WHAT MAKES A DIFFERENCE IN ACHIEVING HIGHER LABOR PRODUCTIVITY?
The Case of Low-Income Countries in Latin America[*]

by

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Abstract:

This study tests the hypothesis that the adverse external business conditions, that firms in poor Latin American countries face, may be an important explication of the generally low levels of productivity. However, the empirical results, based on the survey of more than 1300 business in Ecuador, Guatemala, Honduras and Nicaragua, do not confirm this hypothesis. Compared to all the variables that are under the firms control, such as capital intensity, energy use, and worker skills, the external business environment (macroeconomic instability and labor regulations) has very little impact on productivity.

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1. INTRODUCTION

During the last few years, economists, business analysts, and policymakers have all focused considerable attention on Latin American productivity growth because, unfortunately, even after 15 years of market-oriented policies and reforms, productivity is still not growing.

According to some studies, the evidence seems to indicate that insufficient education may have played a role in the lack of productivity growth. However, other evidence suggests that lack of capital investment has limited the growth in productivity. Still other authors have suggested that the low quality of the microeconomic business environment has been holding back the productivity. Certainly, there is no consensus about what factors could be limiting the growth of productivity in the region.

Considering that productivity varies enormously around the region, the objective of the present study is to analyze the role played by external factors on labor productivity in low-income Latin American countries: Ecuador, Guatemala, Honduras and Nicaragua. Since labor productivity is the output per hour worked and we are interested in the role played by external factors, the other input factors are treated as causal factors at the production process level (capital intensity, vintage and technology).

Since this study is interested in fostering productivity in the manufacturing sectors in low-income countries in Latin America, the main objective is to know what makes a difference in achieving higher labor productivity and, equally importantly, what does not. This includes determining what factors of the microeconomic business environment can best explain the labor productivity difference. These factors may affect and/or work through market conditions (demand factors, relative input prices/factor availability and other industries); policy and regulation (import barriers, competition and concentration roles, state ownership, labor roles, unionism, and other types of regulation); and corruption and governance.

The paper has five main sections following this introduction. The first provides a brief overview of the relationship between labor productivity and the quality of the microeconomic business environment. Section III presents a descriptive analysis of manufacturing labor productivity, firm characteristics and microeconomic business constraints. Section IV presents the results of the labor productivity decomposition analyses based on regression. Section V concludes, discussing some possible policy implications.

2. FOSTERING LABOR PRODUCTIVITY: THE QUALITY OF THE MICROECONOMIC BUSINESS ENVIRONMENTS

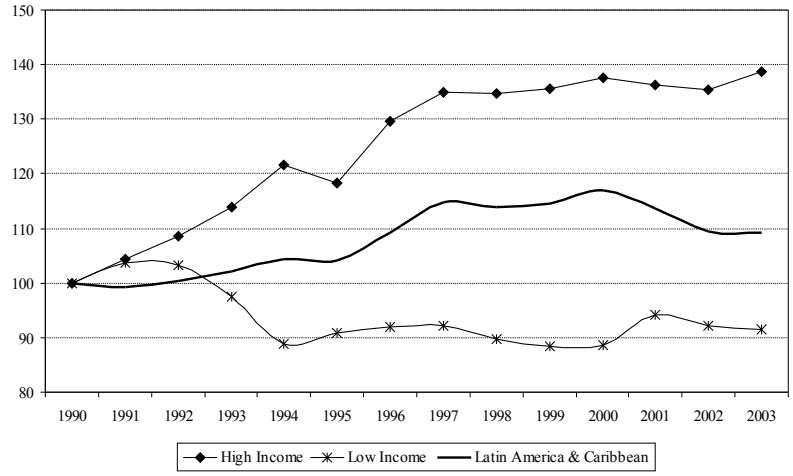
In the 1980s and 1990s, the manufacturing sectors in Latin America underwent large changes due to outward-oriented policies which completely changed the institutional environment. State enterprises were privatized and competition strengthened through a liberalization of foreign trade. Regional trade relations were reinforced by free trade agreements. Presumably, the increased exposure to foreign competition on the home market and abroad provided an important stimulus for firms to improve their productivity and cost performance.

However, while the high-income countries in Latin America (Argentina, Brazil, Chile, Mexico) did indeed experience a substantial increase in labor productivity during the 1990s, this was not the case for the low-income countries in the region (Bolivia, Colombia, Guatemala, Honduras, Nicaragua, Peru). The latter actually seem to have suffered a reduction in labor productivity during the reform period (see Figure 1).

The poor manufacturing labor productivity performance in low-income Latin American countries shows that sound macroeconomics policies and a stable political and legal context, while necessary to ensure a prosperous economy, are not sufficient. Recently, several studies have been finding that economic growth, productivity and competitiveness also depend on improving the microeconomic foundations. For example, the paper by Cole, Ohanian, Riascos and Schmitz (2004) evaluate why Latin America has not replicated Western economic success and find that this failure is primarily due to TFP that is not accounted for by human capital differences, but rather reflects inefficient production: Latin

America has many more international and domestic competitive barriers than do Western and successful East Asian countries.

Figure 1. Manufacturing Labor Productivity Index: 1990-2003 (Year Base 1990=100)



Source: World Development Indicator, World Bank.
Note: High-Income Countries: Argentina, Mexico, Chile and Brazil.
Low-Income Countries: Colombia, Peru, Guatemala, Bolivia, Honduras, Nicaragua.

According to Batos and Nasir (2004), the persistence of productivity differences among countries can be largely explained by differences in the investment climate and by microeconomic environments: the policy, institutional, and regulatory environment in which businesses must operate. These findings suggest that progress in the quality of microeconomic business environment should yield real improvements in enterprise performance and immediate productivity in Latin America, especially by creating the right incentives (Easterly, 2001), promoting competition, and protecting consumer rights (Lewis, 2004).

Table 1 compares the relatively rich Latin American countries with the relatively poor in terms of GDP per capita (corrected for differences in purchacing power) and value added in the manufacturing sectors. It shows that the average growth rate of GDP per capita was positive in the poorer countries and negative in the richer countries, and that the growth of value added in the munufacturing sector was larger in the poorer countries than in the richer

countries. This means that the low level of productivity growth observed in the poorer countries is not a result of generally bad economic performance during the period under investigation, but rather must have some deeper structural explanations.

Table 1. GDP PPP per capita and Manufacturing Value Added (Annual Average: 2000-2003)

Group or Country	GDP PPP per capita		Manufacturing Value Added	
	International $	Growth	Share of GDP	Growth
Latin America & Caribbean	3780	-1.0	15.6	-0.5
High Income	5362	-0.5	16.4	0.7
Low Income	1412	0.7	14.3	2.5
High-income countries				
Argentina	7089	-3.1	16.4	-0.8
Mexico	5846	-0.7	17.7	-1.9
Chile	5055	1.9	18.1	3.8
Brazil	3459	-0.2	13.3	1.8
Low-income countries				
Peru	2071	1.5	14.5	2.3
Colombia	2001	0.9	13.4	2.2
Guatemala	1724	-0.2	12.9	0.8
Ecuador	1347	2.2	13.2	2.2
Bolivia	1011	0.3	13.3	2.3
Honduras	933	0.5	17.3	3.9
Nicaragua	795	0.0	15.5	3.5

Source: World Development Indicator, World Bank.

3. MANUFACTURING LABOR PRODUCTIVITY

3.1. The Data

The data used in this study is from the Investment Climate Surveys carried out by the World Bank Group during 2000-2003. These surveys report on the investment climate and economic decisions of more than 14,000 firms in over 30 countries. The sampling frame was constructed to be broadly representative of enterprises within each country in terms of sector, size and geographic location. The countries used for this study are: Ecuador (2003), Guatemala (2003), Honduras (2003) and Nicaragua (2003). These are the only poor Latin

American countries for which there are comparable data. Bolivia and Peru were excluded because many questions in the questionnaire were different, and because there were too many missing observations.

The main variables available from the survey at the establishment level are the following: general information about the firm; sales and supplies; investment climate constraints; infrastructure and services; financing; labor relations; business-government relations; capacity, innovation, and learning; and productivity information. Table 2 presents the differences between manufacturing sector structure of the countries used for this study. In general, the main industries are food, wood and furniture and garments. In Ecuador, most firms belong to the food industry, whereas, in Guatemala, most firms are concentrated in the garments industry. In Honduras and Nicaragua, most of the firms surveyed were from the wood and furniture industry.

Table 2. Characteristics of Companies Surveyed by Country and Industry (In percent)

Industry	Ecuador	Guatemala	Honduras	Nicaragua	Total
Food	20.6	19.0	21.6	14.7	19.0
Wood and Furniture	7.5	13.2	25.7	22.7	17.3
Garments	8.2	25.8	18.9	12.8	16.4
Non-metallic & Plastic Materials	9.5	14.4	14.1	15.4	13.3
Metals & Machinery	17.9	9.0	6.8	9.9	10.9
Chemicals & Pharmaceutics	17.5	7.4	4.3	7.8	9.3
Textiles	8.2	5.6	3.6	3.4	5.2
Beverages	5.0	2.8	4.8	4.6	4.3
Leather	5.7	2.8	-	8.7	4.3
Total (Number of firms)	441	431	439	436	1747

Source: Investment Climate Surveys / World Bank Group.

3.2. Manufacturing Labor Productivity of Low-Income Countries in Latin America

There are many different approaches to measuring productivity and their calculation and interpretation require careful consideration, in particular when undertaking international comparisons. The choice between them depends on the purpose of productivity measurement and on the availability of data. In general, there are two labor productivity

measures: labor productivity based on gross product and labor productivity based on value added[1].

Obtaining an appropriate measure of output is difficult because product variety and quality differences make it impossible to obtain a single physical output unit. Thus, the labor productivity measure used in this paper is based on value added because we have a reliable measure of both value added and value of total production for each sub-sector.

Specifically, we calculate labor productivity as value added per hour worked. To secure comparability across countries, value added is converted to "2000 International Dollars" using purchasing power parity conversion information from the World Development Indicators 2005.

It should be kept in mind that this definition shows how labor is used to generate value added and its changes over time, or differences between companies, reflect the joint influence of differences in capital, as well as technical and organizational efficiency.

Even after adjusting for purchasing power, the output value per worker per hour is much lower in the poor Latin American countries than in Brazil. Productivity in Ecuador, Guatemala, Honduras, and Nicaragua are all less than a quarter of the level in Brazil (see Table 3).

Table 3. Average Manufacturing Labor Productivity (Gross Value Added per Hour Worked[1], PPP - 2000 US$)

Country	2000	2001	2002	Average Annual Growth	Relative Productivity[2]
Peru	57.1	51.0	-	-10.6	0.40
Ecuador	37.0	32.6	29.2	-11.1	0.24
Guatemala	15.5	15.7	18.4	9.4	0.12
Honduras	20.2	22.9	19.3	-1.0	0.15
Nicaragua	25.2	25.7	20.5	-9.2	0.17
Brazil	79.6	97.0	136.1	31.0	1.00

Source: Author's estimation.
Note: [1] It is assumed that all workers work 40 hours per week, 48 weeks per year.

[1] See OECD (2001).

[2] By comparing them with Brazil.

Table 4 shows that there are large productivity variations across industries. The textile industry has relatively high productivity in all of the four countries studied, especially in Honduras. In contrast, the leather industry has low productivity across the board. Metals and Machinery is the sector with highest productivity in Ecuador but lowest in Honduras. These differences depend at least to some extent on the presence of natural resources.

Table 4. Average Manufacturing Labor Productivity by Industry, 2002 (Gross Value Added per Hour Worked, PPP - 2000 US$)

Industry	Ecuador	Guatemala	Honduras	Nicaragua
Food	30.5	19.4	34.0	38.4
Beverages	18.1	24.9	10.7	24.9
Textiles	35.5	21.3	73.3	23.6
Garments	13.8	12.7	11.9	9.7
Leather	10.9	5.6	-	9.8
Wood and Furniture	16.2	11.0	12.4	12.5
Chemicals & Pharmaceutics	29.2	32.1	24.3	37.2
Non-metallic & Plastic Materials	26.1	26.8	13.6	19.5
Metals & Machinery	31.6	18.6	9.5	16.8
Total Average	26.0	18.3	19.5	20.7

Source: Author's estimation.
Note: This sample excludes some very small sectors that are not present in all countries, like the tobacco industry.

3.3. Microeconomic Business Environment and Manufacturing Labor Productivity

According to Pfeffermann, Kisunko, and Sumlinski (1999) and Lora, Cortés and Herrera (2001), the major obstacles to doing business in Latin America are unpredictability of the judiciary, lack of financing, inadequate supply of infrastructure, cumbersome tax regulations and/or high taxes, and corruption. Another study find that small, medium, and large firms do not share a common major obstacle: whereas small firms report street crime, theft and disorder as their biggest problem, for medium firms, the most substantial problem is taxes and regulations, and for large firms it is political instability (Schiffer and Weder, 2001). Finally, Batra, Kaufmann and Stone (2003) find that the leading constraint to

enterprises is corruption, followed by inflation, financing, political instability and infrastructure in Latin America.

The variables used in this study can be divided into two groups: factual variables and variables measuring perceptions. The factual variables include sector, firm size, export status, management education and worker skills. The perception variables include management's perception as to the severity of the following four constraints: labor regulation, financing, and macroeconomic instability.

Firm Characteristics

Table 5 shows the difference in labor productivity by size of firm. On average, the large firms are the most productive and the microenterprises the least. In particular, large firms are 3.2 times more productive than microenterprises, 1.8 times more than small firms and only 0.6 times more than medium firms. However, there are differences across countries. For instance, medium sized firms have higher labor productivity than large firms in Honduras and the small firms are more productive than medium sized firms in Ecuador and Guatemala.

Table 5. Manufacturing Labor Productivity by Size of Firm[1] (Gross Value Added per Hour Worked)

Size of Firm	Ecuador	Guatemala	Honduras	Nicaragua	Total
Labor Productivity (Average, PPP, 2000 US$)					
Micro	16.4	9.3	8.2	11.9	10.9
Small	23.6	21.0	13.2	17.0	18.7
Medium	18.6	17.9	34.0	22.3	22.1
Large	38.5	24.0	29.9	57.4	34.4
Total Average	26.0	18.3	19.5	20.7	21.0
Composition (% of firms)					
Micro	15.2	24.9	30.1	38.8	27.8
Small	26.4	29.4	27.1	32.6	29.1
Medium	26.4	18.1	16.4	16.7	19.2
Large	32.0	27.6	26.4	12.0	23.9
Total Firms	303	381	292	384	1360

Source: Author's estimation.
Note: [1] Definition by number of employees: Micro (Up to 10); Small (Up to 25); Medium (Up to 60); and Large (Over 60).

In general, the low-income countries present low labor productivity because more than half percent of the enterprises are small and micro firms. This situation is more intense in Nicaragua and Honduras than Guatemala and Ecuador.

On the other hand, there are studies which suggest that export oriented firms are more productive because they operate in more competitive industries. According to Table 6, the exporting firms are indeed 1.7 times more labor productive than non-exporting firms. In terms of composition, these firms only represent 31% of the total.

Table 6. Manufacturing Labor Productivity by Exporter (Gross Value Added per Hour Worked)

Exporter	Ecuador	Guatemala	Honduras	Nicaragua	Total
Labor Productivity (Average, PPP, 2000 US$)					
No Export	21.8	14.4	12.6	18.6	17.1
Export	36.4	24.8	33.5	27.5	29.8
Total Average	26.0	18.3	19.5	20.7	21.0
Composition (% of firms)					
No Export	71.6	62.2	67.1	76.3	69.3
Export	28.4	37.8	32.9	23.7	30.7
Total Firms	303	381	292	384	1360

Source: Author's estimation.

Considering both variables simultaneously, we generally find that the most productive firms are the large exporting firms. For example, 68 percent of large firms export. In contrast, the less productive firms are non-exporting microenterprises. In consequence, productivity enhancing policies might focus on helping small and micro enterprises gain access to export markets.

Human Resources

According to Table 7, on average there is no significant difference in labor productivity between firms that employ mostly skilled labor and firms that rely mostly on unskilled labor. Indeed, in Honduras and Nicaragua, the firms employing mainly unskilled labor have higher labor productivity than those that employ mainly skilled labor.

Table 7. Manufacturing Labor Productivity by Worker Ability[1] (Gross Value Added per Hour Worked)

Worker	Ecuador	Guatemala	Honduras	Nicaragua	Total
Labor Productivity (Average, PPP, 2000 US$)					
Unskilled	23.8	17.3	21.5	24.1	21.1
Skilled	27.3	20.0	17.5	17.3	20.8
Total Average	26.0	18.3	19.5	20.7	21.0
Composition (% of firms)					
Unskilled	37.0	62.5	50.0	50.8	50.8
Skilled	63.0	37.5	50.0	49.2	49.2
Total Firms	303	381	292	384	1360

Source: Author's estimation.
Note: [1] Definition: Unskilled (Over 50% of workers are unskilled); Skilled (Over 50% of workers are skilled).

On the other hand, the training of workers is a key activity to increase labor productivity. Lewis (2004) shows that those enterprises that give training to their workers have higher labor productivity. Similar results are present in this study. Table 8 shows that countries with a higher percentage of employees who receiving training, both skilled and unskilled employees, has higher labor productivity. These results indicate that training may be a way to achieve high labor productivity.

Table 8. Training by Worker Ability (Gross Value Added per Hour Worked)

Worker	Ecuador	Guatemala	Honduras	Nicaragua	Total
Training (% of employees)					
Unskilled	36.2	20.6	18.6	14.0	23.8
Skilled	61.1	15.2	21.4	21.3	32.5
Training (% of firms)					
Unskilled[1]	97.4	61.2	79.8	45.1	68.7
Skilled[2]	98.7	60.9	80.1	45.1	69.0

Source: Author's estimation.
Note: Number of firms: [1] 934; and [2]938

The education of managers is also a key to explain productivity at the firm level. Table 9 shows that the education level of the top manager has a strong impact on average labor productivity in the firm. The most significant differences are present when comparing the firms with graduate and postgraduate manager with the rest; the difference is more than 80 percent.

Table 9. Manufacturing Labor Productivity by Education of Manager (Gross Value Added per Hour Worked)

Education Level	Ecuador	Guatemala	Honduras	Nicaragua	Total
Labor Productivity (Average, PPP, 2000 US$)					
Primary	9.9	9.1	5.9	9.6	8.5
Secondary	12.9	15.8	12.9	11.3	13.3
Vocational	17.0	9.6	8.5	12.2	11.3
University Training	23.2	11.1	10.5	9.7	12.3
Graduate	23.5	19.3	24.9	22.2	22.5
Postgraduate	35.8	33.9	38.1	41.6	37.4
Total Average	26.1	18.3	19.5	20.7	21.0
Composition (% of firms)					
Primary	1.3	9.2	14.7	20.8	11.9
Secondary	2.7	8.7	13.4	8.6	8.3
Vocational	4.3	7.6	5.8	8.1	6.6
University Training	7.6	19.4	12.0	9.9	12.5
Graduate	56.5	37.3	41.4	31.3	40.7
Postgraduate	27.6	17.8	12.7	21.4	19.9
Total Firms	301	381	292	384	1358

Source: Author's estimation.

In general, education and training are very important variables to explain the labor productivity. The skilled and unskilled workers appear to have similar contributions to labor productivity in the production process, but training activities make a difference. The most important impact, however, seem to arise from the education of the top manager, who is responsible for the introduction of new technology and modern management techniques.

Labor Regulations

Labor regulation is another factor that may potentially affect labor productivity. However, according to Table 10, which presents the responses to the question: "Please tell if labor regulations are a problem for the operations and growth of your business," this does not

seem to be the case for our four countries. The majority of firms responded that labor regulations are only a minor obstacle, and productivity does not seem to differ depending on the answer.

Table 10. Manufacturing Labor Productivity by Labor Regulations (Gross Value Added per Hour Worked)

Obstacle	Ecuador	Guatemala	Honduras	Nicaragua	Total
Labor Productivity (Average, PPP, 2000 US$)					
Minor[1]	26.1	20.1	14.5	19.1	20.1
Moderate	23.3	18.1	27.7	33.4	24.2
Major[2]	27.2	12.7	33.0	23.0	22.3
Total Average	26.0	18.3	19.5	20.8	21.0
Composition (% of firms)					
Minor	77.9	60.1	67.8	83.8	72.4
Moderate	9.9	22.3	17.8	10.2	15.2
Major	12.2	17.6	14.4	6.0	12.4
Total Firms	303	381	292	383	1359

Source: Author's estimation.
Note: [1]Include the scale no obstacle and minor obstacle; [2] Include the scale major obstacle and very severe obstacle

According to another question in the survey, the optimal level of employment is generally lower than the current level, mainly because labor regulations makes it very expensive to lay off excess workers.

Competition

According to the economic literature, competition is one of the main factors explaining labor productivity. Presumably, if a firm has a market share of more than 90%, it is a monopoly, and thus experiences little competition. If it has a market share between 40 and 90% it experiences at least some competition, and if it has a low market share, it experiences full competition.

According to Table 11, firms with a market share between 40 and 90% have much higher productivity than the other two groups. These firms are large and important within their industries, but they do at least face some competition, which gives them incentives to improve productivity. The monopolies show the lowest levels of labor productivity in all four countries, possibly because they have little pressure to be competitive.

Table 11. Manufacturing Labor Productivity by Share of the National Market (Gross Value Added per Hour Worked)

Range	Ecuador	Guatemala	Honduras	Nicaragua	Total
Labor Productivity (Average, PPP, 2000 US$)					
Low	26.7	15.4	20.5	19.3	19.4
Middle	35.1	38.2	13.7	32.5	31.6
High	20.2	11.7	19.2	16.1	18.2
Total Average	26.0	18.3	19.5	20.7	21.0
Composition (% of firms)					
Low	48.8	82.2	69.2	66.1	67.4
Middle	17.2	13.6	11.0	15.4	14.3
High	34.0	4.2	19.9	18.5	18.2
Total Firms	303	381	292	384	1360

Source: Author's estimation.
Note: Low (< 40%); Middle (< 40% and <90%); High (> 90%)

Technology

One of the ways to improve labor productivity is to install labor saving technology. Table 12 shows that the companies who think they have better technology than their closest competitors do indeed tend to have higher labor productivity. The differences are not large, however. In general, approximately half of the firms believe their technology is about the same as the competition, one quarter that it is less advanced, and one quarter that it is more advanced.

Table 12. Manufacturing Labor Productivity by Technology[1] (Gross Value Added per Hour Worked)

Technology	Ecuador	Guatemala	Honduras	Nicaragua	Total
Labor Productivity (Average, PPP, 2000 US$)					
Less advanced	23.7	18.2	14.4	23.9	20.3
About the same	24.5	17.6	21.1	18.0	20.0
More advanced	32.4	20.5	19.8	25.1	24.0
Total Average	25.9	18.4	19.5	21.1	21.0

Composition (% of firms)					
Less advanced	26.0	28.4	17.9	19.1	23.0
About the same	53.0	51.8	50.9	53.2	52.3
More advanced	20.9	19.7	31.3	27.7	24.7
Total Firms	296	380	291	376	1343

Source: Author's estimation.
Note: [1]The production process compared with the closest competitor.

Financing Constraints

There are several studies that show that financing constitutes a bottleneck for many firms in low-income countries. According to Batra, Kaufman and Stone (2003), in Latin America, more than 60 percent of firms identified financing to be a major constraint for the operation and growth of business. Table 13 shows similar results, around 50 percent of the firms identified access to financing as a major constraint.

Table 13. Manufacturing Labor Productivity by Access to Financing (Gross Value Added per Hour Worked)

Obstacle	Ecuador	Guatemala	Honduras	Nicaragua	Total
Labor Productivity (Average, PPP, 2000 US$)					
Minor[1]	28.0	21.4	23.9	20.1	23.3
Moderate	25.8	12.3	27.8	26.7	21.5
Major[2]	23.6	16.9	14.9	19.6	18.6
Total Average	26.0	18.3	19.1	20.7	20.9
Composition (% of firms)					
Minor	49.8	49.1	32.5	30.7	40.5
Moderate	8.6	16.0	9.7	13.8	12.4
Major	41.6	34.9	57.8	55.5	47.1
Total Firms	303	381	289	384	1357

Source: Author's estimation.
Note: [1]Include the scale no obstacle and minor obstacle; [2] Include the scale major obstacle and very severe obstacle

On average, the firms that identified access to financing as minor and moderate obstacle are the more productive. This may suggest a virtuous circle, where access to financing allows the introduction of better technology, which improves productivity, which in turn improves the access to financing.

Table 14, relating financing costs to labor productivity, shows the same picture. The firms who say that financing constraints are a minor problem have higher productivity than firms who have major financing constraints. Still, the differences are not large. And still, more than half of the firms interviewed face major financing constraints.

Table 14. Manufacturing Labor Productivity by Cost of Financing (Gross Value Added per Hour Worked)

Obstacle	Ecuador	Guatemala	Honduras	Nicaragua	Total
Labor Productivity (Average, PPP, 2000 US$)					
Minor[1]	30.7	21.3	26.4	18.6	23.7
Moderate	25.2	21.3	23.9	20.2	22.2
Major[2]	23.2	14.4	15.4	21.8	18.9
Total Average	26.0	18.3	19.1	20.7	20.9
Composition (% of firms)					
Minor	34.0	44.1	25.6	26.1	32.8
Moderate	9.2	12.9	10.4	12.3	11.4
Major	56.8	43.0	64.0	61.6	55.8
Total Firms	303	381	289	383	1356

Source: Author's estimation.
Note: [1]Include the scale no obstacle and minor obstacle; [2] Include the scale major obstacle and very severe obstacle

Macroeconomic Instability

Recently, several studies showed that the macroeconomic instability is a main economic constraint to business. According to Table 15, more than half of the firms in all four countries identified macroeconomic instability as a major obstacle to business. The perception about the importance of macroeconomic instability does not seem to be related to labor productivity, however.

Table 15. Manufacturing Labor Productivity by Macroeconomic Instability (Gross Value Added per Hour Worked)

Obstacle	Ecuador	Guatemala	Honduras	Nicaragua	Total
Labor Productivity (Average, PPP, 2000 US$)					
Minor[1]	26.0	23.9	22.6	16.7	22.2
Moderate	18.2	21.1	22.3	28.2	23.4
Major[2]	28.1	15.6	17.1	19.2	19.5
Total Average	26.0	18.3	19.6	20.7	21.0

Composition (% of firms)					
Minor	32.0	21.8	29.2	25.3	26.6
Moderate	14.5	17.3	16.8	24.2	18.5
Major	53.5	60.9	54.0	50.5	54.8
Total Firms	303	381	291	384	1359

Source: Author's estimation.
Note: [1]Include the scale no obstacle and minor obstacle; [2] Include the scale major obstacle and very severe obstacle

In general, the variations in labor productivity seem to be explained by firm size, export status, management education, worker skills, worker training, and financing constraints. In the following we will test the relative importance of each of these factors in a framework that captures all major possible causes simultaneously and reflects their relationships to each other within a given hierarchy.

4. LABOR PRODUCTIVITY DECOMPOSITION ANALYSES

The methodology of this research is a regression-based decomposition that recently has been used in strategic management research. Fields (2004) explains that the value added of regression-based decompositions is based on the following question: How much of the variation in *Y* is accounted for by each of the independent variables *X*? The answers are useful to managers who want to know which *X*s they should manage and which they can safely ignore.

In general, the methodology uses a multivariate decomposition model and the weights from the decomposition are constructed to sum to the total percentage of variance explained (R^2). These weights, derived axiomatically[2], are given by the following formula:

$$s_k = \frac{\mathrm{cov}(X_k \beta_k, Y)}{Var(Y)} = cor(X_k, Y)\frac{\sigma_k}{\sigma_Y}\beta_k \qquad (1)$$

where s_k is the share of variation in the dependent variable attributed to the *k*'th explanatory variable, β_k is that variable's regression coefficient, σ_k is the standard deviation of the *k*'th explanatory variable, $cor(X_k, Y)$ is the correlation between the *k*'th explanatory variable and the dependent variable *Y*, and σ_Y is the standard deviation of the dependent variable. The normalized weights p_k are obtained by dividing each s_k by R^2,

[2] See Annex 1.

so that each weight is expressed as a fraction of the total percentage of variance explained and the weights sum to 100%:

$$p_k = \frac{s_k}{R^2} \tag{2}$$

Table 16 presents the outcome of several estimations and the weights given in Equation 1. The control variables are: country dummies, industry dummies and energy and capital. These variables are all very important to explain labor productivity.

In general, the regression results confirm all the partial correlations that we found in the previous section. The negative coefficients on the three country dummies indicate that the productivity levels in Guatemala, Honduras, and Nicaragua are smaller than in Ecuador (the excluded category). This is also what we saw in Table 3.

The significantly positive coefficients on the four sectors: Food, Chemicals & Pharmaceutics, Non-metallic and Plastics, and Metals and Machinery indicates that productivity is generally higher in these sectors compared to the remaining sectors, when controlling for other factors.

Medium and large firms were found to have higher productivity than small firms, as expected, and the same was found for exporting firms compared to non-exporting firms. In addition, the manager's education level was found to have a significantly positive effect on productivity. When controlling for other factors, workers skill level was also found to be significantly positive.

Two control variables, which have not been discussed above, also proved to be very important for productivity. One is capital intensity (capital stock per hour worked) and the other is energy intensity (energy expenditure per hour worked). Both have a strong positive effect on labor productivity.

The variables measuring perception also yielded the expected results. Labor regulations and macroeconomic instability both have a significantly adverse effect on labor productivity, while the effect of financing constraints was found to be insignificant.

Table 16. Dependent variable: ln (Labor Productivity) in each firm[1]

Variable	Model 1			Model 2			Model 3			Model 4		
	β_k		s_k	β_k		s_k	β_k		s_k	β_k		s_k
Constant	**2.357**	*		**2.170**	*		**2.195**	*		**2.244**	*	
	(0.115)			(0.160)			(0.162)			(0.161)		
Guatemala	**-0.577**	*	**0.015**	**-0.547**	*	**0.014**	**-0.505**	*	**0.013**	**-0.488**	*	**0.013**
	(0.105)			(0.105)			(0.105)			(0.105)		
Honduras	**-0.563**	*	**0.017**	**-0.543**	*	**0.016**	**-0.532**	*	**0.016**	**-0.531**	*	**0.016**
	(0.110)			(0.113)			(0.113)			(0.113)		
Nicaragua	**-0.321**	*	**-0.003**	**-0.289**	*	**-0.003**	**-0.295**	*	**-0.003**	**-0.294**	*	**-0.003**
	(0.095)			(0.097)			(0.099)			(0.099)		
ln(Capital[1])	**0.211**	*	**0.085**	**0.210**	*	**0.085**	**0.217**	*	**0.089**	**0.218**	*	**0.089**
	(0.030)			(0.030)			(0.030)			(0.030)		
ln(Energy[2])	**0.230**	*	**0.091**	**0.218**	*	**0.086**	**0.223**	*	**0.089**	**0.224**	*	**0.089**
	(0.031)			(0.031)			(0.031)			(0.031)		
Food	**0.275**	**	**0.006**	**0.273**	**	**0.006**	**0.296**	*	**0.007**	**0.294**	*	**0.007**
	(0.110)			(0.111)			(0.110)			(0.109)		
Chemical & Pharmaceutics	**0.607**	*	**0.015**	**0.570**	*	**0.014**	**0.568**	*	**0.014**	**0.574**	*	**0.014**
	(0.140)			(0.139)			(0.139)			(0.139)		
Non-metallic & Plastic Materials	**0.225**	**	**0.003**	**0.219**	**	**0.003**	**0.220**	**	**0.003**	**0.221**	**	**0.003**
	(0.097)			(0.097)			(0.097)			(0.097)		
Metals & Machines	**0.359**	*	**0.004**	**0.346**	*	**0.004**	**0.358**	*	**0.004**	**0.359**	*	**0.004**
	(0.093)			(0.093)			(0.094)			(0.094)		
Medium Firm	**0.228**	**	**0.006**	**0.200**	**	**0.005**	**0.220**	**	**0.006**	**0.214**	**	**0.006**
	(0.090)			(0.092)			(0.094)			(0.093)		
Large Firm	**0.242**	**	**0.011**	**0.182**		**0.008**	**0.186**		**0.008**	**0.184**		**0.008**
	(0.120)			(0.122)			(0.120)			(0.120)		
Export		**			**			**			**	
	0.163	*	**0.006**	**0.154**	*	**0.006**	**0.149**	*	**0.005**	**0.147**	*	**0.005**
	(0.092)			(0.092)			(0.092)			(0.092)		
Manager Education					**			**			**	
				0.042	*	**0.012**	**0.042**	*	**0.012**	**0.042**	*	**0.012**
				(0.025)			(0.025)			(0.024)		
Worker Ability				**0.436**	**	**0.002**	**0.462**	**	**0.002**	**0.436**	**	**0.002**
				(0.204)			(0.209)			(0.209)		
Labor Regulations								**			**	
							-0.065	*	**0.002**	**-0.058**	*	**0.002**
							(0.035)			(0.035)		
Financing Access							**0.046**		**-0.001**	**0.037**		**-0.001**
							(0.049)			(0.041)		
Financing Cost							**-0.039**		**0.001**			
							(0.052)					
Macroeconomic Instability											**	**0.002**
										-0.073	*	
										(0.044)		
R^2	**0.256**			**0.259**			**0.267**			**0.268**		
Observations	**1190**			**1189**			**1185**			**1185**		

Notes: Standard errors are given in parenthesis is below the estimated coefficients. Coefficients significant at: 1% (*); 5% (**) and 10% (***). The s_k's are Factor Inequality Weights from the Fields' Decomposition. They show how much of the total variation in Labor Productivity that can be attributed to each explanatory variable.

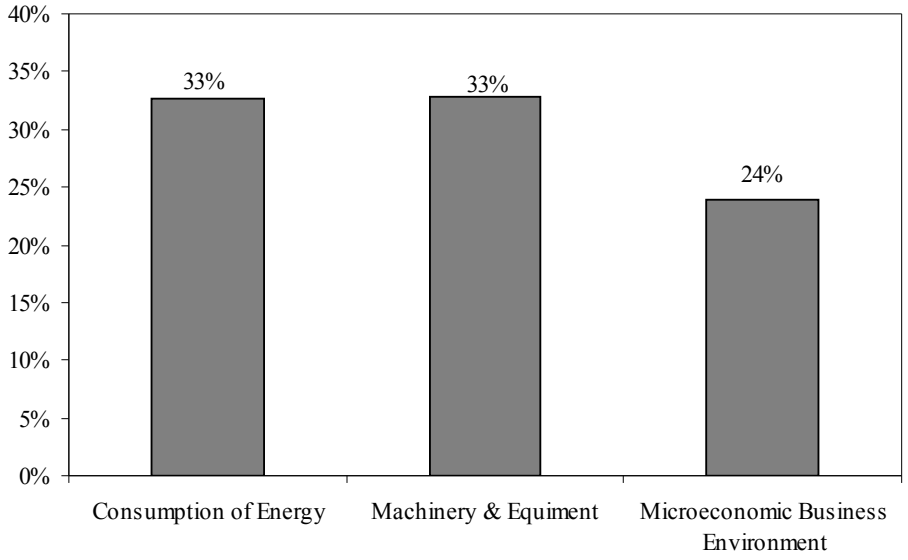
1: Machinery and Equipment per hour worked;

2: Consumption of Energy per hour worked.

Applying Equation 2 and aggregating by variable groups, Figure 1 shows that the two main factors that explain differences in labor productivity are the expenditure on energy and the capital intensity. These variables each explain 33% of explained variation in productivity. All the micro-economic business environment factors together only explain 24%. The rest is explained by the country dummies.

The fact that energy and capital are so important for labor productivity, indicates that they are both very important complementary factors in the production function. It is thus worrying that more than half of the firms have severe financing constraints and that more than 80 percent of firms experienced interruptions in the electricity supply. Nicaragua and Honduras have the highest frequency of interruption, 30 times a year on average. In contrast, Ecuador has the longest interruptions, 15 hours on average.

Figure 2. Labor Productivity: Regression-Based Decomposition



Source: Based on the Factor Inequality Weights (s_k) of Model 4 in Table 16.

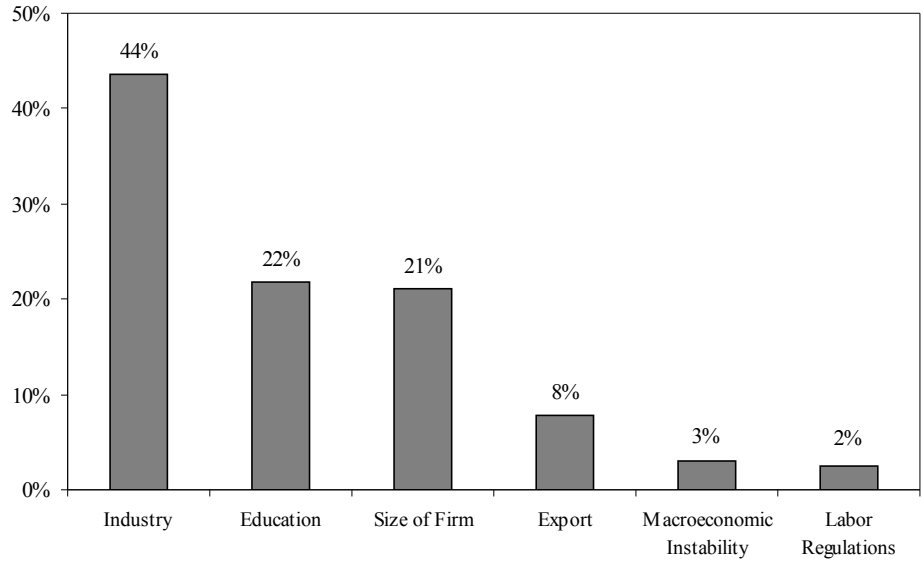
Similar problems exist in water supply, telephone and transport services. Moreover, approximately 55 percent of the firms indicated that the efficiency of government in delivering services, such as public utilities, public transportation, security, is very

inefficient or inefficient. Therefore, improving the delivery of services could improve the labor productivity in the short run.

Some studies found that the quality of microeconomic business environment should yield real improvements in enterprise performance and immediate productivity in Latin America. However, Figure 2 shows that its share is the lowest in explaining the labor productivity differences in low-income countries of the region.

Taking into account the individual components included in the microeconomic business environment, Figure 3 shows that labor productivity differences are mainly due to the firm's characteristics: industry, manager's education, training, size and export orientation. Only 5% is explained by external factors, such as macroeconomic instability and labor regulations.

Figure 3. Microeconomic Determinants: Regression-Based Decomposition



Source:

5. CONCLUSIONS

This study started out with the hypothesis that the adverse external business conditions, that firms in poor Latin American countries face, may be an important explication of the generally low levels of productivity. However, the empirical results, based on the survey of more than 1300 business in Ecuador, Guatemala, Honduras and Nicaragua, do not confirm this hypothesis. Compared to all the variables that are under the firms control, such as capital intensity, energy use, and worker skills, the external business environment (macroeconomic instability and labor regulations) has very little impact on productivity.

Obviously, the firms' perception on the importance of the latter two constraints may not be a perfect measure of the external business environment, but even with substantially improved measures, it is unlikely to become as important as the firms' own choices.

However, even the variables that are under the firms' control, can be affected by public policy, so there are still several policy recommendations arising from the present study.

By far the most important factors for labor productivity were shown to be capital intensity and energy use, both variables that the firm controls, but which may be affected by public policy. Easier access to financing, for example, may induce firms to modernize and thus increase labor productivity. It also seems that a tax on energy use, for example implemented to reduce carbon emissions, would signicantly compromise labor productivity, and thus salaries and living standards, in poor countries such as those included in the present study.

The education of management and the training of workers were also shown to be important factors in explaining differences in labor productivity. These are again internal company decisions, which nevertheless can be influenced by public policy. On-the-job training and complementary courses, for example, could be subsidized by the government, just as full-time education is. On-the-job training actually has several advantages over full-time education. One is that the person being trained continues to work and contribute to

GDP, and the other is that the skills being learned are usually closely related to the needs of the productive sector, which cannot always be said about full-time education.

Size of the firm was also shown to be important for productivity, so the government should try to remove the disincentives to company growth. For example, informal microenterprises are often exempt from paying taxes, but as soon as they grow a bit and become formal, they face steep increases in taxes and bureaucracy. This explains why you can sometimes observe 20 micro-businesses side by side doing essentially the same thing, and competing strongly with each other, when it would seem more logical to create one bigger, more powerful and more modern company.

Finally, the status as exporter also seem to be important for labor productivity, so the government could try to encourage exports. This can be done in many ways from improving export infrastructure to direct incentives in the form of subsidies or tax breaks.

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ANNEX 1: Regression-Based Decomposition

Following the Fields (2004)'s framework, consider a standard regression equation of the form:

$$Y = \sum_{k=0}^{K} X_k \beta_k + \varepsilon \tag{1}$$

where Y is a vector of labor productivity for all firms in the sample and X is a matrix with k explanatory variables, including an intercept. Given the regression equation (1), the variance of Y can be decomposed as:

$$Var(Y) = \mathrm{cov}(\sum_{k=0}^{K} X_k \beta_k, Y) + \mathrm{cov}(\varepsilon, Y) \tag{2}$$

Or, upon dividing through by Var(Y),

$$1 = \sum_{k=0}^{K} \frac{\mathrm{cov}(X_k \beta_k, Y)}{Var(Y)} + \frac{\mathrm{cov}(\varepsilon, Y)}{Var(Y)} = \sum_{k=0}^{K} s(X_k) + s(e) \tag{3}$$

where $s(e)$ is the weight associated with the error and each "s-weight" $s(X_k)$ is the weight of the k'th explanatory variable . The $s(X_k)$ is given by

$$s(X_k) = \frac{\mathrm{cov}(X_k \beta_k, Y)}{Var(Y)} = cor(X_k, Y) \frac{\sigma_{X_k}}{\sigma_Y} \beta_k \tag{4}$$

where β_k is that variable's regression coefficient, σ_{X_k} is the standard deviation of the k'th explanatory variable, $cor(X_k, Y)$ is the correlation between the k'th explanatory variable and the dependent variable Y, and σ_Y is the standard deviation of the dependent. It may be noted that the last term in (3) is excluded, the remaining s-weight sum exactly to R^2. Finally, expressing the $s(X_k)$'s in terms of their contribution to R^2, we obtain the "p-weights"

$$p(X_k) = \frac{s(X_k)}{R^2} \tag{5}$$

such that the $p(X_k)$'s sum to 1. The results given in (1)-(5) provide a full decomposition of the variance.