Local Economic Development Through Export-Led Growth: The Chilean Case * †

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Abstract

We study the causal impact of export growth on Chilean local economic development by exploiting spatial and time variations in local exposure arising from past differences in industry specialization across local labor markets and the evolution of tariffs and exports across industries. We find that growing exports implied a significant reduction in labor informality and labor income gains in more exposed local markets, driven by job creation and wage growth in the formal sector. These effects concentrate on senior skilled workers. Exposed locations also exhibit a relative decline in monetary poverty.

JEL Classification: F14, F16, J23, J31, O17, Q02, R12, R23.

Keywords: Export Growth, Tariff Cuts, Local Labor Markets, Employment, Informality, Wages, Poverty, Chile.

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I Introduction

Classic trade models underline the differential impacts of trade on employment and wages across sectors, occupations and skill groups (Heckscher-Ohlin, Ricardo-Viner). A recent and booming literature emphasizes the spatial dimension by documenting substantial differences in the effects of trade on individuals living in geographic locations with different patterns of industrial specialization.[1] Following these advances, we study the causal effect of export growth on local economic development in an small and open economy such as Chile.

We exploit spatial and time variations in local exposure arising from past differences in industry specialization across geographic locations and the evolution of export growth (and tariffs cuts) across industries. We focus on typical outcomes such as employment, labor informality, wages, and monetary poverty. Our findings allow us to conclude that in the Chilean case export growth have promoted local economic development through the creation of better paid formal jobs.

Figure 1 depicts the unconditional correlation between the change in poverty rate (FGT0) and the change in exports between 2000 and 2006 at the level of Chilean local labor markets (LLMs). First, we note that the vast majority of LLMs exhibit both a growth in exports and a strong decline in monetary poverty. Second, it shows that locations more exposed to export growth exhibit a greater relative decline in monetary poverty.[2] Throughout the paper we will demonstrate that this relationship is causal and we will investigate the mechanisms behind this finding.

The empirical strategy is very close to the shift-share design proposed by Bartik (1991).[3] For identification we exploit two sources of variation: (i) Export growth (and tariff cuts) vary over time and across industries; and (ii) Chilean LLMs exhibit different patterns of industry specialization. These patterns are constructed using 1992 census data, a date prior to the period under study (2000-2006). To address the possible endogeneity of export growth, we use the average industry tariff cut across destination countries as an instrument for exports, assuming that tariffs' changes are not driven by the actions of Chilean firms and workers. The exogeneity of LLM's employment industrial composition assumes that unobserved industry shocks do not affect regional outcomes through the same combination of exposure shares. We conduct a pre-trend analysis to justify this assumption and perform a robustness exercise applying the econometric framework developed by Borusyak, Hull, and Jaravel (2021). Under this framework, identification follows from the quasi-random assignment of shocks, exposure shares are allowed to be endogenous

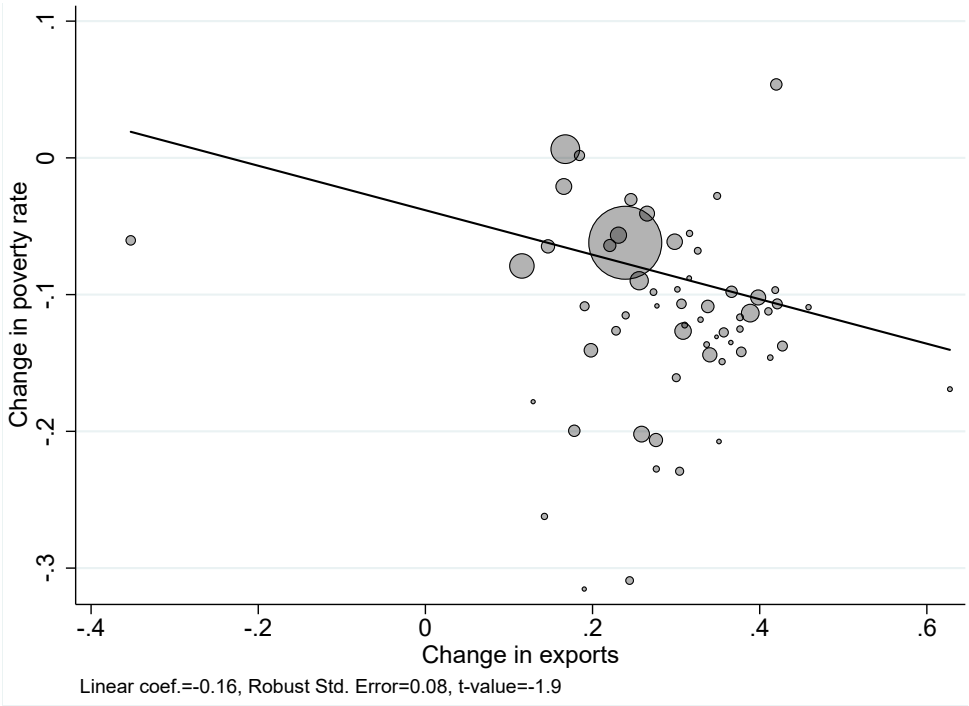
[1] Topalova (2010), Kovak (2013), Autor, Dorn, and Hanson (2013), Dauth, Suedekum, and Findeisen (2014), Costa, Garred, and Pessoa (2016), Dix-Carneiro and Kovak (2017), Caliendo, Dvorkin, and Parro (2019), among many others.

[2] The relation also holds if we use the local change in export tariffs instead of the change in exports. See Figure A1 in the appendix.

[3] This method has also been applied by many recent papers (e.g. Topalova (2010), Kovak (2013), Autor et al. (2013), Costa et al. (2016), Dix-Carneiro and Kovak (2017; 2019)).

and standard errors can be clustered at the industry-level. Our estimates deliver relative effects across geographic units but cannot account for the aggregate effects of growing exports, which depend on spillovers across industries in different locations and other general equilibrium effects operating through changes in input and output prices, firms' productivity and aggregate demand multiplier effects.[4]

Figure 1
Export growth and poverty decline



Notes. Observations = 60 local labor markets (LLMs). The change in exports across LLMs (horizontal axis) measured as the interaction of local industry employment shares in 1992 and the evolution of (log) exports across industries between 2000 and 2006. The change in poverty rate across LLMs (vertical axis) between 2000 and 2006 calculated using a poverty line of USD 5.5 per day per person. Fitted line weighted by LLM's share of Chile's population of working age in 1992 (bubble size). LLMs are defined by Casado-Díaz et al. (2017). Sources. 1992 Chilean census, CASEN, BACI.

The main data set comes from the Chilean national household survey (*Encuesta de Caracterización Socioeconómica Nacional-CASEN*) conducted by the Chile's Ministry of Planning (MIDEPLAN) every two or three years.[5] We also use information from the 1992 Chilean demographic census (*Censo Nacional de Población y de Vivienda*) sourced from the Chile's National Institute of Statistics (*Instituto Nacional de Estadística-INE*). To construct the measure of export growth and export tariff cuts at the industry-level we employ two datasets: the BACI database (*Centre d'Etudes Prospectives et d'Informations Internationales-CEPII*) and the United Nations Conference on Trade and Development (UNCTAD) Trade Analysis Information System (TRAINS).

The baseline estimation equation regresses each outcome variable (labor informality rates, employment, average wages, monetary poverty) on exports exposure. We include

[4]See for instance Acemoglu, Autor, Dorn, Hanson, and Price (2016) and Caliendo et al. (2019).
[5]The CASEN survey is national in scope and includes information on more than 300 municipalities (*comunas*) which are aggregated into 61 LLMs.

LLM and region-year fixed effects so we are exploiting within-LLM variation over time in each region. The preferred specification also controls for several preexisting trends. Exports exposure is endogenous because industry shocks affecting the labor market might be correlated with shocks to exports supply. Therefore we instrument exports exposure with the average industry tariff cuts, again, assuming that tariff changes do not depend on the behavior of Chilean firms and workers. The results of first-stage regressions suggest that the instrument has a strong predictive power.

We find that locations with greater exposure to growing exports experienced a relative decline in labor informality and a rise in labor income, which were driven by job creation and wage gains in the formal sector of the economy. These gains concentrated in the group of senior (41 to 65 years old) skilled workers, i.e. those with at least one year of tertiary education completed; supporting the idea that these workers are most in demand by exporting firms. In this line, the two occupations with the greatest relative increase in employment were production managers and engineers and technicians. This last group, as well as machine operators, assemblers and clerical workers also exhibit relative wage gains. Exposed locations also experience a relative decline in monetary poverty.

Our paper fits in the vast literature studying the effects of exports on domestic firms, workers, and markets. Exporters typically pay higher wages and hire more workers than non-exporters (Bernard and Jensen 1999; Bernard et al., 2007), while there is also an exporter skilled wage premium explained by quality provision and skill upgrading (Verhoogen, 2008; Brambilla et al., 2012), profit sharing and the provision of specialized skilled tasks (Matsuyama, 2007). Moreover, greater access to foreign markets encourages firms to simultaneously export and invest in raising productivity and product quality (Lileeva and Trefler, 2010; Atkin et al., 2017). At the spatial level, greater access to developed country markets reduced poverty, shifted labor away from agriculture and created formal jobs in Vietnam (McCaig, 2011; McCaig and Pavcnik, 2018). In China, counties more exposed to the reduction in tariff uncertainty post China's accession to the World Trade Organization in 2001 experienced growing exports and foreign direct investment, and higher total and per capita GDP (Erten and Leight, 2021). On the other hand, domestic tariff cuts that increased import competition slowed the pace of poverty reduction and wage growth in India and Brazil (Topalova, 2010; Dix-Carneiro and Kovak, 2017).

Our work is also closely related to recent papers studying the impact of both supply and demand shocks on local labor markets. César, Falcone, and Gasparini (2021) document that Chilean LLMs more exposed to Chinese import competition exhibit a relative rise in labor informality, especially among young and unskilled workers, and locations more exposed to growing demand for primary products experience employment gains for the young and reallocation from self-employment towards formal salaried jobs and relative wage gains among old-age workers. Dauth et al. (2014, 2017) finds that German locations specialized in export-oriented industries have had employment

gains that outweighed the employment losses of regions specialized in import-competing industries, concluding that in Germany globalization fostered manufacturing employment. Egger, Kaynak, and Zoller-Rydzek (2020) documents similar findings for Turkey. Costa et al. (2016) find that Brazilian microregions more exposed to import competition exhibit relative slower growth in manufacturing wages than less exposed areas, while locations specialized in commodities have had relative wage gains and shifts towards formal employment.

We contribute to this literature by providing causal evidence on the heterogeneous effects of export growth across sub-population groups by exploiting spatial and time variations in exports exposure across local labor markets in a small and open developing economy. Our results confirm previous findings in the literature and contribute with solid empirical evidence that growing exports enhance the creation of better jobs that promote local economic development and contribute to reducing monetary poverty.

The rest of the paper organizes as follows. Section II discusses the empirical strategy and includes a detailed description of the data and summary statistics. All empirical findings are presented and discussed in Section III. We finish with some concluding remarks in Section IV. Additional figures and tables are included in the Appendix.

II Empirical strategy

II.1 Approach and identification

Our empirical strategy exploits cross-local labor market variation in the evolution of exports exposure (and export tariffs) stemming from the interaction of initial differences in local employment composition by industry and the temporal evolution of exports (and export tariffs) across industries. Locations with a higher initial participation of workers in largely exposed industries such as crop production, farming of animals or forestry and logging will be more exposed to export growth. The industrial composition of employment across LLMs is constructed using 1992 census data, some years before the period under study (2000-2006).

In order to study the effect of growing exports on Chilean LLMs we estimate the following regression equation:

$$Y_{lt} = \beta_0 + \beta_1 EE_{lt} + \alpha_l + \gamma_r \times \delta_t + Y_{l,2000} \times \delta_t + \varepsilon_{lt} \tag{1}$$

where Y is an outcome of interest such as the log average wage of formal salaried workers and l and t index LLMs and time, respectively.

EE is a measure of exports exposure at the LLM-level, constructed as the interaction between the initial pattern of industrial composition in each LLM, as given by the local

employment share in 1992 (w_{rj}^{1992}), and the log value of exports at the industry-level:

$$EE_{lt} = \sum_{j} w_{lj}^{1992} Log(exports)_{jt} \tag{2}$$

Dependent variables (Y_{lt}) are labor market outcomes such as the labor informality rate, (log) number of formal salaried jobs, (log) number of informal salaried jobs, (log) number of self-employment jobs, (log) average monthly formal wage, (log) average monthly informal wage, (log) average monthly self-employment income, (log) average household per capita income, and poverty rate (FGT0). To account for potential heterogeneous effects, we run separate regressions for different sub-population groups according to skill and age. In all cases we include LLM (α_l) and region-year ($\gamma_r \times \delta_t$) fixed effects and therefore exploit within LLM variation in exports exposure over time in each region. The preferred specification controls also for several preexisting trends: (i) Demographic variables: percentage of child under ages 0-17 in population, fractions of population under ages 18-35, 36-49, 50-65, and above 65, percentages of population with primary education-or below, secondary education, and tertiary education; (ii) Economic variables: local employment shares in the primary and manufacturing sectors, female labor force participation, and average household per capita income; (iii) Exposure to trade with China; (iv) Exposure to offshoring; and (v) Exposure to routine task content of jobs.

We weight each observation by the 1992 LLM share of national labor force. This estimation strategy provides average treatment effects that are weighted by workers instead of LLMs (as in Autor et al. (2013) and Costa et al. (2016)). We present and discuss the results of unweighted regressions in the section of robustness exercises.

EE_{lt} is potentially endogenous because industry shocks affecting local labor market outcomes (e.g. shocks to input or output markets, technological progress, changes in preferences) are correlated with the supply of exports. To account for this endogeneity concern, we instrument exports exposure using a measure of local exposure to export tariffs cuts ($Tariff_{lt}$). Specifically:

$$Tariff_{lt}^{IV} = \sum_{j} w_{lj}^{1992} Tariff_{jt} \tag{3}$$

where $Tariff_{jt}$ is the average industry tariff across destination countries. Intuitively, this variable serve as an instrument for export growth if it is capable of capturing a demand-driven shock that allows Chile to increase its exports of different products within specific manufacturing and primary industries over time in response to declining export tariffs in destination countries. This variable is exogenous as it does not depend on the decisions of Chilean firms or workers. The identifying assumptions are that (i) tariff cuts are not driven by Chilean demand and supply industry shocks, (ii) LLMs with a higher initial share of labor allocated to industries with larger export growth are not differentially

affected by other labor market shocks or trends; and (iii) export shocks do not affect labor mobility across LLMs in the short-run.

Assumption (i) is justified in the context of tariffs cuts being implemented by third countries (i.e. export partners) and the relatively small size of the Chilean economy. For asumptions (ii) we conduct a pre-trend analysis. Assumption (iii) states that estimates may be biased if workers migrate across locations in response to export shocks.[6] Unfortunately, the CASEN surveys do not include questions related to migration status until 2009. To partially alleviate this concern we run regressions using total population and population of working age (both in logs) as dependent variables and we find that population does not shift across locations in response to changes in exports exposure.

II.2 Data and descriptives

We combine four data sets: household surveys, a demographic census, trade data and tariffs data. The Chilean national household survey (*Encuesta de Caracterización Socioeconómica Nacional-CASEN*) is conducted by Chile's Ministry of Planning (MIDEPLAN) every two or three years. We base our analysis on the 2000, 2003, and 2006 surveys. We do not include the following surveys (i.e. 2009 and 2012) because tariff changes in these years are not correlated with export growth across industries (see discussion in the following section), which is required for the first-stage to work. We also incorporate the 1994 survey to conduct a pre-trend exercise. These surveys provide information on Chilean workers located in different LLMs throughout the country. The employment module includes information on employment status, sources of labor income, pension access, and municipality of residence (*comuna*), among other relevant variables.

We adopt two alternative definitions for labor informality. First, we compute the share of salaried workers that have no right to receive a pension when retired, in the sense that they do not contribute to any pension fund. This is our preferred definition because it is based on social security access, and it is also related to international standards suggested by the International Labour Organization (ILO). Second, we incorporate self-employed workers without a college degree to the group of informal workers, which allows us to consider a larger fraction of workers, not only salaried ones. This definition of labor informality partially accounts for the potential mobility of (unskilled) workers between salaried and self-employment jobs.

We restrict the sample to individuals under ages 18 to 65. To identify local labor markets (LLMs) we follow the definition proposed by Casado-Díaz, Rowe, and Martínez-Bernabéu (2017).[7] We construct all the relevant variables at the LLM-level

[6] Previous evidence suggests that Chilean workers do not migrate in response to trade shocks (César, Falcone, and Gasparini (2021). Relatedly, Dix-Carneiro and Kovak (2017) finds that there is imperfect labor mobility across Brazilian microregions in the context of trade liberalization.

[7] The authors created a data set classifying 302 municipalities into 62 LLMs by means of an optimization algorithm based on evolutionary computation using commuting data from the Chilean Internal Migration Database (CHIM) and Censuses data for 1982, 1992 and 2002.

using population weights.

Additionally, we use the 1992 Chilean demographic census (*Censo Nacional de Población y de Vivienda*) sourced from Chile's National Institute of Statistics (*Instituto Nacional de Estadística-INE*). These data is used to construct the initial pattern of industry specialization in each LLM, as measured by local employment shares at the three-digit industry-level. This variable is interacted with the log of total exports and the (weighted) average tariff, both of which vary across industries and time.[8] It is worth noting that we count on census data that includes the complete sample of Chilean population, which minimizes potential measurement errors.

Data on exports by industry and year comes from the BACI data set elaborated by the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). Tariffs data was obtained from the United Nations Conference on Trade and Development (UNCTAD) Trade Analysis Information System (TRAINS). We calculate a weighted average industry tariff across destination countries.

Trade variables

Between 2000 and 2006 Chilean exports more than tripled, from 18.9 to 60.3 billion USD. The increase in exports was generalized across industries. However, Chilean exports exhibit a high degree of concentration, e.g. in 2006 more than 60 percent of exports concentrate in two single industries, Manufacture of basic precious and non-ferrous metals (37.4 percent of total exports) and Mining of non-ferrous metal ores (24.8 percent). The period under study includes the first years of the commodity boom (e.g. between 2003 and 2006 the international price of copper doubled). Our results are robust to controlling for the participation of the mining sector in local employment, and also to excluding LLMs with the highest participation of mining. On the other side, imports more than doubled during these years, from 17.4 to 38.2 billion USD. Chilean imports are much more diversified than its exports. The industries with the higher import share in 2006 are Extraction of crude petroleum and natural gas (15.4 percent), Manufacture of motor vehicles (9 percent), and Manufacture of refined petroleum products (6.5 percent).

Table 1 shows that the period under study characterizes by a strong trade liberalization, as there were large declines in both export and import tariffs. Export tariffs across industries decreased on average from 10.3 percent in 2000 to 5.7 percent in 2006, while import tariffs diminished on average from 14.5 percent to 9.7 percent during the same period, and there is a lot of variability across industries.

Are these changes in trade tariffs correlated with changes in trade flows? Figure 2 answers this question. The upper panel shows that most industries saw a decline in export tariffs between 0 a 10 p.p., and that industries with a larger reduction in tariffs exhibit

[8]To perform the matching between census and trade data we created a concordance table that assigns each three-digit industry reported in the 1992 Census to a single four-digit industry of the International Standard Industrial Classification (Rev. 4).

a higher increase in exports. This correlation is key to our identification strategy. On the imports side, the lower panel shows that most industries exhibit a decline in import tariffs between 4 and 6 p.p., but these changes in tariffs are not correlated with changes in import flows across industries. This is the main reason why we focus most of our analysis on studying the causal effect of export growth only. However, we conduct a robustness exercise incorporating the import side to verify that our main findings are robust to this inclusion.

Figure 3 depicts the spatial distribution of the 2000-20006 change in exports exposure and tariffs cuts across Chilean LLMs. Darker colors correspond to LLMs that exhibit a higher value of $\overline{\Delta EE}$ and $\overline{\Delta Tariffs}$ and, therefore, are more exposed to these shocks. We separate LLMs' exposition using different percentiles of the $\overline{\Delta EE}$ and $\overline{\Delta Tariffs}$ distribution as thresholds (p5, p10, p25, p50, p75, p95). Both export growth and tariff cuts concentrate in LLMs located in the Central region such as Cabildo, Carahue, Rengo and Melipilla. The map highlights that regions more exposed to export growth are very similar to those more exposed to export tariffs cuts, i.e. the first-stage works in the expected direction. Indeed, the unconditional correlation between $\overline{\Delta EE}$ and $\overline{\Delta Tariffs}$ across LLMs is 0.70, and it is statistically significant at the 1 percent level.

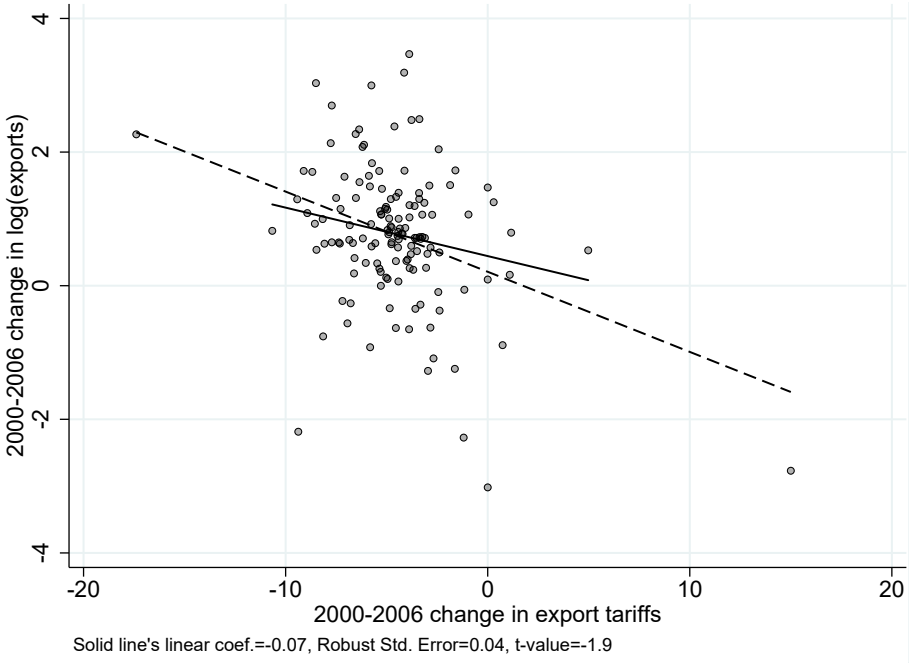
Table 1. Evolution of tariffs and trade flows

	Mean	SD	P10	P25	P50	P75	P90
Panel A: Export tariffs							
2000	10.3	5.0	4.6	6.9	10.0	12.9	16.3
2006	5.7	4.6	1.2	2.6	5.1	7.6	11.0
Panel B: Exports (millions of 2015 USD)							
2000	134.2	565.6	0.4	1.9	10.4	43.6	167.0
2006	421.5	2287.0	0.5	4.5	20.3	91.4	484.7
Panel C: Import tariffs							
2000	14.5	1.8	14.3	14.3	14.3	14.3	14.3
2006	9.7	1.8	8.9	9.3	9.6	9.8	10.0
Panel B: Imports (millions of 2015 USD)							
2000	120.8	232.4	3.0	10.2	43.5	124.6	317.8
2006	268.9	632.4	5.7	19.9	84.4	286.5	640.1
Number of industries				139			

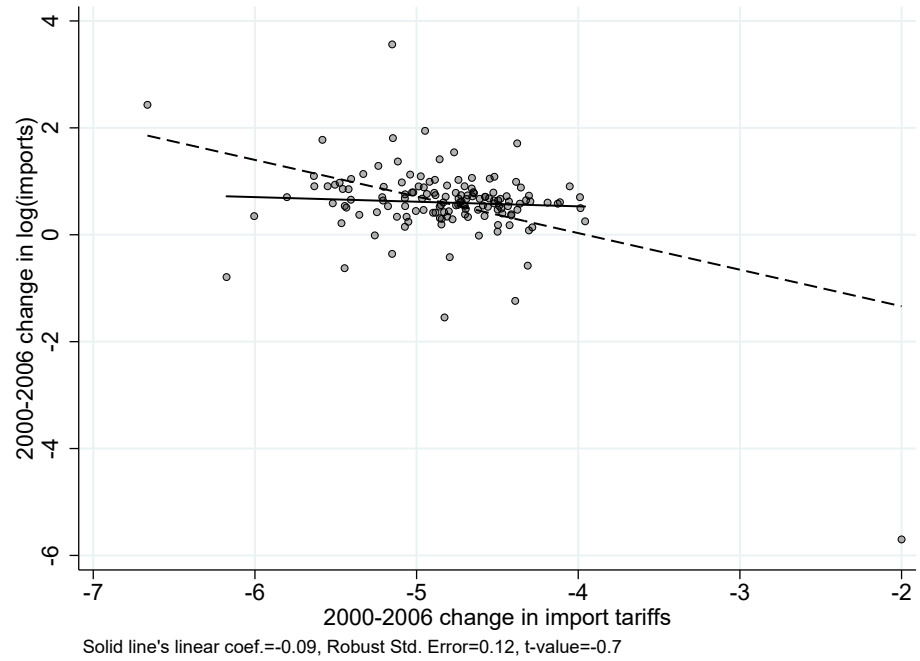
Notes. Trade values measured in constant million USD. Industries defined at the four-digits the International Standard Industrial Classification (Rev. 4). Sources: BACI and TRAINS.

Figure 2
Correlation between changes in tariffs and trade flows at the industry-level

(a) Exports

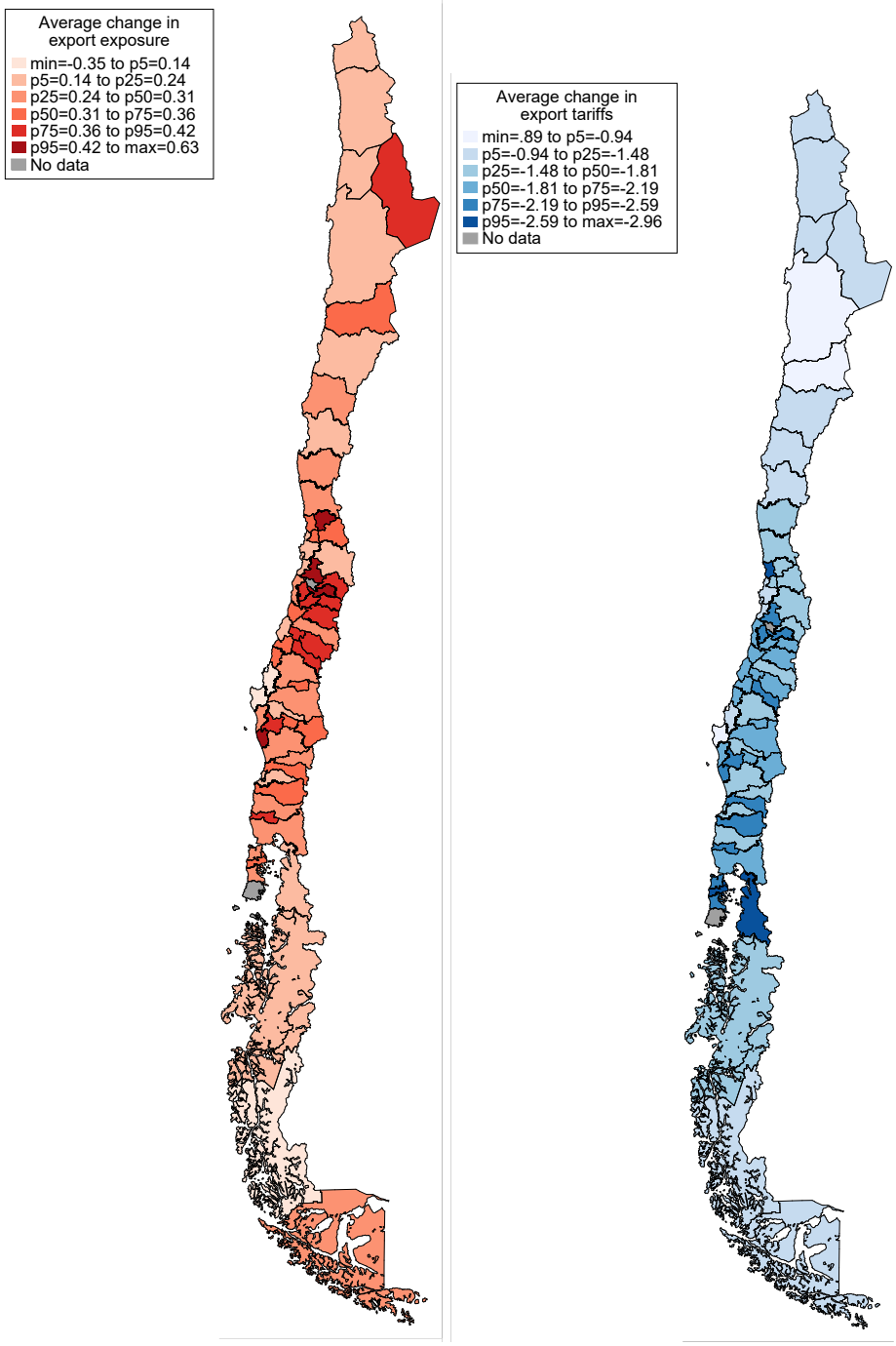


(b) Imports



Notes. Observations = 139. Industries defined at the four-digit of the International Standard Industrial Classification (Rev. 4). The solid lines exclude 1 percent outliers in each variable. Sources: BACI and TRAINS.

Figure 3
Spatial distribution of exports and tariffs changes



Notes. The change in exports exposure-left (the change in export tariffs-right) across LLMs measured as the interaction of local industry employment shares in 1992 and the evolution of log exports (average tariffs) across industries and time. This figure plots the 2000-2006 change in each of these variables across LLMs over time. LLMs are defined by Casado-Díaz et al. (2017). Sources. 1992 Chilean census, BACI, and TRAINS.

Labor market variables

Table 2 presents descriptive statistics for the most relevant variables at the LLM level. We report the average and standard deviation (in parenthesis) across LLMs for each year of the sample period. The period under study exhibits a considerable improvement in

labor market outcomes. The average employment rate increased by 4.3 p.p. between 2000 and 2006. The unemployment rate fell accordingly, from 10.3 percent in 2000 to 7.3 percent in 2006. The labor informality rate decreased from 22.4 percent to 19.3 percent, and this was mainly driven by the creation of formal salaried jobs, which increased by 19.4 percent between 2000 and 2006. The average formal wage exhibits a small decline (-3 percent), while informal wage and self-employment income grew by 7.4 percent and 8.5 percent, respectively. The average poverty rate declined by 7 p.p. between 2003 and 2006. In line with trade statistics described above, the average exports exposure increased from 4.32 in 2000 to 4.58 in 2006. While average exports tariffs diminished from 4.23 to 2.66 during this period.

Table 2. Local labor markets statistics

	2000	2003	2006
Employment rate	0.585	0.603	0.628
	(0.048)	(0.046)	(0.046)
Unemployment rate	0.103	0.098	0.073
	(0.023)	(0.020)	(0.020)
Labor informality rate	0.224	0.217	0.193
	(0.055)	(0.049)	(0.040)
Labor informality rate*	0.358	0.358	0.336
	(0.067)	(0.068)	(0.060)
Formal wage jobs	610.3	657.0	729.0
	(643.0)	(694.6)	(768.1)
Informal wage jobs	151.1	164.6	163.6
	(155.0)	(171.2)	(170.7)
Self-employment jobs	172.3	181.6	212.3
	(178.8)	(187.0)	(222.2)
Formal wage	724.6	688.1	702.5
	(172.5)	(127.6)	(128.6)
Informal wage	349.8	353.3	375.6
	(66.7)	(78.6)	(79.6)
Self-employment income	446.2	444.8	484.3
	(98.0)	(101.4)	(99.8)
Poverty rate (FGT0)	0.40	0.40	0.33
	(0.12)	(0.11)	(0.09)
Exports exposure	4.32	4.38	4.58
	(1.60)	(1.64)	(1.66)
Tariffs (IV)	4.23	3.63	2.66
	(1.21)	(1.07)	(0.94)
Number of districts	60	61	61
Number of observations	225 183	229 956	231 346

Notes. Labor market statistics are restricted to adults under ages 18-65. Each value represents the weighted average across LLMs for each year. Standard deviation is in brackets. Weights are LLM's share of country's population of working age in 1992. Employment rate is the fraction of employed adults in the total adult population. Unemployment rate is the share of adults in the labor force that have been actively looking for a job in the last month. Labor informality rate is the fraction of unregistered salaried workers. The second definition (*) includes self-employed workers without a tertiary degree as informal. Employment levels are expressed in thousand workers. Monthly wages expressed in constant USD PPP 2005. Sources. CASEN household surveys, 1992 Chilean census, BACI, and TRAINS.

III Results

III.1 Main estimates

In this section we discuss the main estimates of the (relative) impact of exports growth on local economic development. We are interested in labor market outcomes at the district-level: the labor informality rate, share of salaried jobs in total employment, number of formal salaried jobs, number of informal salaried jobs, number of self-employment jobs, average formal wage, average informal wage, average self-employment income, average household per capita income and poverty rate (FGT0).

Baseline estimates of equation (1) are reported in Table 3. All columns display fixed effect-two-stage least squares estimates in which exports exposure is instrumented using local average tariffs as an exogenous shifter. All regressions include LLM and region–year fixed effects and therefore exploit within LLM variation over time in each region. Standard errors are robust against heteroskedasticity and clustered at the LLM level. Different columns subsequently account for several preexisting trends, computed as the value of a given variable in 2000 interacted with year dummies. The variables used to compute preexisting trends are the following. From column (2) onward we include demographic variables: the shares of population in age groups 0–17, 18–35, 36–49, 50–65, and more than 65; and the shares of population of working age with no high-school, high school degree and college degree. Column (3) adds economic variables: the log average per capita income, female labor force participation, and employment shares in the primary and manufacturing sectors. Columnn (4) and (5) add LLM's exposure to imports and exports to China (column 4), and offshoring (column 5). The exposures in columns 4 and 5 are computed as shift-share variables, i.e. as a weighted average of the initial industry-level imports, exports and the offshoring index of Feenstra and Hanson (1999), using the 1992 industry shares in local employment as weights. Column (6) adds a LLM-level index of job routinization. Routinization is defined as a quantification of local jobs that are repetitive, codifiable, and susceptible to be replaced by automation technologies. The index is defined at the occupation level using information from the Survey for Adult Skills from the OECD (

Panel A shows that the instrument has a strong predictive power and it is statistically significant at the 1 percent level in all specifications; the hypothesis of weak instrument is rejected. In Panel B the dependent variable is the labor informality rate. Results suggest that there is a negative and significant effect of exports exposure on labor informality. An increase in exports exposure of 0.152 (i.e., the median growth of exports exposure across LLMs) results in a relative decline in the fraction of unregistered salaried workers of around 2.46 percentage points (column 6); compared to a LLM with no exports exposure, *ceteris paribus*.[9] The relative decline is 4.04 p.p. if we include non-professional self-employed as

[9]The median change in exports exposure at the LLM level between 2000–2003 and 2003–2006 was 0.152; the mean and standard deviation were 0.124 and 0.106.

informal workers (Panel C). The economic magnitudes of estimated coefficients are large and need to be interpreted with caution.

Results in Panel D show that districts more exposed to export growth exhibit a relative increase in the fraction of salaried jobs in total employment. To decompose this result, Panels E, F and G present the estimates for local employment levels: number of formal salaried jobs, number of informal salaried jobs and number of self-employment jobs, respectively. The three variables are expressed in logarithms so point estimates can be interpreted as semi-elasticities. In panel D we find that exports have a strong creation effect on formal salaried jobs. Presumably, export growth is likely to be more intense in large companies that exhibit higher rates of labor formalization than non-exporters. Results in Panel G suggests that locations more exposed to export growth exhibit a strong relative decline in the number of self-employment jobs, compared to regions with no exports exposure. The point estimates for the log number of informal salaried workers are negative but statistically indistinguishable from zero (Panel F). Overall, these estimates suggests that in locations exposed to export growth there is reallocation from self-employment towards new salaried jobs in the formal sector.

Table 4 reports the baseline estimates for the impact of exports on incomes and poverty. Results in Panel A suggests that locations more exposed to export growth exhibit a relative increase in the average monthly wage of formal workers, in line with the idea that growing exports encourage the creation of high paid formal salaried jobs. Point estimates for the log average monthly wage of informal workers and the log average self-employment income (Panels B and C) are positive but statistically insignificant.

Finally, Panels D and E show that exposed locations face a relative increase in the average household per capita income that leads to a relative decline in the fraction of individuals with household per capita income below the 5.5 USD (per day per person) poverty line.

Table 3. The effects of exports on employment outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: First-stage regression						
Export tariffs (IV)	−0.125***	−0.114***	−0.112***	−0.125***	−0.128***	−0.129***
	(0.019)	(0.014)	(0.014)	(0.008)	(0.008)	(0.007)
KP F-stat	35.0	53.7	46.7	159.0	199.3	227.6
R-squared	0.926	0.946	0.955	0.960	0.961	0.962
Panel B: Labor informality rate						
Exports exposure	−0.308***	−0.163**	−0.165**	−0.164**	−0.160**	−0.162**
	(0.115)	(0.073)	(0.082)	(0.070)	(0.066)	(0.067)
Panel C: Labor informality rate (incl. self-employment)						
Exports exposure	−0.380***	−0.316***	−0.302***	−0.277***	−0.259***	−0.266***
	(0.110)	(0.103)	(0.107)	(0.088)	(0.082)	(0.081)
Panel D: Share of salaried jobs						
Exports exposure	0.195***	0.181***	0.185***	0.144***	0.137***	0.139***
	(0.058)	(0.051)	(0.057)	(0.038)	(0.037)	(0.036)
Panel E: Log (number of formal salaried jobs)						
Exports exposure	1.154***	0.809*	0.987*	0.669**	0.667***	0.675***
	(0.360)	(0.425)	(0.511)	(0.270)	(0.251)	(0.235)
Panel F: Log (number of informal salaried jobs)						
Exports exposure	−0.376	−0.064	0.105	−0.178	−0.183	−0.180
	(0.370)	(0.297)	(0.420)	(0.296)	(0.305)	(0.274)
Panel G: Log (number of self-employment jobs)						
Exports exposure	−0.659*	−0.774**	−0.677**	−0.819***	−0.716***	−0.759***
	(0.354)	(0.366)	(0.314)	(0.239)	(0.238)	(0.218)
Observations	182	182	182	182	182	182
Preexisting trends						
Demographics	-	Yes	Yes	Yes	Yes	Yes
Economic conditions	-	-	Yes	Yes	Yes	Yes
Trade with China	-	-	-	Yes	Yes	Yes
Offshoring	-	-	-	-	Yes	Yes
Routinization	-	-	-	-	-	Yes

Notes. All regressions include LLM and region-year fixed effects. All regressions run by 2SLS using industry tariffs weighted by 1992 industrial composition at the LLM level as instrument for exports exposure. Preexisting trends are: percentage of child under ages 0-17 in population, fractions of population under ages 18-35, 36-49, 50-65, and above 65, percentages of population with primary education-or below, secondary education, and tertiary education (Column 2 and onwards); local employment shares in the primary and manufacturing sectors, and female labor force participation (Column 3 and onwards); exposure to China's imports and exports (Column 4 and onwards); exposure to offshoring (Columns 5 and 6); and exposure to routine task content of jobs (Column 6). Robust standard errors clustered at the LLM level. Regressions weighted by LLM's share of Chilean population of working age in 1992. Significance at the 1, 5 and 10 percent levels denoted with ***, ** and *.

Table 4. The effects of exports on incomes and poverty

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Log (average formal wage)						
Exports exposure	0.451***	0.371**	0.525***	0.458***	0.411**	0.384***
	(0.151)	(0.166)	(0.199)	(0.169)	(0.162)	(0.140)
Panel B: Log (average informal wage)						
Exports exposure	0.530*	0.470	0.543	0.361	0.327	0.322
	(0.321)	(0.291)	(0.350)	(0.271)	(0.258)	(0.262)
Panel C: Log (average self-employment income)						
Exports exposure	0.442*	0.167	0.369	0.279	0.209	0.207
	(0.267)	(0.242)	(0.244)	(0.199)	(0.194)	(0.199)
Panel D: Log (average per capita income)						
Exports exposure	−0.026	0.040	0.467**	0.480***	0.450***	0.426***
	(0.309)	(0.364)	(0.201)	(0.172)	(0.170)	(0.158)
Panel E: Poverty rate (FGT0)						
Exports exposure	−0.433***	−0.167*	−0.327***	−0.271***	−0.257***	−0.254***
	(0.108)	(0.090)	(0.093)	(0.055)	(0.058)	(0.057)
Observations	182	182	182	182	182	182
Preexisting trends						
Demographics	-	Yes	Yes	Yes	Yes	Yes
Economic conditions	-	-	Yes	Yes	Yes	Yes
Trade with China	-	-	-	Yes	Yes	Yes
Offshoring	-	-	-	-	Yes	Yes
Routinization	-	-	-	-	-	Yes

Notes. All regressions include LLM and region-year fixed effects. All regressions run by 2SLS using industry tariffs weighted by 1992 industrial composition at the LLM level as instrument for exports exposure. Preexisting trends are: percentage of child under ages 0-17 in population, fractions of population under ages 18-35, 36-49, 50-65, and above 65, percentages of population with primary education-or below, secondary education, and tertiary education (Column 2 and onwards); local employment shares in the primary and manufacturing sectors, and female labor force participation (Column 3 and onwards); exposure to China's imports and exports (Column 4 and onwards); exposure to offshoring (Columns 5 and 6); and exposure to routine task content of jobs (Column 6). Robust standard errors clustered at the LLM level. Regressions weighted by LLM's share of Chilean population of working age in 1992. Significance at the 1, 5 and 10 percent levels denoted with ***, ** and *.

III.2 Heterogeneous effects by age and skill

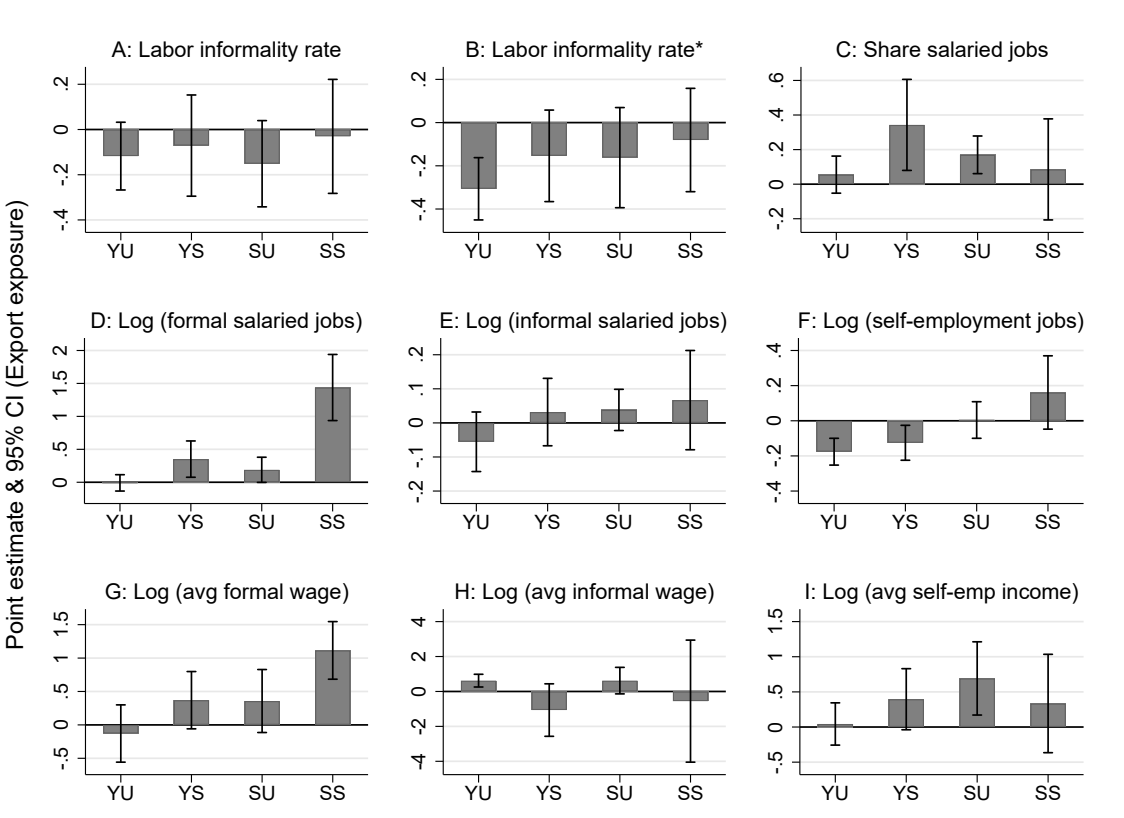
In this section we explore the heterogeneous effects of growing exports by age and worker skill level. We separate workers in two age groups: young (18 to 40 years old) and

senior (41–65); and two skill groups: unskilled (high-school diploma or below) and skilled (at least one year of tertiary education completed). Figure 3 plots the estimated coefficients and confidence intervals from running regression (1) separately for four different groups: young unskilled (YU), young skilled (YS), senior unskilled (SU) and senior skilled (SS).

We find that relative gains in the average formal wage and employment concentrate in the group of senior skilled workers. These results suggest that more educated workers with enough work experience are probably the most demanded by exporting firms. To a lesser extent, young skilled workers also take advantage of the new formal salaried jobs.

We also find labor income gains for senior unskilled self-employed workers, who are likely to have a trade and enough work experience to benefit themselves from an improvement in local labor market conditions.

Figure 3
Heterogeneous effects of exports on employment and income by age and skill



Notes. Observations = 182. Regressions are analogous to Tables 1 and 2, Column (6). Point estimates correspond to separate regressions for four mutually exclusive samples based on age and skill. Young workers (Y): 18–40; Senior workers (S): 41–65; Unskilled workers (U): high-school diploma or below; Skilled workers (S): at least one year of tertiary education completed. Labor informality rate is the fraction of unregistered salaried workers. The second definition (*) includes self-employed workers without a tertiary degree as informal. The capped lines provide 95 percent confidence intervals.

III.3 Heterogeneous effects by occupation

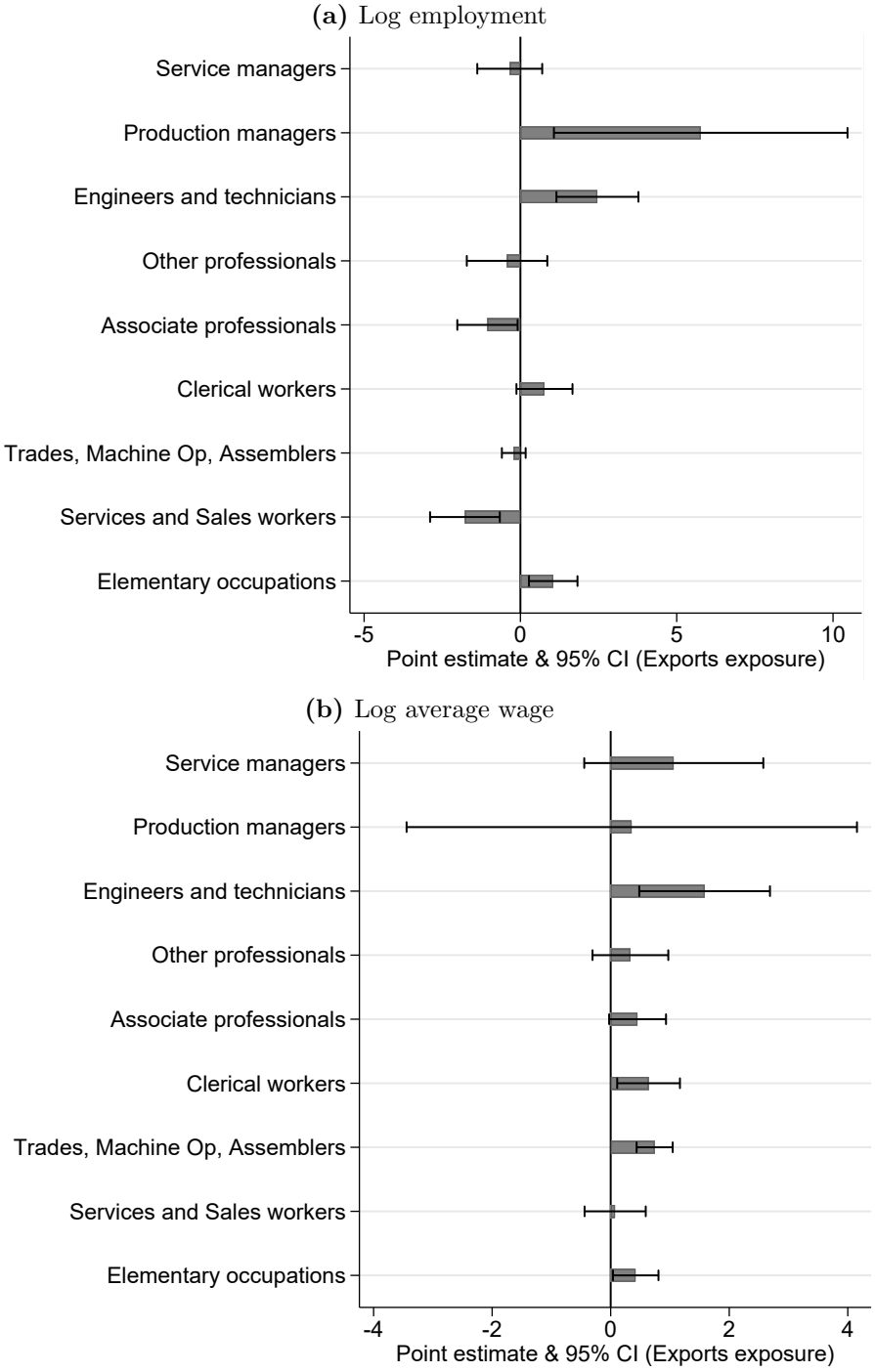
This section investigates the heterogeneous impacts of growing exports on

employment and wages by occupational categories. We separate workers in nine groups, which are close to the first-digit of the International Standard Classification of Occupations (ISCO 08).

Figure 5 plots the estimated coefficients and confidence intervals from running regression (1) separately for the (log) employment level of each group. Results are very interesting and intuitive, as we find that locations more exposed to export growth exhibit relative employment gains mainly in two categories, which are likely to be complementary to exporting activities: production managers and engineers and technicians. These results are in line with previous findings for Chilean manufacturing plants documented by Brambilla, Lederman, and Porto (2016).

Figure 5 presents the estimates for the impact of growing exports on the (log) average wage of each occupation. First, we note that estimated coefficients are positive for all occupations. Again, and in line with economic intuition, the group that benefits the most from exports expansions are engineers and technicians. Trade workers, machine operators and assemblers also present relative wage gains, and the same occurs for clerical workers. These workers are likely to be involved in productive and administrative tasks related to exporting activities.

Figure 4
Heterogeneous effects of exports on employment and wage by occupation



Notes. Observations = 182. Regressions are analogous to Tables 1 and 2, Column (6). Point estimates in each panel correspond to separate regressions for nine mutually exclusive samples of workers based on occupational categories.

III.4 Pre-trend analysis

A typical concern of estimates of treatment effects is whether the exposure variable (exports shocks in our case) correlates with preexisting trends at the LLM level. If this

is the case, estimates could be biased by preexisting trends that persisted during the exposure period. We control for a large set of trends based on observed variables in the initial year of data, which substantially ameliorates this concern. As an additional validity test, we study the correlation between past changes in observed variables (in a pre-sample period) and future exports exposure.

The pre-sample period goes from 1994 to 2000. We run the following regression by OLS:

$$\Delta x_{l0} = \gamma_0 + \gamma_1 \Delta EE_{lt} + \Delta \varepsilon_{l0} \tag{4}$$

For each variable x we regress the change between 1994 and 2000 (Δx_{l0}) on the change in exports exposure during 2000-2006 (ΔEE_{lt}); where x are LLM-level observable variables during the pre-sample period. We consider the following variables: employment rate, unemployment rate, informality rate, average wage, poverty rate, share of service workers in local employment, share of salaried workers in local employment, share of semi-skilled workers (high-school diploma) and share of highly skilled workers (at least one year of tertiary education complete).

Results are reported in Table 5, column (1).[10] All estimates are non-significant, which highlights that there is no correlation between past trends in LLM observables and the later change in exports exposure.

In columns (2) to (4) we conduct additional exercises. In column (2), we replace ΔEE with the instrument $\Delta Tariffs^{IV}$. In column (3), we replace ΔEE with a dummy variable that indicates whether ΔEE is above the median across LLMs. Column (4) is analogous to column (3) with the difference that the dummy variable is computed based on $\Delta Tariffs^{IV}$. Again, all results remain non-significant.

[10] These regressions use 55 observations (LLMs) because the 1994 CASEN has a lower regional coverage than the 2000 CASEN.

Table 5. Pre-trend tests

	Change in exports exposure	Change in tariffs (IV)	High exposure to exports	High exposure to tariffs (IV)
Employment rate	−0.058	0.013	−0.006	0.003
	(0.051)	(0.011)	(0.022)	(0.028)
Unemployment rate	0.016	0.001	0.013	0.039
	(0.027)	(0.009)	(0.017)	(0.034)
Labor informality rate	−0.018	−0.007	0.016	−0.050
	(0.082)	(0.019)	(0.049)	(0.042)
Log average wage	0.156	−0.009	0.065	−0.037
	(0.223)	(0.045)	(0.111)	(0.124)
Poverty rate (FGT0)	0.156	−0.009	0.065	−0.037
	(0.223)	(0.045)	(0.111)	(0.124)
Share of service workers	0.131	−0.029	0.017	−0.063
	(0.109)	(0.028)	(0.053)	(0.075)
Share of salaried workers	−0.058	0.011	0.005	0.013
	(0.063)	(0.015)	(0.028)	(0.045)
Share of semi-skilled workers	−0.006	0.001	−0.009	−0.015
	(0.027)	(0.007)	(0.013)	(0.017)
Share of highly-skilled workers	0.032	−0.000	−0.013	−0.003
	(0.030)	(0.008)	(0.018)	(0.031)
Observations	55	55	55	55

Notes. Each coefficient corresponds to a separate regression. Dependent variables in row panels. Changes in row variables refer to years 1994-2000. Explanatory variables in columns. Changes in column variables refer to years 2000-2006. Column (1): Change in exports exposure; Column (2): Change in tariffs (IV); Column (3): Change in exports exposure above the median; Column (4): Change in tariffs (IV) above the median. Regressions control for region fixed effects. Regressions weighted by LLM's share of Chilean population of working age in 1992. Robust standard errors clustered at the LLM level are in parentheses. Significance at the 1, 5 and 10 percent levels denoted with *, ** and *.

III.5 Robustness exercises

We estimate several alternatives to our baseline regression to validate the robustness of our results to: estimate directly on exposure to local tariffs cuts (IV), include imports exposure, use different employment outcomes, rule out the influence of outliers, not use weights in the regression, leave aside locations with greatest importance of crop production (which exhibits the largest Rotemberg weight), excluding districts with greatest participation of the mining industry (which concentrates most exports), and estimate more conservative confidence intervals applying an alternative methodology. We describe these tests below. All results, unless noted otherwise, are quantitatively similar to our baseline

estimates in Tables 3 and 4. They are reported in the appendix.

Robustness to estimate the effects directly on local tariffs. Table A2 presents the estimates of running equation (1) by OLS directly on the instrumental variable, i.e. the local exposure to tariffs cuts (as in Dix-Carneiro and Kovak, 2017, 2019). Results are strongly robust and estimated coefficients are estimated very precisely. The signs of estimated coefficients are the opposite compared to the baseline estimates in Tables 3 and 4, i.e. a decrease in local tariffs leads to a relative decline in labor informality, mainly through the creation of new formal salaried jobs, and to a relative increase in the average formal wage of salaried workers.

Robustness to including imports exposure. Tables A3 (part 1) and A3 (part 2) present the baseline estimates when including local imports exposure, which is calculated in the same manner as exports exposure.[11] These regressions are run with two endogenous variables and two instruments. The new instrument is the local average industry import tariff, also calculated as a shift-share variable. The first-stage works well for the case of exports exposure, but in the case of imports exposure the tariff IV presents a positive and statistically significant coefficient, which suggests that imports have grown faster in locations that experience lower tariff cuts, which is at odds with economic intuition.[12] In this context, these estimates should be interpreted with caution. Importantly, all estimates for exports exposure remain strongly robust. Results show that LLMs more exposed to growing imports exhibit a relative decline in employment (of all worker types) and a relative increase in the average formal wage, which leads to a rise in the average household per capita income and to a small decline in monetary poverty.

Robustness to alternative employment outcomes. Table A4 presents the estimates for the impact of exports exposure on the employment rate (Panel A) and the unemployment rate (Panel B). The estimates for unemployment are computed for individuals that are economically active (i.e. either employed or unemployed), while the estimates for employment include also inactive individuals. In line with economic intuition, point estimates for the employment rate are positive while those for unemployment are negative, but in both cases they are statistically indistinguishable from zero.

Robustness to population shifts. Migration across LLMs represents a threat to our empirical strategy. Estimates might be biased if workers migrate across locations in response to exports shocks and changes in local economic conditions. To address this potential concern we estimate regressions using the logarithm of population counts as dependent variables. Panel C of Table A4 corresponds to total population and Panel D to population of working age (18–65). Point estimates are statistically indistinguishable from zero, which is reassuring as it indicates that population shifts across districts do not drive our results.

[11] $IE_{lt} = \sum_j w_{lj}^{1992} Log(imports)_{jt}$, IE is a measure of imports exposure at the LLM-level, constructed as the interaction between the initial pattern of industrial composition in each LLM, as given by the local employment share in 1992 (w_{rj}^{1992}), with the log value of imports at the industry-level.

[12] This table is not included in the paper but it is available upon request.

Robustness to outliers in exports exposure. To rule out that results are driven by outliers, we conduct a robustness exercise in which we exclude extreme values defined as the top and bottom 5 percent of the distribution of exports exposure. Results are in Table A5.

Robustness to not using district importance weights. The baseline specification is a weighted regression with weights given by LLM's share in Chilean population of working age in 1992. In this unweighted alternative specification all districts are given the same importance in the regression irrespective of their size. Results are in Table A6.

Robustness to excluding districts with greatest importance of crop production. In their discussion of Bartik instruments, Goldsmith-Pinkham, Sorkin, and Swift (2020) recommend to report the industries with the highest Rotemberg weights (i.e. those that explain a greater fraction of the variation in the instrument). We report these statistics in Table A1. The first column in Panel A shows that the crop production industry has the highest Rotemberg weight (explains $0.919/1.344 = 68.4$ percent of the variation in the IV), which indicates that reduced-form estimates may be sensitive to unobserved shocks affecting LLMs specialized in this industry. We conduct two robustness exercises. First, we add a pre-trend for the employment share of crop production to our baseline estimates (see column 2 of Table A7). Second, we exclude the 5 percent locations (i.e. three LLMs) with the highest participation of crop production (see column 3).[13]

Robustness to excluding locations with greatest importance of mining. The mining sector concentrates most of Chilean exports (e.g. more than 60 percent in 2006). Moreover, the period under study includes a sharp rise in the international price of copper (i.e. it more than doubled between 2003 and 2006) and other raw materials. To take into account these facts, we perform two robustness exercises (which closely follow the format of the previous exercise). First, we add a pre-trend for the employment share of the mining sector to our baseline estimates (column 2 of Table A8). Second, we exclude the 5 percent locations (i.e. three LLMs) with the highest participation of mining (column 3 of Table A8).[14].

Robustness to alternative shifh-share design. In Bartik regression models, errors could share common shocks across locations with similar industrial compositions. Borusyak, Hull and Jaravel (2021) discuss settings of shift-share designs in which confidence intervals obtained following the usual methods tend to be too liberal. We conduct a robustness exercise in which we apply the method proposed by Borusyak et al. (2021). Under this framework, identification follows from the quasi-random assignment of shocks while exposure shares are allowed to be endogenous. This method also allows to correct standard errors for clustering at the original level of the shock variable, that is, the industry level. Under this methodology, the point-estimates of the coefficients are by

[13]The excluded LLMs are Rengo, Parral and Carahue.
[14]The excluded LLMs are Calama, Diego De Almagro and Cabildo.

construction the same, while the confidence intervals are estimated more conservatively. We report results in Table A9.

IV Concluding Remarks

In this paper we empirically investigate the causal effect of growing exports on Chilean local labor market outcomes. Using data from national household surveys, census, trade flows and trade tariffs, we document that locations with a higher share of workers allocated to industries more exposed to tariffs cuts and rising exports exhibited a better relative performance in terms of labor market indicators such as formal employment and formal wages than less exposed locations, which led to increasing the average household per capita income and reducing monetary poverty. We conclude that growing exports promote local economic development through the creation of higher quality jobs.

Formal employment and formal wage gains concentrate on senior skilled workers, who seem to be the workers most in demand by exporting firms. Relatedly, the two occupations that exhibit the largest relative increase in employment in response to growing exports are production managers and engineers and technicians. The last group, as well as machine operators, assemblers and clerical workers, also exhibit relative wage gains, which supports the idea that these workers perform tasks that complement exporting activities.

Finally, and importantly, our estimates correspond to relative effects across local labor markets but does not account for the aggregate economic impact of growing exports, which depend on spillovers across industries in different regions and other general equilibrium effects (e.g. changes in prices, total factor productivity, and aggregate demand multiplier effects).

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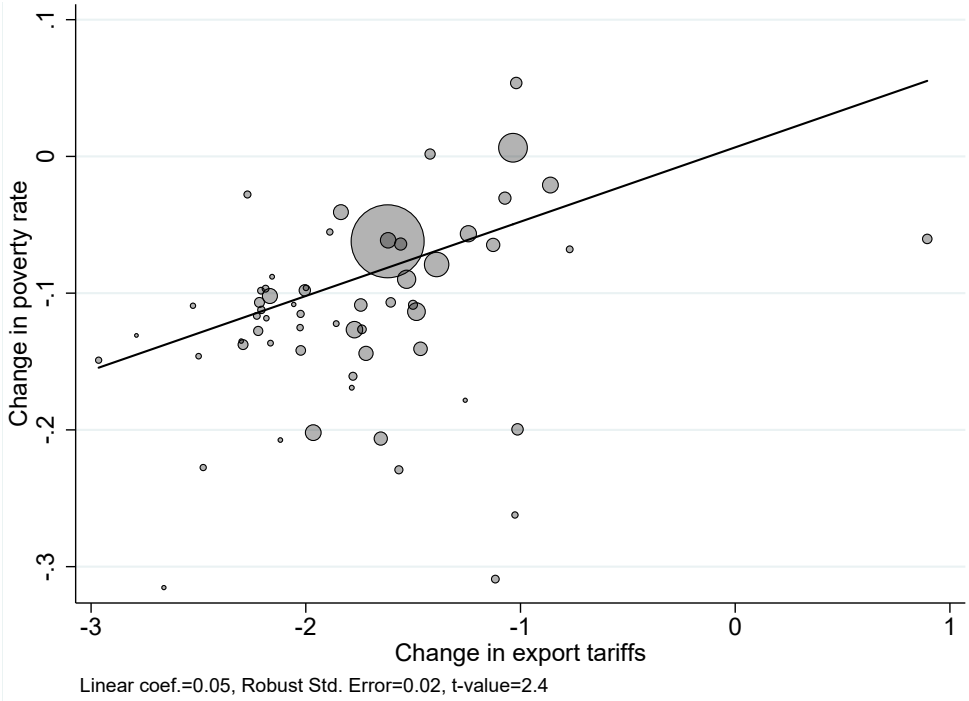
A Appendix

Figure A1
Export tariffs change and poverty decline



Notes. Observations = 60 local labor markets (LLMs). The change in export tariffs across LLMs (horizontal axis) measured as the interaction of local industry employment shares in 1992 and the evolution of average tariffs across industries between 2000 and 2006. The change in poverty rate across LLMs (vertical axis) between 2000 and 2006 calculated using a poverty line of USD 5.5 per day per person. Fitted line weighted by LLM's share of Chile's population of working age in 1992 (bubble size). LLMs are defined by Casado-Díaz et al. (2017). Sources. 1992 Chilean census, CASEN, BACI.

Table A1. Summary of Rotermberg weights

Panel A: Negative and positive weights

	Sum	Mean	Share
Negative	-0.344	-0.006	0.204
Positive	1.344	0.103	0.796

Panel B: Top 10 Rotemberg weight industries

	$\hat{\alpha}_k$	g_k	$\hat{\beta}_k$	Ind Share
Growing of crops	0.919	14.741	0.020	9.370
Farming of animals	0.128	10.438	0.014	2.753
Forestry and logging	0.100	11.545	0.021	1.397
Manufacture of wood products	0.053	13.063	0.020	1.159
Production of meat, fish, fruit, veg., oils	0.041	15.111	-0.013	1.987
Sawmilling and planing of wood	0.041	13.749	0.023	0.534
Mining of non-ferrous metal ores	0.025	15.700	-0.092	0.812
Fishing farms	0.024	12.116	-0.010	1.471
Manufacture of grain mill products	0.007	10.582	0.027	0.160
Manufacture of dairy products	0.004	11.315	0.008	0.303

Panel C: Variation across years in α_k

	Sum	Mean
2006	0.431	0.006
2003	0.309	0.004
2000	0.260	0.004

Notes. Statistics for the Rotemberg weights. Statistics correspond to aggregated weights for a given industry across years (Panel B) and for a given year across industries (Panel C). Panel A reports the share and sum of negative Rotemberg weights. Panel B reports the top ten industries and Panel C the top five years with highest Rotemberg weights. The g_k is the national industry exports exposure, $\hat{\beta}_k$ is the coefficient from the just-identified regression, and Ind Share is the industry share (multiplied by 100 for legibility).

Table A2. Effects of tariff cuts

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Labor informality rate						
Export tariffs	0.038**	0.019**	0.018**	0.021**	0.020**	0.021**
	(0.018)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)
Panel B: Labor informality rate (incl. self-employment)						
Export tariffs	0.048***	0.036***	0.034***	0.035***	0.033***	0.034***
	(0.017)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)
Panel C: Share of salaried jobs						
Export tariffs	−0.024***	−0.021***	−0.021***	−0.018***	−0.018***	−0.018***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)
Panel D: Log (number of formal salaried jobs)						
Export tariffs	−0.145**	−0.092**	−0.110**	−0.084***	−0.085***	−0.087***
	(0.058)	(0.042)	(0.045)	(0.031)	(0.030)	(0.028)
Panel E: Log (number of informal salaried jobs)						
Export tariffs	0.047	0.007	−0.012	0.022	0.023	0.023
	(0.050)	(0.034)	(0.046)	(0.037)	(0.039)	(0.035)
Panel F: Log (number of self-employment jobs)						
Export tariffs	0.083**	0.088**	0.076*	0.103***	0.092***	0.098***
	(0.039)	(0.040)	(0.040)	(0.031)	(0.031)	(0.029)
Panel G: Log (average formal wage)						
Export tariffs	−0.056***	−0.042**	−0.059***	−0.057***	−0.053**	−0.049***
	(0.018)	(0.018)	(0.022)	(0.022)	(0.021)	(0.018)
Panel H: Log (average informal wage)						
Export tariffs	−0.066	−0.054*	−0.061*	−0.045	−0.042	−0.041
	(0.040)	(0.030)	(0.035)	(0.033)	(0.032)	(0.033)
Panel I: Log (average self-employment income)						
Export tariffs	−0.055*	−0.019	−0.041	−0.035	−0.027	−0.027
	(0.030)	(0.026)	(0.025)	(0.024)	(0.024)	(0.025)
Panel J: Poverty rate (FGT0)						
Export tariffs	0.054***	0.019**	0.037***	0.034***	0.033***	0.033***
	(0.020)	(0.009)	(0.009)	(0.007)	(0.008)	(0.008)
Observations	182	182	182	182	182	182
Preexisting trends						
Demographics	-	Yes	Yes	Yes	Yes	Yes
Economic conditions	-	-	Yes	Yes	Yes	Yes
Trade with China	-	-	-	Yes	Yes	Yes
Offshoring	-	-	-	-	Yes	Yes
Routinization	-	-	-	-	-	Yes

Notes. Analogous to Tables 3 and 4 but run by OLS using the local tariff variable (the IV) as a measure of local exposure to export trade liberalization.

Table A3. Inclusion of imports exposure (part 1: employment)

	(1)	(2)	(3)	(4)	(5)	(6)
Panel B: Labor informality rate						
Exports exposure	−0.308***	−0.156**	−0.146*	−0.149**	−0.149**	−0.152**
	(0.118)	(0.072)	(0.078)	(0.068)	(0.067)	(0.067)
Imports exposure	0.004	−0.008	−0.019	−0.013	−0.010	−0.009
	(0.007)	(0.008)	(0.012)	(0.009)	(0.009)	(0.009)
Panel C: Labor informality rate (incl. self-employment)						
Exports exposure	−0.380***	−0.309***	−0.276***	−0.257***	−0.242***	−0.251***
	(0.111)	(0.101)	(0.099)	(0.084)	(0.081)	(0.080)
Imports exposure	0.002	−0.007	−0.026*	−0.018	−0.014	−0.014
	(0.007)	(0.011)	(0.014)	(0.011)	(0.011)	(0.011)
Panel D: Share of salaried jobs						
Exports exposure	0.195***	0.185***	0.183***	0.147***	0.141***	0.142***
	(0.057)	(0.050)	(0.056)	(0.038)	(0.038)	(0.036)
Imports exposure	−0.002	−0.004	0.002	−0.002	−0.003	−0.002
	(0.003)	(0.006)	(0.009)	(0.009)	(0.009)	(0.008)
Panel E: Log (number of formal salaried jobs)						
Exports exposure	1.155***	0.854**	1.017**	0.727**	0.742***	0.747***
	(0.383)	(0.428)	(0.507)	(0.286)	(0.271)	(0.254)
Imports exposure	−0.023	−0.047**	−0.030	−0.051	−0.066*	−0.063**
	(0.019)	(0.023)	(0.043)	(0.036)	(0.035)	(0.032)
Panel F: Log (number of informal salaried jobs)						
Exports exposure	−0.375	0.050	0.276	−0.000	−0.007	−0.014
	(0.368)	(0.313)	(0.430)	(0.300)	(0.311)	(0.271)
Imports exposure	−0.007	−0.119***	−0.171***	−0.156***	−0.154***	−0.146***
	(0.019)	(0.037)	(0.065)	(0.052)	(0.051)	(0.042)
Panel G: Log (number of self-employment jobs)						
Exports exposure	−0.659*	−0.706*	−0.546	−0.692**	−0.581**	−0.628**
	(0.362)	(0.376)	(0.341)	(0.271)	(0.268)	(0.248)
Imports exposure	−0.020	−0.071	−0.130**	−0.112*	−0.118*	−0.116**
	(0.016)	(0.053)	(0.065)	(0.063)	(0.061)	(0.058)
KP F-stat	15.9	26.2	23.0	60.3	69.1	79.4
Observations	182	182	182	182	182	182
Preexisting trends						
Demographics	-	Yes	Yes	Yes	Yes	Yes
Economic conditions	-	-	Yes	Yes	Yes	Yes
Trade with China	-	-	-	Yes	Yes	Yes
Offshoring	-	-	-	-	Yes	Yes
Routinization	-	-	-	-	-	Yes

Notes. Analogous to Table 3 but including local imports exposure, which is calculated as a shift-share variable using the 1992 industrial employment composition at the LLM level, and it is instrumented with local average industry import tariffs.

Table A3. Inclusion of imports exposure (part 2: incomes)

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Log (average formal wage)						
Exports exposure	0.451***	0.306*	0.427**	0.359*	0.301*	0.277*
	(0.153)	(0.171)	(0.207)	(0.187)	(0.176)	(0.154)
Imports exposure	0.006	0.069***	0.099***	0.087***	0.097***	0.095***
	(0.013)	(0.024)	(0.023)	(0.019)	(0.018)	(0.018)
Panel B: Log (average informal wage)						
Exports exposure	0.530*	0.487*	0.574*	0.415	0.360	0.356
	(0.319)	(0.292)	(0.348)	(0.276)	(0.265)	(0.270)
Imports exposure	0.008	−0.018	−0.031	−0.048	−0.029	−0.030
	(0.016)	(0.031)	(0.036)	(0.032)	(0.028)	(0.028)
Panel C: Log (average self-employment income)						
Exports exposure	0.444*	0.181	0.342	0.265	0.203	0.198
	(0.257)	(0.226)	(0.241)	(0.197)	(0.192)	(0.198)
Imports exposure	−0.043***	−0.015	0.027	0.012	0.005	0.008
	(0.016)	(0.035)	(0.040)	(0.039)	(0.039)	(0.039)
Panel D: Log (average per capita income)						
Exports exposure	−0.027	−0.050	0.344	0.360*	0.326*	0.302*
	(0.318)	(0.386)	(0.223)	(0.191)	(0.187)	(0.174)
Imports exposure	0.022	0.094**	0.123***	0.106***	0.109***	0.109***
	(0.021)	(0.041)	(0.040)	(0.027)	(0.027)	(0.027)
Panel E: Poverty rate (FGT0)						
Exports exposure	−0.433***	−0.129	−0.285***	−0.232***	−0.223***	−0.219***
	(0.104)	(0.097)	(0.088)	(0.059)	(0.061)	(0.059)
Imports exposure	−0.004	−0.040***	−0.042***	−0.034***	−0.030***	−0.030***
	(0.008)	(0.008)	(0.013)	(0.010)	(0.009)	(0.009)
KP F-stat	15.9	26.2	23.0	60.3	69.1	79.4
Observations	182	182	182	182	182	182
Preexisting trends						
Demographics	-	Yes	Yes	Yes	Yes	Yes
Economic conditions	-	-	Yes	Yes	Yes	Yes
Trade with China	-	-	-	Yes	Yes	Yes
Offshoring	-	-	-	-	Yes	Yes
Routinization	-	-	-	-	-	Yes

Notes. Analogous to Table 4 but including local imports exposure, which is calculated as a shift-share variable using the 1992 industrial employment composition at the LLM level, and it is instrumented with local average industry import tariffs.

Table A4. The effects of exports on employment and population

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Employment rate						
Exports exposure	0.051	0.044	0.039	0.016	0.014	0.007
	(0.073)	(0.053)	(0.049)	(0.044)	(0.043)	(0.047)
Panel B: Unemployment rate						
Exports exposure	−0.054	0.004	−0.032	−0.013	−0.021	−0.023
	(0.043)	(0.037)	(0.038)	(0.026)	(0.023)	(0.023)
Panel C: Log (population)						
Exports exposure	0.310	0.154	0.231	0.011	0.043	0.042
	(0.285)	(0.343)	(0.348)	(0.186)	(0.179)	(0.169)
Panel D: Log (population of working age)						
Exports exposure	0.219	0.060	0.184	−0.036	−0.003	−0.002
	(0.280)	(0.318)	(0.319)	(0.155)	(0.149)	(0.142)
KP F-stat	35.0	53.7	46.7	159.0	199.3	227.6
Observations	182	182	182	182	182	182
Preexisting trends						
Demographics	-	Yes	Yes	Yes	Yes	Yes
Economic conditions	-	-	Yes	Yes	Yes	Yes
Trade with China	-	-	-	Yes	Yes	Yes
Offshoring	-	-	-	-	Yes	Yes
Routinization	-	-	-	-	-	Yes

Notes. Analogous to Tables 3 and 4. The employment rate is the fraction of population of working age (18–65) that is employed. The unemployment rate is the percentage of individuals that are economically active and were looking for a job in the last month.

Table A5. Exclusion of outliers in exports exposure

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Labor informality rate						
Exports exposure	−0.333**	−0.217**	−0.232**	−0.205**	−0.201**	−0.199**
	(0.168)	(0.097)	(0.104)	(0.086)	(0.083)	(0.082)
Panel B: Labor informality rate (incl. self-employment)						
Exports exposure	−0.405***	−0.370**	−0.364**	−0.289**	−0.277**	−0.292***
	(0.156)	(0.153)	(0.151)	(0.115)	(0.108)	(0.108)
Panel C: Share of salaried jobs						
Exports exposure	0.223***	0.209***	0.173**	0.109*	0.107*	0.123**
	(0.075)	(0.066)	(0.079)	(0.063)	(0.063)	(0.061)
Panel D: Log (number of formal salaried jobs)						
Exports exposure	1.173**	1.146*	1.348**	0.805**	0.799**	0.853***
	(0.480)	(0.589)	(0.644)	(0.322)	(0.316)	(0.306)
Panel E: Log (number of informal salaried jobs)						
Exports exposure	−0.448	−0.084	0.055	−0.232	−0.237	−0.120
	(0.507)	(0.382)	(0.506)	(0.408)	(0.403)	(0.346)
Panel F: Log (number of self-employment jobs)						
Exports exposure	−0.810*	−0.586	−0.384	−0.549	−0.496	−0.601
	(0.413)	(0.584)	(0.555)	(0.465)	(0.425)	(0.394)
Panel G: Log (average formal wage)						
Exports exposure	0.581***	0.540**	0.636**	0.484**	0.460**	0.398**
	(0.184)	(0.228)	(0.256)	(0.207)	(0.182)	(0.161)
Panel H: Log (average informal wage)						
Exports exposure	0.867**	1.270**	1.581**	1.161**	1.132**	1.150**
	(0.387)	(0.587)	(0.736)	(0.533)	(0.489)	(0.490)
Panel I: Log (average self-employment income)						
Exports exposure	0.357	0.069	0.306	0.237	0.193	0.193
	(0.377)	(0.299)	(0.316)	(0.252)	(0.211)	(0.219)
Panel J: Poverty rate (FGT0)						
Exports exposure	−0.369***	−0.132*	−0.268**	−0.150*	−0.146*	−0.141*
	(0.112)	(0.080)	(0.112)	(0.083)	(0.082)	(0.077)
KP F-stat	46.9	36.4	33.3	108.4	126.9	127.4
Observations	161	161	161	161	161	161
Preexisting trends						
Demographics	-	Yes	Yes	Yes	Yes	Yes
Economic conditions	-	-	Yes	Yes	Yes	Yes
Trade with China	-	-	-	Yes	Yes	Yes
Offshoring	-	-	-	-	Yes	Yes
Routinization	-	-	-	-	-	Yes

Notes. Analogous to Tables 3 and 4 but excluding the top and bottom 5 percent extreme values of the distribution of exports exposure.

Table A6. Unweighted regressions

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Labor informality rate						
Exports exposure	−0.413**	−0.199*	−0.164*	−0.127*	−0.127*	−0.128*
	(0.174)	(0.102)	(0.097)	(0.068)	(0.067)	(0.067)
Panel B: Labor informality rate (incl. self-employment)						
Exports exposure	−0.510***	−0.415***	−0.282**	−0.219***	−0.218***	−0.227***
	(0.190)	(0.159)	(0.115)	(0.084)	(0.083)	(0.080)
Panel C: Share of salaried jobs						
Exports exposure	0.158**	0.211***	0.188***	0.127**	0.126**	0.129***
	(0.067)	(0.066)	(0.072)	(0.056)	(0.055)	(0.048)
Panel D: Log (number of formal salaried jobs)						
Exports exposure	1.407**	1.287**	1.553**	0.803***	0.802***	0.796***
	(0.590)	(0.578)	(0.677)	(0.260)	(0.257)	(0.231)
Panel E: Log (number of informal salaried jobs)						
Exports exposure	−0.647	0.192	0.767	0.251	0.241	0.228
	(0.484)	(0.544)	(0.560)	(0.299)	(0.311)	(0.269)
Panel F: Log (number of self-employment jobs)						
Exports exposure	−0.926**	−1.073**	−0.169	−0.489	−0.477	−0.524
	(0.452)	(0.543)	(0.557)	(0.387)	(0.383)	(0.336)
Panel G: Log (average formal wage)						
Exports exposure	0.660**	0.503**	0.571**	0.326	0.320*	0.292**
	(0.288)	(0.241)	(0.249)	(0.202)	(0.186)	(0.145)
Panel H: Log (average informal wage)						
Exports exposure	0.714**	0.580	0.725*	0.294	0.288	0.309
	(0.355)	(0.364)	(0.403)	(0.288)	(0.275)	(0.262)
Panel I: Log (average self-employment income)						
Exports exposure	0.813**	0.345	0.484	0.297	0.290	0.273
	(0.352)	(0.243)	(0.306)	(0.214)	(0.204)	(0.222)
Panel J: Poverty rate (FGT0)						
Exports exposure	−0.433***	−0.175	−0.260***	−0.144**	−0.142**	−0.132**
	(0.159)	(0.122)	(0.096)	(0.072)	(0.070)	(0.066)
KP F-stat	53.4	23.8	22.9	160.1	166.6	241.7
Observations	182	182	182	182	182	182
Preexisting trends						
Demographics	-	Yes	Yes	Yes	Yes	Yes
Economic conditions	-	-	Yes	Yes	Yes	Yes
Trade with China	-	-	-	Yes	Yes	Yes
Offshoring	-	-	-	-	Yes	Yes
Routinization	-	-	-	-	-	Yes

Notes. Analogous to Tables 3 and 4 but not using weights, so all LLMs weigh the same irrespective of their size.

Table A7. Controlling for crop production

	Full sample		Excluding LLMs with highest crop prod.
	(1)	(2)	(3)
Panel A: Labor informality rate			
Exports exposure	−0.162**	−0.220*	−0.178**
	(0.067)	(0.120)	(0.078)
Panel B: Labor informality rate (incl. self-employment)			
Exports exposure	−0.266***	−0.423***	−0.282***
	(0.081)	(0.146)	(0.088)
Panel C: Share of salaried jobs			
Exports exposure	0.139***	0.125*	0.128***
	(0.036)	(0.065)	(0.038)
Panel D: Log (number of formal salaried jobs)			
Exports exposure	0.675***	1.208***	0.655***
	(0.235)	(0.404)	(0.240)
Panel E: Log (number of informal salaried jobs)			
Exports exposure	−0.180	0.083	−0.319
	(0.274)	(0.460)	(0.277)
Panel F: Log (number of self-employment jobs)			
Exports exposure	−0.759***	−0.845*	−0.754***
	(0.218)	(0.491)	(0.229)
Panel G: Log (average formal wage)			
Exports exposure	0.384***	0.704***	0.382***
	(0.140)	(0.247)	(0.140)
Panel H: Log (average informal wage)			
Exports exposure	0.322	0.815*	0.371
	(0.262)	(0.486)	(0.258)
Panel I: Log (average self-employment income)			
Exports exposure	0.207	0.776**	0.180
	(0.199)	(0.325)	(0.196)
Panel J: Poverty rate (FGT0)			
Exports exposure	−0.254***	−0.198*	−0.268***
	(0.057)	(0.112)	(0.056)
KP F-stat	227.6	94.5	220.3
Observations	182	182	173
Preexisting trends			
Baseline PT	Yes	Yes	Yes
Share crop production	-	Yes	-

Notes. Column 1 is analogous to column 6 in Tables 3 and 4. Column 2 adds a pre-trend for the employment share of crop production. Column 3 exclude the 5 percent of locations with the highest participation of crop production.

Table A8. Controlling for mining

	Full sample		Excluding LLMs with highest mining
	(1)	(2)	(3)
Panel A: Labor informality rate			
Exports exposure	−0.162**	−0.122	−0.122*
	(0.067)	(0.098)	(0.067)
Panel B: Labor informality rate (incl. self-employment)			
Exports exposure	−0.266***	−0.339***	−0.205**
	(0.081)	(0.116)	(0.082)
Panel C: Share of salaried jobs			
Exports exposure	0.139***	0.214***	0.145***
	(0.036)	(0.051)	(0.040)
Panel D: Log (number of formal salaried jobs)			
Exports exposure	0.675***	0.744**	0.589**
	(0.235)	(0.323)	(0.240)
Panel E: Log (number of informal salaried jobs)			
Exports exposure	−0.180	0.269	0.033
	(0.274)	(0.405)	(0.220)
Panel F: Log (number of self-employment jobs)			
Exports exposure	−0.759***	−1.429***	−0.728***
	(0.218)	(0.297)	(0.269)
Panel G: Log (average formal wage)			
Exports exposure	0.384***	0.396**	0.239*
	(0.140)	(0.201)	(0.143)
Panel H: Log (average informal wage)			
Exports exposure	0.322	0.486	0.444
	(0.262)	(0.381)	(0.339)
Panel I: Log (average self-employment income)			
Exports exposure	0.207	0.444	0.528**
	(0.199)	(0.295)	(0.211)
Panel J: Poverty rate (FGT0)			
Exports exposure	−0.254***	−0.273***	−0.231***
	(0.057)	(0.091)	(0.065)
KP F-stat	227.6	113.6	188.4
Observations	182	182	173
Preexisting trends			
Baseline PT	Yes	Yes	Yes
Share crop production	-	Yes	-

Notes. Column 1 is analogous to column 6 in Tables 3 and 4. Column 2 adds a pre-trend for the employment share of the mining sector. Column 3 exclude the 5 percent of locations with the highest participation of the mining sector.

Table A9. Alternative shift-share design

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Labor informality rate						
Exports exposure	−0.413***	−0.199**	−0.164*	−0.127*	−0.127*	−0.128*
	(0.105)	(0.087)	(0.091)	(0.075)	(0.073)	(0.074)
Panel B: Labor informality rate (incl. self-employment)						
Exports exposure	−0.510***	−0.415***	−0.282**	−0.219**	−0.218**	−0.227***
	(0.098)	(0.138)	(0.139)	(0.096)	(0.090)	(0.087)
Panel C: Share of salaried jobs						
Exports exposure	0.158***	0.211**	0.188**	0.127***	0.126***	0.129**
	(0.031)	(0.090)	(0.080)	(0.049)	(0.046)	(0.050)
Panel D: Log (number of formal salaried jobs)						
Exports exposure	1.407***	1.287***	1.553***	0.803***	0.802***	0.796***
	(0.202)	(0.346)	(0.354)	(0.168)	(0.167)	(0.159)
Panel E: Log (number of informal salaried jobs)						
Exports exposure	−0.647*	0.192	0.767*	0.251	0.241	0.228
	(0.376)	(0.389)	(0.394)	(0.364)	(0.354)	(0.384)
Panel F: Log (number of self-employment jobs)						
Exports exposure	−0.926***	−1.073**	−0.169	−0.489	−0.477	−0.524*
	(0.269)	(0.484)	(0.372)	(0.340)	(0.304)	(0.302)
Panel G: Log (average formal wage)						
Exports exposure	0.660***	0.503**	0.571***	0.326*	0.320**	0.292**
	(0.175)	(0.229)	(0.201)	(0.174)	(0.145)	(0.143)
Panel H: Log (average informal wage)						
Exports exposure	0.714***	0.580	0.725	0.294	0.288	0.309
	(0.253)	(0.591)	(0.632)	(0.507)	(0.481)	(0.487)
Panel I: Log (average self-employment income)						
Exports exposure	0.813***	0.345	0.484	0.297	0.290	0.273
	(0.204)	(0.343)	(0.311)	(0.247)	(0.227)	(0.229)
Panel J: Poverty rate (FGT0)						
Exports exposure	−0.433***	−0.175	−0.260**	−0.144*	−0.142*	−0.132*
	(0.105)	(0.139)	(0.110)	(0.079)	(0.077)	(0.075)
KP F-stat	53.4	23.8	22.9	160.1	166.6	241.7
Observations	182	182	182	182	182	182
Preexisting trends						
Demographics	-	Yes	Yes	Yes	Yes	Yes
Economic conditions	-	-	Yes	Yes	Yes	Yes
Trade with China	-	-	-	Yes	Yes	Yes
Offshoring	-	-	-	-	Yes	Yes
Routinization	-	-	-	-	-	Yes

Notes. These regressions calculate standard errors clustered at the industry-level applying the method developed by Borusyak, Hull, and Jaravel (2021).