DISCUSSION PAPER SERIES

DP16180
(v. 2)

LABOR MARKET POWER IN DEVELOPING COUNTRIES: EVIDENCE FROM COLOMBIAN PLANTS

Francesco Amodio and Nicolás de Roux

DEVELOPMENT ECONOMICS, INDUSTRIAL ORGANIZATION AND LABOUR ECONOMICS

ISSN 0265-8003

LABOR MARKET POWER IN DEVELOPING COUNTRIES: EVIDENCE FROM COLOMBIAN PLANTS

Francesco Amodio and Nicolás de Roux

Discussion Paper DP16180
First Published 21 May 2021
This Revision 18 January 2023

Centre for Economic Policy Research
33 Great Sutton Street, London EC1V 0DX, UK
Tel: +44 (0)20 7183 8801
www.cepr.org

LABOR MARKET POWER IN DEVELOPING COUNTRIES: EVIDENCE FROM COLOMBIAN PLANTS

Abstract

How much can employers in low and middle-income countries suppress wages below marginal productivity? Using plant and customs data from Colombia, we exploit pre-determined variation across plants in sales export destinations combined with variation in exchange rates to generate plant-specific shocks to marginal revenue productivity and labor demand. We estimate a firm-level labor supply elasticity of around 2.5, implying that workers produce about 40% more than their wage level. This result is driven by plants that account for a large share of local employment, consistent with an oligopsonistic labor market model.

JEL Classification: J42, L10, O14, O54

Keywords: Labor market power, Export, Colombia

Francesco Amodio - francesco.amodio@mcgill.ca
Department of Economics, McGill University and CEPR

Nicolás de Roux - nicolas.de.roux@uniandes.edu.co
Universidad de los Andes, Department of Economics

Acknowledgements
We thank Cristhian Acosta for excellent research assistance. We are thankful to Arin Dube, Marcela Eslava, Fabian Lange, Suresh Naidu, Fernando Saltiel, Eric Verhoogen, Roman David Zarate, two anonymous referees as well as conference session participants at NEUDC 2020, SOLE 2021, and RIDGE Labor Workshop 2021 for their comments. Errors remain our own. We gratefully acknowledge the Social Sciences and Humanities Research Council of Canada for financial support. All the data processing and analysis was carried in DANE's servers and in accordance with their data confidentiality guidelines.

Measuring Labor Market Power in Developing Countries: Evidence from Colombian Plants*

Francesco Amodio† Nicolás de Roux‡

October 19, 2022

Abstract

How much can employers in low and middle-income countries suppress wages below marginal productivity? Using plant and customs data from Colombia, we exploit predetermined variation across plants in sales export destinations combined with variation in exchange rates to generate plant-specific shocks to marginal revenue productivity and labor demand. We estimate a firm-level labor supply elasticity of around 2.5, implying that workers produce about 40% more than their wage level. This result is driven by plants that account for a large share of local employment, consistent with an oligopsonistic labor market model.

Keywords: labor market power, export, Colombia.
JEL Codes: J2, J3, J42, O14, O54.

*We thank Cristhian Acosta for excellent research assistance. We are thankful to Arin Dube, Marcela Eslava, Fabian Lange, Suresh Naidu, Fernando Saltiel, Eric Verhoogen, Román David Zárate, two anonymous referees as well as conference session participants at NEUDC 2020, SOLE 2021, and RIDGE Labor Workshop 2021 for their comments. Errors remain our own. We gratefully acknowledge the Social Sciences and Humanities Research Council of Canada for financial support. All the data processing and analysis was carried in DANE's servers and in accordance with their data confidentiality guidelines.

†francesco.amodio@mcgill.ca, McGill University and CIREQ, Leacock Building, 855 Sherbrooke St. West, Montreal QC H3A 2T7, Canada.

‡nicolas.de.roux@uniandes.edu.co, Universidad de Los Andes, Calle 19A No 1-37 Este, W 823, Bogotá, Colombia.

1 Introduction

Recent papers have shown that employers in the US enjoy a certain degree of market power in the labor market (Bassier, Dube, and Naidu 2022; Berger, Herkenhoff, and Mongey 2022; Deb, Eeckhout, Patel, and Warren 2022). This finding has important implications for policy, for example regarding the employment consequences of raising the minimum wage (Manning 2021). The labor market power of employers depends on the elasticity of the labor supply they face, which can be less than infinity because of different mechanisms that involve search frictions, firm-specific amenities, and limited geographic mobility of workers (Manning 2003, 2010; Card, Cardoso, Heining, and Kline 2018; Méndez-Chacón and Van Patten 2022). Providing credible estimates of the labor supply elasticity and thus labor market power is challenging because wages are endogenously determined by the interaction of the supply and the demand of labor.

To tackle the measurement issue, the literature mainly exploits sources of plausibly exogenous variation in specific settings such as the labor market of schoolteachers (Ransom and Sims 2010), military hospitals (Staiger, Spetz, and Phibbs 2010), nurses (Matsudaira 2014), university faculty (Goolsbee and Syverson 2019), online labor markets (Dube, Jacobs, Naidu, and Suri 2020), and the construction industry (Kroft, Luo, Mogstad, and Setzler 2020). Other studies attempt to provide broader evidence using measures of concentration among employers in the same local labor market as proxies for market power (Benmelech, Bergman, and Kim 2022; Azar, Marinescu, and Steinbaum 2022), or by estimating the wedge between marginal labor productivity and wages using production function estimation techniques (Brummund 2012; Yeh, Macaluso, and Hershbein 2022). Using employer concentration as a proxy for labor market power is problematic because it is itself endogenous to supply and demand, and a purely descriptive outcome. Estimating labor market power using a production function approach is troublesome as it requires strong assumptions both for estimating output elasticities and for deriving wage markdowns.[1]

This paper uses data from Colombia and a source of exogenous variation that is novel to this literature to measure labor market power for the entire manufacturing sector in a developing country setting. We overcome the main identification challenges by combining plant and customs data. We merge the information from the Encuesta Anual Manufacturera (EAM) [Annual Manufacturing Survey], a census of Colombian manufacturing plants, with data on their international transactions in the period 1994 to 2009. Similar to, among others, Park, Yang, Shi, and Jiang (2010) and Bastos, Silva, and Verhoogen (2018), we leverage pre-determined variation

[1]For instance, the control function approach requires that the relationship between the productivity term and the level of investment or materials usage is monotonic (see e.g. de Roux, Eslava, Franco, and Verhoogen 2021). Moreover, in the presence of market power in the output market, markdowns for one input can only be obtained if the market for another input is perfectly competitive (Morlacco 2020; Yeh, Macaluso, and Hershbein 2022; Brooks, Kaboski, Li, and Qian 2021).

across plants in sales export destinations combined with variation in currency exchange rates to generate plant-specific shocks to the marginal revenue productivity and thus variation in labor demand.

A simple model of imperfect labor market competition informs our empirical analysis. Following a positive shock to marginal revenue productivity, if the labor market is perfectly competitive, the equilibrium number of hired workers will increase, but the wage paid will not. This is because the firm takes the price of labor as given and equal to the ongoing market wage. If the firm has labor market power, both the equilibrium number of hired workers *and* the wage paid will increase. We can thus identify the elasticity of the inverse labor supply curve by taking the ratio between the log change in wage and the log change in employment.

Evidence shows that Colombian manufacturers have high labor market power. We estimate a firm-level labor supply elasticity of about 2.5. This corresponds to a wage markdown of 1.4, implying that the marginal revenue product of labor is about 40% higher than the wage paid. Our findings stand up to a battery of robustness checks including alternative sample selection and definitions of the export-driven marginal revenue product shock. In all specifications, we account for and net out shocks that affect all plants within the same metropolitan areas and narrowly defined industries, which could potentially bias the estimated labor supply elasticity at the firm level. We also show that conditioning on the full set of local labor market-sector-year fixed effects does not affect our results.

After documenting that Colombian manufacturers have a high degree of labor market power, we explore its underlying causes. In an oligopsony model of the labor market, employers compete strategically for workers, and labor market power is higher for larger firms. In contrast, a simple labor market model with search and matching frictions predicts that, in equilibrium, labor market power decreases with firm size (Burdett and Mortensen 1998). We find in our data that plants that account for a larger share of employment in their local labor market face a steeper labor supply curve and have higher labor market power. We interpret this as evidence that, in the Colombian manufacturing sector, strategic interactions among employers are more important than search and matching frictions in generating labor market power. This same heterogeneity result also rules out alternative explanations based on efficiency wage or bargaining arguments.

Finally, we ask whether the effect of export shocks on wages is driven by firm-level upgrading and its possible effects on workforce composition and the skill premium. First, we estimate the labor supply elasticity using data on blue-collar workers only, for which we expect heterogeneity in skills to be less salient, and find similar results. Second, we show that export shocks have no impact on the share of blue-collar workers, suggesting little change in workforce composition. Third, we find no evidence that exchange rate-driven export shocks increase overall investment, investment in machinery or equipment, or R&D expenditures. We also find no effects on the output product mix; and although export shocks increase the probability of introducing new inputs, these are not of higher quality (as proxied by their price). These results suggest that plants do not upgrade their production processes in response to export shocks, and that changes in workforce composition or skill premium do not drive our results.

We see our paper as having multiple contributions to the literature. First and foremost, we make a methodological contribution to the measurement of labor market power. We leverage granular information on exports combined with plausibly exogenous variation in exchange rates to generate plant-specific shocks to labor demand. We use the wage and employment responses to these labor demand shocks to measure the labor market power of Colombian manufacturers, for which we estimate an average plant-level labor supply elasticity of around 2.5 and a wage markdown of 1.4.

Our paper adds to a rapidly growing literature that measures labor market power in different settings. Estimates from the US and other high-income countries derived using different methods generally indicate lower labor market power than what we find for Colombian plants.[2] For example, Azar, Berry, and Marinescu (2022) use an IO-style approach to estimate a differentiated jobs model with application data from a large employment website and find a firm-level labor supply elasticity of 4.8. Using matched employer-employee data from Oregon, Bassier, Dube, and Naidu (2022) adopt a separations-based strategy and estimate an elasticity of 4.2.[3] A notable exception is Yeh, Macaluso, and Hershbein (2022), who focus on US manufacturing and, using a production function approach, find a markdown of 1.53 which implies a 1.88 elasticity.

The literature on labor market distortions in low and middle-income countries presents a wider range of estimates. Alfaro-Ureña, Manelici, and Vasquez (2021) study the effect of the expansions of multinational companies in Costa Rica on the wages of workers in domestic firms. They estimate a pass-through of changes in value added per worker to wages of 0.09 and a retention-wage elasticity of 9.28, which indicates a low level of wage-setting power of domestic firms.[4] Felix (2021) investigates whether changes in labor market power can explain the negative effect of the 1990s trade liberalization in Brazil on employment and wages. She estimates an average wage markdown of 2.[5] In India, Muralidharan, Niehaus, and Sukhtankar

[2]In their review of studies across a range of labor markets, and focusing on best-practice estimates, Sokolova and Sorensen (2021) report an average firm-level labor supply elasticity across studies of 7.1, implying a wage markdown of 1.14. This is not surprising considering that labor market institutions in low-income countries are typically more favorable to employers than to employees. This is especially true in Latin America, where many countries have a history of violent repression of labor market disputes and low unionization rates (Saavedra and Maruyama 1999; Mejía and Uribe 2009; Klor, Saiegh, and Satyanath 2020).

[3]These estimates are consistent with the experimental and quasi-experimental evidence from Cho (2018), Dube, Jacobs, Naidu, and Suri (2020) and Kroft, Luo, Mogstad, and Setzler (2020) among others.

[4]Relatedly, Hjort, Li, and Sarsons (2020) show that multinationals transmit externally imposed changes in wages at the headquarters to their foreign establishments. But, shocks to the exchange rate of the home country only have a transitory effect on foreign establishment wages.

[5]Relatedly and using employer-employee data from Brazil, Tucker (2017) shows that firms have more monop-

(2021) exploit experimental variation in the quality of implementation of the National Rural Employment Guarantee Scheme and estimate a lower bound for employer-specific labor supply elasticities of 3.07. Brooks, Kaboski, Li, and Qian (2021) develop a method to detect oligopsonistic labor market power that focuses on the co-movement between wage markdowns and employment shares. They apply it to study labor markets in Chinese and Indian manufacturing and find evidence of labor market power. Finally, Tortarolo and Zárate (2020) use our same data on Colombian plants to study the extent of imperfect competition in product and labor markets. Using intermediate inputs as instruments for wages, they find that on average firms pay wages that are 11% lower than the marginal revenue product of labor, implying a wage markdown of 1.12 instead of the 1.4 that we estimate. This discrepancy may be due to violations of the exclusion restriction related to factors that simultaneously affect intermediate input use and labor choices, or to the LATE nature of both estimates.

Our results also speak to the literature on the effects of exporting on firms in low-income countries (Clerides, Lach, and Tybout 1998; Atkin, Khandelwal, and Osman 2017; Garcia-Marin and Voigtländer 2019) and their workers (Verhoogen 2008; Frias, Kaplan, and Verhoogen 2012). Most recently, Frias, Kaplan, Verhoogen, and Alfaro-Serrano (2021) use the late 1994 devaluation of the Mexican peso to show that exporting has a significant positive effect on the wage premia of Mexican firms and limited effects on workforce skill composition. Our findings are consistent with theirs in showing that exchange rate-driven positive export shocks increase wages. We qualify this effect further by contrasting the change in wages with the change in employment to measure the firm-level inverse labor supply elasticity and thus labor market power among Colombian firms.

Finally, our paper relates to the literature on rent sharing, which studies the pass-through of changes in firm-level productivity or revenues to wages (Guiso, Pistaferri, and Schivardi 2005; Card, Devicienti, and Maida 2013; Kline, Petkova, Williams, and Zidar 2019; Lamadon, Mogstad, and Setzler 2022). In particular, Garin and Silvério (2018) use data on Portuguese firms and combine variation in export destinations across firms with the differential decrease in countries' imports due to the 2008 recession to generate firm-specific export shocks and identify the impact of these shocks on output and wages. They find pass-through elasticities ranging between 0.12 and 0.25, with effects primarily found in labor markets characterized by more durable employment relationships and lower fluidity. They interpret their findings as suggestive of substantial barriers to employee turnover that give incumbent workers higher threat points and bargaining power during periods of higher demand.

The rest of the paper is organized as follows. Section 2 illustrates the simple framework that guides our analysis. Section 3 introduces the data and empirical strategy. Section 4 illustrates

sony power over current workers than over new hires. Pham (2021) shows that China's trade policy reforms of 2001 reduced labor market distortions while MacKenzie (2019), using plant-level data from India, shows that trade causes a larger reduction in product markups than in labor markdowns.

the main empirical results and explores their robustness. Section 5 discusses potential mechanisms and rules out alternative interpretations of our findings. Section 6 concludes.

2 Conceptual Framework

A simple, textbook model of imperfect labor market competition informs our empirical analysis (Manning 2003). Consider a firm that produces output Y using labor N as input, i.e. $Y = Y(N)$ with $Y'(N) > 0$ and $Y''(N) < 0$. Output is sold at a given exogenous price P. If the labor market is perfectly competitive, the firm faces an infinitely elastic labor supply and takes the market wage w as given. If the firm has labor market power, its supply of labor will depend on the wage offered and be equal to $N(w)$. Let $w(N)$ denote the inverse labor supply.

The firm chooses the amount of labor that maximizes

$$PY(N) - w(N)N \tag{1}$$

which leads to the first order condition

$$\begin{aligned} P\frac{\partial Y(N)}{\partial N} &= w(N) + \frac{\partial w(N)}{\partial N}N \\ P\frac{\partial Y(N)}{\partial N} &= w(N)\left[1 + \frac{\partial w(N)}{\partial N}\frac{N}{w(N)}\right] \end{aligned} \tag{2}$$

where the left-hand side denotes the marginal revenue product of labor (MRPL), and the right-hand side denotes the marginal cost of labor (MCL). This equation makes clear that the MCL and its relationship to the wage $w(N)$ are affected by the inverse elasticity of labor supply $\varepsilon = \frac{\partial w(N)}{\partial N}\frac{N}{w(N)}$.

If the labor market is perfectly competitive, then $\varepsilon = 0$, $w(N) = w$, and the MRPL equals the ongoing market wage. This situation is depicted in the left panel of Figure 1. If the firm has labor market power, the inverse labor supply curve is upward-sloping. As shown in the right panel, this introduces a wedge at equilibrium between the MRPL and the wage paid by the firm. The size of the wedge is a measure of labor market power and is exactly equal to ε.

Consider now the impact of a positive change in the unit price of output P. Each unit produced commands now a higher price: the MRPL curve shifts upwards. The left panel of Figure 1 shows that, if the labor market is perfectly competitive, the equilibrium number of hired workers will increase, but the wage paid will not. This is because the firm still takes the price of labor as given and equal to the ongoing market wage. This is not the case if the firm has labor market power. Both the equilibrium number of hired workers *and* the wage paid will increase, as shown in the right panel of the figure.

This discussion makes it clear that we can exploit exogenous changes in the MRPL to identify the elasticity of the inverse labor supply curve, which is a measure of labor market power. Under the null hypothesis of perfectly competitive labor markets, changes in the MRPL do not lead to higher wages. Under the alternative hypothesis of a firm that has some degree of labor market power, wages would change with the MRPL. We can then identify the elasticity of the inverse labor supply curve by taking the ratio between the log change in wage and the log change in employment, i.e. $\varepsilon = \frac{\Delta w}{\Delta N}\frac{N}{w} \approx \frac{\Delta log(w)}{\Delta log(N)}$.

This static framework does not contemplate any dynamics. If labor supply responds to wage changes with a lag, the firm's labor market power is a weighted average of the short-run and long-run inverse elasticity of labor supply (Boal and Ransom 1997). Even if labor supply is perfectly elastic in the long run, its short-run inverse elasticity is still informative of labor market power, the more so the higher the firm's future discount rate.

3 Empirical Strategy

3.1 Data

We combine three sources of data. The first one is the Encuesta Anual Manufacturera (EAM) [Annual Manufacturing Survey].[6] Administered by Colombia's national statistical agency (DANE), the EAM is a census of all Colombian manufacturing plants with 10 or more employees. We use plant-level data from 1994 to 2009. The data provide information on plant-level quantities and prices for both outputs and inputs at fine product code levels. We use information on output to assign plants to sectors. In particular, we consider the 2, 3 and 5-digit product codes the plant has produced the most in value for the sample period, and assign the plant to the corresponding sector. Importantly for our purpose, the data also carry information on the number of workers and the wage bill, reported separately for blue-collar (production) and white-collar (managers and technicians) workers.

We combine this information at the plant level with transaction-level data from Colombia's customs agency, the Dirección de Impuestos y Aduanas Nacionales (DIAN). The data provide detailed information on each and all international transactions made by Colombian firms – exports and imports – including product code, transaction quantity, value, and, importantly, the destination or origin country of the transaction. We merge each plant in the EAM dataset with customs records to establish whether the firm to which each plant belongs exported or imported to a given country in a given year. Finally, we use exchange and inflation rates from the International Financial Statistics (IFS).[7]

[6] For other papers using these data see for example Eslava, Haltiwanger, Kugler, and Kugler (2010), Kugler and Verhoogen (2011), and Fieler, Eslava, and Xu (2018).

[7] A few countries don't have information in the IFS. In those cases, we gathered information from the corresponding central banks.

A crucial component of our empirical analysis is the construction of exogenous firm-level shocks to the marginal revenue product of labor and thus labor demand. We construct these shocks as follows. First, we derive for each plant i the export share to destination country d in the previous year, labeled as S_{idt-1}. In our baseline exercises, we consider only the top 20 destination countries – by total export value of all Colombian firms in the sample period – and plants in the top 15 export (2-digit) sectors,[8] and compute

$$S_{idt-1} = \frac{Exp_{idt-1}}{\sum_d Exp_{idt-1}} \tag{3}$$

where Exp_{idt-1} is the total value of exports to destination country d in the previous year. We interpret S_{idt-1} as a firm-level measure of exposure to market conditions in country d. We can use these shares to generate a pre-determined firm-specific measure of exposure to exchange-rate fluctuations. Let then

$$R_{dt} = R^n_{dt} \left(\frac{CPI_{dt}}{CPI^{col}_t} \right) \tag{4}$$

be the real exchange rate between the Colombian peso and the foreign currency of country d at time t. R^n_{dt} is the nominal exchange rate – in pesos per unit of foreign currency – while CPI_{dt} is the Consumer Price Index in country d in the same year and CPI^{col}_t is the Consumer Price Index of Colombia at time t. An increase in R_{dt} corresponds to a real depreciation of the Colombian peso in relation to the foreign currency.

Finally, we combine the two variables and derive

$$E_{it} = \sum_d S_{idt-1} R_{dt} \tag{5}$$

E_{it} is plant-specific and time-varying. It captures export-driven firm-level shocks to marginal revenue productivity. Those plants that in the previous year have exported more to a given country experience a larger positive shock to their marginal revenue productivity when the Colombian peso depreciates in relation to that foreign currency. This is because each unit of output sold in the destination market brings in higher revenues in Colombian pesos.

Table 1 shows a set of summary statistics for the main variables we use in the empirical analysis. Nominal variables are in Colombian pesos of the year 2000. The median yearly sales value is 838 million, or about 400,000 dollars at the average exchange rate of 2,088 pesos per dollar in 2000. The median plant hires 26 workers – of which 17 are blue-collar – and has a monthly wage bill of 6.5 million, 5.6 going to blue-collar workers. The average plant hires 0.2% of the local workforce as measured by the total number of workers hired by plants in our data in the

[8] We impose these restrictions to increase statistical power. Section 4.4 shows that results are robust to different choices of top export destinations and export sectors. The initial dataset contains 11,963 plants, and those that belong to the top 15 export sectors are 9,253, or around 77% of the total. When focusing on the top 10 export sectors in one of the robustness exercises below, we use information on 6,646 plants, or around 56% of the total.

local labor market the plant operates in. Both the median and the average of the export shocks are equal to one.[9]

3.2 Specification

We estimate the following regression specification

$$\ln y_{igst} = \theta_i + \lambda_{gt} + \delta_{st} + \beta_y E_{igst} + u_{igst} \tag{6}$$

where y_{igst} is the dependent variable of interest of plant i located in local labor market g in sector s at time t.[10] Plant fixed effects θ_i capture and net out time-invariant differences across plants. λ_{gt} and δ_{st} stand for local labor market-year and sector-year fixed effects as discussed below. Our coefficient of interest is β_y, which captures the effect on y_{igst} of firm-specific exchange rate-driven shocks to the marginal revenue product of labor. The effect is causal insofar as E_{igst} is uncorrelated with the residual u_{igst}. We allow u_{igst} to be correlated across observations belonging to plants operating in the same 3-digit sector and local labor market by clustering standard errors at that level.

We consider two main dependent variables: the number of hired workers N_{igst} and the average wage w_{igst} paid by the firm. E_{igst} captures firm-specific positive shocks to the marginal revenue product of labor. Section 2 explains that, if the labor market is perfectly competitive, the equilibrium number of hired workers increases with E_{igst}, but the wage paid does not, i.e. $H_0 : \beta_N > 0, \beta_w = 0$. If the firm has labor market power, both the equilibrium number of hired workers *and* the wage paid will increase, i.e. $H_1 : \beta_N > 0, \beta_w > 0$.

The previous section also shows that we can estimate the elasticity of the inverse labor supply curve as the ratio between the two estimated coefficients, i.e. $\hat{\varepsilon} = \hat{\beta}_w / \hat{\beta}_N$.[11]

[9] Appendix Figure A1 shows the full distribution of the exchange-rate driven export shock E_{it}. We consider Colombia as a destination country with nominal and real exchange rates equal to one. Therefore, if a plant only sells domestically both S_{idt-1} and R_{dt} are equal to one and, according to Equation 5, E_{it} is also one. Hence, non-exporting firms explain the bunching in the distribution at one. Appendix Table A1 reports the number of observations in each year for which E_{it} is exactly one, lower than one, or higher than one. In all the years (except for the year 2000, relative to which we normalize all the real exchange rates) there is a large number of plants experiencing a shock greater than one (corresponding to an overall depreciation) and a large number of plants with shocks smaller than one (corresponding to an overall appreciation).

[10] Our local labor markets correspond to the Áreas Metropolitanas [Metropolitan Areas] in Colombia defined by DANE and shown in Figure A2 in the Appendix. These areas are composed of a main urban center and its associated municipalities. The plants of the EAM in our sample belong to 13 different local labor markets.

[11] We assume that firms can adjust employment levels from t to $t + 1$ so that our estimates capture a long-run inverse elasticity. This is likely the case as we use year-to-year variation for identification. If this assumption fails, we would be estimating a short-run inverse elasticity, which is still informative of labor market power as discussed in Section 2.

3.3 Identification Concerns

A first concern with our identification strategy pertains to its ability to isolate firm-level shocks to labor demand. If a firm employs a sizeable share of the workforce in the local labor market, a positive shock to its demand for labor becomes indistinguishable from an aggregate labor demand shock which would increase wages even in the presence of a perfectly competitive labor market. A somewhat related concern is that plants operating in the same local labor market may have similar export shares and therefore be exposed to the same exchange rate fluctuations. Also in this case, the estimated β would be biased as it would also capture the impact of market-level shocks rather than firm-level ones. To address these concerns, we control flexibly for aggregate local labor market conditions by including the full set of local labor market-year fixed effects λ_{gt} in our baseline specification.

Similarly, if firms in the same sector have similar export shares, the impact of industry-level shocks would be nested in the estimated β. We take this into account by adding as regressors the full set of sector-year fixed effects δ_{st}, which net out both observed and unobserved sector-specific shocks that affect all plants operating in sector s at time t. We do this up to a 5-digit definition of sectors, effectively comparing firms within the same narrowly defined industry and year.[12] Appendix Table A2 reports the adjusted R^2 we obtain when regressing the export shock E_{igst} on these different sets of fixed effects. Column (5) shows that, in our most demanding specification including 5-digit sector-year fixed effects, the adjusted R^2 is 0.37. This indicates that there is still meaningful residual variation in the export shock variable that we can exploit for identification.

A fourth concern with our approach is that if plants that export more to a given country also import more from that country, exchange rate fluctuations will have an impact on firm decisions regarding production inputs. This may, in turn, have an independent impact on firm decisions regarding wages and the number of workers hired. To address this concern, we follow a strategy analogous to de Roux, Eslava, Franco, and Verhoogen (2021) and use import shares during the previous year to derive a measure of exchange rate risk exposure on the import side that mirrors the one we derived for exports, which we label as I_{igst}.[13] We include it as an additional regressor in all specifications in order to control for the effect that exchange rate shocks may have on the plant's labor decisions through their effect on imports.

More generally, E_{igst} is a Bartik-type term and its effect has a causal interpretation insofar as this variable is uncorrelated with the residual u_{igst} in equation (6). Goldsmith-Pinkham,

[12] For example, the 3-digit industry code corresponding to "Paper Pulp, Paper, and Cardboard" is divided into 20 different 5-digit codes. As discussed later in Section 4.4, we check if our estimates are robust to the inclusion of local labor market-sector-year fixed effects. We do so despite the limited variation left to exploit for identification. Appendix Table A9 reports the corresponding results.

[13] Specifically, we derive $SI_{iot-1} = \frac{Imp_{iot-1}}{\sum_o Imp_{iot-1}}$ with Imp_{iot-1} being the total value of imports from origin country o in the previous year, and calculate $I_{it} = \sum_o SI_{iot-1} R_{ot}$.

Sorkin, and Swift (2020) show that a sufficient condition for this to be the case is that past firm-level export shares S_{idt-1} are orthogonal to the evolution of other unobserved determinants of y_{igst} over time. We explore the validity of this assumption with several robustness checks, reported in Section 4.4. In a related paper, Borusyak, Hull, and Jaravel (2022) show that if the average level of exposure to each one of the shocks is small and uncorrelated with the shocks themselves, then the instrument is valid. In our case, this requires that the average of lagged export shares S_{idt-1} across observations be small and uncorrelated to the real-exchange rate shocks R_{dt} in equation (4). This assumption seems plausible in our context since the export destinations of individual Colombian plants at a given point in time are unlikely to be systematically correlated with year-to-year fluctuations in the exchange rate.

4 Results

4.1 Sales and Production Value

We start by showing that exchange rate-driven shocks impact sales and total value produced by the plant, thus affecting marginal revenue productivity and the firm's labor demand. Table 2 presents the results obtained when estimating equation (6) having as dependent variables the log of total sales (Panel A) and the value of the plant's production (Panel B), which includes inventory.[14] Plant fixed effects and the import shock variable I_{igst} are included as additional regressors in all specifications, while different time trends are controlled for across columns. Column (1) reports the estimates obtained when including year fixed effects while columns (2) to (5) report the estimates obtained when including local labor market-year fixed effects. Columns (3), (4), and (5) show the estimates obtained when also adding 2-digit, 3-digit and 5-digit sector-year fixed effects. Panel A shows that the effect of the exchange rate-driven export shock on sales is positive and significant in all specifications. The coefficient of column (5) implies that an increase in the export shock measure of one standard deviation is associated with a 1.3% increase in sales. Similarly, Panel B shows that export shocks lead to an increase in the value of the plant's production. The result in column (5), which accounts for 5-digit sector-specific time-varying shocks, implies that an increase in the export shock measure of one standard deviation leads to an increase of the total value produced by the plant of 1.6%.

4.2 Number of Workers and Wages

Table 3 reports the estimated effect of the export shock on the number of workers hired by the plant (Panel A) and the average wage (Panel B). Each column includes a different set of fixed effects, mirroring Table 2. Panel A shows that devaluation shocks are associated with an increase in the number of workers hired by the plant. The coefficient of column (5) implies that

[14] Both variables are measured in constant pesos of the year 2000.

a one standard deviation increase in the export shock measure increases the number of workers hired by 1%. At the same time, the results in Panel B show that export shocks increase the average wage paid by the plant. In all five columns the coefficient is positive and significant which implies that, even after controlling for local labor market conditions and narrowly defined industry-specific shocks, positive exchange rate-driven shocks increase average wages. The coefficient of column (5) implies that a one standard deviation increase in the export shock variable increases wages by 0.4%.

In Appendix Table A3, we explore if shocks have a persistent effect on the number of workers and wages. To do so, we calculate the median of the export shock in the full sample and define two dummies: DE_{igst}, equal to one if the firm shock is above the median in year t, and DE_{igst-1}, equal to one if the firm shock is above the median in $t-1$. We then replace in equation (6) the export shock variable E_{igst} with these dummies and their interaction.[15] Evidence suggests that the effect of the shock is persistent, but it does not cumulate over time.

4.3 Labor Supply Elasticity and Market Power

Using the estimated coefficients reported in Panel A and B of Table 3 we can estimate the inverse elasticity of the labor supply curve faced by the average Colombian plant. In Section 3, we explain how the inverse elasticity is equal to $\varepsilon = \beta_w/\beta_N$. Panel C of Table 3 shows for each specification the estimated ε, equal to the coefficient from Panel B divided by the corresponding coefficient of Panel A, and its corresponding standard error.[16] The estimated inverse elasticity ranges from 0.36 to 0.41. This last estimate implies that the marginal revenue product of labor is 41% higher than the wage paid, which is evidence that Colombian manufacturing plants have a meaningful degree of labor market power.

Panel D shows the estimated elasticity of the labor supply curve. An increase in wages of 1% leads to an increase in the supply of labor ranging from 2.44% to 2.94%. Azar, Berry, and

[15]More precisely, we implement the following regression specification

$$\ln y_{igst} = \theta_i + \lambda_{gt} + \delta_{st} + \beta DE_{igst} + \gamma DE_{igst-1} + \eta DE_{igst} \times DE_{igst-1} + u_{igst}$$

including also analogous terms for the import shock as controls. The comparison

$$\mathbb{E}(\ln y_{igst}|DE_{igst} = 1, DE_{igst-1} = 1) - \mathbb{E}(\ln y_{igst}|DE_{igst} = 1, DE_{igst-1} = 0) = \gamma + \eta$$

is informative of whether the effect of the export shock cumulates over two consecutive time periods while the comparison

$$\mathbb{E}(\ln y_{igst}|DE_{igst} = 0, DE_{igst-1} = 1) - \mathbb{E}(\ln y_{igst}|DE_{igst} = 0, DE_{igst-1} = 0) = \gamma$$

is informative of whether the effect of the shock persists in the following period.

[16] We obtain the standard errors of the elasticity and the inverse elasticity by combining the separate estimates of β_w and β_N to obtain a single covariance matrix using the STATA `suest` command. Note that these point estimates and standard errors are the same as those obtained implementing a 2SLS estimation procedure and using E as instrument for $\ln N$ to identify the effect of the latter on $\ln w$.

Marinescu (2022) find a firm-level labor supply elasticity in the US close to 4.8, corresponding to an inverse elasticity of 0.21. Therefore, the degree of labor market power of Colombian manufacturers is higher than the one of US employers.[17]

4.4 Robustness

These findings stand up to several robustness checks, whose results we report in the Appendix. We start by showing that our findings are robust to alternative definitions of the exchange rate-driven export shock and estimation samples. Tables A4 and A5 show that the results of Table 3 are robust to the set of destination countries and export sectors considered in the construction of the export shock. We obtain similar estimates if we consider the top 100 destination countries instead of the top 20, and plants in the top 10 export sectors as opposed to the top 15 used in the baseline exercise.

Next, we investigate whether our results are robust to using different definitions of export shares. Table A6 shows that using shares in $t-2$ instead of shares in $t-1$ does not change the results. Table A7 reports the estimates obtained when considering destination shares in the period 1994-1997 and implementing the analysis over plant observations in 1998 through 2009.[18] While somewhat less precise, the results are very similar to those reported in Table 3, and support the assumption that the shares used in the baseline version of the export shock are indeed exogenous.

To further explore the exogeneity of the shares, Table A8 presents the results from a placebo exercise that estimates the effects of leads of the export shock on the main variables of interest. If shares are orthogonal to the evolution of the number of workers and wages through time, these leads should not have any effect on the number of workers hired by the plant or the average wage at time t. To define the leads we use leads of the exchange rates and replace them in equation (5). That is, we define E_{it+s} by substituting the term R_{dt} – the real exchange rate of destination country d in year t – in equation (5) with its lead R_{dt+s}. Table A8 shows the estimated effect of the leads of the export shock on the number of hired workers (Panel A). In general, the leads are not correlated with wages or employment. The only exception is in Column (2), Panel B, were we find a positive and significant relation between the lead E_{it+1} and wages. Yet, this is not necessarily problematic as E_{it+1} can be serially correlated with E_{it} through serial correlation of the exchange rate terms R_{dt} and R_{dt+1}. Indeed, when we control for E_{it} in column (4), the effect of E_{it+1} on wages is no longer significant.

[17] Focusing on US manufacturers, Yeh, Macaluso, and Hershbein (2022) estimate an average plant-level labor supply elasticity of 1.88. Based on our estimates and corresponding standard errors, we cannot reject at standard levels of significance the null hypothesis that our estimates are different. Yet, these estimates are not directly comparable since, as discussed above, Yeh, Macaluso, and Hershbein (2022) use a production function estimation approach which does not exploit plausibly exogenous variation in the marginal revenue product of labor.

[18] In this case the term S_{idt-1} of equation (3) is constant across years and is equal to the ratio between exports of plant i in years 1994-1997 to destination d and total exports of plant i in 1994-1997.

As explained above, the validity of our identification strategy relies on its ability to isolate firm-level shocks to labor demand as opposed to more aggregate labor demand shocks. We address this concern further by including in our regression specification the full set of local labor market-sector-year fixed effects. This means that we exploit for identification variation in the export shock across plants within the same sector, local labor market, and year. Appendix Table A9 shows the corresponding results. Estimates are stable across specifications and remarkably similar to the baseline ones reported in Table 3. We also test for whether export shocks that affect other plants in the same industry and local labor market impact plant-level wages and employment. In Appendix Table A10, we present the estimates we obtain when regressing the log of employment and average wage at the plant on the average and the maximum export shock experienced by other firms in the same 3-digit sector and local labor market. The results show that shocks to other plants in the same sector and local labor market do not affect employment and wages at a given plant. Note that all estimates are insignificant when including 3-digit and 5-digit sector-year fixed effects, which is what one would expect if those were able to control for and net out market-level shocks at such fine level of disaggregation.

A final concern pertains to the role of the minimum wage. Relative to the median wage, Colombia's national minimum wage is among the highest of Latin America (Mondragón-Vélez, Peña, Wills, and Kugler 2010). The presence of a binding minimum wage drives down the estimated inverse elasticity of the labor supply (Tortarolo and Zárate 2020). This means that we are estimating a lower bound of the labor market power of Colombian plants.

5 Mechanisms and Alternative Explanations

5.1 Strategic Interactions or Search and Matching Frictions?

The model of Section 2 is a simple partial equilibrium model. In a general equilibrium oligopsony model of the labor market, employers engage in Cournot competition for workers and interact strategically when making hiring decisions. In this framework, firm size relates directly to the inverse elasticity of the labor supply curve, and labor market power is higher for plants that account for a larger share of employment in their local labor market (Berger, Herkenhoff, and Mongey 2022; Amodio, Medina, and Morlacco 2022). This prediction stands in sharp contrast to the one of a modern monopsony framework, where labor market power originates from search and matching frictions in the labor market (Burdett and Mortensen 1998). A key feature of the equilibrium in this model is that there is a positive association between firm size and the wage paid, even if workers are equally productive in all jobs. It follows that the wage markdown is lower for larger firms. This is also true if firms are heterogeneous in productivity according to a uniform distribution, so that more productive firms are larger.

From this discussion it follows that studying the relationship between the extent of labor market power and the size of the plant can shed some light on which mechanism – strategic interactions or search and matching frictions – is the main driver of our results (Lu, Sugita, and Zhu 2019). This is particularly important considering the large and expanding literature on information frictions in the labor market in low-income countries (e.g. Abebe, Caria, and Ortiz-Ospina 2021; Abebe, Caria, Fafchamps, Falco, Franklin, and Quinn 2021; Rud and Trapeznikova 2021; Donovan, Lu, and Schoellman 2022; Poschke 2022).[19] To this end, we compute the baseline share of workers employed by the plant relative to the total number of workers employed by all plants in the local labor market it belongs to. We then separate plants in two groups: above and below the median local labor market employment share.[20]

In Table 4, we present the estimated effect of the export shock on the number of workers and wages as obtained separately for these two subsamples. The first five columns show the results for plants with high employment share (above the median). The export shock has an effect on both the number of workers (Panel A) and average wages (Panel B). Columns (6) to (10) report the estimated effect for plants with low employment share (below the median). Here the export shock has a significant effect on the number of workers (Panel A), but the effect on wages is essentially zero (Panel B). Moreover, Panel A shows that the effect on the number of workers is larger for plants with low employment share, which is consistent with the labor supply curve being steeper for plants with high employment share. Indeed, the estimated inverse elasticity is larger for plants in this group. These results support the hypothesis that plants that account for a larger share of employment in their local labor market face a steeper labor supply curve and have higher labor market power, in line with an oligopsonistic labor market interpretation. Importantly, Berger, Herkenhoff, and Mongey (2022) show that in this model the reduced-form firm-level elasticity estimated using plant-level shocks overestimates the structural elasticity. Therefore our estimate of the inverse labor supply elasticity (and hence of labor market power) is a lower bound of the structural inverse elasticity.

In principle, the positive relationship we find between export shocks and wages at baseline could also be consistent with an efficiency wage model where detection of shirking falls with size, and employers hiring more workers need to pay a higher wage to ensure that the no shirking condition holds (Rebitzer and Taylor 1995; Dube, Manning, and Naidu 2018). Yet, the heterogeneity results described above rule out this alternative as well because, if anything, workers at plants that account for a large share of employment should face less incentives to shirk given the scarcity of outside options.

[19] See also Caria and Lessing (2019) for a review.

[20] We compute employment shares in the first year we observe the plant in the data. The median local labor market employment share is 0.3%. 25,685 observations belong to plants with a baseline employment share above the median, and 17,924 to plants with a share below the median. This difference is due to the fact that only 61% of the plants are observed in the first year of the sample, 1994. Plants that appear later in the panel are younger and therefore smaller on average, causing the sub-sample of plant-year observations with a lower-than-median employment share to be smaller than the one of plant-year observations with a higher-than-median share.

Our main results could also be consistent with a model in which workers bargain with employers over wages. But, this is unlikely to be the case in the context of Colombia, which lacks strong unions: according to household survey data, the unionization rate among manufacturing workers across metropolitan areas averages around 1%.[21]

5.2 Quality Upgrading?

Exchange rate-driven export shocks may induce firms to upgrade the quality of their products and hire not only more workers, but also better workers that command higher wages. Upgrading may require investments in capital equipment, the introduction of new technologies, or changes in the input or output mix, necessitating workers with better skills and more training. This would increase both the average wage paid by exporting firms, but also within-industry and within-plant wage dispersion (Verhoogen, 2008; Frias, Kaplan, and Verhoogen, 2012).

To test whether the effect of export shocks on wages is driven by firm-level upgrading, we conduct several different empirical exercises. First, we focus on workforce composition and ask whether our main results hold in a sample of blue-collar (production) workers, for which we expect the heterogeneity in skills to be less salient than for white-collar workers (managers and technicians). In doing this, we can also study the extent to which firm-level revenue productivity growth trickles down to the bottom of the working pyramid. Appendix Table A11 shows that the effect of the export shock on the number of blue-collar workers and blue-collar wages is similar to the effect on all workers and wages. When controlling for 5-digit sector-year fixed effects in column (5), the estimated inverse elasticity of the labor supply is no longer significant, but still as high as 0.29 corresponding to an elasticity of 3.4. In addition, Appendix Table A12 shows that export shocks have no impact on the share of blue collar workers, suggesting little change in workforce composition, a result consistent with Frias, Kaplan, Verhoogen, and Alfaro-Serrano (2021).

Next, we tackle the quality upgrading hypothesis more directly and test whether export shocks lead to changes in capital investment, R&D activity, or the output or input mix. First, we implement the regression specification in equation (6) having as outcome the investment rate, i.e., the ratio between overall investment in year t and capital stock at the beginning of the year. Panel A of Table 5 shows the results. The estimated coefficient of the exchange rate-driven export shock is negative and insignificant in all specifications. Panel B of the same table reports the estimates we obtain when considering specifically investment in machinery and equipment as outcome, which are positive but not significant at standard levels.[22]

[21] Data from the *Gran Encuesta Integrada de Hogares*, Colombia's household survey conducted by DANE. We find an average unionization rate among manufacturing workers across metropolitan areas of 1.1% in 2008 and 0.9% in 2009.

[22] The lack of a relationship between export shocks and investment is confirmed when we consider as outcome a dummy equal to one if the investment rate is higher than 25%. Appendix Table A13 reports these results for both overall investment and investment in machinery and equipment.

Second, we focus on R&D. We use data from the Encuesta de Desarrollo e Innovación Tecnológica (EDIT) [Survey of Technological Development and Innovation], which we merge with our baseline plant-level manufacturing survey. The EDIT collects information on R&D and innovation activities of Colombian manufacturing firms. While administered every two years, the survey asks about R&D expenses and activities in the current and previous year, so that we can effectively build a yearly panel. Unfortunately, this data is available only from 2003 onward, which halves the size of our sample. We estimate the effect of export shocks on total investment in R&D, on purchases of machinery and equipment for R&D, and on investment in technological transfer, technical assistance and R&D consultancy. Tables 6 shows the corresponding the results. We find no effect of the exchange-driven export shock on any of these measures of R&D.

Third, we look at changes in the output or input mix. We define a dummy equal to one if the firm reports a new 8-digit product as output, and an analogous dummy for inputs, and test whether those correlate systematically with export shocks. Panel C of Table 5 shows that the export shock does not induce plants to expand their output mix. Yet, Panel D of the same table shows that the likelihood of introducing a new input increases. Given the focus on firm-level upgrading, the key question is whether this new input is of higher quality. We address this question it in two ways. First, we look at whether the new input has a unit price above the 75th percentile of the distribution of input unit prices in the same year. Panel E of Table 5 shows that this is not the case. Second, we build an input price index that is a weighted average of the unit prices of the inputs used by the plant, with weights equal to their input value share. Panel F of Table 5 shows that the log of the input price index does not respond to export shocks. Although plants expand their input mix, we take these last two results as evidence that the export shock does not lead them to use inputs of higher quality, assuaging the concern that the effect on wages is driven by firm-level upgrading.

As a final test for the possibility of quality upgrading, we use the EAM plant-level data to derive a measure of a sectoral measure of likelihood to upgrade. We define a dummy equal to one if the plant introduced in a given year a new 8-digit output product with unit price above the 75th percentile of the distribution of the plant's output unit prices in the same year. We then average this variable across years for each one of the 78 different 3-digit sector in our data, obtaining a proxy of their propensity to upgrade. We then look at the impact of the export shock on employment and wages in the sub-sample of plants in sectors with a low propensity to upgrade. Panel A of Appendix Table A14 shows the estimates we obtain for sectors with a propensity to upgrade below the median. Both employment and wages are affected by the export shock, with the estimates in column (5) implying an inverse labor supply elasticity of 0.61. For the group of plants with a propensity to upgrade below the 25th percentile of the distribution (Panel B), the estimated inverse labor supply elasticity is 0.48. If anything, these inverse elasticity estimates are larger than those obtained from the baseline sample.

None of the exercises presented in this section would in and of itself completely rule out the possibility that quality upgrading is responsible for the effect of export shocks on wages that we document. Their combination, however, suggests that this mechanism is unlikely to be a major threat to our interpretation of the results.

6 Conclusion

This paper uses data on plants and their international transactions to measure the degree of labor market power among Colombian manufacturers. Plants that experience a positive, exchange-rate driven export shock hire more workers and pay higher wages, consistent with them facing an upward-sloping labor supply curve. We estimate a firm-level elasticity of labor supply of around 2.5, implying that workers produce around 40% more than their wage level.

We interpret our main findings through the lens of a simple model of imperfect labor market competition. Specifically, the evidence favors an oligopsonistic labor market model over other possible interpretations. Yet, existing general equilibrium models that allow for oligopsony power in the labor market do not incorporate other key features of the economy of low and middle-income countries such as, for instance, the presence of a very large and active informal self-employment sector, or credit constraints. One exception is Amodio, Medina, and Morlacco (2022), who show how the sorting of workers across wage work and self-employment shapes the market power of employers in low-income countries, with implication for industrial development. More research is needed in order to establish both theoretically and empirically whether and how other common features of emerging economies matter for labor market power and, in turn, for industrial policy and inclusive growth.

References

Abebe, G., A. S. Caria, M. Fafchamps, P. Falco, S. Franklin, and S. Quinn (2021). Anonymity or Distance? Job Search and Labour Market Exclusion in a Growing African City [Endogenous Stratification in Randomized Experiments]. *Review of Economic Studies 88*(3), 1279–1310.

Abebe, G., A. S. Caria, and E. Ortiz-Ospina (2021). The selection of talent: Experimental and structural evidence from ethiopia. *American Economic Review 111*(6), 1757–1806.

Alfaro-Ureña, A., I. Manelici, and J. P. Vasquez (2021). The Effects of Multinationals on Workers: Evidence from Costa Rican Microdata. Mimeo.

Amodio, F., P. Medina, and M. Morlacco (2022). Labor Market Power, Self-Employment, and Development. IZA Discussion Papers 15477, Institute of Labor Economics (IZA).

Atkin, D., A. K. Khandelwal, and A. Osman (2017). Exporting and Firm Performance: Evidence from a Randomized Experiment. *The Quarterly Journal of Economics 132*(2), 551–615.

Azar, J., S. T. Berry, and I. Marinescu (2022, August). Estimating labor market power. Working Paper 30365, National Bureau of Economic Research.

Azar, J., I. Marinescu, and M. Steinbaum (2022). Labor Market Concentration. *Journal of Human Resources 57*(S), 167–199.

Bassier, I., A. Dube, and S. Naidu (2022). Monopsony in Movers: The Elasticity of Labor Supply to Firm Wage Policies. *Journal of Human Resources 57*(S), 50–86.

Bastos, P., J. Silva, and E. Verhoogen (2018). Export destinations and input prices. *American Economic Review 108*(2), 353–92.

Benmelech, E., N. K. Bergman, and H. Kim (2022). Strong Employers and Weak Employees: How Does Employer Concentration Affect Wages? *Journal of Human Resources 57*(S), 200–250.

Berger, D., K. Herkenhoff, and S. Mongey (2022). Labor market power. *American Economic Review 112*(4), 1147–93.

Boal, W. M. and M. R. Ransom (1997). Monopsony in the labor market. *Journal of Economic Literature 35*(1), 86–112.

Borusyak, K., P. Hull, and X. Jaravel (2022). Quasi-Experimental Shift-Share Research Designs [Sampling-based vs. Design-based Uncertainty in Regression Analysis]. *Review of Economic Studies 89*(1), 181–213.

Brambilla, I. and G. G. Porto (2016). High-income export destinations, quality and wages. *Journal of International Economics 98*, 21–35.

Brooks, W. J., J. P. Kaboski, Y. A. Li, and W. Qian (2021). Exploitation of labor? classical monopsony power and labor's share. *Journal of Development Economics 150*, 102627.

Brummund, P. (2012). Variation in Monopsonistic Behavior Across Establishments: Evidence From the Indonesian Labor Market. Mimeo.

Burdett, K. and D. T. Mortensen (1998). Wage differentials, employer size, and unemployment. *International Economic Review 39*(2), 257–273.

Card, D., A. R. Cardoso, J. Heining, and P. Kline (2018). Firms and labor market inequality: Evidence and some theory. *Journal of Labor Economics 36*(S1), S13–S70.

Card, D., F. Devicienti, and A. Maida (2013, 10). Rent-sharing, Holdup, and Wages: Evidence from Matched Panel Data. *The Review of Economic Studies 81*(1), 84–111.

Caria, S. and T. Lessing (2019). Filling the gap: How information can help jobseekers. IGC Growth Brief.

Cho, D. (2018). The Labor Market Effects of Demand Shocks: Firm-Level Evidence from the Recovery Act. Mimeo.

Clerides, S., S. Lach, and J. R. Tybout (1998). Is Learning by Exporting Important? Micro-Dynamic Evidence from Colombia, Mexico, and Morocco. *The Quarterly Journal of Economics 113*(3), 903–947.

de Roux, N., M. Eslava, S. Franco, and E. Verhoogen (2021). Estimating production functions in differentiated-product industries with quantity information and external instruments. NBER Working Paper 28323.

Deb, S., J. Eeckhout, A. Patel, and L. Warren (2022). What drives wage stagnation: Monopsony or monopoly? BSE Working Paper 1361.

Donovan, K., W. Lu, and T. Schoellman (2022). Labor market dynamics and development. Mimeo.

Dube, A., J. Jacobs, S. Naidu, and S. Suri (2020). Monopsony in online labor markets. *American Economic Review: Insights 2*(1), 33–46.

Dube, A., A. Manning, and S. Naidu (2018). Monopsony and employer mis-optimization explain why wages bunch at round numbers. Working Paper 24991, National Bureau of Economic Research.

Eslava, M., J. Haltiwanger, A. Kugler, and M. Kugler (2010). Factor adjustments after deregulation: Panel evidence from colombian plants. *The Review of Economics and Statistics 92*(2), 378–391.

Felix, M. (2021). Trade, labor market concentration, and wages. Mimeo.

Fieler, A. C., M. Eslava, and D. Y. Xu (2018). Trade, quality upgrading, and input linkages: Theory and evidence from colombia. *American Economic Review 108*(1), 109–46.

Frias, J., D. Kaplan, E. Verhoogen, and D. Alfaro-Serrano (2021). Exports and wage premia: Evidence from mexican employer-employee data. *Review of Economics and Statistics*, Forthcoming.

Frias, J. A., D. S. Kaplan, and E. Verhoogen (2012). Exports and Within-Plant Wage Distributions: Evidence from Mexico. *American Economic Review 102*(3), 435–440.

Garcia-Marin, A. and N. Voigtländer (2019). Exporting and plant-level efficiency gains: It's in the measure. *Journal of Political Economy 127*(4), 1777–1825.

Garin, A. and F. Silvério (2018). How responsive are wages to demand within the firm? evidence from idiosyncratic export demand shocks. Mimeo.

Goldsmith-Pinkham, P., I. Sorkin, and H. Swift (2020). Bartik instruments: What, when, why, and how. *American Economic Review 110*(8), 2586–2624.

Goolsbee, A. and C. Syverson (2019). Monopsony power in higher education: A tale of two tracks. Working Paper 26070, National Bureau of Economic Research.

Guiso, L., L. Pistaferri, and F. Schivardi (2005). Insurance within the firm. *Journal of Political Economy 113*(5), 1054–1087.

Hjort, J., X. Li, and H. Sarsons (2020). Across-Country Wage Compression in Multinationals. Working Paper 26788, National Bureau of Economic Research.

Hummels, D., R. Jørgensen, J. Munch, and C. Xiang (2014). The wage effects of offshoring: Evidence from danish matched worker-firm data. *American Economic Review 104*(6), 1597–1629.

Kline, P., N. Petkova, H. Williams, and O. Zidar (2019, 03). Who Profits from Patents? Rent-Sharing at Innovative Firms. *The Quarterly Journal of Economics 134*(3), 1343–1404.

Klor, E. F., S. Saiegh, and S. Satyanath (2020). Cronyism in State Violence: Evidence from Labor Repression During Argentina's Last Dictatorship. *Journal of the European Economic Association 19*(3), 1439–1487.

Kroft, K., Y. Luo, M. Mogstad, and B. Setzler (2020). Imperfect competition and rents in labor and product markets: The case of the construction industry. Working Paper 27325, National Bureau of Economic Research.

Kugler, M. and E. Verhoogen (2011). Prices, Plant Size, and Product Quality. *The Review of Economic Studies 79*(1), 307–339.

Lamadon, T., M. Mogstad, and B. Setzler (2022, January). Imperfect Competition, Compensating Differentials, and Rent Sharing in the US Labor Market. *American Economic Review 112*(1), 169–212.

Lu, Y., Y. Sugita, and L. Zhu (2019, March). Wage and Markdowns and FDI Liberalization. Discussion paper series HIAS-E-83, Hitotsubashi Institute for Advanced Study, Hitotsubashi University.

MacKenzie, G. (2019). Trade and market power in product and labor markets. Mimeo.

Manning, A. (2003). *Monopsony in Motion: Imperfect Competition in Labor Markets*. Princeton University Press.

Manning, A. (2010). The plant size-place effect: agglomeration and monopsony in labour markets. *Journal of Economic Geography 10*(5), 717–744.

Manning, A. (2021). The elusive employment effect of the minimum wage. *Journal of Economic Perspectives 35*(1), 3–26.

Matsudaira, J. D. (2014). Monopsony in the low-wage labor market? evidence from minimum nurse staffing regulations. *The Review of Economics and Statistics 96*(1), 92–102.

Mejía, D. and M. J. Uribe (2009). Is Violence Against Union Members in Colombia Systematic and Targeted? Documentos cede, Universidad de los Andes - CEDE.

Méndez-Chacón, E. and D. Van Patten (2022). Multinationals, monopsony and local development: Evidence from the united fruit company. *Econometrica*. Forthcoming.

Mondragón-Vélez, C., X. Peña, D. Wills, and A. Kugler (2010). Labor market rigidities and informality in Colombia. *Economía 11*(1), 65–101.

Morlacco, M. (2020). Market power in input markets: Theory and evidence from french manufacturing,. Mimeo.

Muralidharan, K., P. Niehaus, and S. Sukhtankar (2021). General equilibrium effects of (improving) public employment programs: Experimental evidence from India. Mimeo.

Park, A., D. Yang, X. Shi, and Y. Jiang (2010). Exporting and firm performance: Chinese exporters and the asian financial crisis. *The Review of Economics and Statistics 92*(4), 822–842.

Pham, H. (2021). Trade reform, oligopsony, and labor market distortions: Theory and evidence. Mimeo.

Poschke, M. (2022). Wage employment, unemployment and self-employment across countries. Mimeo.

Ransom, M. and D. Sims (2010). Estimating the firm's labor supply curve in a "new monopsony" framework: Schoolteachers in missouri. *Journal of Labor Economics 28*(2), 331–355.

Rebitzer, J. B. and L. J. Taylor (1995). Do labor markets provide enough short-hour jobs? an analysis of work hours and work incentives. *Economic Inquiry 33*(2), 257–273.

Rud, J. P. and I. Trapeznikova (2021). Job creation and wages in least developed countries: Evidence from sub-saharan africa. *The Economic Journal 131*(635), 1331–1364.

Saavedra, J. and E. Maruyama (1999). Los retornos a la educación ya la experiencia en el perú: 1985-1997. *Pobreza y Economía Social: Análisis de una encuesta (ENNIV-1997)*.

Sokolova, A. and T. Sorensen (2021). Monopsony in labor markets: A meta-analysis. *ILR Review 74*(1), 27–55.

Staiger, D., J. Spetz, and C. Phibbs (2010). Is there monopsony in the labor market? evidence from a natural experiment. *Journal of Labor Economics 28*(2), 211–236.

Tortarolo, D. and R. Zárate (2020). Imperfect competition in product and labor markets. a quantitative analysis. Mimeo.

Tucker, L. (2017). Monopsony for whom? evidence from brazilian administrative data. Mimeo.

Verhoogen, E. A. (2008). Trade, Quality Upgrading, and Wage Inequality in the Mexican Manufacturing Sector. *The Quarterly Journal of Economics 123*(2), 489–530.

Yeh, C., C. Macaluso, and B. Hershbein (2022, July). Monopsony in the us labor market. *American Economic Review 112*(7), 2099–2138.

Tables and Figures

Table 1: Descriptive Statistics

	Mean	St. Dev.	Min	Median	Max
Sales	6,694.8	25,847.9	0.0	837.5	842,564.6
Production value	6,911.3	26,276.9	0.0	862.7	864,096.1
Hired workers	78.1	174.9	1	26	3,687
Hired workers (blue-collar)	53.8	129.3	0	17	3,322
Average wage	7.9	5.5	0.0	6.5	198.7
Average wage (blue-collar)	6.8	5.0	0.0	5.6	321.1
Employment share	0.00	0.01	0.00	0.00	0.23
Export shock	1.00	0.11	0.55	1.00	1.87
Import shock	0.99	0.10	0.55	1.00	1.87

Notes. This table present the summary statistics of the main variables used in the empirical analysis. The sample consists of plants in the top 15 2-digit export sectors in the years 1994 to 2009 and the export and import shocks are constructed using information on the top 20 destination countries. The unit of observation is a plant-year. There are 44,963 observations corresponding to 5,446 plants. Nominal variables (sales, production value and wages) are in millions of Colombian Pesos of the year 2000 (the average nominal exchange rate in 2000 was 2088 pesos per dollar). Sales is the total revenue of the plant in the corresponding year, production value is the total value of production at market prices. Hired workers is the total number of workers hired by the plant. Average wage is the average wage paid to workers in the plant. Hired workers (blue-collar) and Average wage (blue collar) are the corresponding values but restricted to blue collar workers. Employment share is the ratio of the total number of workers hired by the plant relative to the total number of workers hired by all plants in the same local labor market in the first year the plant is observed. Export shock is the term E_{it} as defined by equation (5) in the text. Import shock is the equivalent term but defined using import origin shares, as explained in footnote 13 in the text.

Table 2: Effect of Export Shock on Sales and Production Value

	(1)	(2)	(3)	(4)	(5)
	A. Log of Sales				
Export shock	0.203***	0.205***	0.201***	0.169***	0.120***
	(0.034)	(0.034)	(0.034)	(0.035)	(0.036)
Adjusted R^2	0.897	0.898	0.903	0.908	0.909
	B. Log of Production Value				
Export shock	0.211***	0.213***	0.212***	0.184***	0.137***
	(0.034)	(0.034)	(0.034)	(0.035)	(0.036)
Adjusted R^2	0.895	0.896	0.901	0.906	0.908
Plant FE	✓	✓	✓	✓	✓
Year FE	✓				
Year × LLM FE		✓	✓	✓	✓
Year × 2d Sector FE			✓		
Year × 3d Sector FE				✓	
Year × 5d Sector FE					✓
Observations	44,774	44,774	44,774	44,774	44,774

Notes: This table reports the estimated effect of the export shock E_{it} on the log of the plant total sales (Panel A) and the log of total value of production (Panel B), following the specification of equation (6) in the text. The sample consists of plants in the top 15 2-digit export sectors and E_{it} is constructed using information on the top 20 destination countries. The coefficient estimates in each column belong to different specifications. Plant fixed effects and the import shock variable I_{it} are included as additional regressors in all specifications, while different time trends are controlled for across columns. Column (1) reports the estimates obtained when including year fixed effects while columns (2) to (5) report the estimates obtained when including local labor market-year fixed effects. Columns (3), (4) and (5) show the estimates obtained when also adding 2-digit, 3-digit and 5-digit sector-year fixed effects. Standard errors clustered at the level of each local labor market × 3-digit sector are reported in parentheses. * p-value < 0.1; ** p-value < 0.05; *** p-value < 0.01.

Table 3: Effect of Export Shock on Number of Workers and Wages

	(1)	(2)	(3)	(4)	(5)
	A. Log Number of Workers				
Export shock	0.126***	0.124***	0.123***	0.115***	0.090**
	(0.034)	(0.035)	(0.036)	(0.036)	(0.038)
Adjusted R^2	0.919	0.919	0.920	0.922	0.922
	B. Log Average Wage				
Export shock	0.045***	0.045***	0.042***	0.040***	0.037***
	(0.015)	(0.013)	(0.011)	(0.011)	(0.012)
Adjusted R^2	0.810	0.811	0.826	0.829	0.833
	C. Inverse Elasticity of Labor Supply				
Inverse Elasticity	0.361***	0.362***	0.340**	0.347**	0.410**
	(0.138)	(0.139)	(0.135)	(0.144)	(0.202)
	D. Elasticity of Labor Supply				
Elasticity	2.773***	2.764***	2.941**	2.885**	2.439**
	(1.057)	(1.058)	(1.166)	(1.201)	(1.203)
Plant FE	✓	✓	✓	✓	✓
Year FE	✓				
Year × LLM FE		✓	✓	✓	✓
Year × 2d Sector FE			✓		
Year × 3d Sector FE				✓	
Year × 5d Sector FE					✓
Observations	44,963	44,963	44,963	44,963	44,963

Notes: This table reports the estimated effect of the export shock E_{it} on the log of the number of workers hired by the plant (Panel A) and on the log of the average wage paid by the plant (Panel B), following the specification of equation (6) in the text. The sample consists of plants in the top 15 2-digit export sectors and E_{it} is constructed using information on the top 20 destination countries. The coefficient estimates in each column belong to different specifications. Plant fixed effects and the import shock variable I_{it} are included as additional regressors in all specifications, while different time trends are controlled for across columns. Column (1) reports the estimates obtained when including year fixed effects while columns (2) to (5) report the estimates obtained when including local labor market-year fixed effects. Columns (3), (4) and (5) show the estimates obtained when also adding 2-digit, 3-digit and 5-digit sector-year fixed effects. Standard errors clustered at the level of each local labor market × 3-digit sector are reported in parentheses. Panel C presents estimates of the inverse elasticity of the labor supply curve ε, which is obtained by dividing the coefficient in Panel B by the coefficient in Panel A, and their standard errors. Panel D reports estimates of the labor supply curve elasticity (ε^{-1}) and their standard error. * p-value < 0.1; ** p-value < 0.05; *** p-value < 0.01.

Table 4: Effect of Export Shock on Number of Workers and Wages
Heterogeneity According to Local Labor Market Employment Share

	Above Median Empl. Share					*Below Median Empl. Share*				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	A. Log Number of Workers									
Export shock	0.113***	0.119***	0.126***	0.120***	0.090**	0.162**	0.164**	0.145**	0.159**	0.167**
	(0.035)	(0.036)	(0.038)	(0.038)	(0.038)	(0.062)	(0.063)	(0.059)	(0.066)	(0.078)
Adjusted R^2	0.919	0.919	0.921	0.922	0.922	0.795	0.796	0.800	0.802	0.804
	B. Log Average Wage									
Export shock	0.043**	0.043**	0.041***	0.036**	0.031*	-0.013	-0.012	-0.008	-0.006	-0.001
	(0.021)	(0.018)	(0.015)	(0.016)	(0.016)	(0.024)	(0.024)	(0.026)	(0.028)	(0.033)
Adjusted R^2	0.843	0.845	0.859	0.864	0.866	0.709	0.710	0.729	0.729	0.736
	C. Inverse Elasticity of Labor Supply									
Inverse Elasticity	0.383**	0.361**	0.329**	0.285	0.343	-0.080	-0.074	-0.053	-0.037	-0.009
	(0.186)	(0.171)	(0.156)	(0.160)	(0.226)	(0.190)	(0.186)	(0.196)	(0.183)	(0.171)
	D. Elasticity of Labor Supply									
Elasticity	2.609**	2.770**	3.040**	3.352*	2.914	-12.5	-13.6	-18.7	-27.3	-112.7
	(1.265)	(1.313)	(1.445)	(1.796)	(1.915)	(29.8)	(34.4)	(68.8)	(136.0)	(2,173.1)
Plant FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓					✓				
Year × LLM FE		✓	✓	✓	✓		✓	✓	✓	✓
Year × 2d Sector FE			✓					✓		
Year × 3d Sector FE				✓					✓	
Year × 5d Sector FE					✓					✓
Observations	25,685	25,685	25,685	25,685	25,685	17,924	17,924	17,924	17,924	17,924

Notes: This table reports the estimated effect of the export shock E_{it} on the log of the number of workers hired by the plant (Panel A) and on the log of the average wage paid by the plant (Panel B), following the specification of equation (6) in the text. E_{it} is constructed using information on the top 20 destination countries. The sample in Columns (1) to (5) consists of plants in the top 15 2-digit export sectors and with a local labor market employment share above the median across the sample of plants. The local labor market employment share is defined as the number of workers hired by the plant dived by the total number of workers hired by all plants in the same local labor market in the first year the plant is observed. Columns (6) to (10) consider plants below the median local labor market employment share. The coefficient estimates in each column belong to different specifications. Plant fixed effects and the import shock variable I_{it} are included as additional regressors in all specifications, while different time trends are controlled for across columns. Column (1) and (6) report the estimates obtained when including year fixed effects while columns (2) to (5) and (6) to (10) report the estimates obtained when including local labor market-year fixed effects. Columns (3), (4) and (5) and (8), (9) and (10) show the estimates obtained when also adding 2-digit, 3-digit and 5-digit sector-year fixed effects. Standard errors clustered at the level of each local labor market × 3-digit sector are reported in parentheses. Panel C presents estimates of the inverse elasticity of the labor supply curve ε, which is obtained by dividing the coefficient in Panel B by the coefficient in Panel A, and their standard errors. Panel D reports estimates of the labor supply curve elasticity (ε^{-1}) and their standard error. * p-value $<$ 0.1; ** p-value $<$ 0.05; *** p-value $<$ 0.01.

Table 5: Effect of Export Shock on Investment, Products, and Inputs

	(1)	(2)	(3)	(4)	(5)
	A. Investment Rate				
Export shock	-0.045	-0.063	-0.133	-0.042	-0.093
	(0.212)	(0.213)	(0.226)	(0.229)	(0.265)
Observations	43,967	43,967	43,967	43,967	43,941
	B. Investment Rate (machines and equipment)				
Export shock	0.066	0.062	0.045	0.084	0.083
	(0.171)	(0.170)	(0.171)	(0.183)	(0.197)
Observations	43,967	43,967	43,967	43,967	43,941
	C. New Product				
Export shock	0.015	0.015	0.017	0.019	0.023
	(0.016)	(0.016)	(0.016)	(0.016)	(0.018)
Observations	44,915	44,915	44,915	44,915	44,911
	D. New Input				
Export shock	0.044*	0.040*	0.052**	0.050**	0.052**
	(0.023)	(0.022)	(0.022)	(0.022)	(0.024)
Observations	44,172	44,172	44,172	44,168	44,154
	E. New High Price Input				
Export shock	0.022	0.021	0.030*	0.025	0.027
	(0.017)	(0.016)	(0.017)	(0.017)	(0.018)
Observations	44,172	44,172	44,172	44,168	44,154
	F. Input Price Index				
Export shock	0.004	0.005	0.018	0.030	0.048
	(0.036)	(0.037)	(0.038)	(0.039)	(0.042)
Observations	44,269	44,269	44,269	44,265	44,255
Plant FE	✓	✓	✓	✓	✓
Year FE	✓				
Year × LLM FE		✓	✓	✓	✓
Year × 2d Sector FE			✓		
Year × 3d Sector FE				✓	
Year × 5d Sector FE					✓

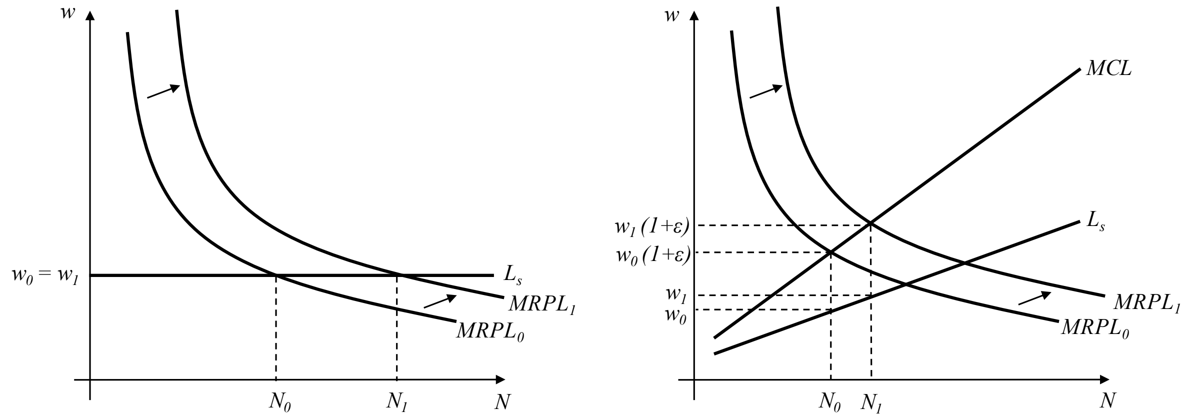
Notes: This table reports the estimated effect of the export shock E_{it} on different variables. In Panel A, the outcome is the ratio of investment to total capital. In Panel B, the outcome are total purchases of machinery and equipment divided by total capital. In Panel C, the outcome is a dummy equal to one if the plant introduced a new 8-digit product in its product mix (a product is new if it was not in the product mix in any of the previous years). In Panel D, the outcome is a dummy equal to one if the plant introduced a new 8-digit input in its input mix. In Panel E, the outcome is a dummy equal to one if the plant introduced an 8-digit input in its input mix and with a cost above the 75th percentile of the distribution of input costs in year t. In Panel F, the outcome an is input price index computed as a weighted average of the prices of the input costs in year t using as weights the importance of each input in the input mix. Plant fixed effects and the import shock variable I_{it} are included as additional regressors in all specifications, while different time trends are controlled for across columns. Column (1) reports the estimates obtained when including year fixed effects while columns (2) to (5) report the estimates obtained when including local labor market-year fixed effects. Columns (3), (4) and (5) show the estimates obtained when also adding 2-digit, 3-digit and 5-digit sector-year fixed effects. Standard errors clustered at the level of each local labor market × 3-digit sector are reported in parentheses. * p-value $<$ 0.1; ** p-value $<$ 0.05; *** p-value $<$ 0.01.

Table 6: Effect of Export Shock on R&D Expenditures

	(1)	(2)	(3)	(4)	(5)
	A. Total R&D				
Export shock	-0.039	-0.035	-0.042*	-0.031	-0.001
	(0.027)	(0.027)	(0.025)	(0.024)	(0.023)
Observations	17,356	17,356	17,356	17,344	17,272
	B. Machines and equipment for R&D				
Export shock	-0.023	-0.020	-0.024	-0.016	0.016
	(0.023)	(0.023)	(0.022)	(0.021)	(0.021)
Observations	17,356	17,356	17,356	17,344	17,272
	C. Technology Transfer, Acquisition and Consulting				
Export shock	0.006	0.007	0.008	0.009	0.010
	(0.007)	(0.007)	(0.006)	(0.006)	(0.007)
Observations	17.356	17,356	17,356	17,344	17,272
Plant FE	✓	✓	✓	✓	✓
Year FE	✓				
Year × LLM FE		✓	✓	✓	✓
Year × 2d Sector FE			✓		
Year × 3d Sector FE				✓	
Year × 5d Sector FE					✓

Notes: This table reports the estimated effect of the export shock E_{it} on different measures of expenditure on research and development (R&D). The source of the R&D data is the EDIT survey. The sample consists of plants in our baseline sample that have information in the EDIT and includes the years 2003-2009. In Panel A, the outcome is (log) total expenditure in R&D. In Panel B, the outcome is (log) expenditure in machines and equipment for R&D. In Panel C, the outcome is (log) expenditures for transfers of technology, acquisitions of technology, or consulting related to technological issues. In all the panels, plant-year observations with a value of zero expenditures are re-coded to log(1). Plant fixed effects and the import shock variable I_{it} are included as additional regressors in all specifications, while different time trends are controlled for across columns. Column (1) reports the estimates obtained when including year fixed effects while columns (2) to (5) report the estimates obtained when including local labor market-year fixed effects. Columns (3), (4) and (5) show the estimates obtained when also adding 2-digit, 3-digit and 5-digit sector-year fixed effects. Standard errors clustered at the level of each local labor market × 3-digit sector are reported in parentheses. * p-value $<$ 0.1; ** p-value $<$ 0.05; *** p-value $<$ 0.01.

Figure 1: Textbook Model of Imperfect Labor Market Competition



Notes: These figures illustrate the equilibrium number of hired workers and wages if the labor market is perfectly competitive – left panel – and if the firm has some labor market power – right panel. If this is the case, a wedge exists at equilibrium between the MRPL (equal to the MCL) and the wage paid by the firm. The size of the wedge is exactly equal to the inverse labor supply elasticity ε. The figures also show how the equilibrium changes following a positive change in the unit price of output P, which amounts to the MRPL curve shifting upwards. If the labor market is perfectly competitive, the equilibrium number of hired workers will increase, but the wage paid will not. If the firm has some labor market power, both the equilibrium number of hired workers *and* the wage paid will increase.

APPENDIX
(for online publication)

Table A1: Count of Export Shocks

Year	1	< 1	> 1	Total
1995	2,646	385	190	3,221
1996	3,041	460	156	3,657
1997	2,930	496	154	3,580
1998	2,780	472	196	3,448
1999	2,603	663	8	3,274
2000	3,069	0	0	3,069
2001	2,179	17	724	2,920
2002	1,993	202	581	2,776
2003	1,862	101	664	2,627
2004	1,873	217	591	2,681
2005	1,842	566	309	2,717
2006	1,873	584	323	2,780
2007	1,879	697	193	2,769
2008	1,900	703	169	2,772
2009	1,854	355	463	2,672
Total	34,324	5,918	4,721	44,963

Notes: This table shows the number of plants that in each year had exchange-rate-driven export shocks below, equal or greater than one. A shock greater than one corresponds to an overall depreciation of the Colombian peso relative to the currencies of the destination where the plant exports. A shock lower than one corresponds to an overall appreciation. A shock equal to one corresponds to observations of plants that did not export.

Table A2: Residual Variation of Export Shocks

	(1)	(2)	(3)	(4)	(5)
Adjusted R^2	0.297	0.3	0.317	0.328	0.369
Plant FE	✓	✓	✓	✓	✓
Year FE	✓				
Year $\times$ LLM FE		✓	✓	✓	✓
Year $\times$ 2d Sector FE			✓		
Year $\times$ 3d Sector FE				✓	
Year $\times$ 5d Sector FE					✓

Notes: This table reports the Adjusted R^2 of a regression of the Export Shock E_{it} on different sets of fixed effects. All columns include plants fixed effects. Column (1) includes year fixed effects while columns (2) to (5) report the estimates obtained when including local labor market-year fixed effects. Columns (3), (4) and (5) show the estimates obtained when also adding 2-digit, 3-digit and 5-digit sector-year fixed effects.

Table A3: Long-lasting Effects of Export Shock

	(1)	(2)	(3)	(4)	(5)
	A. Log Number of Workers				
$\text{Shock}_t > \text{Median}_t$ [a]	0.095***	0.096***	0.097***	0.094***	0.090***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)
$\text{Shock}_{t-1} > \text{Median}_{t-1}$ [b]	0.076***	0.075***	0.082***	0.083***	0.077***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)
Interaction [c]	-0.052***	-0.051***	-0.056***	-0.058***	-0.064***
	(0.015)	(0.015)	(0.015)	(0.016)	(0.017)
Adjusted R-squared	0.927	0.927	0.928	0.930	0.931
P-value H_0: [b] + [c] = 0	0.0340	0.0440	0.0230	0.0360	0.314
	B. Log Average Wage				
$\text{Shock}_t > \text{Median}_t$ [a]	0.026***	0.026***	0.025***	0.025***	0.030***
	(0.007)	(0.006)	(0.006)	(0.006)	(0.007)
$\text{Shock}_{t-1} > \text{Median}_{t-1}$ [b]	0.025***	0.025***	0.024***	0.023***	0.025***
	(0.007)	(0.007)	(0.006)	(0.006)	(0.007)
Interaction [c]	-0.016	-0.014	-0.012	-0.011	-0.016
	(0.010)	(0.010)	(0.009)	(0.009)	(0.010)
Adjusted R-squared	0.822	0.823	0.838	0.841	0.846
P-value H_0: [b] + [c] = 0	0.239	0.171	0.0630	0.0850	0.199
Plant FE	✓	✓	✓	✓	✓
Year FE	✓				
Year × LLM FE		✓	✓	✓	✓
Year × 2d Sector FE			✓		
Year × 3d Sector FE				✓	
Year × 5d Sector FE					✓
Observations	38,079	38,079	38,079	38,079	38,079

Notes: This table reports estimates of the long term effects of export shocks on the the log of the number of workers hired by the plant (Panel A) and on the log of the average wage paid by the plant (Panel B). Each column of each panel corresponds to a different regression that uses three main variables of interest. The variable of the line labeled "$\text{Shock}_t > \text{Median shock}_t$" is a dummy equal to one if the export shock E_{it} is above the median of the export shocks across plants in year t. The variable of the line labeled "$\text{Shock}_{t-1} > \text{Median shock}_{t-1}$" is a dummy equal to one if the export shock E_{it-1} is above the median of the export shocks across plants in $t-1$. The variable in the line labeled "Interaction" is the interaction between these two terms. The sample consists of plants in the top 15 2-digit export sectors and E_{it} is constructed using information on the top 20 destination countries. The coefficient estimates in each column belong to different specifications. Plant fixed effects and the import shock variable I_{it} are included as additional regressors in all specifications, while different time trends are controlled for across columns. Column (1) reports the estimates obtained when including year fixed effects while columns (2) to (5) report the estimates obtained when including local labor market-year fixed effects. Columns (3), (4) and (5) show the estimates obtained when also adding 2-digit, 3-digit and 5-digit sector-year fixed effects. Standard errors clustered at the level of each local labor market × 3-digit sector are reported in parentheses. The p-values reported in the line "P-value H_0: [b] + [c]" correspond to a test of the null hypothesis that the sum of the coefficient of the terms "$\text{Shock}_{t-1} > \text{Median}_{t-1}$" and "Interaction" is equal to zero. * p-value < 0.1; ** p-value < 0.05; *** p-value < 0.01.

Table A4: Effect of Export Shock on Number of Workers and Wages
Top 100 Destinations

	(1)	(2)	(3)	(4)	(5)
	A. Log Number of Workers				
Export shock	0.140***	0.138***	0.138***	0.129***	0.103***
	(0.034)	(0.034)	(0.036)	(0.036)	(0.038)
Adjusted R^2	0.919	0.919	0.920	0.922	0.922
	B. Log Average Wage				
Export shock	0.049***	0.049***	0.045***	0.042***	0.041***
	(0.014)	(0.013)	(0.011)	(0.011)	(0.012)
Adjusted R^2	0.810	0.811	0.826	0.829	0.833
	C. Inverse Elasticity of Labor Supply				
Inverse Elasticity	0.354***	0.352***	0.329***	0.325**	0.401**
	(0.124)	(0.125)	(0.119)	(0.127)	(0.173)
	D. Elasticity of Labor Supply				
Elasticity	2.826***	2.838***	3.041***	3.073**	2.496**
	(0.993)	(1.005)	(1.101)	(1.198)	(1.077)
Plant FE	✓	✓	✓	✓	✓
Year FE	✓				
Year × LLM FE		✓	✓	✓	✓
Year × 2d Sector FE			✓		
Year × 3d Sector FE				✓	
Year × 5d Sector FE					✓
Observations	44,963	44,963	44,963	44,963	44,963

Notes: This table reports the estimated effect of the export shock E_{it} on the log of the number of workers hired by the plant (Panel A) and on the log of the average wage paid by the plant (Panel B), following the specification of equation (6) in the text. The sample consists of plants in the top 15 2-digit export sectors and E_{it} is constructed using information on the top 100 destination countries. The coefficient estimates in each column belong to different specifications. Plant fixed effects and the import shock variable I_{it} are included as additional regressors in all specifications, while different time trends are controlled for across columns. Column (1) reports the estimates obtained when including year fixed effects while columns (2) to (5) report the estimates obtained when including local labor market-year fixed effects. Columns (3), (4) and (5) show the estimates obtained when also adding 2-digit, 3-digit and 5-digit sector-year fixed effects. Standard errors clustered at the level of each local labor market × 3-digit sector are reported in parentheses. Panel C presents estimates of the inverse elasticity of the labor supply curve ε, which is obtained by dividing the coefficient in Panel B by the coefficient in Panel A, and their standard errors. Panel D reports estimates of the labor supply curve elasticity (ε^{-1}) and their standard error. * p-value < 0.1; ** p-value < 0.05; *** p-value < 0.01.

Table A5: Effect of Export Shock on Number of Workers and Wages
Top 10 Export Sectors

	A. Log Number of Workers				
	(1)	(2)	(3)	(4)	(5)
Export shock	0.140***	0.139***	0.136***	0.129***	0.098**
	(0.038)	(0.039)	(0.041)	(0.040)	(0.045)
Adjusted R^2	0.920	0.920	0.921	0.922	0.922
	B. Log Average Wage				
Export shock	0.055***	0.052***	0.044***	0.044***	0.043***
	(0.016)	(0.014)	(0.012)	(0.012)	(0.014)
Adjusted R^2	0.825	0.826	0.838	0.841	0.846
	C. Inverse Elasticity of Labor Supply				
Inverse Elasticity	0.389***	0.376**	0.325**	0.338**	0.436**
	(0.151)	(0.150)	(0.144)	(0.153)	(0.222)
	D. Elasticity of Labor Supply				
Elasticity	2.571***	2.662**	3.072**	2.956**	2.292**
	(0.995)	(1.061)	(1.355)	(1.334)	(1.164)
Plant FE	✓	✓	✓	✓	✓
Year FE	✓				
Year × LLM FE		✓	✓	✓	✓
Year × 2d Sector FE			✓		
Year × 3d Sector FE				✓	
Year × 5d Sector FE					✓
Observations	29,989	29,989	29,989	29,989	29,989

Notes: This table reports the estimated effect of the export shock E_{it} on the log of the number of workers hired by the plant (Panel A) and on the log of the average wage paid by the plant (Panel B), following the specification of equation (6) in the text. The sample consists of plants in the top 10 2-digit export sectors and E_{it} is constructed using information on the top 20 destination countries. The coefficient estimates in each column belong to different specifications. Plant fixed effects and the import shock variable I_{it} are included as additional regressors in all specifications, while different time trends are controlled for across columns. Column (1) reports the estimates obtained when including year fixed effects while columns (2) to (5) report the estimates obtained when including local labor market-year fixed effects. Columns (3), (4) and (5) show the estimates obtained when also adding 2-digit, 3-digit and 5-digit sector-year fixed effects. Standard errors clustered at the level of each local labor market × 3-digit sector are reported in parentheses. Panel C presents estimates of the inverse elasticity of the labor supply curve ε, which is obtained by dividing the coefficient in Panel B by the coefficient in Panel A, and their standard errors. Panel D reports estimates of the labor supply curve elasticity (ε^{-1}) and their standard error. * p-value $<$ 0.1; ** p-value $<$ 0.05; *** p-value $<$ 0.01.

Table A6: Effect of Export Shock on Number of Workers and Wages
Export Shares in $t-2$

	(1)	(2)	(3)	(4)	(5)
	A. Log Number of Workers				
Export shock	0.118***	0.116***	0.112***	0.108***	0.074**
	(0.032)	(0.032)	(0.033)	(0.034)	(0.036)
Adjusted R^2	0.925	0.926	0.926	0.928	0.928
	B. Log Average Wage				
Export shock	0.041***	0.041***	0.045***	0.043***	0.039***
	(0.015)	(0.013)	(0.011)	(0.012)	(0.014)
Adjusted R^2	0.816	0.817	0.832	0.835	0.838
	C. Inverse Elasticity of Labor Supply				
Inverse Elasticity	0.345**	0.352**	0.403**	0.398**	0.524*
	(0.157)	(0.160)	(0.168)	(0.174)	(0.293)
	D. Elasticity of Labor Supply				
Elasticity	2.902**	2.842**	2.480**	2.512**	1.909*
	(1.323)	(1.296)	(1.035)	(1.098)	(1.069)
Plant FE	✓	✓	✓	✓	✓
Year FE	✓				
Year × LLM FE		✓	✓	✓	✓
Year × 2d Sector FE			✓		
Year × 3d Sector FE				✓	
Year × 5d Sector FE					✓
Observations	38,873	38,873	38,873	38,873	38,873

Notes: This table reports the estimated effect of the export ehock E_{it} on the log of the plant total sales (Panel A) and on the log of the total value of production (Panel B), following the specification of equation (6) in the text. The export shocks term E_{it} is constructed following equation (5) but using destination shares computed in $t-2$ instead of shares in $t-1$. The sample consists of plants in the top 15 2-digit export sectors and E_{it} is constructed using information on the top 20 destination countries. The coefficient estimates in each column belong to different specifications. Plant fixed effects and the import shock variable I_{it} are included as additional regressors in all specifications, while different time trends are controlled for across columns. Column (1) reports the estimates obtained when including year fixed effects while columns (2) to (5) report the estimates obtained when including local labor market-year fixed effects. Columns (3), (4) and (5) show the estimates obtained when also adding 2-digit, 3-digit and 5-digit sector-year fixed effects. Standard errors clustered at the level of each local labor market × 3-digit sector are reported in parentheses. Panel C presents estimates of the inverse elasticity of the labor supply curve ε, which is obtained by dividing the coefficient in Panel B by the coefficient in Panel A, and their standard errors. Panel D reports estimates of the labor supply curve elasticity (ε^{-1}) and their standard error. * p-value < 0.1; ** p-value < 0.05; *** p-value < 0.01.

Table A7: Effect of Export Shock on Number of Workers and Wages
Export Shares 1994-97

	(1)	(2)	(3)	(4)	(5))
	A. Log Number of Workers				
Export shock	0.097***	0.098***	0.087***	0.080***	0.075**
	(0.028)	(0.028)	(0.028)	(0.029)	(0.031)
Adjusted R^2	0.932	0.932	0.933	0.934	0.936
	B. Log Average Wage				
Export shock	0.035**	0.036**	0.049***	0.046***	0.032*
	(0.018)	(0.018)	(0.017)	(0.017)	(0.017)
Adjusted R^2	0.826	0.827	0.844	0.848	0.854
	C. Inverse Elasticity of Labor Supply				
Inverse Elasticity	0.363*	0.362*	0.565**	0.571**	0.428*
	(0.198)	(0.198)	(0.254)	(0.279)	(0.264)
	D. Elasticity of Labor Supply				
Elasticity	2.758*	2.760*	1.769**	1.752**	2.337*
	(1.510)	(1.504)	(0.795)	(0.855)	(1.443)
Plant FE	✓	✓	✓	✓	✓
Year FE	✓				
Year × LLM FE		✓	✓	✓	✓
Year × 2d Sector FE			✓		
Year × 3d Sector FE				✓	
Year × 5d Sector FE					✓
Observations	30,223	30,223	30,223	30,223	30,223

Notes: This table reports the estimated effect of the export shock E_{it} on the log of the plant total sales (Panel A) and on the log of the total value of production (Panel B), following the specification of equation (6) in the text. The export shock term E_{it} is constructed following equation (5) but using destination shares equal total exports of the firm to the destination in years 1994-1997 divided by total exports to all destinations in the same years. The sample consists of plants in the top 15 2-digit export sectors and E_{it} is constructed using information on the top 20 destination countries. The coefficient estimates in each column belong to different specifications. Plant fixed effects and the import shock variable I_{it} are included as additional regressors in all specifications, while different time trends are controlled for across columns. Column (1) reports the estimates obtained when including year fixed effects while columns (2) to (5) report the estimates obtained when including local labor market-year fixed effects. Columns (3), (4) and (5) show the estimates obtained when also adding 2-digit, 3-digit and 5-digit sector-year fixed effects. Standard errors clustered at the level of each local labor market × 3-digit sector are reported in parentheses. Panel C presents estimates of the inverse elasticity of the labor supply curve ε, which is obtained by dividing the coefficient in Panel B by the coefficient in Panel A, and their standard errors. Panel D reports estimates of the labor supply curve elasticity (ε^{-1}) and their standard error. * p-value < 0.1; ** p-value $<$ 0.05; *** p-value < 0.01.

Table A8: Effect of Export Shock on Number of Workers and Wages
Leads of Export Shock

	A. Log Number of Workers				
	(1)	(2)	(3)	(4)	(5)
Export shock$_{it}$	0.087**			0.176**	0.121***
	(0.039)			(0.056)	(0.046)
Export shock$_{it+1}$		0.046		-0.108**	
		(0.036)		(0.046)	
Export shock$_{it+2}$			0.015		-0.060
			(0.032)		(0.037)
Adjusted R^2	0.935	0.935	0.935	0.935	0.935
	B. Log Average Wage				
Export shock$_{it}$	0.033**			0.024	0.032**
	(0.013)			(0.020)	(0.014)
Export shock$_{it+1}$		0.032**		0.011	
		(0.015)		(0.023)	
Export shock$_{it+2}$			0.021		0.002
			(0.015)		(0.016)
Adjusted R^2	0.861	0.861	0.861	0.861	0.861
Plant FE	✓	✓	✓	✓	✓
Year × LLM FE	✓	✓	✓	✓	✓
Year × 5d Sector FE	✓	✓	✓	✓	✓
Observations	33,935	33,935	33,935	33,935	33,935

Notes: This table reports the estimated effect of the export shock E_{it} and its leads E_{it+1} and E_{it+2} on the log of the number of workers hired by the plant (Panel A) and on the log of the average wage paid by the plant (Panel B), following the specification of equation (6) in the text. Leads of the export shock term are obtained by substituting leads in $t+1$ and $t+2$ of the real exchange rate terms for R_{dt} in equation (5). The sample consists of plants in the top 15 2-digit export sectors and E_{it} is constructed using information on the top 20 destination countries. The coefficient estimates in each column belong to different specifications. Plant fixed effects, local labor market-year, 5-digit sector year fixed effects and the import shock variable I_{it} are included as additional regressors in all specifications. Standard errors clustered at the level of each local labor market × 3-digit sector are reported in parentheses. * p-value $<$ 0.1; ** p-value $<$ 0.05; *** p-value $<$ 0.01.

Table A9: Effect of Export Shock on Number of Workers and Wages
LLM-Sector-Year FEs

	(1)	(2)	(3)	(4)
	A. Log Number of Workers			
Export shock	0.126***	0.126***	0.120***	0.092**
	(0.034)	(0.036)	(0.036)	(0.039)
Adjusted R^2	0.919	0.920	0.921	0.922
	B. Log Average Wage			
Export shock	0.045***	0.043***	0.042***	0.039***
	(0.015)	(0.011)	(0.011)	(0.012)
Adjusted R^2	0.810	0.826	0.829	0.832
	C. Inverse Elasticity of Labor Supply			
Inverse Elasticity	0.361***	0.344***	0.352***	0.423***
	(0.115)	(0.098)	(0.096)	(0.155)
	D. Elasticity of Labor Supply			
Elasticity	2.773***	2.904***	2.838***	2.364***
	(0.881)	(0.823)	(0.771)	(0.867)
Plant FE	✓	✓	✓	✓
Year FE	✓			
Year × LLM FE × 2d Sector		✓		
Year × LLM FE × 3d Sector			✓	
Year × LLM FE × 5d Sector				✓
Observations	44,963	44,963	44,963	44,963

Notes: This table reports the estimated effect of the export shock E_{it} on the log of the number of workers hired by the plant (Panel A) and on the log of the average wage paid by the plant (Panel B), following the specification of equation (6) in the text. The sample consists of plants in the top 15 2-digit export sectors and E_{it} is constructed using information on the top 20 destination countries. The coefficient estimates in each column belong to different specifications. Plant fixed effects and the import shock variable I_{it} are included as additional regressors in all specifications, while different time trends are controlled for across columns. Column (1) reports the estimates obtained when including year fixed effects. Columns (2), (3) and (4) show the estimates obtained when including local labor market-sector-year fixed effects, with the sector definition being 2-digit, 3-digit and 5-digit respectively. Standard errors clustered at the level of each local labor market × 3-digit sector are reported in parentheses. Panel C presents estimates of the inverse elasticity of the labor supply curve ε, which is obtained by dividing the coefficient in Panel B by the coefficient in Panel A, and their standard errors. Panel D reports estimates of the labor supply curve elasticity (ε^{-1}) and their standard error. * p-value < 0.1; ** p-value < 0.05; *** p-value < 0.01.

Table A10: Effect of Market Level Shocks on Number of Workers and Wages

	A. Log Number of Workers				
	(1)	(2)	(3)	(4)	(5)
Average export shock	0.134**	0.133**	0.095	0.043	0.048
	(0.058)	(0.058)	(0.060)	(0.064)	(0.069)
Adjusted R^2	0.918	0.918	0.919	0.921	0.922
Max export shock	0.007	0.014	0.028	-0.003	-0.005
	(0.021)	(0.021)	(0.022)	(0.022)	(0.023)
Adjusted R^2	0.918	0.918	0.919	0.921	0.922
	B. Log Average Wage				
Average export shock	-0.013	-0.018	-0.004	-0.007	-0.039
	(0.054)	(0.049)	(0.034)	(0.038)	(0.042)
Adjusted R^2	0.812	0.813	0.828	0.831	0.835
Max export shock	-0.037**	-0.018	0.021*	0.003	-0.003
	(0.016)	(0.016)	(0.013)	(0.013)	(0.014)
Adjusted R^2	0.812	0.813	0.827	0.831	0.835
Plant FE	✓	✓	✓	✓	✓
Year FE	✓				
Year × LLM FE		✓	✓	✓	✓
Year × 2d Sector FE			✓		
Year × 3d Sector FE				✓	
Year × 5d Sector FE					✓
Observations	42,677	42,677	42,677	42,677	42,677

Notes: This table reports the estimated effect of market level export shocks on the log of the number of workers hired by the plant (Panel A) and on the log of the average wage paid by the plant (Panel B), following the specification of equation (6) in the text. In lines labeled "Average export shock" the measure of export shock is the average of the export shock E_{it} across plants in the same local labor market and three digit sector of plant i leaving plant i out of the average. In lines labeled "Max export shock"the measure of export shock is the maximum export shock E_{it} among plants in the same local labor market and three digit sector of plant i but leaving plant i out of this set. The sample consists of plants in the top 15 2-digit export sectors and the export shock is constructed using information on the top 20 destination countries. The coefficient estimates in each column belong to different specifications. Plant fixed effects and the import shock variable I_{it} are included as additional regressors in all specifications, while different time trends are controlled for across columns. Column (1) reports the estimates obtained when including year fixed effects while columns (2) to (5) report the estimates obtained when including local labor market-year fixed effects. Columns (3), (4) and (5) show the estimates obtained when also adding 2-digit, 3-digit and 5-digit sector-year fixed effects. Standard errors clustered at the level of each local labor market × 3-digit sector are reported in parentheses. * p-value < 0.1; ** p-value < 0.05; *** p-value < 0.01.

Table A11: Effect of Export Shock on Number of Workers and Wages
Blue Collar Workers

	(1)	(2)	(3)	(4)	(5)
	A. Log Number of Workers				
Export shock	0.113***	0.111***	0.112***	0.104***	0.080***
	(0.024)	(0.024)	(0.024)	(0.025)	(0.026)
Adjusted R^2	0.903	0.903	0.905	0.906	0.908
	B. Log Average Wage				
Export shock	0.046***	0.047***	0.039***	0.037***	0.023*
	(0.014)	(0.014)	(0.013)	(0.013)	(0.014)
Adjusted R^2	0.726	0.727	0.745	0.749	0.756
	C. Inverse Elasticity of Labor Supply				
Inverse Elasticity	0.408***	0.426***	0.349***	0.350**	0.293
	(0.146)	(0.150)	(0.134)	(0.144)	(0.185)
	D. Elasticity of Labor Supply				
Elasticity	2.451***	2.350***	2.868***	2.855**	3.418
	(0.880)	(0.829)	(1.103)	(1.178)	(2.156)
Plant FE	✓	✓	✓	✓	✓
Year FE	✓				
Year × LLM FE		✓	✓	✓	✓
Year × 2d Sector FE			✓		
Year × 3d Sector FE				✓	
Year × 5d Sector FE					✓
Observations	44,204	44,204	44,204	44,204	44,204

Notes: This table reports the estimated effect of the export shock E_{it} on the log of the number of blue collar workers hired by the plant (Panel A) and on the log of the average wage paid by the plant to blue collar workers (Panel B), following the specification of equation (6) in the text. The sample consists of plants in the top 15 2-digit export sectors and E_{it} is constructed using information on the top 20 destination countries. The coefficient estimates in each column belong to different specifications. Plant fixed effects and the import shock variable I_{it} are included as additional regressors in all specifications, while different time trends are controlled for across columns. Column (1) reports the estimates obtained when including year fixed effects while columns (2) to (5) report the estimates obtained when including local labor market-year fixed effects. Columns (3), (4) and (5) show the estimates obtained when also adding 2-digit, 3-digit and 5-digit sector-year fixed effects. Standard errors clustered at the level of each local labor market × 3-digit sector are reported in parentheses. Panel C presents estimates of the inverse elasticity of the labor supply curve ε, which is obtained by dividing the coefficient in Panel B by the coefficient in Panel A, and their standard errors. Panel D reports estimates of the labor supply curve elasticity (ε^{-1}) and their standard error. * p-value $<$ 0.1; ** p-value $<$ 0.05; *** p-value $<$ 0.01.

Table A12: Effect of Export Shock on Share of Blue Collar Workers

	A. Share of blue collar workers				
	(1)	(2)	(3)	(4)	(5)
Export shock	-0.002	-0.003	-0.001	-0.002	-0.003
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
Adjusted R^2	0.733	0.734	0.736	0.737	0.739
Plant FE	✓	✓	✓	✓	✓
Year FE	✓				
Year × LLM FE		✓	✓	✓	✓
Year × 2d Sector FE			✓		
Year × 3d Sector FE				✓	
Year × 5d Sector FE					✓
Observations	44,963	44,963	44,963	44,963	44,963

Notes: This table reports the estimated effect of the export shock E_{it} on the ratio of blue collar workers to total employment of the plant, following the specification of equation (6) in the text. The sample consists of plants in the top 15 2-digit export sectors and E_{it} is constructed using information on the top 20 destination countries. The coefficient estimates in each column belong to different specifications. Plant fixed effects and the import shock variable I_{it} are included as additional regressors in all specifications, while different time trends are controlled for across columns. Column (1) reports the estimates obtained when including year fixed effects while columns (2) to (5) report the estimates obtained when including local labor market-year fixed effects. Columns (3), (4) and (5) show the estimates obtained when also adding 2-digit, 3-digit and 5-digit sector-year fixed effects. Standard errors clustered at the level of each local labor market × 3-digit sector are reported in parentheses. * p-value < 0.1; ** p-value < 0.05; *** p-value < 0.01.

Table A13: Effect of Export Shock on Investment, Additional Measures

	(1)	(2)	(3)	(4)	(5)
	A. Investment > 25% capital				
Export shock	-0.007	-0.009	-0.018	-0.021	-0.023
	(0.021)	(0.021)	(0.021)	(0.021)	(0.023)
Observations	43,967	43,967	43,967	43,967	43,941
Adjusted R^2	0.0671	0.0673	0.0683	0.0698	0.0720
	B. Investment in Machines and Equipment > 25% capital				
Export shock	0.006	0.009	0.002	-0.002	0.006
	(0.017)	(0.018)	(0.018)	(0.018)	(0.019)
Observations	43,967	43,967	43,967	43,967	43,941
Adjusted R^2	0.0769	0.0768	0.0777	0.0777	0.0783
Plant FE	✓	✓	✓	✓	✓
Year FE	✓				
Year × LLM FE		✓	✓	✓	✓
Year × 2d Sector FE			✓		
Year × 3d Sector FE				✓	
Year × 5d Sector FE					✓

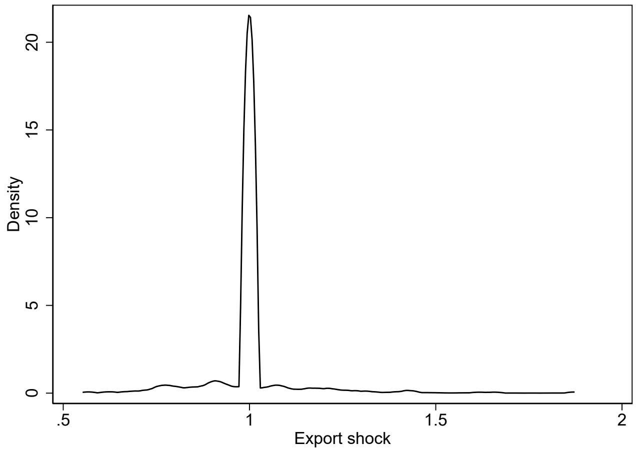
Notes: This table reports the estimated effect of the export shock E_{it} on additional investment variables. In Panel A, the outcome is a dummy equal to one if the ratio of investment to total capital in year t is higher than 25%. In Panel B, the outcome is a dummy equal to one if the ratio of total purchases of machinery and equipment to total capital in year t is higher than 25%. Column (1) reports the estimates obtained when including year fixed effects while columns (2) to (5) report the estimates obtained when including local labor market-year fixed effects. Columns (3), (4) and (5) show the estimates obtained when also adding 2-digit, 3-digit and 5-digit sector-year fixed effects. Standard errors clustered at the level of each local labor market × 3-digit sector are reported in parentheses. * p-value $<$ 0.1; ** p-value $<$ 0.05; *** p-value $<$ 0.01.

Table A14: Effect of Export Shock on Number of Workers and Wages
Sectors with Low Propensity to Upgrade

	(1)	(2)	(3)	(4)	(5)
	A. Sector Propensity to Upgrade < Median				
	Log Number of Workers				
Export shock	0.177***	0.176***	0.171***	0.149***	0.124***
	(0.043)	(0.044)	(0.044)	(0.046)	(0.045)
Observations	11,526	11,526	11,526	11,526	11,526
Adjusted R^2	0.922	0.922	0.925	0.927	0.929
	Log Average Wage				
Export shock	0.057**	0.068**	0.091***	0.087***	0.076***
	(0.028)	(0.028)	(0.022)	(0.023)	(0.025)
Observations	11,526	11,526	11,526	11,526	11,526
Adjusted R^2	0.792	0.793	0.820	0.822	0.824
	B. Sector Propensity to Upgrade < Pct. 25				
	Log Number of Workers				
Export shock	0.238***	0.233***	0.345***	0.322***	0.292***
	(0.076)	(0.074)	(0.079)	(0.083)	(0.096)
Observations	2,522	2,522	2,522	2,522	2,522
Adjusted R^2	0.926	0.927	0.932	0.933	0.936
	Log Average Wage				
Export shock	0.112**	0.088*	0.108**	0.137***	0.139**
	(0.045)	(0.047)	(0.047)	(0.048)	(0.056)
Observations	2,522	2,522	2,522	2,522	2,522
Adjusted R-squared	0.833	0.836	0.854	0.855	0.858
Plant FE	✓	✓	✓	✓	✓
Year FE	✓				
Year × LLM FE		✓	✓	✓	✓
Year × 2d Sector FE			✓		
Year × 3d Sector FE				✓	
Year × 5d Sector FE					✓

Notes: This table reports the estimated effect of the export shock E_{it} on the log of the number of workers hired by the plant and on the log of the average wage paid by the plant, following the specification of equation (6) in the text and for samples of sectors with low propensity to upgrade. To obtain a sample of sectors with low propensity to upgrade, we compute for each plant a dummy equal to one if the plant introduced in year t a new product with a price above the 75th percentile of the distribution of its product prices. The average of this dummy across all years and plants in each 3-digit sector is its propensity to upgrade. We consider plants in sectors with a propensity to upgrade below the median (Panel A) and below the 25th percentile (Panel B). Furthermore, the sample consists of plants in the top 15 2-digit export sectors and E_{it} is constructed using information on the top 20 destination countries. The coefficient estimates in each column belong to different specifications. Plant fixed effects and the import shock variable I_{it} are included as additional regressors in all specifications, while different time trends are controlled for across columns. Column (1) reports the estimates obtained when including year fixed effects while columns (2) to (5) report the estimates obtained when including local labor market-year fixed effects. Columns (3), (4) and (5) show the estimates obtained when also adding 2-digit, 3-digit and 5-digit sector-year fixed effects. Standard errors clustered at the level of each local labor market × 3-digit sector are reported in parentheses. * p-value < 0.1; ** p-value < 0.05; *** p-value < 0.01.

Figure A1: Export Shock Distribution



Notes: This figure shows the distribution of the exchange rate-driven export shocks in our sample. A shock greater than one corresponds to an overall depreciation of the Colombian peso relative to the currencies of the destination where the plant exports. A shock lower than one corresponds to an overall appreciation. A shock equal to one corresponds to observations of plants that did not export.

Figure A2: Metropolitan Areas in Colombia

Notes: This figure shows in the map of Colombia the location of metropolitan areas that we consider as local labor markets in our exercises. Each metropolitan area is composed of a main urban center and its associated municipalities. The plants in the EAM in our sample belong to 13 different metropolitan areas which are labeled in the map. These are: 1. Barranquilla: city of Barranquilla and municipality of Soledad. 2. Cartagena: city of Cartagena. 3. Montería: city of Montería. 4. Cúcuta: city of Cúcuta and municipalities of Villa del Rosario, Los Patios, and El Zulia. 5. Bucaramanga: city of Bucaramanga and municipalities of Floridablanca, Girón, and Piedecuesta. 6. Medellín: city of Medellín and municipalities of Barbosa, Bello, Caldas, Copacabana, Envigado, Girardota, Itagui, La Estrella, and Sabeneta. 7. Manizales: city of Manizales and municipality of Villa María. 8. Pereira: city of Pereira and municipalities of Dos Quebrada and La Virginia. 9. Ibagúe: city of Ibagué. 10. Bogotá: city of Bogotá. 11. Villavicencio: city of Villavicencio. 12. Cali: city of Cali and municipality of Yumbo. 13. Pasto: city of Pasto.