Preparing to Export*

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Abstract

We document considerable heterogeneity among Brazilian exporters. Recent starters or switchers differ substantively from continuing exporters in size and export-market penetration. Surprisingly, this heterogeneity is not reflected in the workforce composition regarding observed worker skills or occupations. Using linked employer-employee data, we turn to a typically unknown worker characteristic: a worker's prior experience at other exporters. We show that anticipated export status, predicted with destination-country trade instruments, leads firms to prepare their workforce by hiring workers from other exporters, and that hiring former exporter workers predicts both a wider reach of destinations and a deeper penetration of destinations. This evidence is consistent with the hypothesis that exporters actively prepare for anticipated export-market access and with the idea that few key workers may determine a firm's export success.

Keywords: International trade; exporter behavior; trade and labor market interactions

JEL Classification: F12, F14, F16

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1 Introduction

A large body of empirical evidence and trade theories suggest that exporters substantively differ from non-exporters regarding their size, productivity and workforce composition.[1] To investigate performance differences more closely, this paper compares Brazilian exporters among themselves regarding the time pattern of exporting and their workforce characteristics to learn about successful and lasting export-market participation.

There is considerable heterogeneity in performance and sizes among exporters, not just between exporters and non-exporters. When we classify Brazilian exporters by their export-market presence in the current and two preceding periods, the implied ranking of export market success is mirrored in an almost perfectly monotonic size ranking from only about 80 workers at in-out switching exporters to 550 workers at exporters with a sustained OECD-market presence. Surprisingly, however, this substantive heterogeneity in export performance and sizes is not reflected in observable workforce characteristics. The workforce composition regarding skills and occupations is economically similar among exporters and in some cases statistically indistinguishable. This leads us to hypothesize that unobserved worker characteristics are important determinants of export-market performance.

To elicit more information on unknown worker skills, we use rich linked employer-employee data for the universe of Brazilian manufacturing firms and their export behavior between 1990-2001 to extract an otherwise unobserved worker characteristic: a worker's prior experience at other exporting firms. We define *hires from exporters* as the head count of hired workers whose immediately preceding employment was at an exporter. We find that anticipated exporting, predicted with foreign import-demand instruments, leads firms to prepare their workforces with hires from exporters. Our findings are consistent with the hypothesis that exporters actively build up workforce expertise for future export-market access, especially if export-market participation is anticipated to be lasting.

Much empirical research has established evidence that firms with a competitive advantage self-select into exporting, but typically find no positive effects on employment or productivity change after export-market entry. Research by Clerides, Lach and Tybout (1998) on plants in Colombia, Mexico and Morocco or by Bernard and Jensen (1999) on U.S. firms, for instance, shows a significant difference in productivity between exporters and non-exporters but no significant difference in productivity change after export-market entry.[2] Our data allow us to analyze the extent to which firm differences

[1] The literature documents exporter premia for many countries, beginning with Bernard and Jensen (1995) for U.S. manufacturing exporters. Differences typically exist even before export-market entry. Isgut (2001) presents evidence for Colombia and Alvarez and Lopez (2005) for Chile, consistent with firm-level advantages prior to exporting.

[2] Much of the literature provides evidence that a firm-level competitive advantage leads to export-

prior to exporting are the outcomes of active firm choices in preparation for exporting.

Recent trade theories investigate industry dynamics when firms simultaneously engage in innovation and export-market participation. Yeaple (2005) shows in a static model with ex ante identical firms and heterogeneous workers, whose skill is complementary to innovative technology, that the firms' binary choice of process innovation induces the sorting of more skilled workers to innovative firms, leading to firm heterogeneity ex post and to exporter premia in equilibrium. The Yeaple (2005) model is closely related to our empirical exercise. As multilateral trade costs drop, more firms in the differentiated-goods sector adopt innovative technology and raise their employment, hiring away the top-skilled workers from differentiated-goods producers with lower technology.[3] Departing from ex ante heterogeneous firms, Costantini and Melitz (2008) reintroduce a stochastic productivity component from Hopenhayn (1992) into the Melitz (2003) model and allow firms to choose process innovation. In simulations of the dynamic industry equilibrium, an anticipated future reduction of multilateral trade costs leads firms to adopt innovation in advance, while waiting for export-market participation.[4]

These theory models predict that exporters, and especially larger exporters in Costantini and Melitz (2008), adopt more advanced technology in response to anticipated returns from export-market entry. In our linked employer-employee data for Brazilian exporters, however, we find only minor differences among exporters in workforce skills and occupations, which should expectedly correspond to firm-level technology. There are at least three possible explanations for the puzzlingly small workforce differences: export-market success is mere luck; export-market success is independent of workforce characteristics if process innovations or product-quality upgrades can be achieved regardless of workforce skill; or typically unobserved workforce characteristics are most important for export-market success. Using the workers' prior job history and their experience at other exporters as a proxy to unobserved skill, we document that the latter explanation is most plausible.

Related recent studies provide empirical evidence that firms jointly choose innovative activity and export-market participation. For the Canada-U.S. Free Trade Agreement, Trefler (2004) documents that Canadian plants that face deeper tariff cuts in

ing, and typically not the reverse. Exceptions are Van Biesebroeck (2005), who reports evidence that exporting subsequently raises productivity for sub-Saharan African manufacturing firms, and Crespi, Criscuolo and Haskel (2008) who use survey data for U.K. firms in which exporters that report to have mostly learnt from clients exhibit faster productivity growth.

[3]Also considering ex ante identical firms, Ederington and McCalman (2008) allow for a continuous technology choice in a dynamic industry-equilibrium model and show that a drop in foreign trade costs raises the rate of technology adoption at exporters but delays it at non-exporters. Workers do not play a specific role.

[4]Atkeson and Burstein (2008) address price setting by exporters and also analyze the joint innovation and export-participation choice in a dynamic model of trade with heterogeneous firms, allowing for a continuous technology choice.

their product markets raise plant-level labor productivity faster. Verhoogen (2008) demonstrates that Mexico's exchange-rate devaluation during the 1994 Peso crisis leads initially more productive plants to increase exports and to pursue process certification more frequently than initially less productive plants, consistent with process innovation prior to exporting. Iacovone and Javorcik (2008) use additional information on plant-level capital investment and on the unit price of products for Mexican plants and show that the unit price exhibits an increase two years prior to exporting, suggestive of quality upgrading, and that the increase in unit price coincides with a physical-investment spurt. Bustos (2005) documents with Argentinean firm data that, once MERCOSUR reduces import duties in Argentina's neighboring export markets, exporters upgrade technology significantly more rapidly and upgrade workforce skills significantly faster than non-exporters. Our analysis contributes to this line of empirical research and adds novel labor-market evidence. We use sector-level shipments from countries other than Brazil into Brazil's export markets outside Latin America as instruments for a Brazilian firm's future export status. Beyond existing empirical work on major trade reforms or large exchange rate shocks, our approach addresses firm-level workforce preparations for exporting in tranquil times.

A related literature on spillovers from foreign-owned to domestic firms considers the moves of individual workers between employers. An often recounted episode of know-how dissemination from a foreign investment project is the Bangladeshi joint venture Desh-Daewoo between a local entrepreneur and Daewoo of Korea. Of the 130 founding workers, trained by Daewoo in Korea, 115 left Desh once their non-compete clause expired and set up their own exporting firms (Rhee 1990). As a result, the Bangladeshi garment industry grew from a small number of firms in 1979 to more than 700 exporters by 1985. Gershenberg (1987) studies survey evidence from 41 Kenyan manufacturing firms and argues that managerial know-how dissemination was low, partly because of high retention rates at foreign-owned firms. In contrast, Görg and Strobl (2005) document for 204 surveyed firms in Ghana that those whose owners have prior work experience at foreign-owned firms in the same industry are more productive than competitors. Beyond small-sample survey evidence, Poole (2009) uses linked employer-employee data from the same Brazilian source as we do and documents a statistically significant increase in earnings of incumbent workers at domestic firms after workers from foreign-owned firms join, but the pay increase is small in economic terms. For export-market participation, in contrast, we find the hiring of few former exporter workers to be an economically important variable, predicting a probability increase in export-market participation of about three percentage points. This is a considerable change given an overall exporting frequency of only five percent in the manufacturing universe and is similar in magnitude to what only substantive changes in observed workforce characteristics would predict.

Rich information on workforce composition as well as past and future exporter performance allows us to seek more precise evidence. Firms with initially less skilled

workforces pursue the strongest advance hiring of former exporter workers in response to favorable foreign demand. Hiring workers from continuous exporters is more strongly associated with reaching additional export markets than hiring workers from firms that just started exporting. Firms that anticipate continuous future exporting pursue relatively more advance hires.

The remainder of the paper proceeds as follows. We describe our data in Section 2 and document substantial differences among exporters in size and export performance. In Section 3, we explore workforce and other firm characteristics that are potentially related to the substantial size and performance differences. In Section 4, we turn to our main analysis of workforce choices in anticipation of favorable foreign demand and demonstrate active workforce preparations for subsequent export-market participation. Section 5 concludes.

2 Data and Exporter Categories

One main data source is the universe of Brazilian exporters: a three-dimensional panel data set by firm, destination country and year between 1990 and 2001. We combine the exporter data with the universe of formal-sector firms and all their formally employed workers. This second data source is a three-dimensional linked employer-employee panel by firm, worker and year between 1990 and 2001. The combined employer-employee data provide us with workforce information for exporters in the formal sector, and complement the exporter data with the universe of formal-sector non-exporters. We restrict ourselves to manufacturing firms. We combine these data with worldwide trade flow data to construct instrumental variables (IVs) for a Brazilian firm's export status.

Exporter data. Exporter data derive from the universe of Brazilian customs declarations for merchandize exports by any firm collected at SECEX (*Secretaria de Comércio Exterior*). For comparability to other studies, we remove agricultural and mining firms as well as commercial intermediaries from the exporter data and only keep manufacturing firms that report their direct export shipments. We deflate export sales to their August-1994 equivalents using the monthly U.S. consumer price index (from Global Financial Data). The choice of August 1994 is motivated by the timing of Brazil's last major currency reform in July 1994, which put the Brazilian Real (BRL) value at an initial exchange rate of one with the U.S. dollar (USD). See Appendix A for more detail on the SECEX data.

Linked employer-employee data. Our source for linked employer-employee data is RAIS (*Relação Anual de Informações Sociais*), a comprehensive register of workers formally employed in any sector of Brazil's economy. RAIS offers information on worker

characteristics such as education, a detailed occupational classification that reflects the skill intensity of the job, the firm's industry, and the legal form of the company including its foreign ownership. While RAIS offers comprehensive workforce information, data on domestic sales are neither available from SECEX nor RAIS. See Appendix B for more detail on RAIS.

We keep observations for the years 1990 through 2001, drop all firms outside manufacturing, and then use the data for the construction of several sets of variables. First, we use employment on December 31st to obtain information on the firm's workforce size and composition across all its plants. We pay attention mainly to the education and occupation categories and construct according shares (see Appendix B for definitions). Second, we use worker IDs to trace recent hires at potential exporting firms back to their preceding employer and count the number of gross hires who were employed at an exporter in their immediately preceding job. For the purpose of worker tracking, we restrict the worker sample to all proper worker IDs (11-digit *PIS*).

Third, we obtain industry information for every firm. RAIS reports industries at the subsector IBGE classification (roughly comparable to the *NAICS 2007* three-digit level) over the full sample period. Subsector IBGE industries are recorded by plant, however. There are multi-plant firms in our sample, and we assign the industry associated with most employees in a given year to multi-plant firms. At the subsector IBGE level, there are twelve manufacturing industries in RAIS. The main sector affiliation of firms varies over time. Including both non-exporters and exporters, there is a total of 1,767,491 firm-year observations in our manufacturing data (after restricting the sample period to the years 1992-2001 in order to measure exporting status with two lags). There are 36,599 observations of firms that change sector so that firm effects are not nested within sector effects in later empirical analysis. In regression analysis, we will use one lead year so that our basic regression sample will have 1,557,474 firm-year observations for 1992-2000. When we condition on employment changes at the firm level, only firms with a observations for two consecutive years remain in the sample, which drops in size to 1,277,201 firm-year observations for 1992-2000. Given the still large sample size, we will report statistical significance at the one-percent significance level throughout this paper.

Table A.1 in the Appendix reports firm counts, the share of exporters and select firm characteristics by subsector IBGE. On average, only about five percent of Brazilian formal-sector manufacturing firms are exporters, a considerably smaller share than in Chile, where 21 percent of manufacturing plants are exporters in 1990-96 (Alvarez and Lopez 2005), or Colombia (18 percent of plants in 1991 Brooks 2006), Mexico (36 percent of plants in 1996, Iacovone and Javorcik 2008) or the United States (18 percent of firms in 2002, Bernard, Jensen, Redding and Schott 2007). Exporting is most frequent in machinery and equipment manufacturing industries, where workforce sizes per firm also tend to be large. Except for transportation equipment, the industries with most frequent exporting are populated by firms with below-average sizes and below-

average exports per firm. We will account for sector differences with industry-fixed effects in all later regressions.

Worldwide trade flows. Our IVs for anticipated export status are imports into Brazil's export destinations from source countries other than Brazil, by subsector IBGE. We use WTF data on bilateral trade (Feenstra, Lipsey, Deng, Ma and Mo 2005) from 1991 to 2000 to construct the IVs by subsector IBGE, year and six world destinations.[5] We concord the SITC (Rev. 2) sectors at the four-digit level in WTF to subsector IBGE.[6] We then calculate aggregate imports into each foreign destination country, excepting imports from Brazil, by subsector IBGE. The IVs will prove to be significant predictors of export status but are plausibly unrelated to firm- or worker-level shocks other than export-market effects outside Brazil.

Exporter categories. We are interested in export-market success over time. We consider the current year and two preceding years and record in which of the three years a Brazilian firm was an exporter with at least one reported foreign shipment (8 possible combinations). We first order firms by current-year export status (t), within current-year status by past-year status ($t-1$), and within those by two-years past status ($t-2$). Table 1 shows our resulting ranking of export success, with the category in the upper-most row showing the least successful exporters (permanent non-exporters) and the lower-most row containing the most successful exporters (sustained OECD exporters). Beyond the basic time-pattern ranking, we further separate no-exporting firms into those that are permanent non-exporters (non-exporters in every sample year) and current non-exporters (with foreign sales in at least one sample year). We further separate continuous-exporting firms into non-sustained exporters that serve no single destination in all three consecutive years, into sustained non-OECD exporters that serve at least one non-OECD country for three years, and into sustained OECD exporters that serve at least one OECD country for three years (resulting in a total of 11 possible combinations).

We choose these export-status categories to clarify beyond a two-period categorization that there is considerable heterogeneity among exporters, both in terms of workforce sizes and export values. Our time-pattern and destination-market ranking of export-market success is a refinement of a simpler two-period grouping of exporters into *non-exporters* for three consecutive years, exporters that *quit exporting* (including past quitters), firms that *start exporting* (including past starters), and exporters with *continuous exporting*. Curiously, our refined export-status ranking is almost perfectly

[5]The six world destinations are Asia-Pacific Developing countries (APD), Central and Eastern European countries (CEE), North American countries (NAM excluding Mexico), Other Developing countries (ODV), Other Industrialized countries (OIN), and Western European countries (WEU). We remove Latin American and Caribbean countries (LAC) from our set of IVs.

[6]Our novel concordance is available at URL *econ.ucsd.edu/muendler/brazil*.

Table 1: Export Status Ordering

Export status	Export period $t-2$	$t-1$	t	Firm-year observations (1)	Workers per firm (2)	Annual exports (3)
Non-Exporter for three years						
Permanent non-exporter[a]	0	0	0	1,596,947	12	
Current non-exporter[a]	0	0	0	60,198	66	
Quit Exporting						
Past quitter	1	0	0	9,101	79	
In-out switcher	0	1	0	7,626	76	
Recent quitter	1	1	0	6,569	102	
Start Exporting						
Recent starter	0	0	1	18,420	104	310.7
Re-entrant	1	0	1	3,181	137	231.0
Past starter	0	1	1	12,252	149	923.1
Continuous Exporting						
Non-sustained continuous exporter[b]	1	1	1	6,044	178	561.3
Sustained non-OECD exporter[b]	1	1	1	21,915	232	888.4
Sustained OECD exporter[b]	1	1	1	25,238	552	10,802.7

[a]Permanent non-exporters do not export in any sample year; current non-exporters export in at least one sample year.

[b]Non-sustained continuous exporters export in three consecutive years but serve no single destination in all three years; sustained non-OECD exporters serve at least one destination (but no 1990-OECD member country) in three consecutive years; sustained OECD exporters serve at least one 1990-OECD member country in all three years.

Source: SECEX 1990 through 2001 (t: 1992-2001), manufacturing firms (subsectors IBGE 2-13).
Notes: Universe of 1,767,491 manufacturing firm-year observations. Exports (fob) in thousands of August-1994 USD.

mirrored in the firms' ranking by workforce size (column 2). For example, permanent non-exporters have an average size of twelve workers, in-out switchers who recently quit exporting employ 76 workers, recent export starters employ 104 workers, while sustained OECD exporters employ 552 workers on average. This surprising workforce-size monotonicity is preserved for all but one pair of neighboring rows.[7] Our refined export-status ranking is also positively related to export sales (column 3, correlation coefficient of .11 at firm level).

The vast majority of formal-sector manufacturing firms (over ninety percent) never exports in any year between 1990 and 2001. The 57,149 firms that quit or start exporting make up more than half of all firms that export in at least one year between

[7] A two-period classification would have lumped past quitters with non-exporters, but their workforce size turns out to be more similar to other quit-exporting firms under the refinement. Similarly, a two-period classification would have lumped past starters with continuous-exporting firms, but their workforce is more similar to other start-exporting firms under the refinement.

1990 and 2001 but account for only eleven percent of all export sales. Even among the continuous exporters, it is the select group of sustained OECD exporters that dominates. The 25,238 sustained OECD exporters are fewer than one-third of all current exporters, but they ship close to four-fifth of Brazilian exports. This paper aims to investigate the workforce characteristics which are associated with this heterogeneity among exporters.

3 Workforce Characteristics among Exporters

As documented in the preceding Section, there are considerable differences in size and export-market performance between exporters. We now turn to associated workforce characteristics. Table 2 reports summary statistics for the universe of manufacturing firms, but restricts the sample to 1992-2000 to account for one lead in addition to two lags in export status. Exporters are about five times more likely to be an affiliate of a foreign multinational enterprise (MNE) than the average firm, and firms with continuous exporting about seven times more likely than the average.

Even among exporters, substantive differences in foreign-market participation and size exist. Compared to firms that start exporting, continuous exporters serve one log point more destinations and have more than one log point larger sales per destination. Continuous exporters have only a one-in-twelve chance to quit exporting, while firms that recently started exporting (within the past two years) quit exporting with a one-in-three chance. Exporters (with mean employment of 285 workers) are considerably larger than the average firm (which employs 28 workers). Among exporters of different status, workforce sizes vary substantively from an average of 87 at recent export quitters to an average of 386 workers at continuous exporters.

Surprisingly, however, workforce characteristics do not reflect these performance and size differences. The most prevalent occupation in manufacturing, skilled blue-collar work, is performed by 63 percent of workers at the average manufacturing firm and by around 57 percent of workers at exporters, almost independent of the exporters' export status. The most prevalent schooling level in manufacturing is primary education. Similar to occupations, there are considerably more primary schooled workers at the average manufacturing firm with a share of 76 percent than at exporters with a share of 67 percent, but there is only minor variation across exporters.

While workforce characteristics are surprisingly stable across exporters, despite marked performance and size differences, there is a considerable difference in hiring among exporters. Continuous exporters shrink most rapidly in employment during the 1990s (downsizing even more rapidly than recent export quitters). Menezes-Filho and Muendler (2007) document that this employment downsizing is associated with labor productivity improvements, especially among exporters and in comparative advantage industries. Despite net employment reductions at continuous exporters, the

Table 2: Summary Statistics

Variable	All firms (1)	Ex-porters (2)	Export Status (t) Continuous (3)	Start (4)	Quit (5)
Foreign-market participation					
Indic.: Exporter (t)	.049	1.000	1.000	1.000	
Indic.: Affiliate of foreign MNE (t)	.0001	.0005	.0007	.0002	.0002
Log # Destinations (t)	.986	.986	1.375	.376	
Log Exports/Destination (t)	3.832	3.832	4.423	2.906	
Anticip. Continuous Exporting (t+1)	.038	.674	.918	.280	
Anticip. Start Exporting (t+1)	.021	.148		.389	.219
Anticip. Quit Exporting (t+1)	.016	.177	.082	.331	.454
Anticip. Non-exporter for three years (t+1)	.924				.327
Size					
Employment (t)	28.2	285.4	386.1	127.9	87.2
Net Employment Change ($t-1$ to t)	-.2	-5.5	-13.0	7.2	-6.1
Workforce characteristics					
Share: Unskilled blue-collar occupation (t)	.130	.127	.120	.137	.132
Share: Skilled blue-collar occupation (t)	.631	.576	.573	.580	.560
Share: White-collar occupation (t)	.239	.297	.306	.283	.309
Share: Primary school education (t)	.756	.673	.662	.690	.690
Share: High school education (t)	.207	.232	.234	.229	.228
Share: Tertiary education (t)	.037	.095	.104	.081	.081
Workforce background					
Indic.: Hires from Exporters (in t)	.265	.861	.899	.801	.728
Gross Hires from Exporters (in t)	2.2	25.5	32.8	14.1	9.0

Sources: SECEX and RAIS 1990-2001 (t: 1992-2000), manufacturing firms (subsectors IBGE 2-13).
Notes: 1,557,474 regression sample observations (employment change based on 1,277,201 observations of firms with consecutive-year presence). Export status as defined in Table 1. Current exporters (column 2) include firms with continuous exporting (column 3) or that start exporting (column 4) but not firms that recently quit exporting (column 5). Workforces on December 31st. Exports (fob) and annualized December wages in thousands of August-1994 USD.

reallocation of former exporter workers is directed towards them. Workers with prior employment at other exporters most frequently move to other continuous exporters: continuous exporters hire the largest gross number of former exporter workers—hiring more than double as many former exporter workers as export starters and more than three times as many as recent export quitters. The hiring pattern across exporters is consistent with the hypothesis that workers with a former exporter background may bring valuable but otherwise unobserved skills with them.

Although only about five percent of manufacturing firms are exporters, roughly half of the manufacturing labor force is employed at exporters (as implied by the bottom row of Table A.1). So, at a common separation rate of roughly one-third in manufacturing during the 1990s, a substantial number of workers that shift between employers has a potential background in exporting.[8] At exporters, there is around one former-exporter hire per ten employed workers, with a slightly higher rate at export starters and export quitters and a somewhat lower rate at the average manufacturing firm. For continuous exporters shrink their workforces, the share of former exporter workers in continuous-exporter workforces rises faster than at other firms.

We now turn to describing these differences more systematically with regressions that document exporter premia across exporters. Much research has shown that non-exporters significantly differ from exporters along several dimensions, including workforce characteristics.[9] Less attention has been paid to differences among exporters. In our exporter-premia regressions, we condition on sector and year effects, as well as on the firm's log employment to control for the part of the exporter premium that is explained by size differences.

Table 3 shows that workers at continuous exporters earn a wage premium of .44 log points over workers at non-exporters, and even workers at recent export-market quitters earn .32 log points more than workers at firms with no exports for three years. Only a small part of this wage premium is due to different workforce compositions, as the log wage residual from a regression on educational and occupational workforce variables shows. The residual log wage still exhibits a premium between .25 and .35 log points over non-exporters. This is consistent with the hypothesis that unobserved worker characteristics are associated with a firm's export status. Just as the means in

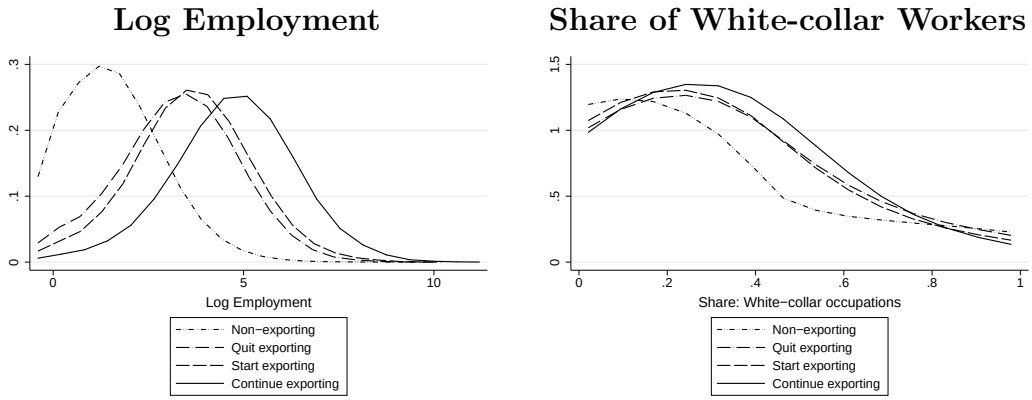
[8]Computations of turnover statistics on the linked-employer data shows that both worker separation and accession rates are around 30 percent in the formal manufacturing sector during the sample period, with accession rates slightly below separation rates.

[9]Bernard and Jensen (1995) first regressed firm characteristics on an export indicator (and control variables) to measure exporter premia, and found marked differences. Additional evidence has confirmed their findings since. Bernard et al. (2007) report that U.S exporters in 2000 exhibit 19 percent larger employment than non-exporters, pay 17 percent higher wages and employ a 19 percent larger share of nonproduction workers. Isgut (2001) reports similar exporter premia for Colombia. Van Biesebroeck (2005) finds even more pronounced differences for sub-Saharan exporters, which employ three times as many workers as non-exporters and pay 34 percent higher wages in the early 1990s.

Table 3: Exporter Premia conditional on Log Firm Size

	Export Status			t-tests of null-hypothesis	
	Continuous	Start	Quit		
Firm characteristic	(1)	(2)	(3)	(1)==(2)	(2)==(3)
Earnings					
Log Annual Wage	.440	.307	.316	≠	
	(.003)	(.003)	(.004)		
Residual Log Annual Wage	.351	.248	.256	≠	
	(.003)	(.003)	(.003)		
Workforce composition					
Share: Unsk. blue-collar occupation	-.021	-.003	-.001	≠	
	(.001)	(.001)	(.002)		
Share: Skilled blue-collar occupation	-.081	-.070	-.085	≠	≠
	(.001)	(.002)	(.002)		
Share: White-collar occupation	.102	.073	.086	≠	≠
	(.001)	(.001)	(.002)		
Share: Primary school education	-.111	-.076	-.061	≠	≠
	(.001)	(.001)	(.002)		
Share: High school education	.047	.034	.021	≠	≠
	(.0009)	(.001)	(.001)		
Share: Tertiary education	.064	.042	.040	≠	
	(.0006)	(.0008)	(.001)		
Workforce background					
Log Gross Hires from Exporters	1.215	.764	.545	≠	≠
	(.006)	(.006)	(.007)		

Sources: SECEX and RAIS 1992-2001, manufacturing firms (subsectors IBGE 2-13).
Notes: Premia are coefficients from linear regressions of the firm characteristic on export status dummies, controlling for the firms' log employment, sector and year effects in the universe of 1,767,491 manufacturing firm-year observations. Export status as defined in Table 1. The omitted baseline category is non-exporters for three years. Workforces on December 31st. Annualized December wages in thousands of August-1994 USD, residual log wage from a linear regression on educational and occupational workforce composition variables. Log number of gross hires from exporters set to missing if zero. Robust standard errors in parentheses. In columns 4 and 5, rejections of the null hypothesis of equality are reported for t tests at one percent significance.



Sources: SECEX and RAIS 1992-2001, manufacturing firms (subsectors IBGE 2-13).
Note: Export status as defined in Table 1. Workforces on December 31st. Epanechnikov kernels with bandwidths .4 (employment) and .2 (white-collar occupations).

Figure 1: **Density Estimates of Sizes and White-collar Shares**

Table 2 above suggested, the estimated workforce composition differences in Table 3 are economically small and not always statistically significant (at the one-percent significance level in the universe of firms). Skilled blue-collar occupations, for instance, are the dominant jobs in manufacturing (Table 2) and are roughly constant at a 7 to 8 percent premium for exporters of any status over non-exporters. For primary educated workers, the most frequent schooling level in manufacturing workforces, there are differences not only between non-exporters and exporters but also across exporters of different status (while the raw mean differences in Table 2 showed no marked variation across exporters of different status). The percentage point differences in educational attainment are economically small, however, when compared to the substantive differences in log points for gross hires from other exporters. Continuous exporters hire .5 log points more workers from other exporters (despite their net shrinking workforces) than export starters (which net expand their workforces).[10]

This evidence leads us to hypothesize that former exporter workers possess unobserved skills that are associated with exporter performance and could be more relevant performance predictors than conventional observable workforce differences. Before we investigate this hypothesis in detail in the following Section, we look beyond mean comparisons and plot nonparametric estimates of densities for firm characteristics. In the left graph of Figure 1, the kernel estimates for log employment reiterate the marked size rankings from Table 1 before, with continuous exporters' sizes exhibiting a clearly right-shifted probability mass over firms that start exporting, firms that quit

[10]The differences in pay and gross hires of former exporter workers are even more pronounced in premia regressions that do not condition on size, and workforce characteristics premia economically more similar among exporters.

exporting, and non-exporters in this order. The ranking becomes less clear-cut for shares of white-collar occupations in the right graph of Figure 1. While there is still a pronounced difference between non-exporters and exporters, the density functions for exporters with different status exhibit multiple crossings and do not suggest as clear a ranking as there appears to be for sizes.

4 Preparing to Export

Prior research shows that workforce characteristics differ between non-exporters and exporters. The preceding Sections document in addition that export-market performance and sizes also differ markedly between exporters of different status. But commonly observed workforce characteristics such as educational attainment and occupations are quite similar among exporters despite substantively different export performance and size. We now query whether unobserved workforce characteristics, in particular a worker's background from experience at other exporters, are important predictors of future export-market participation, and to what extent the hiring of former exporter workers occurs in preparation for export-market participation.

Predictions of future export-market participation. Table 4 reports binomial logit predictions for future export-market participation $(t+1)$, given today's export participation and firm-level characteristics.[11] All specifications condition on sector and year effects.[12] Consistent with much prior evidence, firms with larger employment are more likely to be exporters than non-exporters one year later, and firms with more highly educated workers or with more skill-intensive occupations are more likely to be exporters than non-exporters. But, conditional on schooling, only the most skill-intensive professional occupations are a statistically significant predictor of next-period exporting (at the one-percent significance level). In line with existing evidence on sunk costs of export-market entry (e.g. Roberts and Tybout 1997), current exporting is a highly significant predictor of future exporting with a predicted marginal probability increase of roughly .2.[13] Hysteresis in exporting is better explained by a firm's presence in more export destinations than by its market penetration of given destinations.

[11] The binomial exporter-nonexporter dichotomy makes this initial specification closely comparable to Clerides et al. (1998), Alvarez and Lopez (2005) or Crespi et al. (2008).

[12] A conditional logit specification for firm-fixed effects performs poorly, reducing the estimation sample by more than 90 percent to only 98,731 observations and predicting an export-market participation rate of 26.2 percent, far above the actual 4.9 percent. In contrast, a linear probability model with firm-fixed effects, similar to our first-stage instrumental-variable regression below (Table 5) performs reasonably well, with negative predicted probabilities for just two percent of the sample. The linear model shows a strong association between hiring former exporter workers and export-market participation. For descriptive evidence, we limit our discussion to the more conservative estimates from binomial logit.

[13] Estimates vary from $.048(1-.048) \cdot 3.326 = .152$ in specification 1 to .218 in specification 4.

Table 4: Logit Prediction of Future Export-Market Participation

	Exporter $(t+1)$			
Predictor (t)	(1)	(2)	(3)	(4)
Log Employment	.673	.574	.550	.505
	(.005)*	(.006)*	(.007)*	(.008)*
Share: High school education	.248	.246	.245	.251
	(.027)*	(.031)*	(.030)*	(.031)*
Share: Tertiary education	.818	.735	.732	.757
	(.047)*	(.054)*	(.054)*	(.054)*
Share: Skilled blue-collar occ.	-.223	-.198	-.198	-.158
	(.026)*	(.028)*	(.028)*	(.029)*
Share: Other white-collar occ.	-.046	-.054	-.039	-.099
	(.050)	(.057)	(.056)	(.058)
Share: Techn. or supervis. occ.	-.028	.078	.080	-.109
	(.041)	(.046)	(.046)	(.060)
Share: Profess. or manag'l. occ.	.597	.506	.507	.274
	(.058)*	(.069)*	(.068)*	(.079)*
Indic.: Exporter	3.326	3.148	3.147	4.495
	(.025)*	(.027)*	(.027)*	(.037)*
Log # Destinations	.579	.698	.694	.729
	(.018)*	(.020)*	(.020)*	(.018)*
Log Exports/Destination	.175	.193	.189	.199
	(.007)*	(.007)*	(.007)*	(.007)*
Indic.: Affiliate of foreign MNE	-.352	-.287	-.299	-.317
	(.483)	(.492)	(.492)	(.449)
Rel. Employment Chg. ($t-1$ to t per t)		.009	.010	.013
		(.005)	(.005)	(.006)
Indic.: Hires from Exporters		.709	.674	1.234
		(.017)*	(.018)*	(.023)*
Log Gross Hires from Exp.			.056	.110
			(.009)*	(.009)*
Indic.: High-skill firm				.287
				(.028)*
Indic.: High-skill firm × Indic.: Hires from Exporter				-1.661
				(.034)*
Indic.: High-skill firm × Indic.: Exporter				-.464
				(.030)*
Observations	1,557,474	1,277,201	1,277,201	1,277,201
Pseudo R^2	.622	.624	.629	.629
Predicted probability $\hat{P}$	.048	.051	.051	.051

Sources: SECEX and RAIS 1990-2001 (t: 1992-2000), manufacturing firms (subsectors IBGE 2-13).
Notes: Logit regressions, controlling for sector and year effects. Binary present and future exporter indicators represent firms that start exporting and that continue exporting. Workforces on December 31st. Exports (fob) in thousands of August-1994 USD. Log number of destinations and log exports per destination set to zero for non-exporters. Log number of gross hires from exporters set to zero if zero hires. High-skill firms are firms with a share of technical/supervisory and professional/managerial occupations in the top quartile of firm-year observations. Robust standard errors in parentheses (asterisk marks significance at the one percent level).

Among the exporters, firms with double the current number of export destinations have about a four times larger predicted marginal probability than firms with double the current exports per destination.[14] There is no evidence that being an affiliate of a foreign multinational enterprise (MNE) is a significant predictor of future exporting after controlling for current exporting. These estimates are highly robust across specifications.

Starting with specification 2, we investigate the predictive power of hiring former exporter workers. Whereas relative net employment expansions have no statistically significant effect on next-year exporting (at the one-percent level), the indicator for hiring former exporter workers is highly significant. In economic terms, hiring former exporter workers has similar predictive power for future exporting as has an eightfold increase in the share of tertiary educated workers in the workforce at current exporters.[15] This suggests that hiring key workers with an exporting background from prior employers is strongly associated with future export-market participation. Specification 3 includes the log number of gross hires from exporters, if non-zero. The included variable reduces the coefficient on the indicator for hiring former exporter workers by little and has itself a significantly positive coefficient. This suggests that it is a small number of key workers with an exporting background that matters most for the prediction.

So as to understand at which firms hiring former exporter workers has the strongest predicted effect on future export-market participation, we construct an indicator variable for high-skill firms. We classify a firm as high-skill intensive if its current share of technical/supervisory and professional/managerial occupations falls into the top quartile of firm-year observations. Specification 4 includes the high-skill firm indicator and its interactions with the exporting indicator and the indicator for hiring former exporter workers. Coefficient estimates show that, at high-skill firms, the association between future exporting and hiring former exporter workers is absent. This suggests that hiring key workers with an exporting background matters most for exporting at firms whose operations exhibit relatively less initial skill intensity.

The finding that workers with particularly relevant skills for exporting move to exporters after favorable export-market shocks is consistent with predictions of trade theory. In recent models with endogenous technology adoption such as Yeaple (2005) and Costantini and Melitz (2008), falling variable trade costs induce more firms in differentiated-goods industries to adopt innovative technology and raise their employ-

[14] The implied probability increases are $\ln(2) \cdot .048(1-.048) \cdot .579 = .018$ for export destinations and $\ln(2) \cdot .048(1-.048) \cdot .175 = .005$ for exports per destination.

[15] The respective predictions are that hiring former exporter workers is associated with a probability increase for next-year export-market participation by $.051(1-.051) \cdot .709 = .034$ percentage points in specification 2. By comparison, increasing the share of tertiary educated workers at exporters eightfold from .1 to .8, substituting the primary-educated workers, is associated with a $.051(1-.051) \cdot .7 \cdot .735 = .025$ point probability increase.

ment, hiring away from differentiated-goods producers with lower productivity (in Costantini and Melitz 2008) or hiring away the top-skilled workers from firms with inferior technology (in Yeaple 2005). The timing of hiring and technology-adoption decisions is explicitly modelled by Costantini and Melitz who show in simulations that anticipated future drops in variable trade costs lead firms to adopt innovation before the anticipated favorable trade shock manifests itself.

Export-market shocks. To make the predictions of the Yeaple (2005) and Costantini and Melitz (2008) models operable for empirical analysis, we seek proxy variables for export-market shocks that are not related to domestic economic conditions in Brazil or to favorable firm-level supply shocks. While a large swing in the real exchange rate or dismantling trade barriers offers substantive variation beyond a firm's control, findings from such large-scale experiments, which can have considerable macroeconomic consequences, are arguably less instructive about exporter behavior during tranquil times. We therefore adopt an instrumentation strategy that relates a firm's export-market participation a year into the future with current destination-market shocks.

On the first stage of our instrumental-variable approach, we predict a firm's future export status with import-demand shocks at foreign destinations. The idea for such import-demand IVs is that Brazilian firms inform themselves about foreign market conditions through the media, trade fairs, or specialized trade journals on their product markets, and follow foreign market conditions by observing their own residual demand if they are currently exporting. When they observe a favorable foreign import-demand shock, firms expect a higher chance of exporting next year and prepare their workforces similar to technology upgrading in Yeaple (2005) or Costantini and Melitz (2008). We use non-Brazilian shipments by sector to six world destinations other than Latin America and the Caribbean (Asia-Pacific Developing countries APD, Central and Eastern European countries CEE, North American countries NAM excluding Mexico, Other Developing countries ODV, Other Industrialized countries OIN, and Western European countries WEU) to proxy the information that Brazilian firms may have about these world destinations.

There is little econometric guidance to date for the selection among multiple valid IVs when a few IVs are potentially weak but others strong. If the F statistic for the hypothesis that the instrumental-variable coefficient is non-zero on the first stage surpasses a value of ten, an instrument is commonly considered a strong one (Stock, Wright and Yogo 2002). We have six potential IVs but need at most three IVs to jointly predict whether a firm quits, starts or continues exporting. To select the strongest possible set of IVs, we use the F statistic like an information criterion. We first regress the binary future exporting indicator on all six IVs and other exogenous variables, conditioning on firm, sector and year effects. From this initial regression we select the three IVs with the highest t statistics. We then set out to add IVs in the order of their t statistics, from next highest to lowest, and observe the evolution of the F statistic as

Table 5: Foreign Demand and Future Export-Market Participation

	Exporter	Export Status (t+1)		
	(t+1)	Continuous	Start	Quit
Instrument (t)	(1)	(2)	(3)	(4)
Foreign Import Demand at sector level (IV)				
Non-Brazil Imports in OIN	-.188	-.117	-.072	.070
	(.040)*	(.028)*	(.037)	(.032)
Non-Brazil Imports in WEU	.045	.012	.032	-.030
	(.010)*	(.007)	(.009)*	(.008)*
Non-Brazil Imports in NAM	-.043	.012	-.055	-.002
	(.013)*	(.009)	(.012)*	(.010)
Observations	1,277,201	1,277,201	1,277,201	1,277,201
R^2 (within)	.042	.216	.081	.201
F statistic	18.01	6.06	14.06	11.24
Foreign Import Demand at sector level × Export Status at firm level (IV × Exp.)				
Non-Brazil Imports WW × Cont. Exp.	-.079	-.031	-.048	.035
	(.002)*	(.002)*	(.002)*	(.002)*
Non-Brazil Imports WW × Start Exp.	-.063	-.008	-.055	.032
	(.002)*	(.002)*	(.002)*	(.002)*
Non-Brazil Imports WW × Quit Exp.	-.021	-.007	-.014	-.019
	(.002)*	(.002)*	(.002)*	(.002)*
Observations	1,277,201	1,277,201	1,277,201	1,277,201
R^2 (within)	.043	.217	.082	.202
F statistic	494.44	123.25	314.79	286.54

Sources: SECEX and RAIS 1990-2001 (t: 1992-2000), manufacturing firms (subsectors IBGE 2-13).
Notes: Linear regressions, controlling for firm, sector and year effects. Binary future exporter indicator represents firms that start exporting at t+1 or that continue exporting at t+1; future and current export status as defined in Table 1. Non-Brazilian imports in Other Industrialized countries (OIN), Western European countries (WEU), North American countries (NAM excluding Mexico), and worldwide (WW excluding Latin America and Caribbean). Additional regressors: current export status, workforce characteristics and MNE indicator as in Table 6. Standard errors in parentheses (not clustered because firms not nested within sectors; asterisk marks significance at the one percent level).

we include IVs, with the intent to stop including IVs as soon as the F statistic starts falling. We find the import-demand IVs of OIN, WEU and NAM to have similarly high t statistics (between 3.9 and 3.4 in absolute value) and then add CEE to the regression, which has the next highest t statistic (1.7 in absolute value). With this addition, the F statistic for joint significance of the IVs drops, however, from 18.0 to 14.1. We therefore use no IVs other than import demand in OIN, WEU and NAM.

The upper panel in Table 5 shows the results from linear regressions of future exporting on these pure demand IVs and other regressors (current export status, workforce characteristics and an MNE indicator as in Table 6 below), conditional on firm, sector and year effects.[16] There is no a priori expected sign for coefficients on our foreign import-demand measures. A positive sign is consistent with favorable consumer demand conditions at the foreign destination both for Brazilian and non-Brazilian exporters. A negative sign is consistent with unfavorable residual demand at the foreign destination for Brazilian exporters in the wake of large shipments by non-Brazilian export countries. By this interpretation of coefficients in Table 5 (columns 1 through 3 in upper panel), shipments from non-Brazilian export countries to North America and other industrialized countries tend to substitute Brazilian exports whereas others' shipments to Western Europe tend to complement Brazilian exports. Expectedly, the signs are reversed for Brazilian firms that quit exporting (column 4).

Predictive power of the IVs is a concern. While the F statistic clearly exceeds ten for the binary future exporter indicator and export starters, the F statistic falls below the threshold of ten for continuous exporting status and comes close to the threshold for firms that quit exporting. We will therefore interpret second-stage results for continuous exporters and export quitters with caution.

These foreign import-demand IVs arguably capture pure demand effects, which are common to all firms within a sector. However, in the presence of sunk costs of exporting (Dixit 1989) not all firms are expected to respond to foreign demand shocks in the same way. In this regard, it is plausible to interact the worldwide foreign demand shock with a firm's initial export status category and to use the interacted variables as IVs. We exclude imports into any Latin American or Caribbean economy from the measure of worldwide imports and interact worldwide import demand with indicators for the three export status categories other than non-exporters (Table 1). The lower panel in Table 5 shows the results for the first-stage of the according interacted instrumental variable regression. Expectedly, the F statistics now far exceed the threshold of ten. Note that a firm's initial export status category is also among the controls in this regression so that firm-level supply shocks that are well summarized by the export status do not confound second-stage estimation. If firm-level supply shocks exhibit some persistence, however, so that current export status does not completely summarize future firm-level supply conditions, then second-stage results from interacted IVs cannot be interpreted

[16] Firms are not nested within sectors in our data so standard errors cannot be clustered.

as purely related to foreign demand.

Hiring former exporter workers. We now consider the hiring of former exporter workers at time t as a firm-level preparation for future export-market participation. For this purpose, we use anticipated export-market participation at $t+1$ as instrumented by the above-mentioned observed foreign import-demand shocks at t. The idea is that firms observe favorable export-market conditions at t and choose their workforces at t to prepare for export-market participation at $t+1$. For empirical implementation, we use a single outcome variable that captures the hiring of former exporter workers, including zero hires, but that accounts for the potential non-linearity in the importance of additional hires (see the evidence from predictions of future export-market participation in Table 4). We define the outcome of hiring former exporter workers as the log of one plus the hires from exporters (one plus the head count of workers hired at t whose immediately preceding employment was at an exporter). This measure of gross hiring is well defined for zero hires and increases continuously at a decreasing rate in the number of gross hires.[17]

Results in Table 6 show that anticipated future exporting is positively associated with advance hiring of former exporter workers. Coefficient estimates are strictly larger when future exporting is instrumented (column 3 through 5) than in ordinary regression (columns 1 and 2). Using pure foreign-demand IVs (column 4), which only capture sector and time variation in imports abroad, predicts that firms prepare for an anticipated fifty percentage-point increase in the probability of export-market participation next year with 23 gross hires of former exporter workers in advance.[18] This is a plausible number. The average exporter contracts 26 former exporter workers per year during the sample period, while recent export quitters just hire nine former exporter workers on average and the mean manufacturing firm just hires two (Table 2). Using foreign-demand IVs interacted with the firm's present export status (column 5), leads to a smaller magnitude: by this measure, an anticipated fifty percentage-point increase in the exporting probability next year results in advance gross hiring of eight former exporter workers. Ordinary least-squares regression predicts even fewer advance hires of former exporter workers (column 2), with an anticipated probability increase in next-year exporting by fifty percentage points leading to advance hiring of only half a former exporter worker.

[17] We experimented with four alternative outcome measures: the log of one plus gross hires from exporters *two* years into the future, the log of gross hires from exporters set to zero for zero hires (with a resulting zero outcome for both no hires and one hire), the plain head count of hired former exporter workers, and the binary indicator of hiring at least one former exporter worker. Results are consistent with the findings reported here. Anticipated exporting two years into the future is associated with about half the hiring response compared to anticipated exporting one year into the future.

[18] By the coefficient estimate in column 4, implied gross hiring of former exporter workers is $.5 \cdot \exp\{3.833\} = 23$ workers for a fifty percentage-point increase in the exporting probability, is $.5 \cdot \exp\{2.814\} = 8$ by column 5 and $.5 \cdot \exp\{.106\} = .5$ by column 2.

Table 6: HIRES FROM EXPORTERS

	Log [1 + Hires from Exporters] (t)				
	no IV		IV		IV × Exp.
	OLS	Firm FE	OLS	Firm FE	Firm FE
Predictor (t unless noted otherwise)	(1)	(2)	(3)	(4)	(5)
Anticip. Exp. (t+1), *instr. in (3)-(5)*	.326 (.003)*	.106 (.003)*	9.647 (1.646)*	3.833 (.645)*	2.814 (.104)*
Indic.: Continue Exporting	.837 (.004)*	.317 (.005)*	-6.613 (1.316)*	-.186 (.087)	-.048 (.016)*
Indic.: Start Exporting	.639 (.004)*	.272 (.004)*	-4.572 (.920)*	-.383 (.114)*	-.204 (.019)*
Indic.: Quit Exporting	.523 (.004)*	.212 (.004)*	-.932 (.257)*	.472 (.045)*	.401 (.009)*
Rel. Empl. Chg. (t−1 to t per t)	-.008 (.0002)*	-.003 (.0002)*	-.018 (.002)*	-.005 (.0005)*	-.004 (.0003)*
Log Employment	.297 (.0004)*	.266 (.0008)*	.168 (.023)*	.194 (.013)*	.214 (.002)*
Share: High school education	.009 (.002)*	.007 (.002)*	-.028 (.008)*	-.001 (.004)	.001 (.003)
Share: Tertiary education	.046 (.004)*	-.023 (.004)*	-.111 (.029)*	-.029 (.007)*	-.028 (.006)*
Share: Skilled blue-collar occ.	-.017 (.002)*	-.004 (.003)	-.024 (.005)*	-.014 (.005)*	-.011 (.004)*
Share: Other white-collar occ.	-.056 (.003)*	-.061 (.005)*	-.035 (.009)*	-.052 (.008)*	-.055 (.007)*
Share: Techn. or supervis. occ.	.098 (.004)*	.040 (.005)*	.096 (.010)*	.042 (.008)*	.041 (.006)*
Share: Profess. or manag'l. occ.	.170 (.005)*	.029 (.007)*	.140 (.015)*	.055 (.012)*	.048 (.009)*
Indic.: Affiliate of foreign MNE	.059 (.042)	.032 (.044)	.195 (.114)	.098 (.071)	.080 (.059)
Indic.: High-skill firm	-.106 (.002)*	-.052 (.002)*	-.125 (.006)*	-.067 (.004)*	-.063 (.003)*
Indic.: High-sk. firm × Indic.: Exp.	-.265 (.004)*	-.087 (.005)*	-.121 (.028)*	.080 (.030)*	.034 (.008)*
Observations	1,277,201	1,277,201	1,277,201	1,277,201	1,277,201
R^2 (overall)	.530	.499		.346	.392

Sources: SECEX and RAIS 1990-2001 (t: 1992-2000), manufacturing firms (subsectors IBGE 2-13).
Notes: Linear regressions, controlling for sector and year effects. Specifications 2, 4 and 5 control for firm effects in addition. Specifications 3, 4 and 5 use instrumented binary future exporter indicator (column 1 of Table 5 for specifications 4 and 5). Binary future exporter indicator represents firms that start exporting at t+1 or that continue exporting at t+1; current export status as defined in Table 1. Workforces on December 31st. High-skill firms are firms with a share of technical/supervisory and professional/managerial occupations in the top quartile of firm-year observations. Standard errors in parentheses (asterisk marks significance at the one percent level).

Several explanations are consistent with these differences in magnitude. The estimate in column 2 does not separate demand shocks from firm-level cost shocks or other supply shocks related to firm performance. Similarly, the estimate in column 5 partly confounds demand shocks with the persistent part in firm-level supply shocks. Only the estimate in column 4 arguably isolates foreign demand shocks. In theory models with homothetic demand under a constant elasticity of substitution such as Yeaple (2005) and Costantini and Melitz (2008), relative demand shocks and relative supply shocks would lead to similar firm-level responses regarding export participation and employment. But if changes to foreign consumer tastes are more persistent than firm-level productivity shocks, then demand-side predicted changes in export-participation should plausibly lead to larger employment responses than firm-side changes. Similarly, if production rearrangements in response to firm-level technology shocks require larger sunk cost than are needed for scaling up production to capture extra residual demand in a foreign market, then the demand-side shock should lead to a larger employment response on average. Finally, if Brazilian exporters suffer common adverse supply shocks in some sectors, such as more rapidly increasing import competition under falling trade barriers and a more rapidly appreciating sectoral real exchange rate, their employment will contract (see contraction at continuous exporters in Table 2) and hiring be depressed so that favorable foreign demand conditions are partly offset.

Other estimates are also consistent with the interpretation that strong firm-side performance is not necessarily associated with hiring former exporter workers. Firms that recently quit exporting hire 1.5 more workers than current exporters (columns 4 and 5). Similarly, firms with a large share of college educated workers hire fewer former exporter workers. High-skill firms hire fewer former exporter workers, even if they are also exporters (a negative net coefficient in column 5). As the only exception to the overall pattern, a larger share of skill-intensive white-collar occupations is associated with hiring more former exporter workers. The only exception aside, these empirical patterns are consistent with the interpretation that initially less well staffed firms pursue the strongest advance hiring of former exporter workers in response to favorable foreign demand shocks.

So as to relate anticipated firm performance to advance workforce choices, we use IVs to discern between firms with different future export performance, separating next year's continuous exporters from firms that start exporting and firms that quit exporting. Table 7 shows the estimates. In all specifications that result in a significant difference between neighboring coefficients (columns 1, 2, 4 and 5), firms that anticipate to become continuous exporters hire significantly more former exporter workers in advance. Export quitters hire the fewest former exporter workers but still significantly more than non-exporters. The ranking of point estimates is the reverse in column 4 but pure demand instruments turn weak when we move from a binary exporting indicator to export status categories (Table 5), and neighboring coefficients do not statistically significantly differ from each other. Overall, the results suggest that firms with a more

Table 7: Hires from Exporters and Anticipated Export Status

	Log [1 + Hires from Exporters] (t)				
	no IV		IV		IV × Exp.
	OLS	Firm FE	OLS	Firm FE	Firm FE
	(1)	(2)	(3)	(4)	(5)
Antic. Cont. Exp. (t+1),	.347	.180	-34.124	-5.257	4.704
instr. in (3)-(5)	(.006)*	(.005)*	(92.514)	(5.701)	(.504)*
Antic. Start Exp. (t+1),	.342	.095	20.719	7.221	4.332
instr. in (3)-(5)	(.004)*	(.004)*	(30.987)	(2.460)*	(.342)*
Antic. Quit Exp. (t+1),	.046	.040	-11.230	12.528	3.266
instr. in (3)-(5)	(.005)*	(.004)*	(74.078)	(3.523)*	(.383)*
Observations	1,277,201	1,277,201	1,277,201	1,277,201	1,277,201
R^2 (overall)	.530	.499		.005	.332

Sources: SECEX and RAIS 1990-2001 (t: 1992-2000), manufacturing firms (subsectors IBGE 2-13).
Notes: Linear regressions, controlling for sector and year effects. Specifications 2, 4 and 5 control for firm effects in addition. Specifications 3, 4 and 5 use instrumented future export status (columns 2 through 4 of Table 5 for specifications 4 and 5). Future and current export status as defined in Table 1. Additional workforce and MNE control variables as in Table 6. Standard errors in parentheses (asterisk marks significance at the one percent level).

lasting anticipated future exporter status pursue relatively more advance hires of former exporter workers. This ranking is consistent with Costantini and Melitz (2008), where cumulative favorable foreign demand shocks lead to a higher probability of firm-level innovation.

In summary, firms hire former exporter workers in advance of anticipated favorable export conditions, and firms that anticipate to become continuous exporters pursue relatively more such advance hires. We now return to a descriptive investigation into the importance of advance hiring or former exporter workers for a firm's performance in foreign markets.

Destinations reached and export penetration per destination. We seek additional evidence on two aspects of exporter performance. We decompose the log of a firm's exports into the log number of its export destinations and its log exports per destination. We relate these two outcomes a year into the future to the firm's present characteristics, including its hires of former exporter workers. Both outcomes influence a firm's export intensity, the fraction of the firm's foreign sales in total sales.

Brooks (2006) documents for Colombian manufacturing plants that low-intensity exporters do not grow into high intensity exporters over time. This may either be so because exporters grow larger but increase foreign and domestic sales proportionally, or because exporters fail to substantively advance their export-market penetration. Our Brazilian data suggest that continuing exporters do succeed in raising exports.

Table 8: Predictions of Destination Number and Exports per Destination

Predictor (t unless noted otherwise)	Log # Destinations (t+1) (1)	(2)	Log Exports/Dest. (t+1) (3)	(4)
Log # Destinations (t+1)			.105 (.012)***	.104 (.012)***
Log Exports/Destination (t+1)	.025 (.003)***	.025 (.003)***		
Log Employment	.180 (.008)***	.176 (.008)***	.291 (.017)***	.290 (.017)***
Rel. Empl. Chg. ($t-1$ to t per t)	-.002 (.003)	-.002 (.003)	-.006 (.003)**	-.006 (.003)**
Indic.: Hires from Exporters	-.009 (.010)		-.007 (.021)	
Log Gross Hires from Exp.	.007 (.004)*		.013 (.008)*	
Indic.: Hires from Start Exp.		.011 (.008)		.028 (.015)*
Log Gross Hires from Start Exp.		-.009 (.004)**		-.008 (.009)
Indic.: Hires from Cont. Exp.		.001 (.011)		.015 (.026)
Log Gross Hires from Cont. Exp.		.016 (.004)***		.015 (.008)*
Indic.: High-skill firm	.023 (.011)**	.024 (.011)**	.004 (.023)	.004 (.023)
Indic.: High-sk. firm × Indic.: Hires fr. Exp.		-.017 (.014)		-.031 (.031)
Obs.	50,395	50,395	50,395	50,395
R^2 (within)	.033	.034	.030	.030

Sources: SECEX and RAIS 1990-2001 (t: 1992-2000), manufacturing firms (subsectors IBGE 2-13).
Notes: Linear regressions, controlling for firm, sector and year effects. Workforces on December 31st. Exports (fob) in thousands of August-1994 USD. Log number of gross hires from exporters set to zero if zero hires. High-skill firms are firms with a share of technical/supervisory and professional/managerial occupations in the top quartile of firm-year observations. Additional workforce and MNE control variables as in Table 6. Robust standard errors in parentheses (asterisk marks significance at the one percent level).

The 1993 cohort, for instance, augments total exports from 760 million to 1.30 billion USD (August-1994 equivalents fob) after five years, although the number of continuing exporters drops to a quarter. Similarly, the 1996 cohort raises total exports from 1.04 billion to 1.35 over five years, although the number of continuing exporters drops to a quarter. Continuing Brazilian exporters achieve this increase partly by entering additional export destinations. The 1993 cohort, for example, doubles the reach of average export destinations per firm from two to four between 1993 and 2001. On the other hand, the dominance of sustained OECD exporters (Table 1) is consistent with export market success related to a deep penetration of select foreign destinations. We now turn to firm-level predictors that explain these two dimensions of export performance: the number of destinations that an exporter reaches and its export penetration per destination.

Table 8 shows two pairs of regressions for exporting firms, one pair with the log number of destinations as dependent variable (columns 1 and 2) and one pair with the log exports per destination as dependent variable (columns 3 and 4). Each regression conditions on the other outcome variable to isolate the covariation of predictors. A firm's workforce characteristics exhibit similar covariations with the outcomes as in our binomial regression of exporting on current characteristics (Table 4), so we suppress the workforce shares and the MNE indicator for brevity. Although exporters that reduce their employment ship to more destinations and sell more exports per destination a year into the future, exporters that hire former exporter workers are more successful in both dimensions (columns 1 and 3). The sum of coefficients on the gross hiring of former exporter workers is strictly positive for two or more hires. But not all former exporter worker hires predict success in the same way. Gross hiring from recent export starters is negatively related to the number of export destinations, whereas gross hiring from continuous exporters predicts presence in more destinations. Arguably, experience at continuous exporters is associated with more valuable skills. Interestingly, the different prediction for workers hired from export starters and from continuous exporters does not carry over to the other dimension of export success. For exports per destination, both hiring workers from export starters and from continuous exporters is associated with more shipments. The importance of specific skills for expansions into more destinations is also reflected in the indicator for high-skill firms, which is a significant predictor of more destinations but not of more sales per destination. Overall, these findings are consistent with the hypothesis that workers with a background at continuous exporters have unobserved characteristics that are more important for reaching additional destinations than workers just with prior experience at recent export starters.

5 Concluding Remarks

Using rich linked employer-employee data that track Brazilian manufacturing firms, their export behavior and their workers over more than a decade, we document substantive size and performance differences across exporters, not only between exporters and non-exporters. Even though exporters markedly differ in export market penetration and size, there is surprisingly little variation in their observed workforce composition regarding worker schooling and occupations. We hypothesize that typically unobserved worker characteristics may matter and use workers' employment histories to infer their prior expertise from employment at other exporters. Consistent with our hypothesis, we find that the hiring of a small number of such former exporter workers is an economically important predictor of a firm's future export-market participation. The exact origins of former exporter workers' skills remain a matter for future research. Former exporter workers may have special skills from passive learning or active training at former exporters, or their prior exporter employment may signal a screened ability. Instead, we examine the hiring firms' behavior more closely.

Workforce preparations are consistent with recent trade models where firms can both choose export-market participation and engage in innovation, while each activity raises the return to the other. In these models, firms actively prepare for export-market participation through prior workforce and technology upgrading. To measure the extent of workforce preparations for exporting in tranquil times, we use import demands for non-Brazilian goods outside Latin America as instruments. We find strong evidence for advance hiring of former exporter workers in response to favorable foreign demand. The response is particularly strong at firms with initially less skilled workforces and at firms that anticipate continuous future exporting. Hiring workers from continuous exporters is more strongly associated with reaching additional export markets than hiring workers from firms that just started exporting. These results are consistent with the hypothesis that firms, especially firms with long-term export potential, actively contract a competitive workforce to add to their initial advantage, and then select to export.

Appendix

A SECEX exports data

All export values in the SECEX exports data are reported in current U.S. dollars (USD), free on board (fob). We have observations on exporting plants, declared export values and export destinations for the years 1990 through 2001. We aggregate monthly plant-level export information to years and firms. As mentioned in the text, we deflate export sales to their August-1994 equivalents using the monthly U.S. consumer price index (from Global Financial Data). Table A.1 reports firm counts, exporter shares and select firm characteristics by subsector IBGE.

We consider as industrialized countries the 24 OECD member countries in 1990: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal (including Madeira Islands), Spain (including Alborán, Parsley Island, and Canary Islands), Switzerland, Turkey, United Kingdom (including Channel Islands), and the United States. We exclude the following types of exports and destinations: immediate reexports of imports, on-board aircraft consumption, and non-declared destinations.

Exporting is transitory for most Brazilian exporters. Similar to evidence in Brooks (2006) for Colombian plants between 1981 and 1991, only a fraction of any cohort of first-time exporters continues to export after a year. Of the 1993 cohort, for instance, less than a quarter of firms is still an exporter by 1998, five years later. Of the 1996 cohort, only slightly more than a quarter of firms is still an exporter by 2001.[19]

B RAIS linked employer-employee information

Brazilian law requires every Brazilian plant to submit detailed annual reports with individual information on its workers and employees to the ministry of labor (*Ministério de Trabalho*, MTE). The collection of the reports is called *Relação Anual de Informações Sociais*, or RAIS, and typically concluded at the parent firm by March for the preceding year of observation. RAIS is a nationwide, comprehensive annual record of workers formally employed in any sector (including the public sector). RAIS covers, by law, all formally employed workers, captures formal-sector migrants, and tracks the workers over time. By design, however, workers with no current formal-sector employment are not in RAIS. The data provides monthly spell information on individually identified workers at individually identified plants. Similar to our treatment of the SECEX data, we aggregate the monthly worker-plant information to years and firms.

[19] An empirical supplement with according tabulations is available at URL *econ.ucsd.edu/muendler*.

Table A.1: Firm Characteristics by Industry

Subsector IBGE	Firm-year observ.	Workers per firm	Share (%) exporters	Workers per exp.	Exports per exp.
Non-metallic mineral products	137,091	18.8	.026	212.5	1,574.7
Metallic products	201,093	24.8	.046	288.4	5,974.8
Machinery, equipment and instruments	73,976	39.4	.152	167.9	1,962.3
Electrical and telecomm. equipment	40,603	51.9	.123	285.8	2,618.3
Transport equipment	39,169	80.9	.103	622.4	13,010.7
Wood products and furniture	234,913	15.2	.042	120.1	1,064.9
Paper and paperboard, and publishing	132,108	23.0	.023	349.9	5,118.3
Rubber, tobacco, leather, and prod. nec.	96,152	25.3	.082	173.1	2,805.6
Chemical and pharmaceutical products	131,110	37.2	.099	206.4	2,100.9
Apparel and textiles	332,926	20.6	.025	314.1	1,290.1
Footwear	48,881	46.5	.099	335.2	2,630.4
Food, beverages, and ethyl alcohol	299,469	34.1	.024	637.2	9,372.6
Total	1,767,491	27.7	.049	278.9	3,598.7

Sources: SECEX and RAIS 1990-2001, manufacturing firms (subsectors IBGE 2-13).
Notes: Employment on December 31st. Exports (fob) in thousands of August-1994 USD.

Annual aggregation removes seasonal fluctuations in worker accession and separation rates from the data.

RAIS primarily provides information to a federal wage supplement program (*Abono Salarial*), by which every worker with formal employment during the calendar year receives the equivalent of a monthly minimum wage. A strong incentive for compliance is that workers' benefits depend on RAIS so that workers follow up on their records. The payment of the worker's annual public wage supplement (*Abono Salarial*) is exclusively based on RAIS records. The ministry of labor estimates that currently 97 percent of all formally employed workers in Brazil are covered in RAIS, and that coverage exceeded 90 percent throughout the 1990s.

Education and occupation categories. We group education information from nine RAIS education categories into three categories as shown in Table B.2.

Occupation indicators derive from the 3-digit CBO classification codes in our nationwide RAIS data base, and are reclassified to conform to ISCO-88.[20] We map RAIS occupations into ISCO-88 categories and regroup them into five categories as shown in Table B.3.

Earnings. For descriptive purposes, we use the monthly December wage paid to workers with employment on December 31st of a given year. RAIS reports the December wage in multiples of the current minimum wage. We use the log of annualized

[20]See online documentation at URL *econ.ucsd.edu/muendler/brazil*.

Table B.2: Education Categories

	RAIS category	Education Level
1.	8.-9.	Some College or College Graduate
2.	6.-7.	Some High School or High School Graduate
3.	1.-5.	Illiterate, or Primary or Middle School Educated (*reference category*)

December wages as our earnings measure, defined as the reported monthly wage times the December U.S. dollar equivalent of the current minimum wage times 12. Similar to export values, we deflate this earning measure to its August-1994 equivalent using the monthly U.S. consumer price index (from Global Financial Data).

Sector and legal form. Sector information for the firm is not available from the exporter data (SECEX), which only reports exported products, so we extract a firm's industry from RAIS. We use the annual mode of subsector IBGE across the firms' workers because, within the firms, plants can operate in different sectors. Subsector IBGE information is reported for the full sample period, whereas finer industry categories only become available in later years.

RAIS also reports a firm's legal form, including its direct foreign ownership by a foreign company (the according legal form code is "branch or office of foreign company"). Indirect foreign ownership, minority foreign ownership, or portfolio holdings do not fall under this category. We use the annual mode of legal form across the firms' workers to deal with occasional coding errors of legal form. The self-reported foreign-ownership category in RAIS potentially differs from foreign ownership in Poole (2009), who uses independent information on direct and indirect foreign ownership from the Central Bank of Brazil for a shorter sample period.

Table B.3: Occupation Categories

	ISCO-88 occupation category	Occupation Level
1.	Legislators, senior officials, and managers	Professional or Managerial
	Professionals	Professional or Managerial
2.	Technicians and associate professionals	Technical or Supervisory
3.	Clerks	Other White Collar
	Service workers and sales workers	Other White Collar
4.	Skilled agricultural and fishery workers	Skilled Blue Collar
	Craft and related workers	Skilled Blue Collar
	Plant and machine operators and assemblers	Skilled Blue Collar
5.	Elementary occupations	Unskilled Blue Collar (*reference category*)

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