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# PREPARING TO EXPORT

Claudio Labanca
Danielken Molina
Marc-Andreas Muendler

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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 it 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.

Claudio Labanca
Monash University
Menzies Building (Bldg 11)
Room 879E
Wellington Road
Clayton, VIC 3800
Australia
claudio.labanca@monash.edu

Marc-Andreas Muendler
Department of Economics, 0508
University of California, San Diego
9500 Gilman Drive
La Jolla, CA 92093-0508
and NBER
muendler@ucsd.edu

Danielken Molina
Inter-American Development Bank
1300 New York Avenue NW
Washington, DC 20577
danielkenm@iadb.org

A comprehensive empirical Online Supplement with additional tabulations and regression specifications is available at: econ.ucsd.edu/muendler/papers/brazexp-suppl.pdf

# 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

[1]For 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, Trefler 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.

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, Opromolla 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 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, consis-

tent 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) and that this learning reduces the costs associated with entering a new export market (e.g. Albornoz et al. 2012, Morales, Sheu and Zahler 2019). 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 those 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. However, in order not to capture the potentially distortive effects of the Great Recession on trade and labor markets, we focus on 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, and we deflate them to August 1994 (when the Brazilian Real was introduced). For consistency with other studies in the literature, 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).[2] We provide additional detail on RAIS in Appendix A.2.

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 ex-

[2]Further 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.

porter share in the U.S. universe of manufacturing firms (Bernard, Jensen and Schott 2009).[3] 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 workers back to the workers's previous employers. 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. 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.

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).[4] We consider six destination groups: 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).[5] We link WTF imports by destination, region and sector to firm-level data from RAIS and

[3] Single-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.

[4] To 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*.

[5] We 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 S2.

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.

# 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 ranking of export-market success is almost perfectly mirrored in the firms' 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 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.[6]

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

[6]About 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.

Table 1: EXPORT STATUS ORDERING

| Export status | Export period $t-2$ | $t-1$ | $t$ | Firm-year observations (1) | Workers per firm (2) | Annual exports (3) |
|---|---|---|---|---|---|---|
| **Non-Exporter** | | | | | | |
| 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 | 1050.618 |
| **Continuous Exporters** | 1 | 1 | 1 | 87,644 | 340.556 | 6086.939 |

[a]Permanent 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 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 exporters workers and 40% of all Brazilian manufacturing workers.[7]

## 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 and penetration 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 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 tiem. Similarly, white-collar

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

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).

occupations are preformed 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. Arguably less attention has been paid to differences among exporters. Table 3 presents the results of exporter-premia regressions that regress average firm earnings and other workforce char-

acteristics 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.[8]

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 occupations, for instance. Exporters are more likely to have workers to 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 come 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.

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. 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

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

Table 3: EXPORTER PREMIA

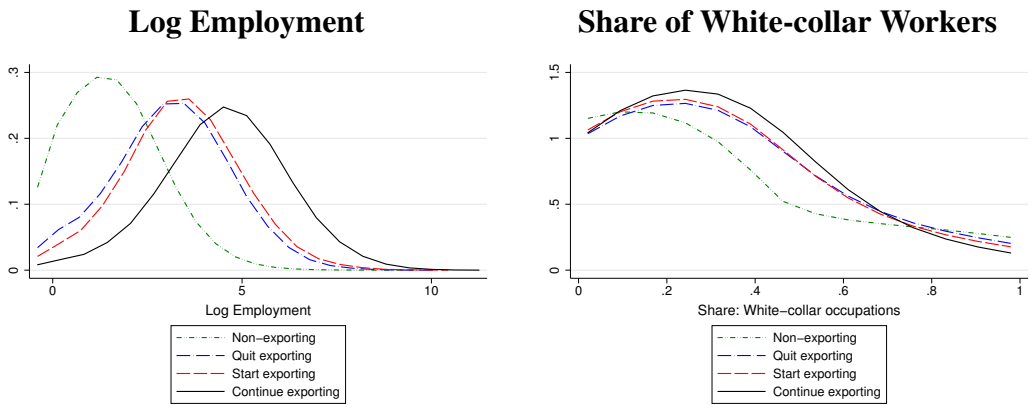
| Firm characteristic | Export Status: Continuous (1) | Start (2) | Quit (3) | $t$-tests of null-hypothesis: (1)==(2) | (2)==(3) | Obs. |
|---|---|---|---|---|---|---|
| **Panel A: Earnings** | | | | | | |
| Log Annual Wage | .720*** (.058) | .467*** (.043) | .441*** (.036) | $\neq$ | | 2,735,184 |
| Residual Log Annual Wage | .783*** (.066) | .554*** (.051) | .465*** (.041) | $\neq$ | $\neq$ | 2,735,184 |
| **Panel B: Observed workforce composition** | | | | | | |
| Share: Any white-collar occ. | .033** (.014) | .038*** (.010) | .050*** (.008) | | $\neq$ | 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) | $\neq$ | | 2,773,097 |
| Share: High school education | .010 (.008) | .018*** (.006) | -.002 (.005) | | $\neq$ | 2,773,097 |
| Share: Primary school education | -.084*** (.014) | -.068*** (.010) | -.042*** (.007) | | $\neq$ | 2,773,097 |
| **Panel C: Typically unobserved workforce background** | | | | | | |
| Indic.: Hires from Exporters | .528*** (.018) | .394*** (.021) | .265*** (.017) | $\neq$ | $\neq$ | 2,773,097 |
| Log Hires from Exporters | 1.295*** (.076) | .809*** (.063) | .513*** (.046) | $\neq$ | $\neq$ | 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).

experience than export quitters. These differences, both between exporters and non-exporters and among exporters with different status, are statistically significant and economically meaningful.[9]

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

[9]The differences in pay and gross hires of former exporter workers are similarly pronounced in premia regressions that condition on size, and workforce characteristics premia are also economically similar among exporters (see Online Supplement).




*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**

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 similar compositions as their less successful and smaller competitors.

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. Yet, 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 potential 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 time of anticipated 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:

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

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. Compared to studies that use major macroeconomic shocks, such as real exchange rate devaluations, or large-scale policy changes, such as the elimination of trade barriers, as 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 $\hat{x}_{ist} = z_{st}\hat{\gamma}_z + \mathbf{y}'_{ist}\hat{\boldsymbol{\gamma}}_y$ to make hiring decisions on experts with export skills $h_{ist}$:

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

Our main hypothesis is that the coefficient $\beta_x$ 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, we expect the regions APD and CEE to exert particularly strong import demand growth. 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 $\mathbf{y}_{ist}$ 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.1) 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). Our IV's statistical significance in $t$ tests (Table B.1) 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 tests consistently reject the absence of an effect on the second stage, mitigating concerns that standard inference may mislead, consistent 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 $\mathbf{y}_{ist}$. 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 include firm fixed-effects, which absorb unobserved time-invariant factors affecting the demand for experts. In addition, we control for year effects and sectoral linear trends that capture time-varying factors affecting the demand for experts and global product markets. Finally, we control for sectoral absorption, which measures the domestic demand for a sector's products.

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 for 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.[10] 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.1).

External migration, and the potential labor supply of experts through immigration, 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 Brazi, the share of foreign nationals from any Asian country (other than Japan) 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 0.003 percent in 1994 to .005 percent in 2007 and, when including Japanese nationals, from 0.035 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 Brazi), see Appendix Table B.2). We conclude that external migration is unlikely to be a major concern for identification.

[10] In 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

| | **Exporter at time $t$** | | **Exporter at time $t+1$** | |
|---|---|---|---|---|
| Dependent Variable ($t$): | Entire Sample Indic. Exp. ($t$) (1) | Firms with hires>0 Indic. Exp. ($t$) (2) | Entire Sample Indic. Exp. ($t+1$) (3) | Firms with hires>0 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).

## 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. 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 spec-

ifications 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 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.

Table 5: HIRES FROM EXPORTERS

| Dependent Variable ($t$): | Indic. Hire | | log(Hires) | |
|---|---|---|---|---|
| | OLS | IV | OLS | IV |
| | (1) | (2) | (3) | (4) |
| **Panel A: Exporter at time t** | | | | |
| Indic. Exporter ($t$) | 0.028*** | 2.151*** | 0.041*** | 1.734** |
| | (0.004) | (0.559) | (0.007) | (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*** | 2.721*** | 0.040*** | 2.335* |
| | (0.004) | (0.590) | (0.008) | (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).

2) 3-digit level.[11]

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

[11]Given the limited number of 29 clusters at the ISIC rev. 2 3-digit level, in Appendix Table B.4 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).

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. An explanation is that our 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 in 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.3). 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

A literature 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

Table 6: HIRES FROM EXPORTERS BY OCCUPATION

| Dependent Variable ($t$): | Indic. Hire | | log(Hires) | |
|---|---|---|---|---|
| | OLS | IV | OLS | IV |
| | (1) | (2) | (3) | (4) |
| **Panel A: Hiring of exporter workers from professional or managerial occupations** | | | | |
| Indic. Exporter ($t$) | 0.024*** | 0.210 | 0.018 | -0.023 |
| | (0.003) | (0.288) | (0.014) | (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*** | 0.323 | 0.018 | -0.378 |
| | (0.003) | (0.260) | (0.012) | (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*** | 0.327 | 0.008 | -0.562 |
| | (0.003) | (0.301) | (0.013) | (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*** | 2.003*** | 0.024* | 1.651** |
| | (0.004) | (0.546) | (0.009) | (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*** | 0.692 | 0.000 | 1.616 |
| | (0.003) | (0.547) | (0.014) | (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.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).

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.[12] 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) 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).[13] 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). Our IV strategy causally isolates labor-demand responses to foreign product-market conditions and allows us to identify the relevant worker group for export-market entry in Brazil: experts in skilled blue-collar occupations. Among the skilled blue-collar occupations for manufacturing in the CBO are jobs 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. These aspects of expertise impact the competitiveness of a firm's products in international markets.

[12]For details on the classification of occupations see Appendix A.3 and Table A.3.

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

Table 7: HIRES OF SKILLED BLUE COLLARS AND THE PRESENCE OF EXPORTER MANAGERS

| Dependent Variable ($t$): | Indic. Hire SBC | | log(Hires SBC) | |
|---|---|---|---|---|
| | OLS | IV | OLS | IV |
| | (1) | (2) | (3) | (4) |
| **Panel A: Hiring workers from skilled blue-collar (SBC) occupations** | | | | |
| Indic. Exporter ($t$) | 0.023*** | 2.004*** | 0.023* | 1.655** |
| | (0.004) | (0.545) | (0.009) | (0.616) |
| Ind. Hire Exporter Manager ($t-1$) | 0.051*** | 0.015 | 0.054*** | 0.042*** |
| | (0.003) | (0.009) | (0.008) | (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*** | 2.041*** | 0.018 | 1.679** |
| | (0.004) | (0.562) | (0.009) | (0.642) |
| Ind. Hire Exporter Manager ($t-1$) | 0.053*** | 0.123* | 0.039*** | 0.103 |
| | (0.004) | (0.056) | (0.009) | (0.136) |
| Ind. Exporter ($t$) $\times$ Ind. Hire Exporter Manager ($t-1$) | -0.005 | -0.245 | 0.027** | -0.113 |
| | (0.005) | (0.140) | (0.009) | (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.3. 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).

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).[14] 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 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.

## 5.3 Firing recent exporter hires upon unexpected export failure

Regression specifications so far offer evidence for our main hypothesis that a firm hires away exporter workers when it can expect to realize export-market access. A corollary of our 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.[15] 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 observa-

[14] The first-stage regressions are reported in Table S.3 of the Online Supplement.

[15] We thank Don Davis for this idea.

Table 8: SEPARATIONS OF EXPORTER HIRES AT UNEXPECTEDLY UNSUCCESSFUL FIRMS

| Dependent Variable ($t+1$): | Indic. Separation (1) | log(Separations) (2) |
|---|---|---|
| **Panel A: Unsuccessful Exporters, *Pred. Ind. Exporter* above Median** | | |
| Pred. Indic. Exporter ($t$) | 2.705*** | 5.364** |
| | (0.413) | (1.845) |
| Observations | 765,651 | 122,401 |
| **Panel B: Unsuccessful Exporters, *Pred. Ind. Exporter* above 75th Percentile** | | |
| Pred. Indic. Exporter ($t$) | 2.262*** | 4.700* |
| | (0.650) | (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. 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).

tions 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 8 reports the results from OLS regression on predicted export status.[16] 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 more recent

[16]In 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: LOG SALARY CHANGES FOR HIRES FROM EXPORTERS

| | OLS | IV |
|---|---|---|
| | (1) | (2) |
| **Panel A. Dependent Variable: Change in mean Log Salary** | | |
| Indic. Exporter ($t$) | 0.003 | -0.142 |
| | (0.002) | (0.949) |
| **Panel B. Dependent Variable: Change in mean Workers Observable Log Salary Component** | | |
| Indic. Exporter ($t$) | -0.001 | 0.062 |
| | (0.001) | (0.166) |
| **Panel C. Dependent Variable: Change in mean Plant-fixed Log Salary Component** | | |
| Indic. Exporter ($t$) | 0.006** | -0.457 |
| | (0.002) | (0.915) |
| **Panel D. Dependent Variable: Change in mean Log Salary Residual Component** | | |
| Indic. Exporter ($t$) | -0.002 | 0.253 |
| | (0.002) | (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).

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 8 to the hiring estimates for the same sample of firms suggests that unexpectedly failing exporters separate from between 50 and 65 percent of the recently poached experts.[17]

## 5.4 Wage changes and hiring from exporters

In Table 9 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 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 $\ln w_{jt} = \boldsymbol{z_{jt}}'\boldsymbol{\vartheta}_t + \psi_{i(j)t} + \nu_{jt}$ in the cross section of workers $j$ year by year to isolate three log wage components for every worker (as in Menezes-Filho, Muendler and Ramey 2008):[18] The first term, $\boldsymbol{z_{jt}}'\hat{\boldsymbol{\vartheta}}_t$, 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 $\nu_{jt}$. 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 export experience (column 1). These effects are driven by the fixed-plant component, indicating that the salary premium associated with exporting skills 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 the earlier literature that has documented the existence of a wage premium for managers with exporting skills (e.g. Mion and Opromolla 2014). When we use our more demanding IV model to isolate changes in salaries due to preparatory hiring, however, we do not find a statistically significant change in the plant-fixed salary component.

[17]The 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.5).

[18]To 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.

# 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.[19]

### 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-

[19] An 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.[20] 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

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

(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 (*reference category*) |

Occupation indicators derive from the 3-digit CBO classification codes in our nationwide RAIS data base, and are reclassified to conform to ISCO-88.[21] 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 (*reference category*) |

[21] See 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

Table B.1 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 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.1 reports the coefficient from

Table B.1: ALTERNATIVE FIRST STAGE REGRESSIONS: IMPORTS IN ALL REGIONS

| | **Exporter at time $t$** | | **Exporter at time $t+1$** | |
|---|---|---|---|---|
| Dependent Variable ($t$): | Entire Sample Indic. Exp. ($t$) (1) | Firms with hires>0 Indic. Exp. ($t$) (2) | Entire Sample Indic. Exp. ($t+1$) (3) | Firms with hires>0 Indic. Exp. ($t+1$) (4) |
| Log Non-Brazil Imports in APD | 0.017*** | 0.043*** | 0.014*** | 0.035*** |
| | (0.004) | (0.009) | (0.003) | (0.008) |
| Log Non-Brazil Imports in CEE | 0.005 | -0.002 | 0.002 | 0.005 |
| | (0.003) | (0.010) | (0.003) | (0.009) |
| Log Non-Brazil Imports in NAM | 0.003 | 0.009 | 0.002 | 0.009 |
| | (0.005) | (0.017) | (0.006) | (0.021) |
| Log Non-Brazil Imports in ODV | -0.003 | -0.007 | 0.003 | 0.010 |
| | (0.005) | (0.015) | (0.005) | (0.014) |
| Log Non-Brazil Imports in OIN | 0.000 | -0.003 | -0.005 | -0.021 |
| | (0.004) | (0.014) | (0.006) | (0.024) |
| Log Non-Brazil Imports in WEU | -0.010 | -0.009 | -0.013 | -0.021 |
| | (0.008) | (0.021) | (0.008) | (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).

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.2 we use as the instrument imports into APD countries from countries outside of 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 , 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)

Table B.2: HIRES FROM EXPORTERS, EXCLUDING APD IMPORTS FROM LATIN AMERICA

| Dependent Variable ($t$): | Indic. Hire | | log(Hires) | |
|---|---|---|---|---|
| | OLS | IV[a] | OLS | IV[a] |
| | (1) | (2) | (3) | (4) |
| **Panel A: Exporter at time t** | | | | |
| Indic. Exporter ($t$) | 0.028*** | 2.126*** | 0.041*** | 1.696* |
| | (0.004) | (0.545) | (0.007) | (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*** | 2.723*** | 0.040*** | 2.310* |
| | (0.004) | (0.595) | (0.008) | (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 |

[a]IV 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).

are now only significant at the 90-percent confidence level.

In Table B.3 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 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.4 we assess the statistical significance of our

Table B.3: HIRES FROM EXPORTERS AND FUTURE EXPORT STATUS

| Dependent Variable ($t$): | Indic. Hire | | log(Hires) | |
|---|---|---|---|---|
| | OLS | IV | OLS | IV |
| | (1) | (2) | (3) | (4) |
| **Panel A: Exporter at time t+2** | | | | |
| Indic. Exporter ($t+2$) | 0.026*** | 2.648 | 0.038*** | 0.611 |
| | (0.003) | (1.651) | (0.005) | (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*** | 1.675* | 0.029** | 0.735 |
| | (0.003) | (0.839) | (0.009) | (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).

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

In Section 5.3 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 8 in the text), we present in Appendix Table B.5 the preceding predicted expert

Table B.4: ALTERNATIVE INFERENCE: WILD BOOTSTRAP $p$-VALUES

| Dependent Variable ($t$): | Indic. Hire | | log(Hires) | |
|---|---|---|---|---|
| | OLS | IV | OLS | IV |
| | (1) | (2) | (3) | (4) |
| **Panel A: Exporter at time t** | | | | |
| Indic. Exporter ($t$) | 0.028 | 2.151 | 0.041 | 1.734 |
| | [0.000] | [0.054] | [0.000] | [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 | 2.721 | 0.040 | 2.335 |
| | [0.000] | [0.072] | [0.000] | [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).

hires.

Table B.5: HIRES FROM EXPORTERS AT UNEXPECTEDLY UNSUCCESSFUL EXPORTERS

| Dependent Variable $(t+1)$: | Indic. Hire (1) | log(Hires) (2) |
|---|---|---|
| **Panel A: Unsuccessful Exporters, *Pred. Ind. Exporter* above Median** | | |
| Pred. Indic. Exporter $(t)$ | $3.353^{***}$ | $8.521^{***}$ |
| | (0.431) | (1.802) |
| Observations | 765,651 | 122,401 |
| **Panel B: Unsuccessful Exporters, *Pred. Ind. Exporter* above 75th Percentile** | | |
| Pred. Indic. Exporter $(t)$ | $2.278^{**}$ | $9.034^{***}$ |
| | (0.749) | (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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# *Online Supplement to*

# Preparing to Export

Claudio Labanca, *Monash University*

Danielken Molina, *Microsoft*

Marc-Andreas Muendler, *UC San Diego, CESifo and NBER*

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This Online Supplement collects evidence to complement the paper "*Preparing to Export*" (Labanca, Molina and Muendler 2021). In Section S1 we present supplemental empirical evidence, and in Section S2 we report the mapping of countries into six relevant export destination groups for Brazil (outside Latin America and the Caribbean) in the period 1994-2007.

## S1 Supplemental Empirical Evidence

In Table S.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 S.2 reports the first-stage regressions underlying the IV regressions in Table 6 (columns 2 and 4) in the text. The according IV specifications under equation (2) alter the second-stage dependent variable and measure the hiring of workers grouped by occupation at the previous employer in 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). The Anderson-Rubin Wald test statistic exceeds a $p$-value of 5 percent in all occupations except skilled blue-collar (SBC) occupations. In other words, we fail to reject the absence of a second-stage effect in the specifications except those for skilled-blue collar occupations. On the first stage, the $F$ statistic for the entire sample (column 1 in Table S.2) exceeds 15, but in the restricted sample with only firms that hire at least one exporter worker from the respective occupation group the $F$ statistic falls short of a critical value of 10—except in the case of skilled blue-collar workers.

In Table 7 in the text, we investigate the relation between poaching of skilled blue-collar (SBC) workers and the presence of managers with exporting experience. Table S.3 reports the associated first-stage regressions. In Panel A, we use APD imports as the single instrument to predict export

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

| | Export Status | | | $t$-tests of null-hypothesis | | Obs. |
|---|---|---|---|---|---|---|
| | Continuous | Start | Quit | | | |
| Firm characteristic | (1) | (2) | (3) | (1)==(2) | (2)==(3) | |
| **Panel A: Earnings** | | | | | | |
| Log Annual Wage | .437*** | .296*** | .295*** | $\neq$ | | 2,735,184 |
| | (.049) | (.029) | (.021) | | | |
| Residual Log Annual Wage | .604*** | .446*** | .373*** | $\neq$ | $\neq$ | 2,735,184 |
| | (.064) | (.037) | (.029) | | | |
| **Panel B: Observed workforce composition** | | | | | | |
| Share: Any white-collar occ. | .089*** | .072*** | .079*** | | | 2,773,097 |
| | (.023) | (.013) | (.010) | | | |
| Share: Skilled blue-collar occ. | -.087*** | -.078*** | -.082*** | | | 2,773,097 |
| | (.024) | (.013) | (.011) | | | |
| Share: Unsk. blue-collar occ. | -.002 | .006 | .003 | | | 2,773,097 |
| | (.010) | (.007) | (.006) | | | |
| Share: Tertiary education | .073*** | .049*** | .043*** | $\neq$ | | 2,773,097 |
| | (.010) | (.006) | (.005) | | | |
| Share: High school education | .041*** | .037*** | .014*** | | $\neq$ | 2,773,097 |
| | (.009) | (.006) | (.005) | | | |
| Share: Primary school education | -.114*** | -.086*** | -.058*** | $\neq$ | $\neq$ | 2,773,097 |
| | (.013) | (.008) | (.006) | | | |
| **Panel C: Typically unobserved workforce background** | | | | | | |
| Indic.: Hires fr. Exporters | .158*** | .170*** | .076*** | | $\neq$ | 2,773,097 |
| | (.020) | (.016) | (.013) | | | |
| Log Hires fr. Exp. | .348*** | .291*** | .003 | | $\neq$ | 526,285 |
| | (.054) | (.037) | (.030) | | | |

*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).

status. In Panel B, we need two instruments: one to predict export status and one additional instrument to predict the interaction of previously hired exporter managers with predicted export status. We use the interaction between APD imports and an indicator for hired exporter managers as the second instrument. Except for the interaction-term instrument for the intensive margin of hiring (column 4), all instruments pass the $F$ test with a conventional critical value.

Table S.2: HIRING BY OCCUPATION: FIST-STAGE REGRESSIONS

| Dependent Variable ($t$): | Entire Sample Indic. Exp. ($t$) (1) | Firms with hires>0 Indic. Exp. ($t$) (2) |
|---|---|---|
| **Panel A: Hiring of exporter workers from professional or managerial occupations** | | |
| Non-Brazil Imports in APD | 0.014*** | 0.054 |
| | (0.004) | (0.029) |
| $F$-stat. excluded instrument | 15.182 | 3.501 |
| Observations | 1,722,626 | 44,133 |
| **Panel B: Hiring of exporter workers from technical or supervisory occupations** | | |
| Non-Brazil Imports in APD | 0.014*** | 0.060* |
| | (0.004) | (0.024) |
| $F$-stat. excluded instrument | 15.182 | 6.156 |
| Observations | 1,722,626 | 59,480 |
| **Panel C: Hiring of exporter workers from other white collar occupations** | | |
| Non-Brazil Imports in APD | 0.014*** | 0.053* |
| | (0.004) | (0.021) |
| $F$-stat. excluded instrument | 15.182 | 6.410 |
| Observations | 1,722,626 | 36,480 |
| **Panel D: Hiring of exporter workers from skilled blue collar occupations** | | |
| Non-Brazil Imports in APD | 0.014*** | 0.043*** |
| | (0.004) | (0.009) |
| $F$-stat. excluded instrument | 15.182 | 20.905 |
| Observations | 1,722,626 | 205,985 |
| **Panel E: Hiring of exporter workers from unskilled blue collar occupations** | | |
| Non-Brazil Imports in APD | 0.014*** | 0.037* |
| | (0.004) | (0.015) |
| $F$-stat. excluded instrument | 15.182 | 6.574 |
| Observations | 1,722,626 | 67,669 |

*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 $t-1$ 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 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).

Table S.3: HIRES OF SKILLED BLUE COLLARS AND MANAGERS: FIRST STAGE REGRESSIONS

| Dependent Variable ($t$): | Ind. Exp. ($t$) Entire Sample (1) | Ind. Exp. ($t$) × Ind. Hire Exp. Man. ($t-1$) Entire Sample (2) | Ind. Exp. ($t$) Firms with hires>0 (3) | Ind. Exp. ($t$) × Ind. Hire Exp. Man. ($t-1$) Firms with hires>0 (4) |
|---|---|---|---|---|
| **Panel A: Hiring workers from skilled blue-collar (SBC) occupations** | | | | |
| Non-Brazil Imports in APD | 0.014*** | | 0.043*** | |
| | (0.004) | | (0.010) | |
| $F$-stat. Export ($t$) inst. | 15.010 | | 20.797 | |
| Observations | 1,722,626 | | 205,985 | |
| **Panel B: Hiring workers from skilled blue-collar (SBC) occupations, manager-exporter interaction** | | | | |
| Non-Brazil Imports in APD | 0.014*** | 0.001 | 0.043*** | 0.005 |
| | (0.004) | (0.001) | (0.009) | (0.004) |
| Non-Brazil Imports in APD | 0.004* | 0.035** | -0.000 | 0.024* |
| × Ind. Hire Exp. Man. ($t-1$) | (0.001) | (0.011) | (0.001) | (0.011) |
| $F$-stat. Export ($t$) inst. | 11.246 | | 10.700 | |
| $F$-stat. interaction instr. | | 9.996 | | 4.621 |
| 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*: APD stands for Asia-Pacific Developing countries. All regressions include the following controls: firm and year effects, sectoral linear trends, employment changes between $t-1$ 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 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).

# S2 Country Groups

**Asia-Pacific Developing countries (APD):** Bhutan, Bouvet Island, British Indian Ocean Territory, Burma, Cambodia, Canton and Enderbury Islands, China, Christmas Island, Cocos (Keeling) Islands, Cook Islands, East Timor, Fiji, French Polynesia, Heard Island and McDonald Islands, Hong Kong, Indonesia, Kiribati, People's Democratic Republic of Korea, Republic of Korea, People's Democratic Republic of Laos, Macao, Malaysia, Maldives, Marshall Islands, Mayotte, Micronesia, Federated States of Mongolia, Myanmar, Nauru, New Caledonia, New Hebrides, Niue, Norfolk Island, Pacific Islands (trust territory), Palau, Papua New Guinea, Philippines, Pitcairn, Samoa, Singapore, Solomon Islands, Taiwan, Thailand, Timor-Leste, Tokelau, Tonga, Tuvalu, Vanuatu, Viet Nam, Wallis and Futuna.

**Central and Eastern European countries (CEE):** Albania, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Former Yugoslav Republic of Macedonia, Republic of Moldova, Poland, Romania, Serbia and Montenegro, Slovakia, Slovenia, Ukraine, Yugoslavia.

**North American countries (NAM, excluding Mexico):** American Samoa, Bermuda, Canada, Greenland, Guam, Johnston Island, Midway Islands, Northern Mariana Islands, Saint Pierre and Miquelon, Puerto Rico, U.S. Miscellaneous Pacific Islands, U.S. Minor Outlying Islands, Wake Island.

**Other Developing countries (ODV)** Afghanistan, Algeria, Angola, Antarctica, Armenia, Azerbaijan, Bahrain, Bangladesh, Benin, Botswana, British Antarctic Territory, Brunei Darussalam, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Democratic Republic of the Congo, Côte D'Ivoire, Dahomey, Djibouti, Dronning Maud Land, Egypt, Equatorial Guinea, Eritrea, Ethiopia, French Southern and Antarctic Territories, Gabon, Gambia, Georgia, Ghana, Guinea, Guinea-Bissau, India, Islamic Republic of Iran, Iraq, Israel, Jordan, Kazakhstan, Kenya, Kuwait, Kyrgyzstan, Lebanon, Lesotho, Liberia, Libyan Arab Jamahiriya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Nepal, Neutral Zone, Niger, Nigeria, Oman, Pakistan, Occupied Palestinian Territory, Qatar, Russian Federation, Rwanda, Réunion, Saint Helena, Sao Tome and Principe, Saudi Ara-

bia, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, Sri Lanka, Sudan, Swaziland, Syrian Arab Republic, Tajikistan, United Republic of Tanzania, Togo, Tunisia, Turkey, Turkmenistan, Uganda, United Arab Emirates, Uzbekistan, Western Sahara, People's Democratic Republic of Yemen, Zaire, Zambia, Zimbabwe.

**Other Industrialized countries (OIN):** Australia, Japan, New Zealand.

**Western European countries (WEU):** Andorra, Austria, Belgium, Canary Islands, Ceuta, Melilla, Cyprus, Denmark, Faroe Islands, Finland, France (including Metropolitan France), Germany, Gibraltar, Greece, Holy See (Vatican City State), Iceland, Ireland, Italy, Liechtenstein, Luxembourg, Malta, Monaco, Netherlands, Norway, Portugal, San Marino, Spain, Svalbard and Jan Mayen, Sweden, Switzerland, United Kingdom, Åland Islands.

**Latin American and Caribbean countries (LAC):**[22] Anguilla, Antigua and Barbuda, Argentina, Aruba, Bahamas, Barbados, Belize, Bolivia, Brazil, British Virgin Islands, Cayman Islands, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Falkland Islands, French Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Mexico, Montserrat, Netherlands Antilles, Nicaragua, Panama, Paraguay, Peru, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and The Grenadines, South Georgia and The South Sandwich Islands, Suriname, Trinidad and Tobago, Turks and Caicos Islands, Uruguay, U.S. Virgin Islands, Venezuela.

[22]Latin American and Caribbean countries are excluded from the set of instrumental variables in this paper.