The Anatomy of Colombian Bureaucratic Hierarchies

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The effective deployment of the bureaucracy is fundamental to government performance and economic development. We study the organizational architecture of the central administration for a large sample of municipal governments in Colombia. Our analysis yields four main findings. First, municipal population is the strongest predictor of the size of the local bureaucracy, but there is substantial variation in bureaucratic size even among municipalities with similar population or expenditure on public personnel. Second, while almost all municipal governments have employees at all hierarchical levels, the share of top managers monotonically decreases and the shares corresponding to lower layers grow as bureaucracies expand. However, only the largest bureaucracies achieve a pyramidal structure. Third, average wages monotonically increase with the hierarchical level, but they remain largely constant within levels for bureaucracies of different sizes. Fourth, larger shares of higher-level bureaucrats are robustly associated with municipal tax revenue per capita, conditional on bureaucratic size.

KEYWORDS

Bureaucracy, knowledge hierarchies, state capacity, decentralization

La Anatomía de las Estructuras Burocráticas en Colombia

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El uso efectivo de la burocracia es fundamental para el buen desempeño de los gobiernos y el desarrollo económico. En este artículo estudiamos la estructura organizacional de un amplio número de gobiernos municipales en Colombia. Nuestro análisis arroja cuatro resultados principales. Primero, el tamaño de la población es el principal predictor del tamaño de la burocracia, pero este tamaño varía bastante entre municipios con población o gastos de nómina semejantes. Segundo, si bien casi todos los municipios tienen funcionarios en todos los niveles de la estructura jerárquica, las burocracias más grandes tienen una proporción decreciente de directivos y proporciones crecientes de todos los niveles inferiores. Sólo las burocracias más grandes presentan una estructura jerárquica piramidal. Tercero, los salarios son en promedio mayores para niveles jerárquicos más altos, pero permanecen constantes al interior de un mismo nivel entre burocracias de distintos tamaños. Cuarto, la proporción de funcionarios en las capas superiores está asociado de manera positiva y robusta con el recaudo tributario per capita.

KEYWORDS

Burocracía, jerarquías de conocimiento, capacidad estatal, descentralización

1 | INTRODUCTION

A growing body of research has documented a positive link between the fiscal and administrative capacity of the state and long-run economic development (Besley and Persson, 2011; Dincecco and Katz, 2016; Johnson and Koyama, 2017). This literature shows that having a state that is better able to raise revenue, protect people's lives and property, and provide public goods is generally associated with better economic performance. This literature largely focuses on the macro political and economic factors that shape the development of state capacity, but leaves unexplored the inner structure and functioning of the government, which is arguably fundamental to the development of policies that contribute to the strengthening of state effectiveness.

A parallel empirical literature has increasingly explored the personnel and organizational economics of the state, with a strong emphasis on the developing world (Finan et al., 2017; Besley et al., 2022). One strand of research studies bureaucratic recruitment, highlighting the important roles of remuneration, missional alignment, and patronage (Dal Bó et al., 2013; Besley and Ghatak, 2018; Xu, 2018; Deserranno, 2019; Colonnelli et al., 2020; Spenkuch et al., 2023). Another strand of work analyzes the benefits and potential pitfalls of high-powered incentives or monitoring schemes (Banerjee et al., 2008; Glewwe et al., 2010; Muralidharan and Sundararaman, 2011; Khan et al., 2016; Dhaliwal and Hanna, 2017; Acemoglu et al., 2020). Yet another strand of literature considers the allocation of tasks across different bureaucrats and the trade-off between rules and discretion (Kelman, 1990; Bandiera et al., 2021; Decarolis et al., 2023; Szucs, 2024).

Importantly, while this growing body of research has provided many valuable insights on the drivers of bureaucratic effectiveness, it has mostly focused on the characteristics and performance of individual bureaucrats within a given organizational structure.[1] Much less is known about the potential impact of changes to the organizational structure on the functioning of governments, with some notable exceptions. Snowberg and Ting (2024) present a theoretical model that conceives of government as a hierarchy dedicated to solving problems and examines the political incentives that shape this structure and associated outcomes. Chiovelli et al. (2024) study the fiscal and political consequences of the introduction of a new layer of provincial governors in the Spanish colonial empire as part of the Bourbon reforms. Mastrorocco and Teso (2024) trace the development of the federal bureaucracy in the United States throughout the 19th century and leverage variation in technological innovations (telegraph and railroads) to document the importance of monitoring costs for bureaucratic expansion.

In contrast, a voluminous literature has studied the hierarchical structure of firms and other organizations in the private sector (Garicano and Zandt, 2013; Garicano and Rossi-Hansberg, 2015). This literature has uncovered the economic logic behind different organizational structures, focusing in particular on the development of knowledge hierarchies that involve the deployment of increasingly specialized workers to address problems of growing complexity (Garicano, 2000). Empirical work in this literature has documented the relationship between organizational structure and firm outcomes, such as output or growth (e.g., Caliendo et al., 2015).

In this paper, we study the organizational architecture of the central administration for a large sample of municipal governments in Colombia. Colombian municipalities offer an ideal laboratory for this study for several reasons. First, Colombia embarked on an ambitious decentralization program at the end of the 20th century that awarded local governments with substantial resources and authority over the provision of local public goods (e.g., education, health, water, and sanitation). Hence, these municipal governments are meaningful agents

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[1]Henceforth, we use the term *bureaucrat* to refer generically to all government workers.

in the process of local development. Second, the process of decentralization also awarded municipal governments with substantial discretion over the size and composition of local bureaucracies. We leverage newly-collected administrative microdata on local bureaucracies to reconstruct the hierarchical structure of the municipal governments.

Our analysis yields four main findings. First, municipal population is the strongest predictor of the size of the local bureaucracy, but there is substantial variation in bureaucratic size even among municipalities with similar population or expenditure on public personnel. Second, while almost all municipal governments have employees at all hierarchical levels, the share of top managers monotonically decreases and the shares corresponding to lower layers grow as bureaucracies expand. However, only the largest bureaucracies achieve a pyramidal structure. Third, average wages monotonically increase with the hierarchical level, but they remain largely constant within levels for bureaucracies of different sizes. Fourth, larger shares of higher-level bureaucrats are robustly associated with municipal tax revenue per capita, conditional on bureaucratic size.

The remainder of the paper is organized as follows. Section 2 provides the institutional background on the administrative structure of Colombian municipalities, public finance, and decentralization. Section 3 discusses the data and provides summary statistics on our study sample. Sections 4-6 present our results on the size, structure, and cost of the municipal bureaucracy. Section 7 presents some suggestive results on the link between the structure of the bureaucracy and government performance, focusing on tax revenue. Finally, section 8 concludes.

2 | INSTITUTIONAL BACKGROUND

2.1 | Administrative Structure

Colombia is administratively divided into 32 departments plus the capital district of Bogota. Each department is further subdivided into municipalities, of which there are 1,103.[2] The mayor is the top municipal authority and is elected every four years using plurality rule. These are partisan elections and most mayors are affiliated to a national political party. Mayors face a one-term limit, but can be re-elected after one term out of office. The municipal council varies in size depending on population, ranging from 7 to 21 members, except for Bogota with 45 members. The council is elected concurrently with the mayor using proportional representation and provides oversight over the executive. The council must approve the mayor's proposal for the yearly budget, as well as changes to the rates for local taxes or fees, credit operations or commitments involving future revenue streams. The national legislative assembly is the only institution authorized to create new taxes.

Municipalities vary in their institutional complexity, based on a seven-tier categorization that depends on their population and current revenue. Categories range from 1 to 6, with larger numbers corresponding to smaller municipalities with less revenue, plus a special category for the largest cities. All municipalities have a *personero* (ombudsman), who acts as a local representative of the Inspector General (Procuraduria General de la Nación, PGN) and is elected by the council for a four-year term. The municipal category determines the maximum salary of the mayor, which also serves as a cap on the remuneration of all other local public officials. Municipalities in the upper categories (i.e., larger and richer) have their own Comptroller (contraloría) to oversee local public finances, while those in lower categories are overseen by the Comptroller of their department. Municipalities in the upper

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[2]There are also 19 non-municipal districts (*Areas no municipalizadas*) located in remote and sparsely populated areas. These districts are administered by the corresponding department and fall outside the scope of our study.

categories also have elected neighborhood boards (Juntas Administradoras Locales, JAL) that provide additional oversight on the municipal government.

Law 1551 of 2012 awards municipalities discretion over their administrative structure, including the composition and complexity of the local bureaucracy. Law 909 of 2004 regulates the civil service and distinguishes between different categories of public servants:

1. **Elected:** Individuals entering the public service through popular election. For the central administration of the municipal government, this category only includes the mayor.
2. **Discretionary:** Individuals serving at the pleasure of a higher authority. This category includes all heads of divisions or subunits (e.g., secretary of education, press secretary, head of legal affairs). This also includes advisors (*asesores*) serving in positions of trust and that respond directly to the mayor.
3. **Fixed term:** Individuals that belong to the civil service on a fixed term. The municipal ombudsman (personero) falls in this category, as well as the chief of internal control (*Jefe asesor de control interno*).
4. **Career:** Individuals belonging to the civil service. This category is highly regulated in terms of entry, promotion, and, exit. Career bureaucrats are overseen by public law and their employment requires an official appointment into the civil service.
5. **Temporary:** Exceptionally, the municipal government can create temporary positions with a duration of less than 12 months.

Decree 785 of 2005 provides an official classification of positions in the public administration of subnational governments. This classification consists of five ranks:

- **Director:** High-ranking positions that involve the development and implementation of public policies, programs, and projects. This category includes the mayor, ombudsman, and all heads of divisions, except for the ones listed as advisors.
- **Advisor:** Individuals who directly assist or advice public officials in directive positions. Besides proper advisors, this category also includes the heads of legal counsel, planning, press, and internal control.
- **Professional:** Jobs that require specialized knowledge at the level of a college degree. These positions may involve some coordination and supervisory duties within sub-units. This category includes positions like the treasurer.
- **Technician:** Jobs that require the implementation of processes and procedures for technical missional duties and support, as well as some related to science and technology.
- **Assistant:** Jobs that provide support services to the higher levels or that involve manual or very simple tasks. This category includes personal secretaries, guards, drivers, cleaners.

Each municipality must have an official administrative structure that lists each position and the unit to which it belongs. The mayor has authority over the size and composition of the local bureaucracy, conditional on budgetary restrictions. This structure is reflected in an official document called *manual de funciones* that states the responsabilities of each position, as well as its rank and the type of appointment. The municipal council can create subranks within each category that regulate the salary. Decree 785 of 2005 provides general requirements of education and experience for each rank, which vary based on the municipal category. It is possible to replace an educational requirement with additional work experience according to an equivalence that is also set by the law.

2.2 | Public Finance

Municipalities rely on three main sources of revenue. These are tax revenue, non-tax revenue (i.e., fines and fees), and transfers from the central government. The main local taxes are the property tax and a tax on gross business receipts. Municipalities can issue fines for traffic violations or for the infringement of public ordinances, and can charge fees for public services such as energy or street cleaning, as well as for the use of public spaces such as slaughterhouses or market squares. Municipal governments enjoy almost complete discretion over the use of their own tax and non-tax revenue, with the exception of certain earmarks.[3]

The central government transfers money to the municipalities through a system called Sistema General de Participaciones (SGP). These transfers are entirely formula-determined and largely earmarked. The bulk of SGP transfers provides funding for service provision in the areas of education, health, water, sanitation, sports, and culture. Smaller municipalities (categories 4-6) also receive a share for fully discretionary spending (*libre destinación*), including operating expenditures. This share of SGP transfers, combined with municipal tax and non-tax revenue (net of earmarks), constitutes their disposable current revenue (*ingresos corrientes de libre destinación*).

Spending by municipal governments can be disaggregated into current and capital spending. Current spending is the sum of operating expenditures and debt interest payments. Operating expenditures ensure the proper functioning of the municipal government and are spread across three bodies: (i) the central administration, (ii) the municipal council and (iii) the office of the *personero* (ombudsman). The central administration corresponds to all bureaucrats and administrators working in 'city hall', including the office of the mayor and subsidiary dependencies (e.g., secretary of education), and is the main focus of our study. For the period 2010-2018, the central administration accounts for 84% of operating expenditures on average, while the council and ombudsman account for roughly 9% and 7% respectively (Carreri and Martinez, 2024).

2.3 | Decentralization in Colombia

This fiscal and administrative structure was created through a series of decentralization reforms that began with the introduction of local elections for mayors in 1988.[4] Colombia's new constitution, approved in 1991, was pivotal in this effort and introduced the election of other subnational officials (departmental governors and assemblies, municipal councils). The constitution awarded greater responsibilities to subnational governments (municipalities and departments) in the provision of public goods (articles 356 and 357).

Over the following years, several laws further developed this decentralized institutional framework. Law 60 of 1993 created a formula-based system of intergovernmental transfers through which the central government provided funding for these expenditures. The original system consisted of two funds called *situado fiscal* and *participaciones municipales*. The *situado* was used to transfer earmarked resources to the departments for the provision of education and health. The *participaciones* were used to provide earmarked resources to the municipalities for expenditures in various areas, also including education and health, as well as water and sanitation, transportation, housing, etc. Importantly, both of these funds were entirely formula-based and non-partisan.

The system was largely overhauled by Law 715 of 2001, with additional minor changes

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[3]For instance, a share of property tax revenue must be transferred to a regional environmental agency.
[4]Before then, the president appointed the governors of the departments, who in turn appointed the mayors. Term length for the mayors was initially set for two years, but increased to three in 1994 and four in 2003.

introduced in Law 1176 of 2007. The new system unified the *situado* and *participaciones* into the Sistema General de Participaciones (SGP). However, the three main features of the transfer system remained unchanged: (i) earmarked, (ii) formula-based, (iii) non-partisan. SGP transfers are highly regulated and funds must be kept in a separate account from other sources of municipal revenue. The vast majority of SGP transfers (96%) are sectorial, with a small residual share allocated mostly to pensions and support for native indigenous communities. The sectorial share is divided between education (59%), health (25%), water and sanitation (5%), and general purpose (11%). Management of the resources for education, health and water is allocated between departments and municipalities based on competencies. For instance, only larger 'certified' municipalities have full autonomy over their education systems. The allocation of resources within sectors varies across municipalities based on current levels of provision and unsatisfied needs.

In the case of the general purpose category, municipalities in categories 4-6 can spend up to 42% of the received transfers at their full discretion (*libre destinación*), including operating expenditures. The remaining amount must go to capital spending at the discretion of the municipality (*libre inversión*), with the exception of fixed percentages assigned to sports (8%) and culture (6%). The allocation of transfers in the general purpose category is a function of population and poverty levels, but it also rewards municipalities for raising more local tax revenue. Since 2007, municipalities also receive additional transfers in this component for meeting the cap on operating expenditures set by Law 617 of 2000 (Carreri and Martinez, 2024). In particular, transfers increase in the difference between the cap and the actual value of the overspending ratio (operating expenditures/current revenue).

3 | DATA

The main source for our analysis is hand-collected data on the structure of municipal bureaucracies. Our data collection effort targeted 1,000 municipalities (90% of the total). This includes all municipalities in category 6 and a subset of those in categories 4 and 5. We rely mostly on publicly-available information downloaded from the website of each municipality and on information provided by municipal governments in response to our direct requests. This information largely corresponds to the official structure of the central bureaucracy of the municipal government, which is usually contained in an official document (*manual de funciones*) that lists each position and specifies its title, hierarchical level, type of appointment, and the sub-unit (office) that it belongs to. We have also collected additional data on the salary for each position.

Several features of the data are worth noting. First, the data is cross-sectional in nature and offers one observation per municipality. The timing of this observation varies across municipalities (e.g., most recent version of the manual de funciones), ranging from 2014 to 2024. The average year of observation on bureaucratic structure is 2020 and on wages is 2022. Second, the focus of our attention is the central administration of the municipal government. However, municipalities often have local utility companies or decentralized sectoral agencies (e.g., tourism, sports, housing). While these entities fall outside the scope of our analysis, we use available information on their existence to ensure that they do not affect our findings (e.g., mismeasurement of the bureaucracy in larger municipalities that are more likely to have decentralized government agencies). Third, our data only covers the official set of members of the bureaucracy. The Colombian public sector increasingly relies on external contractors hired on fixed-term service provision contracts to assist in the running of the government. While these contractors are also mostly outside of the scope of our analysis, we use additional data from the national agency for civil service (*Departamento*

Administrativo de la Función Pública, DAFP) to measure their number and examine their incidence on our findings.

The results we present below are based on a sample comprised exclusively of municipalities in category 6. This ensures that all municipalities in the sample face the same set of rules regarding their administrative structure (e.g., no municipal comptroller), public finance (e.g., cap on operating expenditures at 80% of current revenue), and the compensation of local bureaucrats (e.g., same cap on the salary of the mayor). This restriction also helps to further alleviate concerns regarding omitted decentralized agencies, insofar as the municipalities in category 6 are the the smallest ones and their local governments tend to not be very institutional complex.

Our ongoing data-collection effort currently provides information for 603 such municipalities (62%). We further drop four municipalities with fewer than seven employees, which leaves us with a sample of 599 municipalities. The map in Figure 1 shows the location of these municipalities. The geographic coverage of our sample (which remains incomplete) extends to all regions of Colombia. Table 1 provides summary statistics on relevant municipal characteristics for the municipalities in our sample (599), those in our wider sampling frame (1000), and for all municipalities in the country. The municipalities in our sample are generally smaller, with an average population close to 15,000 inhabitants. They are highly comparable in terms of urbanization and poverty, with the average municipality having 59% of the population living in rural areas and 22% having unmet basic needs. The average distance to Bogotá, the country's capital, is 292 kilometres (km), while the distance to the respective department's capital is 80 km. These capitals are underrepresented in our sample (only 1% vs 3% in the country as a whole) because these are generally larger cities not in category six. Eight percent of the municipalities in our sample were founded on or after 1990, when the decentralization process took off. This share is comparable to the rest of the country. Averaging for the period 2014-2018, the municipalities in our sample have an average yearly current revenue of 3.8 billion Colombian pesos (COP), which is equivalent to 0.56 million US dollars (USD).[5] Their personnel expenses average 1.1 billion COP (0.28 million USD) per year while their investment budget (corresponding to all public goods) averages 16 billion COP (4 million USD). Hence, these municipalities manage considerable sums of money with the potential to transform the living conditions of their inhabitants.

4 | SIZE OF THE BUREAUCRACY

This section presents our findings on the size of municipal bureaucracies in Colombia. Our data-collection effort on the official structure of these organizations reveals that the average municipality in our sample has 27.3 bureaucrats. The 25th percentile is 16, the median is 23, and the 75th percentile is 34. These numbers are generally comparable to an estimate based on the number of records per municipality in the registry of government employees (SIGEP) managed by DAFP, which has a mean of 25.5. Appendix Figure A.1 provides a more detailed analysis of this comparison.[6] We can also use data on the universe of public agencies (also from DAFP) to examine the impact of decentralized municipal agencies on our estimates.[7] If we exclude the 108 municipalities with any decentralized agencies, we

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[5]We use an exchange rate of 4,000 COP per USD for these calculations.

[6]The distribution of sizes based on SIGEP data has thicker tails. This suggests that there is both systematic underreporting of bureaucrats in the SIGEP database at the bottom and potential duplicates at the top. Adding the external contractors naturally leads to a longer right tail.

[7]Appendix Figure A.2 shows a binned scatter plot of municipal population against a dummy equal to one if the local government has a decentralized agency. There is a strong positive correlation, with larger municipalities being more likely to have a decentralized agency.

obtain an average size of the bureaucracy of 25.5. Alternatively, if we restrict the sample to municipalities with population below 20,000, the average drops slightly to 23.3.

What predicts the size of the bureaucracy? Table 2 presents results from a series of cross-sectional regressions with the number of municipal bureaucrats as dependent variable. The regressors included in these regressions correspond to basic municipal characteristics, focusing particularly on those that are predetermined or not easily changed. All regressions include department fixed effects that account for broad geographic and demographic characteristics as well as the influence of the department government. Nonetheless, these regressions only capture partial correlations and should not be interpreted causally.

Column 1 shows a strong positive correlation between the size of the population (expressed in tens of thousands) and the size of the bureaucracy, with an average increase of 0.67 bureaucrats for every 1,000 inhabitants. This increase is equivalent to 2.5% of the sample mean and the estimate remains very stable and precise as we include additional regressors in columns 2-6. Column 2 shows that a 10 percentage point (pp) increase in the share of rural population is associated with 1.2 fewer bureaucrats (4.4% of sample mean), conditional on population size. This estimate decreases slightly as we include additional regressors, but remains economically and statistically significant. Column 3 then shows that new municipalities created on or after 1990 have close to 6 additional bureaucrats on average, conditional on the size and rural share of the population. This is a very large effect, equivalent to 22% of the sample mean, and is also highly robust. Columns 4 and 5 show that the previous results are unaffected if we further include the respective distances to Bogotá and the department capital, expressed in hundreds of km. The estimates for distance to Bogotá are small and not statistically significant at conventional levels. The distance to the department capital is negatively correlated with the size of the bureaucracy, but the correlation is small, less precise, and not very robust. Column 6 adds the share of population with unmet basic needs (a poverty indicator) as an additional regressor. While this share could easily be itself affected by the size of the bureaucracy, the aim of this analysis is to verify the sensitivity of the previous estimates to controlling for a measure of local development. The correlations for total population, share of rural population, and new municipalities are largely unaffected.

The previous results suggest that total population is one of the most robust predictors of the number of municipal bureaucrats. Panel (a) in Figure 2 shows a scatter plot of population against the size of the bureaucracy, as well as linear and quadratic lines of best fit. The visual evidence confirms the existence of a positive correlation (even in the absence of department fixed effects), but the downward quadratic estimate suggests that the larger municipalities in our sample have somewhat small bureaucracies relative to their size. This is reflected in the scatter plot in panel (b), which shows the number of bureaucrats per 1,000 inhabitants as a function of population. While the smallest municipalities in our sample have five or more bureaucrats per 1,000 inhabitants (inh.), this ratio decreases sharply and stabilizes around one bureaucrat per 1,000 inh. for municipalities with population above 20,000.

This pattern raises a concern related to the composition of our sample. As mentioned above, we restrict the sample to municipalities in category six. The municipal category theoretically should be a function of both population and current revenue, but in practice only the latter matters.[8] As a result, while roughly half of our sample is comprised of municipalities with population below 10,000 inhabitants (which is the *de jure* threshold for category 6), the remaining half is comprised of municipalities that should be in higher

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[8]The criteria for classification in Article 2 of Law 617 of 2000 include thresholds of population and current revenue for each category, but Clause 1 of this Article states that if the municipality falls in one category based on population but falls into a different one based on current revenue, the municipality will be classified according to the latter, thereby making population irrelevant in practice.

categories but are (negatively) selected into the sample due to their low levels of revenue. Half of these municipalities (25% of the total) have population between 10,000 and 20,000 (which should be in category 5). Another 15% of the total has population between 20,000 and 30,000 (the threshold for category 4) and the top 10% has population above 30,000 and as high as 106,000.

In column 7 of Table 2, we assess the impact of the larger municipalities on our estimates by restricting the sample to municipalities with population below 20,000. This restriction roughly drops the top quartile of the sample in terms of population. The results remain qualitatively similar, but the magnitudes change. In the case of population, an increase of one thousand inhabitants is associated with 1.3 extra bureaucrats on average in this sample of smaller municipalities (5.6% of the respective sample mean). This pattern aligns with the visual evidence on the number of bureaucrats per inhabitant in panel (b) of Figure 2. A 10 pp increase in the share of rural population is associated with 0.68 fewer bureaucrats (2.9% decrease relative to the sample mean), while new municipalities in this group have on average 4.6 additional bureaucrats, equivalent to 19.8% of the sample mean. The results remain similar if we further restrict the sample to municipalities with population below 10,000 (roughly the bottom half) in column 8.

Overall, the results in this section document a robust correlation between the size of the bureaucracy and three municipal characteristics: total population, rural share of the population, and date of creation. While population has the largest explanatory power (in a statistical sense), it is worth noting that there is substantial variation in the size of the bureaucracy among municipalities of similar size. Panel (c) in Figure 2 shows the distribution of bureaucratic sizes for each quartile of the distribution of total population. For instance, 56 municipalities have bureaucracies of between 28 and 32 employees. The population in these municipalities ranges from 3,000 to 92,000. This raises the question of whether some small municipalities have excessively large bureaucracies or some larger ones have bureaucracies too small for their size.

The negative correlation between size of the bureaucracy and the share of rural population suggests a positive link between urbanization and state development. In contrast, the systematic increase in the size of the bureaucracy among municipalities created more recently could indicate the presence of weak institutional constraints that give rise to wasteful overspending on public personnel. These correlations also warrant further study.

5 | STRUCTURE OF THE BUREAUCRACY

Having provided some preliminary insights on the size of municipal bureaucracies, this section explores the inner structure of these bureaucracies. Our analysis is inspired by the concept of knowledge hierarchies (Garicano, 2000), whereby organizations employ smaller numbers of more specialized workers who are able to solve more difficult problems but demand higher wages (i.e., pyramidal hierarchical structure). Hence, we focus our attention on the composition of the bureaucracy across hierarchical levels.[9] To recall, there are five such levels in our data: directors, advisors, professionals, technicians, and assistants. To start, we examine whether municipal bureaucracies differ in the number of hierarchical layers. We find that they generally do not: 95% of municipalities have 4 or 5 layers. Of those with 4 layers, 97% do not have advisors. Said differently, almost all municipalities have bureaucrats at all levels of the hierarchy, with most of the (very small) variation associated with the presence of advisors. As indicated above and confirmed by additional results

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[9]For this part of the analysis, we drop from the sample 16 municipalities with missing information on the hierarchical composition of the bureaucracy.

below, this is a small category comprised of very few occupations. Interestingly, the absence of variation in the number of hierarchical layers in our setting for the public sector stands in contrast with previous findings for organizations in the private sector (e.g. Caliendo et al., 2015, on French manufacturing firms).

Given the very limited variation in hierarchical layers at the extensive margin, we focus our attention on the intensive margin. The largest average share of employees across municipalities corresponds to assistants with 33%. This result aligns with the idea of knowledge hierarchies insofar as this is the lowest layer in the hierarchy and comprises the least specialized occupations. However, the second largest layer corresponds to directors with 29% on average. This is inconsistent with the idea of a knowledge hierarchy, as this is the top layer and comprises the most qualified specialists. The third and fourth largest layers are technicians and professionals, which represent 21% and 15% of the average bureaucracy respectively. Finally, advisors represent only 2% on average. Overall, we observe that the hierarchical structure complies with the notion of a knowledge hierarchy, except for the disproportionately large share of bureaucrats in directive positions.

We next explore the link between the size of the bureaucracy and its composition in Figure 3.[10] The plot shows the average share of bureaucrats in each layer, disaggregated by deciles of bureaucratic size (number of bureaucrats). This figure reveals several interesting findings. First, except for directors, the share of bureaucrats in the remaining layers are hierarchically organized for bureaucracies of all sizes.[11] Second, the smallest bureaucracies have the largest share of directors (over 40%) and this share monotonically decreases as the size of the bureaucracy increases. However, only the largest bureaucracies (decile 10) achieve a pyramidal structure such that the share of directors is smaller than those corresponding to lower levels (ignoring advisors). This indicates that local bureaucracies in Colombia are generally "top heavy" and have a disproportionate share of bureaucrats in high-ranking leadership positions. One possible explanation is that these smaller bureaucracies allow a larger number of bureaucrats to hold leadership positions (i.e., everyone is a manager), but that these positions have a very different meaning in terms of their complexity and degree and specialization across bureaucracies of different sizes. We study this possibility below using data on wages.

Third, the decrease in the share of directors for larger bureaucracies is accompanied by increases in all the lower levels, but these take place in a somewhat staggered manner, with lower levels experiencing higher growth earlier in the bureaucratic expansion. To better illustrate this pattern, Table 3 shows the change in average shares for each layer as we move from the first to the fourth decile of bureaucratic size (small to medium), from the fourth to the seventh decile (medium to large), and from the seventh to the tenth decile (large to very large). Column 5 shows that the average share of assistants increases 14 pp between the first and fourth decile, but barely grows afterwards. In contrast, professionals experience the most growth when we move from the seventh to the tenth decile, while the share of technicians grow the most at intermediate levels (i.e., between the fourth and seventh decile).

Besides the hierarchical level, bureaucratic positions also differ in their type of appointment. Figure 4 shows the share of positions in each hierarchical level that correspond to each type of appointment. Among the three lower layers (assistants, technicians, professionals), we observe a similar pattern, with slightly over 60% of positions corresponding to career officers in the civil service. A smaller share (ranging from 11% for professionals to 6% for the others) corresponds to discretionary appointments made by the mayor or other

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[10]Appendix Figure A.3 provides very similar results for the subsample of municipalities with population below 20,000 and its corresponding deciles of bureaucratic size.

[11]The only exception is a higher share of professionals than technicians in the smallest bureaucracies (decile 1).

directors. An even smaller share (close to 5%) corresponds to other types of appointment (e.g., temporary positions). Unfortunately, approximately 25% of positions in our data do not have information on the type of appointment. In contrast to the lower levels, 66% of directors correspond to discretionary appointments and a further 15% are fixed-term appointees. The latter includes mayors, who are elected for a four year term. Hence, the biggest take-away from this analysis is that directors are predominantly appointed in a discretionary way by the mayor, while most bureaucrats at lower levels are career officers.

The small but non-negligible share of discretionary appointments at the lower levels also warrants further study. While 43% of municipalities do not have any discretionary positions at lower levels, those in the top deciles of this share have 18% or more. On the one hand, this could reflect that these are positions of trust (e.g., the personal secretary of the mayor). On the other hand, the increased flexibility in appointments could facilitate political patronage and hinder government effectiveness.

What predicts the structure of the bureaucracy? Table 4 presents results from a series of cross-sectional regressions with department fixed effects. The dependent variable, indicated in the column header, is the share of bureaucrats in the municipality corresponding to each hierarchical level. In line with the evidence in Figure 3, we find that the main predictor of the inner composition of the bureaucracy is its overall size. The results show that a ten-unit increase in the number of bureaucrats is associated with a 4.6pp decrease in the share of directors, which is offset by a 3.2 pp increase in the share of assistants and smaller increases of around 7 pp for each of technicians and professionals. Conditional on the size of the bureaucracy, we find limited evidence of a correlation with the factors that predict this size, such as the total population of the municipality. However, as before, these regressions only capture partial correlations and should not be interpreted causally.

6 | COST OF THE BUREAUCRACY

In this section, we study the cost of the bureaucratic apparatus. To motivate the analysis, Figure 5 shows the distribution of bureaucratic sizes for the municipalities in each quartile of the distribution of the total bureaucratic wage bill. While more expensive bureaucracies tend to be larger on average, the figure reveals substantial overlap in size among bureaucracies with varying total cost. This raises the question about potential wasteful overspending on public wages. However, a careful analysis of this question must take into account regional differences in human capital, wages, and outside options for potential bureaucrats. As part of our ongoing research we are collecting additional data to explore this topic further.

We next explore the salaries of bureaucrats in the different hierarchical layers. The theory of knowledge hierarchies predicts that higher layers are paid higher salaries in return for their greater specialization. In Colombia, the regulatory framework further ensures a hierarchy of wages. As mentioned above, the mayor is the highest paid officer in the municipal bureaucracy and no other bureaucrat can earn a higher salary. Mayoral salaries have a cap based on the municipal category, which is updated yearly by DAFP. DAFP also sets a yearly cap on the salaries of other bureaucrats based on their hierarchical level, with higher layers naturally having higher caps. These caps do not vary across municipal categories. Hence, the salaries of all bureaucrats other than the mayor face two constraints: they cannot exceed that of their respective mayor and they cannot exceed the national cap for their hierarchical level. For instance, in 2024 the cap for the salaries of mayors in category six was set at 5.96 million COP. The national cap for professionals was set at a much higher level, 11.285 million COP, which cannot bind for those in our sample (only category six municipalities). In contrast, the caps on technicians and assistants were both

set at a comparable level of about 4.2 million COP.

Figure 6 plots the distribution of salaries for each level. Given the prominent role of the mayor's salary in the structure of remuneration, we draw a distinction in this plot between the salaries of mayors and those in other director positions. As expected, we find that average salaries are hierarchically organized across layers: mayors have the highest average salary, followed by advisors and other directors, and so on. There is, however, sizable variation within a same layer and considerable overlap across layers (i.e., assistants in some municipalities have salaries comparable to those of directors in others). As part of our ongoing research, we are cleaning the data on the specific occupation corresponding to each position, so that we can do a similar comparison at an even more granular level.

This variation in compensation within layers could be correlated with the size of the bureaucracy. For instance, smaller bureaucracies may pay lower salaries to their mayors, which in turn pushes the whole wage structure for all other levels downwards. We explore this possibility in Figure 7 by plotting the average salary for each hierarchical level across the different deciles of bureaucratic size.[12] The plot provides two noteworthy findings. First, average salaries are hierarchically organized for bureaucracies of all sizes. Second, and most importantly, the average salary within a given layer remains largely constant as bureaucracies expand. I.e., a bureaucrat at the professional level is paid the same on average in the smallest and largest bureaucracies. In the case of directors, this pattern indicates that their higher prevalence in smaller bureaucracies is not associated with lower remuneration and, plausibly, diminished responsibilities.

7 | PERFORMANCE OF THE BUREAUCRACY

We conclude our study by providing a tentative analysis of the link between the structure of the bureaucracy and its performance, focusing on local tax revenue per capita. This is a meaningful outcome for several reasons. First, the existing academic literature awards a prominent role to the ability to raise revenue as a measure of state capacity (Besley and Persson, 2011). Second, local governments in the developing world generally struggle to generate their own revenue and exhibit large vertical fiscal imbalances (Gadenne and Singhal, 2014). Third, higher local tax revenue has been found to contribute to improved public good provision and lower corruption in our setting (Martinez, 2023).

Column 1 in Table 5 shows a positive correlation between the number of bureaucrats in the municipal government and local tax revenue per 10,000 inhabitants. However, it is difficult to attribute causality, as it could be that municipalities that generate more revenue can afford to hire more bureaucrats. Column 2 then includes as additional regressors the respective shares of top managers (which includes directors and advisors for simplicity), professionals, and technicians. The omitted category corresponds to assistants. We find a positive and large correlation between tax revenue and the share of top managers. The results suggest that a 10 pp increase in this share is associated with a 166 million COP increase in local tax revenue per 10,000 inhabitants. This is equivalent to 9% of the sample mean. While it is also difficult to attribute causality to this result, the fact that we are controlling for the size of the bureaucracy suggests that we are not just picking up bureaucratic expansion as a result of higher revenue. Moreover, we know from above that larger bureaucracies tend to have lower shares of top managers. Interestingly, the estimates for the lower layers decrease monotonically, which further suggests that we are capturing a meaningful impact of the hierarchical structure. In the case of professionals, we estimate that a 10 pp increase

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[12]Appendix Figure A.4 provides very similar results for the subsample of municipalities with population below 20,000 and its corresponding deciles of bureaucratic size.

in their share of the bureaucracy is associated with an increase in tax revenue of 132 million COP per 10,000 inhabitants (7% of the sample mean), but this is only statistically significant at the 10% level. For technicians, we find a much smaller and statistically insignificant correlation.

Column 3 then includes municipal characteristics as additional regressors. We find that larger and more rural municipalities, as well as those farther away from Bogotá, collect less tax revenue on average, but the estimates for the structure of the bureaucracy if anything become stronger. While column 3 accounts for total population in a linear fashion, in column 4 we account more flexibly for population by including instead fixed effects for each decile. The results on bureaucratic structure remain largely unchanged. Alternatively, in column 5 we restrict the sample to municipalities with population below 20,000. The estimated impact of the higher layers of the bureaucracy becomes larger. For instance, a 10 pp increase in the share of top managers in this sample is associated with a 246 million COP increase in tax revenue per 10,000 inh. (12% of the sample mean). Further restricting the sample to municipalities with population below 10,000 in column 6 leads to even larger estimates, though the coefficient for the share of professionals loses precision and becomes statistically insignficant at conventional levels. This plausibly relates to the smaller share of professionals observed among these municipalities.

8 | CONCLUSIONS

In this paper, we study the organizational architecture of the central administration for a large sample of municipal governments in Colombia. Our analysis yields four main findings. First, municipal population is the strongest predictor of the size of the local bureaucracy, but there is substantial variation in bureaucratic size even among municipalities with similar population or expenditure on public personnel. Second, while almost all municipal governments have employees at all hierarchical levels, the share of top managers monotonically decreases and the shares corresponding to lower layers grow as bureaucracies expand. However, only the largest bureaucracies achieve a pyramidal structure. Third, average wages monotonically increase with the hierarchical level, but they remain largely constant within levels for bureaucracies of different sizes. Fourth, larger shares of higher-level bureaucrats are robustly associated with municipal tax revenue per capita, conditional on bureaucratic size.

Our analysis is heavily influenced by the notion of knowledge hierarchies. The central idea behind knowledge hierarchies is that an organization's structure should reflect its assigned tasks and the technologies available to solve them. Much of our preliminary analysis supports this perspective. For example, the prevalence of unspecialized, low-paid employees at the bottom of the hierarchy, and the decreasing numbers of higher-paid specialists at higher levels is a central feature of knowledge hierarchies. Along these lines, a further avenue to probe is whether variations in the difficulty of communication or managerial oversight also play a role in determining structure (e.g., Mastrorocco and Teso, 2024).

Other findings, such as the uniformity in hierarchical depth across municipalities of all sizes, are less consistent with standard knowledge hierarchy accounts. We suspect that political factors are the most promising explanation for these deviations. In the theoretical model developed by Snowberg and Ting (2024), politicians develop knowledge hierarchies in anticipation of future office-holders who may have different policy priorities and incentives to sabotage state functions. This implies that municipalities with high social heterogeneity and electoral turnover will be structured differently from those with high political consen-

sus. Politicians in conflictual environments may staff higher layers with more temporary employees, or they may assign greater responsibilities to lower layers. Both distortions reduce organizational capacity and efficiency relative to "ideal" knowledge hierarchies. The new municipalities in our data, which may plausibly operate in more consensual political settings, offer a promising path for the examination of structural choices.
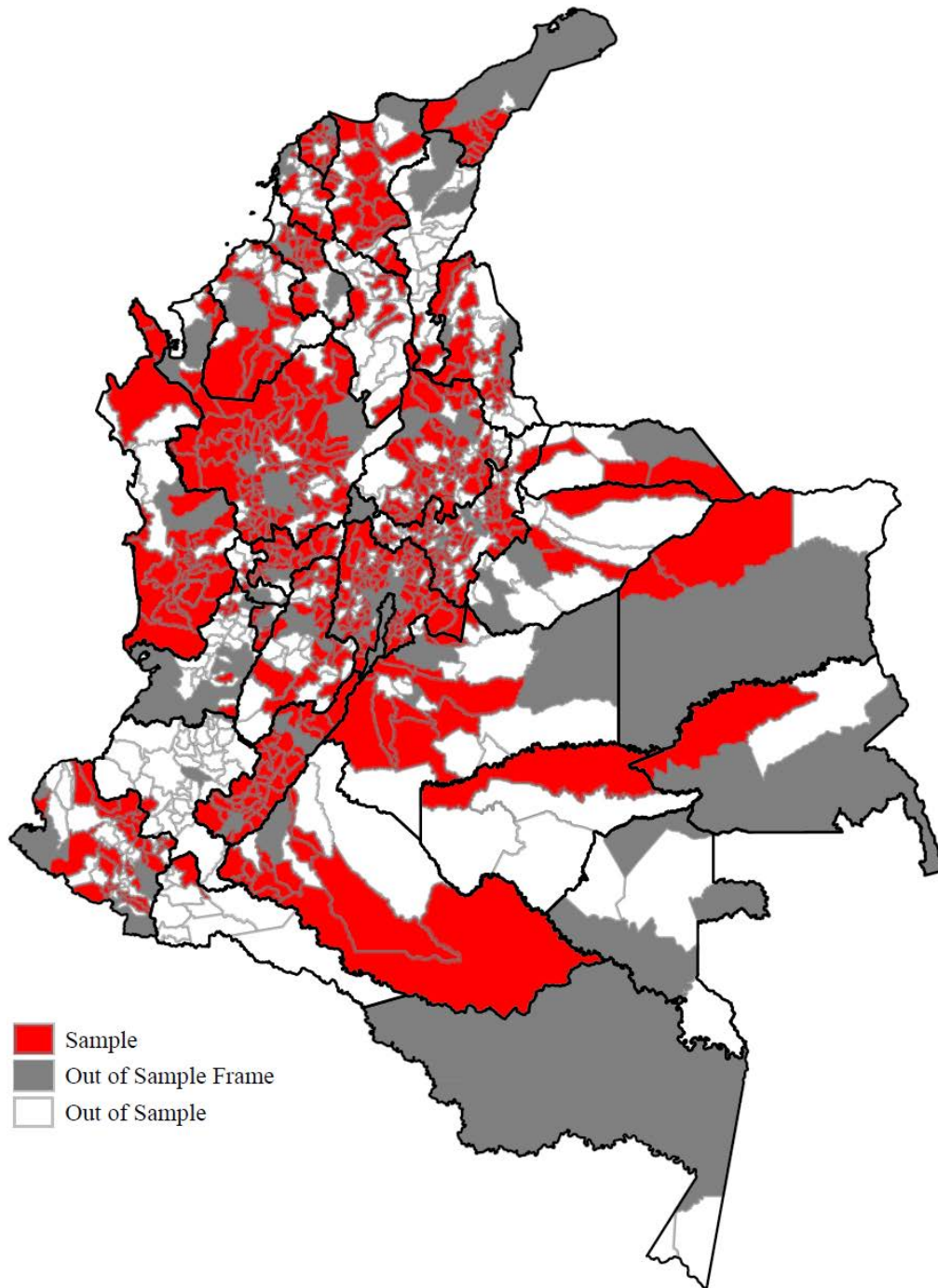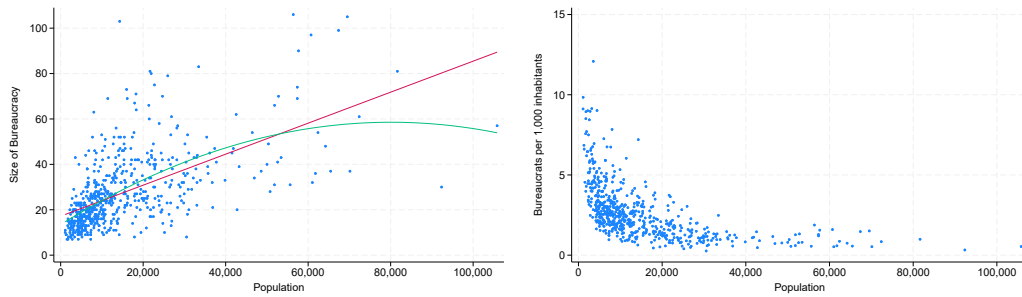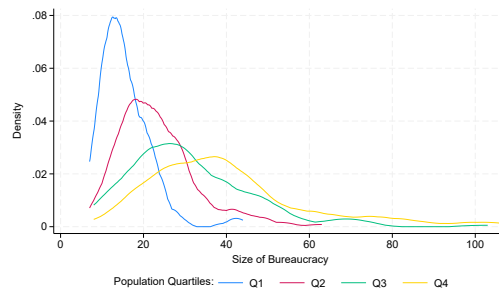
9 | FIGURES

FIGURE 1 Location of sample municipalities. *Notes:* The map above shows in red the municipalities included in our analysis sample, while data collection is still ongoing for those in white. Municipalities in gray fall outside our sampling frame, either because they are not in category 6 or they are non-municipalized districts. Gray lines correspond to municipal boundaries, while those in black denote the boundaries of the departments. *Source:* own data collection.

(a) Scatter: population and bureaucracy

(b) Bureaucrats per capita

(c) Distribution of bureaucratic size

FIGURE 2   Municipal population and the size of the local bureaucracy *Notes:* Panel (a) shows a scatter plot of municipal population against the number of officials in the local bureaucracy. The red and green lines correspond to linear and quadratic lines of best fit, respectively. Panel (b) shows a scatter plot of municipal population against the number of bureaucrats per 1,000 inhabitants. Panel (d) shows the distribution of bureaucratic sizes for each quartile of the distribution of municipal population. *Sources:* Own data and 2018 population census.
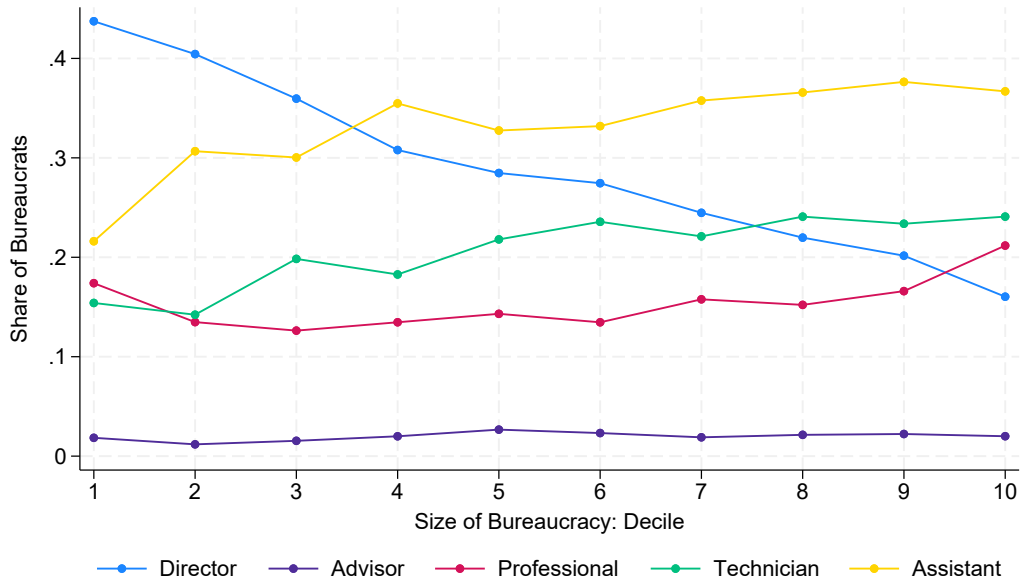
FIGURE 3   Size of bureaucracy and hierarchical structure. *Notes:* The figure shows the average share of bureaucrats belonging to each level of the hierarchy for each decile of the distribution of bureaucratic sizes. *Source:* own data collection.
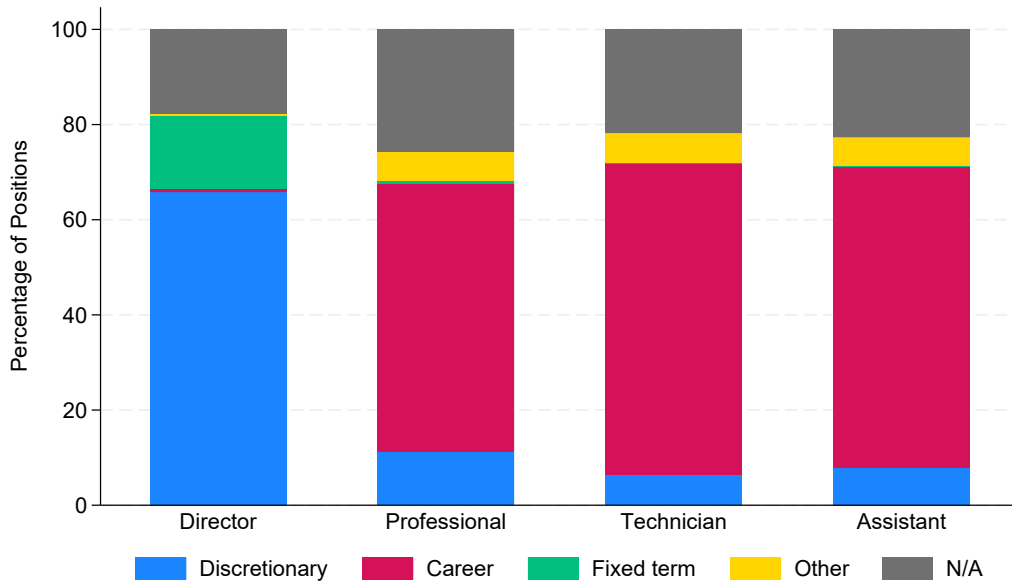

FIGURE 4   Hierarchical structure and type of appointment. *Notes:* The figure shows for each hierarchical level the share of bureaucrats with each type of appointment. Fixed term includes elected officials (mayors). Other includes temporary appointments, official workers, and other negligible categories. *Source:* own data collection.
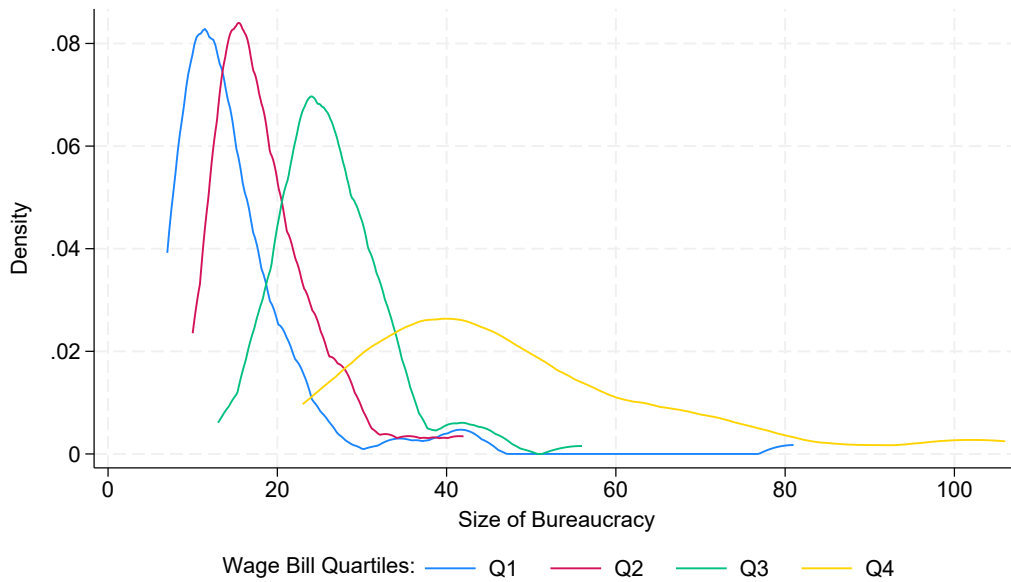
FIGURE 5   Distribution of bureaucratic sizes by total wage bill. *Notes:* The figure shows the distribution of bureaucratic sizes (number of bureaucrats) for each quartile of the distribution of the total bureaucratic wage bill. *Source:* own data collection.
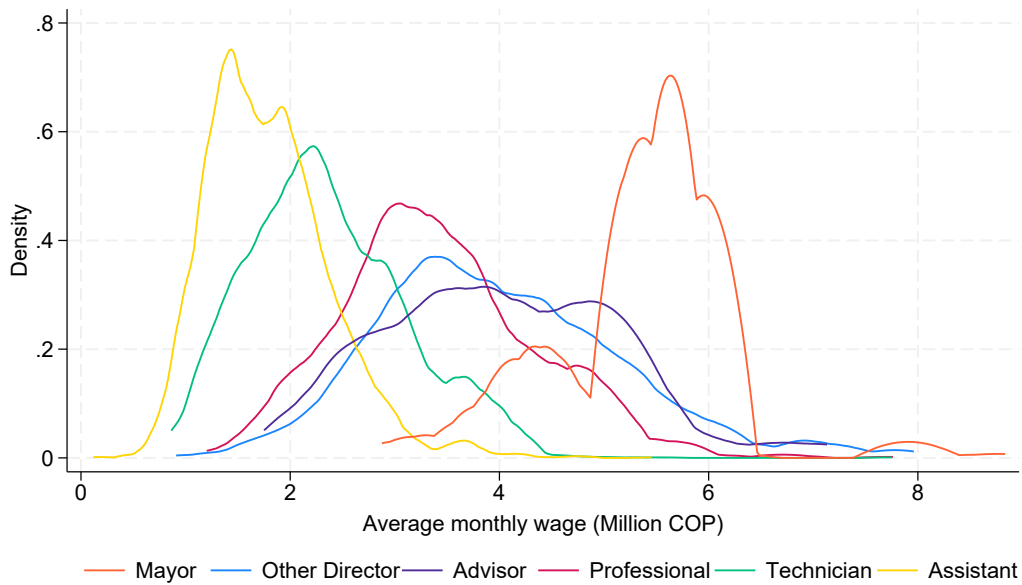
FIGURE 6   Distribution of wages by hierarchical level. *Notes:* The figure shows the distribution of wages for each level in the hierarchical structure. *Source:* own data collection.

FIGURE 7   Size of bureaucracy and average salary by hierarchical level. *Notes:* The figure shows the average salary for bureaucrats in each hierarchical level for each decile of the distribution of bureaucratic sizes. *Source:* own data collection.

10 | TABLES

TABLE 1   Summary statistics of municipal characteristics

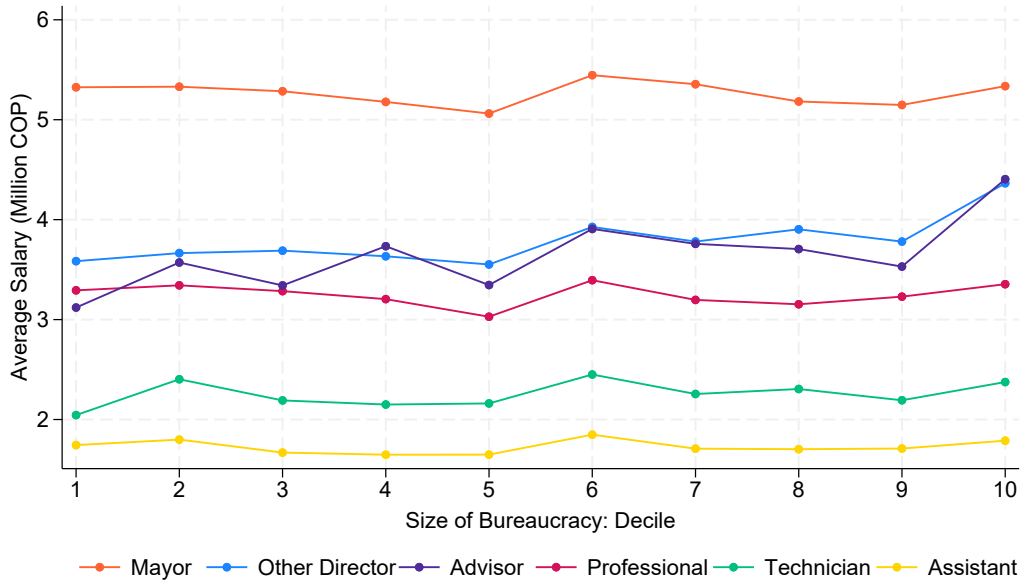|	Sample	Sampling frame	All
	(1)	(2)	(3)
Population	14,939	17,051	43,011
Share of rural population	0.59	0.59	0.56
Share with unmet basic needs	0.22	0.23	0.23
Distance to Bogotá	292.31	315.46	321.55
Distance to dpt. capital	79.75	82.27	81.46
New municipality (=1)	0.08	0.08	0.08
Department capital (=1)	0.01	0.01	0.03
Current revenue	3,854.41	3,952.93	3,998.53
Tax revenue	2,253.37	2,328.74	2,363.75
Operating expenses	1,955.10	1,986.28	2,007.55
Personnel expenses	1,124.05	1,152.86	1,164.37
Investment	15,944.10	17,374.01	17,667.98
N	599	1,000	1,122

Notes: Table shows averages for municipal characteristics. Column 1 displays information for the 599 municipalities with available information and used in our analysis. Column 2 corresponds to the 1,000 municipalities included in our sampling frame. Column 3 provides information for all the municipalities (and non-municipalized districts) in the country. New municipality is a dummy equal to one if the municipality was founded on or after 1990. Fiscal variables correspond to averages for the period 2014-2018. *Sources:* Census 2018 (population, ruraliry, UBN); panel CEDE (distances); DANE (new municipalities); DNP (fiscal outcomes).

TABLE 2 Municipal characteristics and the size of the bureaucracy

	Dependent variable: number of bureaucrats							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Population	6.741***	6.213***	6.484***	6.520***	6.565***	6.583***	13.02***	11.98***
	(0.644)	(0.639)	(0.624)	(0.638)	(0.638)	(0.638)	(1.353)	(2.064)
Share of rural population		-12.03***	-11.51***	-11.40***	-10.77***	-9.751***	-6.794**	-6.247**
		(2.849)	(2.786)	(2.795)	(2.806)	(2.883)	(2.864)	(2.866)
New municipality (=1)			6.039***	5.986***	6.149***	6.526***	4.649**	6.208***
			(1.921)	(1.928)	(1.880)	(1.889)	(2.026)	(2.222)
Distance to Bogotá				-0.446	-0.0886	0.287	-0.130	-0.0697
				(0.819)	(0.831)	(0.850)	(0.846)	(0.892)
Distance to dpt. capital					-2.513**	-2.045*	-1.639	1.267
					(1.171)	(1.170)	(1.174)	(1.108)
Share w/ unmet basic needs						-6.736		
						(4.218)		
Observations	595	595	595	595	595	595	451	286
R-squared	0.483	0.499	0.506	0.506	0.511	0.513	0.459	0.465
Mean DV	27.19	27.19	27.19	27.19	27.19	27.19	23.22	19.02
Department FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population	Any	Any	Any	Any	Any	Any	$< 20k$	$< 10k$

Notes: Table shows estimates from cross-sectional regressions of the size of the bureaucracy on municipal characteristics. Population is expressed in tens of thousands. Shares of rural population and unmet basic needs range from zero to one. New municipality is a dummy equal to one if the municipality was founded on or after 1990. Distances to Bogotá and the corresponding department's capital are expressed in hundreds of kilometres. All regressions includes department fixed effects. Column 7 restricts the sample to municipalities with population below 20,000, while column 8 further drops municipalities with population above 10,000. Robust standard errors reported in brackets. *** p<0.01, ** p<0.05, * p<0.1. *Sources:* own data, 2018 census (population, rural share, UBN share), DANE (new municipalities), panel CEDE (distances).

TABLE 3 Change in hierarchical structure across bureaucratic sizes

	Director	Advisor	Professional	Technician	Assistant
	(1)	(2)	(3)	(4)	(5)
D1 to D4	-0.130	0.002	-0.039	0.029	0.139
D4 to D7	-0.063	-0.001	0.023	0.038	0.003
D7 to D10	-0.084	0.001	0.054	0.020	0.010

Notes: The table shows the change in the average share of bureaucrats belonging to each hierarchical level for transitions between the first and fourth decile of bureaucratic size (row 1), the fourth and seventh decile (row 2), and the seventh and tenth decile (row 3). *Source:* own data.

TABLE 4 Municipal characteristics and the structure of the bureaucracy

	Director	Advisor	Professional	Technician	Assistant
	(1)	(2)	(3)	(4)	(5)
Number of bureaucrats	-0.046***	-0.002	0.007**	0.008**	0.032***
	(0.005)	(0.001)	(0.003)	(0.004)	(0.006)
Population	-0.002	0.005***	0.006	-0.003	-0.007
	(0.005)	(0.002)	(0.005)	(0.005)	(0.007)
Share of rural population	-0.013	0.013*	-0.013	0.015	-0.003
	(0.026)	(0.007)	(0.025)	(0.027)	(0.036)
New municipality (=1)	-0.015	0.015	0.008	0.036*	-0.044*
	(0.017)	(0.014)	(0.019)	(0.021)	(0.022)
Distance to Bogotá	-0.008	0.001	-0.001	0.018**	-0.009
	(0.008)	(0.002)	(0.007)	(0.008)	(0.010)
Distance to dpt. capital	0.004	-0.005	-0.004	0.007	-0.002
	(0.011)	(0.003)	(0.008)	(0.010)	(0.014)
Observations	579	579	579	579	579
R-squared	0.403	0.097	0.191	0.246	0.215
Mean DV	0.292	0.0195	0.153	0.206	0.330
Department FE	Yes	Yes	Yes	Yes	Yes

Notes: Table shows estimates from cross-sectional regressions of the dependent variable in the header on municipal characteristics. Number of bureaucrats is expressed in units of ten. Population is expressed in tens of thousands. Share of rural population ranges from zero to one. New municipality is a dummy equal to one if the municipality was founded on or after 1990. Distances to Bogotá and the corresponding department's capital are expressed in hundreds of kilometres. All regressions includes department fixed effects. Robust standard errors reported in brackets. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. *Sources:* own data, 2018 census (population, rural share), DANE (new municipalities), panel CEDE (distances).

TABLE 5 Bureaucratic structure and local tax revenue

	Dependent variable: tax revenue per 10,000 inh.					
	(1)	(2)	(3)	(4)	(5)	(6)
Number of bureaucrats	198.5***	267.3***	367.3***	345.1***	588.8***	934.3***
	(46.41)	(60.76)	(82.59)	(82.04)	(130.0)	(312.0)
Share of top managers		1,661**	1,766**	1,658**	2,455***	2,928**
		(702.7)	(695.7)	(705.6)	(859.3)	(1,233)
Share of professionals		1,319*	1,546**	1,530**	2,124**	2,592
		(779.1)	(754.6)	(774.3)	(1,024)	(1,598)
Share of technicians		236.5	343.6	405.5	337.7	654.0
		(499.6)	(461.9)	(475.6)	(558.3)	(843.3)
Population			-276.4***		-688.9***	-1,325***
			(61.34)		(185.4)	(468.5)
Share of rural population			-909.1***	-863.6***	-1,145***	-1,498***
			(287.7)	(288.8)	(358.2)	(518.5)
New municipality (=1)			152.4	160.6	113.8	-300.1
			(166.8)	(172.0)	(194.9)	(332.6)
Distance to Bogotá			-352.8***	-365.5***	-422.7***	-574.0***
			(96.32)	(99.90)	(121.0)	(189.2)
Distance to dpt. capital			-36.08	-46.69	22.77	69.55
			(123.3)	(126.7)	(152.0)	(247.8)
Observations	548	548	548	548	425	272
R-squared	0.257	0.271	0.336	0.350	0.331	0.279
Mean DV	1837	1837	1837	1837	1973	2078
Department FE	Yes	Yes	Yes	Yes	Yes	Yes
Population decile FE	No	No	No	Yes	No	No
Population	Any	Any	Any	Any	< 20k	< 10k

Notes: Table shows estimates from cross-sectional regressions of tax revenue per 10,000 inhabitants on bureaucratic and municipal characteristics. Number of bureaucrats is expressed in units of ten. Share of top managers includes directors and advisors. Population is expressed in tens of thousands. Share of rural population ranges from zero to one. New municipality is a dummy equal to one if the municipality was founded on or after 1990. Distances to Bogotá and the corresponding department's capital are expressed in hundreds of kilometres. All regressions includes department fixed effects. Column 4 also includes dummies for each decile of the distribution of population. Column 5 restricts the sample to municipalities with population below 20,000, while column 6 further drops municipalities with population above 10,000. Robust standard errors reported in brackets. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. *Sources:* own data, 2018 census (population, rural share), DANE (new municipalities), panel CEDE (distances).

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A | OTHER TABLES AND FIGURES

(a) Distribution: Own data vs SIGEP
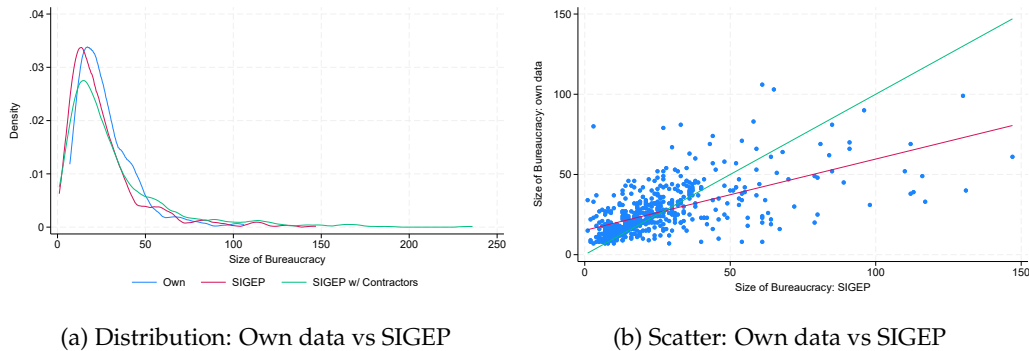
(b) Scatter: Own data vs SIGEP

FIGURE A.1 Comparison of data sources on size of bureaucracy *Notes:* Panel (a) shows the distribution of bureaucratic sizes (number of bureaucrats in central administration) for the municipalities in our sample. Blue line corresponds to own collected data. Red line corresponds to the number of bureaucrats in the online registry of public employees (SIGEP) manged by DAFP. Green line further includes the contractors working in the central administration according to SIGEP. *Source:* Own data corresponds to hand-collected information from municipal governments. SIGEP: https://www1.funcionpublica.gov.co/en/web/sigep2/directorio.
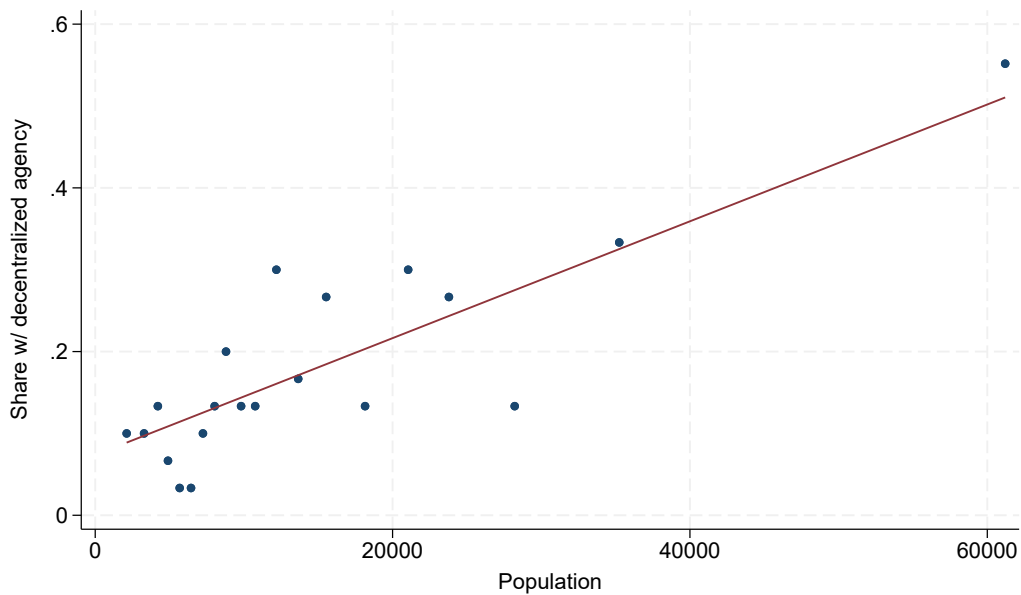

FIGURE A.2 Population and administrative complexity *Notes:* Figure shows a binned scatterplot of municipal population against a dummy equal to one if the municipal government has a decentralized administrative agency. *Source:* own data collection and listing of government agencies available at https://www.datos.gov.co/Funci-n-p-blica/Universo-de-entidades/h7zv-k39x/about_data.
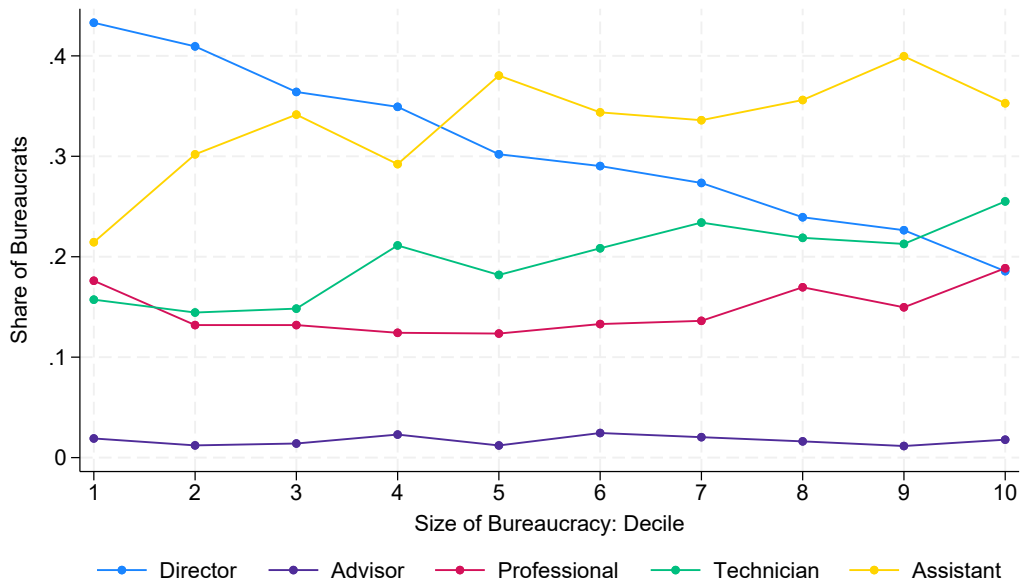
FIGURE A.3 Size of bureaucracy and hierarchical structure among municipalities with population below 20,000. *Notes:* The figure shows the average share of bureaucrats belonging to each level of the hierarchy for each decile of the distribution of bureaucratic sizes. These deciles are defined among municipalities with population below 20,000. *Source:* own data collection.
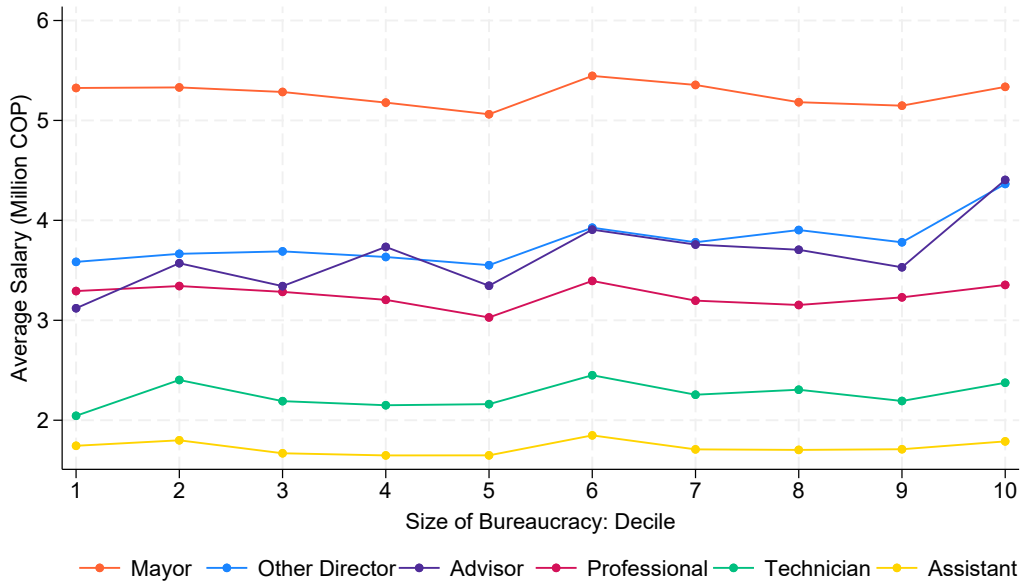

FIGURE A.4 Size of bureaucracy and average salary by hierarchical level among municipalities with population below 20,000. *Notes:* The figure shows the average salary for bureaucrats in each hierarchical level for each decile of the distribution of bureaucratic sizes. These deciles are defined among municipalities with population below 20,000. *Source:* own data collection.