Office Support and Firm Scale-up in Brazil*

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Abstract

We document an overlooked organizational margin of firm growth: the office-support function. Using matched employer–employee data for Brazilian manufacturing from 2004 to 2016, we classify six-digit occupations into production, office-support, and management functions. Office-support employment has expanded while management remains nearly flat. Firms progressively build this back-office workforce over their life cycle. Its employment share declines with firm size, and its wages are less than half of managers', consistent with scalable organizational overhead. Around first adoption, employment excluding office-support workers rises 17–23% and entry into export markets increases, especially among young and small firms. Office support emerges as a low-cost organizational input associated with 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? A growing literature shows that manufacturers increasingly combine production with nonproduction activities (Fort, Pierce, and Schott, 2018a; Ding et al., 2025). In U.S. evidence, much of this expansion is associated with professional, technical, and other high-skill service work. We document a different margin in Brazil. The growing nonproduction workforce is concentrated in comparatively low-paid office-support workers—clerks, assistants, secretaries, and related occupations—rather than managers or high-skill professionals. We study when firms build this back-office function and how it relates to 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 business functions: production (core), office support (admin), and management. Three facts emerge. First, manufacturing becomes increasingly office-support intensive. Between 2004 and 2016, the within-firm share of office-support workers rose from 15.5% to 19.7%, while the core share fell from 82.5% to 77.0%, and the management share remained nearly flat. 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 office-support workers in levels, consistent with fixed costs of establishing the function and the economies of scale once it is in place. Office-support 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, provides a lower-cost margin for handling documentation, scheduling, record keeping, invoicing, procurement, and other nonproduction tasks without proportionally expanding the managerial function.

Third, firms build this function over the life cycle. Core production is nearly universal at birth, whereas office support is not: only 37% of firms employ an office-support worker in their first observed year, compared with 87% employing core workers. Among firms observed from

birth, the probability of employing an office-support worker rises steadily with age, and, conditional on having all three functions, office-support employment grows faster than either core or managerial employment. Office support is therefore not simply an organizational attribute firms are born with; it is a margin they develop as operations expand.

To clarify how office support fits into theories of firm organization, we introduce a simple framework that complements the canonical hierarchy view (Garicano, 2000; Caliendo and Rossi-Hansberg, 2012). We keep a hierarchy structure, managers remain necessary for supervision, decision making, and other tasks that cannot be delegated to office-support workers. The distinct organizational margin is how firms perform routine back-office tasks. At small scale, managers can absorb these tasks alongside their managerial responsibilities; as their volume grows, firms can instead pay a fixed cost and specialize them into a separate office-support function. The framework therefore interprets office support not as another rung in the hierarchy, but as a form of specialization within nonproduction work. This distinction helps rationalize why firms can expand their organizational capacity without proportionally deepening managerial hierarchy, and why office-support employment can rise while its share falls with firm size.

We then examine what happens around the office-support adoption. Employment outside the office-support function rises by 17–23% during the following three years, so the expansion is not mechanically explained by adding the first office-support worker. Exporting provides a second marker of scale. Among firms that had not previously exported, the probability of exporting is flat before office-support adoption and rises 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 larger in regions experiencing greater growth in automation technology.

Office-support adoption is an endogenous organizational decision. We do not interpret these event studies as causal effects of office-support workers. Instead, the event studies locate office-support adoption within the firm's growth process. Together, the life cycle and event-time evidence suggest that firms build this organizational function near the point at which they expand the rest of their workforce and begin undertaking scale-related activities such as exporting. The automation heterogeneity is also consistent with support becoming more valuable when

production-enhancing technologies increase firm capacity or incentives to operate at large scale.

Our main contribution is empirical. A recent literature documents the expansion of non-production work in manufacturing, using categories such as production versus nonproduction employment, white-collar labor, or firms' nonmanufacturing establishments (Fort, Pierce, and Schott, 2018b; Ding et al., 2025; Engbom et al., 2025). The detailed occupation codes in our data reveal that, within Brazilian manufacturing firms, this shift is concentrated in routine office support rather than management or professional services, in contrast with the high-skill expansion emphasized in U.S. evidence (Ding et al., 2025). This distinction is particularly relevant for developing countries, where we show, firms can build organizational capacity through a lower-skill, inexpensive back-office workforce. We further connect this occupational change to the firm life cycle, finding that firms progressively add and deepen the office-support function as they grow, with first adoption coinciding with a discrete expansion of the rest of the workforce.

This distinction also speaks to work on organization and firm growth. Theories of firm organization emphasize limits to managerial time and gains from delegation (Lucas, 1978; Garicano, 2000; Caliendo and Rossi-Hansberg, 2012), while empirical work focuses mainly on managerial layers or broad categories of white-collar labor (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). We identify a different organizational margin: office-support labor as a firm function rather than another rung in the hierarchy. Support workers do not supervise production; they perform back-office tasks that complement it. At small scale, infrequent support needs can be absorbed by owners or managers or purchased from outside providers. As firm operations grow and those needs become recurrent, building an internal support workforce becomes more economical. Office support thus belongs alongside organizational investments such as standardization (Argente et al., 2025) that accompany scale-up.

Our results also complement evidence that firms reorganize around growth opportunities, such as foreign-market entry or technological change. Exporters alter 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 built around this transition, although export entry is only one manifestation

of the broader scale-up process. Similarly, technological change can alter the division of labor between production and nonproduction activities. Technology investment has been linked to rising nonproduction employment in U.S. manufacturing (Dunne, Haltiwanger, and Troske, 1997), while robot diffusion in Brazil induced within-firm reallocation of labor toward support activities (Rodrigo, 2022).

Brazil is a particularly informative setting to analyze this organizational margin. Its granular employer–employee data allow us to distinguish production, management, and office-support functions and to track their development within firms. The distinction between internal organization and firm boundaries is also economically meaningful in this setting. During our sample period, Brazilian regulation substantially restricted outsourcing, while its later expansion allowed specialized providers to perform non-core activities at scale (Felix and Wong, 2026). More broadly, Brazilian evidence shows that firms reorganize in response to trade, factor prices, and technology (Dix-Carneiro and Kovak, 2017; Felix, 2026; Caunedo, Felix, and Manysheva, 2026; Rodrigo, 2022). Against these alternative adjustment margins, we isolate a basic but understudied form of internal organization: as manufacturing firms grow, they build a relatively inexpensive back-office function alongside 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 three business functions. Management titles are led by *supervisor*, *gerente* (manager), and *diretor* (director), attached to production, operations, and maintenance. Office-support/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 distinct occupations by function and group; Appendix Figure A.2 plots employment shares for the disaggregated groups; and Appendix Table A.3 reports gender and education by function—in 2016, the female share was 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 employing each function—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 function 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 function by year. Between 2004 and 2016, the office-support 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 function.

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 function whose employment share declines with firm size. The expansion of office support occurs throughout the firm-size distribution. Between 2004 and 2016, the office-support 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 office-support share declines with firm size. This pattern is consistent with two related features of office-support services. First, establishing a distinct office-support function may involve a fixed organizational cost, making adoption less attractive for smaller firms. Second, once established, office-support services can be spread over a larger production workforce, generating economies of scale in administration. Larger firms, therefore, employ more office-support workers in levels but fewer of them per production worker.[1]

Office-support is also inexpensive relative to the main organizational alternative. Average monthly pay is R$961 for office-support workers, less than half the R$2,227 earned by managers and only modestly above the R$820 earned by core workers (Appendix Table A.4). These relative wage differences remain fairly constant between 2004 and 2016 (Appendix Figure A.5). Office support thus provides a comparatively low-cost margin through which firms can delegate routine coordination, documentation, or administrative tasks without proportionally expanding

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

the managerial function.

Taken together, the low relative cost of office-support labor, the stability of the managerial share across firm sizes, and the declining office-support share with size are consistent with increasing functional specialization rather than simply a deeper managerial hierarchy. In smaller firms, routine support tasks may be absorbed by managers or other workers. As the demand for these tasks becomes sufficiently large and recurrent, establishing a specialized office-support function becomes worthwhile; once in place, its fixed component can be spread over a larger production workforce. Section 4 formalizes this mechanism.

Fact 3: Firms build and deepen the *office support* function 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, whereas only 37% employ office-support 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, while the other two organizational functions are acquired more gradually.

Figure 2 plots the probability that a firm employs each function as it ages, relative to birth, controlling for firm and year fixed effects. By age ten, the probabilities of employing office-support workers and managers are approximately 30 percentage points higher than at birth. In contrast, the probability of employing core workers remains unchanged and close to zero because that function is already nearly universal among new firms. These patterns indicate that organizational functions are added progressively as firms mature.

Life-cycle specification conditional on all functions. For life-cycle outcomes conditional on organizational structure, we estimate "age effect" coefficients β_k separately for each function (core, office-support, managers):

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

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. For the intensive-margin outcomes, we restrict our attention to firms employing all three functions in every included year.

Conditional on having all three functions, the estimates from equation (1) reveal that office-support employment grows faster over the life cycle than either core or managerial employment (Appendix Figures A.6). Differences in wage growth across the three functions are small and not statistically distinguishable (Appendix Figure A.7). The distinctive life-cycle pattern therefore lies primarily in the quantity of office-support labor firms employ rather than in changes in its relative price.

Office-support is also strongly associated with market scale. Virtually all employment at exporting firms is located in firms that employ office-support workers, whereas a nontrivial share of exporter employment is at firms without managers (Appendix Figure A.8). These cross-sectional relationships motivate our subsequent analysis, which traces employment, exporting, and wages around a firm's first adoption of office-support and asks whether adoption coincides with a transition toward operating at a larger scale.[2]

4 A Simple Framework for Organizational Specialization and Firm Scale

We use a simple framework to formalize office support as a distinct organizational margin. Managers remain necessary for supervision and decision making, but routine back-office tasks can either be performed by managers or specialized into a separate office-support function. The framework therefore retains managerial hierarchy while adding a specialization margin within nonproduction work.

Let n denote the production workforce. Managerial requirements are

$$H(\ell) = h\ell, \qquad h > 0,$$

[2]Consistent with this interpretation, Appendix Figure A.9 shows that both exporters and non-exporters increased office-support workers over time. The increase is larger among non-exporters, in part because exporters already rely more heavily on office-support labor.

where ℓ is the nonmanagerial workforce and h is managerial input required per nonmanagerial worker. Production also generates routine support tasks,

$$S(n) = \kappa n^{\rho}, \qquad \kappa > 0, \quad 0 < \rho < 1,$$

where κ captures the intensity of support requirements and $\rho < 1$ captures economies of scale in routine support.

Managers earn w_m. Office-support workers earn w_a and supply $\phi > 0$ units of routine support. Because office-support workers also require managerial oversight, their effective cost per unit of routine support is

$$c_a \equiv \frac{w_a + h w_m}{\phi},$$

whereas routine support performed by managers costs

$$c_m \equiv w_m.$$

We focus on $c_a < c_m$, so that specialized office support is the cheaper input once the fixed organizational cost F_a has been paid.

Without office support, managers perform routine support alongside managerial tasks. With specialization, office-support workers perform routine support and the firm saves $(c_m - c_a)S(n)$ in variable organizational costs. Adoption is therefore optimal when $(c_m - c_a)S(n) \geq F_a$, which implies the scale threshold

$$n_A = \left[\frac{F_a}{\kappa(c_m - c_a)} \right]^{1/\rho}.$$

Small firms therefore rely on managers for routine support, while sufficiently large firms specialize these tasks into a separate back-office function.

The framework also rationalizes the different employment profiles across firm size. Let $b \equiv \kappa/\phi$. Above the adoption threshold,

$$a(n) = bn^{\rho}, \qquad m(n) = h(n + bn^{\rho}).$$

The managerial employment share is

$$s_m(n) = \frac{h}{1+h},$$

which is independent of firm size, while the office-support share is

$$s_a(n) = \frac{bn^{\rho-1}}{(1+h)(1+bn^{\rho-1})},$$

which declines with n since $\rho < 1$. Thus, larger firms employ more office-support workers in levels but fewer relative to their workforce, while the managerial share remains flat.

The organizational margin is therefore specialization within nonproduction work rather than the addition of another managerial layer. Managers remain responsible for supervision and decision making, while routine back-office tasks are shifted to a specialized support function once scale makes specialization economical.

Appendix B endogenizes production scale. There, lower-cost support reduces the marginal organizational cost of expansion, so office support can substitute for managers in routine tasks while remaining complementary to production at the firm level. This provides one interpretation of the scale-up patterns examined in Section 5.

5 Office-Support Adoption and Firm Scale-up

Section 3 and 4 characterize first office-support adoption as an endogenous specialization decision: firms build the back-office function when routine support demand becomes large enough to justify its fixed cost. We now ask what happens to firm scale around that organizational transition. We examine employment first and then exporting, a high-fixed-cost activity associated with operating at a larger market scale. Because office-support adoption is endogenous, the event studies are descriptive, in the sense that they characterize how firm outcomes evolve around adoption rather than identify causal effects of office-support 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 office-support 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-function status. Standard errors are clustered by firm. Treatment is absorbing. The sample contains 279,226 firms that hire their first office-support worker between 2004 and 2016, and 34,340 never-adopters used as controls.

Adoption coincides with a sharp increase in firm scale. Firm employment rises right after the first office-support adoption, reversing the relative decline observed 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 office-support worker. Core and managerial employment both rise after adoption (Appendix Figure A.11). Figure 3 shows that even after excluding the office-support workers, employment still rises by roughly 17–23% over the following three years. Appendix Figure A.12 shows the corresponding growth paths by function. Thus, first adoption occurs along with a substantial expansion of the rest of the firm's workforce, rather than merely changing its occupational composition. This pattern complements the cross-sectional evidence in Section 3, firms progressively build the office-support function as they grow, and first adoption occurs near a discrete expansion in production and managerial employment.

The endogenous-scale extension in Appendix B provides an interpretation of this pattern. In the model, specializing routine support lowers the organizational cost of operating at larger scale, allowing production employment to expand. Managerial employment can also rise with

scale even though office-support workers substitute for managers in routine tasks.

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 functions by the third year—but the managerial estimates are substantially less precise (Appendix Figure A.14). Thus, the post-adoption adjustment appears primarily along the employment margin rather than through large wage changes.

Adoption also precedes entry into export markets. Exporting provides a second marker of scale-up. Figure 4 traces the exporter indicator around the first office-support 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.

This timing is consistent with office support being part of firms' organizational capacity building as they approach scale-up opportunities. In the framework, exporting need not generate demand for office support directly. Rather, access to larger markets can raise desired production scale, increasing routine support requirements and the value of a scalable back-office function. This interpretation connects to Labanca et al. (2024), who shows that Brazilian firms prepare for export entry by changing their workforce before entering foreign markets. Our evidence points to a different organizational margin around that transition: the creation of an office-support function.

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, office-support employment is roughly 40–50 percentage points higher two to three years after export entry than in the entry year; substantial pre-entry differences make this exercise descriptive (Appendix Figure A.16). Importing is flat before office-support 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 the corresponding estimates are half and null for firms with 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 results reinforce the life-cycle evidence in Section 3. Office-support adoption is not simply a feature of already large, mature firms. It mainly occurs 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 office-support adoption and 0.8 percentage points after three years. The corresponding increase is much smaller in low-robot-growth regions.

While regional robot machinery growth may be correlated with other determinants of firm expansion, the pattern is nevertheless consistent with the general scale mechanism in Section 4, production-enhancing technologies can increase the scale at which firms wish to operate, thereby raising routine support requirements and the value of performing those tasks with a scalable, low-cost input rather than managerial labor. The analogous split by changes in trade exposure does not show the same differential pattern, it highlights instead the value of first

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

mover advantage (Appendix Figure A.21).[4] Together with the size and age results, these findings place office-support adoption near broader transitions toward larger operating scale, while leaving open the causal forces that jointly drive organizational change and firm growth.

6 Conclusion

Brazilian manufacturing firms become increasingly office-support intensive as they grow. This function 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 build the function progressively over the life cycle. Around first adoption, employment outside office-support 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 place the creation of the back-office function near an important transition in the firm's growth process.

These findings broaden the empirical view of firm organization beyond managerial layers, and broad measures of white-collar employment. Existing evidence from advanced economies emphasizes the growth of professional, technical, and other high-skill nonproduction activities. In Brazil, the striking expansion is instead in comparatively low-paid office-support occupations. The developing-country contrast suggests that firms can build organizational capacity not only through high-skill professionals or deeper managerial hierarchies, but also through a low-cost support workforce whose services can spread across a growing production operation.

The model interprets this pattern as specialization within the organization. In small firms, managers can absorb routine administrative tasks alongside supervision and decision making. As the volume of support work grows, paying the fixed cost of an internal back-office function becomes worthwhile. Office-support workers then substitute for managerial labor in routine tasks while remaining complementary to production. This perspective also links office support to the firm scale-up process more broadly. The forces that increase the desired production scale

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

raise routine support requirements and, therefore, the value of a scalable, low-cost back office. Consistent with this mechanism, office-support adoption occurs followed by expansions in the rest of the workforce and export entry, with stronger patterns among young and small firms and in regions experiencing greater growth in production-enhancing technologies. These relationships are descriptive, but together they identify office support as an understudied organizational margin of firm growth.

This function may become increasingly relevant in the age of AI. Office-support tasks—such as documentation, record keeping, and routine communication—are among those most AI amenable. Our evidence points to a potentially important channel for AI-driven productivity gains, not only by automating tasks but also by lowering the organizational costs of scaling. Quantifying this channel and its aggregate importance is a natural direction for future research.

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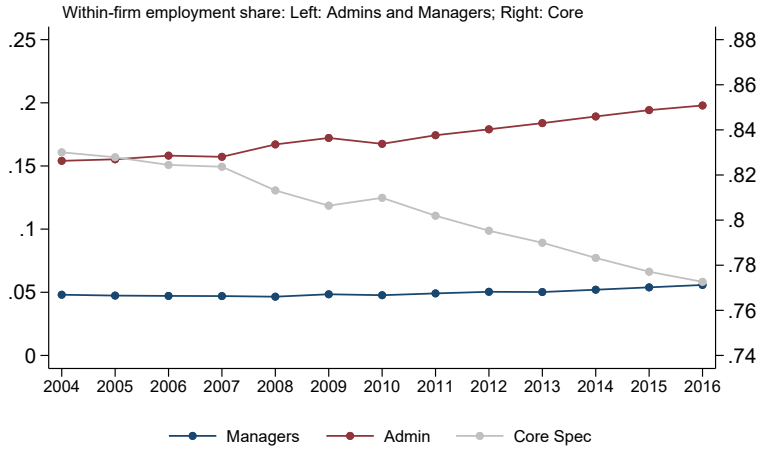
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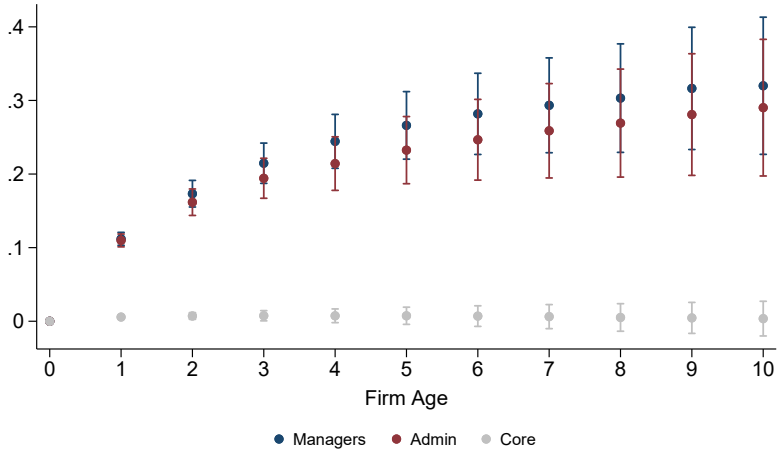
Rodimiro Rodrigo. Robot adoption, organizational capital, and the productivity paradox. Working Paper, Georgetown University, 2022.

Figure 1: Within-firm employment shares by function



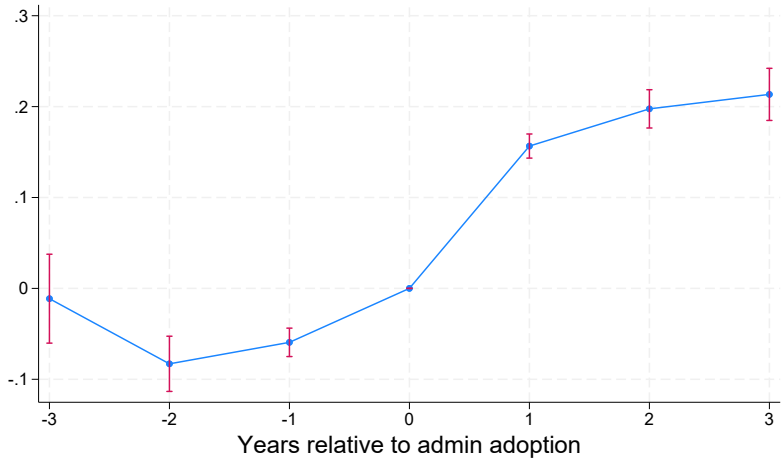
Notes: RAIS manufacturing firm-year panel, 2004–2016, restricted to firms with at least 10 workers and firm age below 31. Six-digit occupations (CBO 2002) are classified into management, admin, and core functions. Each series is the employment-weighted mean across firms of the within-firm employment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

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



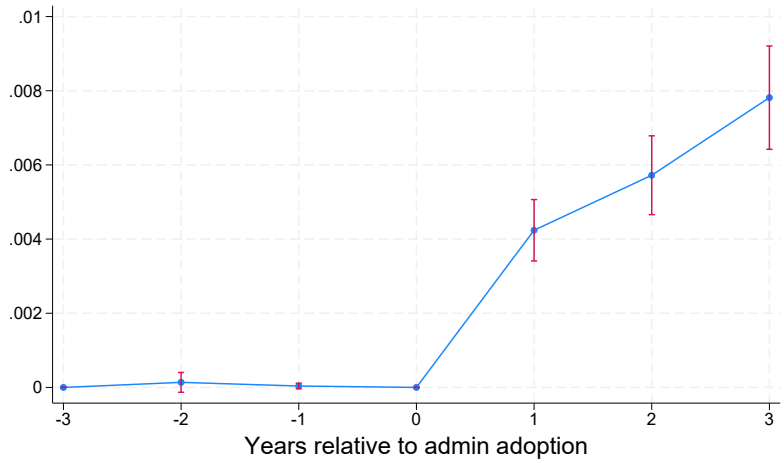
Notes: Coefficients on firm-age indicators (age 0 omitted) from regressions of an indicator for employing each function, estimated separately by function with firm and year fixed effects on the RAIS manufacturing panel, restricted to firms with at least 10 workers observed from birth. Markers denote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

Figure 3: Office-support adoption and employment excluding admin workers



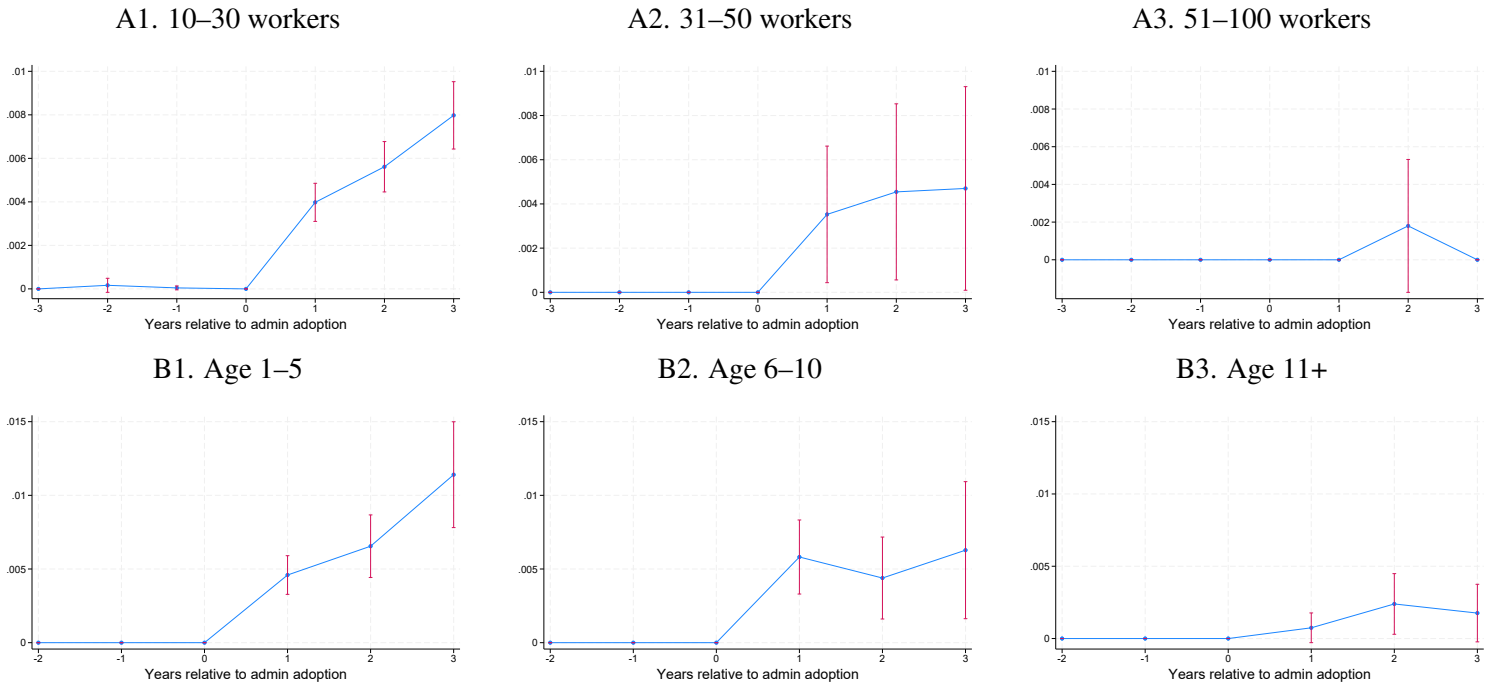
Notes: Event-study estimates of equation (2) for log employment of core and management workers combined, i.e., total firm employment excluding the admin function. Estimator, sample, and controls as in Figure 4. Bars denote 95% confidence intervals based on standard errors clustered by firm.

Figure 4: Office-support 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) under absorbing treatment, with never-adopters as controls and non-parametric trends by industry, state, and management-function 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

A Empirical Appendix

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

A. Management



B. Office-support

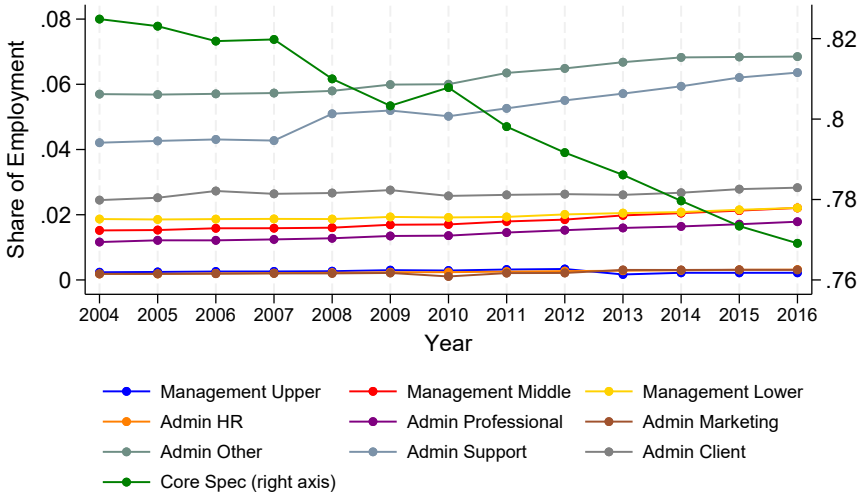


C. Core



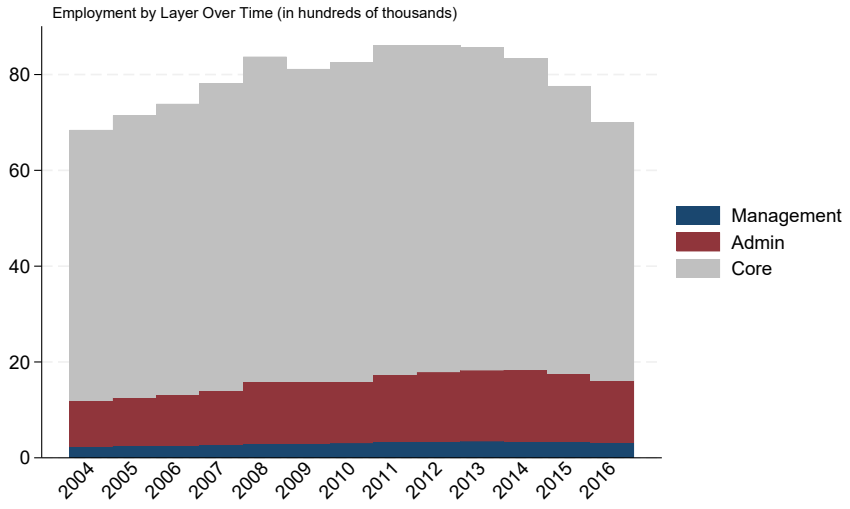
Notes: Word clouds of the Portuguese titles of the six-digit CBO 2002 occupations classified into each function (word size proportional to frequency across occupation titles; Portuguese stopwords and generic filler terms removed). Underlying crosswalk: 2,447 unique codes—2,021 core, 221 admin, 184 management,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

Figure A.2: Employment shares for disaggregated occupation groups



Notes: Aggregate share of employment by year for the disaggregated occupation groups underlying the function 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.

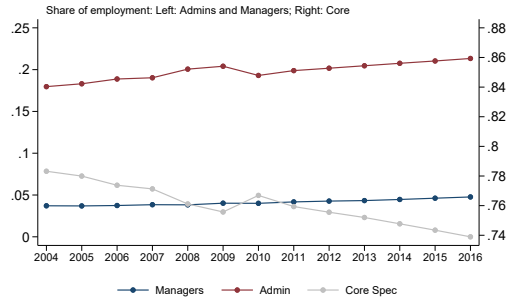
Figure A.3: Employment by function, 2004–2016



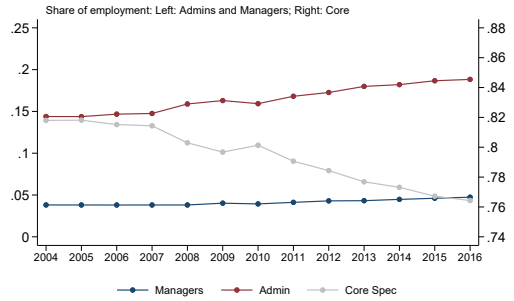
Notes: Total employment by function and year, in hundreds of thousands of workers, stacking management, admin, and core employment. RAIS manufacturing firms with at least 10 workers and firm age below 31.

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

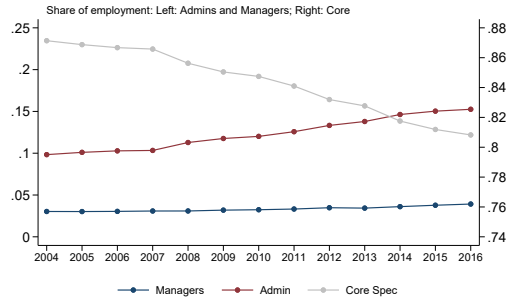
C. Small firms (10–50 workers)



B. Medium firms (51–250 workers)

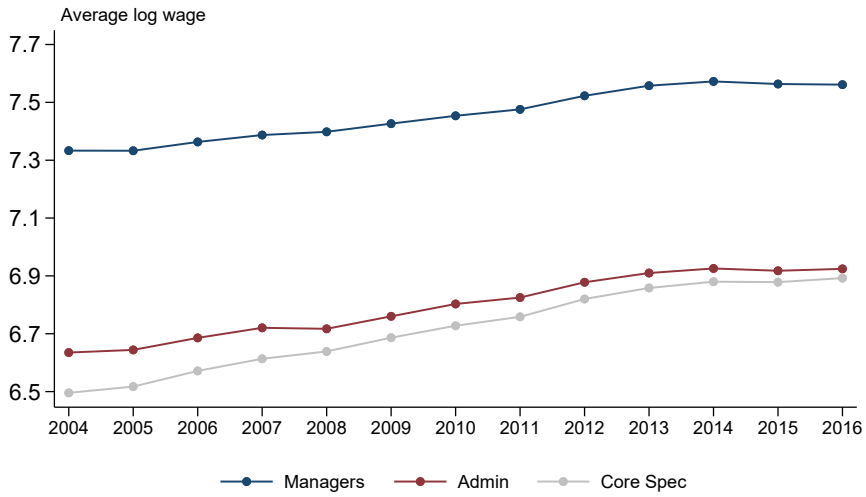


A. Large firms (more than 250 workers)



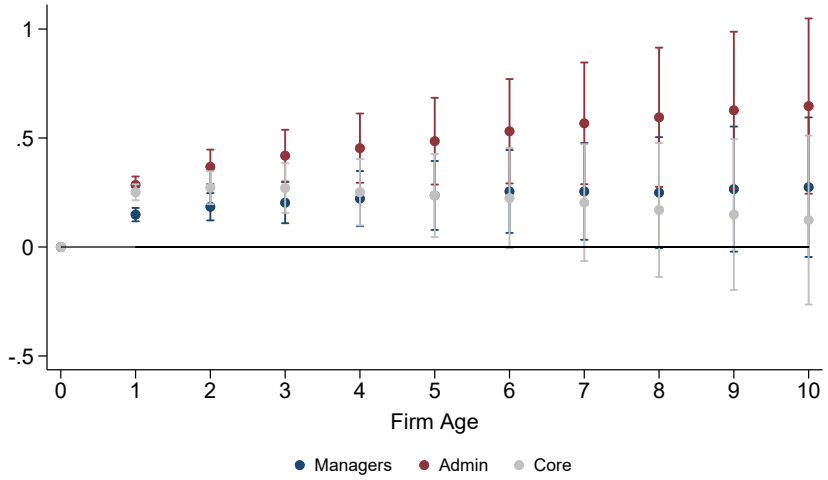
Notes: RAIS manufacturing firm-year panel, 2004–2016, restricted to firms with at least 10 workers and firm age below 31. Size classes by firm employment: small (10–50 workers), medium (51–250), large (more than 250). Within each size class and year, shares are total function employment divided by total 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 function



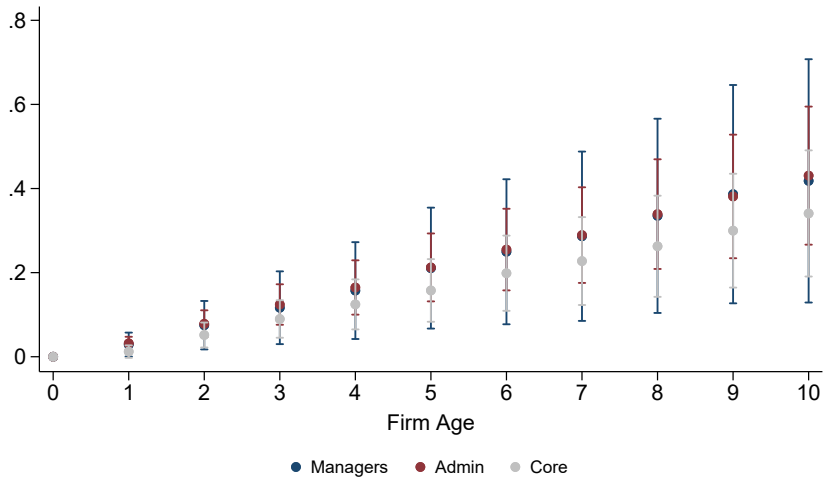
Notes: RAIS manufacturing firm-year panel, 2004–2016, restricted to firms with at least 10 workers and firm age below 31. Each series is the mean across firms of the firm-level average log monthly wage of workers in the function. Wages in current reais.

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



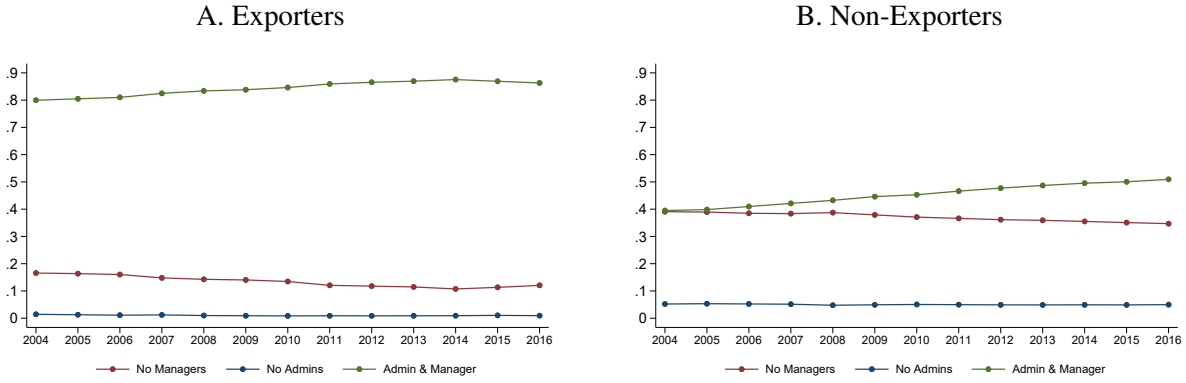
Notes: Estimates of equation (1) for log employment by function, ages 0–10, estimated separately by function with firm and year fixed effects. Sample: RAIS manufacturing firms with at least 10 workers in all years, observed from birth, conditional on having all three functions. Bars denote 95% confidence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

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



Notes: Estimates of equation (1) for the firm-level average log wage by function, ages 0–10, estimated separately by function 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.

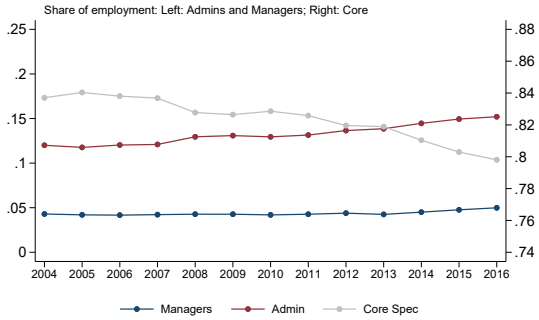
Figure A.8: Employment shares by organizational configuration and export status



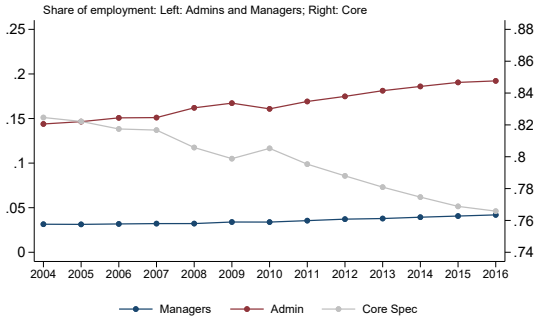
Notes: Share of employment in firms with no managers, in firms with no admin workers, and in firms with both admin and management functions, by year and export status. RAIS manufacturing firms with at least 10 workers, firm age below 31, and at least two years in the panel, matched to the SECEX exporter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

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

A. Always Exporters



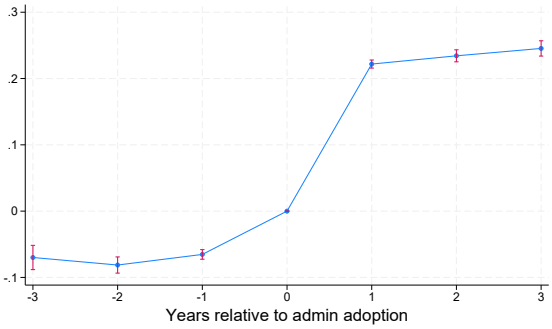
B. Never Exporters



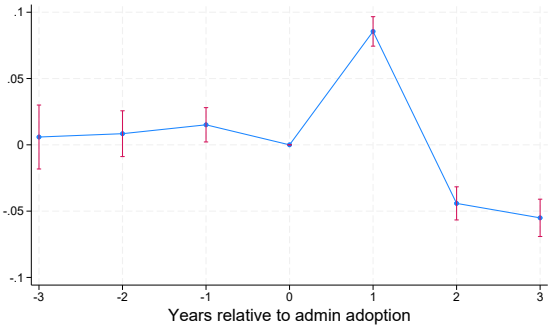
Notes: Aggregate share of employment by function and year, estimated separately for firms that export in every year of the panel (Panel A) and firms that never export (Panel B). Sample and function definitions as in Figure 1; exporter status from SECEX. Left axis: admin and management; right axis: core.

Figure A.10: Office-support adoption and total firm employment

Log employment



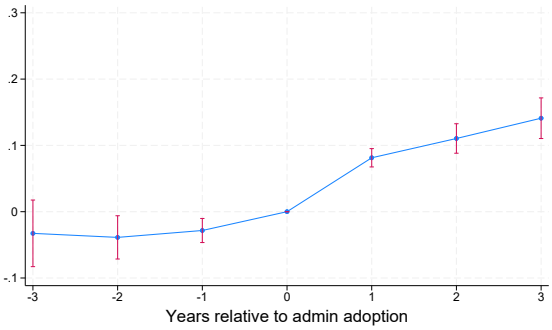
Year-over-year employment growth



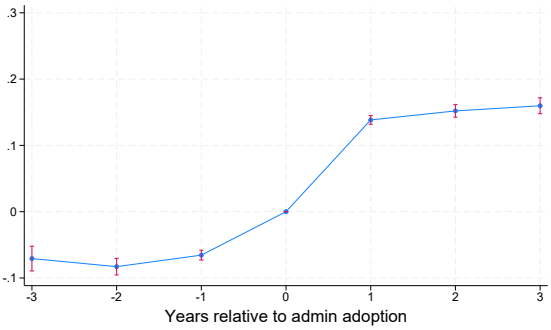
Notes: Event-study estimates of equation (2) for total firm log employment (left) and year-over-year log employment growth (right). Estimator, sample, and controls as in Figure 4. Bars denote 95% confidence intervals based on standard errors clustered by firm.

Figure A.11: Office-support adoption and employment, by function

Management

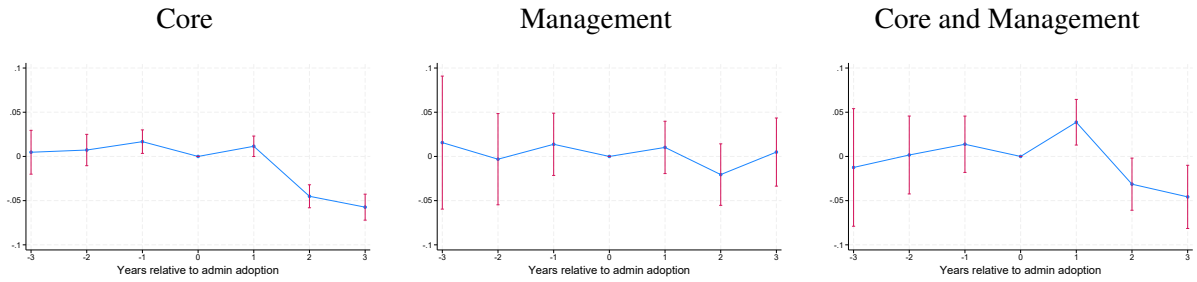


Core



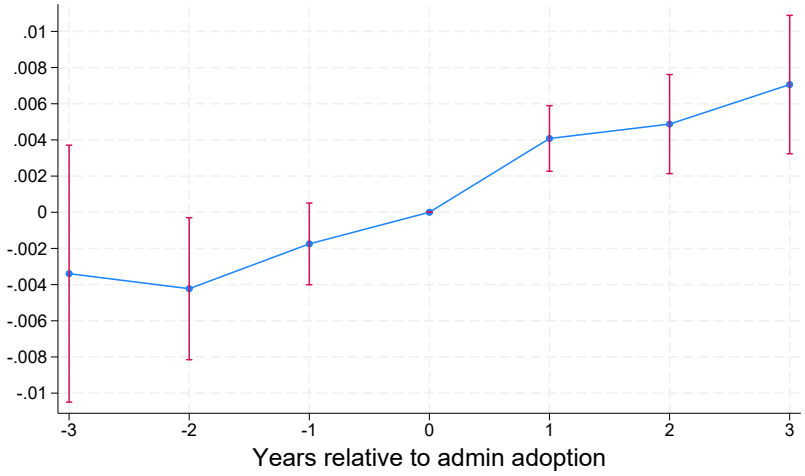
Notes: Event-study estimates of equation (2) for log employment of management (left) and core (right) workers. Estimator, sample, and controls as in Figure 4. Bars denote 95% confidence intervals based on standard errors clustered by firm.

Figure A.12: Office-support adoption and employment growth, by function



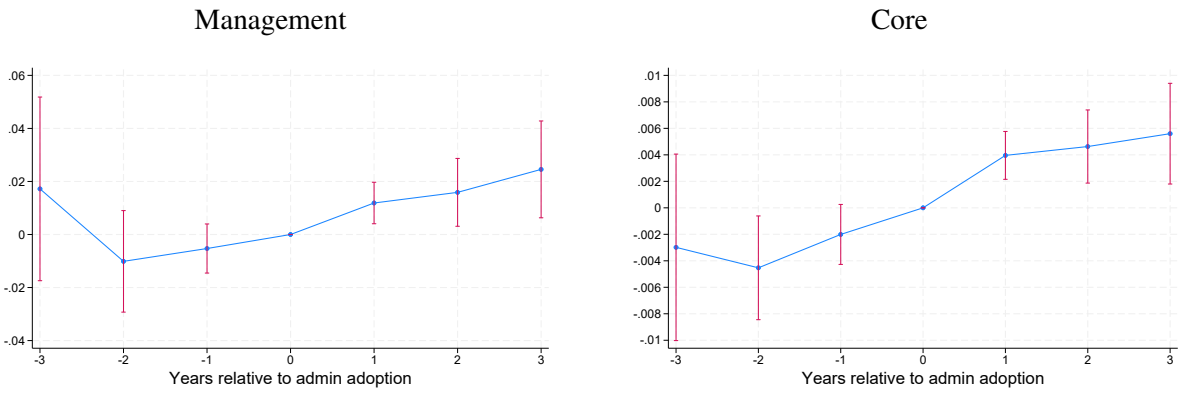
Notes: Event-study estimates of equation (2) for year-over-year log employment growth of core workers (left), management workers (center), and the two functions combined (right). Estimator, sample, and controls as in Figure 4. Bars denote 95% confidence intervals based on standard errors clustered by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

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



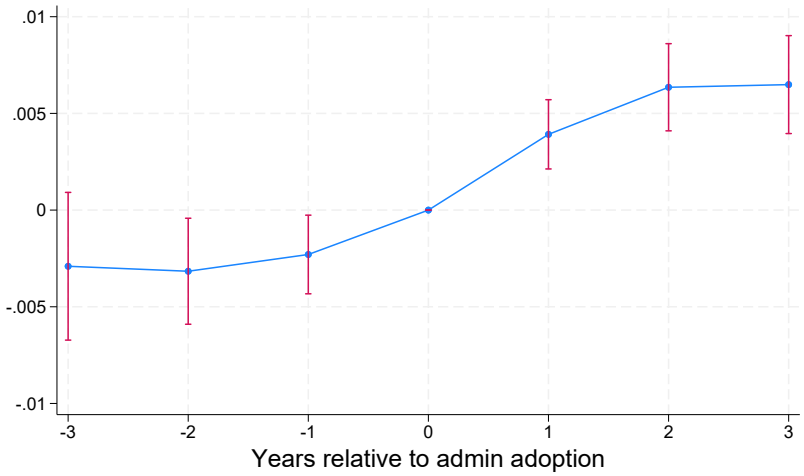
Notes: Event-study estimates of equation (2) for the firm-level average log wage across all workers. Estimator, sample, and controls as in Figure 4. Bars denote 95% confidence intervals based on standard errors clustered by firm.

Figure A.14: Office-support adoption and wages, by function



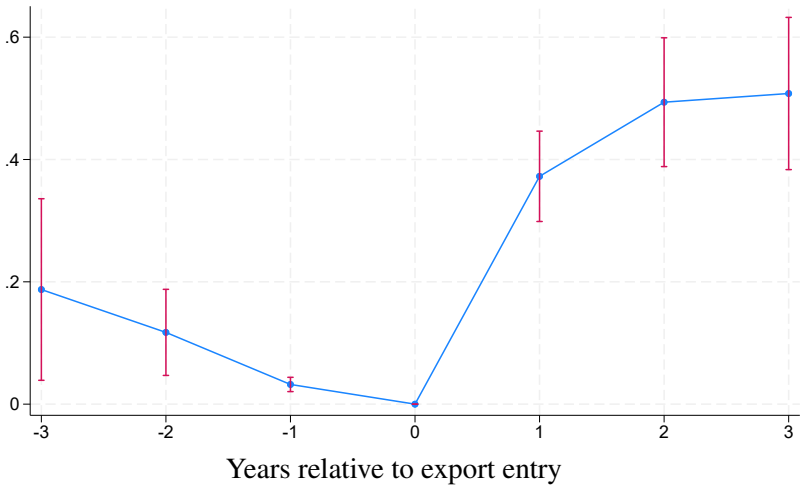
Notes: Event-study estimates of equation (2) for the firm-level average log wage of management (left) and core (right) workers. Estimator, sample, and controls as in Figure 4. Bars denote 95% confidence intervals based on standard errors clustered by firm.

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



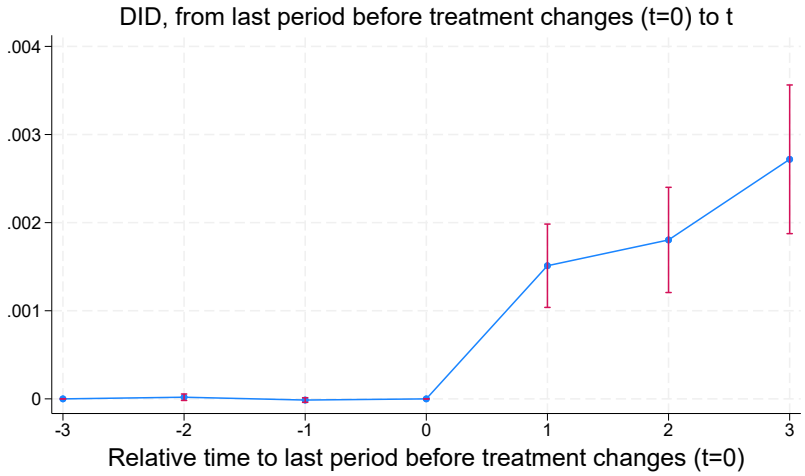
Notes: Event-study estimates for the exporter indicator around first manager adoption, estimated with the same design as equation (2) with manager adoption as the (absorbing) treatment. Estimator, sample, and controls as in Figure 4. Bars denote 95% confidence intervals based on standard errors clustered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

Figure A.16: Office-support employment around export entry



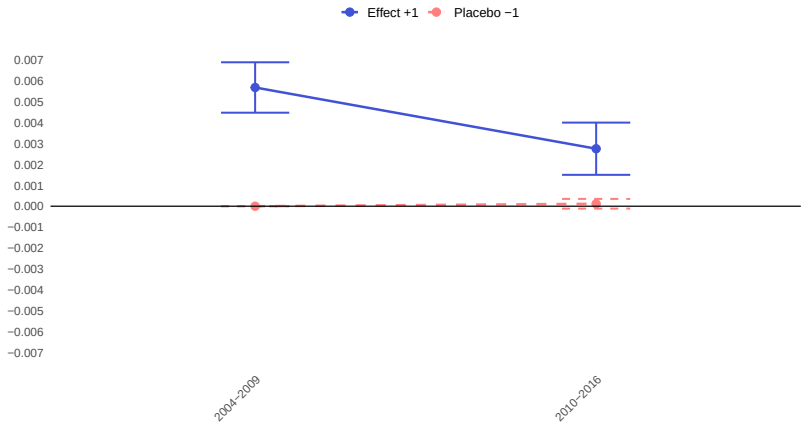
Notes: Event-study estimates for an indicator of admin employment around export entry: the treatment is the exporter indicator and the outcome is the (absorbing) admin indicator, conditional on prior organizational structure, estimated with the estimator of De Chaisemartin and D'Haultfœuille (2026) with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

Figure A.17: Office-support adoption and the probability of importing



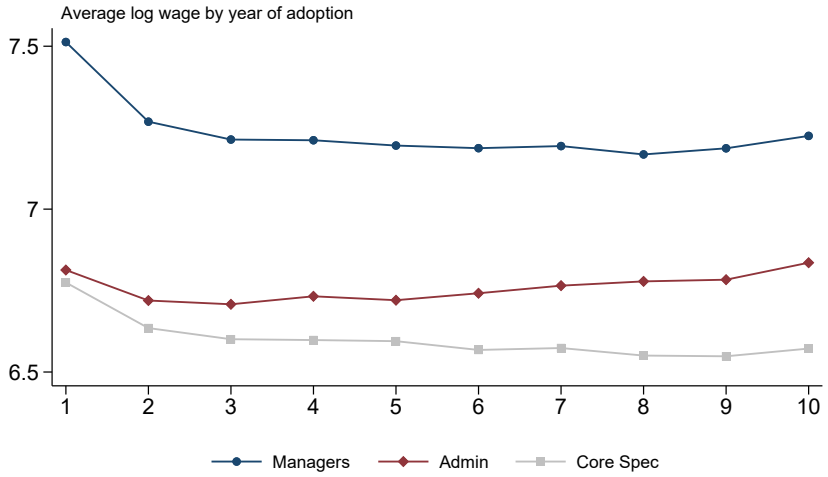
Notes: Event-study estimates of equation (2) for an indicator equal to one if the firm imports in the year. The sample excludes firms that imported before admin adoption; importers account for 0.29% of firm-years in the estimation sample. The three pre-adoption placebos are jointly insignificant ($p = 0.799$). 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.

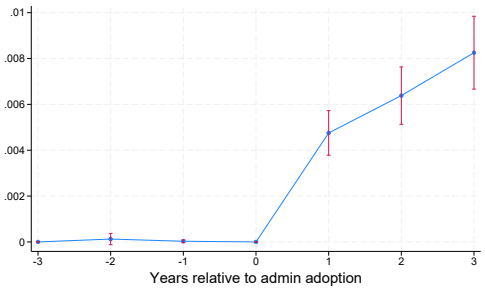
Figure A.19: Average log wage by function and firm age at office-support adoption



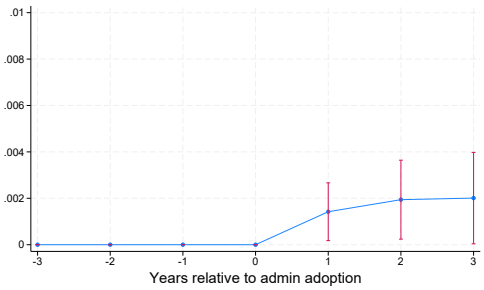
Notes: Average log wage by function, plotted against the firm's age at first admin adoption (years 1–10). RAIS manufacturing firms with at least 10 workers and firm age below 31. Wages in 2010 reais.

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

A. Above-median robot increase

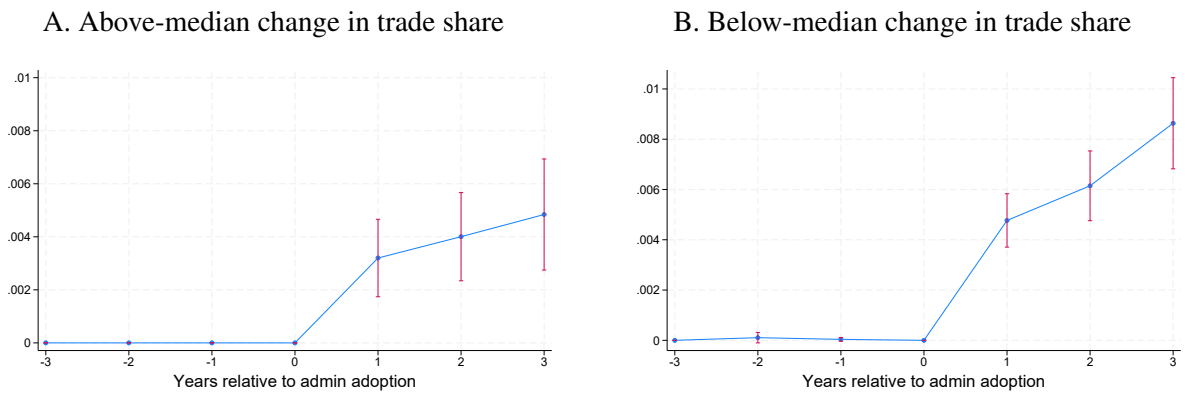


B. Below-median robot increase



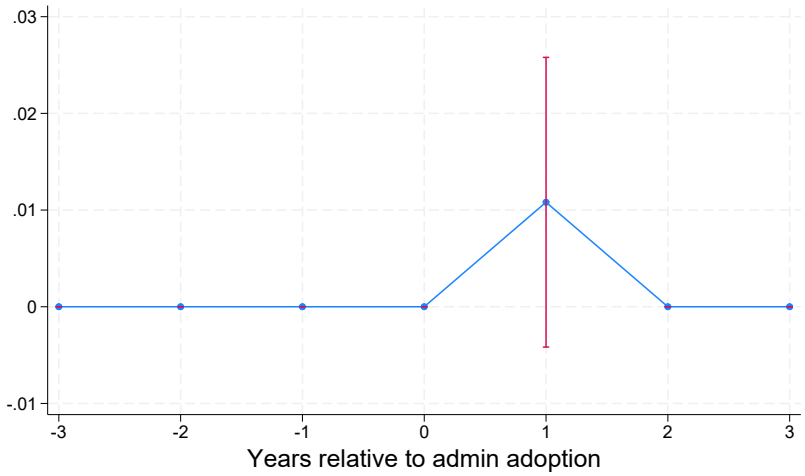
Notes: Event-study estimates of equation (2) for the exporter indicator, estimated separately for firms in microregions with above- and below-median increases in the stock of imported robots between 2004 and 2016, identified from COMEXStats product codes. Maps are in Appendix Figures A.23–A.24. Estimator,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

Figure A.21: Office-support adoption and exporting, by regional change in trade share



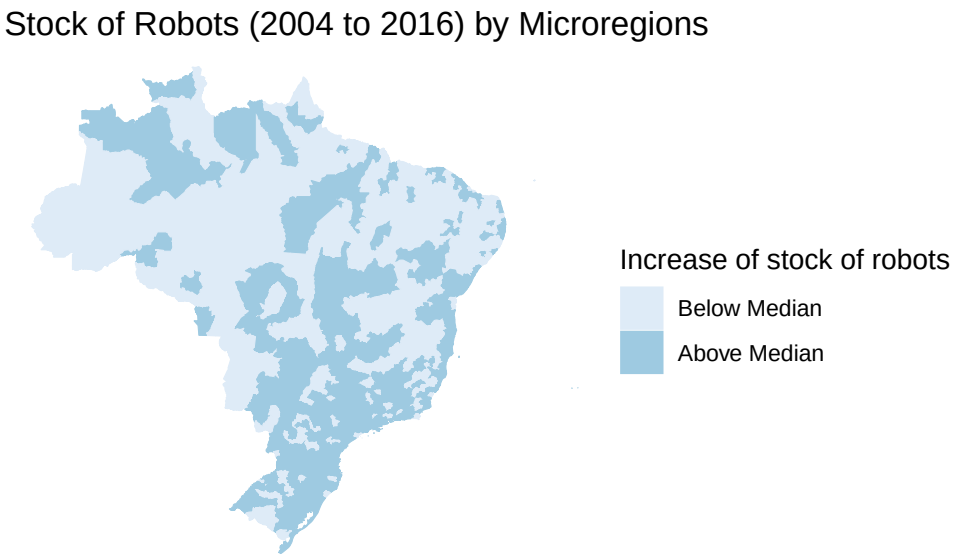
Notes: Event-study estimates of equation (2) for the exporter indicator, estimated separately for firms in microregions with above-median (Panel A) and below-median (Panel B) changes in trade share between 2004 and 2016, computed from COMEXStats. Estimator, sample, and controls as in Figure 4. Bars denote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

Figure A.22: Office-support adoption and exporting, firms with more than 100 workers



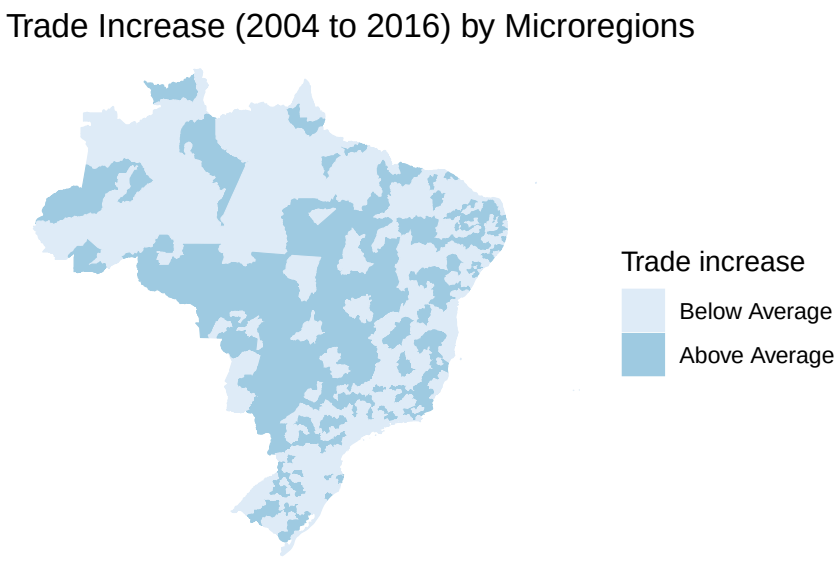
Notes: Event-study estimates of equation (2) for the exporter indicator, restricted to firms with more than 100 workers. Estimator, sample, and controls as in Figure 4. Bars denote 95% confidence intervals based on standard errors clustered by firm.

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.

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 function 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 function 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 function 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 function and detailed group. The crosswalk is available online with the supplemental appendix.

Table A.3: Gender and education by function

	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 function, the table reports the share of male and female workers in the function 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 function is the average number of workers in the function among firms employing the function. 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.

B Endogenous Production Scale and Organization Choice

The baseline model fixes n to isolate the assignment of organizational tasks. This Appendix allows the firm to choose the production scale jointly with management and office support. The extension delivers two additional results. First, office-support specialization raises optimal production scale because it lowers the marginal organizational cost of expansion. Second, office support substitutes managerial labor in routine tasks and still is associated with an increase in managerial employment in equilibrium, which occurs when the scale effect dominates the task-substitution effect.

B.1 The firm's problem

Let $R(n;z)$ denote revenue from operating a production workforce n at productivity or demand state z. We assume $R_n > 0$ over the relevant range and that revenue is sufficiently concave for each organizational regime to have a unique interior optimum. Production workers earn w_n.

The firm chooses its entire organization, (n, m, a, m_H, m_S), by solving

$$\max_{n,m,a,m_H,m_S} \{R(n;z) - w_n n - w_m m - w_a a - F_a \mathbf{1}\{a > 0\}\} \tag{3}$$

subject to (**??**)–(**??**).

The task constraints reduce the problem to a choice between two organizational regimes. Without office support,

$$\pi_0(n;z) = R(n;z) - (w_n + h w_m)\, n - c_m S(n), \qquad c_m = w_m. \tag{4}$$

With office support,

$$\pi_1(n;z) = R(n;z) - (w_n + h w_m)\, n - c_a S(n) - F_a, \tag{5}$$

where c_a is defined in (**??**). The difference in variable cost is the price at which the firm produces routine support. Under no specialization it uses managerial labor at cost c_m; under specialization

it uses office support at cost $c_a < c_m$.

Let $n_0(z)$ and $n_1(z)$ denote the production choices that maximize (4) and (5), respectively, ignoring the fixed cost in the first-order condition. Interior optima satisfy

$$R_n(n_0; z) = w_n + hw_m + c_m S'(n_0), \tag{6}$$

$$R_n(n_1; z) = w_n + hw_m + c_a S'(n_1). \tag{7}$$

Proposition 1 (Office support and endogenous scale)**.** *Suppose $c_a < c_m$, $S'(n) > 0$, and profits are strictly concave in n within each organizational regime. Then*

$$n_1(z) > n_0(z). \tag{8}$$

That is, conditional on paying the fixed organizational cost, a firm organized with specialized office support operates at a larger production scale than the same firm relying on managers for routine support.

Proof. Evaluate the derivative of the office-support profit function at n_0. Using (6),

$$\begin{aligned} \frac{\partial \pi_1(n_0; z)}{\partial n} &= R_n(n_0; z) - (w_n + hw_m) - c_a S'(n_0) \\ &= (c_m - c_a) S'(n_0) > 0. \end{aligned}$$

Strict concavity then implies that the maximizer of π_1 lies to the right of n_0. □

The proposition gives a precise sense in which office support is a complement to production. At a fixed n, admins substitute for managers in routine tasks. In equilibrium, however, this substitution lowers the marginal organizational cost of production, inducing the firm to choose a larger n.

B.2 The adoption decision with endogenous scale

Endogenizing n changes the adoption condition in an economically important way. Define variable profits before the fixed cost as

$$\widetilde{\pi}_0(n;z) = R(n;z) - (w_n + hw_m)\, n - c_m S(n), \tag{9}$$

$$\widetilde{\pi}_1(n;z) = R(n;z) - (w_n + hw_m)\, n - c_a S(n). \tag{10}$$

The firm adopts office support if

$$\widetilde{\pi}_1(n_1;z) - \widetilde{\pi}_0(n_0;z) \geq F_a. \tag{11}$$

The gain from specialization can be decomposed as

$$\widetilde{\pi}_1(n_1;z) - \widetilde{\pi}_0(n_0;z) = \underbrace{(c_m - c_a)S(n_0)}_{\text{direct task-assignment saving}} + \underbrace{[\widetilde{\pi}_1(n_1;z) - \widetilde{\pi}_1(n_0;z)]}_{\text{gain from expanding scale}}. \tag{12}$$

The second term is strictly positive by Proposition 1. Thus the fixed-scale model understates the value of organizational specialization: office support not only performs existing routine tasks more cheaply, it also changes the optimal scale of the firm.

This decomposition is useful for interpreting the event-study evidence. The rise in non-admin employment after adoption need not be viewed as mechanically generated by adding the first office-support worker. In the model, it is the endogenous response of production to a lower marginal organizational cost of operating at scale.

It is worth noting that task substitution does not imply employment substitution. At a given production scale, office-support workers substitute for managerial labor in routine support tasks. Once scale is endogenous, the resulting reduction in organizational costs raises optimal production scale and hence the demand for genuinely managerial tasks. Managerial employment may therefore rise after office-support adoption if this scale effect is sufficiently large. This distinction is relevant given that in the data, adoption is followed by increases in production and managerial employment, even though the model assigns routine support away from managers.

B.3 Productivity, firm growth, and organizational adoption

Finally, the endogenous-scale framework gives a simple comparative static for firm growth. Suppose z raises the marginal return to production, so $R_{nz} > 0$. Then $n_0(z)$ and $n_1(z)$ both increase with z. More importantly, the value of office-support specialization is increasing in z.

Let

$$\mathscr{V}_A(z) = \max_n \widetilde{\pi}_1(n;z) - \max_n \widetilde{\pi}_0(n;z). \tag{13}$$

By the envelope theorem,

$$\mathscr{V}_A'(z) = R_z(n_1(z);z) - R_z(n_0(z);z). \tag{14}$$

Since $n_1(z) > n_0(z)$, $R_{nz} > 0$ implies $\mathscr{V}_A'(z) > 0$. More productive firms, or firms facing larger market opportunities, therefore have a stronger incentive to adopt office support.

The resulting organization of the firm can be summarized as follows. At low fundamentals, the firm remains small and managers absorb routine support. As productivity or demand rises, desired production scale expands, increasing the value of separating routine support from management. Once the fixed cost is covered, the firm adopts office support, which further lowers the marginal cost of expansion and generates a discrete increase in optimal scale. This mechanism connects the life-cycle, size, employment, export, and technology facts with a single organizational choice.

B.4 Summary of Main Model Predictions

The framework delivers five predictions that connect with our empirical findings.

1. **A scale threshold for office support.** Small firms use managers for routine support; sufficiently large firms pay a fixed cost and specialize those tasks into office support.

2. **Different size profiles for managers and admins.** After specialization, the managerial share is constant under the span-of-control technology, while the office-support share declines because routine support is scalable overhead.

3. **Office support and production are equilibrium complements.** Although admins substitute for managers in routine tasks, specialization lowers the marginal organizational cost of production and raises optimal production scale.

4. **Managerial employment need not fall after admin adoption.** If the scale response is sufficiently large, the firm expands both production and management even though managers cease performing routine support.

5. **Larger market opportunities and productivity-raising technologies increase the value of specialization.** Export opportunities and technologies that raise productive capacity therefore make office support more valuable and can bring organizational adoption closer to scale-up events.

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