

Preparing to Export*

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Abstract

Exporters differ markedly in export-market performance. We document that this heterogeneity is not strongly reflected in workforce education or occupations but closely relates to the presence of a few workers with prior export experience. We employ a novel identification strategy to isolate how a firm's hiring decision at home responds to exogenous changes in product demand abroad. Combining Brazilian exporter and linked employer–employee data, we show that firms act on favorable export market conditions by hiring workers with prior experience from incumbent exporters in preparation to export. We find that firms concentrate this preparatory hiring of experts in skilled blue-collar occupations, and that firms separate from the previously hired experts in case the predicted export market entry fails to materialize. The evidence is consistent with the tenet that a few exporting experts in select occupations shape a firm's competitive advantage.

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

JEL Classification: F12, F14, F16

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1 Introduction

Exporters substantively differ in export market performance, but this disparity is not typically reflected in observable workforce characteristics such as education or occupation.¹ The question arises whether the firms' demand for worker skill responds to changing product-market conditions abroad in other ways and, if so, what type of worker skill is closely associated with exporter success. Recent research provides evidence that the domestic labor supply of managers with exporting experience is associated with the export status of hiring firms (Mion and Opromolla 2014, Masso, Roigas and Vahter 2015, Mion, Opromolla and Sforza 2016, Meinen et al. 2018). We investigate the complementary question as to how product-market conditions abroad translate into domestic labor demand for expertise.

We show that, when confronted with favorable changes in foreign product markets, firms actively prepare to export by recruiting *experts*—workers with previous experience at other exporters. We combine exporter data with linked employer-employee data for the universe of formal Brazilian manufacturing firms to identify such experts in any occupation. We document that Brazilian exporters differ in the employment of experts, and expert recruitment is positively associated with a firm's export market performance. To study firms' active preparations for export-market entry we use current trade flows from source countries other than Brazil to major potential export destinations outside Latin America as instrumental variables (IVs). The instruments strongly predict concurrent and future export-market participation of Brazilian firms, and a firm's predicted export status in turn spurs the preparatory hiring of experts. The results support the idea that exporters actively build workforce expertise in preparation for export-market entry and are consistent with the premise that worker mobility spreads export-relevant knowledge through the economy.

One measure of a firm's export success is the persistence of export status over time. Ranking

¹For evidence from cross sections of firms see, for instance, Bernard and Jensen (1997, 1999), Trefler (2004), and Harrigan and Reshef (2015). Results for exporter responses to large-scale trade liberalization are more mixed. Trefler (2004) detects no response of the educational workforce composition at Canadian exporters under the Canada-U.S. Free Trade Agreement, but Bustos (2011) does find that Argentine firms employ more educated workers after the MERCOSUR agreement reduces tariffs in regional export markets. Findings are similarly mixed for major exchange rate shocks. Verhoogen (2008) argues that Mexican exporters upgraded workforce skills as reflected in wages around the Peso devaluation in 1995, whereas Frías et al. (2018) support the interpretation that increases in wage premia at Mexican exporters after the Peso devaluation are largely shared rents not associated with skill upgrading. Brambilla, Lederman and Porto (2012) find that the workforce skill composition at Argentine exporters responded to the revaluation of the Peso against the Brazilian Real in 1999 only among the exporters that ship to high-income countries. Those studies rely on large-scale macroeconomic shocks for identification, whereas our instrumental variables isolate exporter responses during ordinary times.

Brazilian exporters by export-market participation for up to three years, we find this performance measure to closely mirror a monotonic ranking based on firm exports and employment. The most persistent exporters ship, on average, 16 times as much as the marginal in-out switching exporter, and they employ 4 times as many workers. In line with existing evidence (e.g. Bernard and Jensen 1997, Treffer 2004, Harrigan and Reshef 2015), the vast performance heterogeneity between Brazilian exporters is not clearly reflected in conventional workforce characteristics. However, we can elicit from linked employer–employee data an otherwise unobserved worker characteristic: we identify a worker as an expert if the worker’s immediately preceding formal employment in any occupation was at an exporter. We construct a firm-level indicator to record if the firm hires at least one worker from an exporter as an extensive-margin metric of expert recruitment, and we measure the number of hires from exporters as the head count of recruited experts at the intensive margin. Conditioning on a comprehensive set of controls, we find that the most persistent exporters with continuous export-market participation for three consecutive years are 26 percentage points more likely to hire from another exporter than the least persistent exporters. Conditional on hiring at least one expert, the best performing exporters hire more than twice as many experts as the least successful exporters.

These empirical patterns inform our identification strategy in two ways. When it comes to the selection of a strong instrument for export entry, the persistence of export status suggests that elements of a firm’s information set, such as foreign trade flows, are candidate predictors of future export entry. When it comes to the selection of an exogenous instrument, the persistence of export capabilities over time requires an instrument to be clear of persistent firm-level components to preserve validity. We therefore use current sector-level imports into destinations outside Latin America as instruments to predict a Brazilian firm’s export status, conditional on fixed firm and year effects as well as sectoral trends. The only firm-specific attribute of the instrument is the affiliation of a firm with a sector, which we make time invariant by fixing a firm’s sector in the year of first observation. Our panel data allow us to simultaneously condition on a rich set of time-varying worker, firm and sector characteristics, including employment composition and sector-level domestic absorption. The identification strategy isolates export preparations in economically stable times: we can causally relate the hiring of experts to a firm’s endogenous export-market participation, as predicted by exogenous non-Brazilian trade

flows into potential export destinations.²

Our instrumental-variable approach shows that an increase in the probability of export market participation causes significantly more expert hires from other exporters. The effects are sizeable at the extensive and at the intensive margins of expert hiring. Specifically, we estimate that an increase of 10 percentage points in the probability of export-market participation translates into an increase of 22 percentage points in the probability of hiring an expert, compared to an average of 19 percent. Conditional on hiring away at least one worker from an exporter, a 10 percentage-point increase in the probability of export-market participation leads to an increase of 17 percent in the number of hires from exporters. We document that this preparatory expert hiring is concentrated among skilled blue-collar workers, suggesting that export expertise in these occupations is the most valuable for Brazilian exporters. A consistent explanation is that skilled production workers carry with them production and product knowledge previously honed at an exporter. In line with existing studies on the effect of labor market conditions on export performance (e.g. Mion, Oromolla and Sforza 2016, Meinen et al. 2018), we also find that the previous hire of a manager with exporting experience is associated with the subsequent poaching of skilled blue-collar workers from exporters, suggesting that managers with exporter experience are important mediators for expert recruitment.

A corollary of our maintained hypothesis is that firms for which foreign product market conditions predict a high probability of export-market participation, but which subsequently fail to become exporters, should let go the recently poached experts. Our results show that unexpectedly unsuccessful exporters indeed separate from most of the recently hired experts.

These findings shed light on the importance of portable expertise beyond educational and occupational worker skills in shaping a firm's global competitive advantage. Learning by hiring allows firms to take advantage of favorable product-market conditions abroad through the recruitment of experts with export-specific skills. Firms are not just fortuitous beneficiaries of a skilled worker pool, they actively engage in the poaching of experts in preparation to export, consistent with targeted search for relevant skill.

Our paper relates to several strands of the literature. Research into firm-level preparations for

²In an alternative instrumentation approach, we use as a firm-level instrumental variable the interaction between sector-level imports into destinations outside Latin America and a Brazilian firm's export status three years prior. We find firm-level results to be similar, but OLS and IV estimates to be closer to each other, and occupation-specific results to exhibit unexpected sign patterns. Both findings are consistent with the existence of confounding firm-level characteristics.

export-market entry documents varying aspects of readiness. López (2009) invokes Granger causality and argues that capital investment precedes export entry. Iacovone and Javorcik (2012) show that products soon-to-be exported receive a domestic price premium a year prior to export entry, consistent with advance quality upgrading. Aw, Roberts and Xu (2011) structurally estimate a model of innovation and export entry and find that productivity gains result from investments in innovation in conjunction with exporting. Our paper documents preparation to export through worker recruitment.

Trade theory for heterogeneous firms explains how employment of skilled workers or matching of workers to employers relates to export status. One line of research considers competitive labor markets (Manasse and Turrini 2001, Yeaple 2005, Verhoogen 2008, Bustos 2011, Monte 2011, Burstein and Vogel 2017), and another line analyzes search and matching frictions combined with wage bargaining (Davidson, Matusz and Shevchenko 2008, Helpman, Itskhoki and Redding 2010, Coşar, Guner and Tybout 2016). Alternatively, efficiency wages that induce effort or fair wages can vary with revenue between firms (Egger and Kreickemeier 2009, Davis and Harrigan 2011, Amiti and Davis 2012). Our research design considers targeted hiring of experts with specific exporting expertise, related to search and screening for unobserved ability in Helpman et al. (2017). Two examples of static trade models that consider matching by skill, combined with endogenous technology adoption, are Yeaple (2005) and Costantini and Melitz (2008). In these models, falling variable trade costs induce firms in differentiated-goods industries to adopt innovative technology and raise their employment, hiring away the top-skilled workers from firms with inferior technology (in Yeaple 2005) or hiring away from differentiated-goods producers with lower productivity (in Costantini and Melitz 2008). Closely related to preparatory hiring in anticipation of future export-market entry, as in our empirical design, is the dynamic setting of Fajgelbaum (2020), who studies employment growth under search frictions with job-to-job mobility and shows that firms bound to enter the export market accelerate employment growth prior to export-market participation. There is only one type of worker skill in the Fajgelbaum (2020) framework. While broadly consistent with our empirical work and the employment responses to anticipated export-market opportunities, existing dynamic models do not discern workforce skill.

Empirical evidence and theoretical arguments indicate that firms learn about export demand while exporting (Crespi, Criscuolo and Haskel 2008), or from neighboring firms that export (Fernandes and Tang 2014), and that this learning reduces the costs associated with entering a new export market (Al-

bornoz et al. 2012, Morales, Sheu and Zahler 2019, e.g.). This evidence suggests that workers develop export-specific skills while employed at exporting firms. In line with this argument, recent research shows that the labor-market presence of managers with prior experience at other exporters improves a recruiting firm's export performance (Mion and Opromolla 2014, Mion, Opromolla and Sforza 2016, Meinen et al. 2018). These findings indicate that export-specific skills matter and, importantly, that they are portable from firm to firm. The existing evidence lends itself to the interpretation that favorable labor supply conditions, and the availability of managers with export experience in particular, facilitates export performance. Our paper broadens the perspective to workers in any occupation and with any skill, and poses the reverse question as to how favorable product market conditions abroad translate into a firm's labor demand for expertise at home. Studying economy-wide labor-market outcomes, Davidson et al. (2014) and Davidson et al. (2020) document that trade openness can raise match efficiency, cross-industry mobility, and career mobility along the job ladder. Our paper provides firm-level evidence of a preparing-to-export mechanism through which trade openness induces worker mobility. Related to a literature on demand for observed skill and product-market conditions (see for example Guadalupe 2007 and the survey by Fortin and Lemieux 1997), we provide evidence that typically unobserved ability, inferrable from a worker's career trajectory, influences employment opportunities.

The remainder of the paper is organized as follows. We describe the data in Section 2 and document differences among exporters in Section 3. In Section 4 we present our conceptual approach and identification strategy. In Section 5 we turn to the empirical analysis of recruitment in response to foreign product market conditions. Section 6 offers concluding remarks.

2 Data

We combine data from three main sources. Our first data source is the universe of Brazilian exporters: a three-dimensional panel data set by firm, destination country and year. Second, we match these exporter data to the universe of formal firms and their formally employed workers. This second data source is a three-dimensional linked employer-employee panel data set by firm, worker and year. The matched employer-employee-exports data provide us with information on the workforce at

exporters as well as on transitions of workers from firm to firm, and complement the exporter data with the universe of formal non-exporting firms. Third, we combine the former two data sources with worldwide trade flow data by sector at distant destinations for Brazilian exporters to construct instrumental variables (IVs) for export status. Data from these three sources are jointly available for the years 1994 to 2009. To exclude potentially distortive effects of the Great Recession on trade and labor markets, we choose the time period 1994-2007.

2.1 Exporter data

SECEX exporter data derive from the universe of Brazilian customs declarations for merchandise exports by any firm collected at Secretaria de Comércio Exterior (2014). Export values (fob) are reported in current USD. We deflate values to August 1994 when the Brazilian Real was introduced. For consistency with existing studies we restrict the sample to firms in the manufacturing sector (see e.g. Bernard and Jensen 1995, Clerides, Lach and Tybout 1998, Brooks 2006) using the firms' declared industry affiliation in the linked employer–employee data. We relegate additional details on the SECEX data to Appendix A.1.

2.2 Linked employer–employee data

Our source for linked employer–employee data is RAIS (*Relação Anual de Informações Sociais*), a comprehensive administrative register of workers formally employed in any sector of Brazil's economy (Ministério do Trabalho e Emprego 2015). The records cover the universe of formal Brazilian firms, including non-exporters. RAIS offers information on worker characteristics such as education, a detailed occupational classification of the job, the firm's industry, and the legal form of the company including its foreign ownership, as well as the workers' earnings. We use annualized December wages deflated to August-1994 and express them in USD (the newly introduced Brazilian Real in August 1994 started at par with one USD). There are 72 million worker-year observations for employment spells at 490,444 manufacturing firms (2,773,097 firm-year observations).³ We provide additional detail on RAIS in Appendix A.2.

³Further restricting the sample to observations with a firm's annual employment change and two lags of employment levels in Section 5 reduces the sample size to 1,722,626 firm-year observations.

Combining RAIS with the SECEX exporter records, we find 30,044 manufacturing firms that export in at least one sample year (135,805 exporter-year observations). These manufacturing exporters account for only around 5 percent of formal manufacturing firms, similar to the around 5 percent exporter share in the U.S. universe of manufacturing firms (Bernard, Jensen and Schott 2009).⁴ In terms of employment, manufacturing exporters account for 34 million worker-year observations or roughly 47% of Brazilian formal employment during the sample period.

We trace a firm's hired worker back to the worker's previous employer. We define a relevant hire at a manufacturing firm as a worker accession that is not classified as a transfer between the firm's plants and that lasts at least until December 31st of the calendar year. We then track the worker back to the last preceding formal-sector employment for up to three prior years and obtain the former employer's export status. This allows us to identify *hires from exporters* as acceding workers whose immediately preceding formal-sector employment during up to three past years was at an exporter (and, for a robustness exercise, to identify hires from non-exporters in a similar way). For these workers we also extract information on their occupation in the prior employment distinguishing among five ISCO-88 categories: professional or managerial occupations, technical or supervisory occupations, other white-collar, skilled blue-collar and unskilled blue-collar occupations.

In some of our specifications, we also track workers into the future. Specifically, we follow recent hires from exporters into the next calendar year and identify subsequent separations. We define *separations of recent exporter hires* as hires from exporters whose new employment terminates before December 31st of the following year.

2.3 Worldwide trade flows by sector

For the instrumental variable approach in Section 4.2, we use imports into destinations outside Latin America from source countries other than Brazil by 3-digit ISIC subsectors. The import data come from the World Trade Flow (WTF) dataset on bilateral trade flows between 1994 and 2007 (Feenstra et al. 2005).⁵ We consider six destination groups: Asia-Pacific Developing (APD) countries, Central

⁴Single-employee firms enter the RAIS records, explaining the apparently low share of exporter firms compared to data from developing countries that truncate firm samples at a minimum employment level of 10 or 20 employees.

⁵To concord 4-digit SITC (Rev. 2) sectors in WTF with 3-digit ISIC (Rev. 2) sectors we have constructed a comprehensive concordance, available at econweb.ucsd.edu/muendler/html/resource.html#sitc2isic.

and Eastern European countries (CEE), North American countries (NAM excluding Mexico), Other Developing countries (ODV), Other Industrialized countries (OIN), and Western European countries (WEU).⁶ We link WTF imports by destination, region and industry to firm-level data from RAIS and SECEX using the CNAE industry classification. CNAE is reported in RAIS starting in the year 1994. CNAE mirrors the ISIC classification and thus allows us to concord the WTF trade data to firm data via ISIC (see Appendix A.2 for additional detail). We assign each firm to the industry in which it first appears in RAIS, and we disregard imports into Latin America and Caribbean countries.⁷

3 Exporter Types and Workforce Characteristics

3.1 Exporter heterogeneity

To document export success over time, we adopt a lexicographic ranking of export-market participation. We consider the current year and two preceding years and then record in which of the three years a firm was an exporter with at least one reported 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 ($t-2$). Beyond this basic time-pattern ranking, we separate non-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). Table 1 shows our resulting ranking of export success, with the category in the upper-most row reporting the least successful exporters (permanent non-exporters) and the lower-most row containing the most successful exporters (continuous exporters).

These export-status categories clarify that there is considerable heterogeneity among exporters in participation over time but also in terms of workforce sizes and export values. Table 1 shows that our lexicographic ranking of export-market participation over time is almost perfectly mirrored in the firms' cross-sectional ranking by employment (column 2) and annual exports (column 3). For example, permanent non-exporters have an average size of eleven workers, in-out switchers who recently

⁶We report the grouping of Brazil's export destinations into six relevant country sets (outside Latin America and the Caribbean) for the period 1994-2007 in the Online Supplement S3.

⁷In a robustness exercise using firm-level instruments, we interact the WTF imports by destination, region and industry with the firm's prior export status.

Table 1: EXPORT STATUS ORDERING

Export status	Export period			Firm-year observations (1)	Workers per firm (2)	Annual exports (3)
	$t-2$	$t-1$	t			
Non-Exporter						
Permanent non-exporter ^a	0	0	0	2,473,841	11.211	
Current non-exporter ^a	0	0	0	124,847	52.364	
Export Quitters						
Past quitter	1	0	0	15,675	69.781	
In-out switcher	0	1	0	11,632	64.628	
Recent quitter	1	1	0	11,297	87.157	
Export Starters						
Recent starter	0	0	1	25,129	88.484	379.080
Re-entrant	1	0	1	5,156	111.606	232.190
Past starter	0	1	1	17,876	121.875	1,050.618
Continuous Exporters	1	1	1	87,644	340.556	6,086.939

^aPermanent non-exporters do not export in any sample year; current non-exporters export in at least one sample year.

Notes: Universe of 2,773,097 manufacturing firm-year observations. Exports (fob) in thousands of August-1994 USD.

Source: SECEX 1994 through 2007 (t : 1996-2007), manufacturing firms (ISIC rev. 2 300-400).

quit exporting employ 64 workers, recent export starters employ 88 workers, while continuous exporters employ 341 workers on average. Curiously, this employment size monotonicity is preserved for all but one pair of neighboring rows.⁸

The observation counts in Table 1 show that the vast majority of formal-sector manufacturing firms (roughly 90 percent) never exports in any year between 1994 and 2007. The 86,765 firms that quit or start exporting make up approximately half of all firms that export in at least one year between 1994 and 2007 but account for only 5.2 percent of all export sales. Continuous exporters ship close to 95 percent of Brazilian exports and employ approximately 80% of all exporter workers and 40% of all Brazilian manufacturing workers.⁹ The evidence in Table 1 documents that export success is persistent over time at the dominant exporters, prompting us to search for instrumental variables that do not require firm-level variation in our context.

Table 2: SUMMARY STATISTICS

	All firms (1)	Exporters (t) (2)	Exporters ($t + 1$) (3)	Export Status (t)		
				Continuous (4)	Start (5)	Quit (6)
Foreign-market participation						
Indic.: Exporter	.049	1.000	.795	1.000	1.000	.000
Indic.: Anticip. Exporter ($t+1$)	.050	.810	1.000	.902	.647	.197
Log # Destinations	1.044	1.044	1.220	1.402	.392	
Log Exports/Destination	3.669	3.669	3.995	4.218	2.660	
Size						
Employment	25.938	256.436	251.149	340.556	103.353	73.313
Log Employment	1.759	4.126	4.120	4.528	3.395	3.120
Employment Chg. ($t-1$ to t)	.531	3.348	5.741	1.153	7.640	-3.566
Workforce characteristics						
Share: Unsk. blue-collar occ.	.130	.167	.161	.170	.161	.154
Share: Skilled blue-collar occ.	.612	.542	.549	.538	.548	.542
Share: White-collar occ.	.258	.291	.291	.291	.290	.304
Share: Primary school education	.645	.556	.569	.547	.574	.590
Share: High school education	.316	.335	.325	.335	.335	.324
Share: Tertiary education	.038	.108	.107	.118	.091	.086
Workforce background						
Gross Hires from Exporters	1.137	13.481	13.438	15.224	10.310	2.765
Indic.: Hires from Exporters	.190	.673	.684	.721	.586	.455
Log Hires from Exporters	.737	1.683	1.675	1.834	1.345	1.046
Observations	2,773,097	135,805	127,033	87,644	48,161	38,604

Notes: 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) in thousands of August-1994 USD.

Sources: SECEX and RAIS 1994-2007, manufacturing firms (ISIC rev. 2 300-400).

3.2 Workforce composition

Table 2 reports summary statistics for the universe of manufacturing firms. It reconfirms substantive heterogeneity among exporters, also in terms of market reach (destination count) and penetration (exports per destination) abroad. Compared to firms that start exporting, continuous exporters serve 2.7 times (one log unit) more destinations and have 4.6 times (one-and-a-half log units) larger sales per destination.

Perhaps surprisingly, the wide disparity in employment size is not reflected in differences in workforce composition. Conventional workforce characteristics do not clearly differ among exporters. The

⁸About 36 percent of manufacturing exporters are starters; they account for five million worker-year observations out of a total of 34 million in manufacturing and command 5 percent of export sales.

⁹For a breakdown of export-market participation and employment by sector, see Table A.1 in the Appendix.

most prevalent occupation in manufacturing, skilled blue-collar work, is performed by 61 percent of workers at the average manufacturing firm and by around 54 percent of workers at exporters regardless of the exporter's status in terms of export-market participation over time. Similarly, white-collar occupations are performed to a similar degree across exporters, varying only between 29 and 30 percent. The most prevalent schooling level in manufacturing is primary education. There are more primary schooled workers at the average manufacturing firm with a share of 65 percent than at exporters with a share of 56 percent, but there is only minor variation among exporters in terms of primary school educated workers (between 55 and 59 percent) or highly educated workers (between 9 and 12 percent).

Log premium regressions are frequently used to describe firm heterogeneity and show that non-exporters significantly differ from exporters along several dimensions including workforce characteristics. We use log premium regressions to also investigate differences among exporters. Table 3 presents the results of exporter-premia regressions that project average firm earnings and other workforce characteristics on indicators for export status (continuous, starting or quitting exporters), controlling for sector and year effects. The omitted reference category is a non-exporter for at least three years.

Panel A in Table 3 shows that workers at continuous exporters earn, on average, more than twice as much (.72 log units) as workers at non-exporters, and even workers at recent export-market quitters earn 55 percent (.44 log units) more than workers at firms with no exports for three years. To assess the extent to which these wage premia can be explained by differences in the composition of the firm workforce, in Panel A we also present regressions based on residual earnings after controlling for the educational and occupational composition of the firm's workforce. The exporter premia based on residual earnings are, if anything, larger than those based on earnings, suggesting that much earnings variation remains to be explained by other firm or workforce characteristics. These patterns are consistent with the hypothesis that mostly unobserved worker characteristics are associated with a firm's export status and that an exporter's surplus may be shared with workers through wages.¹⁰

The regressions in Panel B of Table 3 show that differences in workforce compositions between exporters are economically small and in many cases statistically insignificant. Consider white-collar

¹⁰For structural evidence on surplus sharing in the cross section of firms see, for example, Helpman et al. (2017).

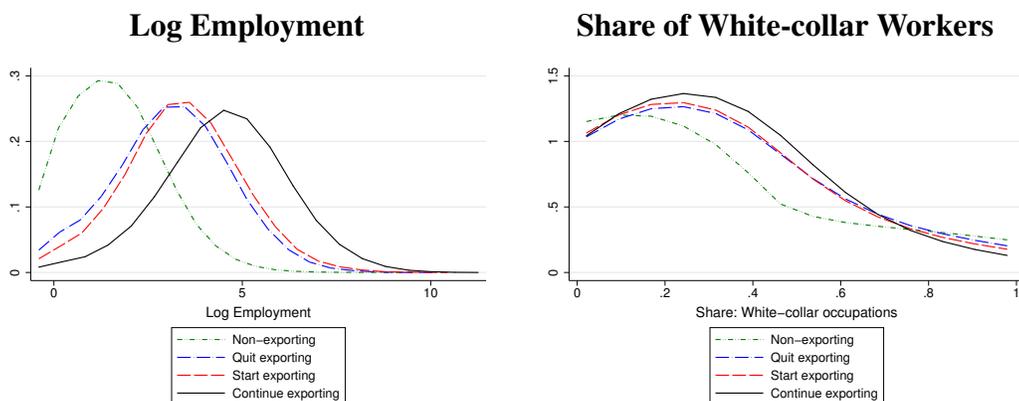
Table 3: EXPORTER PREMIA

Firm characteristic	Export Status			<i>t</i> -tests		Obs.
	Continuous (1)	Start (2)	Quit (3)	of null-hypothesis (1)=(2) (2)=(3)		
Panel A: Earnings						
Log Annual Wage	.720*** (.058)	.467*** (.043)	.441*** (.036)	≠		2,735,184
Residual Log Annual Wage	.783*** (.066)	.554*** (.051)	.465*** (.041)	≠	≠	2,735,184
Panel B: Observed workforce composition						
Share: Any white-collar occ.	.033** (.014)	.038*** (.010)	.050*** (.008)		≠	2,773,097
Share: Skilled blue-collar occ.	-.057*** (.016)	-.060*** (.011)	-.067*** (.010)			2,773,097
Share: Unskilled blue-collar occ.	.023* (.014)	.022** (.010)	.016** (.008)			2,773,097
Share: Tertiary education	.074*** (.010)	.050*** (.007)	.044*** (.005)	≠		2,773,097
Share: High school education	.010 (.008)	.018*** (.006)	-.002 (.005)		≠	2,773,097
Share: Primary school education	-.084*** (.014)	-.068*** (.010)	-.042*** (.007)		≠	2,773,097
Panel C: Typically unobserved workforce background						
Indic.: Hires from Exporters	.528*** (.018)	.394*** (.021)	.265*** (.017)	≠	≠	2,773,097
Log Hires from Exporters	1.295*** (.076)	.809*** (.063)	.513*** (.046)	≠	≠	526,285

Notes: Premia are coefficients from linear regressions of the firm characteristic on export status dummies, controlling for sector and year effects. 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. The residual log annual wage is from a linear regression of average firm earnings on the share of workers in three occupation groups (white-collar, skilled blue-collar, unskilled blue-collar) and three education categories (primary, secondary and tertiary). In columns 4 and 5, rejections of the null hypothesis of equality are reported for *t* tests at 1-percent significance. Standard errors in parentheses, clustered at the 3-digit ISIC sector level. **p* < 0.10, ***p* < 0.05, ****p* < 0.01.

Sources: SECEX and RAIS 1994-2007, manufacturing firms (ISIC rev. 2 300-400).

occupations, for instance. Exporters are more likely to have workers in white-collar occupations than non-exporters, employing between 3.3 and 5.0 log points more white-collar workers. However, these employment premia are similar for exporters of any status and in the case of starting and continuing exports not statistically different at conventional significance levels. A similar pattern also prevails for other observed workforce characteristics. When it comes to the employment of skilled or unskilled blue-collar occupations, starting exporters are neither statistically distinguishable from continuous exporters nor from export quitters. In general, the mean differences in Panel B of Table 2 do not support marked differences among exporters of different status.



Note: Export status as defined in Table 1. Workforces on December 31st. Epanechnikov kernels with bandwidths .4 (employment) and .2 (white-collar occupations).

Sources: SECEX and RAIS 1994-2007, manufacturing firms (ISIC rev. 2 300-400).

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

One typically unobserved worker characteristic is the worker’s prior work experience at an exporter. Panel C in Table 3 shows that continuous exporters, starters and quitters are, respectively, 70 percent (.53 log points), 48 percent (.39 log points) and 31 percent (.27 log points) more likely to hire a worker from another exporter than non-exporters. The variation between exporters is considerably more pronounced in Panel C for a typically unobserved worker characteristic than it is for usually observed characteristics in Panel B. Conditional on hiring a worker from another exporter, continuous exporters hire 63 percent (.49 log units) more workers from other exporters than export starters and export starters hire 35 percent (.30 log points) more workers with prior exporter experience than export quitters. These differences, both between exporters and non-exporters and among exporters with different status, are statistically significant and economically meaningful, and they remain similarly pronounced in premia regressions that condition on firm size (see Appendix Table B.1).

In Figure 1, we look beyond mean comparisons and plot nonparametric estimates of densities for firm characteristics. In the left graph of the Figure, the kernel estimates for log employment reflect 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 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. The minor economic differences of workforce characteristics among exporters in Table 1 and the right graph of Figure 1 suggest that more successful and larger exporters employ scaled-up workforces with workforce compositions that are similar to those at less successful and smaller exporters.

To summarize, existing research documents that workforce characteristics differ between non-exporters and exporters. Our descriptive evidence shows in addition that export-market performance and sizes also differ markedly among exporters, and that exporter size is closely associated with exporter performance in terms of market participation over time. Commonly observed workforce characteristics such as educational attainment and occupations, however, are quite similar among exporters despite substantive diversity in exporter size and performance. In contrast, the typically unobserved worker characteristic of a worker's prior experience at another exporting firm varies systematically among exporters. We now query to what extent the hiring of former exporter workers occurs in preparation for export-market participation.

4 Identification

To causally isolate a firm's labor demand as it prepares for export-market participation, we turn to an identification strategy based on foreign product-market conditions beyond a firm's control and independent of domestic labor-market conditions.

4.1 Conceptual considerations

Consider a firm that receives new and favorable information about product-market prospects abroad, so that the firm's expected additional surplus in a foreign market surpasses its expected fixed entry costs in the market. The expertise of workers with knowledge about the export market can be beneficial to the potential entrant in multiple ways. Learning by hiring may raise the firm's expected surplus through deeper market penetration, as it reaches additional customers (Arkolakis 2010). Learning by hiring may raise the firm's surplus by reducing marginal production or shipping cost to the foreign market, possibly at the expense of higher fixed cost (Bustos 2011). The employment of experts may simply be a sunk or fixed cost of exporting itself.

Learning by hiring to access technological knowledge is the subject of a literature in industrial organization and labor economics (Parrotta and Pozzoli 2012, Poggi and Natale 2020). A conceptual premise of these studies is that knowledge about a general technology is useful across markets. The targeted hiring of experts to access specific knowledge about foreign product markets is arguably less well understood in the literature. The converse mechanism—a shock to local labor supply of high-wage workers and managers and its relationship to export performance—has been shown to matter for international trade (Mion and Opromolla 2014, Masso, Roigas and Vahter 2015). In general, product demand shocks are important contributors to firm performance and to exporter success in particular (Foster, Haltiwanger and Syverson 2016, Arkolakis, Ganapati and Muendler 2021). The relevance of knowledge about foreign market conditions at the firm level has been theoretically modelled and empirically documented by Albornoz et al. (2012) and Morales, Sheu and Zahler (2019), among others. These studies suggest that knowledge from one foreign market carries over to other, related export destinations. Building on this evidence, we hypothesize that, within firms, the knowledge about export demand is bundled among key experts and subsequently portable between firms. The knowledge need not be specific to a single foreign market but is likely relevant across destinations for sequential export-market access to similar foreign destinations. Once a country’s first firm has started exports to a relevant country group (nations sharing income levels or language and legal institutions), other potential exporters can access the knowledge locally, without exporting themselves, through hiring domestic experts away from an incumbent exporter.

In static trade 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 employment, hiring away the top-skilled workers from firms with inferior technology (in Yeaple 2005) or hiring away from differentiated-goods producers with lower productivity (in Costantini and Melitz 2008). A model closely related to our conceptual labor-demand setup is the dynamic firm-level framework by Fajgelbaum (2020), who studies firms’ employment and export decisions under labor market frictions (extending Mortensen 2000) in a small open economy and continuous time.

Firms in Fajgelbaum (2020) differ in productivity (similar to Melitz 2003) and anticipate the same path of domestic and foreign product market conditions as well as domestic labor market conditions.

As a consequence, firms only differ in the remaining time to export-market entry, which is infinite for unproductive firms that permanently remain non-exporters. Firms grow their total employment gradually, up to the anticipated moment of export-market entry, so as to minimize adjustment costs. Beyond general employment in the Fajgelbaum (2020) model, we envisage a role for export-market experts. In a simple variation of the Fajgelbaum (2020) model, we posit that the sunk cost of export-market participation is the wage bill paid to a mass of experts—a flow cost while exporting as in Fajgelbaum (2020). Firms must hire a minimally necessary mass of experts at the prevailing expert salary as a sunk cost for export market participation. To remain consistent with the model, the labor market is segmented so that expert hiring is completely isolated from the general labor market for non-expert workers. Experts have innate export knowledge, regardless of the duration of previous employment at incumbent exporters. The experts' salary is fixed at the maximum wage for general workers in equilibrium, so that experts have no incentive to become general workers, nor can general workers take expert employment. Neither firms nor general workers consider the impact of their wage bargaining on expert salaries. In such a simple and straightforward reinterpretation of the Fajgelbaum (2020), the labor market for experts is a conventional spot labor market.

The reconsideration of sunk export costs as expert wage bills is consistent with evidence and our conceptual motivation. In this reinterpretation of Fajgelbaum (2020), firms jump the employment of experts at the moment of export-market entry to meet the necessary expert threshold. The discontinuity is similar to our evidence that expert hiring is a distinctive feature that markedly varies across exporters at different levels of export performance (Table 3). However, firms gradually and proportionally build up general employment (of all non-expert skill groups) in anticipation of export-market entry, in line with our evidence that exporters with different performance levels do not strongly differ from each other in terms of workforce characteristics, only in size (Table 3). However, wage bargaining and job-to-job poaching is arguably as important a feature of expert labor markets as of the general labor market in practice, so our simple reinterpretation cannot account for other features. Extending the Fajgelbaum (2020) model to multiple skill groups is a technically demanding undertaking beyond the scope of this paper. We consider the insight that firms build up general employment in advance of anticipated export-market entry as widely applicable: frictions in the labor market for experts would also support a gradual buildup of expert employment in advance, but arguably over a shorter period

of time than for general workers if expert salaries are high for otherwise similar adjustment cost.

In order to isolate export-market conditions as the cause of these dynamics, we strive to vary a foreign product demand shifter that is similar to the revenue premium of an exporter (the proportion of anticipated foreign revenues relative to domestic revenues) in Fajgelbaum (2020). A shift in foreign product demand is common to all active and potential exporters. However, only firms that are predisposed in their existing productivity will self-select into exporting, so firm-level data that capture selective entry are important and allow us to control for time invariant firm capability.

4.2 Empirical model

Motivated by these conceptual considerations, we adopt an empirical model of the firm's employment and export decision in two steps. First, a firm i observes export-market conditions z_{st} at time t and specific to the sector s , in which the firm operates, and uses the conditions to predict its own export-market participation x_{ist} , taking into account its characteristics and domestic market conditions \mathbf{y}_{ist} . The estimation equation of the first step takes the form of a linear probability model:

$$x_{ist} = z_{st}\gamma_z + \mathbf{y}'_{ist}\boldsymbol{\gamma}_y + \eta_{ist}. \quad (1)$$

We measure export-market conditions with a single variable z_{st} as sector-level imports into foreign destinations outside of Latin America from source countries other than Brazil. Under empirically plausible conditions that we discuss in detail in the next subsection, the import volume in distant locations z_{st} provides exogenous variation in the probability of Brazilian export-market participation. Some existing studies use major macroeconomic shocks, such as real exchange rate devaluations, or large-scale policy changes, such as the elimination of trade barriers, to capture exogenous sources of variation for export-market participation. Our approach allows us to analyze exporter behavior in ordinary times. In doing so, our instrument is arguably less likely to capture concomitant general-equilibrium consequences that may be associated with economy-wide experiments.

In the second step, firm i uses its predicted export status $\hat{x}_{ist} = z_{st}\hat{\gamma}_z + \mathbf{y}'_{ist}\hat{\gamma}_y$ to make hiring decisions on experts with export skills h_{ist} :

$$h_{ist} = \hat{x}_{ist}\beta_x + \mathbf{y}'_{ist}\boldsymbol{\beta}_y + \epsilon_{ist}. \quad (2)$$

Our main hypothesis is that the coefficient β_x in equation (2) is strictly positive. When firms observe a favorable foreign import-demand shock, they expect a higher chance of exporting, and thus prepare their workforces. This is conceptually similar to top-skill hiring in Yeaple (2005) or technology upgrading in Costantini and Melitz (2008), and it resembles the timing of the sunk cost investment for export entry in Fajgelbaum (2020).

We consider hiring decisions at the extensive and at the intensive margins. For hiring decisions at the extensive margin, the dependent variable h_{ist} in equation (2) takes a value of one if firm i hires an expert (a worker from another exporter) in year t , and zero otherwise. At the intensive margin, h_{ist} is defined as the log number of hires of experts by firm i in year t and only exists for non-zero hires. Important for our interpretation of expert hiring as a preparation to export, we use leads of predicted export status by one, two and three years— x_{ist+1} , x_{ist+2} and $x_{i,t+3}$ —in combination with the same dependent variables h_{ist} at present, and the same right-hand side variables in equations (1) and (2).

To control for firm characteristics and concomitant domestic market conditions, we include in the estimation equations a comprehensive vector of controls \mathbf{y}_{ist} . In particular, we use firm fixed effects to condition on time-invariant firm characteristics. To account for the persistence of exporter performance, we include indicators for the firm's export status at $t-1$ and $t-2$. We include changes in general employment between $t-1$ and t , net of expert hires, to remove otherwise potentially confounding hiring effects. We add firm size as a control to account for the fact that larger employers export more frequently and, under proportionally larger employment turnover, happen to hire more workers from exporters. To control for workforce composition we include employment shares by education and occupation categories and an indicator of a firm's high-skill intensity (an indicator for firm-year observations with employment shares of technical/supervisory and professional/managerial occupations in the top quintile). To account for concomitant macroeconomic shocks and sector-level domestic market fluctuations we use linear sector-level trends, year fixed effect and a measure of sectoral absorption (production plus imports less exports). Finally, we control for a firm's foreign ownership to separate the effects of exports on expert hiring from those of multinational production.

4.3 Export-market shocks as instruments

Candidate instruments z_{st} for export-market participation x_{ist} are the observed trade flows of goods in sector s and year t into any group of destinations abroad (other than Latin America), where imports can originate from any country in the world except from Brazil. Our empirical model has one endogenous variable x_{ist} , so we need exactly one instrument to be just identified.

To find a relevant instrument from foreign import flows that possibly strongly predicts Brazilian firms' export status, we consider six country groups abroad (as described in section 2.3), offering six candidate IVs: Asia-Pacific Developing (APD) countries, 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). Given the fast expansion of trade in the emerging economies of East Asia and in Eastern European transition economies during the period 1994-2007, the regions APD and CEE expectedly exert strong import demand growth. From 1994 to 2007, Brazil's real merchandise exports grew by a factor of 2.7 overall but by factors of 4.4 to APD and 3.7 to CEE. In 2007, Brazil shipped 15.4 percent of its exports to APD but only 1.6 percent to CEE.

To select the most relevant instrument, we first regress the export indicator x_{ist} on all six possible IVs and the vector of firm controls y_{ist} in individual regressions of one instrument at a time. From these initial regressions, we select the instrument with the highest t statistic (see Appendix Table B.2) across possible regression samples (for current or future export status, and for samples including or excluding firms that hire no expert). We find imports into Asia-Pacific Developing (APD) countries to be the single predictor that is consistently and significantly associated with export-market participation of Brazilian firms during the sample period. The coefficient sign is always positive, consistent with the hypothesis that strong demand growth in APD countries attracts imports from elsewhere in the world and from Brazil.

Weak instruments can distort standard inference in IV models (for a recent survey see Andrews, Stock and Sun 2019). The statistical significance of our IV in t tests (Table B.2) may not fully rule out a weak instrument (Lee et al. 2020). We therefore report with all our upcoming results the Anderson-Rubin Wald test. The Wald test statistics consistently reject the absence of an effect on the second stage, mitigating concerns that standard inference may mislead and in line with the high predictive

power of APD imports for Brazilian firms' export market participation.

Validity of our sector-level instrument requires that foreign market conditions in a sector and in destinations outside Latin America z_{st} must affect the hiring of experts h_{ist} in Brazil only through export market participation x_{ist} , conditional on other firm characteristics and domestic markets conditions y_{ist} . One potential concern with the use of sector-level imports as an instrument is that expanding firms may endogenously launch products in sectors that experience better foreign demand. Such sectoral changes would create a spurious correlation between a firm's employment growth and the instrument. We address this concern by assigning each firm to the sector in which it first appears in our data. The time invariant sector affiliation prevents the instrument from capturing potential shifts in a firm's main sector of activity in response to trade shocks.

Another potential source of concern is the putative existence of sector-level global market trends that simultaneously affect the demand for experts in Brazil and the global import demand in a sector. To mitigate this concern we include in our specifications an extensive set of controls for sectoral effects. As mentioned, we condition on firm fixed-effects, which absorb unobserved time-invariant factors affecting the demand for experts, and we control for year effects and sectoral linear trends that capture time-varying factors jointly affecting demand for experts and global product markets. Finally, we control for sectoral absorption, which measures the domestic demand for a sector's products.

One concern with sector-level instruments may be that they might capture generic labor demand changes and therefore general hiring beyond the specific demand for experts. To assess this possibility, we present results from an additional set of regressions, in which we use our IV approach to estimate the effects of export-market participation on the hiring of workers from non-exporting firms. Non-exporters are unlikely to help their workers build export-market expertise. We fail to find evidence that export-market participation shocks lead to hires from non-exporters (see Section 5.3).

In general, the geographic distance of Asia-Pacific Developing (APD) countries to Brazil renders it unlikely that unobserved social or political factors jointly affect demand of experts in Brazil and the success of other countries than Brazil in shipping to APD. For a problem of reverse causality to arise, expert hiring in Brazil would have to generate sizeable changes in global imports to the Asia-Pacific region. During our sample period, Brazil does not command a dominant fraction of trade flows

into APD, with a share in total APD imports of 0.57 percent in 1994 and of 0.98 percent in 2007.¹¹ Moreover, if the mobility of experts in Brazil's labor market drove Brazilian export success in APD, the higher frequency of export status among Brazilian firms would displace other countries' exports and would therefore be negatively correlated with non-Brazilian imports into APD. In contrast, the correlation is strictly positive (Table B.2).

External migration, and the potential labor supply of experts through immigration (Andrews, Schank and Upward 2017), is a conceivable further concern for reverse causality. Our linked employer-employee data RAIS report the foreign nationality of workers who are not naturalized Brazilian. In the early sample years (from 1994-1997), for workers with a migration background from Asian countries we can only discern between Japanese nationals and workers from any other Asian country, including industrialized countries that we remove from APD (and group with OIN). However, inasmuch as immigrants from any Asian country may bring relevant expertise about APD countries to Brazil, the share of foreign nationals from any Asian country may be the relevant measure of labor supply with APD-related expertise. The share of Asian nationals, except from Japan, in the Brazilian workforce slightly increases from .003 percent in 1994 to .005 percent in 2007 and, when including Japanese nationals, from .035 percent in 1994 to .040 percent in 2007. The absolute numbers are small and do not clearly support the hypothesis that migrant stocks with APD expertise alter the local Brazilian labor supply of experts. Even in the absence of sizeable migration flows from Asian countries to Brazil, trade-related migration could be problematic if export market conditions in APD countries are affected by the availability of skilled foreign workers in Brazil through changes in migration to Brazil from countries outside of the APD region. The bulk of migration flows to Brazil is from other Latin American countries. Reassuringly, our baseline results are robust to excluding imports into APD countries from any Latin American country (not just from Brazil, see Appendix Table B.3). We conclude that external migration is unlikely to be a major concern for identification.

An alternative instrumentation approach is to construct firm-level instruments, with the intention to match cross-firm variation in the hiring outcome with cross-firm variation in the IV. In the spirit of related studies, a candidate firm-level instrument is the interaction between our sector level IV for foreign product demand—non-Brazil imports into APD countries—with the three-year lag of a

¹¹In select sectors where Brazil has a strong comparative advantage, such as metal ore mining, the share of Brazil's shipments to APD in total APD imports can exceed 10 percent with a slight increase over the sample period.

Table 4: FOREIGN DEMAND AND EXPORT-MARKET PARTICIPATION

Dependent Variable (t):	Exporter at time t		Exporter at time $t + 1$	
	Entire Sample	Firms with hires > 0	Entire Sample	Firms with hires > 0
	Indic. Exp. (t) (1)	Indic. Exp. (t) (2)	Indic. Exp. ($t + 1$) (3)	Indic. Exp. ($t + 1$) (4)
Log Non-Brazil Imports in APD	0.014*** (0.004)	0.042*** (0.008)	0.011*** (0.003)	0.028*** (0.007)
F -stat. excluded instrument	15.182	25.059	19.342	16.179
Observations	1,722,626	281,465	1,927,372	309,439
Firm and year fixed effects	yes	yes	yes	yes
Sectoral linear trends	yes	yes	yes	yes

Notes: Each cell shows the coefficient from a separate regression. APD stands for Asia-Pacific Developing countries. All regressions include the following controls: firm and year effects, sectoral linear trends, employment changes between $t-1$ (t in columns 3 and 4) and t ($t+1$ in columns 3 and 4) net of hires from exporters, contemporaneous and one-period lagged firm size, shares of worker by education (primary, secondary and tertiary) and occupation (unskilled blue collar, skilled blue collar and white collar) categories, an indicator of a firm's high-skill intensity, an indicator of foreign ownership, one- and two-period lagged export status, and absorption. Standard errors in parentheses, clustered at the 3-digit ISIC sector level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Sources: SECEX and RAIS 1994-2007, manufacturing firms (ISIC rev. 2 300-400).

firm's export status. The assumption that a firm's export status three years in the past is unrelated to its current export status finds support in evidence on export entry (Clerides, Lach and Tybout 1998, e.g.). However, the lexicographic exporter ranking by past export status in our context (Table 1) and studies of export survival in the presence of sunk cost and firm heterogeneity (Albornoz, Fanelli and Hallak 2016, Ruhl and Willis 2017) speak to a persistent relevance of past export performance. In light of these concerns, and since our sector-level instrumentation remains valid in firm-level specifications, we mainly present results from sector-level instruments and discuss evidence from firm-level instruments only as an alternative.

4.4 Foreign product-market shocks and export participation

The first-stage equation (1) shows the identification mechanism at work: the effect of foreign imports on the probability of exporting of Brazilian firms. Table 4 reports results from estimating the linear probability model. There is no a-priori expected sign for the effect of APD imports from countries other than Brazil. A positive sign is consistent with favorable import demand conditions in APD countries 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 presence of large competing shipments by non-Brazilian exporters.

The consistently positive and statistically significant coefficients of Table 4 suggest that non-Brazilian shipments to Asia-Pacific Developing countries do not strongly displace Brazilian exports.¹² This is the case for the sample of all firms (column 1), and the sub-sample of firms that hire at least one worker with export experience at an incumbent exporter (column 2). The coefficients of columns 3 and 4 indicate that imports into APD countries remain positively and significantly correlated with Brazilian export market participation in the following year, suggesting that there is persistence in the effects of foreign-demand on export-market participation. Finally, it is worth to note that in all specifications imports into APD countries strongly predict export-market participation of Brazilian firms, with an F -statistic larger than 15. The F statistics are reassuring. We have a relevant instrument to analyze the domestic hiring decisions of Brazilian firms in response to favourable export-market conditions.

5 Hiring to Export

We now implement the identification strategy and turn to the analysis of firms' expert hiring in response to export-market conditions.

5.1 Hiring away exporter workers

Table 5 shows estimates of equation (2) in columns 2 and 4, and the OLS counterpart without instrumentation in columns 1 and 3. We use two measures for the hiring of experts with export skills h_{ist} —an indicator of at least one hire at the extensive margin and, conditional on at least one hire, the log number of hires at the intensive margin. Panel A uses current export-market participation x_{ist} as the regressor for hiring, and Panel B future export-market participation $x_{is,t+1}$. Recall that the first-stage equation uses current import flows to APD at time t as the information. A firm bases its

¹²In Online Supplement S2 we break down Brazilian exports by sector and document that Brazil's dominant export industries also command most APD exports in our period of interest. Brazil's main export industries produce primary consumption goods. This suggests that exports of Brazilian firms to APD countries concentrate in primary consumption goods, in which Brazil arguably holds a comparative advantage.

anticipated export participation at $t + 1$ on the information at t and, we hypothesize, the anticipated expert status prompts the firm in turn to prepare for exporting by hiring experts in advance at t . While the timing of information, decisions, and their realization is closest to our conceptual considerations in Panel B, in practice firms may receive export-market information months rather than years in advance and go through the hiring and export entry process within the same calendar year. We consider within-year relations in Panel A and make the concomitant timing our benchmark.

We condition on firm effects, year effects and sectoral linear trends so that our inference is based on the variation in foreign market conditions within firms and years and beyond secular economic changes. We use the Anderson-Rubin Wald test to assess the second-stage effects, in case instruments are weak despite favorable F statistics (Lee et al. 2020). We report the according p -value for every IV regression. For both Panels A and B, the Anderson-Rubin Wald test statistic soundly rejects the absence of a second-stage effect. In all specifications, we cluster the standard errors at the ISIC (Rev. 2) 3-digit level.¹³

In line with our hypothesis and conceptual considerations, we find in Panel A that predicted export-market participation within the same calendar year statistically significantly and positively affects the hiring of experts (former exporter workers) during the calendar year, both at the extensive margin of hiring (columns 1 and 2) and at the intensive margin (columns 3 and 4). The IV coefficients of column 2 imply that an increase of 10 percentage points in the probability of export-market participation translates into an increase of 22 percentage points in the probability of hiring an expert, compared to an average probability of 19 percent (see Table 2). Conditional on hiring at least one worker from an exporting firm, a 10 percentage-point increase in the probability of export-market participation leads to an increase of 17 percent in the number of hires from exporting firms (column 4). This increase corresponds to 0.36 extra hires for the average firms and approximately one extra hire for an average exporter. Conditional on hiring at least one former exporter worker, the average firm hires 2.09 workers (0.737 log points), while the average exporter hires 5.38 workers (1.683 log points, see Table 2).

In magnitude, coefficient estimates are strictly larger in the IV than in the OLS regressions. One

¹³Given the limited number of 29 clusters at the ISIC rev. 2 3-digit level, in Appendix Table B.7 we also present p -values from a wild bootstrap procedure that has been found to reduce over-rejection rates when the number of clusters is small (Cameron, Gelbach and Miller 2008, Davidson and MacKinnon 2010).

Table 5: HIRES FROM EXPORTERS

Dependent Variable (t):	Indic. Hire		log(Hires)	
	OLS (1)	IV (2)	OLS (3)	IV (4)
Panel A: Exporter at time t				
Indic. Exporter (t)	0.028*** (0.004)	2.151*** (0.559)	0.041*** (0.007)	1.734** (0.646)
F -stat. excluded instrument		15.182		25.060
Anderson-Rubin Wald test p -value		0.000		0.016
Observations	1,722,626	1,722,626	281,465	281,465
Panel B: Exporter at time $t+1$				
Indic. Exporter ($t + 1$)	0.033*** (0.004)	2.721*** (0.590)	0.040*** (0.008)	2.335* (0.926)
F -stat. excluded instrument		19.342		16.179
Anderson-Rubin Wald test p -value		0.000		0.003
Observations	1,927,372	1,927,372	309,439	309,439
Firm and year fixed effects	yes	yes	yes	yes
Sectoral linear trend	yes	yes	yes	yes

Notes: Binary exporter indicator represents firms that export at t in Panel A or at $t + 1$ in Panel B. Each cell shows the coefficient from a separate regression. All regressions include the following controls: firm and year effects, sectoral linear trends, employment changes between $t-1$ (t in Panel B) and t ($t + 1$ in Panel B) net of hires from exporters, contemporaneous and one-period lagged firm size, shares of worker by education (primary, secondary and tertiary) and occupation (unskilled blue collar, skilled blue collar and white collar) categories, an indicator of a firm's high-skill intensity, an indicator of foreign ownership, one- and two-period lagged export status, and sectoral absorption. Workforces on December 31st. First-stage results are presented in Table 4. Standard errors in parentheses, clustered at the 3-digit ISIC sector level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Sources: SECEX and RAIS 1994-2007, manufacturing firms (ISIC rev. 2 300-400).

explanation for the observed negative bias in OLS estimates is that OLS estimates capture the confounding effect of favorable firm-level productivity shocks, which prompt firms to access export markets while experiencing production factor savings including labor savings. An additional factor contributing to the larger magnitude of IV estimates is that the IV regressions measure the local average treatment effect of export-market participation on responding firms that are susceptible to favorable foreign demand conditions. In contrast, the OLS regressions measure the average effects on the universe of firms, including the bulk of never-exporting firms that are not susceptible to favorable foreign demand.

Panel B of Table 5 shows the estimated effects of predicted export participation one year in the future ($t + 1$) on the current hiring of workers from incumbent exporters. The observation count increases slightly compared to Panel A because we lose fewer observations with lead variables in

late sample years than with lagged variables in early sample years. Similar to Panel A, the estimated effects are positive and statistically significant at the intensive and extensive margins of hiring. The evidence suggests that, in line with our conceptual considerations in Section 4.1, Brazilian firms begin to update their workforce before the anticipated export-market entry. This anticipatory behavior is mostly restricted to a one-year window. For later years ($t + 2$ and $t + 3$), the IV effects lose statistical significance at conventional confidence levels and instruments are powerful only at the intensive margin (see Anderson-Rubin p -values in Appendix Table B.6). While we detect an effect of predicted export status up to three years into the future on current expert hiring, the coefficient attains statistical significance at the 90-percent confidence level. Overall, the patterns are plausible and consistent with a waning effect of predicted export status the further into the future the firm's planning horizon extends.

5.2 Hiring away exporter workers by occupation

Research in industrial organization and labor economics suggests that certain skilled workers carry valuable knowledge, such as on patents, from firm to firm (e.g. Parrotta and Pozzoli 2012, Braunerhjelm, Ding and Thulin 2020, Poggi and Natale 2020). In light of this evidence it is natural to posit that poaching workers in preparation for exporting is more targeted at workers whose skills are particularly valuable for export-market participation. To investigate this possibility more closely, in Table 6 we present the results from estimating equation (2) separately for the hiring of workers grouped by occupation at the previous employer. Earlier studies have shown that the hiring of managers and high-wage workers is related to improved export-market performance (Mion and Opromolla 2014, Masso, Roigas and Vahter 2015). In our analysis of preparatory hiring to export, we might therefore expect to observe more intense anticipatory poaching from certain occupations than others.

We use five main occupation categories under the internationally common ISCO-88 classification, to which we map the RAIS reported Brazilian occupation classification CBO for the period 1994-2007.¹⁴ In OLS regressions, the indicator of expert hires (column 1) is positively and statistically significantly associated with predicted export status for all occupations, but the log number of expert hires (column 3) is statistically significantly associated (at the 90-percent confidence level)

¹⁴For details on the classification of occupations see Appendix A.3 and Table A.3.

Table 6: HIRES FROM EXPORTERS BY OCCUPATION

Dependent Variable (t):	Indic. Hire		log(Hires)	
	OLS (1)	IV (2)	OLS (3)	IV (4)
Panel A: Hiring of exporter workers from professional or managerial occupations				
Indic. Exporter (t)	0.024*** (0.003)	0.210 (0.288)	0.018 (0.014)	-0.023 (0.829)
F -stat. excluded instrument		15.182		3.501
Anderson-Rubin Wald test p -value		0.476		0.979
Observations	1,722,626	1,722,626	44,133	44,133
Panel B: Hiring of exporter workers from technical or supervisory occupations				
Indic. Exporter (t)	0.030*** (0.003)	0.323 (0.260)	0.018 (0.012)	-0.378 (0.662)
F -stat. excluded instrument		15.182		6.156
Anderson-Rubin Wald test p -value		0.229		0.546
Observations	1,722,626	1,722,626	59,480	59,480
Panel C: Hiring of exporter workers from other white collar occupations				
Indic. Exporter (t)	0.016*** (0.003)	0.327 (0.301)	0.008 (0.013)	-0.562 (0.733)
F -stat. excluded instrument		15.182		6.410
Anderson-Rubin Wald test p -value		0.285		0.468
Observations	1,722,626	1,722,626	36,480	36,480
Panel D: Hiring of exporter workers from skilled blue collar occupations				
Indic. Exporter (t)	0.024*** (0.004)	2.003*** (0.546)	0.024* (0.009)	1.651** (0.617)
F -stat. excluded instrument		15.182		20.905
Anderson-Rubin Wald test p -value		0.000		0.014
Observations	1,722,626	1,722,626	205,985	205,985
Panel E: Hiring of exporter workers from unskilled blue collar occupations				
Indic. Exporter (t)	0.022*** (0.003)	0.692 (0.547)	0.000 (0.014)	1.616 (1.180)
F -stat. excluded instrument		15.182		6.574
Anderson-Rubin Wald test p -value		0.159		0.140
Observations	1,722,626	1,722,626	67,669	67,669
Firm and year fixed effects	yes	yes	yes	yes
Sectoral linear trend	yes	yes	yes	yes

Notes: Binary exporter indicator represents firms that export at t in Panel A or at $t + 1$ in Panel B. Each cell shows the coefficient from a separate regression. All regressions include the following controls: firm and year effects, sectoral linear trends, employment changes between $t - 1$ (t in Panel B) and t ($t + 1$ in Panel B) net of hires from exporters, contemporaneous and one-period lagged firm size, shares of worker by education (primary, secondary and tertiary) and occupation (unskilled blue collar, skilled blue collar and white collar) categories, an indicator of a firm's high-skill intensity, an indicator of foreign ownership, one- and two-period lagged export status, and sectoral absorption. Workforces on December 31st. First-stage results are presented in the Online Supplement Table S.1. Standard errors in parentheses, clustered at the 3-digit ISIC sector level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Sources: SECEX and RAIS 1994-2007, manufacturing firms (ISIC rev. 2 300-400).

with predicted exporting only for workers hired from skilled blue-collar occupations at the previous employer. This exclusive importance of experts in skilled blue-collar occupations carries through to the causal IV regressions (columns 2 and 4).¹⁵ Expert hiring in preparation to export is exclusively concentrated among workers in skilled blue collar occupations at the previous employer (Panel D), with statistically significant coefficients at 99- and 95-percent confidence levels. We do not find a statistically significant relationship between predicted export participation and the hiring of workers in any other occupation, including managers and professional workers (Panels A, B, C, and E). Among the skilled blue-collar occupations for manufacturing in the CBO are occupations such as tool and machine preparers in assembly-line production, computer numeric control machine operators, installers of equipment, and numerous crafts related occupations. Workers in these occupations arguably command expertise in production processes and their adjustment, product quality and its requirements of the manufacturing process, as well as the management of lead and suitable delivery times. This skilled blue-collar expertise arguably promotes the competitiveness of a firm's products in international markets.¹⁶

We further query the potential importance of exporter managers for firms' export-market participation, as documented in earlier research (Mion and Opromolla 2014, Masso, Roigas and Vahter 2015). We investigate the possible association between the poaching of skilled blue-collar (SBC) workers and the presence of managers with export experience. For this purpose, we use the past hiring of exporter managers (the hiring of exporter managers one year prior) as a predictor of skilled blue-collar hiring from exporters. We also investigate the interaction of exporter managers' presence with export status as an additional predictor. Table 7 presents the results.

In Panel A, we use imports into APD from countries other than Brazil as the single instrument to predict export status and find the preceding hiring of managers from incumbent exporters to cause a larger number of concurrent expert hires (column 4).¹⁷ However, the presence of previously hired exporter managers is not a statistically significant correlate of expert poaching at the extensive hiring margin (column 2). We further explore in Panel B whether the interaction of previously hired exporter managers with predicted export status, instrumented with the interaction between APD imports and

¹⁵The first-stage regressions are reported in Table S.1 of the Online Supplement.

¹⁶Similarly, Muendler (2008) documents for the period of Brazil's trade reform in the 1990s that the expanding export industries are intensive in skilled blue-collar occupations.

¹⁷The first-stage regressions are reported in Table S.2 of the Online Supplement.

Table 7: HIRES OF SKILLED BLUE-COLLAR WORKERS AND EXPORTER MANAGERS

Dependent Variable (t):	Indic. Hire SBC		log(Hires SBC)	
	OLS (1)	IV (2)	OLS (3)	IV (4)
Panel A: Hiring workers from skilled blue-collar (SBC) occupations				
Indic. Exporter (t)	0.023*** (0.004)	2.004*** (0.545)	0.023* (0.009)	1.655** (0.616)
Ind. Hire Exporter Manager ($t-1$)	0.051*** (0.003)	0.015 (0.009)	0.054*** (0.008)	0.042*** (0.012)
F -stat. Export (t) inst.		15.010		20.797
Anderson-Rubin Wald test p -value		0.000		0.014
Observations	1,722,626	1,722,626	205,985	205,985
Panel B: Hiring workers from skilled blue-collar (SBC) occupations, manager-exporter interaction				
Indic. Exporter (t)	0.024*** (0.004)	2.041*** (0.562)	0.018 (0.009)	1.679** (0.642)
Ind. Hire Exporter Manager ($t-1$)	0.053*** (0.004)	0.123* (0.056)	0.039*** (0.009)	0.103 (0.136)
Ind. Exporter (t) \times Ind. Hire Exporter Manager ($t-1$)	-0.005 (0.005)	-0.245 (0.140)	0.027** (0.009)	-0.113 (0.262)
F -stat. interaction instr.		11.246		10.700
F -stat. Export (t) inst.		9.996		4.621
Anderson-Rubin Wald test p -value		0.000		0.035
Observations	1,722,626	1,722,626	205,985	205,985
Firm and year fixed effects	yes	yes	yes	yes
Sectoral linear trends	yes	yes	yes	yes

Notes: Hires of exporter workers restricted to skilled-blue collar occupations at previous employer. Binary exporter indicator represents firms that export at t . Each cell shows the coefficient from a separate regression. All regressions include the following controls: employment changes between $t-1$ and t net of hires from exporters, contemporaneous and one-period lagged firm size, shares of worker by education (primary, secondary and tertiary) and occupation (unskilled blue collar, skilled blue collar and white collar) categories, an indicator of a firm's high-skill intensity, an indicator of foreign ownership, one- and two-period lagged export status, and sectoral absorption. Workforces on December 31st. First-stage results are presented in the Online Supplement Table S.2. Standard errors in parentheses, clustered at the 3-digit ISIC sector level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Sources: SECEX and RAIS 1994-2007, manufacturing firms (ISIC rev. 2 300-400).

an indicator for hired exporter managers, adds explanatory power to predicted expert hiring. There is no statistically significant evidence at conventional confidence levels that the interaction improves the fit (columns 2 and 4). From the results in Panel A—in particular the positive correlation between previous exporter manager hiring and the poached number of skilled blue-collar workers from exporters at the intensive hiring margin (column 4)—we can reconcile findings in the literature with our approach: the presence of exporter managers helps attract skilled blue-collar workers in the preparation to export.

As mentioned above, an alternative IV approach is to construct firm-level instruments for export market participation. In Appendix Tables B.4 and B.5 we present second-stage results from using as the IV the interaction between non-Brazil imports into APD countries and three-year lags of export status. The results from those alternative IV constructs are broadly in line with our main results. However, in firm-level regressions (Table B.4) OLS and IV results differ less from each other and, in occupation-level regressions (Table B.5) the estimated effects in some specifications indicate a negative and significant impact of export market participation on the demand for experts in specific occupations. In particular, the hiring of unskilled blue-collar workers as well as technical and supervisory workers (column 2 in Panels B and E of Table B.5) is reduced by export market participation. Negative effects of product-market expansions on factor demand are difficult to reconcile with production theory.¹⁸ The finding of negative labor demand effects from product-market expansions is consistent with the possibility that a firm's export decision depends on firm-specific factors (Bernard and Jensen 2004, Bernard et al. 2012), some of which may persist endogenously over time. If, for instance, a firm's productivity improvement leads to labor saving efficiency in unskilled blue-collar as well as technical and supervisory occupations, and at the same time to improved export-market access over time (Clerides, Lach and Tybout 1998), then an alternative firm-level instrument can generate the empirical pattern we observe. However, the alternative instrument would fail to fully isolate the effects of demand shocks from underlying firm characteristics.

5.3 Hiring away non-exporter workers

One potential source of concern is that our sector-level instrument may correlate with aggregate shifts in product demand so that the estimated effects on expert hires may reflect a generic increase in labor demand rather than an increase in demand of exporting skill. To investigate this hypothesis, in Table 8 we use our empirical model to estimate the effect of changes in export market conditions on hiring of workers from non-exporting firms. If the instrument captures more generic labor demand changes, we expect to find sizeable and significant effects of export demand shocks also on the hiring of workers

¹⁸For individual factors, a non-homothetic production function can generate a negative relationship between favorable product-market conditions and individual factor demand only if the relationship is strictly positive and sufficiently large in magnitude for at least one other factor because, at given factor prices, the cost function of any production function is nondecreasing in output.

Table 8: HIRES FROM NON-EXPORTERS

Dependent Variable (t):	Indic. Hire		log(Hires)	
	OLS (1)	IV (2)	OLS (3)	IV (4)
Panel A: Hiring of non-exporter workers				
Indic. Exporter (t)	0.015*** (0.003)	0.858* (0.344)	-0.015* (0.007)	0.723 (0.458)
F-stat. excluded instrument		15.182		15.382
Anderson-Rubin Wald test p -value		0.015		0.078
Observations	1722626	1722626	136303	136303
Panel D: Hiring of non-exporter workers from skilled blue collar occupations				
Indic. Exporter (t)	0.012*** (0.003)	0.598* (0.264)	-0.017 (0.009)	1.140* (0.554)
F-stat. excluded instrument		15.182		16.389
Anderson-Rubin Wald test p -value		0.036		0.007
Observations	1722626	1722626	96272	96272
Firm and year fixed effects	yes	yes	yes	yes
Sectoral linear trend	yes	yes	yes	yes

Notes: Binary exporter indicator represents firms that export at t . Each cell shows the coefficient from a separate regression. All regressions include the following controls: firm and year effects, sectoral linear trends, employment changes between $t - 1$ and t net of hires from exporters, contemporaneous and one-period lagged firm size, shares of worker by education (primary, secondary and tertiary) and occupation (unskilled blue collar, skilled blue collar and white collar) categories, an indicator of a firm's high-skill intensity, an indicator of foreign ownership, one- and two-period lagged export status, and sectoral absorption. Workforces on December 31st. First-stage results are presented in Table 4. Standard errors in parentheses, clustered at the 3-digit ISIC sector level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Sources: SECEX and RAIS 1994-2007, manufacturing firms (ISIC rev. 2 300-400).

from non-exporting firms, who are less likely to have exporting skills.

Table 8 shows that export-market participation predicted using sector-level imports in APD countries (see IV specifications of columns 2 and 4) does not have a significant impact on hiring of workers from non-exporting firms at conventional significance levels. Relative to the effects on hiring from exporting firms of Table 5 and Table 6, the magnitude of the IV coefficients in Table 8 is closer to zero. Overall, these findings indicate that favorable export market conditions prompt prospective exporters to poach workers from incumbent exporters but not from non-exporters, suggesting that our approach isolates specific labor demand for experts beyond generic labor demand.

5.4 Firing recent exporter hires upon unexpected export failure

Regression specifications so far offer evidence for the hypothesis that a firm hires away exporter workers when it can expect to realize export-market access. A corollary of this hypothesis is that a firm in a sector with favorable foreign demand conditions, which predict a heightened probability of export-market participation, should lay off its currently poached hires from exporters if it unexpectedly fails to become an exporter.¹⁹ To pursue this placebo-like treatment, we follow recent hires from exporters in the current year into the next calendar year and identify separations that occur before the end of the next calendar year. We define *separations of exporter hires* as hires from exporters in the current year whose new employment terminates before December 31st of the following year. We then restrict the firm sample in two ways. First, we keep only those firm observations whose predicted export indicator in year t from equation (1) is above the sample median, consistent with a favorable expectation of export-market participation. Of those firm observations, we only keep the ones that turn out to be observed as non-exporters in the year. Second, we keep only firm observations with predicted export status above the 75th percentile in year t , and of those only the observed non-exporters in the year.

For each restricted sample of unexpectedly failing exporters, we replicate equation (2) and regress separations from current exporter hires at the extensive margin (an indicator of at least one separation of exporter hires at a firm) and at the intensive margin (the log number of separations of exporter hires) on the prediction of the firm's export status \hat{x}_{ist} and the control variables. Note that separations in this exercise are only counted for the experts who were recently hired from exporters.

Table 9 reports the results from OLS regression on predicted export status.²⁰ Results support our placebo-like corollary. Coefficient estimates on the exporting predictor are strictly positive and significant for separations at the extensive separation margin (column 1) and at the intensive separation margin (column 2). This evidence indicates that unexpectedly failing exporters let go recent exporter hires if the exporting predictor induced them to poach more exporter workers in the current year. This is the case for unexpectedly failing exporters above the median (Panel A) and above the 75th percentile of the predicted export probability (Panel B). Comparing the magnitude of the estimates in Table 9 to the hiring estimates for the same sample of firms suggests that unexpectedly failing

¹⁹We thank Don Davis for this idea.

²⁰In this specification predicted export status is a generated regressor. We use 50 bootstraps to compute standard errors for the coefficient on the generated regressor.

Table 9: SEPARATIONS OF EXPORTER HIRES AT UNEXPECTEDLY UNSUCCESSFUL FIRMS

Dependent Variable ($t + 1$):	Indic. Separation (1)	log(Separations) (2)
Panel A: Unsuccessful Exporters, <i>Pred. Ind. Exporter</i> above Median		
Pred. Indic. Exporter (t)	2.705*** (0.413)	5.364** (1.845)
Observations	765,651	122,401
Panel B: Unsuccessful Exporters, <i>Pred. Ind. Exporter</i> above 75th Percentile		
Pred. Indic. Exporter (t)	2.262*** (0.650)	4.700* (2.126)
Observations	335,274	83,341
Firm and year fixed effects	yes	yes
Sectoral linear trends	yes	yes

Notes: The predicted exporter status at t is estimated from equation (1). In Panel A we consider non-exporting firms at t with predicted exporter status strictly above the sample median, and in Panel B strictly above the 75th percentile. Each cell shows the coefficient from a separate regression. All regressions include the following controls: firm and year effects, sectoral linear trends, employment changes between $t-1$ and t net of hires from exporters, contemporaneous and one-period lagged firm size, shares of worker by education (primary, secondary and tertiary) and occupation (unskilled blue collar, skilled blue collar and white collar) categories, an indicator of a firm's high-skill intensity, an indicator of foreign ownership, one- and two-period lagged export status, and sectoral absorption. Workforces on December 31st. The variable *Pred. Ind. Exporter* (t) is a generated regressor, so we bootstrap the standard errors. Standard errors from 50 bootstraps over both stages in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Sources: SECEX and RAIS 1994-2007, manufacturing firms (ISIC rev. 2 300-400).

exporters separate from between 50 and 65 percent of the recently poached experts.²¹

5.5 Wage changes and hiring from exporters

In Table 10 we investigate whether workers hired in preparation to export earn higher salaries at the poaching firm. In particular, for every worker j who is hired from an exporter, we compute the difference in the log salary between the current job and the preceding one ($\ln w_{jt} - \ln w_{j,t-\tau}$). We then use the mean of this log salary difference among workers hired from exporters at each firm i as the dependent variable in our main regression equation (2). To determine the source of the wage increase, we resort to a Mincer log wage regression $\ln w_{jt} = \mathbf{z}_{jt}'\boldsymbol{\vartheta}_t + \psi_{i(j)t} + \nu_{jt}$ in the cross section of workers j year by year to isolate three log wage components for every worker (as in Menezes-Filho, Muendler

²¹The coefficient ratios range between 52 percent under the specification in column 2 of Panel A and 62 percent in column 2 of Panel B (for a comparison see Appendix Table B.8).

Table 10: LOG SALARY CHANGES FOR HIRES FROM EXPORTERS

	OLS (1)	IV (2)
Panel A. Dependent Variable: Change in mean Log Salary		
Indic. Exporter (t)	0.003 (0.002)	-0.142 (0.949)
Panel B. Dependent Variable: Change in mean Workers Observable Log Salary Component		
Indic. Exporter (t)	-0.001 (0.001)	0.062 (0.166)
Panel C. Dependent Variable: Change in mean Plant-fixed Log Salary Component		
Indic. Exporter (t)	0.006** (0.002)	-0.457 (0.915)
Panel D. Dependent Variable: Change in mean Log Salary Residual Component		
Indic. Exporter (t)	-0.002 (0.002)	0.253 (0.437)
F -stat. excluded instrument		12.062
Observations	686,616	686,616
Firm and year fixed effects	yes	yes
Sectoral linear trend	yes	yes

Notes: Log salary change is the difference between the current log salary (component) and the log salary (component) at the preceding exporter. Log salary components from Mincer (1974) regressions by year for the cross section of plants, decomposing the log salary into a worker observable component, a plant-fixed component, and an individual worker residual, and then averaging over current employer's hires from exporters. All regressions include the following controls: firm and year effects, sectoral linear trends, employment changes between $t-1$ and t net of hires from exporters, contemporaneous and one-period lagged firm size, shares of worker by education (primary, secondary and tertiary) and occupation (unskilled blue collar, skilled blue collar and white collar) categories, an indicator of a firm's high-skill intensity, an indicator of foreign ownership, one- and two-period lagged export status, and sectoral absorption. Workforces on December 31st. Standard errors, clustered at the sector level, in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Sources: SECEX and RAIS 1994-2007, manufacturing firms (ISIC rev. 2 300-400).

and Ramey 2008):²² The first term, $z_{jt}'\hat{\theta}_t$, captures the salary component that is explained by an expert's observable characteristics such as education, occupation, labor force experience, gender, age. Then, we isolate the component of the salary that is explained by a plant fixed effect, $\psi_{i(j)t}$. This component reflects both pure plant characteristics and unobserved characteristics of a plant's workforce, such as the average plant-worker match effect. Finally, we have the residual component ν_{jt} . We use the mean difference in each of these salary components among experts hired from exporters at a given firm i as the left-hand side variables in our main regression equation (2).

We find positive OLS effects of export-market participation on salaries of experts with previous

²²To narrow the data to a single job per worker and year, we retain the last recorded and highest-paid job spell (randomly dropping ties) in a given year.

export experience (column 1). These effects are driven by the fixed-plant component, indicating that the salary premium associated with exporting skill stems from the new employer's plant-wide pay. The existence of a plant-fixed effects in wages is consistent with surplus sharing between employer and workers (Helpman et al. 2017, Frías et al. 2018). Our finding of an increase in the plant-fixed salary component is, in turn, consistent with a larger export surplus generated at the new employer, in excess of the previous employer's surplus. The result is also consistent with research that has documented the existence of a wage premium for managers with exporting skill (e.g. Mion and Opromolla 2014). When we use the more demanding IV model to isolate salary changes due to preparatory hiring, however, we do not find a statistically significant change in the plant-fixed salary component.

6 Concluding Remarks

We combine firm-level export information with linked employer-employee data to track Brazilian manufacturing firms, their exports and individual workers over more than a decade. The data document substantive size and performance differences among exporters, not just between non-exporters and exporters. Despite this dispersion in export-market performance and employment, the workforce composition varies little across exporters. Looking into typically unobserved aspects of workers' job trajectories, we find that more successful exporters tend to hire more workers with previous work experience at exporting firms. To measure the extent of active workforce preparations for exporting, we use import demand for non-Brazilian goods in Asian-Pacific developing countries as an instrument. We find that firms hire former exporter workers in response to favorable demand conditions abroad and in preparation of expected export-market entry. This preparatory poaching of experts from exporters is concentrated among workers in skilled blue-collar occupations, suggesting that skills from these occupations are particularly important for export market participation.

Our results are consistent with the idea that firms actively contract a competitive workforce to add to their initial advantage, and then select to export. Firms expect to learn by hiring and prepare for expected export-market participation through workforce upgrading. A firm's competitive advantage in this view is partly under its control, and firms share in an economy's knowledge pool through mobile workers.

These findings have implications for labor-market institutions and related policy. Legally induced labor market frictions, such as non-compete clauses and explicit or indirect impediments to hiring and firing, limit worker mobility and consequently the spread of valuable knowledge from firm to firm. In our specific context, barriers to worker mobility may reduce the firms' ability to recruit experts and hamper domestic firms' chances at successful competition abroad. The presence of portable skills, and the importance of worker mobility to promulgate them, should inform the design of labor market policies and related institutions.

Appendix

A Data Appendix

A.1 SECEX export 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 2009. In our analysis we focus on the years 1994 through 2007 for which it is possible to link SECEX exports data to the other two sources of data that we use. We aggregate monthly plant-level export information to years and firms. 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).

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 2001.²³

A.2 RAIS linked employer-employee data

Brazilian law requires every Brazilian plant to submit detailed annual reports with individual information on its 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. By design, RAIS covers all formally employed workers in any sector (including the public sector) and tracks workers nationwide over time between formal jobs. Workers with no current formal employment, however, are not in RAIS. Our version of the data provides monthly spell information on individually identified workers at in-

²³An empirical supplement with according tabulations is available at URL econ.ucsd.edu/muendler.

dividually identified plants. Similar to our treatment of the SECEX data, we aggregate the monthly worker-plant information to years and firms for most of our analysis. (For Mincer log wage regressions at the worker level we retain the last recorded and highest-paid job spell, randomly dropping ties, in a given year and estimate cross-sectional employer fixed effects at the plant level.) 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 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.

We keep observations for the years 1994 through 2007, 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 and changes over time (see Appendix A.2 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*).

We obtain industry information for every firm. Starting from the year 1994, RAIS reports industries under the CNAE classification, which mirrors the International Standard Industrial Classification (ISIC). CNAE industries are recorded by plant. For multi-plant firms, we assign the mode industry associated with most employees in a given year to multi-plant firms. Since our identification strategy relies on variation in trade shocks across sectors, we assign each firm to only one industry over the sample period, using the industry in which the firm first appears in RAIS. For the concordance to worldwide trade flows by SITC sector, we map the CNAE industry classification to the ISIC (Rev. 2) classification at the 3-digit subsector level. At that subsector level, there are 29 manufacturing industries in RAIS. While RAIS offers comprehensive workforce information, data on domestic sales are neither available from SECEX nor RAIS.

Table A.1: FIRM CHARACTERISTICS BY INDUSTRY

Subsector: 3-digit ISIC	Firm-year observ.	Workers per firm	Share (%) exporters	Workers per exp.	Exports per exp.
Food manufacturing (311)	359,203	30.293	.018	833.129	16799.600
Food manufacturing (312)	56,323	24.148	.041	243.960	3354.037
Beverage industries	24,440	83.027	.060	506.338	3508.831
Tobacco manufactures	1,723	150.140	.211	625.028	36543.050
Manufacture of textiles	113,519	37.434	.059	365.958	2044.622
Manufacture of wearing apparel, except footwear	413,675	14.510	.018	149.101	271.714
Manufacture of leather	38,638	25.573	.079	176.968	4693.771
Manufacture of footwear	82,707	42.464	.085	334.031	2250.403
Manufacture of wood and wood and cork products	187,021	16.402	.056	114.216	1551.871
Manufacture of furniture and fixtures	176,345	13.753	.033	115.726	839.677
Manufacture of paper and paper products	35,295	50.449	.067	403.256	7307.993
Printing, publishing and allied industries	178,821	14.054	.013	192.750	220.705
Manufacture of industrial chemicals	13,579	57.505	.153	242.484	9890.896
Manufacture of other chemical products	75,549	43.144	.126	213.527	2060.816
Petroleum refineries	348	73.759	.032	341.182	55577.550
Manufacture of petroleum and coal products	187	31.374	.118	142.273	4449.997
Manufacture of rubber products	31,915	33.928	.059	326.708	4671.183
Manufacture of plastic products not elsewhere classified	94,458	31.759	.082	166.236	828.816
Manufacture of pottery, china and earthenware	17,571	30.464	.058	241.783	1694.682
Manufacture of glass and glass products	6,067	56.580	.092	414.454	3804.224
Manufacture of other non-metallic mineral products	185,290	14.895	.022	129.890	1223.526
Iron and steel basic industries	39,595	56.156	.089	449.445	16561.250
Non-ferrous metal basic industries	32,222	32.789	.072	266.905	11191.510
Manufacture of fabricated metal products	267,897	16.479	.034	176.682	1263.200
Manufacture of machinery except electrical	111,675	32.916	.146	135.467	2153.327
Manufacture of electrical equipment and supplies	69,275	56.340	.121	340.990	4879.409
Manufacture of transport equipment	64,315	66.001	.088	566.801	17701.890
Manufacture of measuring and control devices	25,667	22.174	.125	93.729	446.809
Other manufacturing industries	69,777	14.029	.069	76.666	525.329
Total	2,773,097	25.938	.049	256.436	4124.779

Notes: Employment on December 31st. Exports (fob) in thousands of August-1994 USD.

Sources: SECEX and RAIS 1994-2007, manufacturing firms (ISIC rev. 2 300-400).

Table A.1 reports firm counts, the share of exporters (from the link to SECEX exporter information) and select firm characteristics by 3-digit subsector ISIC.²⁴ On average, only about 5 percent of Brazilian formal-sector manufacturing firms are exporters, a considerably smaller share than in Chile (21 percent of manufacturing plants export in 1990-96, see Álvarez and López 2005), or Colombia

²⁴We 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.

(18 percent of plants in 1991, see Brooks 2006) and Mexico (36 percent of plants in 1996, see Iacovone and Javorcik 2012). Our data are more closely comparable to the U.S. universe of manufacturing firms (a 5 percent exporter share in the U.S. universe of manufacturing firms, see Bernard, Jensen and Schott 2009). Exporting is most frequent in machinery and equipment manufacturing industries, where workforce sizes per firm also tend to be large.

A.3 Education and occupation categories in RAIS

We group education information from nine RAIS education categories into three categories as shown in Table A.2.

Table A.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 (<i>reference category</i>)

Occupation indicators derive from the 3-digit CBO classification codes in our nationwide RAIS data base, and are reclassified to conform to ISCO-88.²⁵ We map RAIS occupations into ISCO-88 occupations and regroup them into five categories as shown in Table A.3.

Table A.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 (<i>reference category</i>)

²⁵See the online documentation at URL econ.ucsd.edu/muendler/brazil.

A.4 Earnings

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 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).

A.5 Legal form

RAIS 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 (2013), who uses independent information on direct and indirect foreign ownership from the Central Bank of Brazil for a shorter sample period.

B Additional Results and Robustness Checks

In Table B.1 we repeat the premia regressions from Table 3 in the text but condition on firm size (employment) as an additional control in otherwise unchanged specifications.

Table B.2 presents estimation results for the first-stage equation (1) for a vector of possible IVs: import flows into six destination groups from anywhere in the world except from Brazil. The six destination groups are Asia-Pacific Developing (APD) countries, 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 do not consider imports into Latin America as a possible IV. We take four different samples: a sample of all firms with a well defined indicator of export status at t , a sample of all firms that hire at least one expert at t and have a well defined indicator of export status at t , a sample of all firms with a well defined

Table B.1: EXPORTER PREMIA, CONDITIONAL ON FIRM SIZE

Firm characteristic	Export Status			<i>t</i> -tests		Obs.
	Continuous (1)	Start (2)	Quit (3)	of null-hypothesis (1)==(2) (2)==(3)		
Panel A: Earnings						
Log Annual Wage	.666*** (.058)	.452*** (.043)	.431*** (.035)	≠		2735184
Residual Log Annual Wage	.724*** (.067)	.537*** (.051)	.454*** (.041)	≠	≠	2735184
Panel B: Observed workforce composition						
Share: Any white-collar occ.	.039*** (.012)	.040*** (.009)	.051*** (.008)		≠	2773097
Share: Skilled blue-collar occ.	-.061*** (.015)	-.061*** (.011)	-.067*** (.010)			2773097
Share: Unsk. blue-collar occ.	.022 (.014)	.021** (.010)	.016** (.008)			2773097
Share: Tertiary education	.071*** (.010)	.049*** (.007)	.043*** (.005)	≠		2773097
Share: High school education	.008 (.008)	.017*** (.006)	-.002 (.005)		≠	2773097
Share: Primary school education	-.079*** (.014)	-.066*** (.010)	-.041*** (.007)		≠	2773097
Panel C: Typically unobserved workforce background						
Indic.: Hires fr. Exporters	.469*** (.021)	.378*** (.021)	.254*** (.017)	≠	≠	2773097
Log Hires fr. Exp.	1.015*** (.072)	.726*** (.058)	.448*** (.040)	≠	≠	526285

Notes: Premia are coefficients from linear regressions of the firm characteristic on export status dummies, controlling for firm employment (beyond Table 3 specifications), sector and year effects. 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. The residual log annual wage is from a linear regression of average firm earnings on the share of workers in three occupation groups (white-collar, skilled blue-collar, unskilled blue-collar) and three education categories (primary, secondary and tertiary). In columns 4 and 5, rejections of the null hypothesis of equality are reported for *t* tests at 1-percent significance. Standard errors in parentheses, clustered at the 3-digit ISIC sector level. **p* < 0.10, ** *p* < 0.05, *** *p* < 0.01.

Sources: SECEX and RAIS 1994-2007, manufacturing firms (ISIC rev. 2 300-400).

indicator of export status one year into the future $t+1$, and a sample of all firms that hire at least one expert at t and have a well defined indicator of export status at $t+1$. Each entry in Table B.2 reports the coefficient from a regression of export status on the candidate IV and the same set of controls that we consider in the main specifications in the text. Results show that only imports into APD are a statistically significant predictor of export status of Brazilian firms, and that APD imports consistently predict export status in any sample.

In Table B.3 we use as the instrument imports into APD countries from countries outside of

Table B.2: ALTERNATIVE FIRST STAGE REGRESSIONS: IMPORTS IN ALL REGIONS

Dependent Variable (t):	Exporter at time t		Exporter at time $t + 1$	
	Entire Sample	Firms with hires > 0	Entire Sample	Firms with hires > 0
	Indic. Exp. (t)	Indic. Exp. (t)	Indic. Exp. ($t + 1$)	Indic. Exp. ($t + 1$)
	(1)	(2)	(3)	(4)
Log Non-Brazil Imports in APD	0.017*** (0.004)	0.043*** (0.009)	0.014*** (0.003)	0.035*** (0.008)
Log Non-Brazil Imports in CEE	0.005 (0.003)	-0.002 (0.010)	0.002 (0.003)	0.005 (0.009)
Log Non-Brazil Imports in NAM	0.003 (0.005)	0.009 (0.017)	0.002 (0.006)	0.009 (0.021)
Log Non-Brazil Imports in ODV	-0.003 (0.005)	-0.007 (0.015)	0.003 (0.005)	0.010 (0.014)
Log Non-Brazil Imports in OIN	0.000 (0.004)	-0.003 (0.014)	-0.005 (0.006)	-0.021 (0.024)
Log Non-Brazil Imports in WEU	-0.010 (0.008)	-0.009 (0.021)	-0.013 (0.008)	-0.021 (0.024)
Observations	1,722,626	281,465	1,927,372	309,439
Firm and year fixed effects	yes	yes	yes	yes
Sectoral linear trends	yes	yes	yes	yes

Notes: Each entry shows the coefficient from a separate OLS regression. All regressions include the following controls: employment changes between $t - 1$ (t in columns 3 and 4) and t ($t + 1$ in columns 3 and 4) net of hires from exporters, contemporaneous and one-period lagged firm size, shares of worker by education (primary, secondary and tertiary) and occupation (unskilled blue collar, skilled blue collar and white collar) categories, an indicator of a firm's high-skill intensity, an indicator of foreign ownership, one- and two-period lagged export status, and absorption. The country groups 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). Standard errors, clustered at the sector level, in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Sources:* SECEX and RAIS 1994-2007, manufacturing firms (ISIC rev. 2 300-400).

Latin America, excluding not only Brazil but any Latin American or Caribbean country's shipments. OLS regressions in columns 1 and 3 are the same as those reported in Table 5 in the text. In the IV regressions in columns 2 and 4, we find the sign and significance patterns broadly confirmed. Coefficient magnitudes are almost the same for the indicator of expert hires and similar for the log number of hires. However, the coefficients on predicted export status for the log number of hires (in column 4) are now only significant at the 90-percent confidence level.

In Table B.4 we use a firm-level instrument for export status. Specifically, we interact log non-Brazil imports in APD countries and export status at $t - 3$ and use this interaction as an instrument for export status at time t in Panel A or at $t + 1$ in Panel B. These specifications are based on the set of firms that are observed at time $t - 3$, resulting in a lower sample size relative to Table 5. While based

Table B.3: HIRES FROM EXPORTERS, EXCLUDING APD IMPORTS FROM LATIN AMERICA

Dependent Variable (t):	Indic. Hire		log(Hires)	
	OLS (1)	IV ^a (2)	OLS (3)	IV ^a (4)
Panel A: Exporter at time t				
Indic. Exporter (t)	0.028*** (0.004)	2.126*** (0.545)	0.041*** (0.007)	1.696* (0.660)
F -stat. excluded instrument		15.519		26.032
Anderson-Rubin Wald test p -value		0.000		0.019
Observations	1,722,626	1,722,626	281,465	281,465
Panel B: Exporter at time $t+1$				
Indic. Exporter ($t + 1$)	0.033*** (0.004)	2.723*** (0.595)	0.040*** (0.008)	2.310* (0.926)
F -stat. excluded instrument		18.645		15.407
Anderson-Rubin Wald test p -value		0.000		0.004
Observations	1,927,372	1,927,372	309,439	309,439
Firm and year fixed effects	yes	yes	yes	yes
Sectoral linear trends	yes	yes	yes	yes

^aIV is Log Non-LAC Imports in APD: trade flows into Asia-Pacific Developing (APD) countries originating from countries outside Latin America.

Notes: Binary exporter indicator represents firms that export at t in Panel A or at $t + 1$ in Panel B. Each cell shows the coefficient from a separate regression. All regressions include the following controls: employment changes between $t - 1$ (t in Panel B) and t ($t + 1$ in Panel B) net of hires from exporters, contemporaneous and one-period lagged firm size, shares of worker by education (primary, secondary and tertiary) and occupation (unskilled blue collar, skilled blue collar and white collar) categories, an indicator of a firm's high-skill intensity, an indicator of foreign ownership, one- and two-period lagged export status, and sectoral absorption. Workforces on December 31st. Standard errors in parentheses, clustered at the 3-digit ISIC sector level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Sources: SECEX and RAIS 1994-2007, manufacturing firms (ISIC rev. 2 300-400).

on a smaller sample, OLS results in columns 1 and 3 are almost identical to those reported in Table 5 in the main paper. In the IV regressions in columns 2 and 4, we find the sign and significance patterns broadly in line with the main results of Table 5. Coefficient magnitudes in these IV specifications, however, are smaller than in Table 5 and closer to OLS estimates.

In Table B.5 we use a firm-level instrument for export status to estimate hiring responses at the occupational level. In the IV specifications, we interact log non-Brazil imports in APD countries and export status at $t - 3$ and use this interaction as an instrument for export status at time t . These specifications are based on the set of firms that are observed at time $t - 3$, resulting in a lower sample size relative to Table 6. While based on a smaller sample, OLS results in columns 1 and 3 are almost identical to those reported in Table 6. In the IV regressions of columns 2 and 4, we find significant and

Table B.4: HIRES FROM EXPORTERS - FIRM-LEVEL INSTRUMENT

Dependent Variable (t):	Indic. Hire		log(Hires)	
	OLS (1)	IV (2)	OLS (3)	IV (4)
Panel A: Exporter at time t				
Indic. Exporter (t)	0.029*** (0.004)	0.320*** (0.082)	0.040*** (0.008)	0.611* (0.253)
F -stat. excluded instrument		32.709		38.063
Anderson-Rubin Wald test p -value		0.004		0.004
Observations	1610792	1610792	257837	257837
Panel B: Exporter at time $t+1$				
Indic. Exporter ($t + 1$)	0.032*** (0.004)	0.256*** (0.046)	0.041*** (0.008)	0.626*** (0.123)
F -stat. excluded instrument		175.031		273.466
Observations	1664469	1664469	255356	255356
Anderson-Rubin Wald test p -value		0.000		0.000
Firm and year fixed effects	yes	yes	yes	yes
Sectoral linear trend	yes	yes	yes	yes

Notes: Binary exporter indicator represents firms that export at t in Panel A or at $t + 1$ in Panel B. In columns 2 and 4 we use the interaction of "Log non-Brazil imports in APD" and export status at $t - 3$ as an instrument for export status at time t (Panel A) or at $t + 1$ (Panel B). Each cell shows the coefficient from a separate regression. All regressions include the following controls: firm and year effects, sectoral linear trends, employment changes between $t - 1$ (t in Panel B) and t ($t + 1$ in Panel B) net of hires from exporters, contemporaneous and one-period lagged firm size, shares of worker by education (primary, secondary and tertiary) and occupation (unskilled blue collar, skilled blue collar and white collar) categories, an indicator of a firm's high-skill intensity, an indicator of foreign ownership, one- and two-period lagged export status, and sectoral absorption. Workforces on December 31st. Standard errors in parentheses, clustered at the 3-digit ISIC sector level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Sources: SECEX and RAIS 1994-2007, manufacturing firms (ISIC rev. 2 300-400).

positive effects on the hiring of workers in skilled blue collar occupations that are in line with the main results presented in Table 6. At variance with the results of Table 6, however, we find negative effects on the hiring of workers from technical and supervisory occupations (Panel B) and from unskilled blue collar occupations (Panel E). These negative effects are difficult to reconcile with trade theory that would predict positive or at most null effects of positive export demand shocks on labor demand, suggesting that the firm-level instrument may be capturing other confounding factors which result in biased estimates of the relation between export status and hiring behaviour of a firm.

In Table B.6 we look further into the future to query the extent to which firms may plan ahead for two or even three years, using export participation two and three periods in advance (x_{ist+2} and $x_{i,t+3}$), for otherwise the same right-hand side variables in equation (2) and the first stage (1). For the

Table B.5: HIRES FROM EXPORTERS BY OCCUPATION - FIRM LEVEL INSTRUMENT

Dependent Variable (t):	Indic. Hire		log(Hires)	
	OLS (1)	IV (2)	OLS (3)	IV (4)
Panel A: Hiring of exporter workers from professional or managerial occupations				
Indic. Exporter (t)	0.022*** (0.003)	-0.063 (0.079)	0.008 (0.013)	0.888 (0.711)
F -stat. excluded instrument		32.709		23.627
Anderson-Rubin Wald test p -value		0.4283		0.1945
Observations	1,610,792	1,610,792	39,982	39,982
Panel B: Hiring of exporter workers from technical or supervisory occupations				
Indic. Exporter (t)	0.030*** (0.003)	-0.297*** (0.088)	0.013 (0.013)	1.087* (0.447)
F -stat. excluded instrument		32.709		31.667
Anderson-Rubin Wald test p -value		0.0017		0.0026
Observations	1,610,792	1,610,792	54,243	54,243
Panel C: Hiring of exporter workers from other white collar occupations				
Indic. Exporter (t)	0.016*** (0.003)	0.067 (0.094)	0.005 (0.013)	1.656 (1.090)
F -stat. excluded instrument		32.709		2.744
Anderson-Rubin Wald test p -value		0.4604		0.0290
Observations	1,610,792	1,610,792	32,144	32,144
Panel D: Hiring of exporter workers from skilled blue collar occupations				
Indic. Exporter (t)	0.024*** (0.004)	0.470*** (0.107)	0.022* (0.009)	0.514* (0.250)
F -stat. excluded instrument		32.709		34.789
Anderson-Rubin Wald test p -value		0.0010		0.0388
Observations	1,610,792	1,610,792	187,418	187,418
Panel E: Hiring of exporter workers from unskilled blue collar occupations				
Indic. Exporter (t)	0.021*** (0.003)	-0.439*** (0.121)	0.006 (0.014)	-0.323 (0.511)
F -stat. excluded instrument		32.709		16.174
Anderson-Rubin Wald test p -value		0.0002		0.5376
Observations	1,610,792	1,610,792	61,365	61,365
Firm and year fixed effects	yes	yes	yes	yes
Sectoral linear trend	yes	yes	yes	yes

Notes: In columns 2 and 4 we use the interaction of "Log non-Brazil imports in APD" and export status at $t - 3$ as an instrument for export status at time t . Each cell shows the coefficient from a separate regression. All regressions include the following controls: firm and year effects, sectoral linear trends, employment changes between $t - 1$ and t net of hires from exporters, contemporaneous and one-period lagged firm size, shares of worker by education (primary, secondary and tertiary) and occupation (unskilled blue collar, skilled blue collar and white collar) categories, an indicator of a firm's high-skill intensity, an indicator of foreign ownership, one- and two-period lagged export status, and sectoral absorption. Workforces on December 31st. Standard errors in parentheses, clustered at the 3-digit ISIC sector level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Sources: SECEX and RAIS 1994-2007, manufacturing firms (ISIC rev. 2 300-400).

Table B.6: HIRES FROM EXPORTERS AND FUTURE EXPORT STATUS

Dependent Variable (t):	Indic. Hire		log(Hires)	
	OLS (1)	IV (2)	OLS (3)	IV (4)
Panel A: Exporter at time $t+2$				
Indic. Exporter ($t + 2$)	0.026*** (0.003)	2.648 (1.651)	0.038*** (0.005)	0.611 (0.595)
F -stat. excluded instrument		4.233		7.741
Anderson-Rubin Wald test p -value		0.000		0.334
Observations	1,727,590	1,727,590	276,568	276,568
Panel B: Exporter at time $t+3$				
Indic. Exporter ($t + 3$)	0.019*** (0.003)	1.675* (0.839)	0.029** (0.009)	0.735 (0.435)
F -stat. excluded instrument		10.689		8.832
Anderson-Rubin Wald test p -value		0.003		0.099
Observations	1,536,106	1,536,106	245,035	245,035
Firm and year fixed effects	yes	yes	yes	yes
Sectoral linear trends	yes	yes	yes	yes

Notes: Binary exporter indicator represents firms that export at $t + 2$ in Panel A or at $t + 3$ in Panel B. Each cell shows the coefficient from a separate regression. All regressions include the following controls: employment changes between $t+1$ ($t+2$ in Panel B) and $t+2$ ($t+3$ in Panel B) net of hires from exporters, contemporaneous and one-period lagged firm size, shares of worker by education (primary, secondary and tertiary) and occupation (unskilled blue collar, skilled blue collar and white collar) categories, an indicator of a firm's high-skill intensity, an indicator of foreign ownership, one- and two-period lagged export status, and sectoral absorption. Workforces on December 31st. First-stage results are available on request. Standard errors, clustered at the sector level, in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Sources: SECEX and RAIS 1994-2007, manufacturing firms (ISIC rev. 2 300-400).

indicator of expert hires (column 2) we find the instrument to remain strong in the Anderson-Rubin test but the coefficient estimate is only statistically significant at the three-year horizon and only at a 90-percent confidence level. In IV regressions of the log number of expert hires, the Anderson-Rubin test fails to reject the absence of a second-stage effect at conventional significance at conventional levels.

Given the limited number of 29 clusters, in Table B.7 we assess the statistical significance of our results showing p -values from a wild bootstrap in square brackets. Simulations have shown the wild bootstrap to produce a better test size than the standard Wald test under clustering when the number of clusters is small (Cameron, Gelbach and Miller 2008). We follow Davidson and MacKinnon (2010) in applying the wild bootstrap procedure to our IV model. In 999 replications, we find results to be near the borderline of significance around the 5-percent confidence level for the indicator of hiring

Table B.7: ALTERNATIVE INFERENCE: WILD BOOTSTRAP p -VALUES

Dependent Variable (t):	Indic. Hire		log(Hires)	
	OLS (1)	IV (2)	OLS (3)	IV (4)
Panel A: Exporter at time t				
Indic. Exporter (t)	0.028 [0.000]	2.151 [0.054]	0.041 [0.000]	1.734 [0.124]
Observations	1,722,626	1,722,626	281,465	281,465
Panel B: Exporter at time $t+1$				
Indic. Exporter ($t + 1$)	0.033 [0.000]	2.721 [0.072]	0.040 [0.000]	2.335 [0.169]
Observations	1,927,372	1,927,372	309,439	309,439
Firm and year fixed effects	yes	yes	yes	yes
Sectoral linear trends	yes	yes	yes	yes

Notes: Binary exporter indicator represents firms that export at t in Panel A or at $t + 1$ in Panel B. Each cell shows the coefficient from a separate regression. All regressions include the following controls: employment changes between $t - 1$ (t in Panel B) and t ($t + 1$ in Panel B) net of hires from exporters, contemporaneous and one-period lagged firm size, shares of worker by education (primary, secondary and tertiary) and occupation (unskilled blue collar, skilled blue collar and white collar) categories, an indicator of a firm's high-skill intensity, an indicator of foreign ownership, one- and two-period lagged export status, and sectoral absorption. Workforces on December 31st. First-stage results are presented in Table 4. Wild bootstrap p -values from 999 replications in brackets.

Sources: SECEX and RAIS 1994-2007, manufacturing firms (ISIC rev. 2 300-400).

and around the 10-percent confidence level for the log of hired experts.

In Section 5.4 we study unexpectedly failing exporters: firms, with a predicted export indicator in year t from equation (1) above the sample median or the 75th percentile, which nevertheless are not observed exporting during t . For these unexpectedly failing firms we observe their expert hires at t and the subsequent layoffs at $t + 1$. To compare magnitudes of predicted hires and predicted separations (in Table 9 in the text), we present in Appendix Table B.8 the preceding predicted expert hires.

Table B.8: HIRES FROM EXPORTERS AT UNEXPECTEDLY UNSUCCESSFUL EXPORTERS

Dependent Variable ($t + 1$):	Indic. Hire (1)	log(Hires) (2)
Panel A: Unsuccessful Exporters, <i>Pred. Ind. Exporter</i> above Median		
Pred. Indic. Exporter (t)	3.353*** (0.431)	8.521*** (1.802)
Observations	765,651	122,401
Panel B: Unsuccessful Exporters, <i>Pred. Ind. Exporter</i> above 75th Percentile		
Pred. Indic. Exporter (t)	2.278** (0.749)	9.034*** (2.603)
Observations	335,274	83,341
Firm and year fixed effects	yes	yes
Sectoral linear trends	yes	yes

Notes: The predicted exporter status at t is estimated from equation (1). In Panel A we consider non-exporting firms at t with predicted exporter status strictly above the sample median, and in Panel B strictly above the 75th percentile. Each cell shows the coefficient from a separate regression. All regressions include the following controls: firm and year effects, sectoral linear trends, employment changes between $t - 1$ and t net of hires from exporters, contemporaneous and one-period lagged firm size, shares of worker by education (primary, secondary and tertiary) and occupation (unskilled blue collar, skilled blue collar and white collar) categories, an indicator of a firm's high-skill intensity, an indicator of foreign ownership, one- and two-period lagged export status, and sectoral absorption. Workforces on December 31st. The variable *Pred. Indic. Exporter* (t) is a generated regressor, so we bootstrap the standard errors. Standard errors from 50 bootstraps over both stages in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Sources: SECEX and RAIS 1994-2007, manufacturing firms (ISIC rev. 2 300-400).

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