



# Productivity and trade openness in Ecuador's manufacturing industries<sup>☆</sup>

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## ABSTRACT

This study takes an empirical look at whether Ecuador's trade liberalization in the 1990s increased or decreased the productivity of Ecuadorian manufacturing establishments for the period 1997–2003. This research applies robust estimation procedures on micro-level data, controlling for a number of other economic events that may have affected productivity during the period under study. The study takes a particular look at how both exporters and import-competing sectors respond to trade openness. The results suggest evidence of a positive and significant effect of trade openness on the productivity of manufacturing industries in export-oriented industries in the years after the implementation of trade reforms, but decreasing productivity after 2000. Increased aggregate productivity might be a result of both the most productive establishments producing output, and slightly increased own-plant's productivity.

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## 1. Introduction

In the early and mid 1990s Ecuador made important changes in trade policy, aimed at reducing trade barriers and promoting export activities. This policy was in striking contrast to trade policies followed in the 1960s and 1970s, when Ecuador applied import substitution which, given its failure to promote sustainable growth and employment, fell prey to growing criticism in the 1980s.

These changes in trade policies included a tariff reform, important reductions in import restrictions, export promotion laws, the modernization of trade institutions, and the simplification of trade procedures. For instance, and as pointed out by Tamayo (1997), tariff reform brought nominal tariff rates down from a range of 29–290% in 1989 to a range of 0–40% in 1994 (the upper level applying to vehicles).

This aspect of increased trade openness – a tariff reform designed to lower tariffs, reduce their dispersion, and simplify their application – brought about changes in import patterns that had a significant impact on the Ecuadorian manufacturing industry. Imports of capital goods for industry and agriculture grew 24% between 1993 and 1996, and 22% from 1997 to 2003. Imports of consumption goods also experienced considerable growth during the period of tariff reform, increasing 58% between 1993 and 1996, and 80% from 1997 to 2003.

One of the Ecuadorian governments' main reasons for pursuing a trade-oriented policy was to foster growth and productivity (Tamayo 1997, COMEXI, 2004). Trade theory points to various channels through which trade liberalization can affect productivity, although researchers have not been able to give a clear-cut answer as to whether the effect on productivity should always be positive, or whether a clear cause–effect relationship between trade policy and productivity (either in levels or in growth rates) exists. These channels include access to better and cheaper technology, economies of scale, and spillover effects. Firms that work in an open economy can have exposure to foreign technology and may learn about the newest and best production techniques. Firms that export their production have access to other, probably bigger, markets which may allow these firms to produce on a more efficient scale with the typical move down their average cost curves. On the other hand, the entry of foreign firms may reduce the market share of import-competing firms and force them to produce on a lower, less efficient scale. International trade exposure may bring positive spillovers to domestic firms as foreign firms bring more efficient managerial skills, on-the-job-training programs, increased competence, etc.

Whether trade liberalization in Ecuador has indeed had an impact on productivity is an empirical question that needs addressing. The present study analyzes survey data from the Ecuadorian manufacturing industry for the period 1997–2003 to estimate correlations between trade openness and productivity and determine how manufacturing productivity evolves in the sample after the implementation of trade liberalization policies. The study focuses on the estimation of productivity gains resulting from own productivity improvements and the reshuffling of resources from less to more productive establishments. Ecuador also presents a rather unique case for this type of study because any research studying Ecuador's productivity should separate the effects of the economy's recent dollarization and economic shocks from the effects of trade openness.

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The questions this study asks are: (i) How has productivity evolved during the period 1997–2003 in manufacturing sectors in Ecuador?, (ii) What is the evidence of productivity gains coming from either own-plants' improved productivity or from reshuffling resources from less to more productive units, or from both, in the Ecuadorian manufacturing industries after this country's implementation of trade reforms?, (iii) What is the correlation between trade openness and productivity in Ecuadorian manufacturing industries?, (iv) Are export-oriented and import-competing industries more productive after trade liberalization?

Results suggest increased aggregate productivity in some manufacturing industries. Food processing, apparel and leather, and furniture are the industries that demonstrate growth at the end of the study period, that is, 2003 (27%, 15%, and 8%, respectively). Other sectors, such as basic metals and metal products, and machinery, equipment and vehicles show a considerable decrease in productivity at the end of the study period, with a 28% point loss and a 10% point loss, respectively. Sectors like textiles, wood and paper, and chemicals, rubber, plastics, and nonmetallic products present a slightly decreased aggregate productivity in 2003. From 1997 to 2003, productivity of import-competing and nontradable manufacturing industries grew 7% and 25%, respectively. In contrast, the productivity of export-oriented industries was in 2003 lower than in 1997. Aggregate productivity gains seem to stem from both (i) the contribution of the more productive establishments producing more output (a positive reshuffling effect) and, (ii) an increased own plant's productivity at the end of the study period. The results suggest a positive and significant impact of trade openness on export-oriented manufacturing establishments, but after 2000, the negative impacts on productivity of economic events that take place after 2000 seem to outweigh this positive impact.

The following section presents a brief review of the relevant literature that links trade liberalization to effects on productivity. Section 3 presents the estimation method and discusses the empirical hurdles involved in productivity estimations. Section 4 presents the data and a summary statistics, while Section 5 discusses the results. Section 6 gives concluding remarks.

## 2. Productivity and trade liberalization: a brief survey

The empirical literature that studies the effects of policy changes on productivity follows two approaches: the representative firm approach (which uses sectoral- or macro-level data; some studies that use macro-level data find evidence of significant relationships between trade openness and productivity, see for instance, [Edwards, 1998](#)), and the approach that recognizes heterogeneity (which uses micro-level data). For developing countries in particular, the recent availability of establishment data as well as the switch from protective to trade liberalization policies allows researchers to undertake a micro-level approach to the analysis of the productivity impacts of trade openness.

Using the heterogeneity approach, researchers are able to study important issues related to productivity that the representative firm approach cannot tackle. The heterogeneity approach, through the use of establishments' data, not only enables the study of contributions to plants' productivity improvements common to all plants (such as exploitation of economies of scale and intra-plant changes in resource allocation — issues that appear also under the macro or representative firms approach), but also permits researchers to address issues specific to each plant (heterogeneity effects) due to entry/exit, and the reshuffling of resources between plants. Nevertheless, the heterogeneity approach does have its drawbacks. Under heterogeneity a host of problems arise such as data availability, data quality, and simultaneity, which may be more difficult to solve than if using macro-level data.

[Roberts and Tybout \(1996\)](#), chapter 3, summarizes two customary ways to measure productivity in studies that use firm-level data. One type of study follows the traditional measure of productivity à la Solow and constructs Tornqvist indexes of productivity, plant-by-plant. The second type of approach consists in estimating a production function

(with parametric or non-parametric techniques) and then creating a measure of productivity by plants, which the researcher later uses to construct industry wide productivity series. These industry-wide time series contain three terms that describe the main sources of productivity changes at the plant level: (i) intra-plant productivity effects (the subject of the representative plan productivity analysis), (ii) effects of market share reallocations between plants (reshuffling effects), and (iii) turnover effects or the net effects of entries and exits of plants. The last two effects capture the heterogeneity effects of plants. Finally, to analyze the effects of trade policies on productivity, micro-level data studies correlate the measures of productivity with proxies for trade liberalization (or protection) measures. This research follows this second approach.

Recent studies use micro data from Latin American countries to explore the relationship between productivity and trade. A key limitation in this type of study is the lack of quality micro-level data. On the contrary, the literature that addresses productivity issues using firm-level data for industrialized countries is much more extensive. [Bartelsman and Doms \(2000\)](#) survey these empirical studies. Interestingly, according to these authors, research has not yet established the link between exposure to foreign markets and productivity improvements.

[Tybout \(2000\)](#) and [Epifani \(2003\)](#) survey the possible effects of trade policies on manufacturing firms in developing countries. Among these studies, some try to determine whether internal economies of scale explain the correlation between trade liberalization and productivity. Their conclusions suggest that scale efficiency gains are minor and not correlated to trade liberalization ([Tybout and Westbrook, 1995](#)). Plant-level studies find in fact that the re-allocation of resources from less to more productive plants explains productivity gains ([Pavcnik, 2002](#), [Tybout, 2000](#), [Tybout and Westbrook, 1995](#)).

Other studies also consider the existence of turnover effects linked to trade policies. Using plant data from Chile 1975–85, [Tybout \(1996\)](#) finds that the net exit increases aggregate productivity in Chile. Net exit is in fact, in that study, the main component of productivity gains for import-competing industries. On the contrary, for Morocco net entry leads to lower aggregate productivity ([Haddad et al., 1996](#)). For a brief review on the empirical evidence of productivity changes due to resource re-allocation and turnover of plants see [Tybout \(1996\)](#), and [Foster et al. \(1998\)](#).

A third source of aggregate productivity gains that may come with trade liberalization policies is improvements in intra-plant efficiency. [Roberts \(1996\)](#) attributes productivity growth to intra-plant movements, using plant-level data from Colombia for 1977–87.

Without exploring why trade liberalization may affect productivity, some studies use plant- and industry-level data and find a positive and significant correlation between trade measures and productivity measures ([Haddad, 1993](#), [Paus et al., 2003](#)).

Theories also point to an inverse causality: the more productive firms, those able to compete in foreign markets, contribute to trade openness. This channel can exist provided that trade barriers do not prevent firms in a country from competing abroad. Using survey data from Colombia and Morocco, [Clerides et al. \(1998\)](#) analyze the causal link between exporting activities and productivity. They find evidence that points to self-selection where relatively efficient firms become exporters. However, much work still remains to be done to examine the association and causality between trade and productivity, as well as the channels through which this causality may work.

Two issues that run parallel to the analysis of the effect of trade liberalization on productivity are how to measure productivity, and the hurdles involved in estimating production functions and productivity effects.

A great deal of recent literature addresses the question of how to estimate establishment productivity. See [Foster et al. \(1998\)](#) for a more detailed discussion of different approaches to estimating firm productivity. More recently, [Van Biesebroeck \(2003\)](#) compares five different techniques that estimate productivity measures: i) index numbers, ii) data envelopment analysis, iii) instrumental variables

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