Get Organized to Compete!

The impact of an export promotion service on production hierarchies*

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Marcio Vargas da Cruz†
Maurizio Bussolo‡
Leonardo Iacovone§

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Abstract

The relationship between the organization of firms and their export status have been at the core of a recent literature focusing on explaining some puzzles related to heterogeneous productivity, access to foreign market and wages inequality. At the same time, there is now some empirical evidence on the effectiveness of trade promotion policies over the last years, which can include training programs to promote best management practices. This paper aims to connect these recent findings in trade literature to understand the interaction between firms organization, export status and export promotion. We use a unique rich data set on Brazilian firms covering the full manufacturing sector to analyse the impact of a program targeting at improving competitiveness by providing consulting on management and production practices. We found a positive impact of the program on firms' production hierarchy based on knowledge. We use this result to discuss potential channels enabling the program to work and the importance of taking into consideration firm's organization while evaluating trade programs.

Key Words: Export Promotion; Firms' Organization; Managers.

JEL Classification: D22; L23; F14.

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†Graduate Institute of International and Development Studies (Geneva) and Federal University of Paraná. Email: marcio.cruz@graduateinstitute.ch

‡The World Bank, Washington-DC. Email: mbussolo@worldbank.org

§The World Bank, Washington-DC. Email: liacovone@worldbank.org

1 Introduction

The relationship between organization of firms and their export status have been at the core of a recent literature focusing on explaining some puzzles related to heterogeneous productivity, access to foreign market and wages inequality. (Caliendo et al. [2012], Helpman et al. [2012], Mion and Opromolla [2011]). At the same time, there is now some empirical evidence that the effort made in some regions in the last years through trade promotion policies, particularly those ones in developing and emerging countries[1] might be effective (Lederman et al. [2010], Volpe and Carballo [2008]), with heterogeneous results among firms (Volpe and Carballo [2010a]).

Indeed, an important contribution to trade literature from the end of the nineties (Roberts and Tybout [1997], Clerides et al. [1998]) was the understanding that firms are heterogeneous not only across sectors and countries, but also within them. Since then, firm's heterogeneity has been at the center of a rich theoretical and empirical literature (see Melitz and Trefler [2012]) focusing on explaining the relationship between firms productivity and their export performance. Among the effort to formalize these empirical findings in a theoretical model Melitz [2003] and its extensions[2] became seminal references. His model explains heterogeneity among firms as a consequence of differences in their marginal cost determined by randomly drawn differences in productivity.

Caliendo and Rossi-Hansberg [2012] offers a complementary approach in which the source of heterogeneity comes from the demand side. Their model was built on the spirit of Garicano [2000] in which production requires organization of knowledge and inputs. Knowledge is costly to acquire and organization is required to coordinate who learns what and how to solve different production-problems in order to optimize gains of specialization in a firm. At the moment firms introduce new products[3], their market size will determine which organization is compatible with their scale of production. Larger demand will enable firms to afford more knowledge as fixed cost by adding new layers of managers, while economizing knowledge from producer workers. Consequently, their marginal cost goes down and these firms become more competitive.

This approach is interesting for many reasons. First, it is consistent with the fact that selection mechanism is the main source that drives gains from trade but it also allows for the fact that some firms become more productive after being exposed to foreign market as suggested by Lileeva and Trefler [2010] and De Loecker [2007]. Second, it draws attention to the fact that the way firms organize their production matters as highlighted by Antràs and Rossi-Hansberg [2009]. Caliendo et al. [2012] provides empirical evidence that support this theoretical framework. This model can also be connected to some recent findings on the importance of manager's experience and management practices (see Mion and Opromolla [2011], Bloom and Van Reenen [2007],

[1] Bernard and Jensen [2004] have not found significant impact of export promotion on American firms.
[2] [?].
[3] In their model the introduction of new products are randomly assigned.

Bloom and Van Reenen [2010] and Bloom et al. [2012]).

How these recent findings on the importance of management and firm's organization are related to trade program's evaluation literature? First, we should take them into consideration due to the fact they are time-varying components of firm's productivity that may affect export performance. There are now a considerable effort in evaluating export promotion policies at firm level. Usually this literature has been assuming quality of management and firm's organization as unobservable time-constant heterogeneous firms' characteristics. Therefore, additional efforts should be made in order to observe these factors.

The second link is that firms' organization may be affected by export promotion programs. Although this might not be the final outcome, it may be a reasonable proxy for intermediate results of these policies. Analysing the potential impact on firm's organization might also be helpful when there is lack of information on stock of capital, total revenue and production at firm level.

This paper aims to understand the interaction between firms organization, export status and export promotion policies. More specifically, we evaluate how an export promotion program aimed at improving competitiveness by providing consulting on management and production practices may impact firm's organization. We use a unique dataset on a program focusing on enhancing small and medium sized firms competitiveness in Brazil, called PEIEX[4] (Portuguese acronym for Industrial Extension Project for Exporting).

First, we follow Garicano [2000] and Caliendo and Rossi-Hansberg [2012] theoretical frameworks to analyse the relationship between export status and firms' organization. We do so by using a proxy for production hierarchy based on knowledge for Brazilian firms. As suggested by this literature we show that firms use to organize their knowledge on production following a hierarchy in a pyramid shape, where production workers learn the standard production problems and managers deal with exceptions. Then, we follow Caliendo et al. [2012] and show that firms that expand more are the ones that reorganize their production. Furthermore, exporting firms are more likely to change their organization by adding layers of hierarchy.

Based on these findings we evaluate the impact of PEIEX on firms organization. In addition, we analyse potential interactions of the impact of the program and firm's quality of management. Apart from controlling for differences in management's quality based on their wage distribution we also observe the effect of hiring new managers from other firms with previous experience in exporting firms. Indeed, if the role played by managers is important to understand overall firms export performance, this might not be different regarding the way they organize production.

In order to identify the impact of PEIEX we exploit a quasi-experiment provided by a regional

[4]The program was awarded by the Trade Promotion Organization Network World Conference and Awards in 2010.

time variation for its implementation. The program was implemented in the late 2008/2009 through regional units around the country. A critical eligibility rule is that firms should submit an application form to the regional unit and be a "potential exporter", that means be part of a sector in which there is evidence of exporting activity. We instrumented these rules and use the fact that only 10 out of 27 states had opened regional units of PEIEX in the first two years in our identification strategy. The data covers the full manufacturing sector in Brazil with a panel of about 250,000 firms from 2007 to 2010.

The article is structured as follows. Section II provides an overview of the literature related to organization of the firm, management practices, export status and policies focusing on trade promotion. Section III describes the PEIEX program, the data and provides descriptive statistics. Section IV analyses organization and transition of exporting firms . Section V discusses our identification strategy. Section VI shows our results and is followed by the robustness check in Section VII. Finally, the conclusion is presented in section VIII.

2 Related Literature and Theoretical Background

For a long time economists used to be puzzled by large differences in productivity across countries, sectors and more recently between firms and plants within the same country and industries. However, only recently we start to draw more attention to the role of the organization and management practices in this process. It is frequent in empirical economics literature at firm level to assume that differences in management capacity among firms are captured by time-invariant effect (fixed effect) when in reality firms make important changes in their management and organizational structure over time that have impact on their productivity. Success stories such as Carlos Ghosn at Nissan, Steve Jobs at Apple or Sergio Marchionne at Fiat seem to be outstanding, but they are not isolated examples.

Does management really matter? Bloom and Van Reenen [2007] show that there is a strong positive and significant association between management practice quality[5] and a number of firms performance measures (e.g. labor productivity, total factor productivity and profitability). In addition, they demonstrate that there is a considerable amount of heterogeneity regarding management practices across and within countries and industries, which is even larger when firms for firms in developing and emerging countries [Bloom and Van Reenen [2010] and Bloom et al. [2010]].

In a randomized trial conducted on 28 plants across 17 firms from textile industry in India, Bloom et al. [2012] show evidences that the impact of receiving consulting on better management practices raised by 11% the productivity of treated firms. Also, the decision making in these

[5]See Bloom and Van Reenen [2007] to further details about the procedure used to score and differentiate good from bad management practices.

firms became less centralized and they also increased the use of computers. A drawback in this experiment is the fact that due the its high cost, particularly for providing high quality consulting ($ 1.3 million, according to the authors) the number of involved firms were small[6], but further understanding on this question is much needed. As highlighted by Cadot et al. [2011] after decades of tariff reduction it is time to renew the agenda on trade policy analysis toward clarifying the impact of specific trade interventions that goes beyond tariff.

Apart from hiring consulting services, another way to improve management practices and potentially take advantage from other firms expertise is through hiring good managers from more successful firms. Mion and Opromolla [2011] shows that hiring managers[7] with previous experience on exporting firms strongly increase the probability of becoming exporters for new exporters. According to their results, one standard deviation rise in the share of number of managers with export experience acquired outside the firm, increase the probability of being a new exporter by about 35%. Also, Lazear et al. [2012] show that the marginal additional gain of replacing a lower quality manager by a higher quality one can increase the productivity by the same amount of adding approximately 11% of homogeneous workers in a team.

Baranchuk et al. [2011] also argue that outstanding managers are usually matched with larger and more productive firms, which reinforce their complementary relationship. Indeed, an interesting environment for experiments regarding how manager matters is on sports. We frequently see teams with the same players having different performance after changing their coaches. Frick and Simmons [2008] used a panel from German premier soccer league and found that better quality coach improve team's performance.

If on the one hand the empirical literature has been looking closer at the importance of managers on firms performance, on the other hand some theoretical models has been emphasizing the interaction between organization of the firm, productivity and trade status. Caliendo and Rossi-Hansberg [2012] shows that a potential source of heterogeneity among exporting firms performance is correlated to the way firms reorganize their management structure when they become exporters. Their findings demonstrate the follows: a) Firms that export tend to have more layers of management; b) New exporters are more likely to add layers than non-exporters; c) New exporters that add layers expand on average much more than the ones that do not reorganize.

In a theoretical model built on the spirit of Garicano [2000][8], Caliendo and Rossi-Hansberg [2012] explains these findings due to economies of scale related to knowledge. In their model, heterogeneity on productivity and other firms' output results from the way firms organize their

[6]The authors addressed on the paper the issue that might be raised by small sample sizes and how the deal with them.

[7]In this paper they differentiate managers and non-managers workers and shows that their results regarding the positive impact of hiring workers with previous experience on exporting firms works only for managers.

[8]His model demonstrates how firms organize knowledge through different layers

production given the level of demand for their products, which is randomly drawn by an entrepreneur. The production function requires labor and knowledge. Employees can act as production workers (layers $l = 0$) or managers (layers $l \geq 1$). While workers use their unit of time to generate production possibility and solving standard problems for which they are trained, managers use their time on solving exceptional problems that demands further knowledge. Adding an additional layer of management (layers $\partial l > 0$) results in an additional fixed cost, which allows firms to economize in the knowledge acquisition of their employees those who generate production possibility. This allows firms to reach lower average costs conditional on sufficiently large scale of production.

Therefore, the "large enough scale" plays an important role in this process, particularly when one think about an environment with much less trade barriers than it used to be some decades ago. In an open economy, firms can decide to sell domestically or export to other markets. Taking into consideration that firms can face a potential high demand from the rest of the world[9] this could suggest that the demand channel does not seem to be main constraint in place. Nonetheless, the share of firms that become exporters (particularly in developing countries) is still relatively low. In the Brazilian case, for example, only about 5% of manufacturing firms are exporters[10]. So, why most of the firms do not export[11]?

Following Caliendo and Rossi-Hansberg [2012] a first constraint firms might deal with is the uncertainty regarding the product they introduce to the market, for which they might do better in case they have access to additional information about consumers taste or the demand from other firms (in case of intermediary goods).[12]. However, there is also heterogeneity in the production side. Apart from the fact that adding additional layers can make firms economize in knowledge at production workers' level, there is also heterogeneity related to to quality of managers and therefore managing practices related to this[13].

Why some firms would not adopt management practices that optimize productivity? Bloom and Van Reenen [2007] suggest that lack of market competition and firms ownership, in particular those familiy-managed ones where CEO succession is determined by primogeniture. Moreover, Bloom and Van Reenen [2010] and Bloom et al. [2010] also address labor regulation, multinational status, education, lack of delegation and barriers to access finance as part of the explanation, specially but not only in developing countries.

Apart from the relation between productivity and export status, an important prediction

[9]Even in countries like China and India, for which their population represents almost 20% of the world population the potential demand from the rest of the world is very attractive for firms, particularly if we take into consideration consumers purchasing power.

[10]This can be underestimate if a large share of firms export by traders, but it is not likely to be the case in manufacturing.

[11]This is another way to ask the question brought by Bernard and Jensen [2004], "Why some firms export?"

[12]Even with a random component of demand, firms can increase the likelihood of success by accumulating additional knowledge about consumers preference.

[13]Another important source of heterogeneity not exploited by Caliendo and Rossi-Hansberg [2012] is capital and capital-realted technology.

from Caliendo and Rossi-Hansberg [2012] is that the impact of trade liberalization on wages of workers at new exporting firms depend on how these firms react to these shocks with respect to their organization design. Those firms that grow will likely add additional layers of managers and will pay smaller wages in pre-existent layers. Therefore, there is also an important aspect regarding wages inequality within firms. However, this gap on wages may be strongly correlated with differences on quality of managers. This open an interesting possibility of making a bridge between this literature and the findings by Mion and Opromolla [2011], Bloom et al. [2012] and Lazear et al. [2012].

At the same time, in parallel to this literature, there is now some evidences that Export Promotion Agencies (EPA) have been effective, particularly for improving firms export performance at the extensive margin in developing and emerging countries (see Lederman et al. [2010], Volpe and Carballo [2010a], Volpe and Carballo [2010c] and Volpe and Carballo [2010b]). In Brazil, among the services provided by the Brazilian Export Promotion Agency (Apex-Brasil) is the PEIEX. The project aims to 'boost competitiveness and raise the export awareness of micro, small and medium-sized enterprises, as well as improve and expand markets for companies in beginning stages of internationalization'. Their main assistance is providing consultancy for firms to deal with technical-managerial and technological problems. The following section provides further details about the program and describes the data we are using to analyze its impact on firms organization.

3 Data and Descriptive Statistics

3.1 PEIEX Program

PEIEX was launched in the late 2008/2009 as one of the assistance services offered by Apex-Brasil[14]. According to their own definition, the program "aims to boost competitiveness and raise the export awareness of micro, small and medium-sized enterprises" by providing capacity building and coaches. The initiative was released as a supplementary assistance for firms interested in taking part of export promotion services already provided by the agency (e.g. participation in trade fairs and business round) but that were not prepared to take full advantage of these services yet (this could be seen as an early stage of preparation for becoming an exporter). In addition, it became an option for firms to access Apex's services in case they had no access through industry or services association[15].

The program offers consultancy services in partnership with universities and institutes of technology in fields such as business, marketing, human resources management, finance, product

[14]See further details on www.apexbrasil.com.br.
[15]In many cases firms have access to services provided by Apex-Brasil through their industry association.

design and trade. Although PEIEX does not charge firms for these services, their condition is that owners and managers of these firms must be committed in attending interviews and standard evaluations to verify managing procedures adopted by these firms. After applying for the project, firms receive a visit from a PEIEX's consultant who will explain their methodology. In case firms confirm their interest in adhering to the project, a standard competitive strength assessment within different areas of the enterprise will be carried with a final report identifying their strengths and weakness, following by suggestions to be implemented focusing on improving their competitiveness.

An important feature about eligibility that will be exploited in our identification is the fact that firms interested in receiving this assistance must fulfil a registration form made available by PEIEX team and their partner organizations[16] and submit the application to the nearest regional unit of attendance[17]. These regional units - NOs (Portuguese acronym for Project Operational Units), started to be implemented in some of the states across the country in the late 2008/2009. However, there are regional and time variation regarding their implementation. Table 1 shows the number of NOs in each state according to the semester-year they were implemented.

Region	Estado	2007		2008		2009		2010	
		First	Second	First	Second	First	Second	First	Second
Northeast	Ceará	-	-	-	1	1	1	1	1
Northeast	Pernambuco	-	-	-	1	1	1	1	1
Northeast	Alagoas	-	-	-	1	1	1	1	1
Northeast	Sergipe	-	-	-	1	1	1	1	1
Northeast	Bahia	-	-	-	1	4	4	4	4
Southeast	Minas Gerais	-	-	6	6	6	6	6	6
South	São Paulo	-	-	-	-	-	-	-	1
South	Paraná	-	-	-	3	3	3	3	3
South	Rio Grande do Sul	-	-	-	7	7	7	8	8
Center-West	Goiás	-	-	-	1	1	1	1	1
Center-West	Distrito Federal	-	-	-	1	1	1	1	1
Total		-	-	6	23	26	26	27	28

Table 1: Number and schedule of implementation of Peiex's regional units (NOs).

Note: The units were implemented in different micro-regions inside the states.

Most of these units are concentrated in the South and the Northeast (with the exception of the state of Minas Gerais in Southeast). However, an interesting feature from the perspective of a quasi-experiment is that states like São Paulo, Santa Catarina and Rio de Janeiro, that together represent a large share of firms (approximately 45%), exporting firms (almost 60%) and gdp in Brazil received units only in December 2010, August 2011 and September 2011, respectively. Due to the fact that the data we are working on is annual, we considered the year of implementation based on the semester the NO was implemented in the state. Those ones installed in the first semester of the year were considered as being over the year. The ones installed in the second semester was considered as implemented in the subsequent year. Therefore, the unit in São Paulo

[16]This includes industrial associations and universities in Brazil.
[17]There are 27 units of attendance distributed around the country.

is considered as implemented in 2011.

These NOs are composed by a manager, an industrial extensionist manager, firms' extenstionists and trainees. After being selected, the staff are demanded to attend courses on PEIEX's methodology and trade. The first step of the assistance is based on interviews with managers and visits to the plant in order to get further information for an assessment of strengths and weaknesses of the firms following a PEIEX's standard methodology.

Based on this information, the extensionists propose a plan for introducing some improvements in fields related to strategic management, human resources, finance and cost, marketing, production, design and trade. In cases the extensionist have no knowledge to give the necessary support for implementing the project, according to the program's methodology, external consultants would from universities and technological centres would be hired to provide the assistance.

3.2 The Data Set

In order to analyse the interaction between firms organization, export status and export promotion we rely on information resulted from the merge of three major data sets: The RAIS (Portuguese acronym for Annual Social Information Survey), the MDIC[18] (Portuguese acronym for Ministry of Development, Industry and Trade) and PEIEX data, which provides information about firms that received PEIEX assistance from the Brazilian Export Promotion Agency. RAIS is a linked employer-employee dataset that provides detailed information on workers and firms characteristics. It contains unique identifier for workers and firms that allows us follow them over time. The data set covers the period between 2006 to 2010. We focus only on manufacturing data (CNAE2 2 digits from 10 to 33) due to the fact that the main target of the program are manufacturing firms. In addition, this keeps a closer relation between the exported good and the main production activity of the firm[19].

RAIS provides information at plant level (with a unique identifier using 14 digits) that can be aggregated at firm level (using the same identifier at 8 digits). In some cases, firms have plants in different regions. For these cases, we consider the geographic location of the firm as the plant with larger number of employees. In addition, even though this is not a common event, some firms change the information about the CNAE sector they belong. For this reason, we kept the last CNAE[20] declared by the firm in the last year they appear in RAIS. Another cleaning data procedure was due to the fact that we are dealing with changes over time. Therefore, we need information on firms for at least two subsequent years. Hence, we kept firms that are in RAIS in periods t and t-1. In some cases (particularly in the estimations), it was necessary information from firms with two lags. Then, it was kept firms that are in RAIS in at least three subsequent

[18] A list of exporting and importing firms by year is publicly available on-line on the website of MDIC.
[19] RAIS is not very representative for agriculture and there are many traders in services
[20] CNAE is the industry sectoral classification

periods (t-2, t-1 and t).

Table 2 shows the number of firms, exporters, Apex's treated (total) and PEIEX's treated firms by year, as a result of the merging and cleaning procedure. These are manufacturing firms that appears in RAIS at periods t and t-1 [21]. We have approximately one million firm-year observation.

year	Nbr Firms	Exporters	(%)	Apex	(%)	Peiex	(%)
2007	226,765	12,194	5.38	2,533	1.12	-	-
2008	232,159	11,967	5.15	3,175	1.37	-	-
2009	240,470	11,629	4.84	5,809	2.42	2,410	1.00
2010	247,187	11,363	4.60	7,170	2.90	3,518	1.42
Total	946,581	47,153	4.98	18,687	1.97	5,928	0.63

Table 2: Number of manufacturing firms by year (2007-2010)

In order to build a proxy for firms' organization, we follow Caliendo et al. [2012] and Helpman et al. [2012] to classify the layers in a way that make it feasible to analyse the results under Caliendo and Rossi-Hansberg [2012] framework. We used the Classificação Brasileira de Ocupação (CBO) definition of occupation, which is divided in 9 different categories according to similar level of authority and/or competencies[22], hereafter defined as 'layers'. Table 3 describes the original categories and the way we aggregated them for our analysis.

Classification	CBO$^{(a)}$	Occupation	Level$^{(b)}$
CEOs, Directors	CG 1	CEOs, Directors and Managers	-
Senior staff	CG 2	Art and Sciences - high level of experience	4
Supervisors	CG 3	Quality control, technical, accounting	3
Clerks	CG 4	White color - internal administration services	2
	CG 5	White color -external administration services	2
Blue collars	CG 7 and CG 8	Welders, assemblers, machine operators	2
	CG 9	Maintanance workers	2

Table 3: CBO classification

Note: (a) CG 6 refeers to agriculture and it was excluded; (b) Level of competency according to CBO

Based on this classification we build some critical variables used in this paper by using employee information at firm-level. Next section provides descriptive statistics and explains the procedure used to build de variables we used in our estimations.

[21] This procedure was adopted due to the fact that the paper uses lagged information in many occasions.

[22] The concept of competence adopted by CBO has two dimensions: (1) It is a function of the complexity, scope and responsibility of activities in employment or other working relationship; (2) It is related to the characteristics of the work context as an area of knowledge, function, economic activity, production process.

3.3 A proxy for firms' organization

To begin with, we analyze the distribution of wages of workers among the classification we followed in order to check if this criteria match with differences on wages between and within layers. Table 4 shows the distribution of average hourly wage and total amount of hours hired over a year in 2010. The distribution is relatively similar for other years (see Appendix).

Wage/Hour	CEOs/ Directors	Senior staff	Supervisors	Clerks	Blue collars
mean	14.74	12.71	8.27	5.33	5.13
sd	18.61	12.98	7.02	3.95	3.35
p 01	2.56	2.75	2.50	2.07	1.15
p 05	3.31	3.00	3.04	2.90	2.90
p 10	3.99	3.41	3.43	3.00	3.06
p 25	5.63	4.99	4.59	3.42	3.56
p 50	8.74	9.20	6.81	4.37	4.44
p 75	15.98	17.10	10.17	6.00	5.83
p 90	29.58	26.19	14.51	8.54	7.88
p 95	49.92	32.71	18.16	10.78	9.61
p 99	95.88	49.76	28.23	18.42	14.85
Hours hired (year)					
mean	5,978	12,478	18,882	12,078	41,109
sd	28,371	98,286	125,637	87,285	403,867
p 01	176	176	176	176	352
p 05	528	384	528	672	1,232
p 10	880	704	960	1,056	2,112
p 25	2,112	1,760	2,112	2,112	4,048
p 50	2,112	2,112	3,168	3,696	9,328
p 75	4,224	4,928	8,448	8,096	24,464
p 90	8,976	15,312	26,752	19,008	63,360
p 95	16,368	33,264	57,552	34,672	119,680
p 99	59,488	175,504	258,032	137,456	476,960
Nbr. Firms	67,790	37,029	66,727	166,164	219,980
Share	27.42	14.98	26.99	67.22	88.99

Table 4: Distribution of average hourly wage by occupation (in 2010)

The distributions are ranked, which makes sense in economics terms and is consistent with previous findings[23]. Secondly, it is noticeable that wages are heterogeneous not only between layers, but also within them. In fact, the higher the position, the larger the within variation. The difference on the mean wage between the CEO's, Directors and Managers category to blue color was 2.7 times between 2006 and 2008. However, the difference among the 50th percentile (p50) and the 95th percentile (p95) among CEO's, Directors and Managers were around 6 times and it goes to almost 20 times if p95 is compared with p5 in the same category. Therefore, there is more heterogeneity[24] among higher level positions.

Table 5 shows the level of schooling according to different layers. The first layer includes Self-employed entrepreneurs, CEOs, Directors and Managers, which results in more heterogeneity in terms of demanded skills. For the other layers there is a clear correlation between the level of competency and schooling degree[25]. For example, if we compare two extreme cases it is

[23] Caliendo et al. [2012] found similar results to French firms.
[24] Helpman et al. [2012] discusses further wages inequality using similar Brazilian data.
[25] We also can control for years of experience.

noticeable that the share of employees with higher education level is the majority among senior staff (78% in 2010) while almost 55% of blue collars had not completed the secondary degree in 2010. However, the increase of the share of workers with more schooling from 2007 to 2010 is remarkable. The number of blue collar employees increased from 4.63 to about 5.15 millions and the share of them with secondary or higher school jumped from 37% to 45%. These changes are even more significant if we compared the them starting in 2006, when there were 4.36 millions blue collar workers and only 34% with secondary school.

Classes	**No degree**	**Prim.**	**Second.**	**Higher Ed.**	**Posgrad**	**Total**	**Growth**
year = 2007							
CEOs, Directors	7.47	13.16	35.33	43.28	0.76	161,874.08	4.99
Senior staff/manager	2.71	4.14	18.72	73.60	0.83	180,500.75	7.85
Supervisors	7.32	15.91	61.68	14.98	0.11	509,858.67	5.75
Clerks	15.63	25.36	51.29	7.67	0.05	1,023,941.92	4.85
Blue collars	28.84	33.92	36.30	0.92	0.01	4,632,421.92	6.27
Total	23.82	29.82	40.13	6.15	0.07	6,508,597.33	6.02
year = 2010							
CEOs, Directors	6.12	11.06	37.66	43.96	1.20	190,899.92	7.25
Senior staff/manager	2.21	2.87	16.77	77.00	1.14	228,782.08	12.67
Supervisors	5.53	12.98	64.28	17.03	0.18	601,766.08	8.05
Clerks	13.08	22.47	55.93	8.44	0.08	1,214,824.92	8.08
Blue collars	23.44	30.99	44.45	1.10	0.02	5,154,415.00	8.47
Total	19.17	26.74	46.92	7.06	0.11	7,390,688.00	8.47

Table 5: Schooling level by layers (2006-2010)

After analysing some employees' characteristics according to different layers we investigate how this is translated in terms of hierarchies inside firms. Therefore, following the occupation's hierarchy presented in table 3 we classify firms in 4 layers of management[26] (from L0 - a firm with 0 management hierarchy - to L4). Table 4 shows that a large share of firms (about 89%) have blue collars employees, classified as producer workers (L0). If we consider the first two occupations, all of these firms have employees in at least one of them. However, the share of firms with management layer are lower.

Table 6 shows the average number of hours hired by firms and number of layers. It is noticeable that between 2007 and 2010 there was a trend of increasing the number of layers and wages[27]. On average, these firms have between 1.2 and 1.26 layers of managers, but we show later on table 8 that the number of layers use to be larger for exporting firms.

[26]Caliendo et al. [2012] merged two occupations - clerks and blue collars - due to the fact they have similar wages. In the Brazilian case we also found relatively similar wages. However, we found differences with respect to schooling and hours hired among clerks. In addition, when we compare firms with one layer of hierarchy (L0 and L1) against those ones without (only L0) under this classification, we find differences among them regarding size, share of exporters, among other variables. Therefore, we kept 4 layers of management hierarchy and use the alternative classification (3 layers) as robustness check.

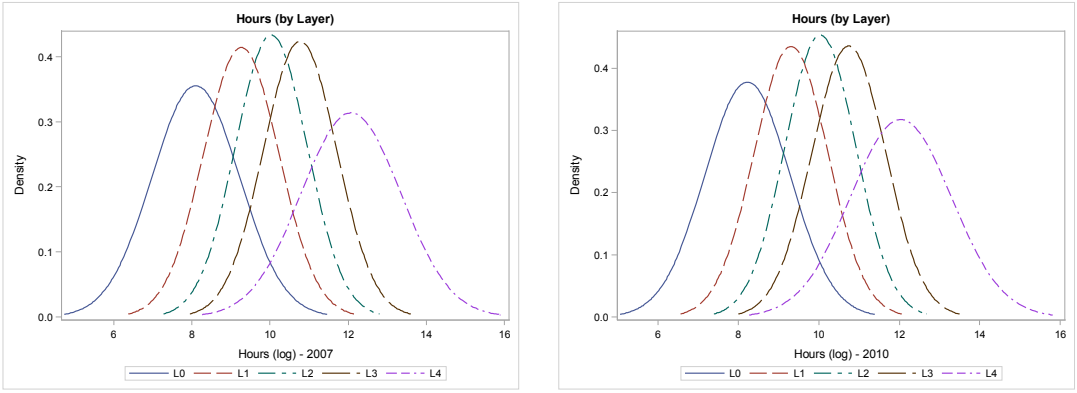
[27]All nominal values are in R$ of 2010, using the IPCA (Portuguese acronym for the National Consumer Price Index), the official inflation index used by Brazilian Central Bank for inflation target.

year	N	hours	wage	layer
mean				
2007	226,188	51,471	4.91	1.20
2008	231,583	54,265	5.02	1.24
2009	239,931	51,213	5.24	1.24
2010	246,674	53,420	5.38	1.26
median				
2007	226,188	11,440	4.01	1.00
2008	231,583	11,968	4.12	1.00
2009	239,931	11,440	4.34	1.00
2010	246,674	11,616	4.48	1.00

Table 6: Average hours hired, wage and number of layers, by year - in R$ of 2010

Another important firm's characteristic related to the hierarchies adopted here is that firms with similar size have different level of organizations. Figures 1 and 2 present the distribution (cumulative probability function) of the amount of hours hired and wage hours according to number of layers. It is noticeable that, on average, larger firms have more layers and pay higher wages.

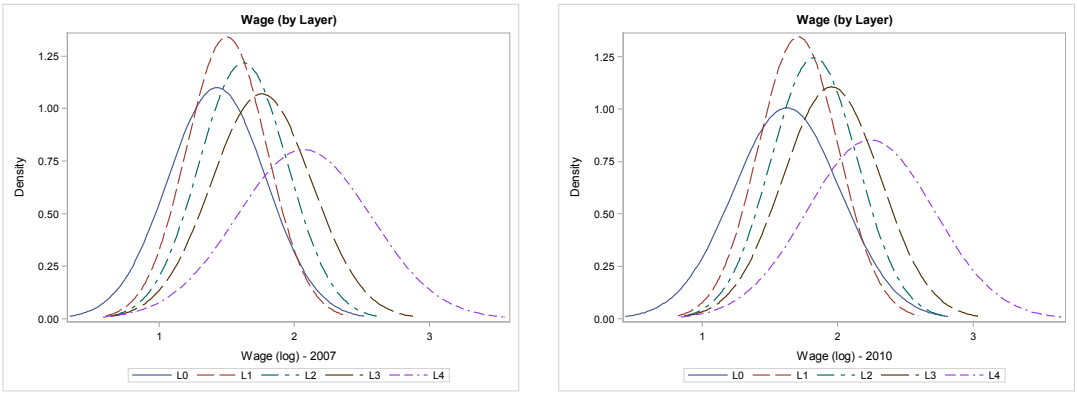
However, it is important to highlight the overlapping among firms with different number of layers. It means that firms with similar size (measured by total amount of hours hired) have different number of layers. Even after controlling for total number of employees (or hours hired), firms have different organization in terms of knowledge-based hierarchy. These figures lead us to the discussion in Caliendo et al. [2012] about the fact that when firms expand they have the option to do it by hiring more workers in previously existing layer or add additional layers. Hence, although it is clear that number of layers are positively correlated with firms' size (in terms of number of employees), there is a lot of heterogeneity regarding how firms organize knowledge in their production when they expand.



(a) Distribution of hours - 2007

(b) Distribution of hours - 2010

Figure 1: Distribution of log(hours) by layers



(a) Distribution of wages - 2007 (b) Distribution of wages - 2010

Figure 2: Distribution of wages by layers

In order to reinforce the argue, let us compare the frequency of firms according to different number of layers, using a narrow firms' size interval. The literature using firm-level data often use the concept of micro, small, medium and large firms based on number of employees (it is also a common concept used for tax purpose in different countries). Table 7 shows that even in a narrow interval regarding number of employees (like the ones commonly used as threshold for differentiate firms by size) firms differ a lot in terms of organization of knowledge. For example, the first two columns presents the frequency of firms of size between 9 and 10 employees over the period of 2007 and 2010. The majority of them have 1 or 2 layers of management, but there are firms in all layers. The same thing is observed among firms between 19 and 20 employees, 99 and 101 or 150 and 450. In addition, this heterogeneity also happens within sector.

LAYERS	$9 \leq L \geq 10$		$19 \leq L \geq 20$		$99 \leq L \geq 101$		$150 \leq L \geq 450$	
	Obs	(%)	Obs	(%)	Obs	(%)	Obs	(%)
0	4,181	14.66	561	5.83	5	0.62	37	0.21
1	12,968	45.48	2,874	29.85	38	4.73	111	0.64
2	8,539	29.95	3,705	38.49	109	13.57	659	3.78
3	2,491	8.74	1,983	20.60	253	31.51	2,576	14.79
4	336	1.18	504	5.24	398	49.56	14,031	80.57
Total	28,515	100	9,627	100	803	100	17,414	100

Table 7: Number of firms by different layer in a narrow interval of firms' size difference (2007-2010)

Table 8 shows the distribution of firms by number of employees and layers due to the fact that the design of PEIEX is clearly targeting an average (relatively small) firm. In Brazil, the large majority of firms in manufacturing has less than 100 employees and are non-exporter. Indeed, the share of exporting firms in manufacturing (between 2007 and 2010) was only about 5% and the share of firms with less than 100 employees was about 96%. In addition, there is more heterogeneity regarding how firms organize knowledge among the smaller ones. If we take firms with more than 500 employees, the large majority will have more than 3 layers of management

and many of them will be among the top exporters.

TOTAL	Number Firms	Column share (%)	Share on total number of firms ≤500	≤100	≤20	≤10
1	309,523	32.78	99.96	99.93	98.59	93.99
2	312,065	33.04	99.99	99.85	90.99	72.69
3	174,937	18.52	99.99	98.84	71.72	41.46
4	86,425	9.15	99.86	92.92	40.83	15.54
5	61,426	6.50	89.33	54.57	9.56	2.20
Total	944,376	100.00	99.28	96.11	80.03	64.07
EXPORTERS						
0	1,981	4.20	99.80	99.34	95.41	86.37
1	4,493	9.53	99.99	99.35	78.72	53.37
2	7,086	15.03	99.94	95.68	53.50	25.50
3	9,198	19.51	99.28	82.95	25.40	7.39
4	24,386	51.73	79.18	34.06	3.56	0.55
Total	47,144	100.00	89.07	61.83	26.35	14.28
APEX						
0	1,592	8.52	99.87	99.75	98.18	91.46
1	3,390	18.15	99.99	99.68	82.89	58.44
2	3,539	18.94	99.97	97.54	59.06	29.90
3	3,513	18.80	99.35	84.54	26.96	7.74
4	6,648	35.59	76.58	33.72	3.94	0.83
Total	18,682	100.00	91.53	72.96	41.07	25.81
PEIEX						
0	950	16.03	99.79	99.79	98.53	91.47
1	1,867	31.50	99.99	99.68	85.75	62.13
2	1,438	24.26	99.99	98.96	68.22	35.74
3	978	16.50	99.80	92.94	40.49	12.07
4	694	11.71	95.10	64.27	11.38	3.31
Total	5,927	100.00	99.36	94.26	67.37	45.28

Table 8: Number of firms by exporting and treatment status and share of firms by number of employees (2007-2010)

Table 8 also shows that the majority of firms with less than 3 layers receiving APEX's assistance are part of PEIEX's program. If we take the ratio of the first column (PEIEX/APEX) the share of firms receiving PEIEX according to their number of layers are respectively (60% among the ones with 0 layer of manegement hierarchy, 55% with 1 layer, 41% with 2 layers, 28% with 2 layers and 10% with 4 layers).

Next, table 9 shows the average size of firms (regarding number of employees) by exporting and PEIEX's treatment status in different regions. First, it's noticeable that PEIEX's treated firms are closer to the average non-exporting firms in terms of size. Second, while almost 60% of exporting firms are concentrated in Southeast, the distribution of the treatment are relatively larger in the South and the Northeast. This is explained by the previous discussion about the geographic distribution of PEIEX regional units (NO). Indeed, one of the target of the program was decentralize Apex's activities. This is important because we use geographic and time variation for NO's implementation as part of our identification strategy. This table also

shows that although exporting firms represent about only 5%, they respond by approximately half of employment in manufacturing (49%). The next subsection shows the shape of firms' hierarchies graphically.

REGION	N	mean	sd	median	share job	share firms
North	25,396	37.11	183.45	7.58	3.30	2.68
Northeast	108,670	31.08	321.49	5.58	11.81	11.48
Southeast	467,988	32.66	267.03	6.75	53.45	49.45
South	287,350	26.21	306.44	5.00	26.34	30.36
Center-West	57,051	25.58	376.01	5.08	5.10	6.03
Total	946,455	30.21	291.67	6.00	100.00	100.00
EXPORTERS	N	mean	sd	median	share job	share firms
North	1,549	260.03	613.45	66.42	1.41	3.29
Northeast	2,116	638.21	1936.24	110.54	4.72	4.49
Southeast	28,080	272.28	1025.19	58.83	26.74	59.55
South	14,384	277.19	1332.12	61.67	13.94	30.51
Center-West	1,022	589.55	2708.47	59.33	2.11	2.17
Total	47,151	296.67	1230.53	61.17	48.92	100.00
APEX	N	mean	sd	median	share job	share firms
North	94	280.77	756.19	46.04	0.09	0.50
Northeast	1,978	253.35	1582.25	19.58	1.75	10.59
Southeast	8,758	263.06	1076.97	44.17	8.06	46.87
South	7,302	230.99	1556.61	22.25	5.90	39.08
Center-West	553	534.39	3428.21	16.92	1.03	2.96
Total	18,685	257.62	1451.88	30.08	16.83	100.00
PEIEX	N	mean	sd	median	share job	share firms
North	-	-	-	-	-	-
Northeast	1,099	35.16	158.07	14.33	0.14	18.55
Southeast	1,433	33.25	79.79	13.17	0.17	24.18
South	3,039	31.09	130.71	10.17	0.33	51.28
Center-West	355	35.51	113.52	11.08	0.04	5.99
Total	5,926	32.63	125.31	11.50	0.68	100.00

Table 9: Number of firms and average size by Export and Apex status (2007-2010)

Note: Share job refers to the share on the total job in Brazil and share firms refers to the share of firms in each group (total, exporters, apex, peiex).

3.4 How firms organize knowledge in hierarchies?

Figure 3 shows the hierarchies of firms in Brazil[28]. We follow Caliendo et al. [2012] to represent firms graphically according to their number of layers. The layers are represented using a square. The vertical axis has the average hourly wage of employee in each layer and the horizontal axis represents the average hours employed in the layer, according to the number of layer of the firms. Therefore, these axes are respectively the height and the length of the square, which represents the payroll of firms by layers. In Garicano [2000] they represent hierarchical organization of firms with the shape of a pyramid, what was called by him as 'pyramidal organization'. It is resulted from the fact that knowledge is non-overlapping and the organization is characterized by the

[28]These are firms in manufacturing sector that appear in RAIS at periods t and t-1, from 2007 to 2010. For further details see descriptive statistics on previous subsection.

problem-solving ability of workers up to the top layer.

Overall, the predicted shape is observed. Firms hire more producer workers (L0) and less managers (L1, L2, L3 and L4). On average, the higher the position of the manager in the hierarchy, the higher is her wage, which is a proxy of knowledge in the production.

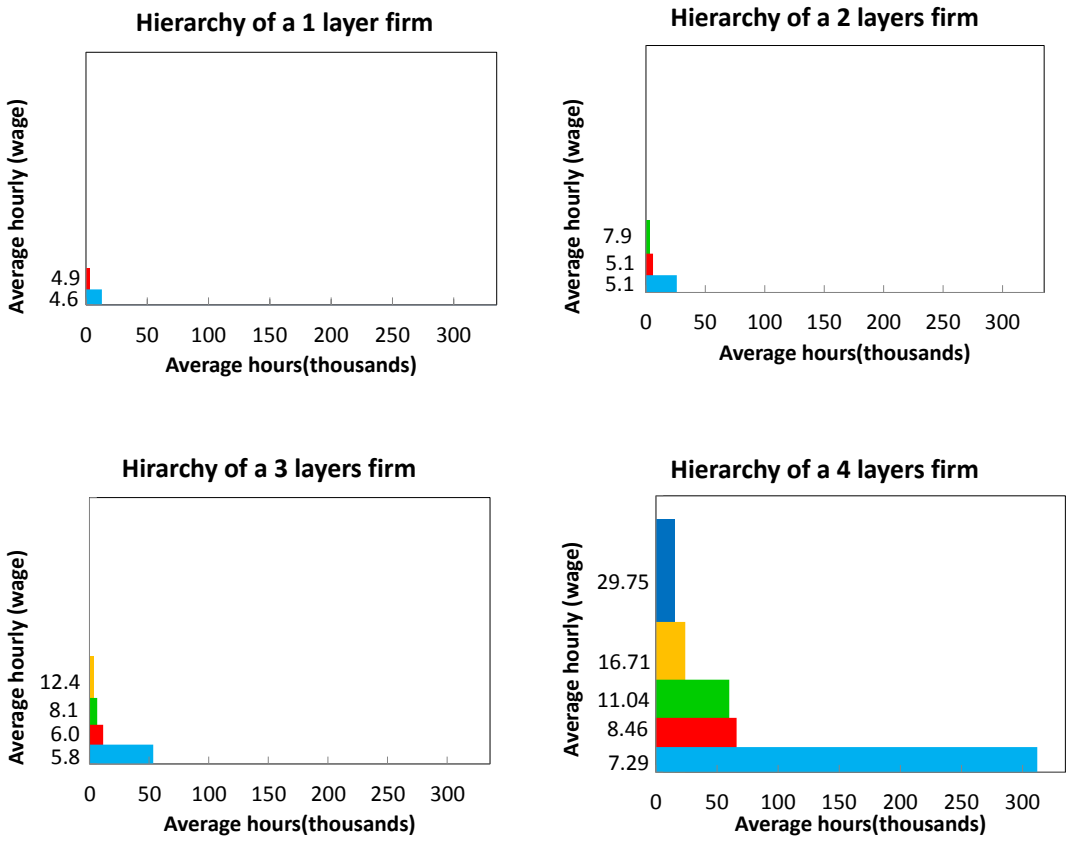


Figure 3: Hierarchies of Brazilian (manufacturing) firms (2007-2010)

Average hourly wage in R$ of 2010.

Figure 4 shows the hierarchy of firms normalized by the top layers. In Caliendo and Rossi-Hansberg [2012] theoretical model, the amount of hours in the top layer are fixed. We fit this property following a similar procedure adopted by Caliendo et al. [2012].

An important difference noted when we compare the layers with the results presented for French firms is that in Brazil, the average hourly wage in the same layer is larger for firms with more layers. A possible explanation for this difference could be the fact that they merged what would be equivalent (for CBO classification) Blue collars and Clerks in one single layer due to the fact that their average wage were similar. In order to check this possibility we used the same hierarchy classification with 3 management layers instead of 4 (see Apeendix A) and this procedure does not change the fact that for Brazilian firms, those ones with more layers pay

larger average hourly wage for a similar layer.

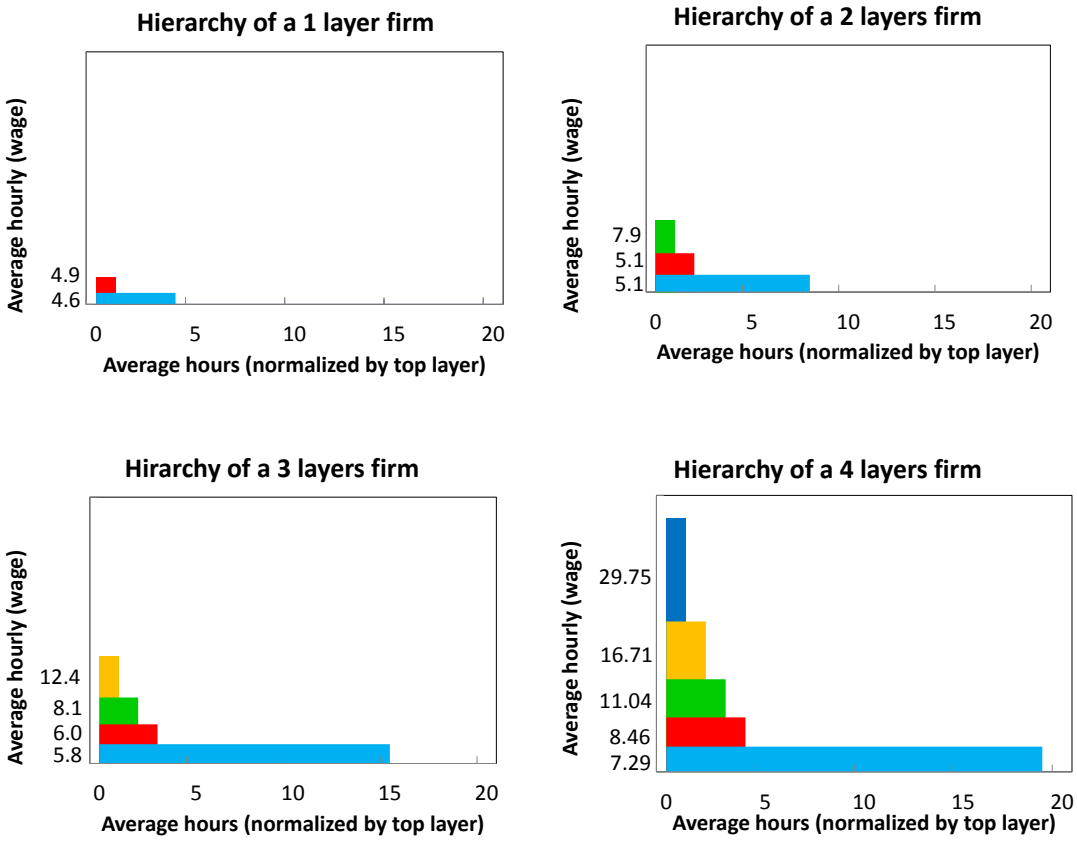


Figure 4: Hierarchies of Brazilian (manufacturing) firms normalized by the top layer(2007-2010)

Figure 5 shows the hierarchies of PEIEX's treated firms. Overall, we notice that they are relatively smaller in terms of hours hired and wage paid for the same number of layers. This is more evident for firms with larger number of layers, but it would be expected due to the fact that among firms with 4 management of layers, those ones that receive PEIEX's assistance are smaller.

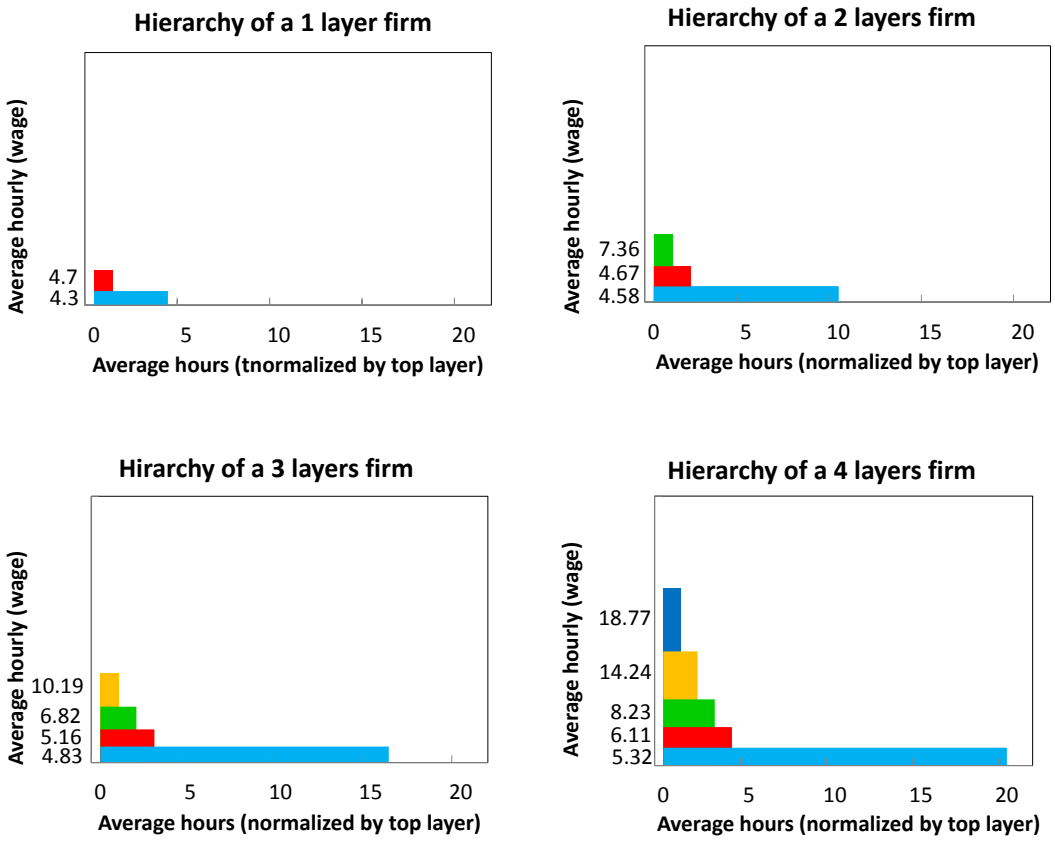


Figure 5: Hierarchies of PEIEX's (manufacturing) Treated firms (2007-2010)

3.5 Descriptive Statistics of Covariates

The first part of our descriptive section aimed to provide further detail about our proxy for firms' organization. Table 10 provides the descriptive statistics of the covariates used in the estimations. In this table, treatment status is based on had received the treatment in at least one year[29]. An important concern for identifying the impact of PEIEX on firms' organization is regarding unobservable variables that could simultaneously affect treatment status and firms' outcome. In order to deal with this we used the richness of the data and followed a recent literature in order to capture firm's characteristics that could confound the outcome. Further details about the procedure regarding how the variables were built is avaiable on Cruz [2013].

To begin with, the number of employees is a critical variable in our model. This variable was built considering the number of employees hired in a year by the firm weighted by the period (number of months) she was hired. Therefore, if a employee was hired by six months it received a weight of 0.5. Overall, as previously discussed, PEIEX's firms have an average number of employees relatively close to untreated ones.

[29]Due to the fact PEIEX's treatment started in 2009, the number of treated firm's observation is almost the double due to the fact that table 10 covers these firms over the period from 2007 to 2010.

Firm's age is a proxy for the age of the firm that takes into account the maximum period of employees' experience working at firm i available in RAIS over time. Although the relationship between their ages and their performance is not very clear, one might think in firms' organization as being determined by different stages of the firm from its beginning. For this perspective, this variable controls a linear (and potential non-linear - we also used firms' age square) trends. PEIEX's treated firms have on average almost 13 years, while untreated firm's have 12. Number of subsidiaries refers to the number of plants apart from the one with larger number of employees, which we consider as being the firm's headquarters. Although PEIEX's treated firms have almost twice more subsidiaries than average it is noticeable that the median is zero for both groups, and the 90th percentile is one for treated.

A second group of covariates refer to employee's characteristics. Wage is the average monthly wage (in R$ of 2010), schooling is the average years of formal school attendance, workers experience is the average time (in years) of experience of employees and share of engineers and R&D workers are the share of employees classified in these occupations according to the CBO.

The third group of variables is related to managers' characteristics. First, we follow Mion and Opromolla [2011] and built a variable to capture information related potential spillovers brought from manager's with previous experience in exporting firms. These variables "Manager exp M_n ", such that n={1,2,3}, are dummies that identify firms that hired managers (according to our based-knowledge hierarchy definition) at period t-1 who were working in exporting firms at period t-1, according to different level of occupations (M1 for CEOs and directors; M2 for senior staff and M3 for supervisors). These variables take the following values:

$$Manager\ exp\ M_n = \begin{cases} 1 & \text{if } \textit{Firm i has hired a manager}^{30} \textit{ at period t in occupation } M_n \\ 0 & \text{if } \textit{Otherwise} \end{cases}$$

The share of firms that hired these managers are very small (less than 1%), but they are larger for PEIEX's firms. Furthermore, we follow the discussion in Lazear et al. [2012] and build a proxy for manager's quality based on their wage distribution according to their occupation. These variables (Manager M_n - Q_j), such that n={1,2,3} and j={I, II, II}, are dummies that take the following values:

$$Manager\ M_n - Q_j = \begin{cases} 1 & \text{if } \textit{Firm i has a manager in occupation } M_n \textit{ in quartile } Q_j \\ 0 & \text{if } \textit{Otherwise} \end{cases}$$

It is noticeable that managers in the first quartile[31] (top managers) are rare on both groups. The share seem relatively close between treated and untreated firms, with more prevalent cases

[31] They are more prevalent among large/exporting firms

of managers (M1) in the third quartile (Q3).

UNTREATED* APEX						
variable	N	mean	sd	p50	p10	p90
Number of Layers*	915,037	2.20	1.16	2.00	1.00	4.00
Size (Employee)	917,107	24.26	187.54	5.75	1.00	37.75
Firm's age	917,230	11.90	8.90	9.83	3.16	22.74
Number of Subsidiaries (t-1)	917,230	0.10	1.48	0.00	0.00	0.00
Wage	917,107	878.52	630.85	739.00	502.59	1,368.20
Schooling	917,076	8.78	2.07	9.03	5.75	11.04
Worker Experience (t-1)	916,993	18.14	7.92	17.46	8.78	28.14
Share Engineers and R&D	917,107	0.003	0.03	0.00	0.00	0.00
Manager exp M1	917,230	0.002	0.04	0.00	0.00	0.00
Manager exp M2	917,230	0.002	0.04	0.00	0.00	0.00
Manager exp M3	917,230	0.004	0.06	0.00	0.00	0.00
Manager M1 - QIV	917,230	0.01	0.13	0.00	0.00	0.00
Manager M2 - QIV	917,230	0.005	0.08	0.00	0.00	0.00
Manager M3 - QIV	917,230	0.01	0.11	0.00	0.00	0.00
Manager M1 - QIII	917,230	0.05	0.22	0.00	0.00	0.00
Manager M2 - QIII	917,230	0.01	0.11	0.00	0.00	0.00
Manager M3 - QIII	917,230	0.03	0.17	0.00	0.00	0.00
Manager M1 - QII	917,230	0.12	0.34	0.00	0.00	1.00
Manager M2 - QII	917,230	0.04	0.21	0.00	0.00	0.00
Manager M3 - QII	917,230	0.09	0.30	0.00	0.00	0.00
Number Exporters region*	917,230	25.97	54.02	4.00	0.00	77.00
(A) Number NO by State	917,230	1.06	2.25	0.00	0.00	6.00
(B) lag(dummy sector Apex - state)	917,230	0.31	0.46	0.00	0.00	1.00
(A)*(B) Interaction term	917,230	0.61	1.82	0.00	0.00	3.00
Exporting Firms (share)	917,230	0.04	0.20	0.00	0.00	0.00
PEIEX*						
variable	N	mean	sd	p50	p10	p90
Number of Layers*	12,623	2.73	1.22	3.00	1.00	5.00
Size (Employee)	12,624	32.82	123.84	11.67	2.33	61.67
Firm's age	12,627	12.71	9.01	10.83	3.49	23.24
Number of Subsidiaries (t-1)	12,627	0.22	1.96	0.00	0.00	1.00
Wage	12,624	809.11	367.42	708.52	515.45	1231.00
Schooling	12,623	8.99	1.77	9.17	6.56	11.04
Worker Experience (t-1)	12,624	17.10	6.28	16.85	9.30	24.96
Share Engineers and R&D	12,624	0.004	0.03	0.00	0.00	0.00
Manager exp M1	12,627	0.004	0.06	0.00	0.00	0.00
Manager exp M2	12,627	0.004	0.06	0.00	0.00	0.00
Manager exp M3	12,627	0.009	0.09	0.00	0.00	0.00
Manager M1 - QIV	12,627	0.003	0.05	0.00	0.00	0.00
Manager M2 - QIV	12,627	*	*	0.00	0.00	0.00
Manager M3 - QIV	12,627	0.002	0.05	0.00	0.00	0.00
Manager M1 - QIII	12,627	0.05	0.22	0.00	0.00	0.00
Manager M2 - QIII	12,627	0.00	0.07	0.00	0.00	0.00
Manager M3 - QIII	12,627	0.02	0.16	0.00	0.00	0.00
Manager M1 - QII	12,627	0.15	0.36	0.00	0.00	1.00
Manager M2 - QII	12,627	0.04	0.21	0.00	0.00	0.00
Manager M3 - QII	12,627	0.10	0.31	0.00	0.00	0.00
Number Exporters region*	12,627	13.67	25.13	3.00	0.00	42.00
(A) Number NO by State	12,627	2.71	3.06	1.00	0.00	7.00
(B) lag(dummy sector Apex - state)	12,627	0.37	0.48	0.00	0.00	1.00
(A)*(B) Interaction term	12,627	1.94	2.91	0.00	0.00	7.00
Exporting Firms (share)	12,627	0.10	0.29	0.00	0.00	0.00

Table 10: Descriptive Statistics - variables used in the regressions (2007-2010)

Treatment status defined as firms that never received APEX (Untreated APEX) and firms that received PEIEX for at least one year (Treated PEIEX)

The fourth group of covariates are related to firm's sector and region environment. These are

important variables since among them are those we used as instrument for PEIEX's treatment. First, in order to control potential exporting neighbourhood-effect we use the "Number Exporters region". This variable was generated by total number of exporting firms by "microrregião" (a territory classification from IBGE that divides Brazil in 555 microrregiões). Due to the fact this variable aims to capture information about the environment around the firm, it is excluding the own firm exporting status.

The number of PEIEX regional units by state (Number NO by State) was build based on the year of implementation(see table 1) of PEIEX regional units in the state of firms' headquarters. Lag of dummy sector Apex by state refers to a dummy identifying sectors (at 5 digits CNAE) in which there were firms that received Apex's treatment (excluding PEIEX) in a previous year (t-1) in the state.

Next section discusses the correlation between firms' expansion and export status. When firms start to export they usually expand their production due to the fact that they have access to a larger market. This expansion demands additional knowledge and firms have the option of reorganize their production by adding additional layers or increase the existent knowledge in the previous ones.

4 Exporting Firms Transition

The literature on trade based on heterogeneous firms has been showing that exporting firms are larger (both in terms of number of employees and value added) and pay higher wages (see Roberts and Tybout [1997], Bernard and Jensen [2004] and Melitz and Trefler [2012]) . Therefore it is straightforward to expect differences between exporting and non-exporting firms in terms of organization design. Table 11 compares number of firms, number of employees, average wages and number of layers between exporting and non-exporting firms. Indeed, the differences among them are evident. To begin with, 73% of exporting firms have three or more layers (54,5% have four layers). On the other hand, almost 85% of non-exporting firms have two layers or less. Also, mean and median wages are larger on exporting firms than non exporting for all layers. This structure is similar to the French firms[32].

[32]Indeed, the share of non-exporting firms with 1 layer or less and exporting firms with 3 layers or more is larger in Brazil than France if we compare our descriptives with Caliendo et al. [2012] .

Number of	Firms		Number Employees		Real Wage	
Layers	N	(%)	Mean	Median	Mean	Median
Non-Exporting Firms						
0	78,565	33.39	3.35	2.00	4.53	3.92
1	80,084	34.04	8.73	5.50	4.79	4.27
2	44,901	19.08	17.65	11.75	5.53	4.88
3	21,165	9.00	36.20	23.25	6.38	5.62
4	10,565	4.49	133.51	61.25	7.89	6.92
Total	235,280	100.00	16.71	5.58	5.13	4.40
Exporting firms						
0	415	3.65	5.47	2.00	6.48	4.58
1	1,018	8.96	15.30	8.88	6.52	5.33
2	1,619	14.25	30.27	17.50	7.52	6.37
3	2,117	18.64	64.02	38.00	9.11	7.31
4	6,191	54.50	551.36	168.08	12.78	10.13
Total	11,360	100.00	318.30	66.75	10.55	8.23

Table 11: Data description by number of layers in the firm (year = 2010)

This positive correlation between being exporter and number of layers (which is also correlated with the size of the firm and its value added[33]) is expected due to the correlation between production hierarchies and firms' size. However, we are interested in understanding this behaviour in a dynamic perspective. So, the next step is to analyse the transition of exporting status and organization. We do so dividing firms in three groups: non-exporters (firms that did not export at periods t_0 and t_1); new exporters (firms that did not export at period t_0 but become exporter at period t_1); continuing exporters (firms that continuously export from 2007 to 2010). Tables 12, 13 and 14 are organized as follows. The rows show the number of layers firms had at period t-1 and the columns show the number of layers these firms have at period t. Thus, this allows us to check all the possible combination regarding number of layers a firm at period t-1 can have at period t.

Table 12 shows the dynamic transition for non-exporting firms by year[34], from 2007 to 2010. Firstly, their transition in terms of layers seems very stable over different years. The main diagonal shows the share of firms that kept the same number of layers. About 82% of the firms without management hierarchy and 74% of the firms with one layer did not change (they represent almost 70% of non-exporting firms). The majority of firms does not change layers over time.

It is also interesting to highlight that among non-exporters (between 1 and 3 layers) the share of firms that rise the number of layers is always smaller than the share of firms that decrease them. Table 13 shows a different scenario for new exporters. Among them, the share of firms that add an additional layer is always larger than those ones that decrease it if we take into

[33]There is no information on value added in this paper, but the evidence is very robust for French firms.

[34]The tables present the dynamic year by year to make clear that firms' behaviour are not being driven by a specific year right after financial crisis.

consideration firms that had between 1 and 3 layers in t_0 (a condition that allows firms to add or subtract at least one layer).

	Number	Year 2007 - 2008 (year t+1)					Firms (2007)	
	of Layers	0	1	2	3	4	Number	Share*
	0	**81.33**	16.15	2.15	0.31	0.06	77,843	36.50
year t	1	12.73	**73.49**	12.13	1.47	0.18	73,187	34.31
	2	3.03	17.34	**66.81**	11.51	1.30	38,214	17.92
	3	1.10	3.51	18.43	**66.01**	10.94	16,766	7.86
	4	0.56	0.83	3.09	15.80	**79.72**	7,272	3.41
Firms	Number	74,011	73,632	39,393	17,940	8,306	213,282	
(2008)	Share*	34.70	34.52	18.47	8.41	3.89		100.00
	Number	Year 2008 - 2009 (year t+1)					Firms (2008)	
	of Layers	0	1	2	3	4	Number	Share*
	0	**82.83**	14.89	1.93	0.30	0.06	79,304	35.69
year t	1	12.96	**74.27**	11.38	1.26	0.13	76,094	34.24
(2008)	2	3.03	17.14	**68.14**	10.69	1.01	40,287	18.13
	3	1.20	3.76	19.19	**66.18**	9.67	18,130	8.16
	4	0.63	0.94	3.15	16.12	**79.15**	8,400	3.78
Firms	Number	77,045	75,984	41,385	18,852	8,949	222,215	-
(2009)	Share*	34.67	34.19	18.62	8.48	4.03	-	100.00
	Number	Year 2009 - 2010 (year t+1)					Firms (2009)	
	of Layers	0	1	2	3	4	Number	Share*
	0	**81.66**	15.75	2.23	0.32	0.05	80,628	35.42
year t	1	12.59	**73.64**	12.06	1.53	0.18	77,335	33.97
(2010)	2	2.81	16.67	**67.74**	11.59	1.19	41,815	18.37
	3	1.17	3.46	18.42	**65.70**	11.26	18,960	8.33
	4	0.63	0.77	3.46	16.80	**78.34**	8,904	3.91
Firms	Number	77,027	77,341	43,250	20,239	9,785	227,642	-
(2010)	Share*	33.84	33.97	19.00	8.89	4.30	-	100.00

Table 12: Distribution of layers at t+1 conditional on layers at t (by year) for 'NON Exporters'

In addition, the share of firms that add one additional layer was for all levels of initial layer and every year, larger than 15% (the smallest level were during 2008 and 2009, period well known by a financial crisis) and the share of firms that jumped for 2 additional layers is not negligible (above 5% in most of the cases from 0 to 3 layer in t_0). Moreover, approximately 91% of the firms with 4 layers in t_0 kept this organization design after switching from non-exporting to exporting status. Therefore, the path we observe as regard layers transition for new exporters are similar to the one described by Caliendo et al. [2012]. Firms that become exporters are more likely to change their organization and add new layers.

	Number	Year 2007 - 2008 (year t+1)					Firms (2007)	
	of Layers	0	1	2	3	4	Number	Share*
	0	**62.50**	18.18	11.36	3.41	4.55	88	7.19
year t	1	4.73	**64.50**	21.30	5.92	3.55	169	13.81
	2	0.76	12.17	**59.32**	22.43	5.32	263	21.49
	3	0.65	1.31	9.15	**64.38**	24.51	306	25.00
	4	-	-	1.01	7.29	**91.71**	398	32.52
Firms	Number	67	161	234	298	464	1224	
(2008)	Share*	5.47	13.15	19.12	24.35	37.91		100.00
	Number	Year 2008 - 2009 (year t+1)					Firms (2008)	
	of Layers	0	1	2	3	4	Number	Share*
	0	**73.41**	19.10	6.37	0.37	0.37	266	9.32
year t	1	6.10	**71.46**	17.13	4.72	0.59	508	17.73
(2008)	2	1.71	10.09	**67.55**	17.55	3.11	644	22.48
	3	0.44	0.58	14.26	**68.27**	16.45	687	23.98
	4	**-**	**-**	1.05	7.64	**91.04**	759	26.49
Firms	Number	241	485	645	665	828	2864	-
(2009)	Share*	8.41	16.93	22.51	23.21	28.90	-	100.00
	Number	Year 2009 - 2010 (year t+1)					Firms (2009)	
	of Layers	0	1	2	3	4	Number	Share*
	0	**57.24**	28.97	9.66	1.38	2.76	145	8.02
year t	1	4.61	**70.72**	17.76	5.26	1.64	304	16.80
(2010)	2	1.30	6.74	**68.91**	17.88	5.18	386	21.34
	3	-	0.50	13.03	**67.17**	19.30	399	22.06
	4	-	-	0.70	7.30	**91.83**	575	31.79
Firms	Number	102	286	390	397	634	1809	-
(2010)	Share*	5.64	15.81	21.56	21.95	35.05	-	100.00

Table 13: Distribution of layers at t+1 conditional on layers at t (by year) for 'New Exporters'

Table 14 shows the yearly dynamic layers transition for continuing exporters. The share of firms that add new layers is much larger than firms that reduce them, which is similar to new exporters. Indeed, it is even larger for established exporters. Also, the majority of the firms have already 3 or 4 layers and among the formers, almost 95% keep the same structure. It means that continuing exporters (usually larger firms) use to have an organization design that is consistent with Caliendo et al. [2012] and Garicano [2000].

These descriptive analysis allow us to verify that an additional difference between non-exporting and exporting firms as highlighted by Caliendo et al. [2012] is the fact that the structure of exporting firms is composed by more layers than non-exporting firms. Also, new exporters are more likely to add layers of managers than non-exporting firms. What is interesting in these findings is that depending on adding layer or not, new exporters react differently in terms of how they distribute production knowledge within the firm when they expand and this can be observed by the average wage in different layers.

	Number	Year 2007 - 2008 (year t+1)					Firms (2007)	
	of Layers	0	1	2	3	4	Number	Share*
	0	**73.48**	16.67	5.30	3.03	1.52	132	2.07
year t	1	5.63	**71.58**	16.09	4.29	2.41	373	5.85
	2	0.29	6.14	**69.57**	18.14	5.86	700	10.98
	3	0.09	0.60	8.28	**69.20**	21.83	1,159	18.17
	4	0.07	0.02	0.12	3.21	**96.56**	4,014	62.94
Firms	Number	124	340	655	1,078	4,181	6,378	
(2008)	Share*	1.94	5.33	10.27	16.90	65.55		100.00
	Number	Year 2008 - 2009 (year t+1)					Firms (2008)	
	of Layers	0	1	2	3	4	Number	Share*
	0	**79.84**	13.71	4.03	2.42	0.00	124	1.94
year t	1	4.12	**72.06**	20.29	2.94	0.59	340	5.33
(2008)	2	0.15	9.16	**71.60**	15.88	3.21	655	10.27
	3	0.37	0.93	11.41	**70.59**	16.70	1,078	16.90
	4	0.07	0.05	0.57	4.59	**94.71**	4,181	65.55
Firms	Number	121	334	690	1,070	4,163	6,378	-
(2009)	Share*	1.90	5.24	10.82	16.78	65.27	-	100.00
	Number	Year 2009 - 2010 (year t+1)					Firms (2009)	
	of Layers	0	1	2	3	4	Number	Share*
	0	**75.21**	17.36	3.31	2.48	1.65	121	1.90
year t	1	9.28	**73.65**	13.77	2.10	1.20	334	5.24
(2010)	2	0.87	10.14	**69.13**	16.67	3.19	690	10.82
	3	0.56	1.21	8.22	**70.84**	19.16	1,070	16.78
	4	0.12	0.10	0.34	3.46	**95.99**	4,163	65.27
Firms	Number	139	354	629	1,027	4,229	6,378	-
(2010)	Share*	2.18	5.55	9.86	16.10	66.31	-	100.00

Table 14: Distribution of layers at t+1 conditional on layers at t (by year) for Continuing Exporters.

Note: 'Continuing Exporters' are defined as firms that had exported every year without interruption from 2006 or before to 2010.

Figure 6 shows the dynamic of firms that become exporters regarding their average wage and hours hired. Overall, we found (see next section) that the prediction of their theory holds in most of the cases when we compare the transition of same firms that become exporters and add additional layers at the same year. It means that same firms that switch export status (from non-exporting to exporting) and add one layer usually pay lower wages for workers at previously existed layers.

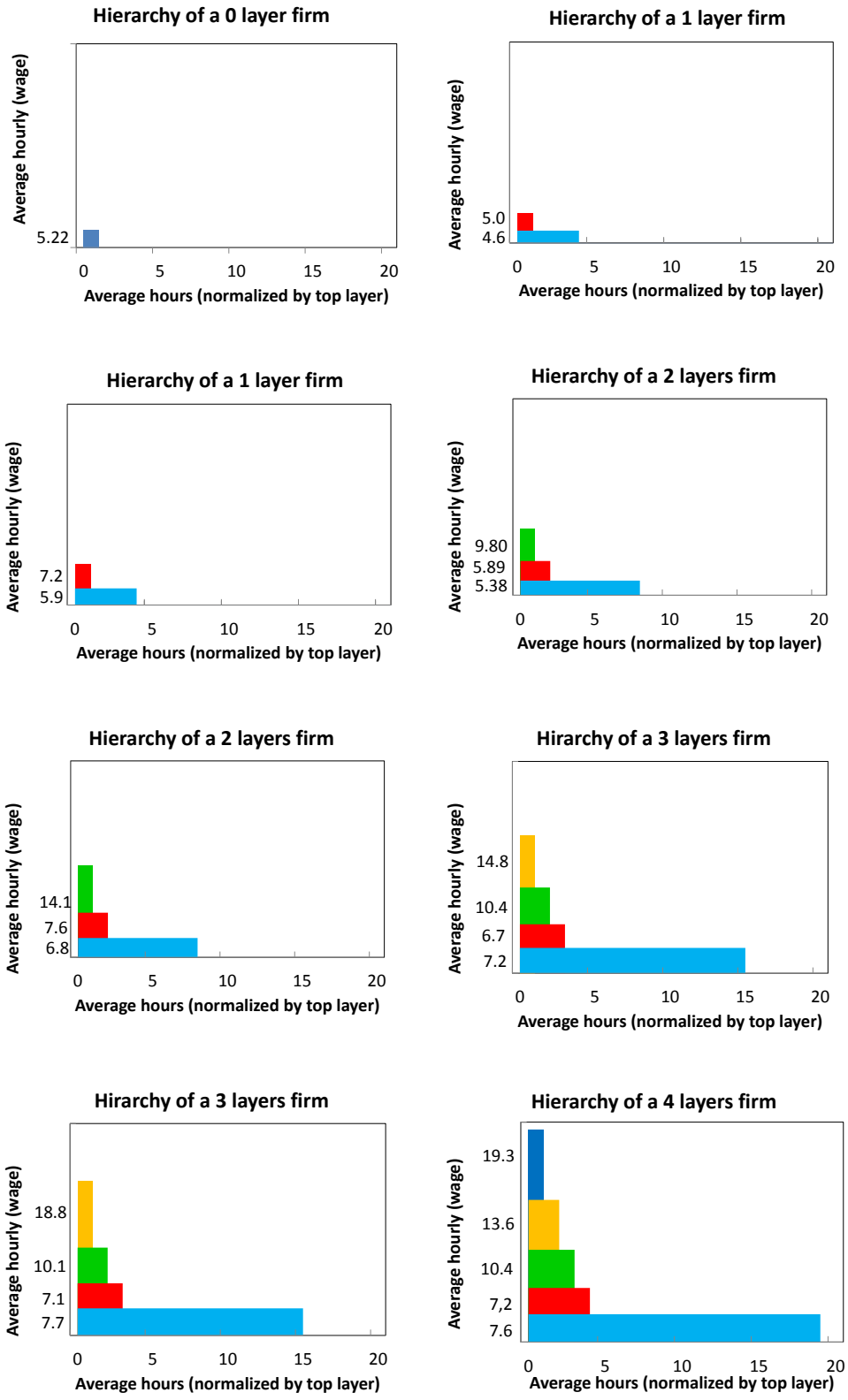


Figure 6: Hierarchies of New Exporting Firms' transition from t-1 to t (2007-2010)

Note: New exporting firms defined as firms that have exported at period t, but have not exported at periods t-1 and t-2

An interesting feature of this model is that it allows for an additional dimension of firms heterogeneity that could explain new findings on empirical trade literature regarding gains in productivity driven by accessing foreign market (see Melitz and Trefler [2012]). An additional dimension of heterogeneity could be regarding differences on managers's quality. In previous section we show (figure 2) that the distribution of hourly wages among managers indicates a large variation which may be a sign of differences in terms of quality. In addition, policies that are targeting to improve the capacity of firms toward become more competitive, such as PEIEX, may impact their organization design as well. The next section provides further details about our identification strategy.

5 Identification Strategy

What would be the expected output for those firms that received PEIEX assistance in case they had not received it? Due to the fact PEIEX is not a randomized experiment, the main issue to identify its average (or marginal) impact on treated is selection. It may be that firms with higher probability of changing their organization structure and/or becoming exporters are more likely to receive the program and this is a likely source of endogeneity. Let us assume:

$$Y_{it} = \alpha + \beta T_{it} + \gamma X + \epsilon \tag{1}$$

Where Y is the outcome of interest; T is treatment (PEIEX assistance in this case); ϵ is the error term. Assuming T as a binary variable, we can only observe $(Y_0|T = 0)$ or $(Y_1|T = 1)$ and this generates a missing data problem (Heckman [2001]). If (T) is correlated with (ϵ) due to the fact that there are unobservables that determines both treatment and output, β will be inconsistent and biased under OLS estimation. This so called endogeneity problem also can be present if (β) is correlated with (ϵ) due to the impact of the intervention is correlated with unobservable (ϵ) that also determines the output (Y).

A critical step toward addressing these potential endogeneity issues is regarding how to deal with unobservables. For this reason, further knowledge with respect to the design and implementation of the program is required. In the case of PEIEX, an important eligibility rule is that firms should fulfil a registration form and submit it at the regional units. Up to 2010, there were 28 units distributed around the country. However, there are cross-variation between states. Also, most of PEIEX's structure are locally based on these units. Brazil has 27 states (including the Federal District, Brasília) and only 10 of them received PEIEX's regional units up to November 2010. Table 15 shows their distribution and number of assisted firms by targeted state in Brazil. There is a strong correlation among these variables.

Region	State	Firms (2007) (%)	Firms (2010) (%)	Unit NO (09-10)	PEIEX's Treated (2009) (%)	(2010) (%)	Exporting Firms (07-08) (%)
North	Rondônia	0.61	0.63	-	*	*	0.51
North	Acre	0.13	0.13	-	*	*	0.06
North	Amazonas	0.45	0.48	-	*	*	1.10
North	Roraima	0.05	0.06	-	*	*	0.12
North	Pará	1.04	1.04	-	*	*	1.66
North	Amapá	0.07	0.07	-	*	*	0.03
North	Tocantins	0.26	0.29	-	*	*	0.02
Northeast	Maranhão	0.50	0.54	-	*	*	0.16
Northeast	Piauí	0.53	0.57	-	*	*	0.13
Northeast	Cear	2.52	2.80	1	6.06	6.74	1.24
Northeast	Rio Grande do Norte	0.80	0.88	-	*	*	0.26
Northeast	Paraíba	0.81	0.86	-	*	*	0.37
Northeast	Pernambuco	2.33	2.49	1	*	0.99	0.75
Northeast	Alagoas	0.36	0.39	1	0.75	0.82	0.15
Northeast	Sergipe	0.43	0.48	1	1.20	1.22	0.14
Northeast	Bahia	2.65	2.78	4	8.17	10.26	1.40
Southeast	Minas Gerais	12.48	12.58	6	24.69	23.62	6.86
Southeast	Espírito Santo	2.04	2.11	-	*	*	1.52
Southeast	Rio de Janeiro	4.88	4.95	-	*	*	3.89
Southeast	São Paulo	29.53	29.06	-	*	*	46.66
South	Paraná	8.89	9.35	3	16.72	17.20	8.26
South	Santa Catarina	9.49	9.86	-	*	*	8.46
South	Rio Grande do Sul	11.16	11.33	8	35.35	33.46	14.01
Center West	Mato Grosso do Sul	0.75	0.81	-	*	*	0.32
Center West	Mato Grosso	1.38	1.55	-	*	*	0.82
Center West	Goiás	3.00	3.27	1	4.44	3.92	1.04
Center West	Distrito Federal	0.56	0.63	1	2.16	1.48	0.05
Total (%)		100.00	100.00	-	100.00	100.00	100.00
Total		232,159	247,187	27	2,410	3,518	24,161

Table 15: Distribution of Firms across states, by exporting and treatment status

Note: (*) States with less than 10 treated firms.

Under the assumption that firms location were not influenced by PEIEX regional units (they were previously established) we could consider that geographic proximity of these units were exogenously to the firm and use it as an instrument to deal with selection into the program. However, it could be that regions with larger number of exporters are those most benefited with number of regional units or location with more organized firms were able to lobby for receiving more units and this level of organization could be correlated with their export performances.

Table 15 shows that this is not the case, particularly due to the fact that São Paulo, which is by far the state with the largest number of exporting firms did not receive a unit over this period. In addition, table 16 shows that there is a weak and not statistically significant correlation (at 5% of confidence level) between the share of exporting firms and the share of PEIEX regional units at state level previously the program started. However, there is a strong statistically significant correlation (at 1% of confidence level) between the share of firms that received PEIEX treatment and the share of PEIEX regional units at the state level.

Therefore, assuming that the decision of PEIEX regional units' location are exogenous to firms' organisation, we will use number of PEIEX regional units in the state of firms' headquarters as an instrument for receiving PEIEX assistance. Another important information about eligibility is that PEIEX aims to improve competitiveness of firms with some potential to be-

	PEIEX	Number Exporters		Change Layer	
	2007-2010	2007	2008	2007	2008
corr	0.957	0.1786	0.1836	0.0451	0.1204
p-value	0.000	0.3727	0.3592	0.8232	0.5498

Table 16: Correlations between number of NOs, number of treated (PEIEX), number of exporters in previous years (2007-2008) and average change of layer in previous years (2007-2008) at state level.

come an exporter. So, the program may work as a bridge for firms that have no access to other Apex's assistance through industry association agreements. Thus, an information that is taking into consideration is the existence of trated firms in other Apex's programs in similar sector. Therefore, another information we used is number of Apex's treated firms in previous years by sector CNAE (5 digits) in each state, weighted by PEIEX's existence. Therefore, it takes the value of 1 at the year PEIEX started and zero otherwise.

The idea is that, once controlled for time-constant heterogeneity and sector-year shocks, the number of Apex's excluding PEIEX treated firms in a similar sector, in previous years, should not impact firm's organization directly. In addition, we used and interaction term between both instruments[35]. So, we used the following specification:

First stage

$$D_{isrt} = \alpha_{isr} + \theta_{st} + \beta_1 Z_{srt} + \iota X_{it} + \zeta_{isrt} \tag{2}$$

Second stage

$$Y_{isrt} = \lambda_{isr} + \kappa_{st} + \tau \hat{D}_{isrt} + \gamma X_{it} + \epsilon_{isrt} \tag{3}$$

Where: T_{isrt} Treatment status of firm i, in sector s, region r, at time t; $Z1_{srt}$ Instruments for Peiex's treatment status in sector s, region r, at time t; (e.g. number of regional office units of Peiex in region (state) r at time t; sectors that received Apex (excluding PEIEX) suport in previous years at time t); $\hat{D}_{it}$: predicted D_{isrt} from the first stage; X_{it} covariates used as control variables at firm level (e.g. number of employees (size of the firm), employees' schooling, managers' characteristics (previous experience in exporting firms), age of the firm, etc.); ζ_{isrt} and ϵ_{isrt}: error terms.

In order to identify the impact of PEIEX it is critical that $\text{cov}(Z_{srt}\ , \epsilon_{isrt}) = 0$ and $\text{cov}(Z_{srt}\ , \zeta_{isrt}) = 0$, it means that the instruments should be orthogonal to the error term (ϵ_{it}) in the second stage. Also, the fact that we are dealing with count data that might be correlated with previous years (hierarchy at t as function of hierarchy in t-1) demands additional cautions regarding non-linearity and dynamic.

We also show that there is a lot of heterogeneity regarding firms' organization even after

[35]The fact we have more than one instrument allows us to carry overidentification restrictions tests.

controlling for size (firms with the same number of workers have different number of layers) and we are interested in analysing the impact of the program on firms organization conditional on firm's size. The problem is that changes in hierarchy and size (measured by total number of workers) might be simultaneously determined which might result in $\text{cov}(X_{it}\ ,\ \epsilon_{it}) \neq 0$. This might be a second source of endogeneity, that may be an issue for identifying τ if $\text{cov}(X_{it}\ ,\ D_{isrt}) \neq 0$. We deal with these issues adopting the following procedures explained bellow.

First all, with respect to the count data properties of our dependent variable, we apply a logarithmic transformation in Y (number of layers) keeping the full number of layers of the firm from 1 to 5. This transformation[36] would allow us to identify τ using Fixed-Effect Instrumental Variable approach in order to control for time-constant firms' heterogeneity. In order to check if the logarithmic transformation provides a reasonable approximation to deal with non-linearities, we compare the coefficients of a Poisson Fixed Effect estimator and a standard panel fixed effect.

For the second source of endogeneity (X_{it}, we instrumented the regressors (number of employees, average employee's wage, average years of employee's schooling and share of engineers and R&D workers, average experience of employees) that could be simultaneously determined with Y_{isrt} using their own variables with 2 lags. The main assumption is that $(X_{it-2}\ ,\ \epsilon_{it}) = 0$, once we control for firms' time-constant heterogeneity.

As a robustness check we adopted a panel fixed-effect procedure without instrumenting D_{it} and using similar procedure to deal with potential endogeneity in X_{it}. Then we compare the results controlling for potential regional (state-year) and sectoral-year shocks. The main assumption in this case would be that there is no time-invariant unobservable variables that determines the access to the program and firms' organization simultaneously. Our covariates X_{it} are controlling for a wide set of time-variant firms characteristics (e.g. management quality based on the wage's distribution for the top layers, new managers hired with former experience in export firms, number of subsidiaries, previous average worker's experience, size, etc.). The specification is the following:

$$log(Y_{isrt}) = \alpha_i + \sigma_{st} + \eta_{rt} + \psi D_{it} + \beta_n\ X_{it} + \epsilon_{isrt} \tag{4}$$

Where: Y_{isrt} is the output of interest; α_i is a firm fixed effect intercept; σ_{st} is a time-sector fixed effect; η_{rt} is a time-region fixed effect; D_{it} is firm's PEIEX's treatment status; X_{it} firms' control covariates and ϵ_{isrt} is the error term. Next section presents the empirical results.

[36]For further discussion see Cameron and Trivedi (1999).

6 Empirical results

6.1 Does PEIEX assistance impact the organization of the firm?

The previous sections show that the definition of layers is an economically meaningful classification and brings important information regarding the dynamic of the firm. One of the target of PEIEX is to make firms more competitive. Caliendo and Rossi-Hansberg [2012] suggest that in a dynamic perspective more competitive firms add more layers, which allows them to reach lower levels of marginal cost. Therefore, to check if PEIEX impacted the organization of the firm we analyze the impact of PEIEX on the change of the number of layers. To begin with, let us check the coefficients through a pooled OLS for equation(5).

$$Y_{isrt} = \lambda + \kappa_{st} + \tau D_{it} + \gamma X_{it} + \epsilon_{isrt} \tag{5}$$

Variable	**OLS1**	**OLS2**	**OLS3**
PEIEX	0.0834	0.072	0.078
	(0.007)	(0.006)	(0.006)
log(Firm's size)	0.319	0.310	0.281
	(0.0006)	(0.0007)	(0.0007)
X1	yes	yes	yes
X2		yes	yes
X3			yes
Sector-year	yes	yes	yes
Region-year	yes	yes	yes
N	742,534	742,376	742,376
R2	0.446	0.470	0.519
cluster (se)	248,786	248,786	248,786

Table 17: OLS estimation

Note: Standard errors clustered at firm level are reported in parentheses. Firm's size is measured by number of employees. The following additional controlling variables are included in the models: X1(Apex excluding Peiex), X2(log of wage, log of schooling, dummy for multinational, share of engineers and R&D workers, lag of average experience, lag of additional plants, dummy Manager export L1 - dummy Manager export L3), X3(dummy TOP managers by nationality status L1-L3)

Table 17 shows the result for ols with different covariates, including log of contemporaneous firm's size. Overall, it suggests that there is a statistically significant positive correlation between Peiex's treatment and number of layers. However, as pointed out in the previous section the coefficients in OLS might be biased due to endogeneity. First, we carry an Instrumental Variable Panel Fixed Effect to control for time-constant heterogeneity among firms, allowing for $\text{cov}(\lambda_{isr}, \gamma X_{it}) \neq 0$. We instrument treatment status D_{it} with Z's and X_{it} with their 2 lags as discussed in previous section. In addition, due to the fact we are interested in firms that are not exported yet, we run the regression on a sample conditioned on firms that had not exported in 2007 and 2010 and had number of layers in period t-1 and period t-2 were smaller than 5.

Tables 18 and 19 show the results for the Instrumental Variable Panel Fixed Effect. We follow the general specification described in equations 2 and 3. In order to test the sensitivity of the parameter for additional covariates we run six different models, for which the difference is on the regressors X_{it}. The results for the second and first stages are presented in subsequent columns for each specification. Apart from controlling for time-constant firm's heterogeneous characteristics we are also using sector-year fixed effect in order to control for aggregate and sector-year specific shocks (e.g. exchange rate, interest rate, tariff reduction).

Instrumental Variable Fixed Effect Estimator ((I/II)						
	Model 01		Model 02		Model 03	
log(Number of LAYERS)	Second Stage	First Stage	Second Stage	First Stage	Second Stage	First Stage
PEIEX	0.1570		0.2000		0.1960	
	(0.0539)		(0.0545)		(0.0544)	
(A) Number NO by State		0.0023		0.0024		0.0024
		(0.0001)		(0.0001)		(0.0001)
(B) lag(dummy Apex's sector state)		-0.0075		-0.0079		-0.0078
		(0.0004)		(0.0004)		(0.0004)
Interaction Term (A)*(B)		0.0033		0.0035		0.0035
		(0.0002)		(0.0002)		(0.0002)
apex(EP)	0.0415	-0.0596	0.0369	-0.0636	0.0336	-0.0639
	(0.0090)	(0.0069)	(0.0092)	(0.0074)	(0.0091)	(0.0074)
log(number employees)t-2			0.0288	0.0037	0.0270	0.0036
			(0.0012)	(0.0003)	(0.0012)	(0.0003)
Firms' age	0.0217	0.0008	0.0100	0.0002	0.0116	0.0002
	(0.0009)	(0.0003)	(0.0010)	(0.0003)	(0.0010)	(0.0003)
Firms' age$\hat{2}$	-0.00051	0.00002	-0.00023	0.00004	-0.00025	0.00004
	(0.00002)	(0.00001)	(0.00002)	(0.00001)	(0.00002)	(0.00001)
log(wage)t-2					0.0003	0.0012
					(0.0013)	(0.0002)
log(schooling)t-2					-0.0117	-0.0030
					(0.0036)	(0.0009)
log(nbr exporters - region)					0.0017	0.0016
					(0.0016)	(0.0005)
share(engenieer and R&D)t-2					0.0241	0.0020
					(0.0074)	(0.0011)
average experience t-2					-0.0039	-0.0001
					(0.0001)	(0.0000)
number of subsidiaries t-2					0.0103	0.0012
					(0.0054)	(0.0009)
Additional Manager's control*						
Managers QII-QIII	NO	NO	NO	NO	NO	NO
Firms Fixed Effect	YES	YES	YES	YES	YES	YES
Sector-Year Fixed Effect	YES	YES	YES	YES	YES	YES
R2	0.0039	0.0273	0.0027	0.029	0.0057	0.029
Number Obs.	834973	834973	731265	731265	731265	731265
F - stat	24.480	37.040	20.660	33.320	29.240	30.880
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000
Number of clusters (Firms)	240,619	240,619	207,431	207,431	207,415	207,415
Nbr Variables	73	75	74	76	80	82

Table 18: Instrumental Variable Fixed Effect Model. Dependent Variable: Number of Layers(cont. 1/2)

Note: Standard errors clustered at firm level are reported in parentheses. Managers are classified by occupations equivalent to CEOs and Directors (M1) Senior staff (M2) and Supervisors M(3). N and F refer to their nationalities, where N(Nationals) and F(Foreigners). Additional Manager's control (Managers QII-QIII) refers to dummy variables for managers in the second and third quartile of wage distribution.

Instrumental Variable Fixed Effect Estimator (II/II)						
	Model 04		Model 05		Model 06	
log(Number of LAYERS)	Second Stage	First Stage	Second Stage	First Stage	Second Stage	First Stage
PEIEX	0.1960		0.1960		0.2070	
	(0.0544)		(0.0544)		(0.0521)	
(A) Number NO by State		0.0024		0.0024		0.0024
		(0.0001)		(0.0001)		(0.0001)
(B) lag(dummy Apex's sector state)		-0.0078		-0.0078		-0.0078
		(0.0004)		(0.0004)		(0.0004)
Interaction Term (A)*(B)		0.0035		0.0035		0.0035
		(0.0002)		(0.0002)		(0.0002)
apex(EP)	0.0336	-0.0639	0.0334	-0.0638	0.0245	-0.0639
	(0.0091)	(0.0074)	(0.0091)	(0.0074)	(0.0085)	(0.0074)
log(number employees)t-2	0.0271	0.0036	0.0270	0.0036	0.0203	0.0036
	(0.0012)	(0.0003)	(0.0012)	(0.0003)	(0.0012)	(0.0003)
Firms' age	0.0116	0.0002	0.0116	0.0002	0.0098	0.0002
	(0.0010)	(0.0003)	(0.0010)	(0.0003)	(0.0010)	(0.0003)
Firms' age$\hat{2}$	-0.00025	0.00004	-0.00025	0.00004	-0.00021	0.00004
	(0.00002)	(0.00001)	(0.00002)	(0.00001)	(0.00002)	(0.00001)
log(wage)t-2	0.0003	0.0012	0.0004	0.0012	0.0011	0.0012
	(0.0013)	(0.0002)	(0.0013)	(0.0002)	(0.0012)	(0.0002)
log(schooling)t-2	-0.0117	-0.0030	-0.0117	-0.0030	-0.0120	-0.0030
	(0.0036)	(0.0009)	(0.0036)	(0.0009)	(0.0035)	(0.0009)
log(nbr exporters - region)	0.0017	0.0016	0.0016	0.0016	0.0017	0.0016
	(0.0016)	(0.0005)	(0.0016)	(0.0005)	(0.0015)	(0.0005)
share(engenieer and R&D)t-2	0.0234	0.0020	0.0236	0.0020	0.0187	0.0020
	(0.0076)	(0.0011)	(0.0077)	(0.0011)	(0.0063)	(0.0011)
average experience t-2	-0.0039	-0.0001	-0.0039	-0.0001	-0.0038	-0.0001
	(0.0001)	(0.0000)	(0.0001)	(0.0000)	(0.0001)	(0.0000)
number of subsidiaries t-2	0.0105	0.0012	0.0105	0.0012	0.0091	0.0012
	(0.0053)	(0.0009)	(0.0053)	(0.0009)	(0.0050)	(0.0009)
Manager exp M1	0.0392	0.0046	0.0393	0.0046	0.0233	0.0044
	(0.0072)	(0.0046)	(0.0072)	(0.0046)	(0.0067)	(0.0046)
Manager exp M2	0.0393	-0.0048	0.0384	-0.0048	0.0274	-0.0048
	(0.0072)	(0.0059)	(0.0072)	(0.0059)	(0.0067)	(0.0059)
Manager exp M3	0.0408	-0.0016	0.0404	-0.0016	0.0256	-0.0016
	(0.0052)	(0.0032)	(0.0052)	(0.0032)	(0.0045)	(0.0032)
Manager M1 N - QIV			0.0113	-0.0014	0.1710	-0.0008
			(0.0129)	(0.0018)	(0.0112)	(0.0019)
Manager M1 F - QIV			0.0161	0.0000	0.0612	0.0012
			(0.0347)	(0.0014)	(0.0283)	(0.0020)
Manager M2 N - QIV			-0.0179	-0.0001	0.1200	0.0003
			(0.0240)	(0.0009)	(0.0221)	(0.0013)
Manager M2 F - QIV			0.1020	0.0020	0.1250	0.0013
			(0.0686)	(0.0030)	(0.0553)	(0.0031)
Manager M3 N - QIV			0.0811	-0.0024	0.2580	-0.0017
			(0.0113)	(0.0013)	(0.0097)	(0.0015)
Manager M3 F - QIV			-0.0541	-0.0012	0.0089	-0.0043
			(0.0314)	(0.0021)	(0.0271)	(0.0028)
Additional Manager's control* Managers QII-QIII	NO	NO	NO	NO	YES	YES
Firms Fixed Effect	YES	YES	YES	YES	YES	YES
Sector-Year Fixed Effect	YES	YES	YES	YES	YES	YES
R2	0.0058	0.0291	0.006	27.83	0.0732	0.029
Number Obs.	731265	731265	731265	731265	731265	731265
F - stat	29.900	29.790	28.570	0.029	24.590	24.590
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000
Number of clusters (Firms)	207,415	207,415	207,415	207,415	207,415	207,415
Nbr Variables	83	85	89	91	101	103

Table 19: Instrumental Variable Fixed Effect Model. Dependent Variable: Number of Layers (cont. 2/2)

Note: Standard errors clustered at firm level are reported in parentheses. Managers are classified by occupations equivalent to CEOs and Directors (M1) Senior staff (M2) and Supervisors M(3). N and F refer to their nationalities, where N(Nationals) and F(Foreigners). Additional Manager's control (Managers QII-QIII) refers to dummy variables for managers in the second and third quartiles of wage distribution.

We notice that APEX's treatment effect is positive in all of our specifications and do not seem very sensitive to changes on covariates once we control for size (instrumented by number of

employees with 2 lags). Also, the first specification (model 01) uses only firms' age and firms' age squared as additional covariates which is clearly exogenous[37] to the program and the outcome.

Therefore, the Local Average Treatment Effect (LATE) of PEIEX (τ) is positive and statistically significant at 1%. However, the dependent variable was log-transformed. In order to interpret the coefficient, we can take the exponential of both sides of eq. 3 and analysing the outcome when conditional on PEIEX(0,1). If we assume (τ=0.20), then the average impact will be 22.1% on the percentage change of the number of layers (on average PEIEX's treated firms have 1.73 layers of management hierarchy). The coefficient for other APEX's assistance is also a positive a statistically significant at 5%. However, we are using it as control variable without infer any causality in this case.

Another interesting result is about the impact of managers coming from previous exporting firms. Overall, the variables "Manager exp M1-M3" are positive and statistically significant in the second stage. This indicates that the positive effect observed by Mion and Opromolla [2011] on export performance might also reflect on firms' organization.

Regarding the results of our first stage, the impact of our instrumental variables on the probability of getting PEIEX are statistically significant at 1%. Our main instrument (number of NOs by state) has a positive sign. The larger the number of PEIEX regional units in the state of the firm, the larger the probability of getting the assistance. A critical assumption in our identification is that this variable is orthogonal to the residuals in both stages. We already showed in our identification (table 16) we cannot reject the null hypothesis that the correlation between number of NOs by state and average changes on firms' organization is different than zero in the period previous to the treatment. In addition, we are using as covariate the log of number of exporters at micro-region level (from Model 04 to Model 06). This variable aims to control for potential exogenous shocks (e.g. external demand) that might impact exporters at regional level and could affect production hierarchy of firms at the same region. However, we see that this variable is significant in the first stage, but not in the second stage.

The second instrument aims to be a proxy for the fact that the program is targeting potential exporters firms that are interested in taking advantage of services for matching foreign buyers. A criteria to identify this potentiality is to use their own information (Apex) on sectors for which these services has been provided. What sign should we expect for its coefficient? We know that PEIEX is strongly correlated with states that received NOs. Therefore, we should expect a positive sign for this variable in this states. This is what we get from our interaction term. For the instrument itself the answer is ambiguous because we are interacting information at sector level (CNAE 5 digits) for states that PEIEX were not available and we are controlling for sector-year shocks (CNAE 2 digits). Therefore if there were sectors (at 5 digits) attended by Apex in

[37] However this does not mean that there is not problem of omitted variables.

the past that are more prevalent in states where PEIEX is not available, once we are controlling for a more aggregate sector-year shock the coefficient's sign will depend on this interaction[38]. Although the interaction between the sector(CNAE 2 digits) year dummies and this instrument make it less straightforward, the advantage is that is very unlikely that it is correlated with the residuals due to our sector-year controls.

We also tested our result for similar specifications keeping only 2 instruments (Number of NO's by state and the lag of sectors - CNAE 5 digits - assisted in each state weighted by PEIEX existence) and one instrument (Number of NO's by state)[39]. The impact is still positive and significant. The advantage of using additional instruments is that it allows us to test for overidentification restriction, which is the next topic.

6.2 Robustness Check

Excluded instruments and overidentification restriction

As previously discussed, a critical assumption in our identification is the exclusive restriction, that means our instruments are orthogonal to the residuals in the first and second stages. While we cannot test this assumption directly, there are some standard procedures that provide additional support to our results. First, table 20 shows the F statistic for joint significance of the instruments Z in the first stage. It is noticeable that we reject the null that all excluded instruments are not significant at 1% of significance. Stock-Yogo shows the critical value for the null that the bias of 2SLS is less than a given fraction (e.g. 5%)of the bias of OLS. Based on the F-statistics of the first stage we can reject the null at 5% of maximal IV relative bias.

Another important result on table 20 is the Hansen J test. Due to the fact we are using three instruments, we can test if at least one of the instruments are exogenous. We do not reject the null hypothesis that all instruments are valid. Therefore, we conclude the overidentifying restrictions are valid. In addition, we run the specification using two instruments (Number of NO's by state and the lag of sectors - CNAE 5 digits - assisted in each state weighted by PEIEX existence) without the interaction term and we also reject the null.

[38]We tested for many different specifications in order to identify what is leading the negative sign of this instrument in the first stage (results are available under request). Indeed, it is leaded by the incidence of firms that are in sectors (5 digits) that received assistance in a previous year in states that were not eligible for PEIEX, until 2010. Nonetheless, conditional on being in a state eligible for PEIEX the effect is positive. The average for lag(dummy sector Apex state) is 0.318, while the average value for the interaction term is 0.635 (Table 24 on Appendix shows these values conditional on firm's treatment status). Therefore, if we multiply these values by the coefficients, the net effect of being in sector (CNAE 5 digits) that received other Apex's services (non-Peiex) treatment in t-1 is that it increases the probability of receiving PEIEX in 0.45%, ceteris paribus. It means that if there are two similar firms in a given sector CNAE 2 digits, and only one of them are in sector that received previous support of APEX in the same state, this will will increase its probability of receiving the program in 0.45%, on average. We also run a panel fixed effect assuming a weight equals zero for states that did not receive NOs. In this case, if we drop the interaction term, the coefficient become positive.

[39]These results are available under request.

Test	Model 01	Model 02	Model 03	Model 04	Model 05	Model 06
F test of excluded instruments						
F-stat	538.15	495.5	493.7	493.68	493.66	493.720
Prob ¿ F	0.000	0.000	0.000	0.000	0.000	0.000
Stock-Yogo weak ID test critical values:						
5% maximal IV relative bias	13.91	13.91	13.91	13.91	13.91	13.91
10% maximal IV relative bias	9.08	9.08	9.08	9.08	9.08	9.08
20% maximal IV relative bias	6.46	6.46	6.46	6.46	6.46	6.46
30% maximal IV relative bias	5.39	5.39	5.39	5.39	5.39	5.39
Overidentification test of all instruments						
Hansen J statistic:	2.25	0.431	0.27	0.272	0.263	0.255
Chi-sq(2) P-val	0.3246	0.806	0.8735	0.8729	0.8768	0.8805

Table 20: Overidentification test: Fixed Effect Instrumental Variable

Poisson Fixed Effect controlling for State-Year shocks

A second robustness check is a Poisson Panel Fixed Effect estimator. An advantage of this method is that it takes into consideration the non-linearity of our dependent count variable. This method become popular with a seminar Hausman et al. [1984]'s paper[40]. Then we run a similar specification with the same logarithm transformation we implemented in the IV Fixed Effect, which allows us to compare the coefficients for checking if this procedure provides a good approximation for the Poisson estimators. Also, we control for regional year (state-year dummies) shocks that plays an important rule in our IV identification strategy.

First of all, it is important to highlight that the coefficient of Peiex's treatment is not sensitive to state-year fixed effect. Tables 21 and tab:xtreg show that adding this controls change the coefficients very little (from 0.041 to 0.039) and the standard errors (from 0.0054 to 0.0055) in the Poisson estimation. Table 22 shows similar results. The coefficients are still strongly positive significant.

The estimation confirms that PEIEX's assisted firms had changed their organization, adding additional layers (this difference is significant at 1%), after controlling for time-constant heterogeneity, a large set of firms' covariates (including proxies for quality of management). The coefficient is smaller than the LATE from the IV.

Finally, the FE Poisson estimators (table 21) relatively close to the ones we obtained with logarithm transformation (table 22), what suggests that the procedure we adopted provides a good approximation of the non-linearity presented in our dependent count variable. In both cases (FE Poisson and Panel FE), PEIEX's coefficients are still positive and significant, but the magnitude are much smaller.

[40](add further details on the assumptions of the method and discuss them in the context of the paper.

Poisson Fixed Effect Estimator						
Dependent variable: number of layers						
Variable	**model 01**	**model 02**	**model 03**	**model 04**	**model 05**	**model 06**
PEIEX	0.0390	0.0376	0.0377	0.0378	0.0325	0.0345
	(0.0051)	(0.0051)	(0.0051)	(0.0051)	(0.0050)	(0.0049)
apex(EP)	0.0229	0.0202	0.0202	0.0201	0.0116	0.0118
	(0.0067)	(0.0066)	(0.0066)	(0.0066)	(0.0061)	(0.0061)
log(number employees)t-2	0.0183	0.0174	0.0174	0.0174	0.0130	0.0129
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Firms' age	0.0118	0.0122	0.0121	0.0121	0.0100	0.0102
	(0.0013)	(0.0013)	(0.0013)	(0.0013)	(0.0012)	(0.0009)
Firms' age$\hat{2}$	-0.00021	-0.00022	-0.00022	-0.00022	-0.00018	-0.00018
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
log(wage)t-2		0.0034	0.0033	0.0034	0.0042	0.0040
		(0.0016)	(0.0016)	(0.0016)	(0.0015)	(0.0015)
log(schooling)t-2		-0.0108	-0.0108	-0.0109	-0.0115	-0.0113
		(0.0037)	(0.0037)	(0.0037)	(0.0035)	(0.0035)
log(nbr exporters - region)		0.0006	0.0006	0.0005	0.0008	0.0009
		(0.0015)	(0.0015)	(0.0015)	(0.0014)	(0.0014)
share(engenieer and R&D)t-2		0.0193	0.0186	0.0187	0.0147	0.0147
		(0.0062)	(0.0065)	(0.0065)	(0.0051)	(0.0052)
average experience t-2		-0.0045	-0.0045	-0.0045	-0.0043	-0.0043
		(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
number of subsidiaries t-2		0.0056	0.0058	0.0058	0.0049	0.0049
		(0.0032)	(0.0032)	(0.0032)	(0.0030)	(0.0030)
Manager exp M1			0.0264	0.0264	0.0156	0.0155
			(0.0050)	(0.0050)	(0.0049)	(0.0049)
Manager exp M2			0.0270	0.0264	0.0189	0.0193
			(0.0050)	(0.0049)	(0.0047)	(0.0047)
Manager exp M3			0.0295	0.0294	0.0193	0.0194
			(0.0039)	(0.0039)	(0.0034)	(0.0034)
Manager M1 N - QIV				0.0161	0.1595	0.1594
				(0.0094)	(0.0080)	(0.0080)
Manager M1 F - QIV				0.0010	0.0335	0.0337
				(0.0219)	(0.0180)	(0.0179)
Manager M2 N - QIV				-0.0007	0.1224	0.1223
				(0.0166)	(0.0148)	(0.0148)
Manager M2 F - QIV				0.0690	0.0828	0.0832
				(0.0426)	(0.0333)	(0.0332)
Manager M3 N - QIV				0.0505	0.2021	0.2021
				(0.0086)	(0.0073)	(0.0073)
Manager M3 F - QIV				-0.0288	0.0135	0.0133
				(0.0209)	(0.0160)	(0.0159)
Additional Manager's control*						
Managers QII-QIII	NO	NO	NO	NO	YES	YES
FIXED EFFECT						
FIRMS	YES	YES	YES	YES	YES	YES
Sector-Year	YES	YES	YES	YES	YES	YES
Region(State)-Year	YES	YES	YES	YES	YES	NO
N	731,265	731,265	731,265	731,265	731,265	731,265
Firms (cluster)	207,415	207,415	207,415	207,415	207,415	207,415
Wald chi2	1,953	2,943	3,059	3,113	24,836	24,550
F-prob	0.000	0.000	0.000	0.000	0.000	0.000

Table 21: Dependente variable: Number of Layers. Poisson Panel Fixed Effect

Note: Standard errors clustered at firm level are reported in parentheses. Managers are classified by occupations equivalent to CEOs and Directors (M1) Senior staff (M2) and Supervisors M(3). N and F refer to their nationalities, where N(Nationals) and F(Foreigners). Additional Manager's control (Managers QII-QIII) refers to dummy variables for managers in the second and third quartiles of wage distribution. Sector (CNAE 2 digits).

Panel Fixed Effect Estimator						
Dependent variable: log(number of layers)						
Variables	**model 01**	**model 02**	**model 03**	**model 04**	**model 05**	**model 06**
PEIEX	0.0463	0.0448	0.0448	0.0449	0.0405	0.0421
	(0.0059)	(0.0059)	(0.0059)	(0.0059)	(0.0058)	(0.0057)
apex(EP)	0.0278	0.0245	0.0245	0.0243	0.0142	0.0144
	(0.0085)	(0.0084)	(0.0084)	(0.0084)	(0.0078)	(0.0078)
log(number employees)t-2	0.0170	0.0161	0.0161	0.0161	0.0124	0.0123
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Firms' age	0.0155	0.0156	0.0156	0.0156	0.0134	0.0108
	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0016)	(0.0010)
Firms' age$\hat{2}$	-0.00025	-0.00027	-0.00027	-0.00027	-0.00023	-0.00022
	(0.00002)	(0.00002)	(0.00002)	(0.00002)	(0.00002)	(0.00002)
log(wage)t-2		0.0013	0.0013	0.0013	0.0019	0.0017
		(0.0013)	(0.0013)	(0.0013)	(0.0012)	(0.0012)
log(schooling)t-2		-0.0117	-0.0117	-0.0117	-0.0121	-0.0123
		(0.0036)	(0.0036)	(0.0036)	(0.0035)	(0.0035)
log(nbr exporters - region)		0.0016	0.0016	0.0016	0.0018	0.0020
		(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0015)
share(engenieer and R&D)t-2		0.0241	0.0234	0.0236	0.0189	0.0188
		(0.0073)	(0.0076)	(0.0076)	(0.0063)	(0.0063)
average experience t-2		-0.0039	-0.0039	-0.0039	-0.0038	-0.0038
		(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
number of subsidiaries t-2		0.0109	0.0111	0.0111	0.0095	0.0097
		(0.0057)	(0.0056)	(0.0056)	(0.0053)	(0.0053)
Manager exp M1			0.0396	0.0397	0.0239	0.0238
			(0.0072)	(0.0072)	(0.0067)	(0.0067)
Manager exp M2			0.0378	0.0370	0.0259	0.0263
			(0.0071)	(0.0071)	(0.0066)	(0.0066)
Manager exp M3			0.0399	0.0395	0.0248	0.0249
			(0.0051)	(0.0051)	(0.0045)	(0.0045)
Manager M1 N - QIV				0.0115	0.1717	0.1717
				(0.0129)	(0.0112)	(0.0112)
Manager M1 F - QIV				0.0170	0.0621	0.0619
				(0.0348)	(0.0284)	(0.0283)
Manager M2 N - QIV				-0.0178	0.1201	0.1202
				(0.0240)	(0.0221)	(0.0222)
Manager M2 F - QIV				0.1009	0.1245	0.1244
				(0.0690)	(0.0557)	(0.0555)
Manager M3 N - QIV				0.0810	0.2582	0.2583
				(0.0113)	(0.0097)	(0.0097)
Manager M3 F - QIV				-0.0538	0.0089	0.0090
				(0.0314)	(0.0272)	(0.0270)
Additional Manager's control*						
Managers QII-QIII	NO	NO	NO	NO	YES	YES
FIXED EFFECT						
FIRMS	YES	YES	YES	YES	YES	YES
Sector-Year	YES	YES	YES	YES	YES	YES
Region(State)-Year	YES	YES	YES	YES	YES	NO
N	779,356	779,278	779,278	779,278	779,278	779,278
R2 (within)	0.00439	0.00738	0.00751	0.00772	0.07546	0.07506
Firms (cluster)	255,428	255,428	255,428	255,428	255,428	255,428
F stat	10.440	15.280	15.650	15.840	134.950	236.790
F-prob	0.000	0.000	0.000	0.000	0.000	0.000

Table 22: Dependent variable: Log(Number of Layers). Panel Fixed Effect

Note: Standard errors clustered at firm level are reported in parentheses. Managers are classified by occupations equivalent to CEOs and Directors (M1) Senior staff (M2) and Supervisors M(3). N and F refer to their nationalities, where N(Nationals) and F(Foreigners). Additional Manager's control (Managers QII-QIII) refers to dummy variables for managers in the second and third quartile of wage distribution. Sector (CNAE 2 digits).

Inequality and Hours Hired in L0

	LOG INEQUALITY			LOG HOURS L0		
Variable	model1	model2	model3*	model1	model2	model3*
PEIEX	0.017	0.017	0.013	0.149	0.144	0.142
	(0.007)	(0.007)	(0.007)	(0.012)	(0.012)	(0.012)
apex(EP)	0.034	0.033	0.026	0.090	0.077	0.074
	(0.012)	(0.012)	(0.012)	(0.022)	(0.022)	(0.022)
log(number employees)t-2	0.012	0.012	0.009	0.013	0.009	0.008
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Firms' age	0.004	0.004	0.002	0.033	0.033	0.032
	(0.003)	(0.003)	(0.002)	(0.005)	(0.004)	(0.004)
Firms' age$\hat{2}$	0.000	0.000	0.000	-0.001	-0.001	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
log(wage)t-2		-0.001	0.000		0.009	0.009
		(0.001)	(0.001)		(0.003)	(0.003)
log(schooling)t-2		0.003	0.003		-0.007	-0.006
		(0.003)	(0.003)		(0.008)	(0.008)
log(nbr exporters - region)		-0.002	-0.002		-0.008	-0.008
		0.002	0.002		0.004	0.004
share(engenieer and R&D)t-2		(0.021)	(0.017)		(0.012)	(0.008)
		0.008	0.008		0.014	0.014
average experience t-2		-0.001	-0.001		-0.012	-0.012
		(0.000)	(0.000)		(0.000)	(0.000)
number of subsidiaries t-2		0.015	0.013		0.042	0.042
		(0.003)	(0.003)		(0.015)	(0.015)
Manager exp M1			0.073			0.049
			(0.016)			(0.026)
Manager exp M2			-0.004			0.128
			(0.017)			(0.028)
Manager exp M3			0.010			0.071
			(0.011)			(0.017)
Manager M1 N - QIV			0.153			-0.139
			(0.023)			(0.035)
Manager M1 F - QIV			0.097			0.218
			(0.054)			(0.106)
Manager M2 N - QIV			0.025			-0.356
			(0.048)			(0.080)
Manager M2 F - QIV			-0.018			0.378
			(0.085)			(0.266)
Manager M3 N - QIV			0.058			-0.111
			(0.023)			(0.035)
Manager M3 F - QIV			0.028			0.430
			(0.069)			(0.162)
Constant	0.106	0.126	0.107	8.821	9.024	9.012
	(0.027)	(0.029)	(0.028)	(0.052)	(0.053)	(0.052)
FIXED EFFECT						
FIRMS	YES	YES	YES	YES	YES	YES
Sector-Year	YES	YES	YES	YES	YES	YES
Region(State)-Year	YES	YES	YES	YES	YES	YES
N	767,572	767,495	767,495	779,356	779,278	779,278
R2 (within)	0.003	0.003	0.041	0.014	0.019	0.022
Firms (cluster)	255,428	255,428	255,428	255,428	255,428	255,428
F stat	5.810	6.210	32.190	32.230	38.850	38.480
F-prob	0.000	0.000	0.000	0.000	0.000	0.000

Table 23: Dependente variables: Log(Number of Within Inequality) and Log(hours hired in L0) - Panel Fixed Effect

Notes: Standard errors clustered at firm level are reported in parentheses. Managers are classified by occupations equivalent to CEOs and Directors (M1) Senior staff (M2) and Supervisors M(3). N and F refer to their nationalities, where N(Nationals) and F(Foreigners). Additional Manager's control (Managers QII-QIII) refers to dummy variables for managers in the second and third quartile of wage distribution. Sector (CNAE 2 digits). Log Inequality refers to the ratio of the average real wage at the top hierarchy (Ln) and production workers (L0). Log hours L0 refers to the log of total hours hired of production workers.

Another robustness check regarding the relationship of our proxy for firm's organization and competitiveness is about within wage inequality and hours hired among producer workers. According to Caliendo and Rossi-Hansberg [2012], a reorganization of the firm by adding more layer of hierarchy would lead to a decrease in the average wage in layers previously existent, even though the average wage could go up. Due to the fact that the new top manager will have a wage that is higher than the previous one and the average wage for producer workers go down, we should expect that the ratio of average wage in the top layer divided by the average wage in L0 should increase.

We run similar specifications from Panel fixed effect for log of inequality. Table 23 shows the results (first three columns). Overall, we observe that within inequality of the average wages increased and its coefficient is statistically significant at 5%.

Another prediction from the theory is that number of hours on previously existent layer would increase. Table 23 shows that the coefficients are positive and significant at 1% of confidence (last three columns). Although we do not have data on value added of these firms, these results do not reject some predictions of the theory which assumes that these changes in organization are correlated to growth and higher productivity.

7 Conclusion

This paper evaluates the impact of a consulting service on management and production practices provided by Apex-Brasil aimed at improving competitiveness of small and medium firms. First, we built a proxy for firms' organization based on a theoretical framework provided by Garicano [2000], Caliendo and Rossi-Hansberg [2012] and Caliendo et al. [2012], which describes a positive relationship between firm's organization, growth and productivity. Then, we provide a detailed descriptive using the richness of the data set to show evidences about the relationship between production hierarchy and exporting performance. Finally, we use the data of PEIEX's program to analyse its impact of firms' organization.

We found a positive impact of PEIEX on firms' organization. On average, based on our IV identification strategy, firms that received the program increase in 22.1% the amount of based-knowledge hierarchy, measured by number of layers. Taking into consideration a median treated firm with 1 layer of hierarchy, it increases its probability to add a second layer. Based on the theoretical reference used in this paper, this option for reorganization suggest that these firms are likely more competitive due to the fact that the increasing in the number of management knowledge allows them to reach smaller marginal cost by economizing on the necessary knowledge for production workers. Although we cannot test it directly, we show that our results are consistent with some predictions of the theory.

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A Descriptive Statistics

UNTREATED APEX's FIRMS						
Variables	N	mean	sd	p50	p10	p90
Size (Employee)	927,770	25.63	208.02	5.83	1.00	38.67
Firm's age	927,894	11.94	8.94	9.83	3.16	22.80
Number of Subsidiaries (t-1)	927,894	0.11	1.51	0.00	0.00	0.00
Share Engenieers and R&D	927,770	0.003	0.03	0.00	0.00	0.00
Wage	927,770	879.79	631.44	739.47	502.68	1,371.99
Schooling	927,739	8.78	2.07	9.03	5.76	11.04
Worker Experience (t-1)	927,657	18.12	7.90	17.45	8.79	28.11
Manager exp L1	927,894	0.002	0.04	0.00	0.00	0.00
Manager exp L2	927,894	0.002	0.04	0.00	0.00	0.00
Manager exp L3	927,894	0.004	0.07	0.00	0.00	0.00
Manager L1 - QI	927,894	0.01	0.14	0.00	0.00	0.00
Manager L2 - QI	927,894	0.005	0.08	0.00	0.00	0.00
Manager L3 - QI	927,894	0.01	0.11	0.00	0.00	0.00
Manager L1 - QIII	927,894	0.05	0.22	0.00	0.00	0.00
Manager L2 - QIII	927,894	0.01	0.11	0.00	0.00	0.00
Manager L3 - QIII	927,894	0.03	0.17	0.00	0.00	0.00
Manager L1 - QIII	927,894	0.13	0.34	0.00	0.00	1.00
Manager L2 - QIII	927,894	0.05	0.22	0.00	0.00	0.00
Manager L3 - QIII	927,894	0.10	0.30	0.00	0.00	0.00
Number Exporters region*	927,894	25.93	53.91	4.00	0.00	76.00
(A) Number NO by State	927,894	1.05	2.25	0.00	0.00	6.00
(B) lag(dummy sector Apex state)	927,894	0.31	0.46	0.00	0.00	1.00
(A)*(B) Interaction term	927,894	0.61	1.82	0.00	0.00	3.00
Exporting Firms (share)	927,894	0.04	0.20	0.00	0.00	0.00
TREATED PEIEX's FIRMS						
variable	N	mean	sd	p50	p10	p90
Size (Employee)	5,926	32.63	125.31	11.50	2.08	62.08
Firm's age	5,928	12.97	9.17	10.99	3.49	23.91
Number of Subsidiaries (t-1)	5,928	0.23	2.13	0.00	0.00	1.00
Share Engenieers and R&D	5,926	0.005	0.04	0.00	0.00	0.00
Wage	5,926	845.43	394.70	740.06	544.72	1273.48
Schooling	5,925	9.16	1.77	9.40	6.70	11.04
Worker Experience (t-1)	5,925	17.26	6.34	17.01	9.46	25.33
Manager exp L1	5,928	0.004	0.06	0.00	0.00	0.00
Manager exp L2	5,928	0.004	0.06	0.00	0.00	0.00
Manager exp L3	5,928	0.008	0.09	0.00	0.00	0.00
Manager L1 - QI	5,928	0.004	0.06	0.00	0.00	0.00
Manager L2 - QI	5,928	*	*	0.00	0.00	0.00
Manager L3 - QI	5,928	0.003	0.05	0.00	0.00	0.00
Manager L1 - QIII	5,928	0.05	0.22	0.00	0.00	0.00
Manager L2 - QIII	5,928	0.01	0.08	0.00	0.00	0.00
Manager L3 - QIII	5,928	0.03	0.16	0.00	0.00	0.00
Manager L1 - QIII	5,928	0.16	0.37	0.00	0.00	1.00
Manager L2 - QIII	5,928	0.05	0.22	0.00	0.00	0.00
Manager L3 - QIII	5,928	0.10	0.31	0.00	0.00	0.00
Number Exporters region*	5,928	12.89	23.91	3.00	0.00	42.00
(A) Number NO by State	5,928	5.07	2.42	6.00	1.00	8.00
(B) lag(dummy sector Apex - state)	5,928	0.68	0.47	1.00	0.00	1.00
(A)*(B) Interaction term	5,928	3.62	3.15	3.00	0.00	8.00
Exporting Firms (share)	5,928	0.09	0.29	0.00	0.00	0.00

Table 24: Descriptive Statistics - variables used in the regressions (2007-2010)

The descriptive is based in a pooling data from 2007 to 2010. Treatment status defined as firms that did not receive APEX at year t (Untreated APEX) and firms that did not received PEIEX at year t(Treated PEIEX)

B Appendix: Production hierarchy 3 Layers Classification

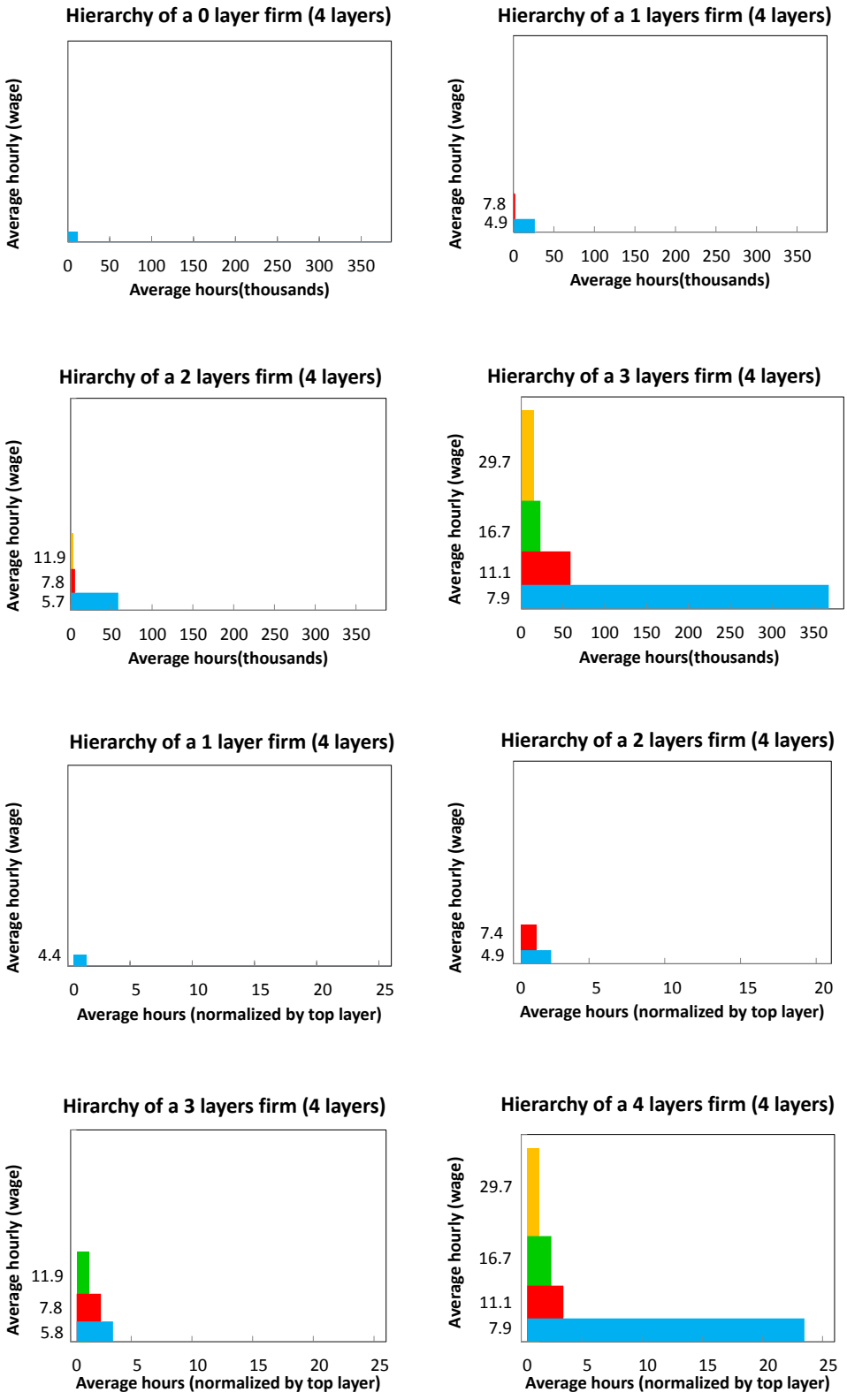

Figure 7: Hierarchies of Firms based on 4 Layers Classification (2007-2010)