Office Support and Firm Scale-up in Brazil*

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Abstract

We document an overlooked organizational margin of firm growth: office support. Using matched employer–employee data for Brazilian manufacturing from 2004 to 2016, we classify six-digit occupations into production, office-support, and management layers. Office-support employment expands while management remains nearly flat, and firms add this layer progressively over the life cycle. Its share declines with firm size and its wages are less than half managers', consistent with scalable organizational overhead. Around first adoption, non-admin employment rises 17–23% and entry into export markets increases, especially among young and small firms. Office support emerges as a low-cost organizational margin of scale-up.

JEL codes: D22, F14, J24, L23, O14.
Keywords: firm organization, office-support workers, exporting, firm life cycle, development.

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1 Introduction

How does the organization of a firm change as it grows? Theories of firm organization emphasize the limits of entrepreneurs' and managers' time and the gains from delegating tasks to specialized workers (Lucas, 1978; Garicano, 2000; Caliendo and Rossi-Hansberg, 2012). Empirically, this literature has focused largely on managers, managerial layers, or broad categories of white-collar labor. Yet many of the nonproduction workers inside firms are neither managers nor highly skilled professionals. They are office-support workers—clerks, assistants, secretaries, and related occupations. We document that this relatively inexpensive layer is an important part of how manufacturing firms reorganize as they scale.

We use matched employer–employee records covering the universe of formal Brazilian manufacturing firms from 2004 to 2016. Six-digit occupation codes allow us to classify workers into three layers: production (core), office support/administrative (admin), and management. Three facts emerge. First, manufacturing becomes increasingly office-support intensive. The employment-weighted average within-firm admin share rises from 15.5% to 19.7%, while the core share falls from 82.5% to 77.0%; the management share changes little. The increase is concentrated not in lawyers, accountants, human resources, or other professional services, but in office clerks, administrative assistants, secretaries, and related support occupations.

Second, office support has the characteristics of a scalable organizational input. Its employment share declines with firm size even though larger firms employ more admin workers in levels, a pattern consistent with fixed costs of establishing the function and economies of scale once it is in place. Admin labor is also relatively inexpensive: average monthly pay is R$961, compared with R$2,227 for managers and R$820 for core workers. Office support therefore offers a lower-cost margin for handling coordination, documentation, and other nonproduction tasks without proportionally expanding the managerial layer.

Third, firms build this layer over the life cycle. Core production is nearly universal at birth, whereas office support is not: only 37% of firms employ an admin worker in their first observed year, compared with 87% employing core workers. Among firms observed from birth, the probability of employing an admin worker rises steadily with age, and conditional on having all three layers, admin employment grows faster than either core or managerial employment. These

patterns suggest that office support is not simply an organizational attribute firms are born with; it is a margin they develop as their operations expand.

We next examine what happens around the first adoption of an admin worker. The timing is striking. Employment outside the admin layer rises by 17–23% during the following three years, so the expansion cannot be explained mechanically by adding the first admin worker. Exporting provides a second marker of scale. Among firms that had not previously exported, the probability of exporting is flat before admin adoption and rises by 0.4 percentage points after one year and 0.8 percentage points after three years. These changes are large relative to the 0.56% exporter incidence in the event-study sample. The export response is concentrated among small and young firms, and is also larger in regions that experienced greater growth in imported robots.

Admin adoption is an endogenous organizational decision, and we do not interpret these event studies as causal effects of office-support workers. Instead, the event studies locate office-support adoption in the firm's growth process. Together, the life-cycle and event-time evidence shows that firms build this organizational layer at roughly the point at which they expand their workforce and begin undertaking scale-related activities such as exporting. The robot heterogeneity is similarly suggestive rather than causal: it is consistent with office-support services becoming particularly valuable where production technologies expand productive capacity.

Our contribution is empirical. A growing literature documents the expansion of nonproduction work in manufacturing, using categories such as production versus nonproduction employment, white-collar labor, or firms' nonmanufacturing establishments (Fort, Pierce, and Schott, 2018; Ding et al., 2025; Engbom et al., 2025). The detailed occupation codes in our data show that an important part of this shift occurs within manufacturing firms and is concentrated in routine office support rather than management or professional services. We then connect this occupational change to the firm life cycle: firms progressively add and deepen the office-support layer, and first adoption coincides with a discrete expansion of the rest of the workforce.

This distinction also adds to work on organization and firm growth. Existing research emphasizes management layers, managerial talent, and delegation (Caliendo, Monte, and Rossi-Hansberg, 2015; Akcigit, Alp, and Peters, 2021; Handwerker, Moreira, and Piccone Jr., 2021;

Hjort, Malmberg, and Schoellman, 2026; Engbom et al., 2025). Our evidence identifies a different organizational margin: comparatively inexpensive office-support labor whose services appear partly scalable across the production workforce. In this sense, office support belongs alongside organizational investments such as standardization (Argente et al., 2025) that accompany the transition to larger-scale production. We do not estimate the causal return to this organizational input; we document when it emerges and the firm outcomes that change around its adoption.

The results also complement evidence that firms reorganize around entry into foreign markets. Exporters change managerial hierarchies and hire workers with relevant export experience (Caliendo, Monte, and Rossi-Hansberg, 2019; Labanca, Molina, and Muendler, 2024; Brambilla et al., 2025). We identify a lower-cost organizational margin that is also built around this transition. Export entry, however, is one manifestation of the broader pattern: the central finding is that office-support adoption is closely tied to firm scale-up.

Brazil is a particularly informative setting to analyze this organizational margin. Its granular data allow us to observe firms responding to the demands of scale by reorganizing internally and across firm boundaries, or changing their mix of labor and technology. The distinction between these margins is important because production has increasingly fragmented across firms (Fort, 2017; Boehm and Oberfield, 2023), with theories of organization emphasizing specialization and delegation within the firm.

Moreover, during our sample period, Brazilian regulation substantially restricted outsourcing, especially of core activities. The later expansion of outsourcing allowed specialized providers to perform non-core activities at scale (Felix and Wong, 2026). Trade liberalization generated substantial adjustments across firms, altering firm survival and worker reallocation (Dix-Carneiro and Kovak, 2017; Felix, 2026). Brazil also provides evidence that production organization responds to changes in factor prices and technology: higher relative labor costs can induce mechanization and changes in production scale (Caunedo, Felix, and Manysheva, 2026), while robot adoption is accompanied by a reallocation of workers from production toward support roles as firms reorganize around the new technology (Rodrigo, 2022). Viewed against these alternative margins, the pattern we document isolates a basic but understudied

form of internal reorganization: as firms grow, they build a relatively inexpensive office-support layer between production and management.

2 Data

We combine three Brazilian administrative datasets covering 2004–2016.

RAIS employer–employee links. RAIS provides matched employer–employee records with firm identifiers (CNPJ) and four-digit sector codes (CNAE); we focus on manufacturing. Workers carry six-digit occupation codes (CBO 2002), which we classify into the three layers. Management titles are led by *supervisor*, *gerente* (manager), and *diretor* (director), attached to production, operations, and maintenance. Admin titles are led by *administrador* (administrator), *auxiliar* (clerk), and *assistente* (assistant), alongside in-house professionals (*advogado*, lawyer; *economista*, economist) and front-office support (*recepcionista*, *atendente*). Core titles are led by *trabalhador* (worker), *operador* (operator), and *montador* (assembler), attached to specific materials and processes. Appendix Figure A.1 visualizes the titles as word clouds; Appendix Table A.2 counts occupations by layer and group; Appendix Figure A.2 plots employment shares for the disaggregated groups; and Appendix Table A.3 reports gender and education by layer—in 2016, the female share is 0.407 among admin workers versus 0.253 among core workers and 0.246 among managers. The full crosswalk is available online with the supplemental appendix.

SECEX and COMEXStats trade data. SECEX lists exporting firms by CNPJ, from which we construct an indicator for exporting in a given year. COMEXStats provides monthly import and export volumes and values with municipality and product codes, which we use to identify imported industrial robots, following Rodrigo (2022).

Appendix Table A.4 reports descriptive statistics for the panel of 8,231,314 firm-years. The average firm employs 17.9 workers—15.6 core, 6.8 admin, and 3.5 management among firms with each layer—and pays average monthly wages of R$820 (core), R$961 (admin), and R$2,227 (management). Average firm age is 7.5 years, and 6.7% of firm-years are exporters.

3 Office Support and Firm Scale

Three facts organize the descriptive evidence. Together, they show that the growth of nonproduction employment in Brazilian manufacturing is not primarily an expansion of management or professional services. It reflects the development of a comparatively inexpensive office-support layer that firms add and deepen as they grow.

Fact 1: Manufacturing firms are becoming more *office support* intensive. Figure 1 plots the employment-weighted average within-firm share of each layer by year. Between 2004 and 2016, the admin share (left axis) rose from 15.5% to 19.7%, while the core-production share (right axis) fell from 82.5% to 77.0%. The management share changed little, increasing from 4.7% to 5.5%. The reorganization of manufacturing employment occurred primarily between production and office-support rather than through a thickening of managerial hierarchies. Appendix Figures A.3 report employment levels by layer.

The detailed occupation codes show that this is not conventional professional upgrading. Office clerks (*auxiliar de escritório*), administrative assistants, secretaries, and related support occupations account for most of the increase. Employment shares in human resources, marketing, and client services groups remained relatively stable over the years, and in-house professional occupations such as lawyers and accountants increased only modestly from low initial levels (Appendix Figure A.2). The aggregate increase therefore reflects the expansion of routine support functions within manufacturing firms, rather than the incorporation of professional service activities into manufacturers' payrolls.

Fact 2: *Office support* is a low-cost organizational layer whose share declines with firm size. The shift toward office support appears throughout the firm-size distribution. Between 2004 and 2016, the admin share rose from approximately 18% to 21% among firms with 10–50 workers, from 14.5% to 19% among firms with 51–250 workers, and from 10% to 15% among firms with more than 250 workers (Appendix Figure A.4). Management remained near or below 5% in each size class.

At any point in time, however, the admin share declines with firm size. This pattern is

consistent with two related features of office-support services. First, establishing a distinct admin function may involve a fixed organizational cost, making adoption less attractive for the smallest firms. Second, once the function is in place, its services can be spread over a larger production workforce, generating economies of scale in administration. Larger firms therefore employ more admin workers in levels but require fewer of them per production worker.[1]

The layer is also inexpensive relative to the principal organizational alternative. Average monthly pay is R$961 for admin workers, less than half of managers' R$2,227, and slightly above core workers' R$820 (Appendix Table A.4). This gap among managers, admins, and core-production workers' compensations has remained fairly constant from 2004 to 2016 (Appendix Figure A.5). Office support thus provides a comparatively low-cost margin through which firms can delegate routine coordination and documentation tasks without proportionally expanding the managerial layer.

Fact 3: Firms add and deepen the *office support* layer as they grow over the life cycle. Firms are not generally born with their eventual organizational structure. Table A.1 shows that in their first year, 87% of manufacturing firms employ core workers, but only 37% employ admin workers and 15% employ managers. Among firms born with at least 10 workers, the corresponding shares are 98%, 76%, and 43%. Core production is therefore nearly universal at birth, whereas the two organizational layers are acquired more gradually.

Figure 2 plots the probability of employing each layer by firm age, relative to birth, controlling for firm and year fixed effects. By age ten, the probabilities of employing admin workers and managers are approximately 30 percentage points higher than at birth. The probability of employing core workers remains essentially unchanged and close to zero because that layer is already nearly universal among new firms.

Life-cycle specification conditional on all layers. For life-cycle outcomes conditional on organizational structure, we estimate "age effect" coefficients β_k separately for each layer (core,

[1] The evidence does not separately identify these mechanisms, but the combination of life-cycle adoption and a declining admin share with size is consistent with office support operating as partly fixed organizational overhead.

admin, managers):

$$Y_{it} = \sum_{k=1}^{10} \beta_k \mathbf{1}(\text{Age}_{it} = k) + \delta_i + \delta_t + \varepsilon_{it}, \quad (1)$$

where age zero is the omitted category, Y_{it} is the outcome for firm i in year t (for example, log employment), and δ_i and δ_t are firm and year fixed effects. Standard errors are clustered at the firm level. The sample includes firm-year observations with at least 10 workers and, for the intensive-margin outcomes, firms that employ all three layers in every included year.

Conditional on having all three layers, the estimates from equation (1) reveal that admin employment grows faster over the life cycle than either core or managerial employment (Appendix Figures A.6). Differences in wage growth across the three layers are small and not statistically distinguishable (Appendix Figure A.7), indicating that the distinctive life-cycle pattern lies principally in the quantity of office-support labor firms employ, while their relative cost remains constant over the life cycle too.

The admin layer is also closely associated with market scale: virtually none of exporters' employment is located in firms without admin workers, although a nontrivial share is located in firms without managers (Appendix Figure A.8). We do not interpret these cross-sectional relationships as causal. Rather, they motivate the analysis in the next section, which traces employment, exporting, and wages around the firm's first admin adoption. That analysis asks whether adoption occurs at the point when firms begin to operate at a larger scale.[2]

4 Admin Adoption and Firm Scale-up

Section 3 shows that office support is adopted gradually over the firm life cycle and has features of a scalable organizational input: establishing the layer may involve a fixed cost, while its services can be spread over a growing production workforce. We now ask what happens to firm scale around the point at which this layer is first adopted. We examine employment first and then exporting, a high-fixed-cost activity associated with operating at a larger market scale. Because admin adoption is an endogenous organizational choice, the event studies are descriptive, i.e.,

[2]This is consistent with Figure A.9 shows that both exporters and non-exporters experienced the increase of admin workers. Nevertheless the pattern is larger for non-exporters, since exporters already rely on this type of workers.

they characterize the timing of firm outcomes around adoption rather than causal effects of admin workers.

Design. We estimate firm-level staggered event studies using the heterogeneity-robust estimator of De Chaisemartin and D'Haultfœuille (2026). The corresponding specification is

$$y_{it} = \sum_{\substack{k=-3 \\ k\neq 0}}^{3} \beta_k \mathbf{1}(t - t_i^* = k) + \delta_i + \delta_t + X_{i,t}'\Gamma + \varepsilon_{it}, \tag{2}$$

where t_i^* is firm i's year of first admin adoption, the adoption year is omitted, δ_i and δ_t are firm and year fixed effects, and $X_{i,t}'\Gamma$ represents the estimator's non-parametric trends by industry, state, and management-layer status. Standard errors are clustered by firm. Treatment is absorbing. The sample contains 279,226 firms that first adopt an admin worker during 2004 and 2016, and 34,340 never-adopters used as controls.

Adoption coincides with a sharp increase in firm scale. Firm scale turns sharply positive after office-support/admin adoption, reversing a relative decline in the preceding years. Total employment is roughly 25–28% higher during the following three years (Appendix Figure A.10). Employment growth is concentrated immediately after adoption: year-over-year growth jumps in the first post-adoption year and subsequently moderates, while the employment level remains persistently higher.

The expansion is not simply the mechanical addition of the first admin worker. Core and managerial employment both rise after adoption (Appendix Figure A.11). Figure 3 shows that even after excluding the admin workers, employment still rises by roughly 17–23% over the following three years. Appendix Figure A.12 shows the corresponding growth paths by layer. Thus, the organizational change occurs together with an expansion of the rest of the firm's workforce. This pattern complements the cross-sectional evidence in Section 3: firms add the admin layer as they grow, and once in place the layer accompanies a substantial expansion in production and managerial employment.

Wages move much less than employment. Average firm wages increase gradually by less

than 1% (Appendix Figure A.13). Core wages increase modestly and manager wages somewhat more—roughly 0.5–2.5% across the two layers by the third year—but the managerial estimates are substantially less precise (Appendix Figure A.14). The combination of a large, persistent employment expansion and a small positive wage response is consistent with admin adoption accompanying firm scale-up rather than merely relabeling existing jobs.

Adoption also precedes entry into export markets. Exporting provides a second marker of scale-up. Figure 4 traces the exporter indicator around the first admin adoption, restricting the sample to firms that did not export before adoption. Exporting is essentially flat during the pre-adoption years and begins to increase immediately afterward. The probability of exporting rises by about 0.4 percentage points after one year and 0.8 percentage points after three years. These changes are economically large relative to the estimation sample, in which exporters account for only 0.56% of firm-year observations.

The timing is consistent with office support being part of the organizational capacity firms build before undertaking fixed-cost activities such as exporting. This interpretation also connects to Labanca et al. (2024), who show that Brazilian firms prepare for export entry by changing their workforce before entering foreign markets. Our evidence identifies a different organizational margin: the creation of an office-support layer.

Four complementary exercises provide context for this interpretation. Exporting also increases after manager adoption, although the estimates are less precise (Appendix Figure A.15). Looking in the reverse direction, admin employment is roughly 40–50 percentage points higher two to three years after export entry than in the entry year; sizable pre-entry differences make this exercise descriptive (Appendix Figure A.16). Importing is flat before admin adoption and then rises afterward, but by less than exporting (Appendix Figure A.17). Finally, the post-adoption export pattern also appears in both halves of the sample period, with one-year pre-adoption placebos close to zero (Appendix Figure A.18).

Scale-related changes are concentrated among small and young firms. The patterns are strongest where the scalable nature of office support should matter most. Figure 5 shows that the increase in exporting following adoption is concentrated among small and young firms.

For firms with 10–30 workers, the export probability reaches roughly 0.8 percentage points above its adoption-year level after three years, while estimates are half and null for firms of 31–50 and 51–100 workers respectively. Similarly, the post-adoption increase reaches about 1.2 percentage points among firms aged 1–5, approximately twice the exporter incidence in the estimation sample, and is substantially smaller among older firms.[3] Finally, consistent with the age gradient, firms that adopt earlier generally pay higher manager wages, although the profile partially reverses among the latest adopters (Appendix Figure A.19).

These gradients reinforce the life-cycle evidence in Section 3. Admin adoption is not simply a feature of already large, mature firms. It occurs disproportionately along the margin on which young and small firms are building the organizational capacity associated with subsequent scale.

The association is stronger where robot adoption expanded. Figure A.20 provides a final piece of suggestive evidence. We split firms according to whether their microregion experienced above- or below-median growth in imported robots during 2004–2016. In high-robot-growth regions, exporting rises by approximately 0.5 percentage points one year after admin adoption and 0.8 percentage points after three years. The corresponding changes are about a quarter in low-robot-growth regions.

We do not interpret this comparison causally: regional robot growth may be correlated with other determinants of firm expansion. The pattern is nevertheless consistent with office support becoming particularly valuable when production technologies permit firms to expand their productive capacity. The analogous split by changes in overall trade exposure does not display the same contrast (Appendix Figure A.21).[4] Taken together with the size and age gradients, the evidence points to office support as an organizational margin that firms build when moving to a larger operating scale.

[3] Estimates for firms with more than 100 workers are likewise small and imprecise beyond the first post-adoption year (Appendix Figure A.22).

[4] The robot and trade measures are mapped in Appendix Figures A.23–A.24.

5 Conclusion

Brazilian manufacturing firms become increasingly office-support intensive as they grow. This layer is distinct from management and professional services, relatively inexpensive, and its employment share declines with firm size even as firms employ more office-support workers in levels—patterns consistent with partly fixed, scalable organizational overhead. Firms also build the layer progressively over the life cycle. Around first adoption, employment outside the admin layer rises by 17–23%, while the probability of exporting increases by 0.4–0.8 percentage points. These changes are largest among young and small firms. Because adoption is endogenous, we do not interpret these event studies as causal effects; rather, they locate office-support adoption in the firm's growth process.

These facts broaden the empirical view of firm organization beyond managers and broad white-collar categories. They suggest that scale-up can involve building a lower-cost support layer that handles coordination, documentation, and related nonproduction tasks across a growing production workforce. Office support, therefore, belongs alongside management, delegation, and standardization as an organizational margin associated with larger-scale production. Quantifying its causal return and aggregate importance for firm growth is a natural next step.

These findings bear on models of firm growth and development. In Engbom et al. (2025), following Lucas (1978), entrepreneurs choose how many admin tasks to delegate to hired workers; our evidence locates that specialization within firms, over the life cycle, and alongside scale demands such as exporting or the spread of core-replacing technology, where office support emerges as a low-cost organizational input through which manufacturing firms build the capacity to grow.

These findings may be especially relevant in the age of AI. Office-support tasks—such as documentation, scheduling, record keeping, and routine communication—are among those most amenable to AI. If AI lowers the cost of performing these tasks, it may relax an organizational constraint on firm growth, particularly in developing countries where organizational inputs are scarce. Our evidence thus points to a potentially important channel for AI-driven productivity gains: not only replacing tasks, but lowering the organizational cost of scaling.

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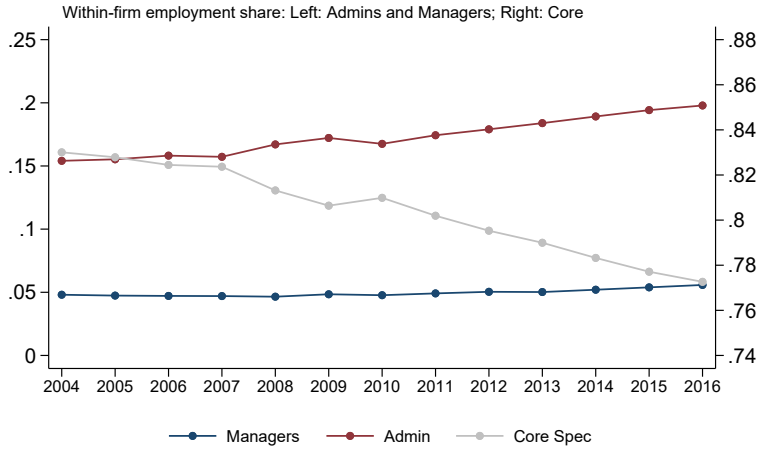
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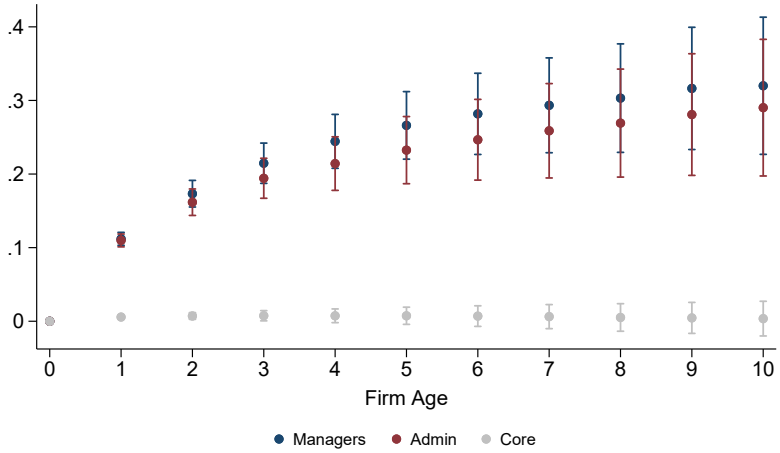
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Figure 1: Within-firm employment shares by layer



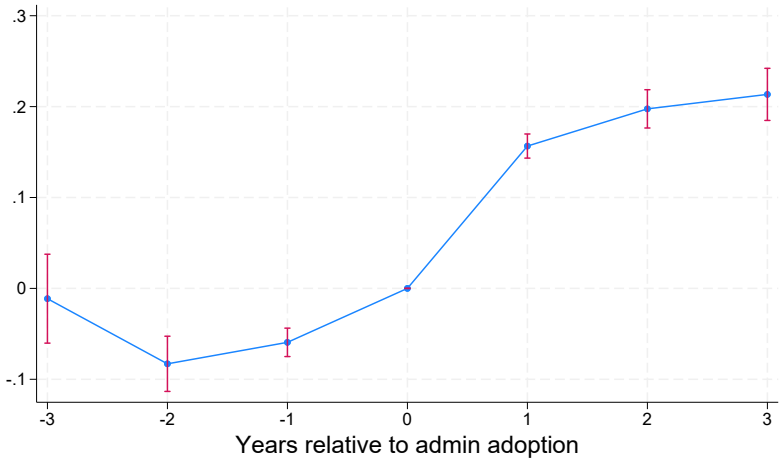
Notes: RAIS manufacturing firm-year panel, 2004–2016, restricted to firms with at least 10 workers and firm age below 31. Six-digit occupations (CBO 2002) are classified into management, admin, and core layers. Each series is the employment-weighted mean across firms of the within-firm employment share of the layer. Left axis: admin and management shares; right axis: core share.

Figure 2: Probability of employing each layer, by firm age



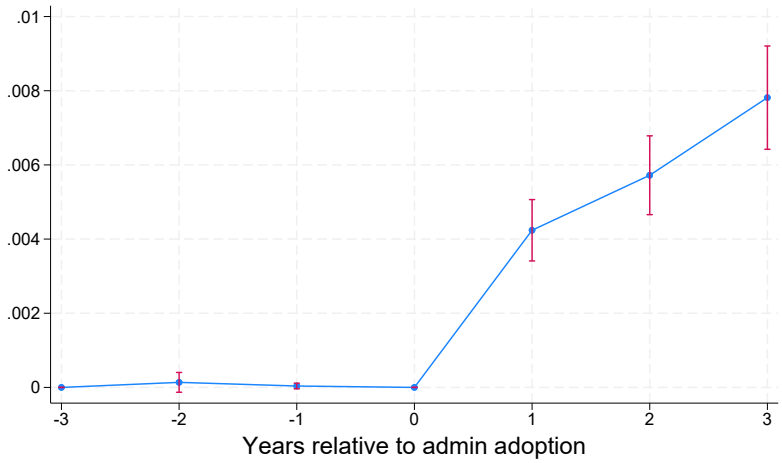
Notes: Coefficients on firm-age indicators (age 0 omitted) from regressions of an indicator for employing each layer, estimated separately by layer with firm and year fixed effects on the RAIS manufacturing panel, restricted to firms with at least 10 workers observed from birth. Markers denote point estimates; bars denote 95% confidence intervals based on standard errors clustered by firm.

Figure 3: Admin adoption and employment excluding admin workers



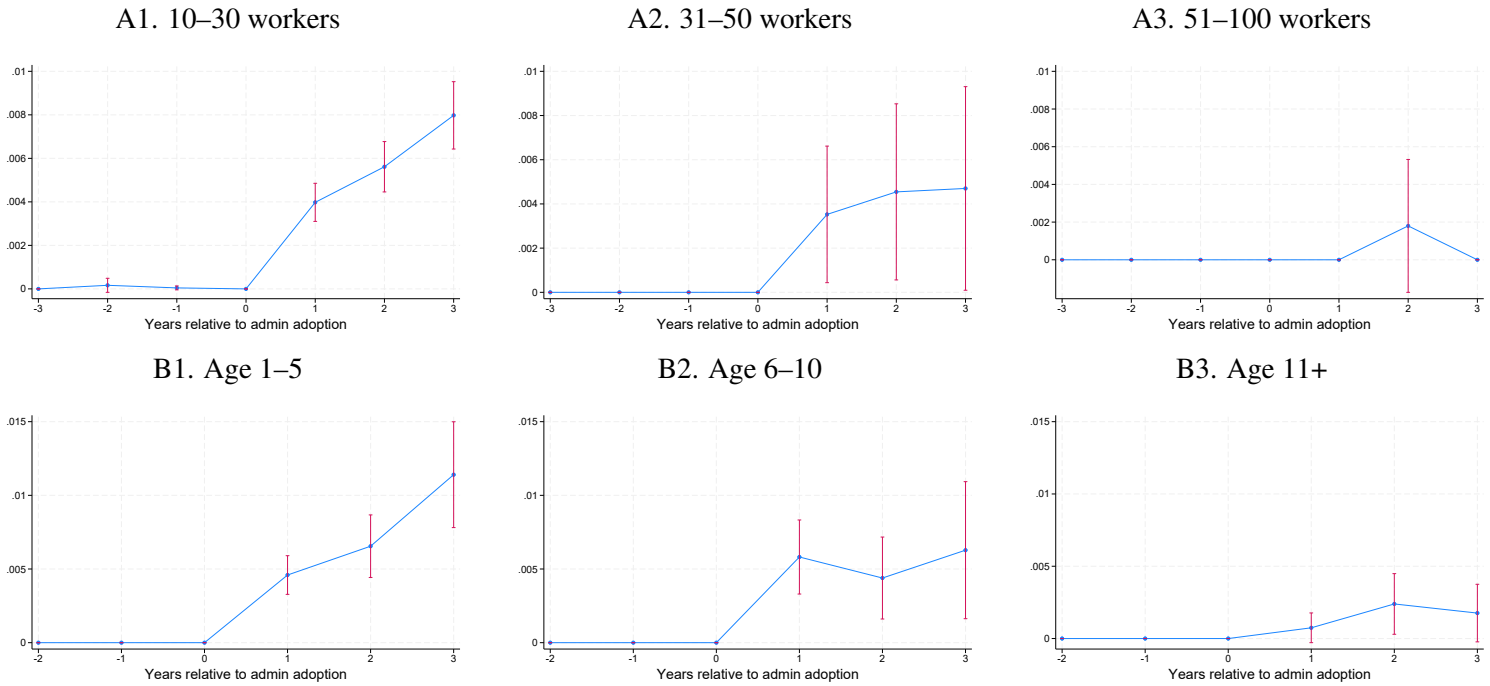
Notes: Event-study estimates of equation (2) for log employment of core and management workers combined, i.e., total firm employment excluding the admin layer. Estimator, sample, and controls as in Figure 4. Bars denote 95% confidence intervals based on standard errors clustered by firm.

Figure 4: Admin adoption and the probability of exporting



Notes: Event-study estimates of equation (2) for an indicator equal to one if the firm exports in the year, estimated with the heterogeneity-robust estimator of De Chaisemartin and D'Haultfœuille (2026) (`did_multiplegt_dyn`) under absorbing treatment, with never-adopters as controls and non-parametric trends by industry, state, and management-layer status. Sample: RAIS manufacturing firms with at least 10 workers, firm age below 31, at least two years in the panel, and no pre-event exporting; 279,226 adopters and 34,340 never-adopters. Bars denote 95% confidence intervals based on standard errors clustered by firm.

Figure 5: Adoption dynamics on the export margin, by firm size and firm age



Notes: Event-study estimates of equation (2) for the exporter indicator, estimated separately by firm size class (Panels A1–A3) and firm age at adoption (Panels B1–B3). Estimates for firms with more than 100 workers are in Appendix Figure A.22. Panels within each row share a common vertical scale. Estimator, sample, controls, and inference are as in Figure 4.

Online Appendix to "Office Support and Firm Scale-up in Brazil,"

by Mayara Felix and Rodimiro Rodrigo

Figure A.1: Occupation titles by layer: word clouds

A. Management



B. Admin

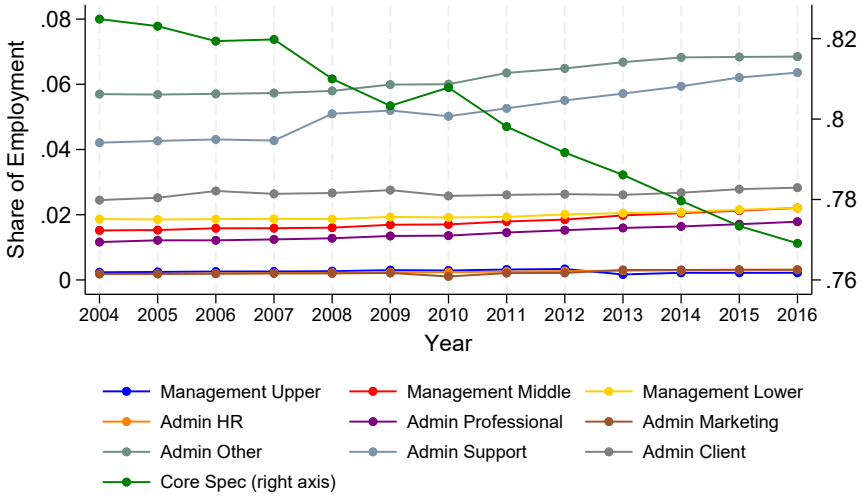


C. Core



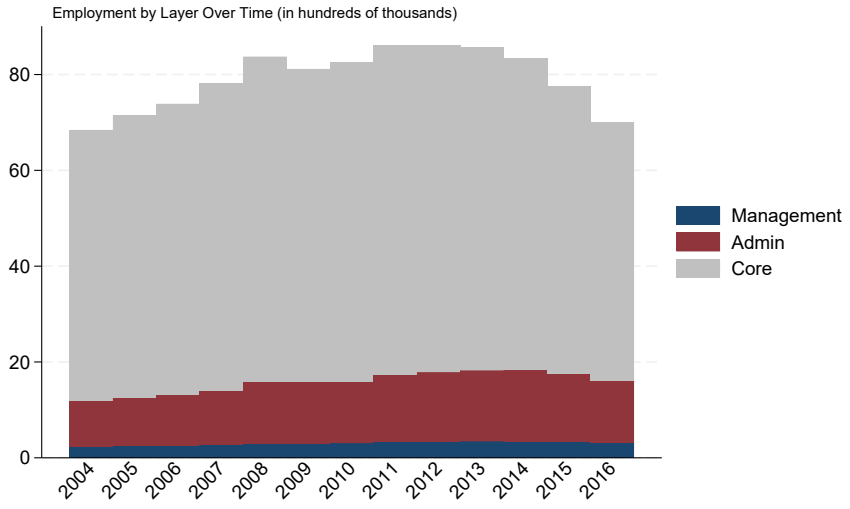
Notes: Word clouds of the Portuguese titles of the six-digit CBO 2002 occupations classified into each layer (word size proportional to frequency across occupation titles; Portuguese stopwords and generic filler terms removed). Underlying crosswalk: 2,447 unique codes—2,021 core, 221 admin, 184 management, and 21 excluded (Appendix Table A.2). Generated with the replication code accompanying the paper.

Figure A.2: Employment shares for disaggregated occupation groups



Notes: Aggregate share of employment by year for the disaggregated occupation groups underlying the layer classification: upper, middle, and lower management; admin HR, professional, marketing, other, support, and client services (left axis); and core specialists (right axis). RAIS manufacturing firms with at least 10 workers and firm age below 31.

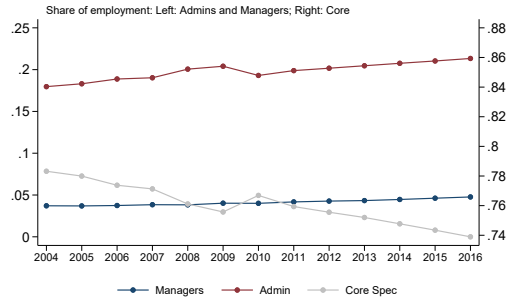
Figure A.3: Employment by layer, 2004–2016



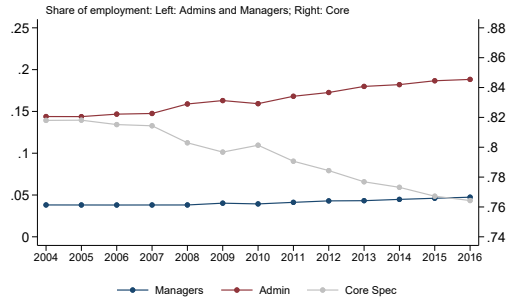
Notes: Total employment by layer and year, in hundreds of thousands of workers, stacking management, admin, and core employment. RAIS manufacturing firms with at least 10 workers and firm age below 31.

Figure A.4: Employment shares by layer across the firm size distribution

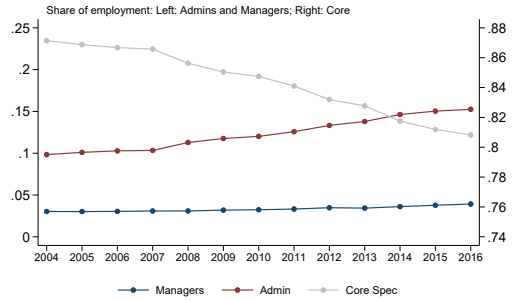
C. Small firms (10–50 workers)



B. Medium firms (51–250 workers)

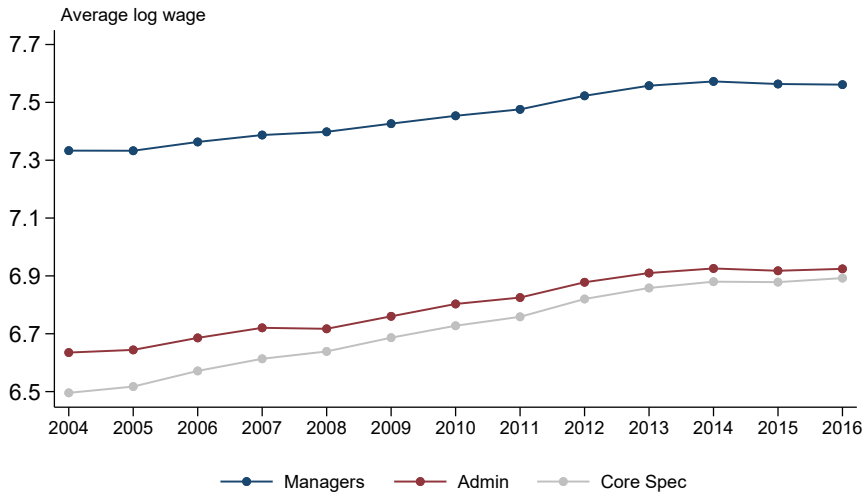


A. Large firms (more than 250 workers)



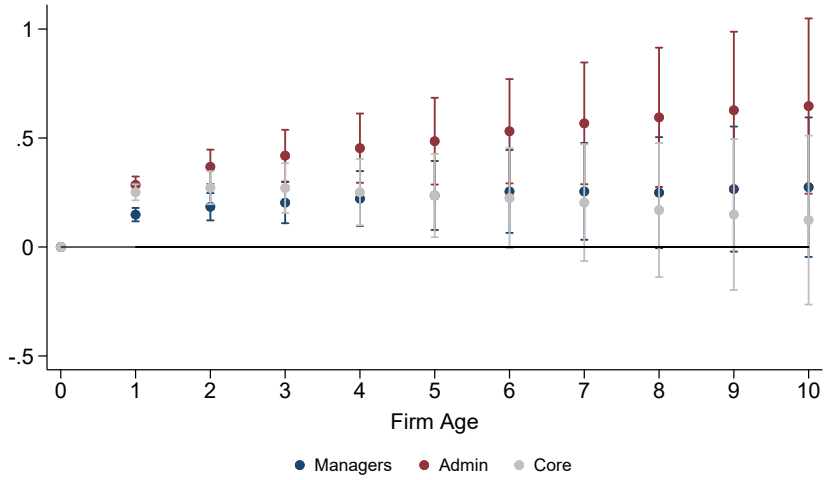
Notes: RAIS manufacturing firm-year panel, 2004–2016, restricted to firms with at least 10 workers and firm age below 31. Size classes by firm employment: small (10–50 workers), medium (51–250), large (more than 250). Within each size class and year, shares are total layer employment divided by total employment. In each panel, the left axis measures admin and management shares and the right axis measures the core share.

Figure A.5: Average log wage by layer



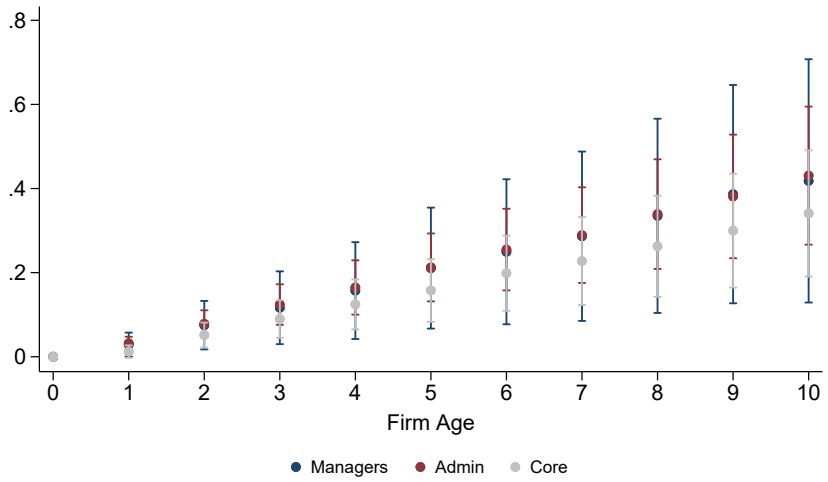
Notes: RAIS manufacturing firm-year panel, 2004–2016, restricted to firms with at least 10 workers and firm age below 31. Each series is the mean across firms of the firm-level average log monthly wage of workers in the layer. Wages in current reais.

Figure A.6: Log employment by layer over the firm life cycle



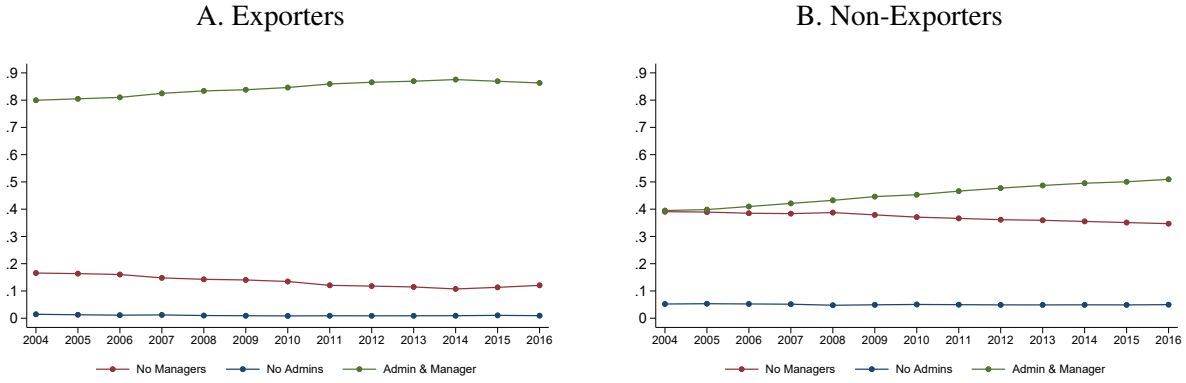
Notes: Estimates of equation (1) for log employment by layer, ages 0–10, estimated separately by layer with firm and year fixed effects. Sample: RAIS manufacturing firms with at least 10 workers in all years, observed from birth, conditional on having all three layers. Bars denote 95% confidence intervals based on standard errors clustered by firm.

Figure A.7: Log wages by layer over the firm life cycle



Notes: Estimates of equation (1) for the firm-level average log wage by layer, ages 0–10, estimated separately by layer with firm and year fixed effects. Sample as in Appendix Figure A.6. Bars denote 95% confidence intervals based on standard errors clustered by firm.

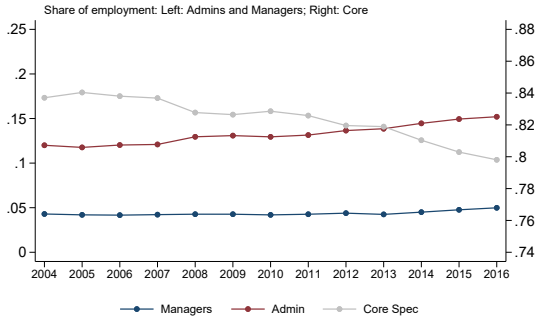
Figure A.8: Employment shares by organizational configuration and export status



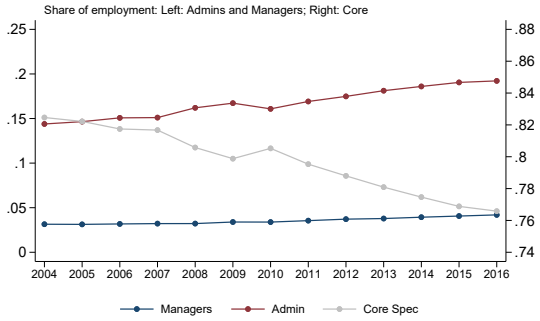
Notes: Share of employment in firms with no managers, in firms with no admin workers, and in firms with both admin and management layers, by year and export status. RAIS manufacturing firms with at least 10 workers, firm age below 31, and at least two years in the panel, matched to the SECEX exporter list; exporter status is an indicator for exporting in the year.

Figure A.9: Employment shares by layer and export status

A. Always Exporters



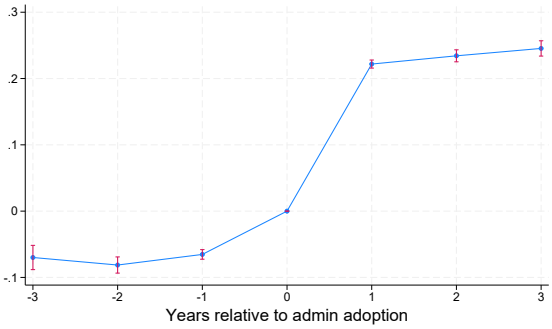
B. Never Exporters



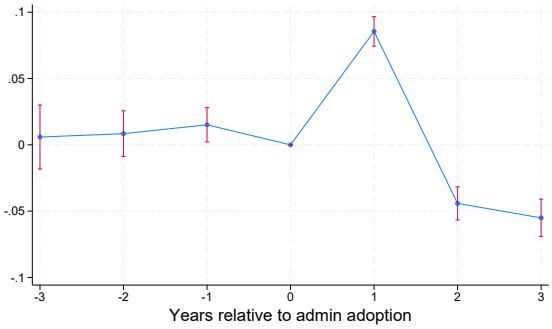
Notes: Aggregate share of employment by layer and year, estimated separately for firms that export in every year of the panel (Panel A) and firms that never export (Panel B). Sample and layer definitions as in Figure 1; exporter status from SECEX. Left axis: admin and management; right axis: core.

Figure A.10: Admin adoption and total firm employment

Log employment



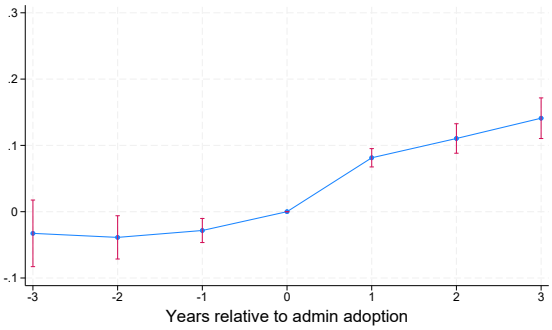
Year-over-year employment growth



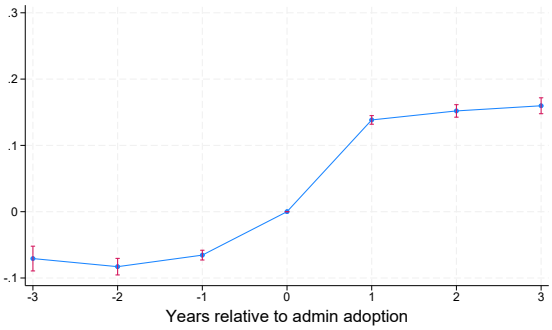
Notes: Event-study estimates of equation (2) for total firm log employment (left) and year-over-year log employment growth (right). Estimator, sample, and controls as in Figure 4. Bars denote 95% confidence intervals based on standard errors clustered by firm.

Figure A.11: Admin adoption and employment, by layer

Management

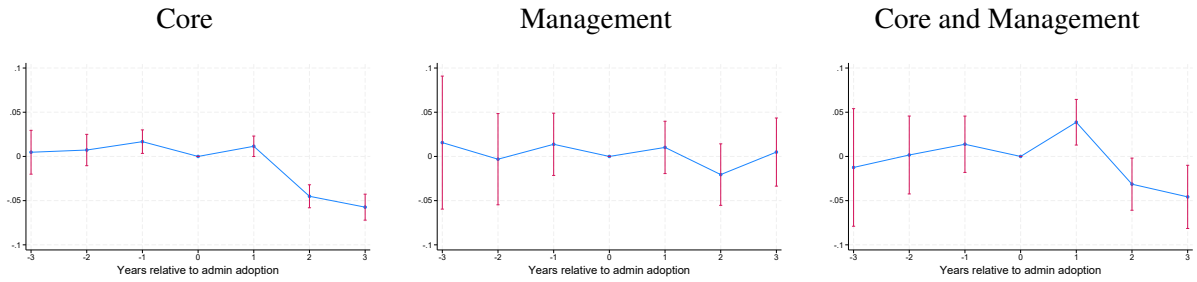


Core



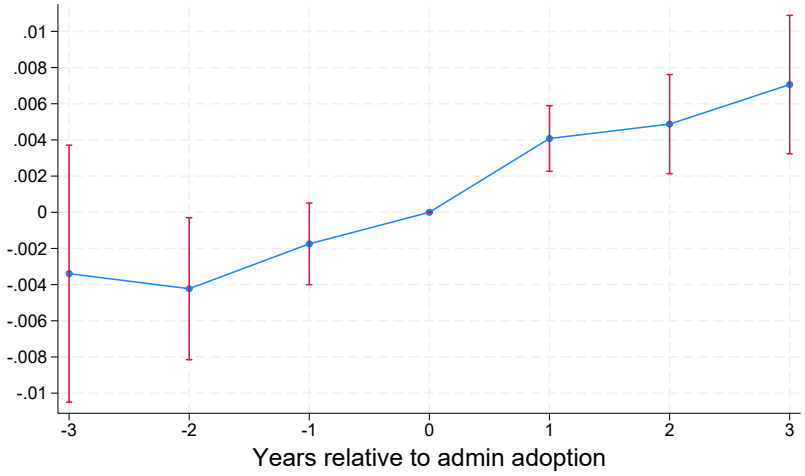
Notes: Event-study estimates of equation (2) for log employment of management (left) and core (right) workers. Estimator, sample, and controls as in Figure 4. Bars denote 95% confidence intervals based on standard errors clustered by firm.

Figure A.12: Admin adoption and employment growth, by layer



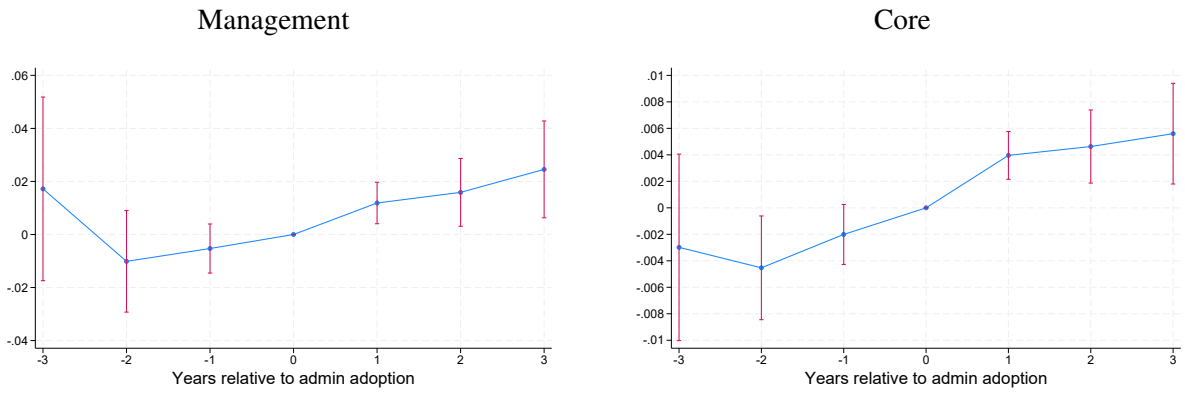
Notes: Event-study estimates of equation (2) for year-over-year log employment growth of core workers (left), management workers (center), and the two layers combined (right). Estimator, sample, and controls as in Figure 4. Bars denote 95% confidence intervals based on standard errors clustered by firm.

Figure A.13: Admin adoption and the firm-level average log wage



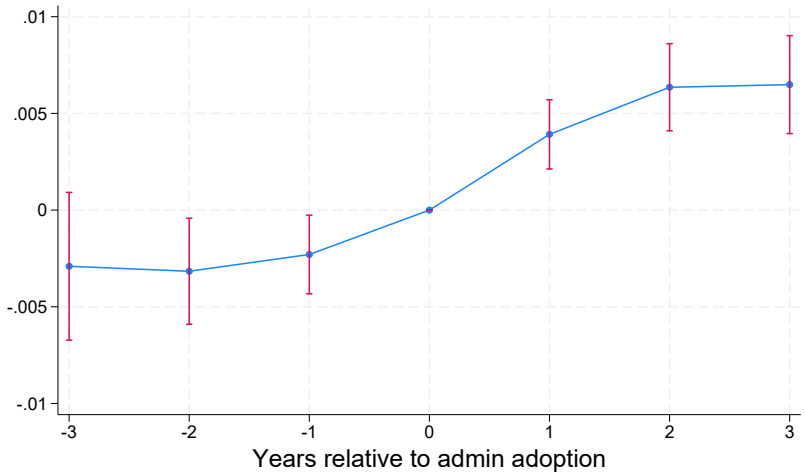
Notes: Event-study estimates of equation (2) for the firm-level average log wage across all workers. Estimator, sample, and controls as in Figure 4. Bars denote 95% confidence intervals based on standard errors clustered by firm.

Figure A.14: Admin adoption and wages, by layer



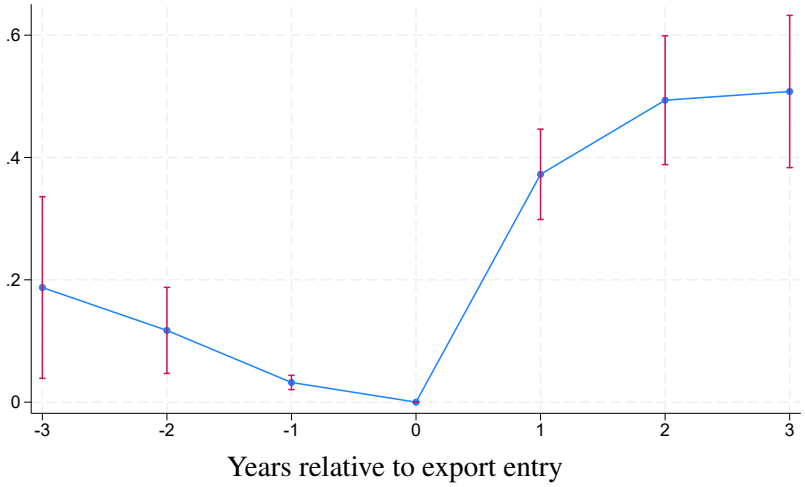
Notes: Event-study estimates of equation (2) for the firm-level average log wage of management (left) and core (right) workers. Estimator, sample, and controls as in Figure 4. Bars denote 95% confidence intervals based on standard errors clustered by firm.

Figure A.15: Manager adoption and the probability of exporting



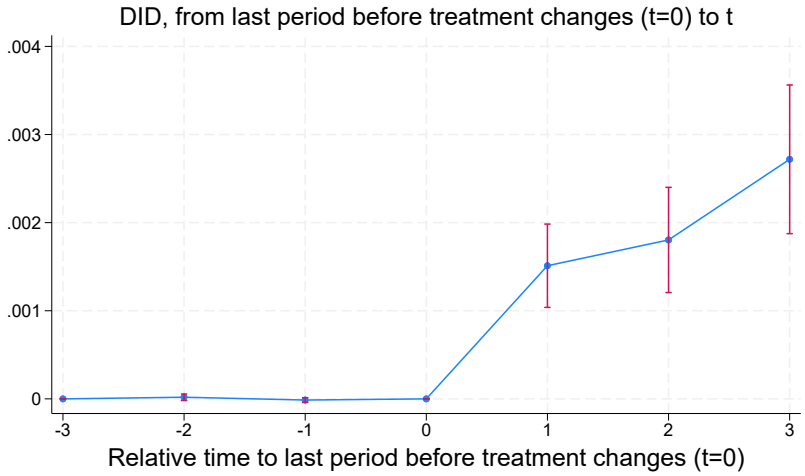
Notes: Event-study estimates for the exporter indicator around first manager adoption, estimated with the same design as equation (2) with manager adoption as the (absorbing) treatment. Estimator, sample, and controls as in Figure 4. Bars denote 95% confidence intervals based on standard errors clustered by firm.

Figure A.16: Admin employment around export entry



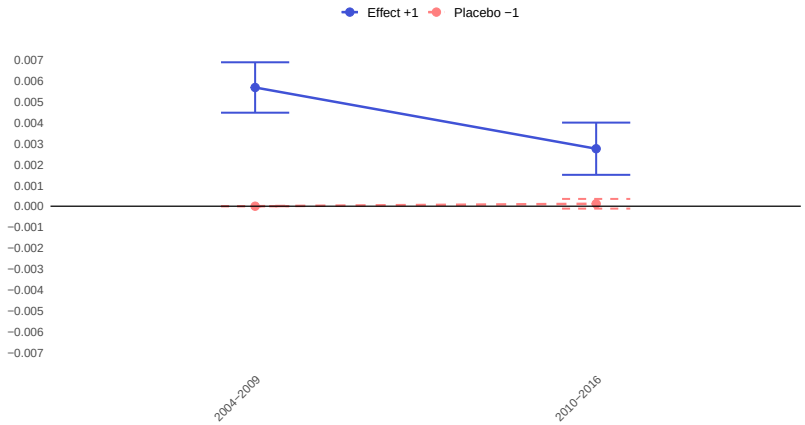
Notes: Event-study estimates for an indicator of admin employment around export entry: the treatment is the exporter indicator and the outcome is the (absorbing) admin indicator, conditional on prior organizational structure, estimated with the estimator of De Chaisemartin and D'Haultfœuille (2026) with never-switchers as controls and non-parametric trends by industry, state, and management-layer status. Bars denote 95% confidence intervals based on standard errors clustered by firm.

Figure A.17: Admin adoption and the probability of importing



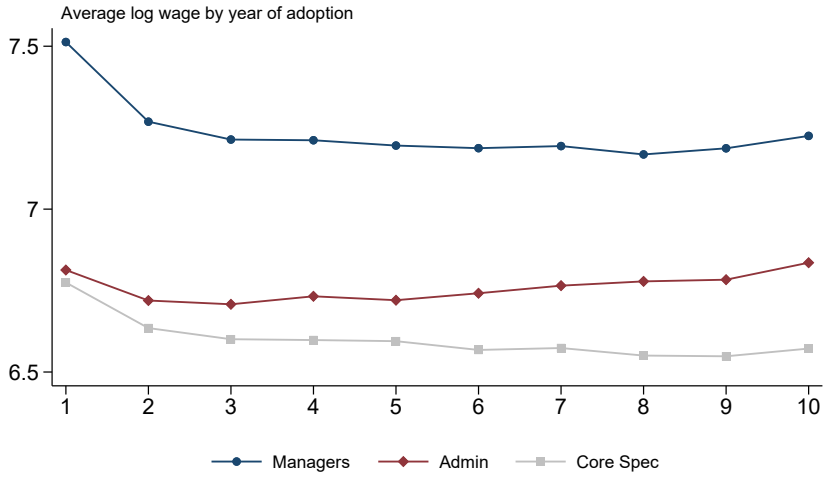
Notes: Event-study estimates of equation (2) for an indicator equal to one if the firm imports in the year. The sample excludes firms that imported before admin adoption; importers account for 0.29% of firm-years in the estimation sample. The three pre-adoption placebos are jointly insignificant ($p = 0.799$). Estimator, treatment definition, controls, and inference are as in Figure 4. Bars denote 95% confidence intervals based on standard errors clustered by firm.

Figure A.18: Adoption dynamics on the export margin, by subperiod



Notes: Estimates of the first post-adoption treatment effect (blue) and the one-year pre-adoption placebo (red) for the exporter indicator, estimated separately for the 2004–2009 and 2010–2016 subperiods. Estimator, sample, and controls as in Figure 4. Bars denote 95% confidence intervals based on standard errors clustered by firm.

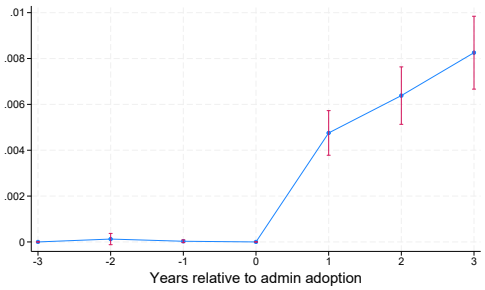
Figure A.19: Average log wage by layer and firm age at admin adoption



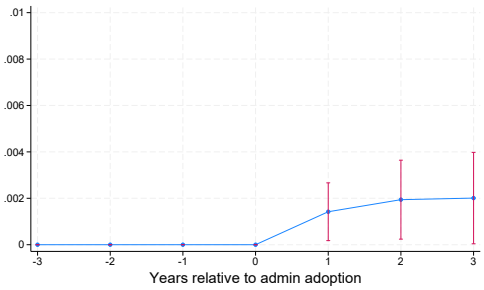
Notes: Average log wage by layer, plotted against the firm's age at first admin adoption (years 1–10). RAIS manufacturing firms with at least 10 workers and firm age below 31. Wages in current reais.

Figure A.20: Adoption dynamics on the export margin, by regional robot exposure

A. Above-median robot increase



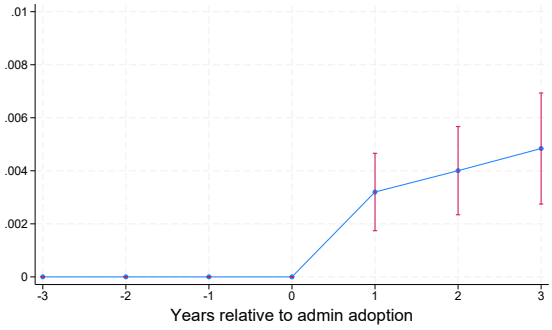
B. Below-median robot increase



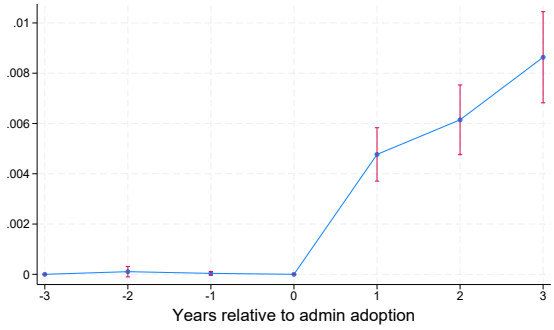
Notes: Event-study estimates of equation (2) for the exporter indicator, estimated separately for firms in microregions with above- and below-median increases in the stock of imported robots between 2004 and 2016, identified from COMEXStats product codes following Rodrigo (2022). Maps are in Appendix Figures A.23–A.24. Estimator, sample, controls, and inference are as in Figure 4.

Figure A.21: Admin adoption and exporting, by regional change in trade share

A. Above-median change in trade share

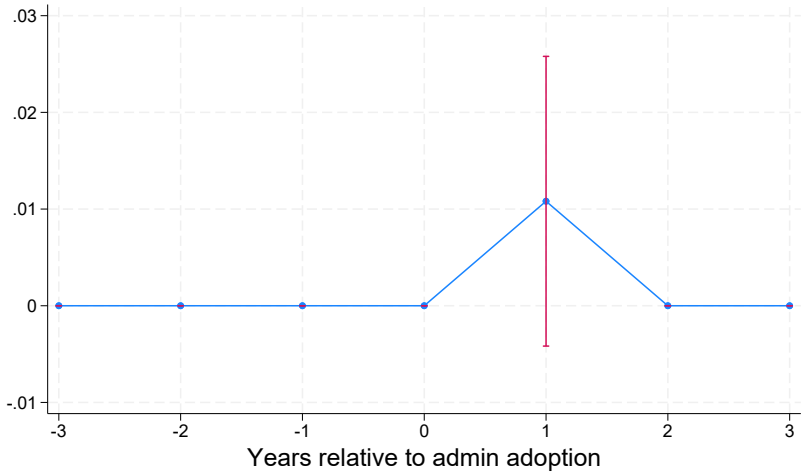


B. Below-median change in trade share



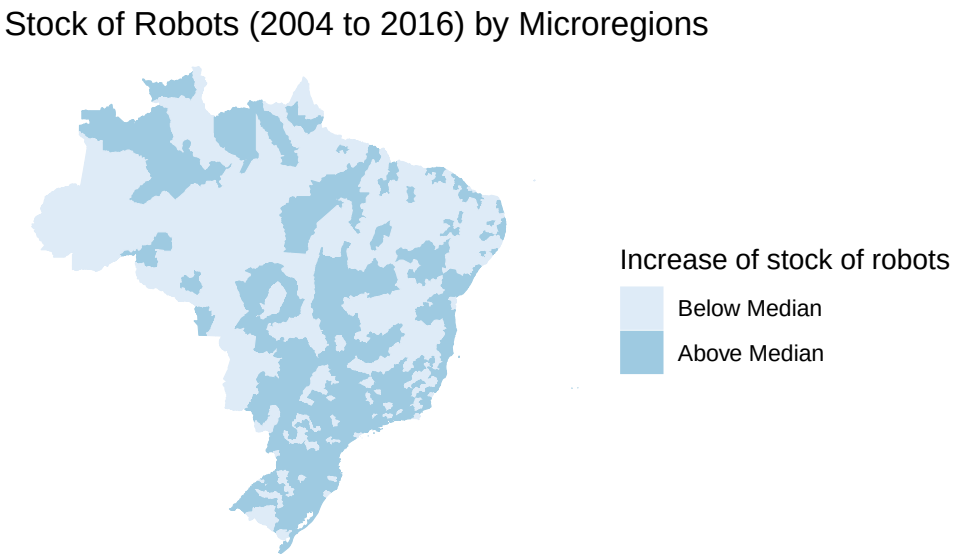
Notes: Event-study estimates of equation (2) for the exporter indicator, estimated separately for firms in microregions with above-median (Panel A) and below-median (Panel B) changes in trade share between 2004 and 2016, computed from COMEXStats. Estimator, sample, and controls as in Figure 4. Bars denote 95% confidence intervals based on standard errors clustered by firm.

Figure A.22: Admin adoption and exporting, firms with more than 100 workers



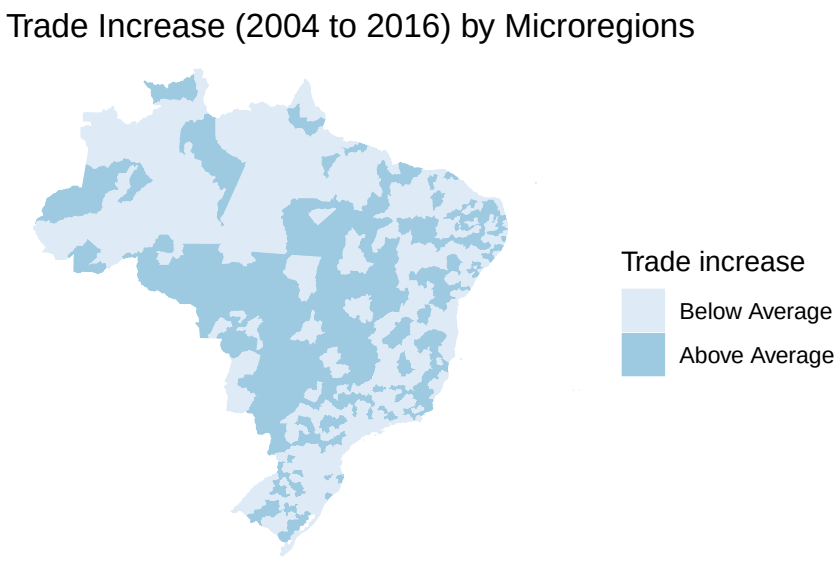
Notes: Event-study estimates of equation (2) for the exporter indicator, restricted to firms with more than 100 workers. Estimator, sample, and controls as in Figure 4. Bars denote 95% confidence intervals based on standard errors clustered by firm.

Figure A.23: Increase in the stock of imported robots by microregion



Notes: Microregions classified by whether their increase in the stock of imported robots between 2004 and 2016 is above or below the median. Robot imports identified from COMEXStats product codes following Rodrigo (2022).

Figure A.24: Trade increase by microregion



Notes: Microregions classified by whether their increase in trade between 2004 and 2016 is above or below the average. Trade flows from COMEXStats.

Table A.1: Share of firms with each layer at birth

	All Firms	Firms with $\geq$ 10 workers
Core	87%	98%
Admin	37%	76%
Manager	15%	43%

Notes: Share of firms employing at least one worker in each layer in the firm's first observed year in RAIS. The first column includes all manufacturing firms; the second restricts to firms with at least 10 workers in the first observed year.

Table A.2: Six-digit occupations by layer and group

Layer	Group	Occupations
Management	Upper	55
	Middle	54
	Lower	75
	Subtotal	*184*
Admin	Professionals	66
	Support	57
	Marketing	43
	Clients and Suppliers	28
	Other	23
	HR	4
	Subtotal	*221*
Core	Sector/function specialization	2,021
Excluded	Drop	21
Total		2,447

Notes: Counts of unique six-digit CBO 2002 occupation codes in the crosswalk constructed for this paper, by layer and detailed group. One code (992205) appears with two tags in the source file and is counted once, under its first tag; it is flagged in the shared file. "Drop" codes are excluded from the analysis. The crosswalk is available online with the supplemental appendix.

Table A.3: Gender and education by layer

	Male				Female			
Year	Share	<HS	HS	College	Share	<HS	HS	College
Panel A: Admin workers								
2004	0.628	0.548	0.360	0.092	0.372	0.360	0.508	0.132
2005	0.625	0.527	0.377	0.095	0.375	0.338	0.522	0.139
2006	0.618	0.506	0.401	0.093	0.382	0.324	0.538	0.139
2007	0.617	0.484	0.420	0.096	0.383	0.303	0.549	0.149
2008	0.605	0.474	0.431	0.095	0.395	0.323	0.534	0.143
2009	0.600	0.451	0.449	0.100	0.400	0.306	0.545	0.149
2010	0.609	0.432	0.465	0.103	0.391	0.283	0.561	0.156
2011	0.602	0.414	0.479	0.108	0.398	0.269	0.561	0.170
2012	0.599	0.398	0.488	0.114	0.401	0.261	0.563	0.176
2013	0.594	0.383	0.495	0.123	0.406	0.251	0.562	0.187
2014	0.591	0.369	0.504	0.127	0.409	0.245	0.563	0.192
2015	0.591	0.359	0.515	0.126	0.409	0.236	0.567	0.197
2016	0.593	0.342	0.518	0.141	0.407	0.221	0.565	0.213
Panel B: Core workers								
2004	0.766	0.777	0.206	0.017	0.234	0.742	0.241	0.017
2005	0.762	0.752	0.230	0.018	0.238	0.712	0.269	0.018
2006	0.760	0.726	0.256	0.018	0.240	0.684	0.297	0.018
2007	0.759	0.696	0.283	0.021	0.241	0.654	0.325	0.021
2008	0.753	0.669	0.309	0.022	0.247	0.629	0.349	0.022
2009	0.750	0.646	0.330	0.024	0.250	0.603	0.372	0.024
2010	0.742	0.616	0.359	0.025	0.258	0.575	0.400	0.025
2011	0.737	0.592	0.381	0.027	0.263	0.554	0.418	0.028
2012	0.735	0.569	0.394	0.037	0.265	0.532	0.436	0.032
2013	0.732	0.545	0.420	0.034	0.268	0.508	0.458	0.033
2014	0.732	0.524	0.434	0.043	0.268	0.486	0.473	0.042
2015	0.739	0.512	0.449	0.039	0.261	0.474	0.485	0.041
2016	0.747	0.492	0.457	0.051	0.253	0.442	0.490	0.068
Panel C: Managers								
2004	0.807	0.377	0.340	0.283	0.193	0.260	0.421	0.319
2005	0.803	0.360	0.352	0.288	0.197	0.236	0.430	0.334
2006	0.796	0.340	0.364	0.296	0.204	0.218	0.437	0.346
2007	0.790	0.324	0.374	0.302	0.210	0.202	0.440	0.358
2008	0.782	0.309	0.386	0.305	0.218	0.189	0.449	0.362
2009	0.773	0.292	0.393	0.315	0.227	0.178	0.451	0.371
2010	0.773	0.278	0.400	0.321	0.227	0.164	0.454	0.382
2011	0.762	0.263	0.409	0.328	0.238	0.149	0.454	0.398
2012	0.758	0.249	0.414	0.337	0.242	0.138	0.451	0.411
2013	0.761	0.237	0.417	0.346	0.239	0.132	0.437	0.431
2014	0.754	0.224	0.416	0.361	0.246	0.121	0.429	0.451
2015	0.754	0.216	0.419	0.365	0.246	0.114	0.422	0.465
2016	0.754	0.208	0.411	0.380	0.246	0.106	0.411	0.483

Notes: For each year and layer, the table reports the share of male and female workers in the layer and, within gender, the distribution of educational attainment: less than high school (<HS), high school (HS), and college.

Table A.4: Descriptive statistics

Year	N	Total Emp.	Employment by Layer			Wage by Layer			Firm Age	Exporter
			Core	Admin	Manager	Core	Admin	Manager		
2004	555,752 (6.8%)	16.725 (105.407)	14.925 (98.001)	6.188 (22.076)	3.405 (10.701)	651.355 (574.204)	842.035 (796.691)	2,071.688 (2,631.841)	4.994 (6.692)	0.082 (0.274)
2005	570,673 (6.9%)	17.138 (109.101)	15.255 (101.237)	6.276 (22.998)	3.394 (10.773)	661.510 (540.396)	836.701 (742.610)	2,044.621 (2,548.331)	5.455 (6.755)	0.085 (0.279)
2006	587,283 (7.1%)	17.300 (111.586)	15.361 (103.796)	6.281 (22.067)	3.391 (11.040)	700.137 (562.138)	862.014 (758.636)	2,092.265 (2,598.821)	5.912 (6.808)	0.078 (0.268)
2007	598,187 (7.3%)	18.190 (120.948)	16.162 (112.875)	6.464 (23.188)	3.460 (11.525)	728.591 (585.748)	886.840 (736.304)	2,115.780 (2,572.369)	6.381 (6.996)	0.075 (0.263)
2008	620,656 (7.5%)	18.865 (126.883)	16.578 (117.578)	6.868 (25.969)	3.514 (11.767)	749.491 (600.159)	883.805 (724.856)	2,135.909 (2,576.029)	6.724 (7.106)	0.068 (0.252)
2009	633,524 (7.7%)	18.178 (123.945)	15.859 (114.698)	6.740 (25.664)	3.470 (11.848)	784.702 (595.167)	916.097 (737.214)	2,173.552 (2,576.033)	7.112 (7.236)	0.065 (0.247)
2010	629,150 (7.6%)	18.709 (127.166)	16.318 (117.183)	6.886 (26.006)	3.503 (12.181)	813.449 (582.191)	957.358 (762.309)	2,208.109 (2,533.509)	7.469 (7.420)	0.062 (0.242)
2011	658,808 (8.0%)	18.766 (125.472)	16.300 (115.071)	7.007 (27.538)	3.528 (12.429)	839.016 (588.387)	971.110 (717.115)	2,230.262 (2,491.236)	7.731 (7.580)	0.059 (0.236)
2012	661,785 (8.0%)	18.808 (124.634)	16.205 (113.218)	7.155 (28.433)	3.576 (12.785)	893.155 (622.588)	1,021.797 (759.471)	2,307.902 (2,483.826)	8.065 (7.761)	0.057 (0.233)
2013	676,541 (8.2%)	18.549 (124.055)	15.912 (112.139)	7.227 (29.110)	3.509 (12.342)	925.579 (620.785)	1,050.418 (777.267)	2,372.368 (2,548.000)	8.380 (7.931)	0.057 (0.232)
2014	685,019 (8.3%)	18.076 (120.354)	15.413 (107.916)	7.194 (29.813)	3.505 (12.324)	942.586 (627.868)	1,061.816 (759.986)	2,377.326 (2,477.216)	8.735 (8.103)	0.058 (0.234)
2015	682,177 (8.3%)	17.230 (114.377)	14.587 (101.806)	7.061 (29.559)	3.461 (11.897)	938.595 (622.339)	1,045.472 (719.588)	2,332.247 (2,410.265)	9.198 (8.230)	0.062 (0.240)
2016	671,759 (8.2%)	16.234 (107.468)	13.694 (94.997)	6.830 (28.901)	3.403 (11.730)	943.990 (602.637)	1,043.229 (684.086)	2,299.508 (2,331.126)	9.685 (8.497)	0.068 (0.252)
Total	8,231,314 (100.0%)	17.921 (119.020)	15.580 (108.854)	6.820 (26.698)	3.475 (11.884)	819.810 (605.094)	960.857 (748.071)	2,227.383 (2,517.060)	7.462 (7.653)	0.067 (0.250)

Notes: Means with standard deviations in parentheses, by year. N is the number of firms (share of the pooled panel in parentheses). Employment by layer is the average number of workers in the layer among firms employing the layer. Wages are average monthly wages in current reais. Exporter is an indicator for exporting in the year (SECEX). Sample: RAIS manufacturing firm-year panel, 2004–2016.