the standard deviation of tariffs, the maximum and minimum tariff and the number of tariff peaks. I merge the resulting database of tariff change to the M&A database to test the hypotheses of the model.

Tariffs for all countries signing free trade agreements follow a similar pattern: they are very spread out and have a high mean before the agreement and they all converge towards zero after the agreement. Figure (21) shows the distribution of average tariffs 2 years before an FTA is signed, during the 2 years before and after the implementation date and for the period 2 years after the FTA date. From the distribution, we can see that the distribution shifts to the left with a lot more tariffs at zero and with the maximum tariff falling substantially.

Over the entire period there has been a continuous fall in tariffs. Figure (22) shows the average, weighted average, minimum and maximum tariffs over all countries in the sample in each time period relative to their respective FTA date as well as the same tariff data computed over each tariff year. The average tariff as well as the spread has fallen from level above 25% to levels close to 2%. The small increase in effective tariffs immediately after time 0 can be due to use of WTO-approved countervailing measures, such as antidumping measures and safeguards.

The evolution of tariffs has varied across the developed and developing world. Figure (23)

Figure 21: Distribution of Tariffs

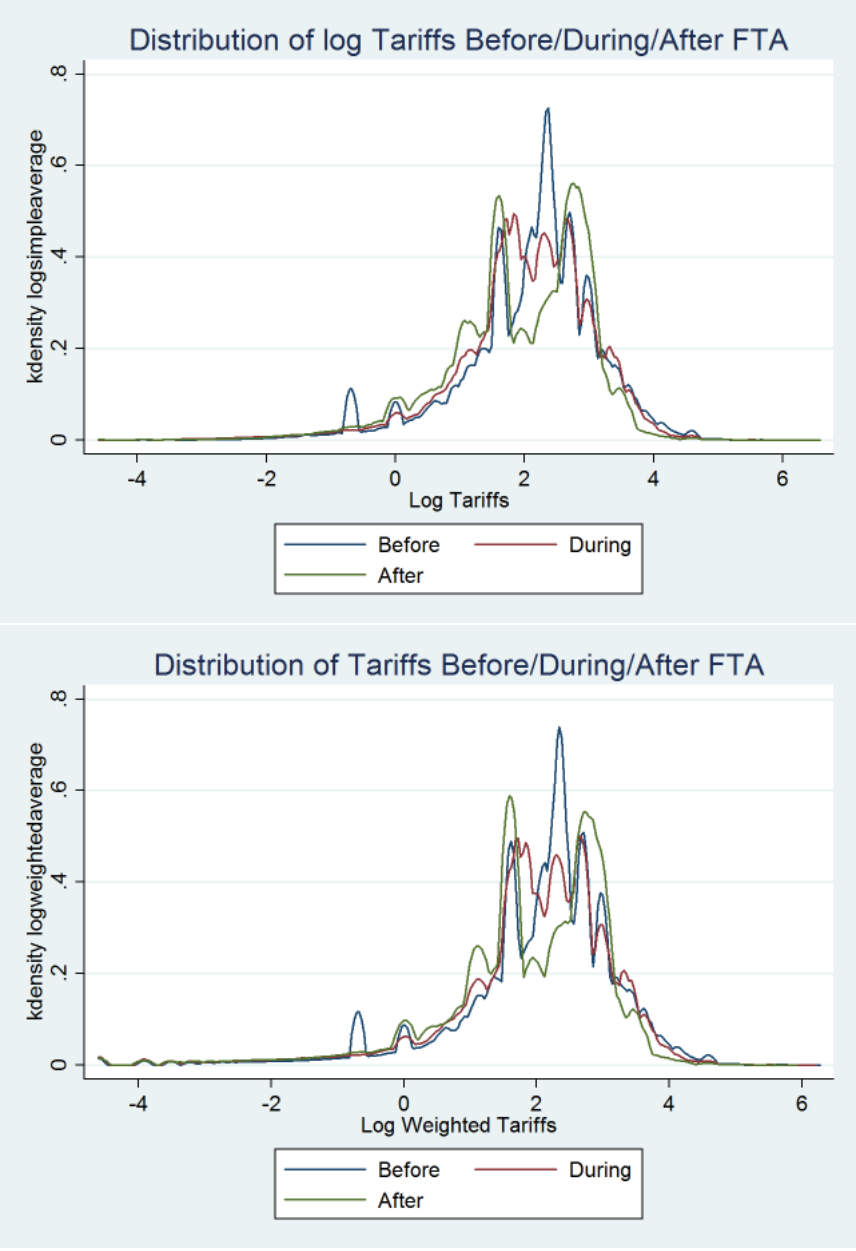
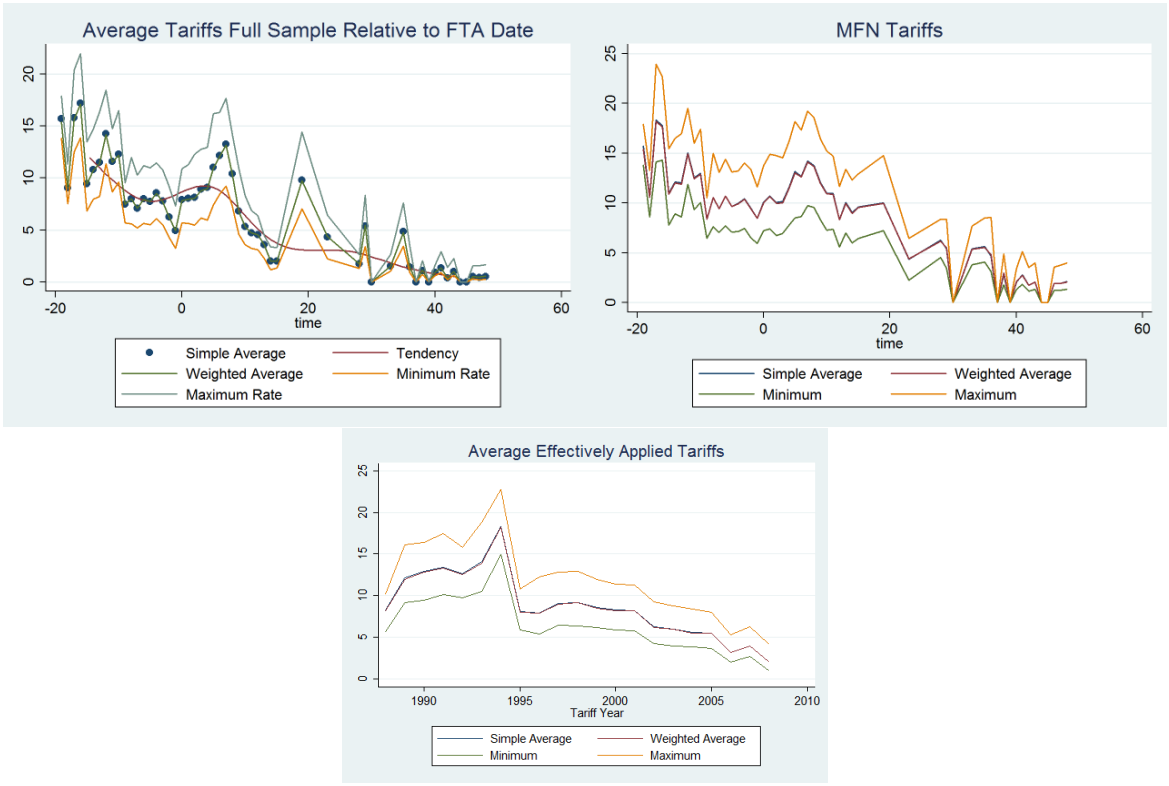


Figure 22: Average Tariffs relative to FTA date



shows that effectively applied tariffs have on average fallen both in developed and developing countries but more so in developing countries where they have fallen from average levels close to 20% to between 0% and 5% coming in line with developed countries. The fall in tariffs in developed countries has been driven, on average, by free trade agreements (a fall in preferential rates) whereas the fall in developing country rates has been driven mainly by fall in effectively applied MFN rates. These graphs show tariffs between pairs of developed and developing countries.

Figure (24) shows that both tariffs imposed by developed countries on developing country exports and tariffs imposed by developing countries on developed country exports have fallen over the observation period. However, the fall in tariffs set by developing countries has fallen the most both because of a decrease in MFN tariffs as more countries join the WTO but particularly because of FTA and the steep drop in preferential tariffs with FTA partners.

Tariffs, unlike other trade costs, are fixed by fiat so they are good variables to test for the exogenous effects of trade protection on economic outcomes. Although they are arguably the result of a political economy tariff-setting game, the impact of any individual firm on tariff settings is quite small unless the sector is very concentrated or is particularly well organized into a strong lobby. Even then, the interests of current lobby members may differ significantly from those of lobby members from 10 years ago who worked for tariffs currently in force. This helps suppport the case that tariffs are good exogenous instruments to measure trade protection. This is particularly true for relatively competitve sectors. I will use average tariffs in similar countries and the same industry for instrrument for tariffs and see if there are differences between less and more concentrated sectors.

Other factors afecting trade between countries, like transportation costs, depend on a wider range of factors including the type of goods being traded, their durability, volume, weight, the investment and quality of infrastructure and so on. Although these issues may affect the relevance of tariff changes as measures of trade competition, they are not exogenous

Figure 23: Tariffs in Developed and Developing Countries

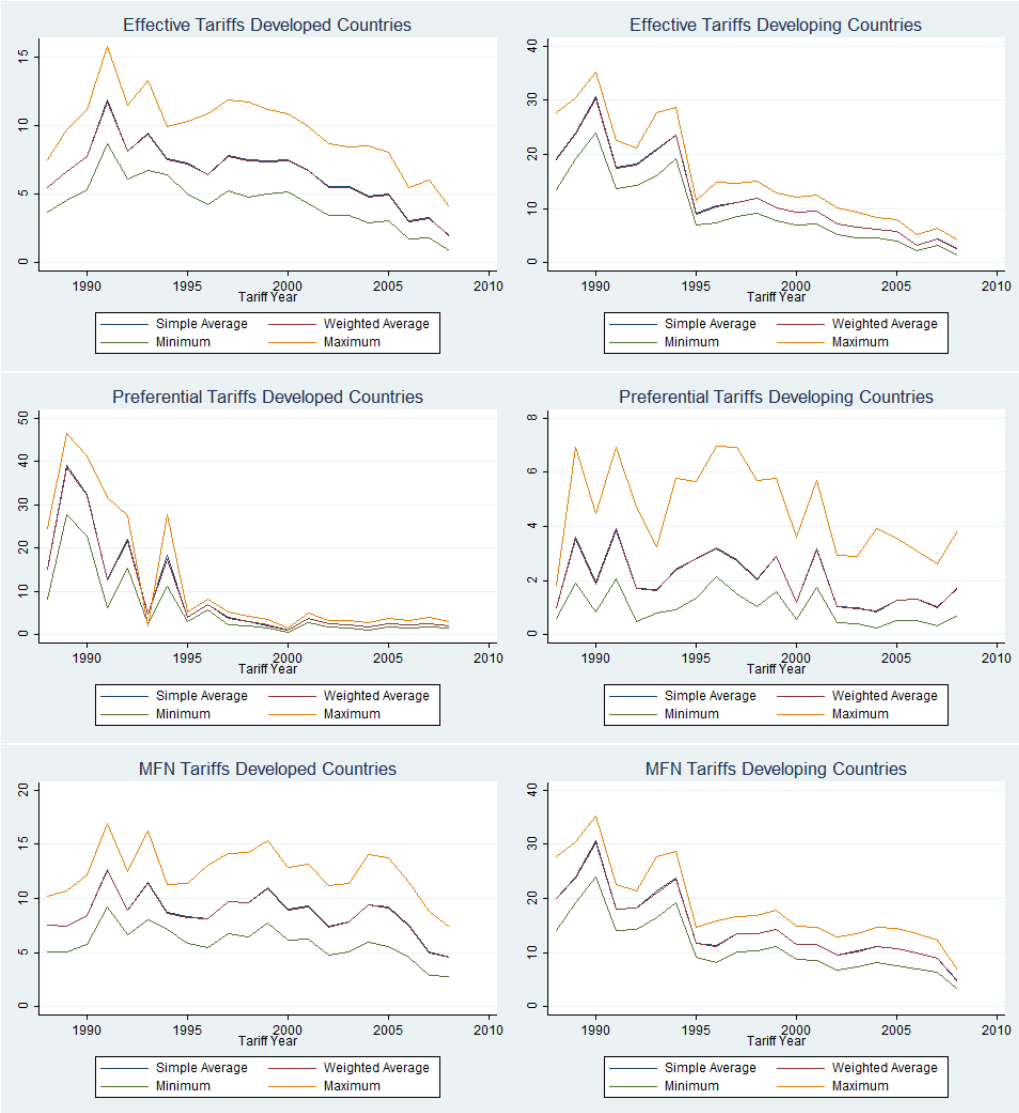
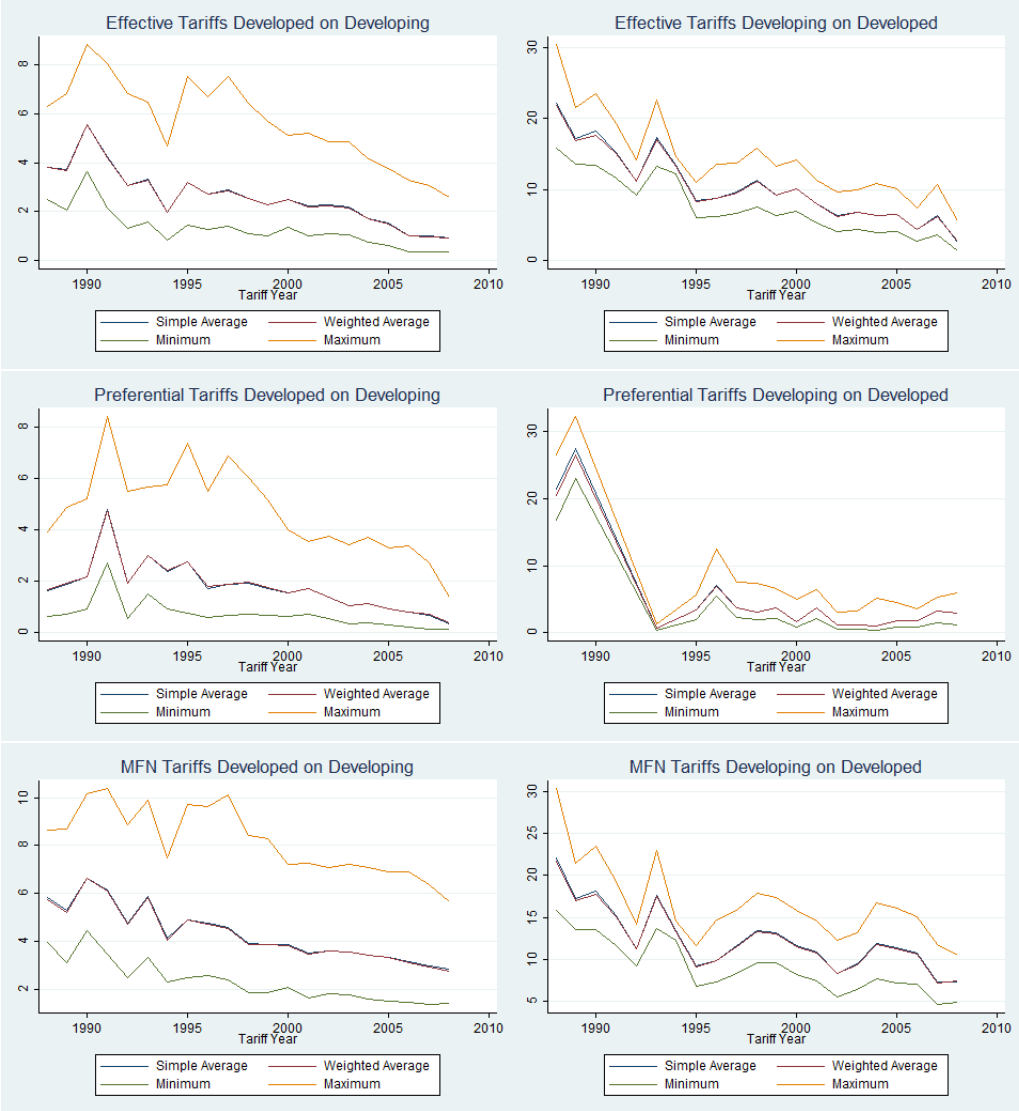


Figure 24: Tariffs between Developed and Developing Countries



trade instruments (see Pagés [2010] for a discusion of the productivity and trade research agenda with special emphasis on transportation costs). In the empirical excercises the differential effect of transportation costs on different goods will be captured by the industry fixed effects.

I also use data on non-tariff-barriers and bilateral tariffs constructed by CEPII for a subsample of my data. This will be a usegful robustness check.

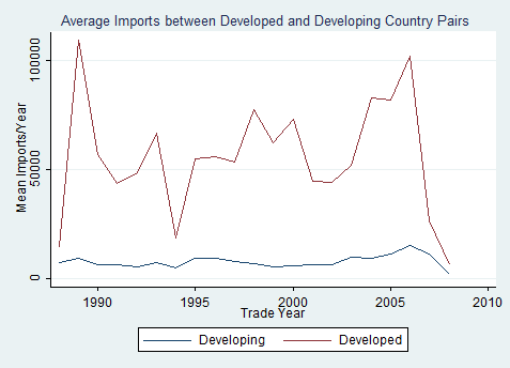
In many regions, such as in Latinamerica, transportation costs represent a higher trade barrier tha tariffs. Other non-tariff barriers are also significant. However, controling for the former using industry fixed effects or direct measures of transportation costs and for the later using import penetration ratios we can still find the ratioanlizing effect of tariff reductions. The identification strategy is plausible in so far as the changes in tariffs are orthogonal to changes in other trade costs such as transport costs. The scarce micro-evidence available on this does not suggest any obvious endogeneity problem (see Hummels [2007], Moreira et al. [2008], Blyde et al. [2009] for some papers explicitly considering transportation data and its effect on trade and relationship with other trade barriers). These authors have shown that transportation costs are proportional to weight-to-value ratios. Therefore, trade costs can be proxied with measures of weight and volume.[2]

4.4 Trade Flow Data

The changes in the productivity thresholds driving the reallocation and resorting of firms between exporting and non-exporting and acquirers and targets is driven by two main forces: the increased import competition that reduces the price level and residual demand for domestic firms in their domestic markets, and the expansion of domestic firms into export markets bidding up the price of scarce domestic factors of production. In the case of linear demand, there is also the effect on average mark-ups which tends to drive less productive

[2]Data available at http://www.iadb.org/dataintal/ComercioConTransporte.aspx

Figure 25: Imports between Pairs of Developed and Developing Countries



firms out of business[3]. To understand whether these mechanism are operating, I look at the change in trade flows following the entry into force of the agreements. The main data is from Comtrade at the same level of disaggregation as the M&A data. I also use bilateral trade flow data from CEPII as a robustness check. Figure (25) shows the average imports per year between pairs of developed and developing countries in the data set. Both the level of imports and their variability is a lot larger between developed than between developing countries. Notable is the large trade collapse following the financial crisis.

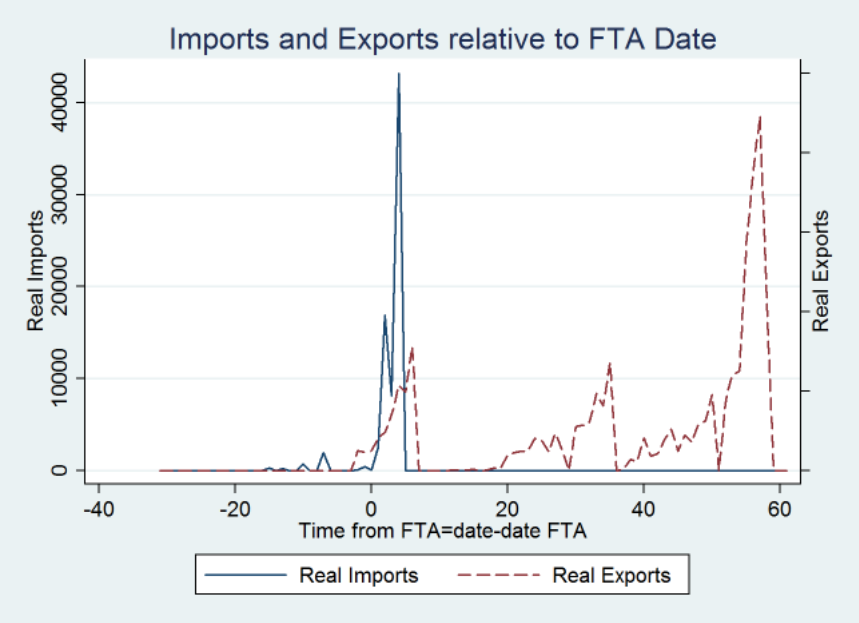
Figure (26) shows the evolution of imports and exports from Commtrade in real terms relative to US imports and exports for each year relative to the FTA date. The figure shows a significant increase in imports around the FTA date as well as an increase in exports. The increase in imports is temporary but whereas the increase in exports si unrelated with the FTA date.

4.5 Firm-level Data

Firm level data comes mainly from Thompson Financial's Worldscope data base as well as the CEPII production data, the World Bank Enterprise Surveys, the Groningen Productivity Database, the "Politics, Policies, and Productivity: An International Dataset" from the

[3]See Appendix

Figure 26: Real Imports and Exports relative to FTA Date



IADB covering the period 2000-2008, and census of manufacturing firms for a number of countries. From these different data sets, I draw measures of productivity, information on industry structure such as number of firms, information on how easy it is to engage in M&A, and information on the firms in each industry: employees, value added, wages, investment. Although most papers using firm-level accounting data use Compustat, the coverage and data quality for international firms is a lot broader in Worldscope and better suited for international studies as this one. Furthermore, Worldscope has better coverage of firms than Compustat for the US and Canada for more recent years which makes it a better choice of database since most of the FTAs analyzed in this paper occur in the later years [Weiner and Ulbricht, 2005]. I use common identifiers to match the firm level data to the M&A data. In particular I collect data that allow me to estimate labor productivity and total factor productivity–such as sales, number of employees, investment and capital–and compare the characteristics of acquirors and targets in each of the deals reported in the M&A database. Furthermore, the quatitative model proposed uses as main inputs the productivity of firms

to establish self-selection into different types of activities.

The production module of CEPII includes information on firms, employees, wages, production, exports, imports, number of firms and industry structure for a subset of the countries and industries in my sample. Differences in industry structure will be used to infer whether the predictions of the oligopoly models or the monopolistic competition models best describe the industry response to trade liberalization.

Table 10: CEPII Production Data Statistics

bdafta	Statistic	Number of firms	Labor	Wages	Production	Value Added	Internal Flow	Exports	Imports
Before	mean	8397.743	654089	29.17743	1.64E+08	6.59E+07	1.41E+08	2.45E+07	3.30E+07
	min	0	28	5.54E-07	1005.15	0	506.788	55.36947	9.698
	max	68269	2484000	66.24169	5.82E+08	2.32E+08	4.90E+08	1.18E+08	1.58E+08
	count	2048	3653	3568	4339	3607	4248	4608	4609
	sd	13572.04	727433	14.14415	1.90E+08	7.88E+07	1.56E+08	3.70E+07	5.01E+07
During	mean	9176.11	561112.6	29.94775	1.22E+08	5.27E+07	1.03E+08	2.19E+07	3.14E+07
	min	0	71	3.59E-07	1281.131	-5147.575	46.20642	8.724982	652.703
	max	76759	2157000	76.27539	6.39E+08	2.53E+08	5.45E+08	1.90E+08	2.29E+08
	count	4409	5814	5744	6153	5667	6001	7606	7606
	sd	12751.11	675108.4	13.08569	1.67E+08	7.22E+07	1.38E+08	3.72E+07	5.78E+07
After	mean	5763.237	339258.8	29.68013	6.91E+07	2.54E+07	5.68E+07	1.43E+07	1.65E+07
	min	0	121	2.281721	8354.402	-13355.53	46.20642	32.24127	4008.786
	max	95664	2114000	98.80344	6.39E+08	2.53E+08	5.45E+08	1.90E+08	2.29E+08
	count	6941	8517	8287	9155	7655	8788	9982	9982
	sd	10807.98	526603.2	9.493496	1.15E+08	4.51E+07	9.77E+07	2.56E+07	3.18E+07
Total	mean	7289.049	474931.2	29.66556	1.07E+08	4.32E+07	9.03E+07	1.91E+07	2.50E+07
	min	0	28	3.59E-07	1005.15	-13355.53	46.20642	8.724982	9.698
	max	95664	2484000	98.80344	6.39E+08	2.53E+08	5.45E+08	1.90E+08	2.29E+08
	count	13398	17984	17599	19647	16929	19037	22196	22197
	sd	12029.96	635414.9	11.78738	1.56E+08	6.53E+07	1.30E+08	3.27E+07	4.67E+07

To construct measures of productivity and productivity dispersion, I use the Worldscope database containing detailed accounting information on public companies. The database includes 55,455 companies domiciled in 71 countries covering information from 1980 to 2008. The data includes company identifiers such as the CUSIP, SEDOL and ticker information useful to match firm data with the SDC Platinum merger data, as well as industry classifications using the SIC system. Using this data, I estimate several measures of productivity to construct the dispersion and to identify where acquiring and target firms lie in the distribution. The entire dataset is an unbalanced panel of 55,455 distinct firms with accounting data

between 1980 and 2008. Besides data required to estimate total factor productivity, such as revenues, employees, wage bill, total capital, investment and inputs, the dataset includes information on international sales and net assets from acquisitions. In the analysis I will explain the different methods I use to estimate productivity.

5 Results and Analysis

The oligopoly theory oand the monopolistic competition theory of M&A and trade share some common predictions as well as some differences in empirically testable implications. After explorting the aggregate data analytically in the previous section, I turn to a more rigorous exploration of the data and statistical analysis of the predicted relationships. In the first section of this part I present some analysis of how FTA emerge as equilibrium outcomes. This is a necessary preliminary step in understanding the effect of FTA on M&A and other outcomes of interest. I then present the main stylized facts in a lot more detail than in the Data Section and finally I show the econometric analysis.

5.1 M&A Patterns and Free Trade Agreements

In this section I document the pattern of M&A across different corss-sections of the data and how they vary relative to the FTA date. In particular, I will explore how M&A vary across FTA; across developed and developing countries; across type of FTA and whether they include both goods and services or only goods; across industry; by type of M&A and whether the merger can be thought of as a horizontal merger or not. The theory has certain predictions regarding the nature of M&A that are trade-related. It shows that the total number of M&A should increase, we should observe more horizontal M&A, clustering should be more pronounced in developed countries with deeper financial sectors, M&A should occur between a more productive and a less productive firm but they should not be in the extremes

of the productivity distribution, and the acquirer should be more productive than the target. The first sub-section shows how M&A vary before and after an FTA along these different dimensions, the second explores the timing relative to the FTA date. I then show how the characteristics of these M&A change. Following the theory, I report patterns according not only to the timing of FTA but to changes in tariffs, the size of the industry, and the productivity dispersion in the industry. The final section shows more formal statistical tests of these relationships.

The data section documented some of the aggregate facts about M&A and trade agreements. However, the unit of analysis in this paper is the M&A deal/ FTA combination where member countries agree on mutual reductions in trade costs. I will show these same facts for the FTAs in my data set showing the trends and the heterogeneity in M&A activity across different cross-sections of the data. Since the theory only tells us something about domestic M&A, I will only refer from now on the M&A between firms within the same country (domestic M&A). Figures (27) and (28) show M&A data before and after the FTA for each FTA in the dataset. Most M&A can be allocated to a particular FTA unequivocally since multiple FTA tend to be separated by several years. In borderline cases, I assign the M&A to the closest FTA. This may be several years away form the FTA date itself. Overall, the aggregate trend is confirmed for individual agreements with M&A increasing in all countries after FTAs are signed.

The main stylized fact is the increase in M&A in the manufacturing sector after FTA. This is the main prediction from the theory: M&A as reallocation between firms as their exposure to international trade increases. It is also noteworthy that the increase in M&A between manufacturing firms is most pronounced for FTA involving developing countries. Compare the absolute and percent increase in M&A between manufacturing firms in a developed and a developing country: in the case of Australia the increase in manufacturing M&A is of approximately 72% while for Chile the increase was 525%. We see similar increases comparing

Figure 27: M&A by Sector for all FTA in Sample (1)

other developing and developed country FTA. The comparison between all developed and developing countries is presented in Figure (29). Another important fact is that trade also affects M&A activity in traditionally non-traded sectors

The difference in both absolute and proportional increases also holds in other sectors, specially in services and finance: while there are, both before and after FTA more M&A in developed countries, the increase is larger in developing countries. This is consistent with findings of more misallocation of resoruces in developing countries prior to trade liberalization as documented in Hsieh and Klenow [2009]. The proportionally larger increase in M&A in the trasportation sector in developing countries is also consistent with the idea of larger misallocations in developing countries and more scope for reallocation both in the sectors diretly exposed to trade (manufacturing) as well as in the sectors that provide services to the tradeable sector.

The coverage of the agreement may also affect the impact of FTA on industry restructuring. The sample contains both types of agreements and Figure (30) shows the change in M&A before and after the deals are signed for each type. In the analysis we will see if these relationships are robust and if coverage is indeed an important factor explaining M&A and industry restructuring. In particular, the scope of M&A in traditioanally non-tradeded sectors and whether this is due to liberalization of these sectors or to the effect of reallocation in the traded sector and derived demand for services is an interesting question to explore further.

Many countries in my database are signatories of several FTA. Figure (31) shows the change in M&A deals before and after FTA are signed separating the effect according to the number of FTA the partner countries have signed. The graph shows that the first FTA has a larger effect than the second and that beyond that point signing new FTA seems not to have a material impact on the nunber of M&A deals. This results is suggestive of the hypothesis of M&A as a reallocation mechanism induced by FTA and trade liberalization

Figure 28: M&A by Sector for all FTA in Sample (2)

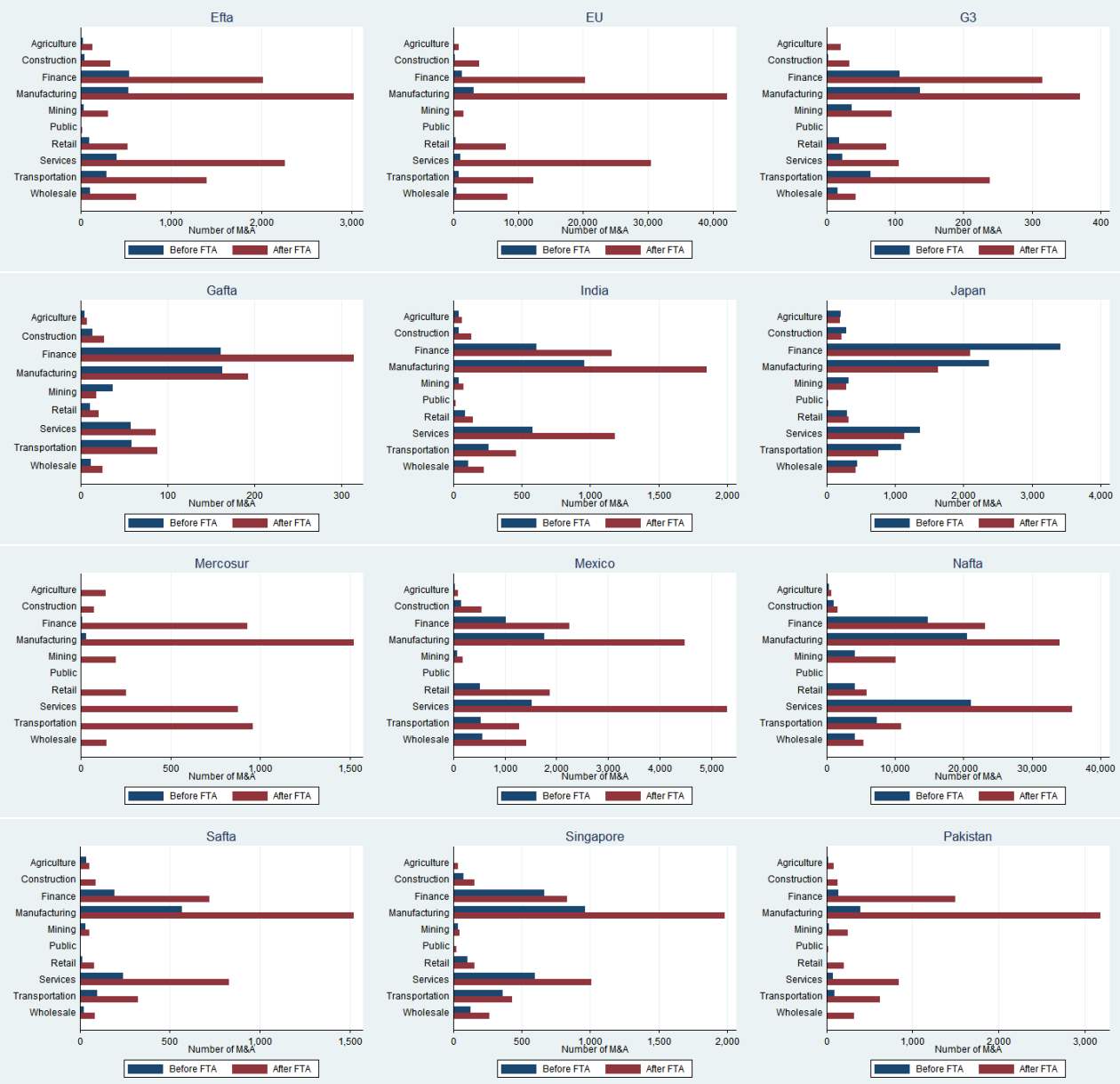


Figure 29: M&A by Industry for Developed and Developing Countries

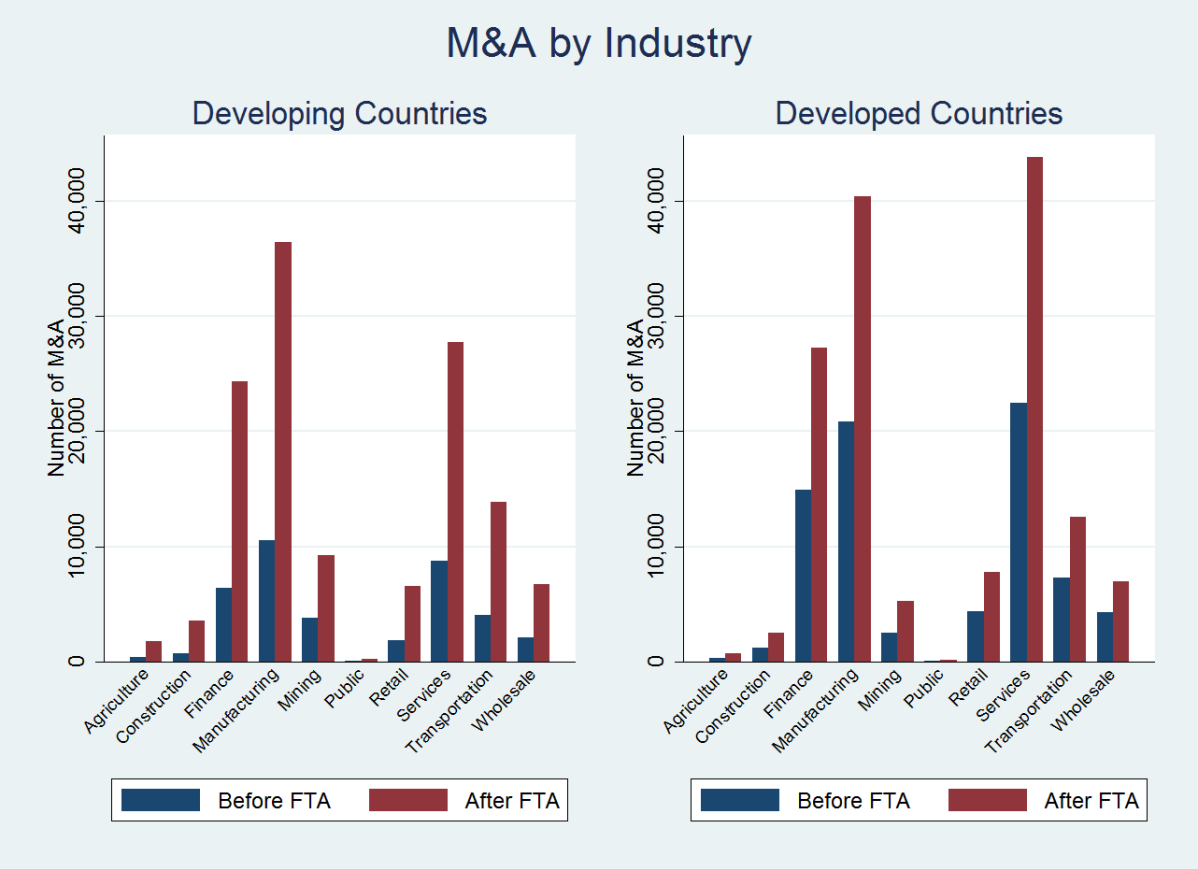


Figure 30: M&A and Agreement Coverage

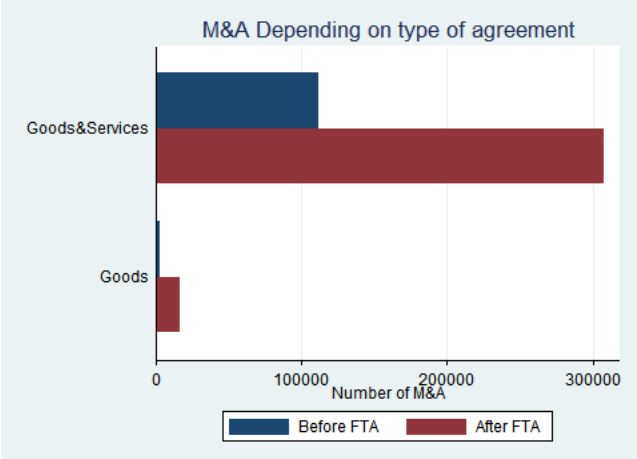
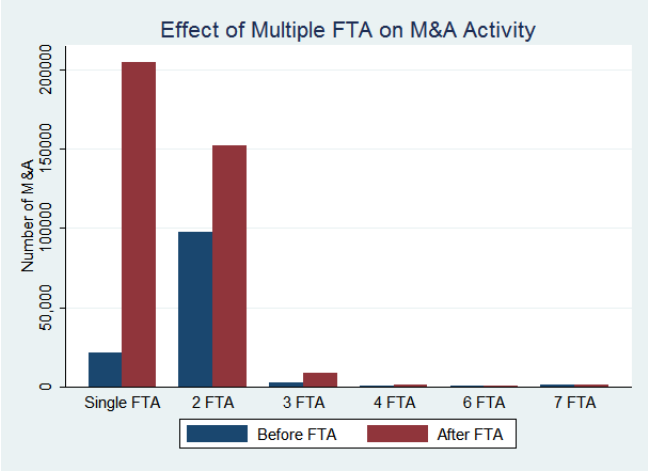


Figure 31: Effect of Multiple FTA on M&A Activity



and the idea of trade protection allowing the coexistence of productive and unproductive firms with a strong rationalizing effect of trade and efficiency enhancing M&A as a natural response to more competitive trade environments.

The full pattern of M&A by year relative to the date of the FTA as shown in Figures (32) and (**??**) show several interesting stylized facts. First, there is a lot more clustering for FTA involving developed countries, fo example, Australia, bilaterals with the US, Nafta, Mexico, show a sharp increase at time 0 (the date the FTA coems into force), whereas FTA between developing countris, like Agadir, Asean and Gafta, do not have this peak but rather have either a gradual increase or a lagged response. There are however, some examples of clustering in developing countries like India FTA, Cafta and Safta.

The pattern for each individual industry over the entire sample is shown in Figure (33). The clustering of M&A as shown by the fatness of the tails of the distributions and the pronounced increase in M&A in all industries during the year of the FTA is consistent with the main hypothesis of the model. All of these distributions are consistent with the idea of the increase in M&A as a transition phenomenon between industry steady-states. M&A before and after the FTA are non-trade related and respond to other factors explored in the

Figure 32: M&A Relative to FTA Year

corporate finance literature. The increase during the FTA, which in all industries seems to cover the 2 years before and the 2 years after the FTA is effective, can be attributed to the industry rationalization forces described in the Melitz [2003] model.

The pattern, as well as the theory, suggests we should analyze the time pattern of M&A in three, rather than two time periods. I divide the time horizon relative to the FTA date into three periods: before the FTA if the year of the deal is earlier than 2 years before the FTA date; during the FTA if the year of the deal is within 2 years of the FTA date; and finally, after the FTA if the year of the deal is after the 2 years of signing the FTA date. The average number of M&A per year over each of these three periods is shown in Figure (34). The average number of M&A per year before the FTA is close to 10,000 before the FTA, increases to 40,000 during the FTA and falls back to below 20,000 after the FTA. In the case of developed countries the average number of M&A is larger than for developing countries before and during the FTA which is consistent with differences in non-trade related determinants of M&A such as financial sector development. However, the average number of M&A is very similar for both sets of countries. This is also consistnet with catching-up of the service sector and the financial sector in developing countries after liberalization increasing the steady-state level of M&A after the FTA.

The pattern of M&A before, during and after FTA are signed by FTA is shown in Figures 35 and **??**. Most of the FTA that do not match the aggregate pattern (low M&A activity before FTA; high during FTA; low after FTA) involve developing countries, such as Agadir, Chile, China, Gafta, and Pakistan. The temporary nature of the increase in M&A, and therefore their rationalizing role, is most pronounced in cases involving industrialized countries such as Australia, the United States, Nafta and Mexico. These observations are consistent with lower impediments to reallocation in developed countries relative to developing countries and large lags in this reallocation in many developing countries.

The theoretical framework developed, both with oligopolistic competition and monopo-

Figure 33: M&A Relative to FTA Date by Industry

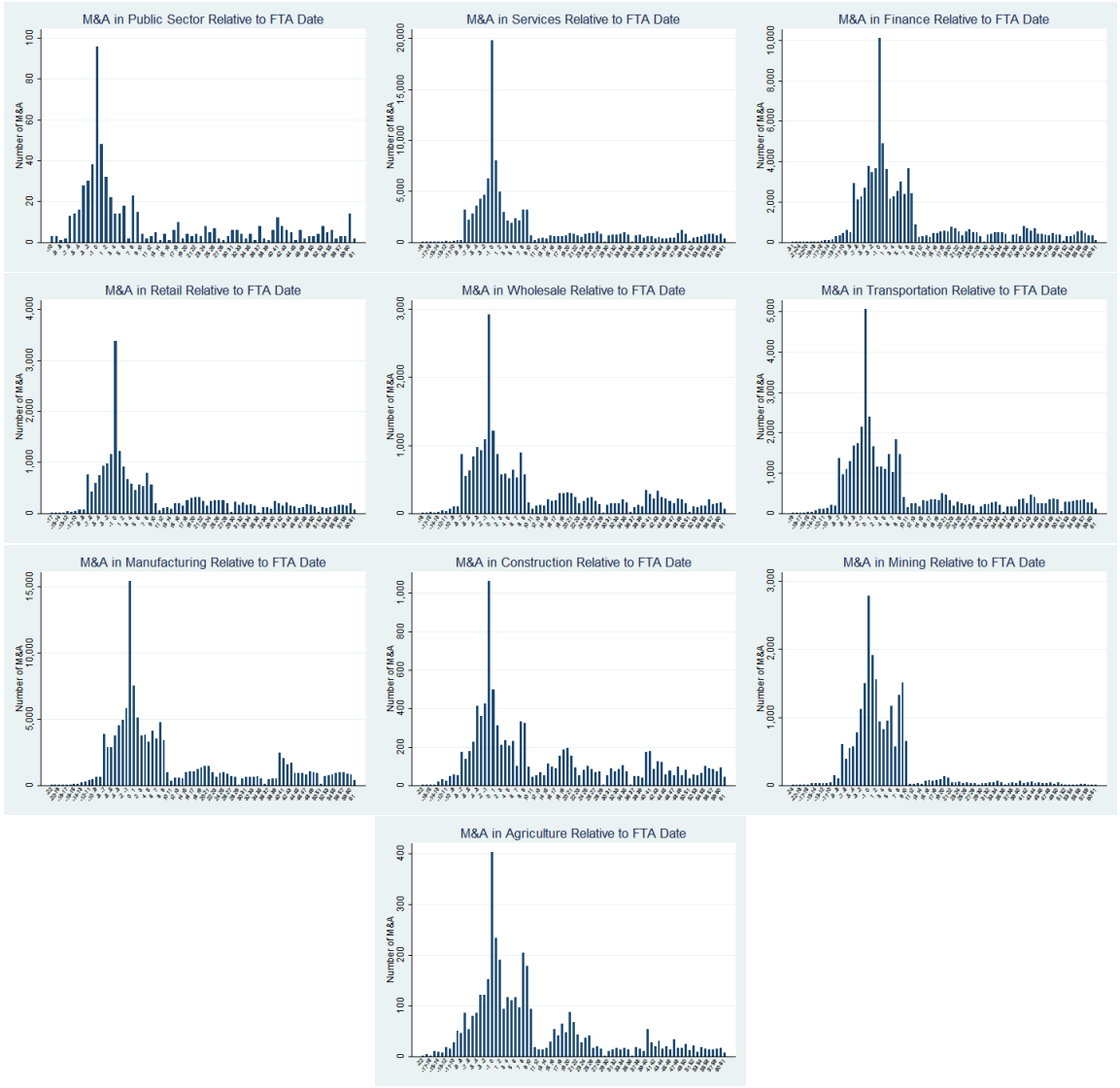


Figure 34: Average M&A per Year Before-During-After FTA Date

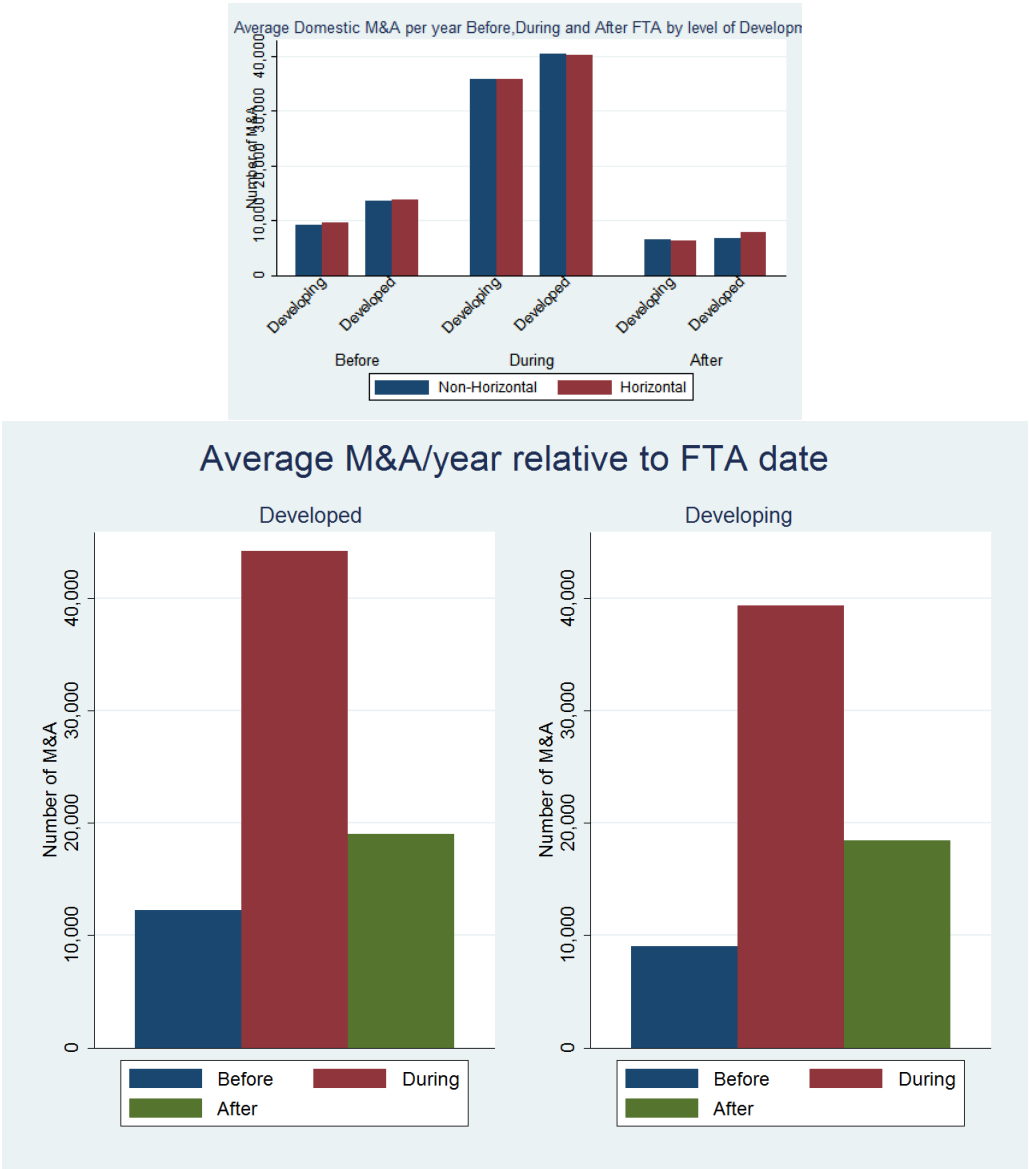


Figure 35: Average M&A per Year Before-During-After FTA Date by FTA

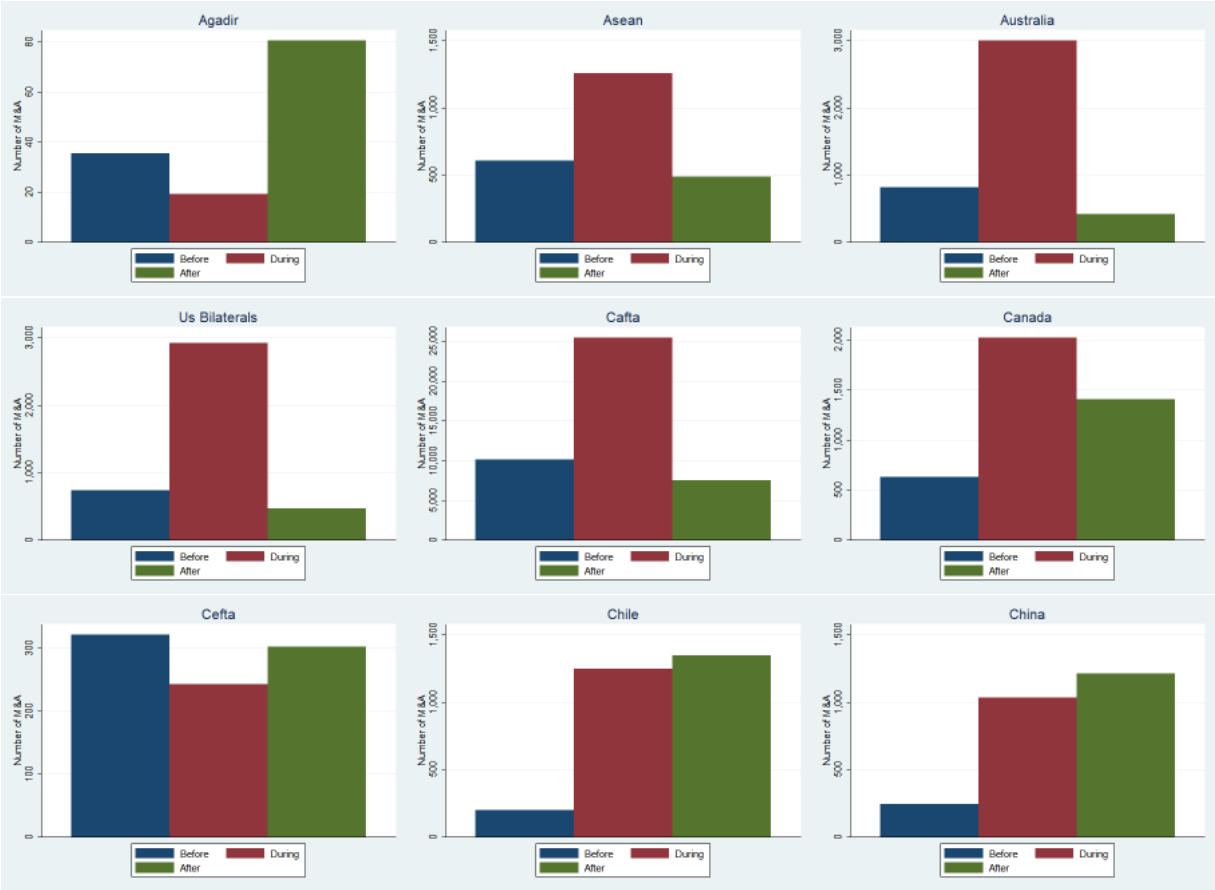


Figure 36: Horizontal and Non-Horizontal M&A By FTA

listic competition, suggests that the increase in M&A reallocates factors of production within the same industry sicne it assumes that factors are sector-specific. This implies that during FTA horizontal M&A should be driving the increase in total M&A. Figures (36) and (**??**) show the total number of horizontal and non-horizontal M&A at the SIC-1 digit level of aggregation for each year relative to the FTA year. Most of the cases where FTA coincide with an increase in horizontal M&A correspond to developed countries such as Austrralia, the United States, Canada, Efta, the EU, and Nafta. Many of the FTA between developing countries have more non-horizontal M&A, such as the case of Agadir, Asean, Chile, Gafta.

5.2 Comparing Targets and Acquirors

The theory presented relies on the idea that firms are heterogeneous and that M&A are a mechanism to redistribute resources between these firms. In this section I document the differences between targets and acquirers and how these differences change for trade-related M&A vs non-trade related M&A. All firm characteristics come from Worldscope and are deflated using country-year GDP deflators. The firm level information incldues net sales, salaries and benefits, R&D, information on discontinued operations, total capital, EBITDA, sales per employee, assets per employee.

The theory predicts that acquirors will be more productive than targets. Productivity tends to be correlated with size in the presence of economies of scale so we should expect acquirors to be larger than targets, on average: smaller firms that have not reached an efficient scale will tend to lose market share as margins fall (model with linear demand), as residual demand contracts for all firms due to import competition, sales of targets should fall and as the more productive firms expand their sales should grow. In this section I document the relationship between acquirors and targets for deals occuring at different years relative to the FTA date. This helps characterize the trade-related M&A with non-trade M&A.

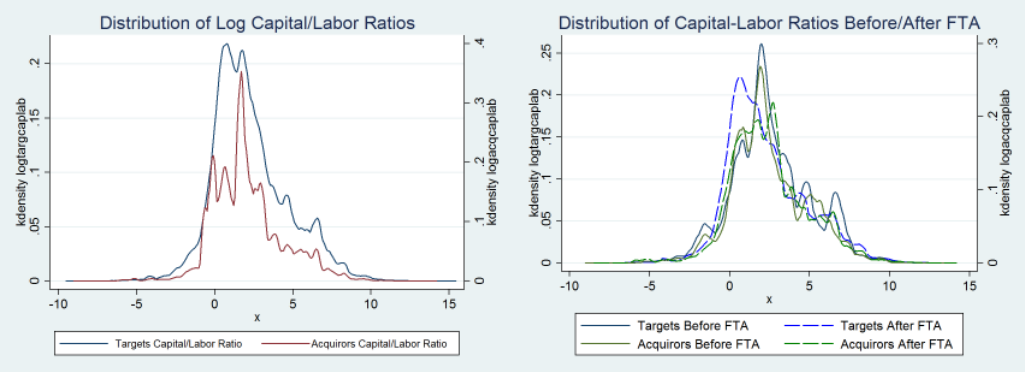
Figure (37) shows the ratio between acquirer and target sales per employee, a measure of productivity, by sector for M&A occuring before and after the FTA. The first graph devides the time period in 3 periods covering the time period before the FTA, the 3 years surrounding the FTA date and the time priod more than 2 years after the FTA. Following the model, my prior was that trade-related FTA would have larger differences between the productivity of targets and acquirors as is the case in agriculture, manufacturing and the public sector. When I divide the time period in equal-length periods before and after the FTA the differences between productivity discrepancies of FTA and non-FTA M&A is largest for agriculture and manufacturing. This evidence is consistent with the mechanisms described in the models: during trade liberalization less productive firms are forced to exit the market

Figure 37: Comparing Targets and Aquirors: Sales and Assets per Employee

and more productive firms grow. The firms that exit and become targets tend to be a lot less productive than the ones that are targets in M&A deals during normal times.

Sales per employee can be affected by capital labor ratios and differences between capital labor ratios between acquirors and targets is suggested both in the corporate finance literature and in the trade literature. In figure (38) I show the distribution of capital/labor ratios between targets and acquirors over the entire sample. Targets are more heterogeneous than acquirors. The second panel shows how the distribution of capital intensity changes for M&A before FTA and after FTA. Firms merging before FTA are a lot more similar in their capital/labor ratios than firms merging after FTA with targets becoming less capital intensive and acquirors becoming more capital intensive. This fact is consistent with the theory of mergers presented with trade-related mergers being motivated by the transfer of resources from less productive to more productive and assuming more productive firms are more capital intensive.

Figure 38: Distribution of Capital-Labor Ratios



The third graph in Figure (37) shows the ratio of acquirer assets per employee to target assets per employee. The graph shows that acquirors always have more assets per employee with a slight increase around the FTA period. The increase in sales per employee during the FTA year is particularly striking and shows that acquirors during trade liberalizations are a lot more productive than acquirors during other periods. Figure (39) shows meaures of firm size. The first graph shows the market capitalization confirming that acquirors tend to be larger than targets. The size difference is also larger for firms engaging in M&A during liberalization periods as shown by the spike in the ratio of market capitalization to close to 40 from lows of below 10 prior to liberalization. Acquirors are also larger as measured by total capital, total assets and propert, plant and equipment and all of these measures diverge more during trade liberalization episodes. The change in these ratios between periods is a lot larger than the market capitalization, though. But the increase in market capitalization of acquirors leading to FTA is consistent with the mechanisms described: the value of assets held by more productive, acquiriring firms increases as they face better prospects than the potential targets. Finally, I show how acquirors are a lot more liquid than targets and how acquirors during FTA are particularly more substantially more liquid than acquirors during non-FTA times. This last observation is an important factor interacting with financial constraints: the more severe these constraints the larger we can expect this ratio to be.

Figure 39: Comparing Targets and Aquirors: Size

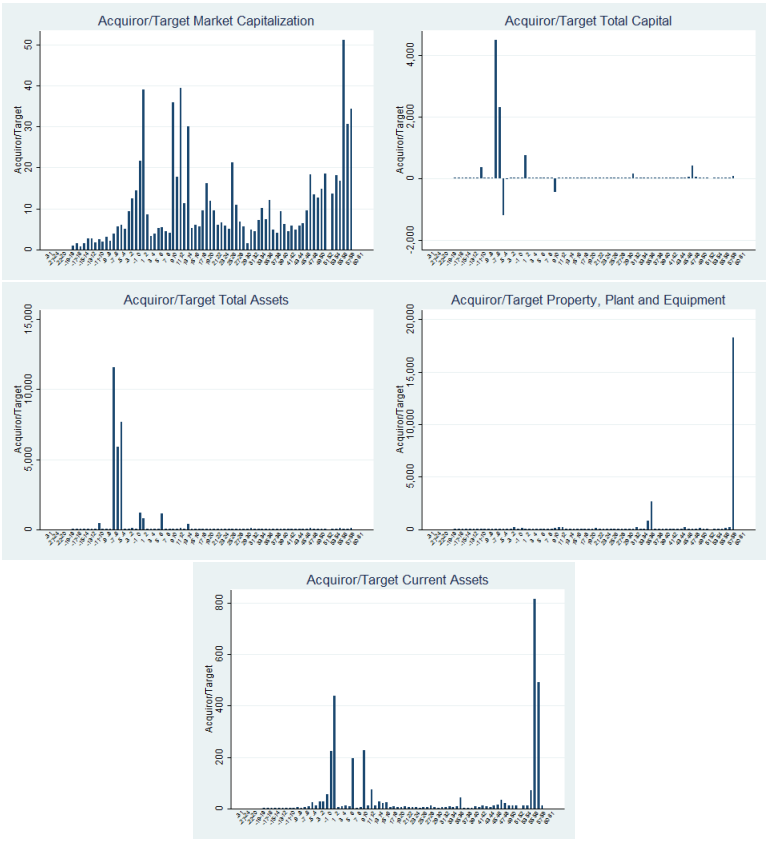


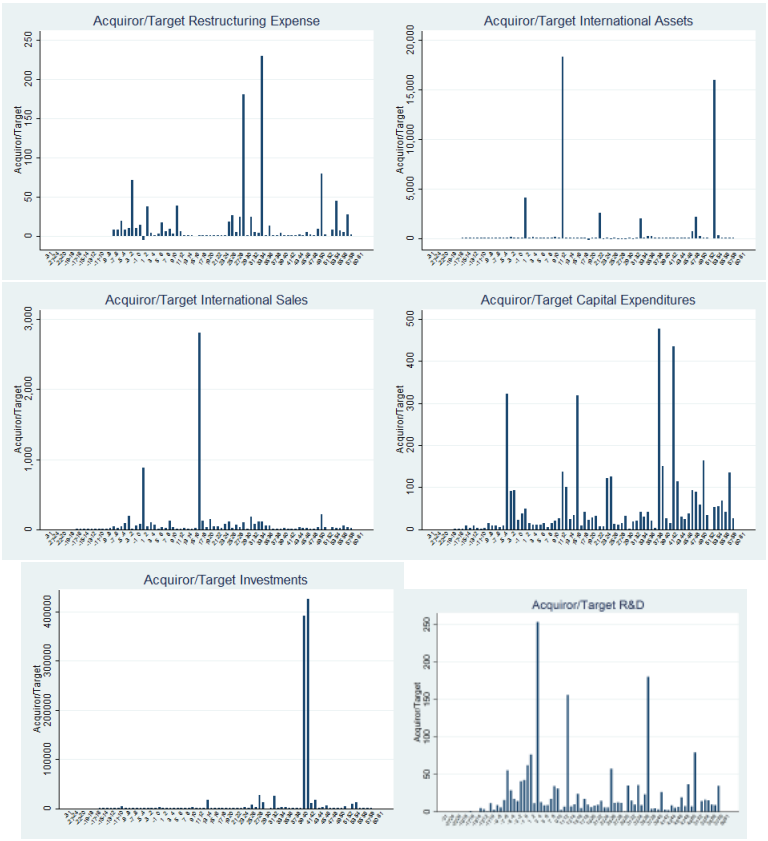
Figure (40) shows comparisons between acquirer and target investments, expenses and international activities. From this figure we see how acquirers spedn more than targets on restructuring but this relationship does not hold the year after an FTA and the difference in this expenditure falls over the two years leading to the FTA. This is consistent with the idea of trade-induced M&A being a restructuring phenomenon and acquiring firms reducing other types of restructuring during trade-liberalization years. Aquiring firms also have more capital expenditures, have more R&D investments and in general invest more than targets. Acquirors are also more active internationally than targets: they own international assets and they have a lot more international sales than targets. Inteerstingly, both international sales and assets are larger than usual fro acquirors the year after an FTA. This is consistent with the mechanisms described in the theory section: firms expanding internationally are more likely to be acquirors in M&A deals in order to increase their capacity as fast as possible and meat foreign demand.

5.3 Firms, Industry Structure and FTA

The theory presented requires several inputs at the firm and industry level. First, to distinguish between the monopolistic and oligopoly models I include variables related with industry structure such as number of firms in an industry, concentration measures such as HHI. Second, the main factor determining the scope of reallocations induced by trade policy is the distribution of productivity: the larger the dispersion, the more scope there should be for efficiency-enhancing reallocations. Another aspect of trade, M&A and productivity is the potential for trade-induced M&A to increase average productivity and reduce the dispersion of productivity. I will present some evidence documenting this effect.

There are many ways of measuring productivity and many econometric issues involved as discussed in Syverson [2010]. I will use the following productivity measures: sales/employee as a measure of labor productivity and TFP estimated as a residual from a regression of

Figure 40: Comparing Targets and Aquirors:Investments and International Sales



a Cobb-Douglass production function (although this specification is a good approximation to more general technologies). In the case of TFP, I will estimate it exploiting the panel structure of the data assuming that the unobserved, firnm-specific productivity is time invariant. I will also control for endogeneity following the methods suggested in Levinsohn and Petrin [2003] (material costs as instruments) and Olley and Pakes [1996] (using investment to proxy for an unobserved time-varying productivity shock, and survival probabilities to correct for selection bias). Although the estimation of productivity poses several econometric challenges, since the input requiered to test the M&A model is the dispersion, as far as the source of bias is common to all firms, this will not be a serious issue. Only the productivity of firms relative to others matters, not the level.

5.3.1 Industry Structure: number of firms, concentration measures

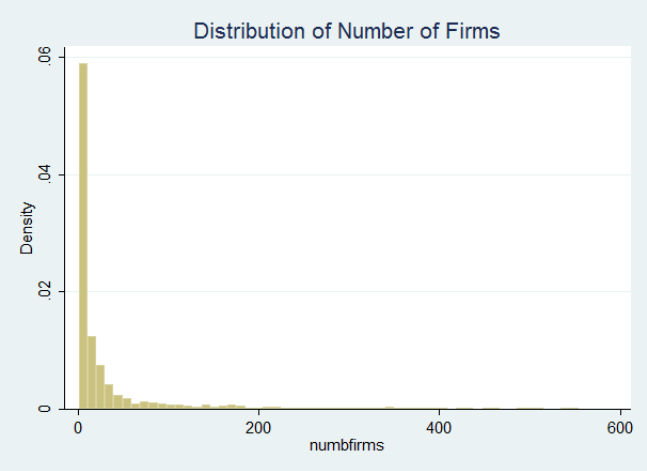
Although the oligopolistic models and the monopolistically competitive models presented share some predictions in terms of the effect of trade on industry restructuring, they also present differences. To include the effect of industry structure on the impact of trade liberalization on M&A I construct, from the Worldscope database, a variables with the number of firms in each country-SIC4-year and the HHI indicating how concentrated the industry is. The range of firms in each cell goes from 1 (97,914 cells) to 554 (554 cells). Figure (41) shows how most country-industry-year cells have very few firms. This can be an indication of an industry with strategic interactions.

To get a sense of the level of concentration in the industry I calculate the HHI index. The HHI index shows that most industries in the sample are not that concentrated.

5.3.2 Sales per employee as a measures of productivity

The first measure of productivity I use is sales per employee. This is a proxy for labor productivity which can be the source of heterogeneity driving selection between firms. Figure

Figure 41: Distribution of Number of firms (Country/Industry/Year)



(42) shows the dispersion of sales per employee over the entire sample for target firms on the left and acquiring firms on the right. Both the median and the dispersion of sales per employee is larger for acquiring firms than for target firms. This heterogeneity suggests that acquirors are on average more productive than targets. The next two panels show the dispersion of sales per employee within division of economic activity and between targets and acquirors. The dispersion of productivity in most sectors is a lot larger during the 5 year window defines as the FTA years (labeled "during"). In all sectors, dispersion falls significantly after the FTA consistent with the idea that the closed economy regime allows more heterogeneous firms to coexist than in the open economy. Also, the dispersion as well as the mean is higher for acquirors than for target firms before and during the FTA and no different after the FTA. These facts all support the idea of productivity heterogeneity being an relevant factor explaining trade-induced M&A.

5.3.3 TFP: fixed effects estimation

Assuming that the only source of heterogeneity that matters is labor productivity is quite restrictive. Specially when the underlying theory refers to capital goods or a composite

Figure 42: Dispersion of Sales/employee for Target and Acquiring firms

production good rather than labor as the sole factor of production. A better measure of firms heterogeneity and one that better matches the theory is total factor productivity (TFP). In the next four subsections I describe the proceedures to estimate TFP from firm-level accounting data correcting for some of the common econometric issues encountered in this type of excercise. For all estimators I deflate all monetary values using country-year GDP deflators from the World Bank. Ideally, one should use industry-specific deflators but I do not have data for all countries in my sample. The measure of output used is net sales or revenues (item 01001 from Worldscope), capital is measured using total capital (item 03998), labor is measured using salaries and benefits (item 01084), internediate inputs are measured using the cost of goods sold (item 01051), investment is measured using total investment (item 02255) and the exit of firms is derived from the inactive date (item 07015). The estimation is done with all firms in the dataset and all countries.

The staring point is the estimation of the production function. Following Syverson [2010] and most of the productivity literature, I assume a Cobb-Douglas production function at the firm level. Although this may seem at odds with the industry structure assumed in the theory, the log-linearized version of these production functions can be though of as linear approximations to more general technologies. The production function is of the form

$$Y_{it} = A_{it} K_{it}^{\alpha} L_{it}^{\beta} M_{it}^{\gamma}$$

Taking logarithms on both sides gives an estimating equation of the form

$$y_{it} = a_{it} + \alpha k_{it} + \beta l_{it} + \gamma m_{it} + \mu_{it}$$

where $\hat{a}_{it} + \hat{\mu}_{it}$ is the estimate of TFP. In estimating this equation I will use the reported measure of total capital and the reported total assets for capital and a measure of labor input derived from total salaries and benefits and total employment. The data has several measures of intermediate inputs which may also be included. The output measure I use is deflated total sales which is an acceptable measure of output. The data is an unbalanced panel of firms from over 70 countries from 1980 to 2009.

The issues when estimating a production function like this via OLS are well known: firms may observe a portion of the productivity shock and adjust inputs accordingly which leads to biased estimates of the coefficients on factors of production; and, there can be selection bias as the sample of firms observed are not a random sample but rather those that have positive productivity shocks and do not exit. If firms with larger capital stocks are less likely to exit following a negative shock, the estimated coefficient on the capital input will be biased downwards. I will discuss solutions for each of these problems and present estimates of productivity and productivity dispersion correcting for each of them. For exposition purposes and to fix ideas I will assume that a_{it} is the part of the productivity shock observed by the firm but not to the econometritian and μ_{it} is the true error term. The first solution will be to estimate the equation using a fixed-effects estimator and the entire panel. The underlying assumption is that $a_{it} = a_i$ is a firm specific attribute which is invariante over time. This estimator only uses the across time variation and the time invariance assumption may be untrue. I will describe the procedures and then present some comparative statistics.

5.3.4 GMM estimators

Another estimator that has been suggested in the literature exploits the stationarity in the series of output, capital and employment and implements a GMM estimator with lags of the dependent variable and all input variables [Blundell and Bond, 1999]. The assumption underlying this procedure is that the productivity shock has both a fixed effect component and a persistence component captured by a serial correlation component. I will consecutively add these assumptions and re-estimate the production function. The objective of using these methods is to solve the endogeneity problem of the OLS estimates using only accounting data from the firms rather than finding an instrument that is correlated with the inputs but not with the productivity shock (Eslava et al. [2009] use exogenous demand shocks to instrument for inputs).

The basic idea of the GMM estimators is that lagged values of the dependent variable are determined in $t-1$ and are therefore uncorrelated with productivity shocks at time t. However, this assumption may fail if there is a long term component to productivity such that,

$$a_{it} = a_i + \mu_{it}$$

To deal with this issue I take first differences of the estimating equation:

$$\Delta y_{it} = \beta \Delta l_{it} + \gamma \Delta m_{it} + \alpha \Delta k_{it} + \mu_{it}$$

Under these assumptions, lags in both levels and differences from $t-2$ onwards are valid instruments. This is my first GMM estimator which I label GMM First Differences.

Another source of correlation between current productivity shocks and past factor inputs can be serial correlation in μ_{it}:

$$\mu_{it} = \rho \mu_{it-1} + \nu_{it}$$

Since

$$y_{it-1} - \beta l_{it-1} - \gamma m_{it-1} - \alpha k_{it-1} - a_i = \mu_{it-1}$$

we can write the production function as

$$y_{it} = a_i(1-\rho) + \rho y_{it-1} + \beta l_{it} + \alpha k_{it} + \gamma m_{it} - \rho\beta l_{it-1} - \rho\alpha k_{it-1} - \rho + \gamma m_{it-1} + \nu_{it}$$

Taking lags to get rid of the fixed effect and using twice lagged values of output to estimate ρ and assuming ν_{it} is uncorrelated with inputs, we arrive at a GMM estimator which includes the dynamics (excluding persistence we have a GMM estimator with no dynamics). The lagged estimating equation is

$$\Delta y_{it} = \rho\Delta y_{it-1} - \beta\Delta l_{it} + \gamma\Delta m_{it} + \alpha\Delta k_{it} - \rho\beta\Delta l_{it-1} + \rho\gamma\Delta m_{it-1} + \rho\alpha\Delta k_{it-1} + \Delta\nu_{it}$$

This leads to a second GMM estimator I call GMM Dynamics since it accounts for serial correlation. I allow ν_{it} to be correlated with inputs and use lags of inputs as instruments.

Blundell and Bond [1999] suggest adding additional restriccions from level equations and estimating a system of GMM equations, one in first differences and one in levels to correct for a bias towards zero of the correlation parameter coming from the correlation of Δy_{it-1} with a_i. The advantage of this procedure is that only modest assumptions are needed. However, we need more time periods per firm and the instruments may be weak. This is the third GMM estimator I use which I call the GMM System Estimator. These GMM estimators also deal well with measurement error in proxy variables.

5.3.5 TFP controling for selection and endogeneity using investment as an instrument

The second method used to estimate the production function and correct for simultaneity and selection is the semi-parametric procedure of Olley and Pakes [1996]. Their suggested estimator uses investment to proxy for the unobserved productivity shock. The two step procedure suggested links current capital stocks with past investment and current investment with current productivity shocks a_{it}. Therefore, current capital is orthogonal to current investment. The capital flow equaion is given by

$$K_{it+1} = (1 - \delta)K_{it} + I_{it}$$

and the optimal investment function, in logarithms, is an unkown monotone function

$$i_{it} = i_t(a_{it}, k_{it})$$

We can therefore solve for the productivity shock observed by the firm by finding the inverse function $h() = i^{-1}$

$$a_{it} = h_t(i_{it}, k_{it})$$

The estimating equation becomes,

$$y_{it} = \alpha k_{it} + \beta l_{it} + \gamma m_{it} + h_t(i_{it}, k_{it}) + \mu_{it}$$

Defining the equation that depend only on capital and investment as

$$\phi(i_{it}, k_{it}) = \alpha k_{it} + h_t(i_{it}, k_{it})$$

we can estimate a first stage equation as

$$y_{it} = \beta l_{it} + \gamma m_{it} + \phi_t(i_{it}, k_{it}) + \mu_{it}$$

where $\phi(i_{it}, k_{it})$ is approximated by a 3rd or 4th order polynomial. This equations gives consistent estimates of $\hat{\beta}$. In the second stage, we need to consistently estimate the coefficient on capital. To do so, we define the function $V_{it} = y_{it} - \hat{\beta} l_{it} - + \hat{\gamma} m_{it}$ and estimate the equation

$$V_{it} = \alpha k_{it} + g_t(\phi_{t-1} - \alpha k_{t-1}) + \mu_{it}$$

where the unknown function $g()$ is approximated by a polynomial function and the entire equation is estimated via nonlinear least squares to take into account the fact that capital appears in the linear and the nonlinear part. This equation gives unbiased estimates of $\hat{\alpha}$ so we can now get unbiased estimates of TFP by firm.

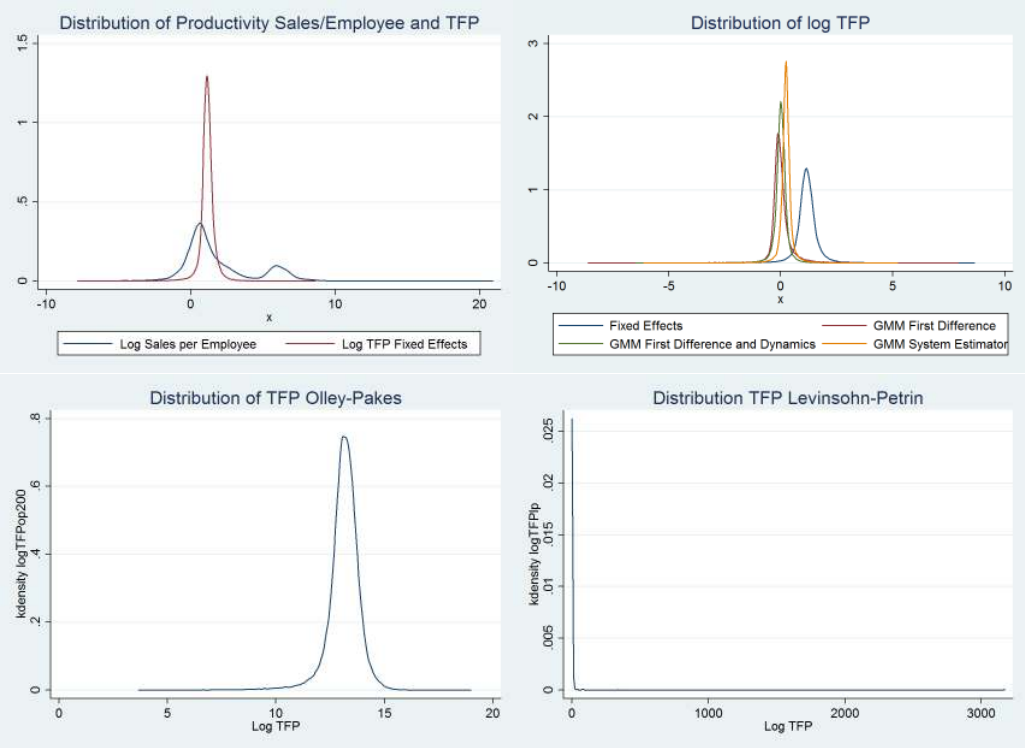
Finally, to control for attrition bias, we first estimate a probit model using the dates firms exit from the sample and include the fitted values of the probability of exiting, $\hat{P}$ into the second stage equation:

$$V_{it} = \alpha k_{it} + g_t(\phi_{t-1} - \alpha k_{t-1}, \hat{P}_{t-1}) + \mu_{it}$$

5.3.6 TFP controling for endogeneity using materials as instruments

Although the procedure suggested by Olley and Pakes [1996] gives unbiased estimates of the parameters of the production function and productivity, if firms have zero investment or if there are missing values for investment, we lose a lot of observations. Another technique in the same spirit as Olley and Pakes [1996] is Levinsohn and Petrin [2003] who suggest using intermediate inputs as proxy rather than investment. In my dataset, there are many more firms with non-zero and non-missing values for intermediate inputs than investment.

Figure 43: Distribution of log TFP Estimations

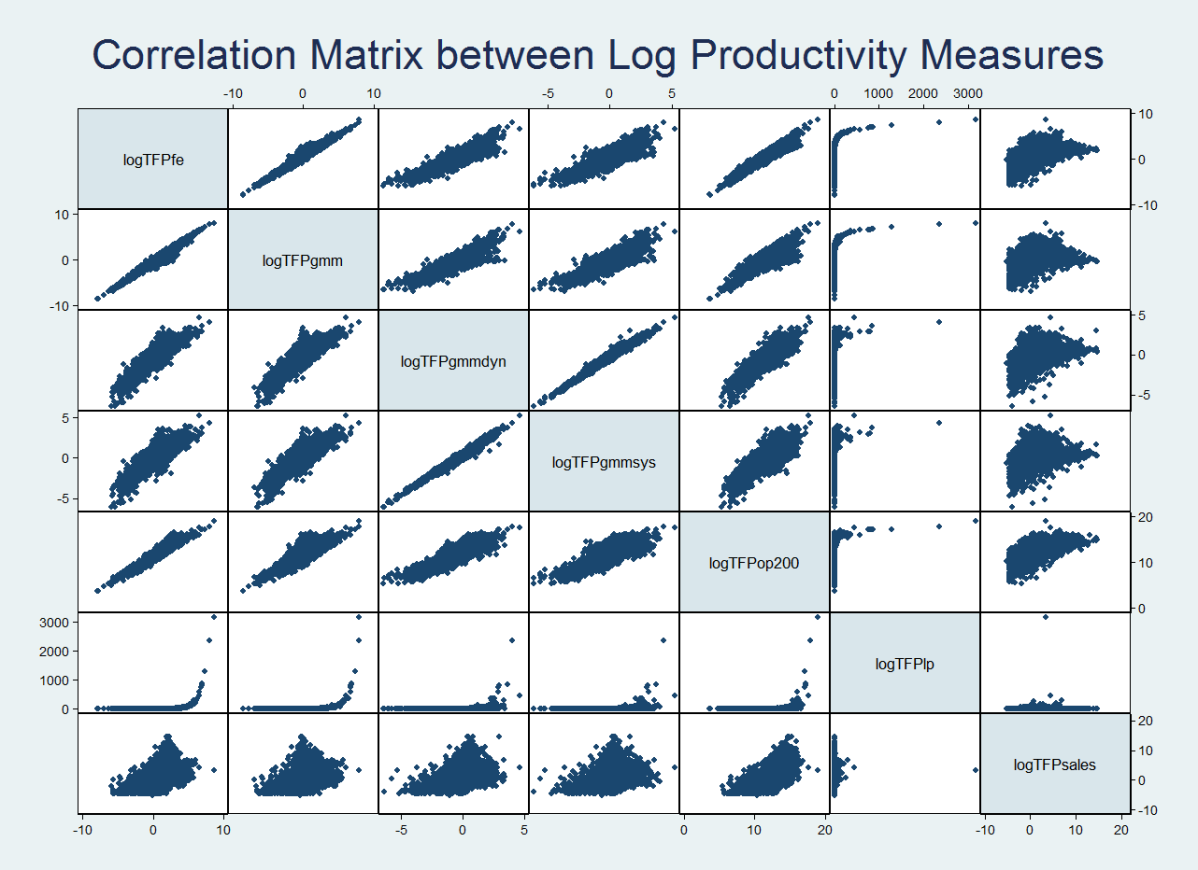


5.3.7 TFP Estimation Results

Figure (43) shows the distribution of log TFP for all methods used. The first panel compares the log of sales per employee, a measure of labor productivity to the fixed effects estimator of TFP. The second panel compares the GMM estimators and the fixed-effects estimator and the last two show the TFP estimators using the Olley-Pakes and the Levinshon-Petrin estimators.

Table (11) and the accompanying graph show the correlation between the different productivity measures. The only measure that does not line-up very well is the Levinsohn-Petrin estimator. This may be beacause the measure used for materials at the firm level is not a good instrument for productivity shocks. Unlike plant-level data with disaggregated expenditures on materials, energy and other inputs, the data set I have is a lot more aggregated and

Table 11: Correlation between log Productivity Measures



subject to accounting conventions that may not always reflect the economic objects needed in the theory. Because of the data requirements of the different estimation techniques the cost of using more sophisticated techniques is less usable observations. The

6 Regression Results

In this section I report the regression results informed by the theory. I use count data methods to model the number of M&A occuring before, during and after the FTA as a function of the variables identified in the closed form solution to the monopolistic competition model. I only use domestic M&A since the theory doesn't tell us anything about cross-

border M&A. I repeat the excercise using different levels of aggregation and taking into account measures of industry structure such as the number of firms to try and distinguish between forms of competition. Table 11 reports the results of a Poisson regression at the most aggregate level in my dataset for tradeable sectors (manufacturing, mining, agriculture) which experience changes in tarrifs following FTA. The technicalities of the estimator are presented in the appendix. I follow the results in the monopolistic competition model to formulate the estimation as a Poisson regression with the number of M&A per division and per period (before, during, after the FTA) and I model the mean of this random variable as a function of the effectively applied tariffs, the preferential tariffs, the dispersion of productivity measures of the size of the industry such as the total capital in the industry and the number of firms, and measures of foreign trade participation. I use exports (International sales) for both the acquirer and the target firms. The theory predicts that the lower the tariffs, the more heterogeneous the industry in terms of productivity and the larger the industry the more M&A we should observe. The mechanism suggested in this paper indicates that the acquirer firm has an incentive to buy a less productive firm if it wishes to expand into the foreign market, so M&A should be positively correlated with acquirer firm sales abroad and negatively correlated with target firm sales. I also include the ratio of foreign trade participation by targets and acquirors. I include a concentration measure also as a proxy for heterogeneity within the industry. I will later test whether the results differ across industries with different degrees of concentration. I run the regressions with different measures of productivity as calculated in the previos section: I use sales/employee as a proxy, a fixed effects estimator, the GMM estimator suggested by Blundell and Bond [1999], the Olley-Pakes estimator correcting for attrition as well as endogeneity and the Levinsohn-Petrin estimator.

The results are presented in terms of incidence rate ratios (IRR) which are easier to interpret than the actual estimated coefficients from the Poisson regressions. The reported

IRR show how by how much as counts increased or decreased by a one unit change in the independent variable.

The results are broadley consistent with the theory. Referring to the first column of Table 11 where I used sales/employee as a measure of productivity, a 1% reduction in effectively applied tariffs increases the number of M&A per year by 0.901. If this is brought about by a fall in preferential tariffs there is an additional increase of 0.957. The larger the industry measured by total capital or number of firms, the more M&A we observe as well: a one firm increase in the industry leads to an additional 1.016 M&A per year as tariffs fall. The more acquirer firms export the more M&A we observe and the more targets export the less M&A we observe. Heterogeneity measured in terms of difference in export participation increases M&A which is consistent with the trade mechanisms discussed in the paper and also with the idea that heterogeneity related to productivity and export participation is what generates industry reallocation through M&A. In this specification, however, the dispersion of productivity measured as the standard deviation of productivity reduces M&A rather than increasing it as expected. Results are robust to the choice of productivity measure both in terms of magnitudes and signs.

I repeat the excercise at different levels of disaggregation. Table 12 reports the results at the finest level of disagreggation in the data, SIC-4 digits. I include the regressions at SIC-1, SIC-2 and SIC-3 digits in the appendix. Using the more disaggregated data allows us to better measure productivity dispersion and to use more observations. The results show again that tariff reductions increase M&A, the size in terms of capital and number of firms also increase M&A, as we found at the most aggregated level. However, now the dispersion of productivity within these more narrowly defined sectors has the largest marginal effect on M&A with between 1.211 and 2.942 additional M&A for every 1 point increase in the standard deviation of productivity. Heterogeneity in terms of participation in the foreign market also has a significant effect on M&A activity although the level of participation is no

Table 12: Determinants of M&A Activity at the Division level

	(1) Sales	(2) FE	(3) GMM_BB	(4) OP	(5) LP
Number of M&A					
Av.Effectively Applied Tariffs	0.901***	0.919***	0.901***	0.919***	0.923***
	(-56.496)	(-51.640)	(-59.628)	(-51.859)	(-49.037)
Av.Preferential Tariffs	0.957***	1.014***	0.989***	1.017***	1.030***
	(-13.691)	(4.080)	(-3.061)	(5.022)	(8.847)
StDev. TFP	0.288***				
	(-71.638)				
Total Capital	1.000***	1.000***	1.000***	1.000***	1.000***
	(32.653)	(92.316)	(76.856)	(91.990)	(100.055)
Number of Firms	1.016***	1.007***	1.008***	1.007***	1.004***
	(92.499)	(48.911)	(48.733)	(52.155)	(37.484)
Target Intl Sales	1.000***	1.000***	1.000***	1.000***	1.000***
	(-37.806)	(-26.953)	(-30.970)	(-26.415)	(-24.486)
Acquiror Intl Sales	1.000***	1.000***	1.000***	1.000***	1.000**
	(15.548)	(3.920)	(7.972)	(3.437)	(2.014)
Targ/Acq Intl Sales	1.000***	1.000***	1.000	1.000***	1.000***
	(18.782)	(-8.641)	(0.288)	(-8.207)	(-9.326)
StDev. TFP		0.926***			
		(-11.030)			
StDev. TFP			0.722***		
			(-34.240)		
StDev. TFP				0.896***	
				(-16.172)	
StDev. TFP					1.184***
					(63.218)
Observations	52	42	36	42	42
Log-Likelihood	-75997.345	-69562.640	-64141.039	-69491.581	-67819.401
Log-likelihood null	-97895.546	-88108.134	-84406.625	-88108.134	-88108.134
Prob chi2	43796.401	37090.988	40531.171	37233.106	40577.467
Pseudo R^2	0.224	0.210	0.240	0.211	0.230

Exponentiated coefficients; z statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

longer significant.

Adding fixed effects for countries and industries yields the results in Table 13. The signs and magnitudes of the coefficients do not change much.

The effect of changes in tariffs may be heterogeneous along productivity and industry structure. Table 13 shows regressions using the GMM Blundell and Bond [1999] estimator at the SIC 4 digit level of aggregation and including interaction terms between the change in preferential tariffs and standard deviation of productivity; between number of firms and change in tariffs and between concentration and productivity.

The results show that the larger the productivity dispersion the larger the impact of a fall in tariffs on M&A activity. Each additional point in productivity dispersion results in an additional 0.756 merger per year besides the initial 0.997. Similarly, interacting the number of firms also shows that the larger the number of firms the more of an impact changes in tariffs have. These results are intuitive: the scope for efficient reallocations of factors of production between firms is larger the more heterogeneous firms are and the more of them there are. They also show the effect of trade in reducing the number of firms significantly with this effect eing larger the more firms there are to start with.

Table 14 shows separate estimates depending on industry structure. I divide the sample in three groups depending on the number of firms: 1 or 2 firms, between 3-5 firms and more than 5 firms. I call them Monopoly-Duopoly, Oligopoly and Competition respectively. The first thing we see is that there is no significant effect of changes in effectifely applied tariffs on M&A for the first two categories. Changes in tariffs only have an impact in industries with more than 5 firms. Changes in preferential tariffs, though, do have an impact on very concentrated industries or in very competitive ones (as defined by number of firms). This is consistent with the oligopoly model presented with M&A occuring preemptively to change industry structure and deter foreign entry. In this case, the theory tells us that M&A occur without any change in trade flows. Indeed, for monoply and duopoly markets, changes in

Table 13: Determinants of M&A Activity at the SIC4 level

	(1) Sales	(2) FE	(3) GMM_BB	(4) OP	(5) LP
Number of M&A					
Av.Effectively Applied Tariffs	0.929***	0.935***	0.978***	0.935***	0.933***
	(-21.652)	(-21.082)	(-7.941)	(-21.040)	(-21.290)
Av.Preferential Tariffs	0.966***	0.890***	0.928***	0.890***	0.896***
	(-5.616)	(-16.985)	(-12.068)	(-17.088)	(-15.709)
StDev. TFP	1.392***				
	(32.045)				
Total Capital	1.000***	1.000***	1.000***	1.000***	1.000***
	(7.473)	(7.387)	(9.321)	(7.880)	(6.549)
Number of Firms	1.015***	1.012***	1.012***	1.012***	1.011***
	(205.208)	(127.374)	(101.927)	(136.117)	(113.415)
Target Intl Sales	1.000*	1.000***	1.000	1.000***	1.000***
	(-1.866)	(-4.579)	(0.147)	(-5.011)	(-4.073)
Acquiror Intl Sales	1.000	1.000*	1.000	1.000**	1.000
	(-0.360)	(1.781)	(-1.115)	(2.215)	(1.381)
Targ/Acq Intl Sales	1.000***	1.000***	1.000***	1.000***	1.000***
	(-4.361)	(-4.501)	(-3.752)	(-4.448)	(-4.856)
StDev. TFP		1.403***			
		(31.311)			
StDev. TFP			2.942***		
			(85.521)		
StDev. TFP				1.344***	
				(31.633)	
StDev. TFP					1.211***
					(44.671)
Observations	887	200	159	200	200
Log-Likelihood	-21683.211	-9669.852	-4908.884	-9667.410	-9285.717
Log-likelihood null	-38381.450	-22043.925	-17982.414	-22043.925	-22043.925
Prob chi2	33396.478	24748.146	26147.060	24753.030	25516.416
Pseudo R^2	0.435	0.561	0.727	0.561	0.579

Exponentiated coefficients; z statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 14: Determinants of M&A Activity at the SIC4 level with fixed effects

	(1) Sales	(2) FE	(3) GMM_BB	(4) OP	(5) LP
Number of M&A					
Av.Effectively Applied Tariffs	0.897***	0.972***	0.966***	0.970***	0.972***
	(-21.652)	(-21.082)	(-7.941)	(-21.040)	(-21.290)
Av.Preferential Tariffs	0.966***	0.890***	0.928***	0.890***	0.896***
	(0.00515)	(0.00695)	(0.00803)	(0.00694)	(0.00700)
StDev. TFP	1.384***				
	(0.0296)				
Total Capital	1.000***	1.000***	1.000***	1.000***	1.000***
	(3.46e-07)	(4.56e-07)	(4.97e-07)	(4.56e-07)	(4.55e-07)
Number of Firms	1.011***	1.008***	1.006***	1.008***	1.009***
	(0.000266)	(0.000325)	(0.000405)	(0.000324)	(0.000358)
Target Intl Sales	1.000*	1.000***	1.000***	1.000***	1.000***
	(8.07e-07)	(1.60e-06)	(1.82e-06)	(1.60e-06)	(1.60e-06)
Acquiror Intl Sales	1.000	1.000***	1.000***	1.000***	1.000***
	(6.87e-07)	(1.33e-06)	(1.51e-06)	(1.34e-06)	(1.33e-06)
Targ/Acq Intl Sales	1.000***	1.000***	0.998	1.000***	1.000**
	(4.93e-05)	(5.32e-05)	(0.00722)	(5.33e-05)	(5.29e-05)
StDev. TFP		1.403***			
		(31.311)			
StDev. TFP			2.942***		
			(85.521)		
StDev. TFP				1.344***	
				(31.633)	
StDev. TFP					1.211***
					(44.671)
Observations	884	200	159	200	200
Log-Likelihood	-21683.211	-9669.852	-4908.884	-9667.410	-9285.717
Log-likelihood null	-38381.450	-22043.925	-17982.414	-22043.925	-22043.925
Prob chi2	33396.478	24748.146	26147.060	24753.030	25516.416
Pseudo R^2	0.435	0.561	0.727	0.561	0.579

Exponentiated coefficients; z statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 15: Determinants of M&A Activity at the SIC4 level with Hetergoeneous Effects

	(1) Productivity_Tariffs	(2) Firms_Tariffs
Number of M&A		
Av.Effectively Applied Tariffs	0.968***	0.979***
	(-10.333)	(-7.711)
Av.Preferential Tariffs	0.996	0.849***
	(-0.550)	(-19.627)
Interaction Tariffs Productivity	0.756***	
	(-16.518)	
StDev. TFP	3.194***	2.913***
	(89.433)	(85.038)
Total Capital	1.000***	1.000***
	(9.561)	(9.779)
Number of Firms	1.012***	1.012***
	(95.159)	(96.636)
Target Intl Sales	1.000	1.000
	(-0.565)	(-0.648)
Acquiror Intl Sales	1.000	1.000
	(-0.811)	(-0.593)
Targ/Acq Intl Sales	1.000***	1.000***
	(-3.822)	(-3.296)
Interaction Tariffs Number of Firms		1.004***
		(22.874)
Observations	159	159
Log-Likelihood	-4660.825	-4696.085
Log-likelihood null	-17982.414	-17982.414
Prob chi2	26643.178	26572.658
Pseudo R^2	0.741	0.739

Exponentiated coefficients; z statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

trade flow do not lead to M&A and the heterogeneity in trade status has no impact on M&A during liberalization. Trade flows do matter for oligopoly and more competitive models. This table, therefore, validates the distinction made between oligopoly models and monopolistically competitive models to study the effect of trade on M&A activity. Finally, the dispersion of productivity increases M&A for competitive industries but not for monopolistic structures, and it actually reduces trade-induced M&A for industries with between 3-5 firms.

So far we have tested the models with data from tradeable sectors such as manufacturing, agriculture and mining. However, we saw in the graphical analysis how M&A activity in response to FTA is not explusive of the traditionally tradeable sectors. Although some reallocation may be driven by non-trade related reforms introduced through FTA, there may also be an effect via trade as service sectors, such as financial services, cater to the restructured tradeing sectors.

To test this hypothesis I match average tariff changes in the tradeable sector per country to the non-tradeable sectors and run the same specification as I did with the tradeable sector. Table 15 shows the results using the different measures of firm productivity. First, se see that for all specification lower preferential tariffs have a significant effect on M&A activity in non-tradeable sectors. Size of the industry as measured by number of firms and by total capital increase M&A. Although many of these sectors are traditionally non-tradeable and do not face tariffs, we see that they actually engage in trade and the signs are as expected: as international sales of acquiring firms increase M&A increase and the opposite is true for targets. This is consistent with acquiring firms expanding into foreign markets. Finally, the more heterogeneous a sector is, the more scope there is for reallocations given an FTA and the more M&A we observe.

The graphical analysis suggested that trade generated more M&A in developed rather than developing countries. The first column pools all the data but additionally shows that

Table 16: Determinants of M&A Activity at the SIC4 level Oligopoly vs Competition

	(1) Monopoly_Duopoly	(2) Oligopoly	(3) Competition
Number of M&A			
Av.Effectively Applied Tariffs	0.993	0.991	0.962***
	(-0.450)	(-1.264)	(-10.733)
Av.Preferential Tariffs	0.877***	1.014	0.950***
	(-3.527)	(1.505)	(-7.017)
StDev. TFP	3.120	0.152***	2.476***
	(1.633)	(-4.394)	(66.374)
Total Capital	1.000	1.000***	1.000***
	(0.112)	(3.075)	(6.291)
Number of Firms	1.620***	1.092*	1.009***
	(3.317)	(1.734)	(69.939)
Target Intl Sales	1.000	1.000**	1.000***
	(1.477)	(-2.450)	(-4.570)
Acquiror Intl Sales	1.000*	1.000***	1.000
	(-1.769)	(4.630)	(-1.108)
Targ/Acq Intl Sales	1.000	0.991***	0.942***
	(-0.897)	(-2.994)	(-11.917)
Observations	45	43	70
Log-Likelihood	-183.567	-241.980	-3192.005
Log-likelihood null	-232.852	-295.390	-12378.974
Prob chi2	98.571	106.820	18373.939
Pseudo R^2	0.212	0.181	0.742

Exponentiated coefficients; z statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 17: Determinants of M&A Activity at the SIC4 level Non-Tradeables

	(1) Sales	(2) FE	(3) GMM_BB	(4) OP	(5) LP
Number of M&A					
Av.Effectively Applied Tariffs	0.998	1.031***	1.026***	1.031***	1.029***
	(-0.747)	(12.368)	(8.901)	(12.177)	(11.272)
Av.Preferential Tariffs	0.870***	0.786***	0.807***	0.786***	0.791***
	(-29.587)	(-49.458)	(-37.504)	(-49.138)	(-48.214)
StDev. TFP	1.507***				
	(79.541)				
Total Capital	1.000***	1.000***	1.000***	1.000***	1.000***
	(30.586)	(52.307)	(56.897)	(53.688)	(54.623)
Number of Firms	1.012***	1.011***	1.012***	1.011***	1.011***
	(495.427)	(366.279)	(365.230)	(367.093)	(382.700)
Target Intl Sales	1.000***	1.000***	1.000***	1.000***	1.000***
	(-5.431)	(-11.054)	(-6.146)	(-11.158)	(-10.934)
Acquiror Intl Sales	1.000***	1.000***	1.000	1.000***	1.000**
	(-11.124)	(2.700)	(0.040)	(2.615)	(2.567)
Targ/Acq Intl Sales	1.000***	1.000***	1.000***	1.000***	1.000***
	(-6.593)	(19.304)	(20.746)	(19.256)	(18.988)
StDev. TFP		1.091***			
		(9.736)			
StDev. TFP			1.421***		
			(21.924)		
StDev. TFP				1.062***	
				(6.695)	
StDev. TFP					1.008***
					(8.379)
Observations	1272	529	429	529	529
Log-Likelihood	-74482.496	-39377.385	-32142.120	-39401.362	-39391.336
Log-likelihood null	-144611.617	-91834.819	-80793.970	-91834.819	-91834.819
Prob chi2	140258.242	104914.868	97303.700	104866.913	104886.965
Pseudo R^2	0.485	0.571	0.602	0.571	0.571

Exponentiated coefficients; z statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

indeed developed countries have a lot more M&A than developing countries. The next two columns show separate estimations for Developed and for Developing country pairs. A fall in preferential tariffs has a larger effect in developing countries than in developed countries. The dispersion of productivity has almost 3 times as large an impact in developed as compared to developing countries. This is consistent with the large literature on missalocations and micro frictions in developing countries that serve as impediments to reallocations (see Hsieh and Klenow [2007]).

Table 17 shows the differences between FTA that cover only goods and those that cover both goods and services. Changes in tariffs have a larger impact on goods only agreeements and the marginal effect of changes in tariffs is larger for goods only agreements than for agreements covering both sectors. These results are surprising.

Finally, the theory presented and the graphical evidence suggests that horizontal M&A defined as those between two firms in the same sector, increase more than non-horizontal M&A during FTA. The rationale is that trade-induced M&A are driven by the reallocation of sector-specific assets between firms. Therefore, they we should observe more horizontal trade-related M&A than non-horizontal. Table 18 shows that we have more horizontal M&A than non-horizontal. However, the marginal effect of a fall in tariffs increases non-horizontal mergers by more than horizontal ones. On the other hand, the dispersion of productivity increases M&A more for horizontal M&A which is consistent with the idea of sector-specific assets being transfered between firms of different productivities when tariffs are reduced.

As a robustness test, I run the same Poisson regression individually for some of the FTA in my database. I report results for Asean and Japan Bilaterals for manufacturing sectors. The size of the coefficients and the sign correspond with the aggregate estimates with a 1% fall in tariffs resulting in 0.9 additional M&A per year. However, in these two cases, the only other statistically significant variables are the size of the industry measured by capital and number of firms.

Table 18: Determinants of M&A Activity at the SIC4 level Developed-Developing

	(1) All	(2) Developed	(3) Developing
Number of M&A			
Av.Effectively Applied Tariffs	0.997	1.269***	1.005*
	(-1.214)	(7.021)	(1.791)
Av.Preferential Tariffs	0.969***	0.596***	0.992*
	(-5.942)	(-6.252)	(-1.654)
StDev. TFP	3.356***	3.008***	1.393***
	(90.922)	(59.249)	(11.235)
Total Capital	1.000***	1.000***	1.000***
	(-3.157)	(3.807)	(7.296)
Number of Firms	1.008***	1.007***	1.043***
	(56.467)	(41.436)	(59.610)
Target Intl Sales	1.000***	1.000	1.000
	(3.312)	(-0.817)	(0.951)
Acquiror Intl Sales	1.000***	1.000***	1.000
	(-4.336)	(-12.746)	(-1.304)
Targ/Acq Intl Sales	1.000***	0.974***	1.000
	(-3.084)	(-2.989)	(-1.312)
1 Both firms in Developed Countries	3.645***		
	(45.423)		
Observations	159	30	129
Log-Likelihood	-3865.437	-1766.485	-674.016
Log-likelihood null	-17982.414	-7082.696	-5484.622
Prob chi2	28233.954	10632.422	9621.213
Pseudo R^2	0.785	0.751	0.877

Exponentiated coefficients; z statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 19: Determinants of M&A Activity at the SIC4 level by Coverage

	(1) All	(2) Goods	(3) Goods_Services
Number of M&A			
Av.Effectively Applied Tariffs	0.971***	1.010*	0.991
	(-8.605)	(1.919)	(-1.393)
Av.Preferential Tariffs	0.928***	0.998	0.743***
	(-12.073)	(-0.322)	(-23.557)
StDev. TFP	2.938***	1.185	2.902***
	(85.373)	(0.387)	(82.656)
Total Capital	1.000***	1.000	1.000***
	(10.071)	(-1.079)	(9.101)
Number of Firms	1.012***	1.041***	1.011***
	(101.891)	(19.816)	(89.672)
Target Intl Sales	1.000	1.000	1.000
	(-0.402)	(-0.071)	(-1.253)
Acquiror Intl Sales	1.000	1.000	1.000
	(-0.924)	(-0.196)	(0.087)
Targ/Acq Intl Sales	1.000***	0.998	1.000***
	(-3.709)	(-0.785)	(-2.737)
1 if only Goods Agreement 0 if Goods and Services	1.261***		
	(3.934)		
Observations	159	28	131
Log-Likelihood	-4903.923	-90.327	-4276.623
Log-likelihood null	-17982.414	-297.822	-17025.612
Prob chi2	26156.983	414.990	25497.979
Pseudo R^2	0.727	0.697	0.749

Exponentiated coefficients; z statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 20: Determinants of M&A Activity Horizontal and Non-Horizontal

	(1) All	(2) Horizontal	(3) Non_Horizontal
Number of M&A			
Av.Effectively Applied Tariffs	0.980***	0.963***	0.981***
	(-5.998)	(-6.123)	(-4.782)
Av.Preferential Tariffs	0.919***	0.918***	0.963***
	(-12.708)	(-7.757)	(-4.608)
StDev. TFP	2.718***	2.852***	2.390***
	(78.903)	(68.920)	(35.382)
Total Capital	1.000***	1.000***	1.000***
	(7.414)	(5.600)	(3.748)
Number of Firms	1.011***	1.011***	1.010***
	(89.801)	(71.790)	(48.181)
Target Intl Sales	1.000**	1.000***	1.000
	(-1.991)	(-2.655)	(-0.553)
Acquiror Intl Sales	1.000	1.000	1.000***
	(-0.198)	(1.407)	(3.737)
Targ/Acq Intl Sales	1.000**	0.973***	1.000***
	(-2.375)	(-7.446)	(-2.730)
1(horizontal) if targsic1=acqsic1	1.899***		
	(29.524)		
Observations	217	113	104
Log-Likelihood	-4444.683	-2863.916	-1394.725
Log-likelihood null	-16118.706	-11652.095	-4048.025
Prob chi2	23348.046	17576.357	5306.600
Pseudo R^2	0.724	0.754	0.655

Exponentiated coefficients; z statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 21: Determinants of M&A Activity at the SIC4 level Asean

	(1) ftaasean
Number of M&A	
Av.Effectively Applied Tariffs	0.934**
	(-2.082)
Av.Preferential Tariffs	1.075***
	(2.754)
StDev. TFP	0.332
	(-0.479)
Total Capital	1.000***
	(4.080)
Number of Firms	1.062***
	(4.086)
Target Intl Sales	1.000
	(-0.391)
Acquiror Intl Sales	1.000
	(0.330)
Targ/Acq Intl Sales	1.007
	(0.675)
Observations	76
Log-Likelihood	-154.550
Log-likelihood null	-406.334
Prob chi2	503.568
Pseudo R^2	0.620

Exponentiated coefficients; z statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 22: Determinants of M&A Activity at the SIC4 level Japan

	(1) ftajapan
Number of M&A	
Av.Effectively Applied Tariffs	0.934**
	(-2.082)
Av.Preferential Tariffs	1.075***
	(2.754)
StDev. TFP	0.332
	(-0.479)
Total Capital	1.000***
	(4.080)
Number of Firms	1.062***
	(4.086)
Target Intl Sales	1.000
	(-0.391)
Acquiror Intl Sales	1.000
	(0.330)
Targ/Acq Intl Sales	1.007
	(0.675)
Observations	77
Log-Likelihood	-156.629
Log-likelihood null	-408.460
Prob chi2	503.662
Pseudo R^2	0.617

Exponentiated coefficients; z statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The last robustness test I do is to consider the possibility of tariff endogeneity. This may particularly be an issue in very concentrated industries where few firms can effectively lobby the government over trade policy. If the larger, more productive firms, for instance, know that trade liberalization will drive competitors out of the market and allow them to expand cheaply into the exporting sector, then they could lobby for a larger tariff reduction. The coefficient on the effect of tariffs on M&A would be biased up.

To try and address this problem, I construct instruments for all tariff measures using the average tariff in all other similar countries and in the same SIC4 sector. Since tariffs are correlated across similar countries as reported in the data section, but tariffs in different countries respond to different political economy processes, this seems like a natural instrument. Table 22 shows the correlation between the individual country/sector tariffs and the instrument.

Table 23: Cross-correlation table

Variables	Effectively Applied Rate	IV Effectively Applied Rate	Preferential Rate	IV Preferential Rate
Effectively Applied Rate	1.000			
IV Effectively Applied Rate	0.867	1.000		
Preferential Rate	0.925	0.781	1.000	
IV Preferential Rate	0.632	0.798	0.929	1.000

I estimate the main results at the SIC-4 level and the results dividing the sample according to the number of firms.The aggregate results do not show substantial differences in the magnitude of the estimated coefficient for instrumented tariffs. If anything they are higher than the estimated coefficients without instrumenting. This would be consistent with a traditional political economy model where firms lobby the government for protection. Using the tariffs agreed thrugh the political economy process there can be endogeneity in the sense that sectors more vulnerable to reorganization and restructuring would also be those lobbying the strongest for smaller changes in tariffs.

Since it is reasonable to suspect that endogeneity of tariffs is more of an issue in more concentrated markets, I report instrumental variable regressions dividing the sample accord-

Table 24: Determinants of M&A Activity at the SIC4 level-IV Regressions

	(1) Sales	(2) FE	(3) GMM_BB	(4) OP	(5) LP
Number of M&A					
Av.Effectively Applied Tariffs	0.955***	0.956***	0.983*	0.956***	0.957***
	(-3.845)	(-3.326)	(-1.670)	(-3.331)	(-3.272)
Av.Preferential Tariffs	0.999	0.993	0.992	0.993	0.993
	(-0.059)	(-0.353)	(-0.493)	(-0.359)	(-0.341)
StDev. TFP	1.189*				
	(1.818)				
Total Capital	1.000*	1.000	1.000**	1.000	1.000
	(1.955)	(1.608)	(2.431)	(1.586)	(1.618)
Number of Firms	1.053***	1.043***	1.042***	1.044***	1.042***
	(8.947)	(5.464)	(5.694)	(5.511)	(5.263)
Target Intl Sales	1.000	1.000	1.000	1.000	1.000
	(-0.835)	(0.356)	(0.518)	(0.355)	(0.360)
Acquiror Intl Sales	1.000	1.000	1.000	1.000	1.000
	(0.609)	(-0.641)	(-0.703)	(-0.638)	(-0.648)
Targ/Acq Intl Sales	1.000***	1.000***	1.000***	1.000***	1.000***
	(-13.050)	(-5.963)	(-7.240)	(-5.964)	(-7.273)
StDev. TFP		1.248			
		(1.407)			
StDev. TFP			1.220		
			(0.819)		
StDev. TFP				1.171	
				(1.303)	
StDev. TFP					1.203
					(1.052)
Observations	887	200	159	200	200

Exponentiated coefficients; z statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

ing to the number of firms (1-2, 3-5, 6 and more). Table 24 shows the results. Compared with Table 15 reporting the estimates without instrumenting, we see that the estimatd coefficient on effectively applied tariffs falls for both concentrated market structures but increases for the more competitive ones. This suggests an upward bias of the estimate without instrumenting consistent with the hypothesis thar firms foreseeing entry may have lobbied for more aggressive tariff cuts: the sectors more prone to M&A activity were also those that had larger tariff cuts. However, preferential tariff coefficients go up for all cases.

The structure of the data suggests that a multilevel model could capture dependence among counts within natural clusters. To allow for this possibility, I estimate a multilevel random-intercept Poisson model with two levels, the industry and the country. These two levels seem the most natural definition of clsuters. Table 25 reports the reults. These estimates do not differ much from the pooled regressions ignoring the possibility of random effects at the two suggested levels.

Table 25: Determinants of M&A Activity at the SIC4 level Oligopoly vs Competition–IV Regressions

	(1) Monopoly_Duopoly	(2) Oligopoly	(3) Competition
Number of M&A			
Av.Effectively Applied Tariffs	0.954**	0.977	0.986
	(-1.993)	(-0.969)	(-1.269)
Av.Preferential Tariffs	0.966	1.022	0.993
	(-0.872)	(0.704)	(-0.514)
StDev. TFP	6.668	0.277**	1.340
	(0.878)	(-2.192)	(1.231)
Total Capital	1.000	1.000	1.000
	(0.818)	(1.078)	(1.050)
Number of Firms	1.491	1.085	1.031***
	(1.223)	(0.683)	(4.425)
Target Intl Sales	1.000	1.000	1.000
	(0.699)	(-0.682)	(-0.076)
Acquiror Intl Sales	1.000	1.000	1.000
	(-0.995)	(1.266)	(-0.676)
Targ/Acq Intl Sales	1.000**	0.993*	0.994**
	(-2.560)	(-1.682)	(-2.322)
Observations	45	43	70

Exponentiated coefficients; z statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 26: Determinants of M&A Activity SIC4: Multilevel Regressions

	(1) Multilevel
Nu(count) yeardeal mber of M&A	
Av.Effectively Applied Tariffs	0.983**
	(-2.548)
Av.Preferential Tariffs	1.011
	(0.796)
StDev. TFP GMM	1.557***
	(32.019)
Total Capital	1.000***
	(-24.391)
Number of Firms	1.003***
	(17.884)
Target Intl Sales	1.000
	(-1.353)
Acquiror Intl Sales	1.000
	(0.483)
Targ/Acq Intl Sales	1.000**
	(-2.236)
Observations	159
Log-Likelihood	-716.158
Log-likelihood null	
Prob chi2	
Pseudo R^2	

Exponentiated coefficients; z statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

7 Conclusions

In this thesis I have explored the effect of trade liberalization, and in particular bilateral trade liberalization, on M&A activity. Using a database combining trade policy variables, trade data, M&A data and firm level data, I have estimated the reduced form of a structural model following Melitz [2003] and contrasted the results with those suggested by oligopoly models. The main idea derived from the theory, is that although simple Cournot Competition models would suggest that M&A activity would fall following trade liberalization, once we introduce firm heterogeneity, M&A are not only used as a mechanism to concentrate market power but rather as a way to reallocate productive assets. The idea that trade policy can have a rationalizing effects on industries is not new: not only is it one of the main conclusions from Melitz [2003] but also from empirical papers like Head and Ries [1999] predating the insights from Melitz-type models. However, this is the first work systematically looking at one restructuring mecanism, namely M&A, and reinterpreting Melitz-style models to help tell us something about the factors that would lead to more or less reorganization through M&A. The theory I present is a theory of M&A as reorganization. I will concentrate on domestic mergers: those between two firms in the same jurisdiction.

Both oligopoly models with heterogeneous firms and monopolistic competition models suggest an increase in M&A as imports reduce the residual demand faced by less productive firms that are unable to export, and as the more productive firms enter the foreign market and expand their capacity domestically. Import competition affects all firms but more productive firms can benefit from access to large foriegn markets. The reported differences in firm characetristics across aquiring and target firms suggests mechanisms similar to those proposed by Shleifer and Vishny [1992]: The value of assets held by less productive firms falls if it remains in the hands of current management, whereas the value of very similar assets in the hands of the firm with better productivity draw increase. One of the main differences between oligopoly models and monopolis competition models is the possibility of

strategic mergers when the market is very concentrated. Two domestic firms may merge to deter entry by a foreign rival. These kind of mergers would not occur simultaneously with a change in trade flows, whereas all trade-related mergers in monopolistically competitive industries would be correlated with an increase in exports by the acquirer and a fall in sales by the target. The theory also suggests that trade-related mergers would tend to be horizontal since firms combine to expand capacity by acquiriring sector specific assets. Since firms have different productivity parameters which can be transferred at a cost to the target firm, although acquirer firms are more productive than targets, they are not the furthest appart.

Empirically, we observe clustering of M&A activity around the date FTA agreements are signed. This clustering occurs both in traditionally tradeable goods directly affected by tariff changes, but also in services, financial sector and other non-tradeable sectors that are complementary to the manufacturing, mining and agricultural sectors. Trade-related mergers also tend to be horizontal rather than across sectors, and they involve heterogeneous firms with the acquirer being larger and more productive than the target. Given that I am dealing with counts of M&A events, I construct databases of counts at different levels of aggregation and estimate reduced forms using count data econometric methods. The reported results suggest that a fall in tariffs of 1% on average increases the number of mergers per year by 1. Although I control for time and industry invariant factors, recent advances in trade policy suggest that tariffs are the result of a complex game between firms and the government. To correct possible biases I instrument for tariffs using the average tariff in the same sector but in a different, but comparable country. Results do not change too much in aggregate but they do change more in very concentrated sectors suggesting a political economy game in these sectors. The data was also analyzed according to the level of developement of the countries, by industry, by FTA and by coverage.

The results, data and analysis of this database suggests avenues for research on industry structure, antitrust and comercial policy and how they interact. Most of the rationales

for M&A suggested tell us that M&A in response to trade usually have efficieny defenses and "failed firm defenses" Only the case of foreign entry deterrence would be unequivacally thought of as anticompetitive. Furthermore, the models dealt with tradeable sectors, but the data showed how non-tradeable sectors, or newly traded sectors also restructure around FTA dates. This may be because of complementarities but the topic of trade and services is still in its infancy.

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A Estimation of Productivity Measures

In this appendix I present the results of estimating productivity measures with different methods and summary statistics of the log TFP results. The first table shows the estimation of the descriptive statistics of the TFP measures derived. The second table shows the production function at the firm level with the 7 methods proposed.

Table 27: Summary Statistics TFP Measures

variable	**N**	**mean**	**sd**	**min**	**max**
TFP FE	109820	1.142337	.5943848	-7.828198	8.653172
TFP GMM	109833	-.0049637	.5765355	-8.598927	7.916698
TFP GMM Dyn.	90722	-.0067329	.3572428	-6.479121	4.646302
TFP GMM Sys.	90722	.2306602	.3340283	-6.129414	5.217623
TFP OP	109833	13.12442	.7626955	3.663778	18.99056
TFP LP	109833	2.478565	14.68476	.0002958	3171.296
TFP Sales/Emp	401448	1.888806	2.408908	-5.141538	20.90648

Table 28: Estimation of Production Function

Variable	Fixed Effects	GMM First Differences	GMM Dynamics	GMM System of Eq.	Olley-Pakes	Levinsohn-Petrin
Ln L	**0.049**	0.003	-0.004	0.005	**0.085**	**0.069**
	(0.001)	(0.006)	(0.004)	(0.004)	(0.018)	(0.003)
ln K	**0.171**	**0.180**	**0.615**	**0.250**	**0.309**	**0.208**
	(0.002)	(0.011)	(0.022)	(0.013)	(0.050)	(0.012)
ln M	**0.693**	**0.840**	**0.185**	**0.668**	**0.448**	**0.700**
	(0.002)	(0.011)	(0.025)	(0.012)	(0.019)	(0.017)
Year					-0.006	
					(0.004)	
Lag 1 ln Y			**0.448**	**0.499**		
			(0.008)	(0.006)		
Lag 1 ln L			-0.007	**-0.013**		
			(0.003)	(0.003)		
Lag 1 ln M			**-0.229**	**-0.307**		
			(0.013)	(0.008)		
Lag 1 ln K			**-0.055**	**-0.106**		
			(0.015)	(0.010)		
Intercept	1.142			**0.231**		
	(0.013)			(0.020)		
Number of obs	109820	90722	74848	90722	69883	109833
Number of groups	16365	14515	13040	14515	7752	55667

Dependent Variable: ln Y

Standard errors clustered at the firm level (bold indicates signficant at 1%)

B The Poisson Regression Estimator and M&A and Trade liberalization at SIC-1, SIC-2, SIC3 digits

My identification strategy is based on the difference in tariff changes across sectors. The theoretical models of M&As suggest that the dependent variable in my specification should be the number of M&As and the independent variable of interest should be the change in tariffs. Since the dependent variable is a nonnegative integer, I will use count data econometric methods and model the number of M&As as being drawn from a distribution that places probability mass at nonnegative integar values only, and where the parameters of the distribution are determined by factors such as changes in tariffs. We can model the number of M&As as following a Poisson distribution. Assume the number or M&As follows a Poisson point process implying that the number of M&As, Y, is drawn from a Poisson distribution:

$$\Pr[Y = y] = \frac{e^{-\mu}\mu^{y}}{y!} \tag{40}$$

where μ is the intensity of rate parameter. The first two moments of this distribution are,

$$E[Y] = \mu \tag{41}$$

$$V[Y] = \mu \tag{42}$$

implying equidispersion.

We can extend the iid framework to the Poisson regression model by parameterizing the relation between the mean parameter μ and covariates X. In out case, the main covariate of interest will be the change in tariffs. We will assume an exponential mean parameterization,

$$\mu_i = exp(\mathbf{x}_i'\beta), i = 1, \ldots, N \tag{43}$$

Since $V[y_i|\mathbf{x}_i'] = exp(\mathbf{x}_i'\beta)$, this model is intrinsically heteroskedastic.

The parameters β in this model can be estimated by maximum likelihood where the likelihood function is given by:

$$lnL(\beta) = \sum_{i=1}^{n} y_i \mathbf{x}_i'\beta - exp(\mathbf{x}_i'\beta) - lny_i' \tag{44}$$

and the Poisson MLE, $\hat{\beta}_p$ is the solution to K non-linear equations corresponding to the first order conditions of the maximum likelihood:

$$\sum_{i=1}^{N}(y_i - exp(\mathbf{x}_i'\beta))\mathbf{x}_i' = \mathbf{0} \tag{45}$$

These functions are all globally concave so we can find unique parameter estimates through Gauss-Newton or Newton-Raphson iterative algorithms. Interestingly, we only need to assume that the conditional mean number of M&As is correctly specified for the estimations to be consistent, rather than assuming that the distribution is Poisson, which may be harder to verify (pseudo-ML, or PML). We will, therefore, only assume the following:

$$E[y_i|\mathbf{x}_i'] = exp(\mathbf{x}_i'\beta) \tag{46}$$

The variance-covariance matrix of the estimated parameters under these assumptions is:

$$V_{PML}[\hat{\beta_P}] = \left(\sum_{i=1}^{N} \mu_i \mathbf{x}_i \mathbf{x}_i'\right)^{-1} \left(\sum_{i=1}^{N} \omega_i \mathbf{x}_i \mathbf{x}_i'\right) \left(\sum_{i=1}^{N} \mu_i \mathbf{x}_i \mathbf{x}_i'\right)^{-1} \tag{47}$$

where $\omega_i = Var[y_i|\mathbf{x}_i]$ is the conditional variance of y_i. This estimation is, therefore, robust to misspecification of the distribution of M&A arrivals.

The estimated coefficients from the regressions of number of M&As on changes in tariffs

should be interpreted as the relative change in the expected number of M&As induced by a unit change in tariffs. We can see this by differentiating the exponential conditional mean with respect to the change in tariffs, x_j:

$$\frac{\partial E[y|\mathbf{x}]}{\partial x_j} = \beta_j exp(\mathbf{x}'\beta) \tag{48}$$

We will focus on the average response given by $\hat{\beta}_j \bar{y}$.

The following table present results for the estimation of the baseline model at different levels of aggregation using the methods described above.

	(1) Sales	(2) FE	(3) GMM_BB	(4) OP	(5) LP
Number of M&A					
Av.Effectively Applied Tariffs	0.952***	0.939***	0.952***	0.939***	0.941***
	(-28.275)	(-41.955)	(-30.905)	(-41.816)	(-40.878)
Av.Preferential Tariffs	0.885***	1.010***	0.948***	1.008**	1.017***
	(-38.187)	(3.110)	(-14.570)	(2.516)	(5.152)
StDev. TFP	0.281***				
	(-76.941)				
Total Capital	1.000***	1.000***	1.000***	1.000***	1.000***
	(92.191)	(135.846)	(129.357)	(135.835)	(132.262)
Number of Firms	1.026***	1.025***	1.029***	1.026***	1.014***
	(147.426)	(134.097)	(142.297)	(146.955)	(115.900)
HHI	1.000***	1.000***	1.000***	1.000***	1.000***
	(22.993)	(11.857)	(7.495)	(12.780)	(11.558)
Target Intl Sales	1.000***	1.000***	1.000***	1.000***	1.000***
	(-31.510)	(-23.445)	(-18.416)	(-23.819)	(-23.209)
Acquiror Intl Sales	1.000***	1.000***	1.000***	1.000***	1.000***
	(9.424)	(8.544)	(3.285)	(8.781)	(8.638)
Targ/Acq Intl Sales	1.001***	1.000***	1.001***	1.000***	1.000***
	(45.537)	(5.757)	(45.103)	(7.900)	(9.581)
StDev. TFP		0.599***			
		(-63.768)			
StDev. TFP			0.400***		
			(-85.835)		
StDev. TFP				0.537***	
				(-79.971)	
StDev. TFP					1.116***
					(40.109)
Observations	75	60	53	60	60
Log-Likelihood	-57659.352	-46891.015	-43831.634	-45651.670	-48349.033
Log-likelihood null	-89859.411	-80521.061	-77552.699	-80521.061	-80521.061
Prob chi2	64400.118	67260.091	67442.131	69738.782	64344.056
Pseudo R^2	0.358	0.418	0.435	0.433	0.400

Exponentiated coefficients; z statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 29: Determinants of M&A Activity at the SIC2 level

	(1) Sales	(2) FE	(3) GMM_BB	(4) OP	(5) LP
Number of M&A					
Av.Effectively Applied Tariffs	0.971***	0.955***	0.963***	0.955***	0.963***
	(-19.856)	(-25.290)	(-19.519)	(-25.396)	(-21.495)
Av.Preferential Tariffs	0.905***	0.891***	0.920***	0.894***	0.885***
	(-31.438)	(-30.697)	(-20.813)	(-29.698)	(-32.455)
StDev. TFP	0.667***				
	(-32.844)				
Total Capital	1.000***	1.000***	1.000***	1.000***	1.000***
	(32.092)	(45.622)	(50.978)	(45.177)	(51.089)
Number of Firms	1.023***	1.024***	1.031***	1.024***	1.016***
	(177.850)	(158.696)	(153.615)	(160.073)	(130.653)
HHI	1.000***	1.000***	1.000***	1.000***	1.000***
	(12.643)	(11.689)	(4.159)	(11.199)	(11.919)
Target Intl Sales	1.000***	1.000***	1.000***	1.000***	1.000***
	(-29.638)	(-19.114)	(-8.043)	(-18.295)	(-19.344)
Acquiror Intl Sales	1.000***	1.000	1.000***	1.000	1.000
	(8.226)	(0.934)	(-6.095)	(0.318)	(0.308)
Targ/Acq Intl Sales	1.000***	1.000***	1.000***	1.000***	1.000***
	(-6.427)	(-9.877)	(-6.807)	(-9.528)	(-10.869)
StDev. TFP		0.691***			
		(-54.907)			
StDev. TFP			0.498***		
			(-65.513)		
StDev. TFP				0.676***	
				(-57.960)	
StDev. TFP					1.113***
					(39.817)
Observations	251	138	122	138	138
Log-Likelihood	-40100.794	-22732.039	-16476.169	-22508.705	-23785.714
Log-likelihood null	-66868.305	-47830.787	-40403.122	-47830.787	-47830.787
Prob chi2	53535.022	50197.496	47853.906	50644.164	48090.146
Pseudo R^2	0.400	0.525	0.592	0.529	0.503

Exponentiated coefficients; z statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 30: Determinants of M&A Activity at the SIC3 level

	(1) Sales	(2) FE	(3) GMM_BB	(4) OP	(5) LP
Number of M&A					
Av.Effectively Applied Tariffs	0.968***	0.944***	0.964***	0.944***	0.944***
	(-17.262)	(-25.413)	(-15.646)	(-25.444)	(-25.379)
Av.Preferential Tariffs	0.919***	0.925***	0.957***	0.925***	0.928***
	(-21.294)	(-16.449)	(-9.489)	(-16.396)	(-15.743)
StDev. TFP	0.988				
	(-0.972)				
Total Capital	1.000***	1.000***	1.000***	1.000***	1.000***
	(19.945)	(34.254)	(31.971)	(34.469)	(34.972)
Number of Firms	1.024***	1.021***	1.023***	1.021***	1.020***
	(212.490)	(156.806)	(140.062)	(164.387)	(157.254)
HHI	1.000***	1.000***	1.000	1.000***	1.000***
	(7.735)	(4.287)	(0.215)	(4.382)	(4.079)
Target Intl Sales	1.000***	1.000***	1.000	1.000***	1.000***
	(-16.634)	(-4.250)	(-0.198)	(-4.319)	(-4.014)
Acquiror Intl Sales	1.000***	1.000***	1.000***	1.000***	1.000***
	(6.196)	(-3.342)	(-3.561)	(-3.368)	(-3.386)
Targ/Acq Intl Sales	1.000***	1.000***	1.000***	1.000***	1.000***
	(-3.289)	(-5.947)	(-4.664)	(-6.006)	(-5.503)
StDev. TFP		1.127***			
		(10.559)			
StDev. TFP			1.272***		
			(18.899)		
StDev. TFP				1.106***	
				(9.917)	
StDev. TFP					1.079***
					(19.390)
Observations	590	197	163	197	197
Log-Likelihood	-23839.301	-10336.381	-6970.870	-10342.618	-10218.151
Log-likelihood null	-50771.918	-32347.248	-27801.655	-32347.248	-32347.248
Prob chi2	53865.234	44021.733	41661.571	44009.260	44258.193
Pseudo R^2	0.530	0.680	0.749	0.680	0.684

Exponentiated coefficients; z statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$