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Trade Liberalization and Industry Dynamics: A Difference in Difference Approach

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TRADE LIBERALIZATION AND INDUSTRY DYNAMICS:

A DIFFERENCE IN DIFFERENCE APPROACH[†]

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Abstract

Recent models of trade with firm heterogeneity predict that opening to trade reduces the number of firms, increases the average size of firms, and decreases firms' markups. This paper uses a large dataset for 28 manufacturing industries and 46 countries to test these predictions. The econometric analysis based on the treatment effects literature shows that on average, trade liberalizations do not decrease the number of firms nor increase the average size of firms. Markups appear to decrease during the three years after the liberalization. We also find that the number of firms and the average size of firms increase in comparative advantage industries.

Key Words: Trade Liberalization, Industry Dynamics, Treatment Effects

JEL Classification: F10, L11

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1. Introduction

Recent models of international trade with firm heterogeneity (e.g., Melitz, 2003; Bernard et al, 2003; Bernard, Redding and Schott, 2007; Melitz and Ottaviano, 2008) predict that when countries move from autarky to free trade, the number of domestic firms decreases, their size increases, and their markups decrease. This paper tests these three predictions using a treatment effects approach and a large panel data for 28 manufacturing industries in more than 40 countries.

We identify the effects of trade reform on these three variables using a difference in difference methodology which compares the effects of trade reform on industry dynamics in liberalizing countries before and after the reform relative to a group of control countries. The central contribution of this paper is the use of this difference in difference approach, which has been rarely used in empirical studies of trade liberalization and has never been used to examine the questions in this paper.[1]

A few empirical studies have examined the effects of opening to trade on the number of firms, their size, and markups by focusing on particular episodes of trade reform.[2] These empirical studies analyze the effects of trade reforms by comparing the variables of interest

[1] Two recent studies that use difference-in-difference estimation are Slaughter (2001), which examines the effects of trade liberalization on per capita income convergence, and Giavazzi and Tabellini (2005), which studies the effects of economic and political liberalizations on economic performance.

[2] Most empirical studies focus on developing countries. For example, the edited volume by Roberts and Tybout (1996) presents a series of empirical studies that examine the effects of trade reforms on plant turnover, average size, and markups, and includes countries such as Chile, Colombia, Mexico and Morocco. Other studies include Levinsohn (1993) for Turkey, Harrison (1994) for Cote d'Ivoire, and Krishna and Mitra (1998) for India. Studies for developed countries are scarce and include Katics and Petersen (1994), and Co (2001) for the US, and Chen, Imbs and Scott (2006) for the EU. For a survey see Tybout (2003).

before and after the reform. Our paper builds on these important existing studies of particular cases of liberalization and complements their evidence. We are not aware of any previous empirical work testing these hypotheses using a large number of countries and industries as we do.

The impact of trade liberalization on economic performance is an important and controversial issue. Although most of the cross-country empirical literature finds that more open economies grow faster,[3] some scholars are skeptical to the robustness of this result (e.g., Rodriguez and Rodrik, 2000). Moreover, these studies do not identify the specific mechanisms by which trade openness may affect growth (Edwards, 1993; Hallak and Levinsohn, 2004). López (2005), on the other hand, argues that a careful examination of the new microeconomic evidence showing that exporting firms are more productive than non-exporters reveals that exporting, and openness in general, increases productivity growth.

This paper focuses on the implications of recent models of trade with firm heterogeneity, which predict that trade liberalizations could generate significant across and within-industry reallocation effects. These models show that opening to trade may generate the traditional resources reallocation from comparative disadvantage to comparative advantage industries, and also from less to more productive firms within industries.[4] In a seminal paper, Melitz (2003) presents a model with one factor of production and one sector, with constant markups, and

[3] Examples include Dollar (1992), Sachs and Warner (1995), Edwards (1998), and Frankel and Romer (1999). For recent surveys see Lewer and Van den Berg (2003) and López (2005).

[4] Given that we only observe the number of establishments in the dataset, we cannot study the effects on entry and exit. As explained in detail in the theoretical section this is not a serious problem because there are implications of the new trade models on the number of establishments at the industry level.

shows that in the presence of firm productivity heterogeneity trade openness generates important within-industry reallocation effects. In particular, exposure to trade reduces the mass of firms and increases average firm size. Bernard, Redding and Schott (2007) extend the Melitz model by considering two factors and two goods, and show that these effects are proportionally larger in comparative advantage industries. Melitz and Ottaviano (2008) construct a model with endogenous markups across firms. This model predicts that opening to trade reduces markups, highlighting the potential pro-competitive effect of trade liberalizations.

This paper examines these three implications using a treatment effects approach in which we classify countries into two groups: those that received the treatment, i.e., liberalized their trade during the period under consideration, and those that did not liberalize during the period, the control group. This technique allows us to identify the effects of trade reforms on the number of firms, their size, and markups. Since the treatment effects may not be constant over time, we also estimate the effects using the methodology recently proposed by Laporte and Windmeijer (2005), which allows the treatment effects to vary over time before and after the treatment occurs.

The data comes from the last actualization of the UNIDO dataset (see Nicita and Olarreaga, 2007) and details information at the 3-digit ISIC level. After removing incomplete observations and data inconsistencies, we end up with data for 46 countries during the period 1981-2004. Our treatment variable corresponds to the trade liberalization episodes defined by Sachs and Warner (1995) and later extended by Wacziarg and Welch (2003).

The main results of the paper are the following. When we assume constant treatment effects, we find some evidence consistent with the idea that increases in trade exposure increase the average size of firms in comparative advantage industries. But the estimates for the number of establishments are the opposite of what we expected. When time-varying treatment effects are considered we find that trade reforms increase the average size in the year of liberalization and it increases in comparative advantage industries during the year before the trade liberalization. We find that markups decrease after the reforms, which confirms findings from previous studies that focus on particular episodes of trade reforms. The results for the number of firms show that trade reforms increase the number of firms in comparative advantage industries.

2. Predictions of the Theory

Traditional models of international trade predict that opening the country to international trade induces a reallocation of resources across sectors. These models are, however, silent about the effects of trade on the number of firms and the average firm size. And since these models assume perfect competition, firms' markup, i.e., the ratio between price (p) and marginal costs (c), is always one. In the Ricardian model for example, trade induces countries to completely specialize in the production of the good in which they have a comparative labor-productivity advantage, while in the Heckscher-Ohlin model trade induces a shift in resources toward the sectors that draw upon the abundant factor. While the output of comparative advantage sectors

should increase, it is not clear whether this increase should come from entry of new firms into these sectors or from an expansion of the existing firms.

The new trade theory of the 1980s, based on models of monopolistic competition, assumes the existence of identical firms, each one producing a different variety of a product. Since firms have symmetric technologies, opening to trade induces all firms to export to all countries. In these models, markups are usually a function of the price-elasticity of demand (ε): $\frac{p}{c} = \left(\frac{\varepsilon}{\varepsilon - 1} \right)$. Since trade liberalizations are likely to increase ε, markups should fall. Head and Ries (1999) use the Helpman and Krugman (1985) model of monopolistic competition to show that a tariff increases the number of plants but has no effect on output per plant. Thus, opening to trade would reduce the number of plants but would not affect the average size.

Starting during the second half of the 1990s, several papers show that exporters are more productive and larger than non-exporters.[5] They also pay higher wages and are more capital intensive. Moreover, most empirical studies find that firms self-select into export markets: only the more productive firms could export.[6] These new stylized facts motivated the development of new trade models based on firm heterogeneity in terms of productivity. One of the first models in this literature is Melitz (2003). In this model there is a continuum of firms each one producing a different variety of a good. Preferences are of Dixit-Stiglitz type with a constant elasticity of substitution (σ), and fixed markups. Labor is the only factor of production. Firms have to make an initial investment before entry to the market, and then they learn their

[5] See, for example, Bernard and Jensen (1995, 1999), Aw et al. (2000), Isgut (2001), Alvarez and López (2005).
[6] See, for instance, Clerides et al. (1998), and Bernard and Jensen (1999).

productivity level and decide whether to produce or exit immediately. In autarky, the mass of firms producing in any given period (M_A) is given by:

$$(1) \qquad M_A = \frac{L}{\sigma\left(\overline{\pi} + f\right)},$$

where L is the endowment of labor, $\overline{\pi}$ is the average profit level and f is the fixed cost of production. In the open economy version of the model, firms make an initial fixed investment in order to export. Since not all firms can afford the entry cost, only the more productive firms export. In addition, more firms, the ones with high productivity draws, start producing the good. The expansion of exporters and the entry of new firms increase the demand for labor, which bids up the real wage and forces the least productive firms to exit. This reallocation of resources increases average productivity and average profits per firm. The increase in average profits implies that the average output per firm is also higher. In the trading equilibrium, the mass of firms (M_T) is given by:

$$(2) \qquad M_T = \frac{L}{\sigma\left(\overline{\pi}_T + f + p_x n f_x\right)},$$

where $\overline{\pi}_T \left(> \overline{\pi}\right)$ is the average profit in the open economy, p_x is the ex-ante probability that one successful entrant will export, n is the number of countries minus one, and f_x is the fixed cost of exporting. From (1) with (2) it is clear that: $M_T < M_A$. Therefore, the number of firms in a country decreases after trade is liberalized.

Melitz and Ottaviano (2008) extend the Melitz model by allowing endogenous markups across firms. This model predicts that opening to trade reduces markups, highlighting in this

way the potential pro-competitive effects of trade liberalizations. As in Melitz, trade reduces the number of firms and increases their size. Bernard, Redding and Schott (2007) introduce an additional industry and factor of production into the Melitz model with constant markups. Here comparative advantage plays an important role in determining the pattern of trade. The model can explain why some countries export more in certain industries, while at the same time intra-industry trade exists. Moving from autarky to (costly) trade increases firm size and reduces the number of firms. But these effects are not the same across industries. Average firm output increases more in comparative advantage industries, while the largest decrease in the number of firms occurs in comparative advantage industries.

A different type of trade model with heterogeneous firms was introduced by Bernard et al. (2003), who assume stochastic firm productivity in the multi-country Ricardian model developed by Eaton and Kortum (2002). Unlike Melitz (2003), this model does not assume a fixed markup and a fixed cost of entry and exporting. Firms (domestic and foreign) compete to produce the same variety, which generates an endogenous distribution of markups. The model and the counterfactual experiments predict that a decrease in trade barriers reduces the number of firms, increases average productivity but does not affect markups. The simulations also show that a 5-percent decrease in trade barriers decreases the number of firms by 3.3% while employment in the industry falls by 1.3%. Since employment falls less than the number of firms, average employment per firm goes up.

The degree of uncertainty with respect to technologies does not seem to affect the main predictions of these models. While Melitz (2003) assumes that technologies are randomly

assigned to firms, Yeaple (2005) assumes that firms can choose between two technologies (a low-cost and a high-cost technology). These technologies use workers with different skills, which are completely observed by the firms. In Yeaple (2005) there are two industries: a differentiated manufactured good and a homogenous good. Preferences are Dixit-Stiglitz type with constant markups. A reduction in trade costs reduces the number of varieties produced in each country. Since each variety is produced by a single firm, the number of firms decreases, and sales concentration increases.

All these models are, however, static. If one allows for dynamics, the results may change in some ways. For example, Emami-Namini and López (2008) extend the Melitz (2003) model by introducing physical capital as a second factor of production, and assume dynamic optimizing behavior of households. The model examines two cases. It first considers Melitz (2003) approach of assuming random technologies. In this case, trade may increase or decrease the number of firms. Second, the model allows firms to choose between two technologies:[7] a high-tech and a low-tech technology. In this second case, trade always generates an increase in the number of operating firms. In this model opening to trade generates two selection processes. In the first selection process, trade allows some firms to export, increasing the price of capital and thereby reducing the number of domestic firms. The average size increases as some firms now produce for international markets. In the second selection process, entry and exit of firms is determined by the effects of trade on the average firm. In the random technologies case, if the

[7] This follows López (2005) argument that firms, at least in developing countries, may choose their technologies when targeting export markets.

average firm benefits from trade, there will be additional entry of high-tech firms, generating a positive growth effect. But if the average firm loses, there will be a negative effect. Thus, the number of firms may increase or decrease. In the case of chosen technologies, since high-tech firms benefit from trade and low-tech firms do not export, there is always a positive growth effect, and the number of firms increases. Therefore, the model predicts that although average size increases, the number of firms may increase or decrease with exposure to trade depending on whether technologies are randomly assigned or chosen by the firms. As in Melitz, trade does not affect markups.

Predictions of Recent Models of Trade with Firm Heterogeneity

Model	Number of firms	Size of firms	Markup
Melitz (2003)	Decreases	Increases	No Change
Bernard, et al. (2003)	Decreases	Increases	No Change
Yeaple (2005)	Decreases	Increases	No Change
Bernard, et al. (2007)	Decreases	Increases	No Change
Melitz and Ottaviano (2008)	Decreases	Increases	Decreases
Emami-Namini and López (2008)	Decreases/Increases*	Increases	No Change

* Result depends on whether technologies are randomly assigned (number of firms may increase or decrease) or chosen by the firms (number of firms increases).

Based on these models, the following testable hypothesis can be proposed:

Hypothesis 1: *Opening to trade may increase or decrease the number of firms. In the case of a decrease, this should be more important in comparative advantage industries.*

Hypothesis 2: *Opening to trade increases the average firm size, and this increase should be more important in comparative advantage industries.*

Hypothesis 3: *Opening to trade may reduce or keep firms' markup constant.*

3. Methodology

3.1 Basic Treatment Effects Model

This paper uses a treatment effects estimation method, which allows us to study the impact of exposure to trade (the treatment) on the liberalizing group (the treated group) relative to the countries that did not liberalize (the control group). To this purpose we look at the pre- and post-treatment effects on the liberalizing countries relative to the control group. We identify the effect of trade liberalization as the estimated difference-in-difference of the outcome variables (e.g., number of firms) between the two groups of countries.

This methodology is implemented by estimating the following equation:

$$y_{ict} = \alpha + \beta_0 Liberalization_{ct} + \delta_i + \delta_c + \delta_t + e_{ict}, \qquad (1)$$

where y_{ict} is the outcome of interest for industry *i* in country *c* at time *t*; $Liberalization_{ct}$ is a step variable equal to 1 in the years after the liberalization in the treated countries and 0 otherwise (see Giavazzi and Tabellini, 2005), δ_i is vector of industry-fixed effects, δ_c is vector of country-fixed effects, and δ_t is vector of time-fixed effects. In some specifications we replace the industry fixed effects for industry specific time trends, $\delta_i * t$. This allows us to control for

time-varying unobserved industry characteristics that may affect the outcomes.[8] We are particularly interested in the sign of the parameter β_0. If trade liberalizations reduce the number of firms and markups, then β_0 should be negative. For the case of average size, β_0 should be positive and for markups β_0 is expected to be negative.

To construct the variable $Liberalization_{ct}$ we classify countries as "opened" or "closed" using the Sachs and Warner (1995) indicator of trade openness, recently updated by Wacziarg and Welch (2003). The treatment group includes all those countries that opened to trade during the period under study. This measure is not free of problems. First, countries liberalizing trade may have also undertaken other structural reforms. Then, we must understand this exercise as one that looks at the effects of overall economic reforms. Second, aggregates measures of liberalization are used to define a country as "opened," therefore, they are not specific to the manufacturing industry. Finally, there are some countries, such as Canada, which are open all the years in the sample and belong to our control group, but that have experienced a reduction in trade costs as result of bilateral free trade agreements. These last two shortcomings are likely to bias our results against finding a relationship between liberalization and industry-specific variables.

We also estimate a variant of equation (1) to examine if the impact of trade liberalization differs across industries depending on a country comparative advantage. According to Bernard, Redding and Schott (2007), the impact trade liberalization is proportionally larger in those

[8] See, for example, Aghion et al. (2003).

industries where the economy has a comparative advantage. Therefore, we estimate a variant of (1):

$$y_{ict} = \alpha + \beta_o Liberalization_{ct} + \beta_1 Liberalization_{ct} * CV_{ict} + \delta_i + \delta_c + \delta_t + e_{ict}, \qquad (2)$$

where CV_{it} is some variable indicating whether or not country *c* has a comparative advantage in industry *i*. In this case, both β_o and β_1 have to be negative for the number of firms, positive for the average firm size and negative for markups. The parameter β_1 captures how disproportionate is the effect of trade liberalization for comparative advantage industries.

It is not an easy to identify the industries in which a country has comparative advantage. Similar to the traditional Heckscher-Ohlin model, in Bernard, Redding and Schott (2007) comparative advantage depends on the interaction between relative factor abundance and factor use intensities. In their model, this is determined by two factors, skilled and unskilled labor. Here we follow the literature on revealed comparative advantage (RCA) and use the traditional Balassa indicator of RCA. This has the advantage of being simple of calculate and it is very intuitive.[9] This indicator is computed as:

$$\mathrm{CV_{it}} = \frac{\frac{X_{it}^c}{X_t^c}}{\frac{X_{it}^w}{X_t^w}}, \qquad (3)$$

where X measures current dollar exports, [10] *c* denotes the country, *i* the industry and *w* the world.

[9] This is, however, not exempt of critiques. See, for example, De Benedictis and Tamberi (2001).
[10] We also experiment with net exports and the results are similar.

Using this indicator, we rank comparative advantage industries using the median for industries in each country. Comparative advantage industries are those with a Balassa indicator above the median in the year of liberalization. By defining this as a dummy variable in the year of liberalization we isolate changes in the ranking of industries over time due to trade reforms. In the case that we do not have information for the year of the reform, we use one or two lags of the Balassa index.

3.2 Model with Time-Varying Treatment Effects

It is possible that the treatment effects are not constant over time and that they manifest either before or after the treatment is received. For example, the number of firms may change a few years after the liberalization or may change before the liberalization in anticipation to the reforms. If the effects of trade reform are spread out over a number of years, then a constant instantaneous effect of trade reform may be misspecified. For this reason, we also estimate (1) and (2) using the method recently proposed by Laporte and Windmeijer (2005), which allows the treatment effects to vary over time. This approach introduces flexibility into the analysis and corrects possible misspecification problems.

Following Laporte and Windmeijer (2005), we estimate the following equation:

$$y_{ict} = \alpha + ... + \gamma_{-3}P_{c,-3} + \gamma_{-2}P_{c,-2} + \gamma_{-1}P_{c,-1} + \beta_0 Liberalization_{ct} + \kappa_0 P_{c,0} + \kappa_1 P_{c,1} + \kappa_2 P_{c,2} + ... + \delta_i + \delta_c + \delta_t + e_{ict},$$

where $P_{c,-j}(P_{c,j})$ are pulse variables that take a value of 1 j periods before (after) the reform and 0 everywhere else. We are interested in the parameters γ_{-j}, which attempt to estimate the treatment effects j periods before the trade reform, β_0 which tries to capture the long-run

treatment effect, and κ_j which attempt to estimate deviations from the long run effect j periods after the trade reform.

In this approach, the effects of trade liberalizations are allowed to differ over time. This method permits examining if the effects of trade reforms occur before the liberalization is implemented. This could happen if there is uncertainty on the exact start date of the treatment or when some of the expected outcomes take place in anticipation to the treatment. In this context, it can be particularly relevant to analyze the effect before the year indicated as that of liberalization because trade barriers and other restrictions are reduced before that year. It may be the case that most of the adjustment occurs before the year of liberalization if the most important trade barriers are reduced before that date or if firms anticipate the decrease in trade barriers. For this methodology, we also estimate two specifications. The first includes industry-specific effects and the second controls for industry-specific trends.[11]

4. Data

The data was obtained from the last actualization of the World Bank's Trade Production Dataset that uses data from the United Nations Industrial Development Organization's Industrial Statistics Database at the three-digit level of the ISIC (Rev 2).[12] Since not all the countries have information for every year and industry, the panel is unbalanced. In addition, the number of establishments is only available from 1981. We are, therefore, constrained to use

[11] Given that the results are similar when including country-specific trends, we only estimate these two specifications.

[12] See Nicita and Olarreaga (2007) for details.

liberalization episodes after 1981. The average size of establishments is computed as the total number of employees divided by the number of establishments in each industry and year. We calculate markups as in Braun and Raddatz (2008):

Markup = (Value of Sales – Payroll – Cost of Materials) / Value of Sales.

There are some problems with this dataset that need to be addressed. First, some countries have very limited data availability. For example, Argentina has data for only three years (1985, 1993 and 1994). In other cases, most notably Brazil, the information is limited to a few industries. Then, we decide to use as filter that each country has information for at lest 10 years and more than 20 industries. Second, we have also excluded countries for which the information is clearly misleading. For example, the average number of establishment for Bangladesh increased from 171 to 880 in only one year (1988 to 1989). In all these cases, these countries are dropped from the sample. After all these cleaning procedures, we have 46 countries. 22 of these countries constitute our treatment group –liberalized after 1981- and the rest are our control group –have been open over the period under study. In Table 1 we present descriptive statistics for years of liberalization episodes.

The list of countries in our control and treatment groups is shown in appendix 1. As we can see, treated countries include nations located in Africa, Asia, Europe, Latin America, and Oceania. A good control group should include countries that are "similar" to the treatment group (Meyer, 1995). Although it is not clear what this means in practice (Slaughter, 2001), the fact that our control countries are located in the same 5 geographic areas as the treated

countries suggests that the control group may be appropriate for this exercise.[13] Moreover, we think it is unlikely that a shock may have systematically affected the treated group differently than the control group.[14]

Before estimating the model, we examine the behavior of the variables of interest before and after the liberalization year for our treated group of countries. To illustrate the changes potentially attributable to the reforms, we plot the median across countries of the three variables 5 years before (t-5) and 5 years after (t+5) the year of liberalization for the 28 manufacturing industries. In general, as it is shown in Figure 1, most of the industries experience an increase in the number of establishments, except for 4 manufacturing sectors. The mean and median change across industries between both years is 35.8% and 34.2%, respectively. In the case of establishments' size, for all the industries there is a reduction in this variable (see Figure 2). The decrease in this variable is impressive. The average and median reductions are 105.8% and 106.2%, respectively. Finally, markups tend to increase when we compare the situation before and after the liberalization year. There are only two industries in which the markups decrease between both years (Figure 3). The mean and median increases in markups are 5.2 and 4.9 percentage points, respectively.

This evidence may be consistent with the fact that we are summarizing our interest variables for countries having comparative advantage in different industries. In order to analyze

[13] In section 6 we address this issue in more detail. We exclude industrial countries from treatment group and we include other control variables, among other robustness checks, and the results are similar to the basic model.
[14] For instance, the debt crisis of 1982 affected countries in both groups in similar ways (e.g., Mexico, which is treated, and Chile which is a control).

how the evolution of these variables differs by type of industries, we show an event study for both groups of industries taking the median of the three variables around a liberalization episode. This exercise is presented in Figure 4 for the number establishments, Figure 5 for the average size and in Figure 6 for markups. In general, the results are fairly similar to those found before. Trade liberalization episodes seem to be accompanied by an increase in the number of firms, a reduction in size, and an increase in markups.

A potential problem with analyzing the evolution of these variables only for treated countries is that they can reflect worldwide trends in industry dynamics. We need to look at the performance of liberalizing countries in comparison with the control group. As we show in Figures 7 through 9, the evolution of these variables for the control group show a similar pattern to that observed for liberalizing countries. Especially in the last part of the period, there has been an increase in the number of establishments and a reduction in the average size of establishments. The case for markups seems to be different. In fact, although there are some fluctuations over time, these are very small. The range for this variable is between 20.0% and 22.5%.

5. Results

The basic results of the constant treatment effects model are presented in Table 2 (for the number of establishments), Table 3 (for the average size, total employment/number of establishments), and Table 4 (for markups). In all these three tables, the dependent variable is measured in logs, so that the parameter of the liberalization dummy can be interpreted as

$100(\exp(\beta_0) - 1)$ change in percentage terms. Columns (1), (2), and (3) show the results with the liberalization dummy, while (4), (5), and (6) include the interaction term between the liberalization dummy and the indicator of comparative advantage.[15]

Table 2 shows that for the number of establishments that the dummy for liberalization is positive, which is the opposite of what most models of trade predict, but it is never significant. This result is robust to the inclusion of industry time trends and country time trends, which controls for time-varying unobserved industry and country characteristics. The interaction term with the dummy for comparative advantage industries, however, is positive and significant (see columns (4), (5) and (6)), suggesting that trade liberalizations increase the number of firms in sectors in which countries have a comparative advantage. This is exactly the opposite of what most theoretical models would predict. It is consistent, however, with dynamic models in which firms can choose their technologies (e.g., Emami-Namini and López, 2008).

Table 3 shows the results for the size of establishments. Here we expected the estimate for liberalization to be positive, but it is always negative. But the interaction term, is positive and significant, which indicates that size increases in comparative advantage industries. This is consistent with Bernard, Redding and Schott (2007), which predicts that average size increases more in comparative advantage industries.

[15] In columns (1) and (4) we control for industry and country differences using a set of industry-specific and country-specific dummy variables. In columns (3) and (5) we include industry-specific trends, and in columns (4) and (6) we include country-specific trends. All specifications also include year-specific dummy variables.

Finally, Table 4 shows the results for markups. Although the estimates for the liberalization dummy are always negative, as we expected, they are not statistically significant. The interaction terms are not significant either.

In summary, we find some evidence consistent with the idea that increases in trade exposure increase the average size of firms in comparative advantage industries. But the estimates for the number of establishments are the opposite of what we expected.

In all these regressions it was assumed that the treatment effects are constant. But treatment effects may vary over time. They could manifest either before (in anticipation of) the reform, or after (with a lag) the reform. Tables 5, 6, and 7 present the results of estimating the model with time-varying treatment effects proposed by Laporte and Windmeijer (2005). Columns (1) and (2) show the basic results, while (3) and (4) include interaction term between the treatment effects and the comparative advantage indicator.

Columns (1) and (2) of Table 5, show that the liberalization dummy is still positive but not significant, suggesting that trade reforms do not have a long-run effect on the number of establishments. It appears, however, that the number of establishments decreases the year of the reform but the estimate is not significant either. In columns (3) and (4) we show the results with interaction terms between liberalization and comparative advantage. Now we see that in years before the trade reform and during the year of the reform, the number of firms increases in comparative advantage industries. The estimate for the liberalization step variable interacted with the dummy for comparative advantage industries is positive and significant indicating that there is a long-run treatment effect of the reform in comparative advantage industries. Again,

this is inconsistent with most recent static trade models although it could be consistent with dynamic models of trade.

Table 6 shows that the estimate for the liberalization variable is negative but not significant implying that the reform does not have long-run effects on the size of firms. But the estimates for the pulse variables corresponding to 3 years after the reform are negative and significant. This may be interpreted as deviations from the long run effect and suggests that most of the effect of the reforms appears several years after they are introduced. But the negative sign is the opposite of what we expected. Moreover, these effects seem to be larger in comparative advantage industries. The estimate for the interaction term between the step variable and the dummy for comparative advantage industries is positive and significant indicating that there is a positive long-term effect on the size of firms in comparative advantage industries, which is consistent with the theory. The estimate for the year of the liberalization is positive, indicating that trade reforms increase the average size in that year in addition to the long-run treatment effect. The size of firms also increases in comparative advantage industries during the year before the trade liberalization.

The effects of trade reforms in markups are presented in Table 7. Here the results are more consistent with the theory. The estimates for the liberalization dummy are never significant even when interacted with the dummy for comparative advantage industries. Thus, trade reforms do not have a long-run impact on markups. But the estimates for the pulse dummies in the second, third, and fourth year after the liberalization are negative and significant. These deviations from the long-run effect suggest that most of the impact of trade reforms shows up

after the reform was introduced. The finding that markups decrease after the reforms is robust to the inclusion of the interaction terms with comparative advantage as well as the inclusion of industry specific time trends. These results confirm finding from previous studies that focus on particular episodes of trade reforms (e.g., Krishna and Mitra, 1998).

6. Robustness Checks

There are several concerns regarding the identifying assumptions in our difference-in-difference estimation. First, there may be other unobserved variables affecting both groups differently. The main concern is on the similarity between the control and treatment group. This has been partially addressed by using industry and country fixed effects, and industry and country trends. By including these variables we control for unobserved and time varying characteristics at the country and the industry level. The industry and country trends control for changes over time that are country and industry specific.

Second, given the potential endogeneity of trade liberalization, our estimations could be biased and inconsistent. This problem is originated by omitted variables that could affect both the independent variables and the measures of trade liberalization. In the absence of good instruments for the trade liberalization measures, we try to reduce this potential bias by (i) performing the difference-in-difference estimation on similar countries, i.e., excluding industrial countries and, following Giavazzi and Tabellini (2005), including year-continent specific effects, and (ii) incorporating additional control variables that could be potentially affecting the results. In order to do that, we include as control variables the size of the country

(measured by population), a time varying measure of distance to markets (measured as in Leamer (1997)),[16] a measure of financial development (credit to private sector as percentage of GDP), and the real exchange rate.[17]

The motivation for including these variables comes from the theoretical models discussed in previous sections. The size of a country determines the number (and size) of firms operating in the industry, because larger countries may accommodate a larger number of firms.[18] The distance variable attempts to capture the effects of trade barriers that are not specific to policies. In fact, countries that are closer to international markets face lower transport costs (and potentially lower exporting fixed costs) than more distant economies. The financial development variable is included to control for differences in countries ability to finance new activities. Finally, by controlling for real exchange rate we want to capture the effect of trade liberalizations and not from the exchange rate fluctuations accompanying trade liberalization.[19]

We present the results in Tables 8, 9, and 10 for the number of establishments, size and markups. The evidence is similar to what we found with the basic model, which gives us confidence that our results are robust to the inclusion of additional control variables and the exclusion of industrial countries.

[16] This is computed as $DM = (\sum_j w_j D_{ij}^{-0.6})^{\frac{-1}{0.6}}$, where w_j is the share of country j in world GDP, and captures how distant is a country to world GDP.

[17] To maximize the number of observation we use bilateral real exchange rate with the United States.

[18] Note also that it has been argued that smaller countries tend to be more open to international trade.

[19] Li (2004) shows evidence that real exchange depreciates after economies open to trade.

7. Conclusions

Recent trade models with firm heterogeneity predict that trade liberalization decreases the number of firms, increases the average size of the surviving firms, and reduces their markups. This paper uses a large data set for 28 industries in 46 countries to test these three predictions. Unlike previous studies, we employ a treatment effect approach and estimate the differential impact of trade reforms on countries that liberalize relative to countries that did not reform during the same time period.

The results show that the number of firms does not decrease after trade reforms, although it increases in comparative advantage industries. The average size of firms increases but only in sectors in which the country has a comparative advantage. Finally, we find that markups decrease during the three and four years after the reform.

The results of this paper generate several questions that may need to be addressed in the trade literature. For example, why does the number of firms do not move according to the predictions of recent models of trade? One possibility is that most models of trade are essentially static. They do not incorporate dynamic optimization of consumers in ways that physical or human capital is accumulated. Judging by the results in Emami-Namini and López (2008), allowing for dynamics may generate different implications for the number of firms. The finding that in comparative advantage industries the number of firms tends to increase is consistent with models of trade that incorporate firm heterogeneity (Bernard et al., 2007). It is not clear, however, why the size of firms does not increase in other industries as well. Finally,

the negative effect on markups suggests that models with endogenous markups, as in Melitz and Ottaviano (2008), can be better suited to explain the effects of trade on firms' markup.

One limitation of the type of exercise we perform in this paper is that we do not analyze the effects of trade liberalization in trading partners. It could be the case that countries reduce their own trade barriers to other countries without necessarily facing lower barriers in those countries. Several of the theoretical models discussed in this paper have implications for industry dynamics when trade costs are reduced and the profitability of exports increase due to lower trade barriers in trading partners. Unfortunately, this is the best one can do with the data available. Moreover, previous studies have followed similar approaches to analyze how trade liberalization affects industry performance in liberalizer countries (Pavcnik, 2002, Roberts and Tybout, 1996). The results of this paper complement this evidence and suggest that it may be important to develop new theoretical models which can explain these new empirical results.

References

Aghion, P., Burgess, R., Redding, S., and Zilimotti, F. (2003). "The Unequal Effects of Liberalization: Theory and Evidence from India," London School of Economics and Political Science.

Alvarez, R., and López, R. A. (2005). "Exporting and Performance: Evidence from Chilean Plants," *Canadian Journal of Economics* 38(4): 1384-1400.

Aw, B.-Y., Chung, S., and Roberts, M. J. (2000). "Productivity and Turnover in the Export Market: Micro-Level Evidence from the Republic of Korea and Taiwan (China)," *World Bank Economic Review* 14(1): 65-90.

Braun, M., and C. Raddatz (2008). "The Politics of Financial Development: Evidence from Trade Liberalization," *Journal of Finance*, Forthcoming.

Bernard, A. B., Eaton, J., Jensen, J. B., and Kortum, S. (2003). "Plants and Productivity in International Trade," *American Economic Review* 93(4): 1268-1290.

Bernard, A. B., and Jensen, J. B. (1995). "Exporters, Jobs and Wages in US Manufacturing: 1967-1987," *Brookings Papers on Economic Activity: Microeconomics*, 67-119.

Bernard, A. B., and Jensen, J. B. (1999). "Exceptional Exporter Performance: Cause, Effect, or Both?" *Journal of International Economics* 47(1): 1-25.

Bernard, A. B., Redding, S. J., and Schott, P. K. (2007). "Comparative Advantage and Heterogeneous Firms," *Review of Economic Studies* 74(1): 31-66.

Chen, N., Imbs, J., and Scott, A. (2006). "The Dynamics of Trade and Competition," National Bank of Belgium Working Paper No. 91, October.

Clerides, S. K., Lach, S., and Tybout, J. R. (1998). "Is Learning by Exporting Important? Micro Dynamic Evidence from Colombia, Mexico and Morocco," *Quarterly Journal of Economics* 113(3): 903-947.

Co, C. Y. (2001). "Trade, Foreign Direct Investment and Industry Performance," *International Journal of Industrial Organization* 19(1-2): 163-183.

De Benedictis, L., and Tamberi, M. (2001). "A Note on the Balassa Index of Revealed Comparative Advantage," Università degli Studi di Macerata and Università Politecnica delle Marche.

Dollar, D. (1992). "Outward-Oriented Developing Economies Really Do Grow More Rapidly: Evidence from 95 LDCs, 1976-1985," *Economic Development and Cultural Change* 40(3): 523-544.

Eaton, J., and Kortum, S. (2002). "Technology, Geography, and Trade," *Econometrica* 70(5): 1741-1780.

Edwards, S. (1993). "Trade Orientation, Distortion and Growth in Developing Countries," *Journal of Economic Literature* 31(3): 1358-1393.

Edwards, S. (1998). "Openness, Productivity and Growth: What do We Really Know?" *Economic Journal* 108(447): 383-398.

Emami-Namini, J., and López, R. A. (2008). "Technology Adoption and the Dynamics of Trade: Theory and Empirical Evidence," Erasmus University (The Netherlands) and Indiana University (USA).

Frankel, J., and Romer, D. (1999). "Does Trade Cause Growth?" *American Economic Review* 89(3): 379-399.

Giavazzi, F., and G. Tabellini. (2005). "Economic and Political Liberalizations," *Journal of Monetary Economics* 52(7): 1297-1330.

Hallak, J. C., and Levinsohn J. (2004). "Fooling Ourselves: Evaluating the Globalization and Growth Debate," NBER Working Paper 10244.

Harrison, A. (1994). "Productivity, Imperfect Competition and Trade Reform: Theory and Evidence," *Journal of International Economics* 36(1-2): 53-73.

Head K., and Ries, J. (1999). "Rationalization Effects of Tariff Reductions," *Journal of International Economics* 47(2): 295-320.

Helpman, E., and Krugman, P. R. (1985). *Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition, and the International Economy* (Cambridge, MA: MIT Press).

Isgut, A. (2001). "What's Different about Exporters? Evidence from Colombian Manufacturing," *Journal of Development Studies* 37(5): 57-82.

Katics, M. M., and Petersen, B. C. (1994). "The Effect of Rising Import Competition on Market Power: A Panel Data Study of US Manufacturing," *Journal of Industrial Economics* 42(3): 277-286.

Krishna, P., and Mitra, D. (1998) "Trade liberalization, Market Discipline and Productivity Growth: New Evidence from India," *Journal of Development Economics*, 56(2): 447-462.

Laporte, A., and F. Windmeijer (2005) “Estimation of Panel Data Models with Binary Indicators when Treatment Effects are not Constant over Time,” *Economics Letters* 88(3): 389-396.

Leamer, E.E. (1997): "Access to Western Markets and Eastern Effort," in Salvatore Zecchini, ed., *Lessons from the Economic Transition, Central and Eastern Europe in the 1990s*, Dordrecht: Kluwer Academic Publishers, pp. 503-526.

Levinsohn, L. (1993). “Testing the Imports-As-Market-Discipline Hypothesis,” *Journal of International Economics* 35(1-2): 1-22.

Lewer, J. J., and Van den Berg, H. (2003). “How Large is International Trade’s Effect on Economic Growth?” *Journal of Economic Surveys* 17(3): 363-396.

Li, X., 2004. “Trade Liberalization and Real Exchange Rate Movement”, *IMF Staff Papers*, 51(3): 553-584.

López, R. A. (2005). “Trade and Growth: Reconciling the Macroeconomic and Microeconomic Evidence,” *Journal of Economic Surveys* 19(4): 623-648.

Melitz, M. (2003). “The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity,” *Econometrica* 71(6): 1695-1725.

Melitz, M., and G. I. P. Ottaviano (2008). “Market Size, Trade, and Productivity,” *Review of Economic Studies*, 75(1): 295-316.

Meyer, B. D. (1995). “Natural and Quasi-Experiments in Economics,” *Journal of Business & Economic Statistics* 13(2): 151-161.

Nicita A., and Olarreaga, M. (2007). “Trade, Production and Protection 1976-2004,” *World Bank Economic Review* 21(1): 165-171.

Pavcnik, N. (2002). "Trade Liberalization, Exit, and Productivity Improvements: Evidence from Chilean Plants," *Review of Economic Studies* 69 (1): 245-276.

Roberts, M. J., and J. R. Tybout (1996). *Industrial Evolution in Developing Countries* (New York, N.Y.: Oxford University Press).

Rodriguez, F., and Dani Rodrik (2000) "Trade Policy and Economic Growth: A Skeptic´s Guide to the Cross-National Evidence", in *NBER Macro Annual 2000*, B. Bernanke and K. Rogoff (eds.) (Cambridge, Massachusetts: National Bureau of Economic Research).

Sachs, J. D., and Warner, A. (1995). "Economic Reform and the Process of Global Integration," *Brookings Papers on Economic Activity* 1, 1-118.

Slaughter, M. J. (2001). "Trade Liberalization and Per Capita Income Convergence: A Difference-In-Differences Analysis," *Journal of International Economics* 55(1): 203-228.

Tybout, J. R. (2003). "Plant- and Firm-Level Evidence on 'New' Trade Theories," in E. K. Choi and J. Harrigan (eds.), *Handbook of International Trade* (Oxford: Blackwell).

Wacziarg, R., and Welch, K. H. (2003). "Trade Liberalization and Growth: New Evidence," NBER Working Paper 10152.

Yeaple, S. (2005). "A Simple Model of Firm Heterogeneity, International Trade, and Wages," *Journal of International Economics* 65(1): 1-20.

Table 1: **Trade Liberalization Episodes**

Year of Liberalization	Frequency	Percent
1985	1	4.2
1986	3	12.5
1988	1	4.2
1989	2	8.3
1990	1	4.2
1991	4	16.7
1993	2	8.3
1994	2	8.3
1995	5	20.8
1996	3	12.5
Total	24	100.0

Source: Authors' elaboration based on Wacziarg and Horn Welch (2003).

Table 2: **Trade Liberalization and the Number of Establishments**

	(1)	(2)	(3)	(4)	(5)	(6)
Liberalization	0.125	0.125	0.133	0.031	0.031	0.039
	(0.90)	(0.90)	(0.96)	(0.19)	(0.19)	(0.23)
Liberalization *Comparative Advantage				0.263	0.263	0.263
				(2.54)*	(2.53)*	(2.54)*
Constant	7.336	6.289	5.876	7.314	6.284	5.867
	(48.58)**	(52.75)**	(69.56)**	(48.92)**	(53.07)**	(70.38)**
Industry dummies	Yes	No	No	Yes	No	No
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	No	Yes	Yes	No
Industry-specific trends	No	Yes	Yes	No	Yes	Yes
Country-specific trends	No	No	Yes	No	No	Yes
Number of Observations	20,982	20,982	20,982	20,982	20,982	20,982
R-squared	0.85	0.85	0.85	0.85	0.85	0.85

Robust t statistics clustered at country-level in parentheses. * significant at 5%; ** significant at 1%

Table 3: **Trade Liberalization and Size of Establishments**

	(1)	(2)	(3)	(4)	(5)	(6)
Liberalization	-0.272	-0.272	-0.276	-0.437	-0.437	-0.441
	(1.61)	(1.61)	(1.63)	(2.36)*	(2.37)*	(2.38)*
Liberalization * Comparative Advantage				0.448	0.448	0.448
				(4.03)**	(4.03)**	(4.03)**
Constant	3.606	3.274	3.651	3.570	3.265	3.605
	(21.90)**	(24.18)**	(38.76)**	(22.52)**	(24.47)**	(42.38)**
Industry dummies	Yes	No	No	Yes	No	No
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	No	Yes	Yes	No
Industry-specific trends	No	Yes	Yes	No	Yes	Yes
Country-specific trends	No	No	Yes	No	No	Yes
Observations	20,204	20,204	20,204	20,204	20,204	20,204
R-squared	0.65	0.65	0.65	0.66	0.66	0.66

Robust t statistics clustered at country-level in parentheses. * significant at 5%; ** significant at 1%

Table 4: **Trade Liberalization and Markups**

	(1)	(2)	(3)	(4)	(5)	(6)
Liberalization	-0.018	-0.018	-0.018	-0.038	-0.038	-0.038
	(0.36)	(0.36)	(0.37)	(0.75)	(0.75)	(0.75)
Liberalization * Comparative Advantage				0.045	0.045	0.044
				(1.26)	(1.25)	(1.25)
Constant	-1.812	-1.410	-1.876	-1.816	-1.411	-1.878
	(23.72)**	(32.57)**	(43.94)**	(23.59)**	(32.85)**	(44.12)**
Industry dummies	Yes	No	No	Yes	No	No
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	No	Yes	Yes	No
Industry-specific trends	No	Yes	Yes	No	Yes	Yes
Country-specific trends	No	No	Yes	No	No	Yes
Observations	23,809	23,809	23,809	23,809	23,809	23,809
R-squared	0.39	0.39	0.39	0.39	0.39	0.39

Robust t statistics clustered at country-level in parentheses. * significant at 5%; ** significant at 1%

Table 5: **Trade Liberalization and the Number of Establishments**

Time Varying Treatment Effects

	(1)	(2)	(3)	(4)
Liberalization (LIB)	0.130	0.130	0.045	0.046
	(0.48)	(0.48)	(0.16)	(0.17)
Year Liberalization (P_0)	-0.069	-0.069	-0.128	-0.129
	(0.34)	(0.34)	(0.65)	(0.65)
1 Year before (P_{-1})	0.050	0.050	-0.068	-0.068
	(0.41)	(0.40)	(0.53)	(0.53)
2 Years before (P_{-2})	0.040	0.040	-0.093	-0.094
	(0.38)	(0.38)	(0.81)	(0.81)
3 Years before (P_{-3})	0.015	0.015	-0.129	-0.129
	(0.16)	(0.16)	(1.22)	(1.22)
4 Years before (P_{-4})	0.012	0.012	-0.150	-0.150
	(0.13)	(0.13)	(1.58)	(1.58)
1 Year after (P_1)	-0.164	-0.165	-0.205	-0.206
	(0.85)	(0.85)	(1.09)	(1.10)
2 Years after (P_2)	-0.049	-0.049	-0.123	-0.123
	(0.25)	(0.25)	(0.65)	(0.65)
3 Years after (P_3)	0.128	0.128	0.078	0.077
	(0.77)	(0.77)	(0.47)	(0.47)
4 Years after (P_4)	0.018	0.018	0.005	0.005
	(0.14)	(0.14)	(0.04)	(0.03)
5 Years after (P_5)	0.079	0.079	0.038	0.037
	(0.65)	(0.65)	(0.31)	(0.30)
6 Years after (P_6)	0.171	0.170	0.181	0.180
	(1.50)	(1.49)	(1.53)	(1.52)
7 Years after (P_7)	0.153	0.152	0.156	0.156
	(1.51)	(1.50)	(1.51)	(1.50)
8 Years after (P_8)	0.270	0.270	0.315	0.315
	(2.53)*	(2.52)*	(2.14)*	(2.14)*
LIB * Comp. Adv	-	-	0.233	0.233
	-	-	(2.64)*	(2.63)*
P_0 * Comp.Adv.	-	-	0.147	0.148
	-	-	(1.65)	(1.66)
P_{-1} * Comp.Adv.	-	-	0.312	0.312
	-	-	(3.02)**	(3.02)**
P_{-2} * Comp.Adv.	-	-	0.342	0.342
	-	-	(3.02)**	(3.02)**
P_{-3} * Comp.Adv.	-	-	0.375	0.376
	-	-	(3.33)**	(3.33)**
P_{-4} * Comp.Adv.	-	-	0.435	0.435
	-	-	(4.00)**	(4.00)**
P_1 * Comp.Adv.	-	-	0.100	0.101
	-	-	(0.76)	(0.77)
P_2 * Comp.Adv.	-	-	0.202	0.202
	-	-	(1.47)	(1.47)
P_3 * Comp.Adv.	-	-	0.126	0.127
	-	-	(1.08)	(1.08)
P_4 * Comp.Adv.	-	-	0.023	0.023
	-	-	(0.20)	(0.20)
P_5 * Comp.Adv.	-	-	0.096	0.096
	-	-	(0.85)	(0.86)
P_6 * Comp.Adv.	-	-	-0.045	-0.045
	-	-	(0.37)	(0.37)
P_7 * Comp.Adv.	-	-	-0.021	-0.021
	-	-	(0.18)	(0.18)
P_8 * Comp.Adv.	-	-	-0.126	-0.126
	-	-	(0.75)	(0.75)
Constant	7.362	6.315	7.314	6.297
	(38.48)**	(33.65)**	(38.51)**	(33.38)**
Observations	20,982	20,982	20,982	20,982
R-squared	0.85	0.85	0.85	0.85

Robust t statistics clustered at country-level in parentheses. * significant at 5%; ** significant at 1%

Table 6: **Trade Liberalization and Size of Establishments**

Time Varying Treatment Effects

	(1)	(2)	(3)	(4)
Liberalization (LIB)	-0.058	-0.059	-0.232	-0.232
	(0.20)	(0.20)	(0.78)	(0.78)
Year Liberalization (P_0)	-0.112	-0.112	-0.028	-0.028
	(0.66)	(0.65)	(0.17)	(0.17)
1 Year before (P_{-1})	-0.070	-0.070	-0.143	-0.143
	(0.51)	(0.51)	(1.13)	(1.13)
2 Years before (P_{-2})	-0.006	-0.006	-0.070	-0.070
	(0.06)	(0.06)	(0.63)	(0.63)
3 Years before (P_{-3})	0.042	0.042	0.001	0.001
	(0.44)	(0.44)	(0.01)	(0.01)
4 Years before (P_{-4})	0.061	0.061	0.031	0.031
	(0.69)	(0.69)	(0.37)	(0.37)
1 Year after (P_1)	-0.085	-0.085	-0.040	-0.040
	(0.54)	(0.54)	(0.25)	(0.25)
2 Years after (P_2)	-0.169	-0.169	-0.118	-0.118
	(1.10)	(1.10)	(0.83)	(0.83)
3 Years after (P_3)	-0.322	-0.321	-0.282	-0.282
	(2.26)*	(2.26)*	(2.10)*	(2.09)*
4 Years after (P_4)	-0.200	-0.200	-0.217	-0.217
	(1.69)	(1.69)	(1.78)	(1.78)
5 Years after (P_5)	-0.343	-0.343	-0.344	-0.344
	(3.12)**	(3.12)**	(3.41)**	(3.40)**
6 Years after (P_6)	-0.367	-0.367	-0.447	-0.447
	(3.27)**	(3.27)**	(3.42)**	(3.41)**
7 Years after (P_7)	-0.290	-0.290	-0.344	-0.344
	(2.79)**	(2.79)**	(2.88)**	(2.88)**
8 Years after (P_8)	-0.455	-0.455	-0.524	-0.524
	(3.83)**	(3.83)**	(3.59)**	(3.59)**
LIB * Comp. Adv	-	-	0.440	0.440
	-	-	(4.82)**	(4.81)**
P_0 * Comp.Adv.	-	-	-0.189	-0.190
	-	-	(2.30)*	(2.30)*
P_{-1} * Comp.Adv.	-	-	0.200	0.200
	-	-	(3.65)**	(3.65)**
P_{-2} * Comp.Adv.	-	-	0.171	0.171
	-	-	(2.17)*	(2.17)*
P_{-3} * Comp.Adv.	-	-	0.111	0.111
	-	-	(1.19)	(1.19)
P_{-4} * Comp.Adv.	-	-	0.070	0.070
	-	-	(0.72)	(0.72)
P_1 * Comp.Adv.	-	-	-0.086	-0.086
	-	-	(0.66)	(0.66)
P_2 * Comp.Adv.	-	-	-0.084	-0.084
	-	-	(0.57)	(0.57)
P_3 * Comp.Adv.	-	-	-0.075	-0.076
	-	-	(0.65)	(0.66)
P_4 * Comp.Adv.	-	-	0.087	0.087
	-	-	(0.71)	(0.71)
P_5 * Comp.Adv.	-	-	0.023	0.022
	-	-	(0.31)	(0.30)
P_6 * Comp.Adv.	-	-	0.246	0.245
	-	-	(1.79)	(1.79)
P_7 * Comp.Adv.	-	-	0.173	0.173
	-	-	(1.27)	(1.27)
P_8 * Comp.Adv.	-	-	0.231	0.231
	-	-	(1.30)	(1.29)
Constant	3.612	3.279	3.585	3.284
	(19.12)**	(20.53)**	(19.99)**	(21.53)**
Observations	20,204	20,204	20,204	20,204
R-squared	0.66	0.66	0.66	0.66

Robust t statistics clustered at country-level in parentheses. * significant at 5%; ** significant at 1%

Table 7: **Trade Liberalization and Markups**

Time Varying Treatment Effects

	(1)	(2)	(3)	(4)
Liberalization (LIB)	0.025	0.025	0.002	0.002
	(0.29)	(0.29)	(0.02)	(0.02)
Year Liberalization (P_0)	-0.015	-0.015	-0.014	-0.014
	(0.20)	(0.20)	(0.18)	(0.18)
1 Year before (P_{-1})	-0.039	-0.039	-0.058	-0.058
	(0.68)	(0.68)	(1.01)	(1.01)
2 Years before (P_{-2})	-0.033	-0.033	-0.040	-0.040
	(0.51)	(0.51)	(0.65)	(0.65)
3 Years before (P_{-3})	0.005	0.005	0.038	0.038
	(0.10)	(0.10)	(0.61)	(0.61)
4 Years before (P_{-4})	-0.044	-0.044	-0.032	-0.032
	(0.97)	(0.97)	(0.61)	(0.61)
1 Year after (P_1)	-0.164	-0.163	-0.197	-0.197
	(2.55)*	(2.55)*	(3.26)**	(3.26)**
2 Years after (P_2)	-0.143	-0.143	-0.168	-0.168
	(2.48)*	(2.48)*	(2.37)*	(2.37)*
3 Years after (P_3)	-0.083	-0.082	-0.070	-0.070
	(1.44)	(1.44)	(1.21)	(1.21)
4 Years after (P_4)	-0.053	-0.053	-0.032	-0.032
	(0.86)	(0.86)	(0.47)	(0.47)
5 Years after (P_5)	-0.004	-0.004	0.022	0.022
	(0.06)	(0.06)	(0.31)	(0.32)
6 Years after (P_6)	-0.011	-0.011	0.059	0.059
	(0.18)	(0.18)	(0.99)	(0.99)
7 Years after (P_7)	0.082	0.082	0.099	0.099
	(1.13)	(1.13)	(1.37)	(1.37)
8 Years after (P_8)	0.041	0.041	0.023	0.023
	(0.79)	(0.79)	(0.47)	(0.47)
LIB * Comp. Adv			0.050	0.050
			(0.75)	(0.75)
P_0 * Comp.Adv.			-0.002	-0.002
			(0.02)	(0.02)
P_{-1}* Comp.Adv.			0.043	0.043
			(0.95)	(0.95)
P_{-2}* Comp.Adv.			0.016	0.016
			(0.22)	(0.22)
P_{-3}* Comp.Adv.			-0.067	-0.067
			(1.56)	(1.56)
P_{-4}* Comp.Adv.			-0.027	-0.027
			(0.53)	(0.53)
P_1* Comp.Adv.			0.076	0.076
			(0.79)	(0.79)
P_2* Comp.Adv.			0.057	0.057
			(0.51)	(0.51)
P_3* Comp.Adv.			-0.027	-0.027
			(0.38)	(0.38)
P_4* Comp.Adv.			-0.048	-0.047
			(0.66)	(0.66)
P_5* Comp.Adv.			-0.056	-0.056
			(0.79)	(0.79)
P_6* Comp.Adv.			-0.154	-0.154
			(2.54)*	(2.54)*
P_7* Comp.Adv.			-0.038	-0.037
			(0.53)	(0.53)
P_8* Comp.Adv.			0.049	0.049
			(0.98)	(0.98)
Constant	-1.812	-1.409	-1.815	-1.410
	(23.72)**	(32.68)**	(23.51)**	(32.96)**
Observations	23,809	23,809	23,809	23,809
R-squared	0.39	0.39	0.40	0.40

Robust t statistics clustered at country-level in parentheses. * significant at 5%; ** significant at 1%

Table 8: **Trade Liberalization and Number of Establishments, Robustness**

	(1)	(2)	(3)
Liberalization	0.021	0.043	0.025
	(0.10)	(0.29)	(0.25)
Liberalization *Comparative Advantage	0.278	0.233	0.258
	(2.98)**	(2.85)**	(3.72)**
Year*Continent Dummies	Y	Y	Y
Industrial countries excluded	N	Y	Y
Other controls	N	N	Y
Population (logs)	N	N	Y
Distance to markets (log)	N	N	Y
Financial development	N	N	Y
Real exchange rate (log)	N	N	Y
Constant	5.890	3.784	-13.508
	(64.20)**	(19.26)**	(1.37)
Observations	20,982	13,653	11,185
R-squared	0.85	0.81	0.83

Robust t statistics clustered at country-level in parentheses. * significant at 5%; ** significant at 1%

Table 9: **Trade Liberalization and Size of Establishments, Robustness**

	(1)	(2)	(3)
Liberalization	-0.533	-0.476	-0.362
	(2.75)**	(3.03)**	(4.03)**
Liberalization *Comparative Advantage	0.394	0.344	0.270
	(4.55)**	(3.89)**	(4.26)**
Year*Continent Dummies	Y	Y	Y
Industrial countries excluded	N	Y	Y
Other controls	N	N	Y
Population (logs)	N	N	Y
Distance to markets (log)	N	N	Y
Financial development	N	N	Y
Real exchange rate (log)	N	N	Y
Constant	4.531	4.488	10.451
	(15.81)**	(15.45)**	(0.84)
Observations	20,204	12,946	10,687
R-squared	0.67	0.66	0.70

Robust t statistics clustered at country-level in parentheses. * significant at 5%; ** significant at 1%

Table 10: **Trade Liberalization and Markups, Robustness**

	(1)	(2)	(3)
Liberalization	0.002	-0.027	0.008
	(0.04)	(0.47)	(0.14)
Liberalization *Comparative Advantage	0.042	0.041	0.039
	(1.19)	(1.09)	(1.20)
Year*Continent Dummies	Y	Y	Y
Industrial countries excluded	N	Y	Y
Other controls	N	N	Y
Population (logs)	N	N	Y
Distance to markets (log)	N	N	Y
Financial development	N	N	Y
Real exchange rate (log)	N	N	Y
Constant	-1.878	-2.317	7.958
	(39.92)**	(18.62)**	(2.18)*
Observations	23,809	14,245	12,375
R-squared	0.40	0.36	0.40

Robust t statistics clustered at country-level in parentheses. * significant at 5%; ** significant at 1%

Figure 1: **Number of Establishments, Before And After**

(In Logs)

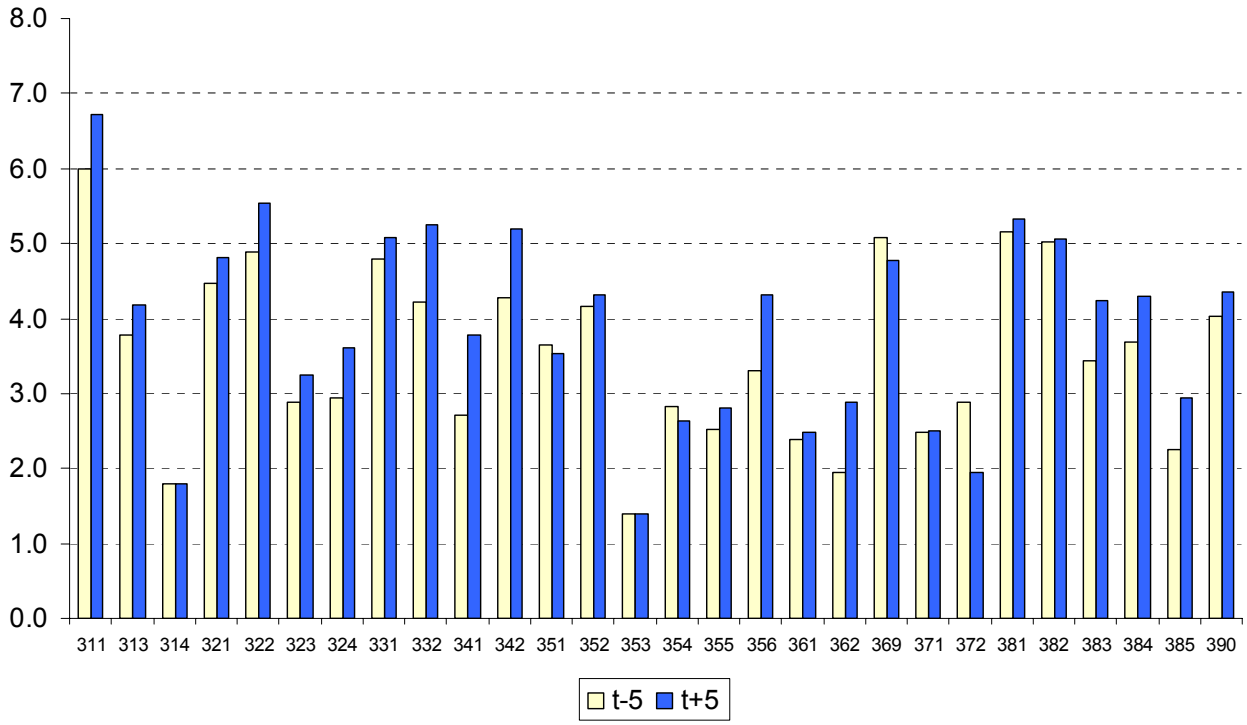


Figure 2: **Establishments Size, Before And After**

(In Logs)

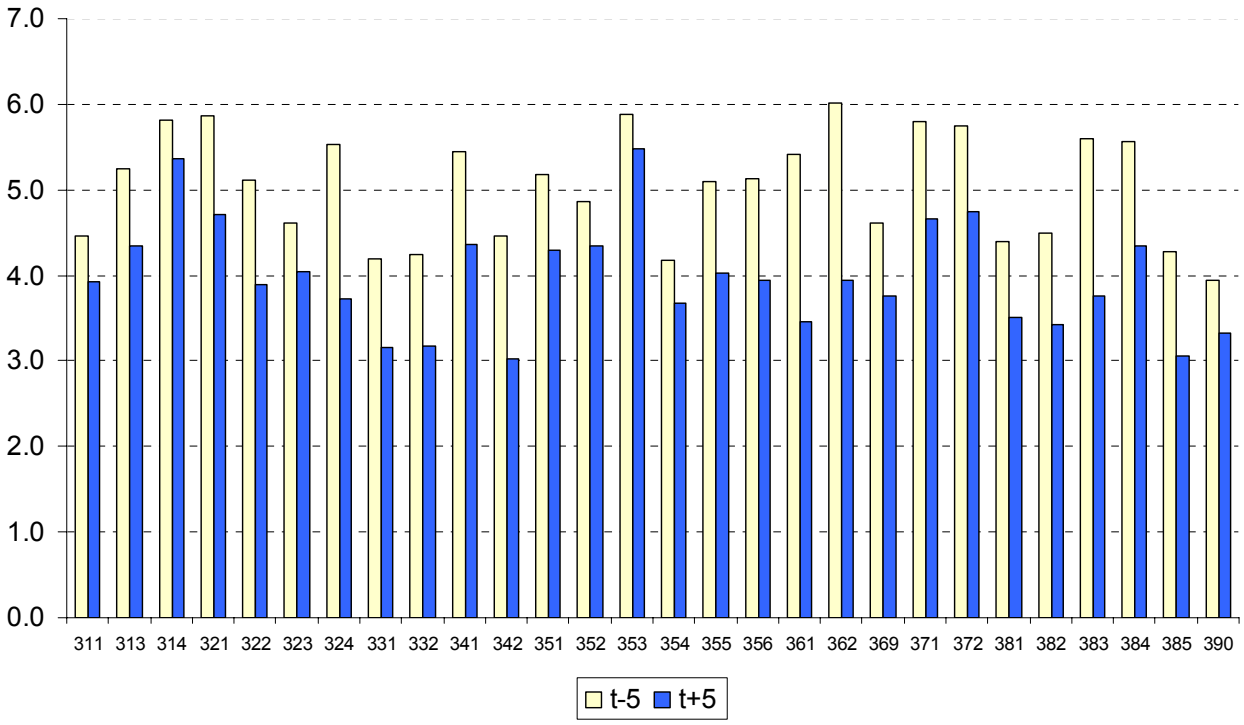


Figure 3: **Markups, Before And After**

(Percentage)

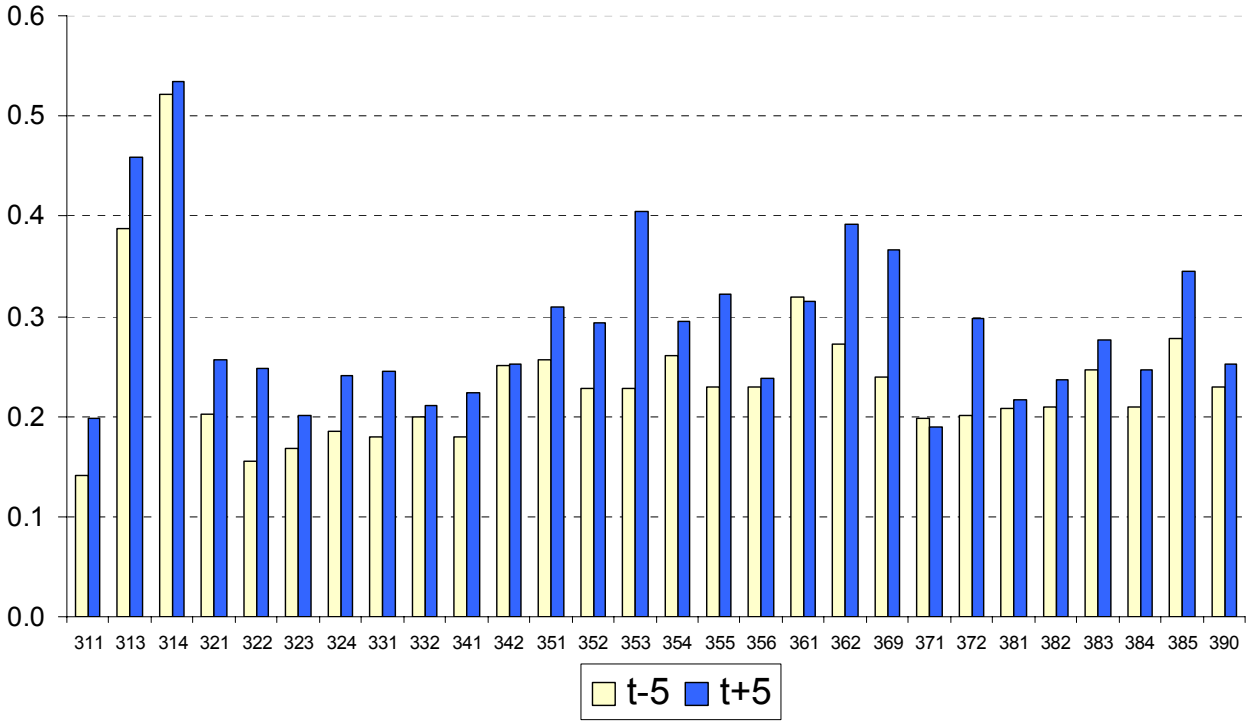


Figure 4: **Number of Establishments by Type of Industry**

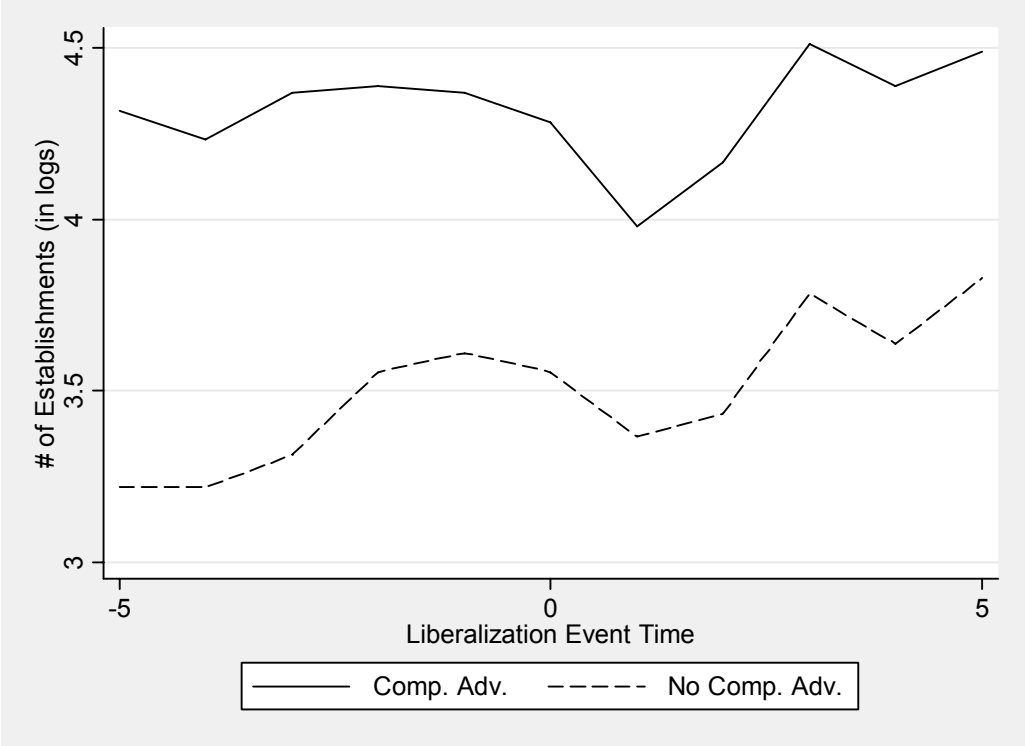


Figure 5: **Establishments Size by Type of Industry**

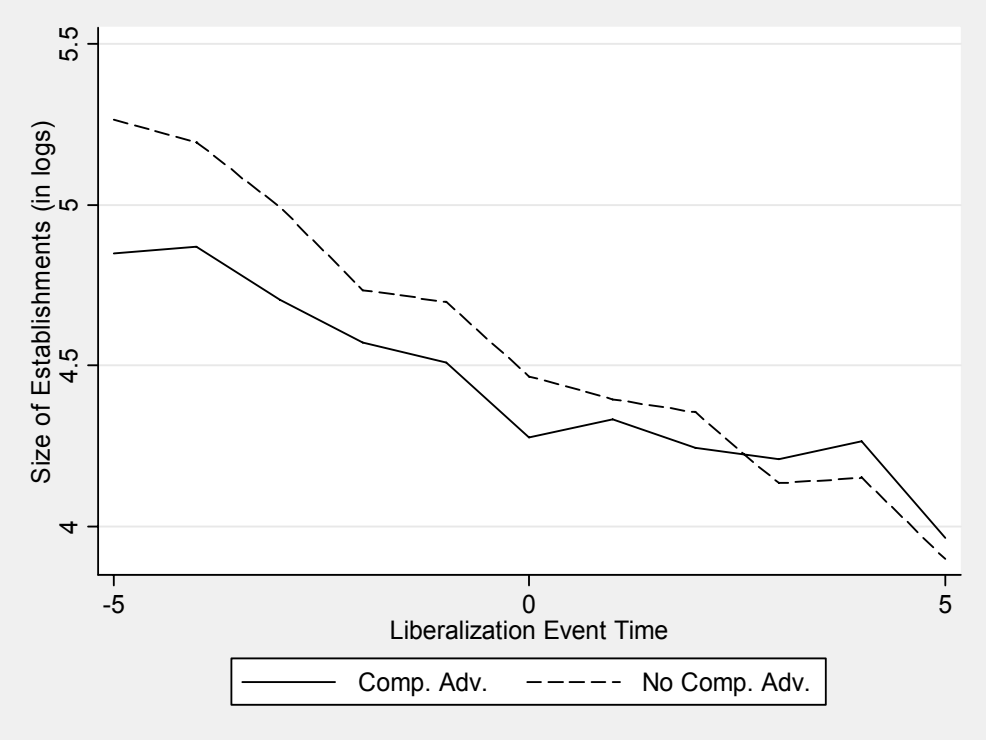


Figure 6: **Markups by Type of Industry**

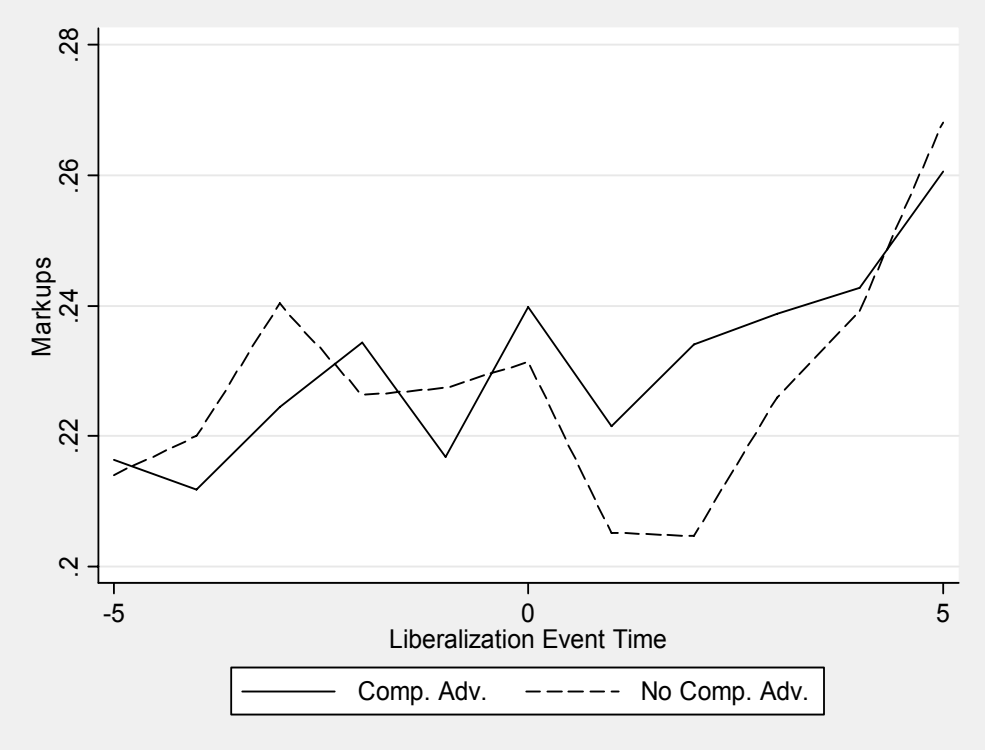


Figure 7: **Number of Establishments, Control Group**

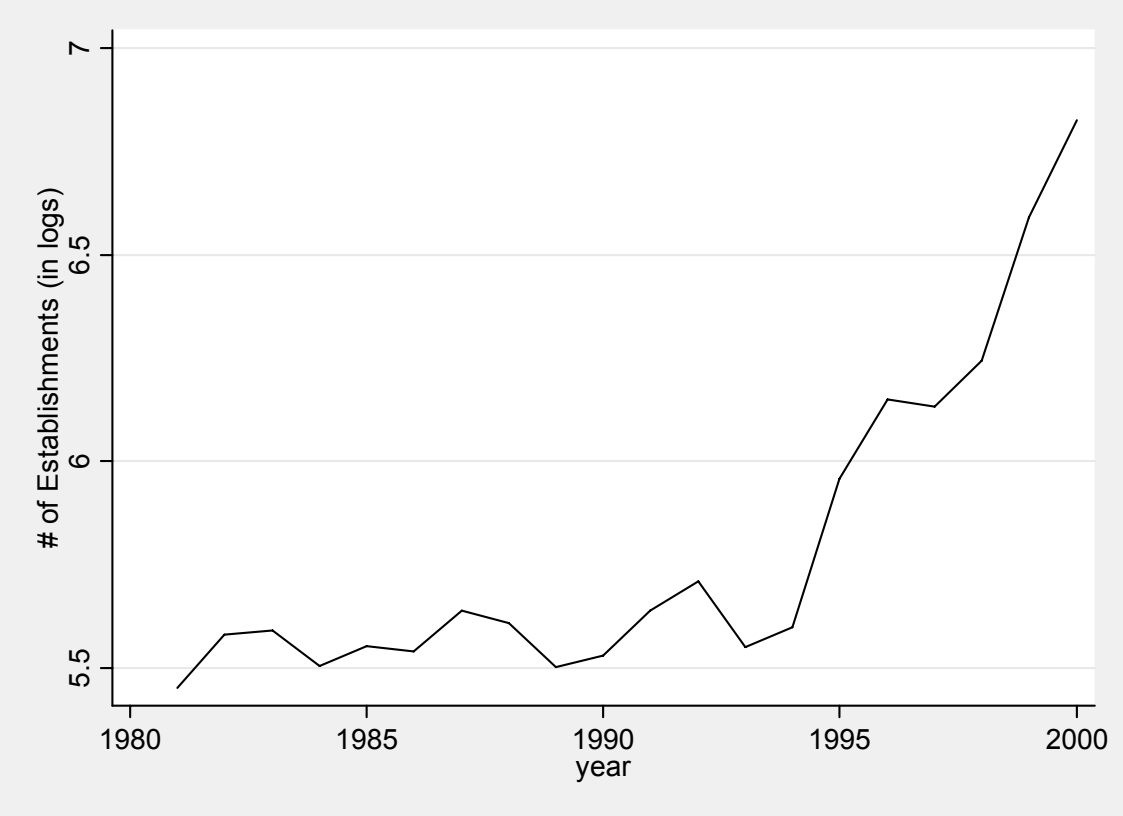


Figure 8: **Establishments Size, Control Group**

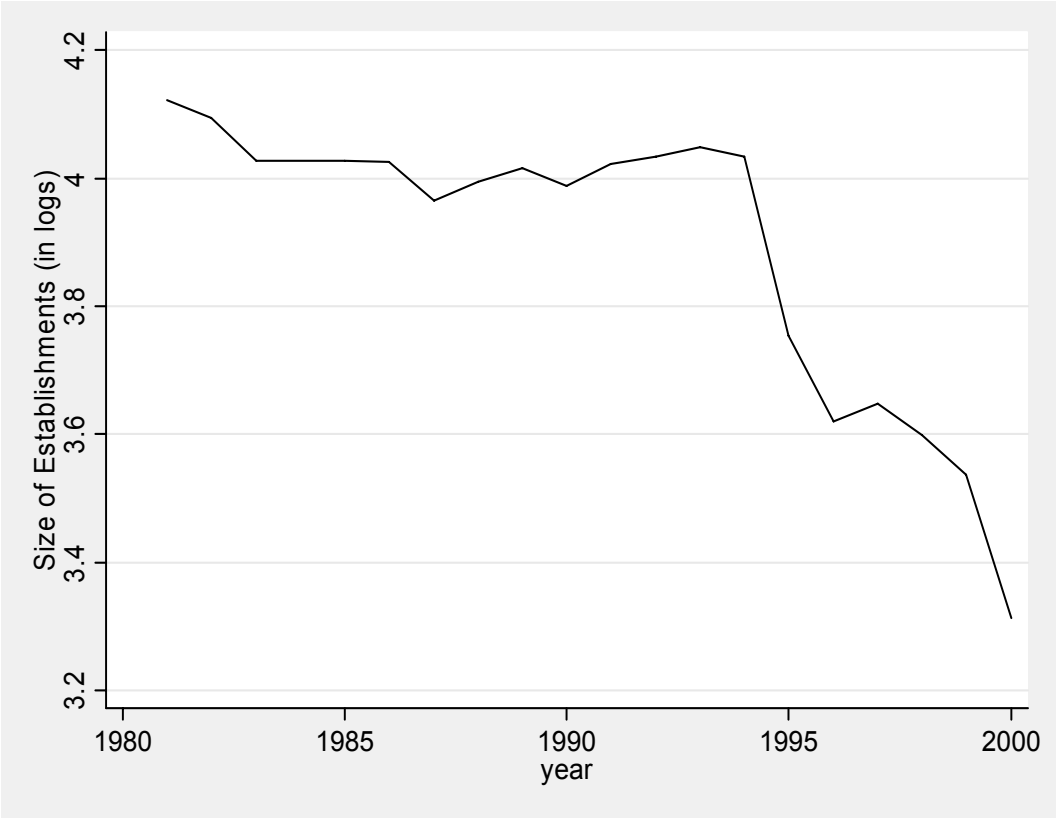
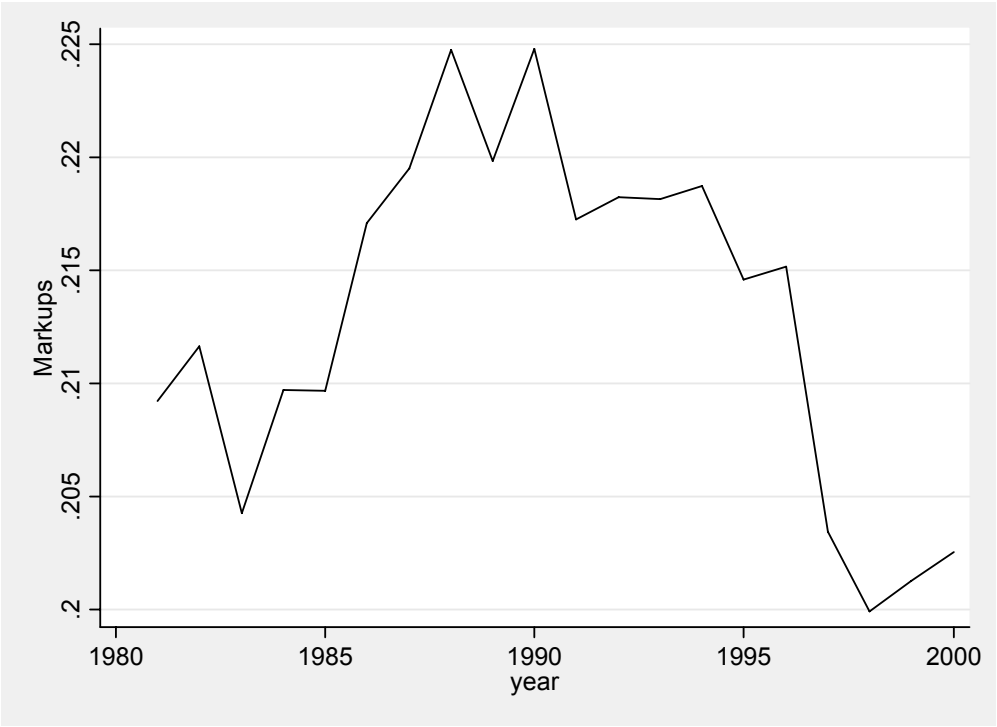


Figure 9: **Markups, Control Group**



Appendix 1: **Control and Treated Countries**

Control		Treated	
AUS	AUSTRALIA	ARM	ARMENIA
AUT	AUSTRIA	AZE	AZERBAIJAN
BLX	BELGIUM-LUX	BOL	BOLIVIA
CAN	CANADA	COL	COLOMBIA
CHL	CHILE	CRI	COSTA RICA
CYP	CYPRUS	ECU	ECUADOR
DNK	DENMARK	EGY	EGYPT
FIN	FINLAND	SLV	EL SALVADOR
DEU	GERMANY	ETH	ETHIOPIA
GRC	GREECE	HND	HONDURAS
IDN	INDONESIA	HUN	HUNGARY
IRL	IRELAND	KEN	KENYA
ITA	ITALY	KGZ	KYRGYZSTAN
JPN	JAPAN	LVA	LATVIA
KOR	KOREA REP.	MEX	MEXICO
MUS	MAURITIUS	MOZ	MOZAMBIQUE
NLD	NETHERLANDS	NZL	NEW ZEALAND
NOR	NORWAY	PER	PERU
SGP	SINGAPORE	PHL	PHILIPPINES
ESP	SPAIN	MDA	REP.MOLDOVA
SWE	SWEDEN	TZA	TANZANIA
GBR	UNTD.KINGDOM	TUN	TUNISIA
		TUR	TURKEY
		VEN	VENEZUELA