The Composition of Local Public Goods: Voting, Sorting, and Welfare *

Damien Capelle Matthew Tauzer

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Abstract

How large are the welfare gains from decentralizing local public goods provision? Using detailed municipal budget data in France, we uncover significant heterogeneity in both the level and the composition of public goods across localities. We show that municipalities with different income levels and population sizes systematically allocate their budgets differently across categories of public goods. We develop a quantitative spatial equilibrium model in which heterogeneous households sort across municipalities and vote over property-tax rates and the composition of public spending. Non-homothetic preferences and differences in rivalry make the preferred public-good mix depend on local residents' income and population size. Relative to a centralized allocation with common tax rates and expenditure shares, decentralization raises ex post welfare by 3.79%, equivalent to €869 per household. Tailoring the composition of public goods generates the largest gains, primarily because municipalities differ in population size.

*D. Capelle, International Monetary Fund, dcapelle[at]imf.org; M. Tauzer, University of California, Berkeley, mtauzer[at]berkeley.edu. We are grateful to Oliver Giesecke for thoughtful conference discussions. We thank Matilde Bombardini, Cecile Gaubert, Enrico Moretti, Charly Porcher, Adrien Bilal, Andrés Rodríguez-Clare, and Emmanuel Saez and conference participants at the Urban Economic Association and the Econometric Society meetings for helpful discussions. The views expressed in the paper are those of the authors and do not necessarily represent the views of the IMF, its Executive Board, or its Management.

1 Introduction

Local amenities shape where people choose to live and are themselves shaped by local residents. Existing work has studied this feedback through reduced-form amenity spillovers and through the endogenous supply of private consumption services (Diamond, 2016; Hoelzlein, 2021; Diamond and Gaubert, 2022; Couture et al., 2024; Almagro and Domínguez-Iino, 2025). Yet many of the amenities that matter most for residential choice—schools, parks, cultural facilities, social services, public safety, and local infrastructure—are publicly provided. Their supply is determined not by market forces but through political processes.

There is a long-standing debate over whether the provision of local public goods should be done at the local level or should be centralized. One view holds that decentralization raises welfare by allowing provision to reflect local preferences and characteristics and by enabling households to sort across jurisdictions (Tiebout, 1956; Oates, 1972). Another emphasizes that decentralization can exacerbate spatial inequality and introduce distortions through property taxation (Calabrese, Epple and Romano, 2012). Despite reaching different conclusions, both strands typically represent local public services as an aggregate good or focus on a single one, most often education. They thus abstract from differences in the composition of public services across locations.

This paper argues that the composition of local public goods is central to the welfare effects of decentralization. Local governments can tailor not only total spending but also the mix of public goods to local preferences and population size. To quantify this margin, we develop a spatial equilibrium model in which households vote over several public goods. Non-homothetic preferences make the preferred spending mix depend on the characteristics of local residents, while differences in rivalry make it depend on municipal population. Our central finding is that the ability to tailor the composition of local public goods is the most important margin of the welfare gains from decentralization.

Our hypothesis is motivated by the substantial heterogeneity in local public goods composition that we uncover using micro-data on municipal spending in France. Differences in expenditure composition are quantitatively important: 79% of the variation in spending per household across public-good categories reflects differences in budget shares, while 21% reflects differences in total spending.

Spending patterns also vary systematically with both local income and population size. For example, spending on family services is 2.4 times as high per household in high-income municipalities as in low-income ones, while spending on social services is lower in richer municipalities. Population gradients are similarly pronounced: large municipalities spend 2.2 times more per household on social services and 2.7 times more on culture than small municipalities. These relationships remain qualitatively similar after controlling flexibly for local demographic and housing characteristics and when we instrument current income and population with historical municipality characteristics.

We interpret these facts through a quantitative spatial equilibrium model in which heterogeneous households choose where to live, consume housing, and vote locally over a property-tax rate and the allocation of municipal expenditure across several public goods. Preferences are non-homothetic both between public and private consumption and within the public-good basket. Moreover, public goods differ in their degree of rivalry. Non-homotheticity makes the preferred composition heterogeneous across households within the same location, while differences in rivalry make it depend on municipal population. These two features are key to rationalize our empirical facts.

Majority voting in each policy dimension yields a unique political equilibrium that, under the conditions used in our calibration, implements the preferred tax rate and spending composition of the household with median utility (Kramer, 1972; Shepsle, 1979; De Donder, Le Breton and Peluso, 2012a). The model thus delivers a tractable solution to the collective choice problem at the local level over multiple public goods and a tax rate in a framework with non-homothetic preferences. In the equilibrium of the model, the distribution of heterogeneous households and the provision of local public goods across municipalities are jointly determined. Each municipality is characterized by an endogenous public-good price index that depends on population size and composition of public goods. This new price index is a key determinant shaping welfare and household sorting.

We discipline the key parameters using the cross-sectional relationships between municipal expenditure shares, local tax burdens, median income, and population. These moments pin down the non-homotheticity for different public goods and differences in their rivalry. Exogenous amenities, fiscal transfers, technology parameters and land supply are recovered by inverting the model to exactly match the spatial distribution of high- and low-skilled population, transfers, median income and rents across the full set of 35,000 communes in France.

We provide external support for the calibrated model using municipal election outcomes. Municipalities with greater model-implied disagreement over the public-good mix have a wider range of political candidates and more competitive elections: the effective number of electoral lists rises from 1.96 to 2.74 and the first-round margin between the two leading lists falls from 46 to 26 percentage points. In addition, incumbent performance is weaker where observed spending is further from the mix preferred by the model's median voter: their vote share rises by 3.6 percentage points in the lowest-loss decile but falls by 1.2 percentage points in the highest. These relationships suggest that the preference heterogeneity recovered from municipal budgets is reflected in measurable political outcomes.

We quantify the welfare gains from decentralization by comparing the observed equilibrium with a centralized counterfactual in which all municipalities face a common property-tax rate and common expenditure shares. This common-policy benchmark is designed to isolate the value of allowing local public goods to be chosen at the local level. The welfare effects of decentralization are theoretically ambiguous. On the one hand they allow local communities to better align the level of property taxation and the bundle of public goods to local preferences and population size. On the other hand, decentralization policies distort private choices due to property taxation, local majority voting may not result in a local welfare-maximizing outcome, and inequality across households and municipalities may increase. These comparisons deliver five important findings.

First, full decentralization leads to substantial welfare gains. Quantitatively, it raises ex post welfare by 3.79% which is equivalent to an additional €869 per household, equivalent to 90.9% of median municipal revenue per household.

Second, the composition of public spending is the most important margin. Allowing municipalities to choose expenditure shares while imposing a common tax rate produces an ex post revenue-equivalent gain of 50.6%, compared with 26.9% when only tax rates are decentralized. While local tax choices also generate positive gains, tailoring the mix of public goods is about twice as important. The mix of public goods is therefore a crucial margin to take into account when evaluating the welfare effects of decentralization. Models that aggregate local services into a single public good omit a substantial share of the gains.

Third, heterogeneity in population size, rather than heterogeneity in household income, is the main source of these welfare gains. Under centralization, large municipalities allocate the same budget shares as municipalities near the median even though the cost of relatively non-rival services can be spread over many more households. Decentralization allows large municipalities to redirect spending toward more congestible services. Small municipalities adjust in the opposite direction, toward relatively non-rival services. The implied public-good price index falls at both ends of the size distribution, with the largest reductions in the upper tail.

Fourth, household mobility strongly amplifies these gains. When population is held fixed, the ex post revenue-equivalent gain from full decentralization is 23.1% of median municipal revenue per household. Allowing households to relocate raises it to 90.9%, almost four times as much. Mobility therefore reinforces the initial gains from tailoring local policies by reallocating households toward large cities offering more attractive combinations of public services, taxes, and rents under decentralization.

Fifth, the distributional effects of decentralization are primarily spatial, between small and large municipalities, rather than between household types. Ex post welfare rises by 3.48% for high-skilled households and 4.04% for low-skilled households. Decentralization slightly reduces sorting by skill and makes municipal public resources more equal, but it increases the dispersion of welfare across municipalities because the gains are largest in large cities.

The conclusions are robust to alternative parameterizations and modeling assumptions. Varying the migration elasticity and the strength of non-homotheticity and rivalry heterogeneity leaves the gains from decentralization economically substantial. The composition margin remains large in all specifications. Allowing central-government transfers to respond endogenously to local income and population size leads to similar conclusions. The results also remain large under national or local ownership of rental income.

Related literature. The paper contributes to the spatial literature on sorting and endogenous amenities. Quantitative spatial models emphasize that the attributes of locations respond endogenously to the agents who locate there (Benabou, 1993; Ahlfeldt et al., 2015; Diamond, 2016; Fajgelbaum et al., 2019; Diamond and Gaubert, 2022; Redding and Sturm, 2024). Recent work analyzes how heterogeneous demand and the market supply of local private services jointly shape neighborhood quality and sorting (Hoelzlein, 2021; Couture et al., 2024; Almagro and Domínguez-Iino, 2025). We introduce an analogous but distinct mechanism: local public services are endogenous amenities supplied through voting. Their composition responds to the local median voter's preferences and to how many households share them. Consequently, spatial sorting and the public-good bundle offered in each location are jointly determined in equilibrium.

Methodologically, the paper extends quantitative models of local amenities in two directions needed to study the endogenous composition of local public goods. First, we allow public goods to differ in their degrees of rivalry and congestibility, making the preferred expenditure mix depend on municipal size. We find that taking into account the heterogeneous degrees of rivalry is quantitatively important when assessing the gains from local choices. Second, we embed a tractable multidimensional voting problem over several public goods and a tax rate in a spatial framework with non-homothetic preferences. The collective decisions are made through majority voting in each dimension *independently*, which we call a Kramer-Shepsle equilibrium following Kramer (1972), Shepsle (1979) and De Donder, Le Breton and Peluso (2012a). This equilibrium concept is appealing because it addresses several issues in settings with multidimensional voting, such as multiplicity, unstable coalitions and dependence on the ordering of decisions. In our model, the resulting equilibrium is unique, independent of the ordering in which collective decisions are taken and implements the preferred policy of the median voter under some conditions.

Our analysis contributes to quantitative work on local public choices and fiscal decentralization. The classic Tiebout mechanism stresses that decentralized provision creates a menu of jurisdictions over which households can sort (Tiebout, 1956; Oates, 1972). We refer to Oates (1999), Scotchmer (2002) and Epple and Nechyba (2004) for comprehensive reviews. Models combining residential choice and voting have quantified this mechanism for local taxation and education or an aggregate public good (Epple and Sieg, 1999; Calabrese, Epple and Romano, 2012; Epple, Romano and Sarpça, 2018).

Closest to us, Calabrese, Epple and Romano (2012) develops and calibrates a quantitative model where households with different incomes and tastes sort into neighborhoods in a city and subsequently vote on a property tax rate to fund schooling. Our paper integrates similar mechanisms on property taxes, but accommodates several public goods, non-homothetic preferences and varying degrees of congestibility. Our results show that it is crucial to consider the mix of public goods to fully account for the welfare gains of decentralization.

Finally, the paper builds on work that recovers preferences for local public goods from spatial choices, capitalized land value and municipal budgets (Rosen, 1974; Borcherding and Deacon, 1972; Bergstrom and Goodman, 1973; Rubinfield, Shapiro and Roberts, 1987; Black, 1999; Bayer, Ferreira and McMillan, 2007). Our approach has a similar flavor to Bergstrom and Goodman (1973) in that we use detailed expenditure shares to discipline non-homotheticities and degrees of congestibility for multiple public services. Our key contribution is to provide external support for our recovered heterogeneity using electoral outcomes and to embed these estimates into a quantitative equilibrium spatial model to evaluate counterfactual systems of local provision.

The remainder of the paper is organized as follows. Section 2 describes the institutional setting, data, and empirical facts. Sections 3 and 4 present the model and characterize the political and spatial equilibrium. Section 5 describes the calibration and electoral validation. Section 6 quantifies the aggregate and distributional effects of decentralization, and Section 7 reports the sensitivity analysis. Section 8 concludes.

2 Facts about the Public Finances of Municipalities

This section presents key empirical patterns in French municipal public finance. Importantly, we document substantial heterogeneity in both the level and composition of public goods provision across municipalities. These motivate our hypothesis that the mix of public goods is important to consider when evaluating the welfare impact of decentralization. We then show that this heterogeneity is significantly related to the local median income and population size.

2.1 Institutional Setting

France's local government structure is an ideal environment for studying fiscal decentralization due to its extensive network of municipalities (*communes*) with considerable fiscal autonomy. France is divided into nearly 35,000 municipalities, which are the smallest administrative units in the country and vary significantly in size, from Paris with over 2 million inhabitants to rural communes with fewer than 100 residents.

Municipalities in France have substantial fiscal independence, including the authority to set local tax rates and influence the allocation of public budgets across, for instance, primary education, local public infrastructure, social services, cultural, community and recreational facilities—such as funding for libraries, sports complexes and organizations, and parks. By contrast, other public goods, such as secondary and higher education or defense, are in the control of higher levels of government.

Municipalities in France make use of several fiscal instruments to collect revenue. The property tax (*taxe foncière*) and housing tax (*taxe d'habitation*) are historically the primary sources of local revenue, although the latter was abolished in 2023 for primary residences. Both taxes rely on cadastral rental values originally assessed in the 1970s and subsequently subject to administrative revaluations. Municipalities also receive revenues from taxes on local businesses. In addition to local revenue sources, central-government support plays an important role in municipal finances, primarily through a system called the *dotation globale de fonctionnement* (DGF). This grant system includes various components, such as a population-based allocation and a progressive element designed to address fiscal disparities.

2.2 Data

To establish key facts about local public finances in municipalities and to later estimate our model, we draw on data from multiple sources.

Municipal finances. We use administrative data on municipal public finances in France, spanning 2012–2022. The data, obtained from the Ministry of Economy and Finance (DGFiP), are derived from mandatory financial reports that municipalities submit to higher governmental authorities. These reports offer granular information about municipal fiscal activities, including revenue streams and spending patterns.

For municipalities with populations exceeding 3,500 residents, expenditures are disaggregated by "function" (e.g., theaters, libraries, primary schools, police) using a multi-digit classification system. This detailed disaggregation enables us to identify heterogeneity in public service bundles across municipalities. We consolidate these functions into ten broader, one-digit categories: administrative services, safety, education, culture, recreation, family, social services, infrastructure, parks, and economic services. We restrict expenditure to class-6 operating expenses (*charges de fonctionnement*), thereby excluding capital projects from our measure of public services. Detailed descriptions of these categories are provided in Appendix A.

To smooth over annual volatility in spending, we aggregate municipal variables over the 2012–2022 sample period. We include only municipalities with spending data across all ten public goods. After this selection process, we end up with a sample that covers 60% of the population. Table B.11 shows that the selected sample is somewhat more affluent, has higher tax rates, and is larger than the average municipality in France.

Household variables. We obtain municipal household-income data for 2018 from the Filosofi database. These data provide information on moments of the income distribution for households within each municipality, which we use to characterize the median household and the average income. Additionally, we use data on household populations and their socio-professional categories from the 2018 population census.

Rents. We obtain gross rental prices per square meter (including utilities) at the municipality level from Breuillé, Grivault and Le Gallo (2020). Their methodology aggregates rental listings from three major online platforms in France (leboncoin, SeLoger, and pap.fr) covering the period 2015-2019. Rental prices are hedonically adjusted for quality attributes (i.e., surface area, average surface area per room) and deseasonalized to construct a standardized rental price index for each municipality.

2.3 Heterogeneity in Revenues, Tax Bases, and Tax Rates

Table 1 highlights the heterogeneity in municipal revenue per household across municipalities. The interquartile range in total revenue per household is around 772 euros. This heterogeneity is driven in part by different property tax rates as

56% of cross-municipal variation in property tax revenue (which accounts for around 42% of total revenue) is attributable to differences in tax rates rather than differences in the tax base.

Second, local property tax rates are different across the income distribution of municipalities. Top-decile municipalities by median household income have a property tax base nearly twice as large as those in the bottom decile (P90/P10 of 1.8) and set lower effective property tax rates (P90/P10 of 0.7). Hence, residents of lower-income municipalities bear disproportionately higher property tax rates. Notably, the progressive design of transfers (the "dotation globale de fonctionnement") and miscellaneous sources of other revenue fully compensates for these differences and brings total revenue nearly to parity across the income distribution (P90/P10 of 1.0).

Table 1: Municipal Revenue and Tax Base Characteristics, 2018

	Median	IQR	P90/P10 Ratio	
			Income	Households
Euros per household (€/hh)				
Total Revenue	2,029	772	1.0	1.9
– Property Tax Revenue	836	386	1.4	2.3
– Transfers & Other	1,183	583	0.9	1.7
Tax Base	4,413	1,791	1.8	1.5
Rates				
Effective Tax Rate	0.60%	0.30%	0.7	1.2
Variance Decomposition (Property Tax Revenue)				
– Rate Share of Variance			56%	
– Base Share of Variance			44%	

Notes: All monetary values are in 2018 euros per household. IQR gives the interquartile range. The P90/P10 ratios compare the mean of each variable among municipalities in the top decile to the mean among municipalities in the bottom decile, where deciles are defined separately by median household income and by number of households.

Table 2: Breakdown of Municipal Budgets

			P90/P10 Ratio		% Variance	
Category	Median (€/hh)	IQR	Income	Households	Rev./hh	Share
Administrative	767	372	1.0	1.0	60	40
Culture	146	151	1.0	2.7	24	76
Economic	10	25	1.1	0.2	8	92
Education	341	182	1.2	1.3	18	82
Family	62	143	2.4	2.3	8	92
Infrastructure	200	185	1.1	0.9	19	81
Parks	83	82	0.9	1.4	10	90
Recreation	189	168	1.1	2.0	28	72
Safety	71	78	1.0	1.3	13	87
Social	82	88	0.7	2.2	19	81
Mean					21	79

Notes: All monetary values are in 2018 euros. IQR denotes interquartile range. Values averaged over 2012–2022. The P90/P10 ratios compare the mean of each variable among municipalities in the top decile to the mean among municipalities in the bottom decile, where deciles are defined separately by median household income and by number of households.

2.4 Heterogeneity in Public Goods Provision

The most important fact, shown in Table 2, is the large heterogeneity in how municipalities spend on various public goods. The interquartile range varies from 25 euros per household for economic spending to 372 euros for administration. To identify the sources of this heterogeneity, we perform a variance decomposition of per-household expenditure for each public good category. Let e_{ip} denote the per-household expenditure on public good p in municipality i. We can express this as:

$$e_{ip} = s_{ip} r_i$$

where s_{ip} is the share of total revenue allocated to good p in municipality i, and r_i is the total per household revenue of municipality i. Taking the variance of the log of this expression and rearranging, we obtain:

$$1 = \frac{\text{Var}(\log s_{ip})}{\text{Var}(\log e_{ip})} + \frac{\text{Var}(\log r_i)}{\text{Var}(\log e_{ip})} + \frac{2\text{Cov}(\log s_{ip}, \log r_i)}{\text{Var}(\log e_{ip})}$$

This decomposition allows us to separate the contribution of variation in total revenue per household and variation in expenditure shares, where we split the covariance equally between the two.

The results of this decomposition, presented in the last two columns of Table 2, reveal that allocation choices (and not differences in total municipal revenue per household) are the dominant source of per-household spending variation across municipalities. Expenditure shares account for 79% of the variation on average, compared with only 21% from revenue differences. This holds across nearly all categories, with share variation explaining over 75% of the variance in education, infrastructure, culture, social services, and parks. This suggests that local choices with respect to the allocation of resources play an important role in shaping public goods provision under decentralization.

In addition, these choices are significantly related to local income and municipal size in ways that differ across public good varieties. For example, spending on family services is 2.4 times as high per household in high-income municipalities as in low-income ones, consistent with evidence from the French Treasury finding a deficit of public childcare supply in low-income municipalities (Direction générale du Trésor, 2023). Social services, on the other hand, show the reverse pattern (P90/P10 of 0.7). Population size (number of households) also generates significant differences in composition, with large municipalities spending, for example, 2.2 times more per household on social services and 2.7 times more on culture than small ones, while spending less on economic services (P90/P10 of 0.2).

Income and Population Effects on Budget Allocations To disentangle the associations of income and municipal size with public good expenditures, we estimate the following equation for each public good category:

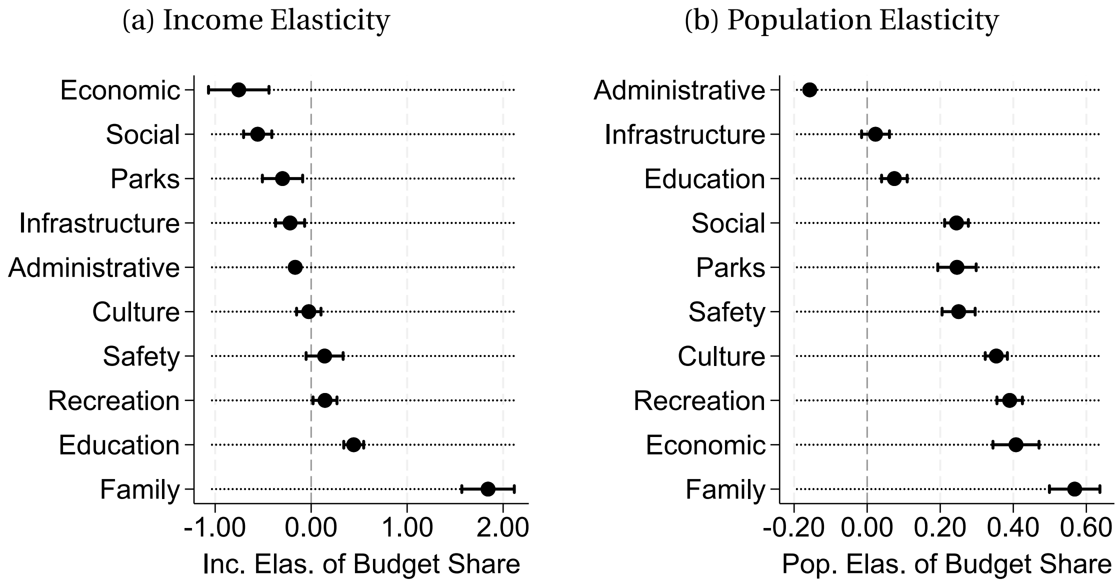
$$\log(s_{jp}) = \alpha + \beta_{1p} \log(y_j^{p50}) + \beta_{2p} \log(pop_j) + X_j'\gamma_p + \varepsilon_{jp},$$

where s_{jp} is the expenditure share of public good p in municipality j, y_j^{p50} is the median income, pop_j is population and X_j is a vector of controls. The coefficient

β_{1p} represents the income elasticity, and β_{2p} the population elasticity. Figure 1 presents these estimates without any controls. Most of the estimated elasticities are statistically significant at the 5% level. Family shows the highest positive income elasticity, around 2: a 1% increase in median income is associated with a 2% increase in spending share.

These gradients with local household income and city population size motivate our model's assumptions of non-homothetic preferences and heterogeneous rivalry across goods.

Figure 1: Elasticity of Public Goods Spending Share



Notes: The figures report the estimated elasticities of municipal expenditure shares with respect to median household income and population for each public-good category. The dependent variable is the log expenditure share, and the regressions include public-good-category fixed effects. Bars report 95% confidence intervals based on standard errors clustered by municipality.

Robustness Checks A potential concern is that omitted municipal characteristics, such as different age and family structures or differences in homeownership rates and second homes, are systematically correlated with median income and population and independently shape the composition of local spending. To address this concern, we augment the baseline specification with controls for age and family structure and household size on the one hand, and with controls for the share of homeowners and the prevalence of second homes on the other. We allow each characteristic in X_j to affect expenditure shares differently across services (γ_p is p-specific).

Appendix Figures C.6 and C.8 show that the main qualitative patterns remain. Family services continue to exhibit by far the largest positive income elasticity, while social services, infrastructure, parks, and administrative services generally display negative or comparatively smaller income elasticities. Population gradients are similarly stable.

Another concern is that income and population may themselves be endogenous to local public-good provision through residential sorting. We therefore instrument current municipal size using population in 1876 and current median income using the municipality's share of "cadres" in 1968, in the spirit of De La Roca and Puga (2017) and, more broadly, Goldsmith-Pinkham, Sorkin and Swift (2020). The historical variables strongly predict their current counterparts, and the IV estimates preserve the main qualitative patterns of the baseline results (see Appendix Figure C.10). The population elasticities are especially stable.

Overall, although they vary slightly across specifications, the estimated income and population elasticities are broadly stable and they remain significantly heterogeneous.

3 A Spatial Equilibrium Model of Sorting and Voting over Local Public Services

To rationalize the empirical patterns documented above and quantify their implications for the welfare effects of decentralization, we develop a spatial equilibrium model in which heterogeneous households choose where to live and vote over the local property tax rate and public-good bundle. Households have non-homothetic preferences over private consumption, housing, and several local public goods, which differ in their degree of rivalry. Municipalities exogenously differ in productivity, their housing supply shifter, and their exogenous amenities.

3.1 Environment and Technology

There is a mass L of households distributed across J locations. Let L_j denote the mass of households living in location j. There are I household types, indexed by i.

The aggregate mass of type i is L_i, and L_{ij} denotes the mass of type-i households in j. Thus, $L_j = \sum_i L_{ij}$ and $\sum_j L_{ij} = L_i$.

There is one final good, which is freely traded across locations and serves as the numeraire. Locations and household types differ in productivity. A type-i household living in j supplies one unit of labor and produces

$$y_{ij} = x_i z_j. \tag{1}$$

Final-good producers are competitive, so y_{ij} is also the household's labor income.

Locations also differ in the housing-supply shifter b_j. This shifter governs the local supply of housing and, together with housing demand, determines the equilibrium rent. We describe housing production in Section 3.4.

Finally, municipalities differ endogenously in their tax rates and provision of public services. Each municipality supplies P public goods. Let $\mathrm{g}_j = \{g_{pj}\}_{p=1}^{P}$ denote their quantities. Local public-good expenditure is financed by central-government transfers T_j and revenue from a local property-tax rate t_j. The final good is the only input into public goods, and one unit of the final good produces one unit of any public good.

3.2 Household Preferences

Households value a public-good composite g and a private-consumption composite u. We refer to these objects as public and private utility, respectively. The elasticity of substitution between them is γ. Public utility aggregates the P locally provided goods with elasticity of substitution γ_g. Private utility combines non-tradable housing services and the tradable final good with a unit elasticity of substitution:

$$v(g,u) = \left[\omega_g(v)^{\frac{1}{\gamma}} g^{1-\frac{1}{\gamma}} + (1-\omega_g(v))^{\frac{1}{\gamma}}\, u^{1-\frac{1}{\gamma}}\right]^{\frac{\gamma}{\gamma-1}}, \tag{2}$$

$$g(\tilde{g}_1,\ldots,\tilde{g}_P) = \left[\sum_{p=1}^{P} \omega_p(v)^{\frac{1}{\gamma_g}}\, \tilde{g}_p^{\,1-\frac{1}{\gamma_g}}\right]^{\frac{\gamma_g}{\gamma_g-1}}, \qquad \sum_{p=1}^{P}\omega_p(v) = 1, \tag{3}$$

$$u(h,c) = h^{\omega_h(v)} c^{1-\omega_h(v)}. \tag{4}$$

Motivated by the empirical relationship between median income, spending composition, and local tax burdens, we allow preferences to be non-homothetic at all tiers. The weight on public utility in (2), the weight on public good p in (3), and the weight on housing in (4) all vary with household utility v. Following Comin and Mestieri (2018), Borusyak and Jaravel (2018), Matsuyama (2019), and Hoelzlein (2021), we use

$$\omega_h(v) = \frac{\alpha_h v^{\nu_h}}{\alpha_h v^{\nu_h} + 1}, \tag{5}$$

$$\omega_g(v) = \frac{\alpha_g v^{\nu_g}}{\alpha_g v^{\nu_g} + 1}, \tag{6}$$

$$\omega_p(v) = \frac{\alpha_p v^{\nu_p}}{\sum_{p'=1}^{P} \alpha_{p'} v^{\nu_{p'}}}. \tag{7}$$

Because these weights depend on v, these equations define utility implicitly. Public good p is more basic than public good p' when $\nu_p < \nu_{p'}$. Similarly, housing is more basic than final-good consumption when $\nu_h < 0$, and public consumption is more basic than private consumption when $\nu_g < 0$.

Private goods are fully rival, whereas public goods differ in their degree of rivalry. A household living in municipality j obtains effective services

$$\tilde{g}_{pj} = g_{pj} L_j^{-\rho_p}, \tag{8}$$

where $\rho_p \in [0, 1]$. The case $\rho_p = 0$ corresponds to a perfectly non-rival good, while $\rho_p = 1$ corresponds to a fully rival good. Equivalently, ρ_p governs scale economies in provision and congestibility: maintaining a given level of effective services requires expenditure per household proportional to $L_j^{\rho_p - 1}$. Allowing for heterogeneity in the degrees of rivalry and congestibility across public goods is motivated by the facts that cities of different sizes spend different amounts on different public goods.

Household decisions. Households make three decisions. First, they choose where to locate, then they vote on the local bundle of public goods and tax rate and finally they decide how to allocate their net-of-tax income between housing services and final goods. Taking public-good provision $\{g_{pj}\}_{p=1}^{P}$, the local tax rate t_j, and rent r_j

as given, a type-i household in municipality j solves

$$u_{ij} = \max_{h,c} \; u(h, c) \tag{9}$$

$$\text{s.t.} \quad y_{ij}(1-\tau) = c + r_j(1+t_j)h, \tag{10}$$

where τ is the national income-tax rate. The local property tax is proportional to housing expenditure.

Let v_{ij} denote the household's indirect utility from private consumption and local public goods. Type-i households also have a type-specific exogenous amenity a_{ij} and an idiosyncratic preference shock ε_j for each location. Their location choice is

$$\max_{j\in\{1,\ldots,J\}} \{V_{ij} + \varepsilon_j\}, \qquad V_{ij} = \ln(a_{ij}v_{ij}), \tag{11}$$

$$\text{with} \quad \varepsilon_j \sim \text{i.i.d. Gumbel}(0, \mu), \tag{12}$$

where the location parameter is normalized to zero and μ is the scale parameter. Consequently, location attractiveness depends on income y_{ij}, the gross housing cost $r_j(1+t_j)$, the level and composition of public services $\{g_{pj}\}_{p=1}^{P}$, congestion L_j, and other local amenities a_{ij}.

3.3 Collective Choice over Public Goods and Tax Rates

After choosing their locations and before making private consumption decisions, residents vote over the allocation of municipal revenue across public goods and over the local tax rate. Consistent with this timing, voters take the municipality's current population and policies elsewhere as given. The model therefore abstracts from strategic tax setting across municipalities.[1]

Households disagree over both policy dimensions. They prefer different tax rates because their contributions to the local budget and their valuations of public

[1] The quasi-experimental evidence from the literature provides no uniform direction for strategic tax interactions. Several studies find little or no response by neighboring jurisdictions (Lyytikäinen, 2012; Isen, 2014), while others find strategic substitutes (Parchet, 2019; Büttner and Poehnlein, 2024) or strategic complements (Thunecke et al., 2026). We therefore see the absence of direct strategic policy reactions as a transparent benchmark. Municipal tax rates remain connected in general equilibrium through household mobility. In unreported simulations of the calibrated model, these indirect tax-rate responses range from weak complementarity to weak substitutability.

relative to private consumption differ. In particular, $\omega_g(v)$ varies with utility. They also prefer different expenditure shares because $\omega_p(v)$ varies across households.

Municipal expenditure is financed by property-tax revenue and transfers from the central government.[2] The municipal budget constraint is

$$t_j r_j H_j + T_j = \sum_{p=1}^{P} g_{pj}, \tag{13}$$

where H_j denotes aggregate housing consumption. Define the share of public revenues spent on public good p in j

$$s_{pj} = \frac{g_{pj}}{t_j r_j H_j + T_j}. \tag{14}$$

The budget constraint implies $\sum_p s_{pj} = 1$, so

$$s_{1j} = 1 - \sum_{p=2}^{P} s_{pj}. \tag{15}$$

Local residents therefore vote over the tax rate and $P-1$ independent expenditure shares, $(t_j, \{s_{pj}\}_{p=2}^{P})$.

Collective choices are determined by pairwise majority voting in each policy dimension, holding the other dimensions fixed. Our equilibrium concept builds on Kramer (1972) and Shepsle (1979). Following De Donder, Le Breton and Peluso (2012a), we refer to it as a Kramer–Shepsle equilibrium.

Definition 1 (Kramer–Shepsle equilibrium)**.** *A policy vector* $(t_j, \{s_{pj}\}_{p=2}^{P})$ *is a Kramer–Shepsle equilibrium if*

- t_j *is the pairwise-majority choice conditional on the expenditure shares* $\{s_{pj}\}_{p=2}^{P}$;
- *each* s_{pj} *is the pairwise-majority choice conditional on the tax rate and the other* $P-2$ *expenditure shares.*

This equilibrium concept has been used in the local political-economy literature, including De Donder and Hindriks (1998), Diba and Feldman (1984), Nechyba (1994), and Sadanand and Williamson (1991), and is related to sequential voting

[2]French municipalities may not borrow to finance current operating expenditures (see Article L. 1612-4 of the *Code général des collectivités territoriales*).

procedures used by Alesina, Baqir and Easterly (1999), Alesina, Baqir and Hoxby (2004), and De Donder, Le Breton and Peluso (2012b). Multidimensional majority voting can generally produce multiple equilibria, unstable coalitions, agenda dependence, or no Condorcet winner (De Donder, Le Breton and Peluso, 2012a). Under the conditions established below, however, the Kramer–Shepsle equilibrium exists, is unique, is independent of the order of voting, and implements the preferred policy of the household with median utility.

3.4 Housing Supply and Landlords

A continuum of landlords supplies housing services at rent r_j per unit. Let B_j denote housing supplied in municipality j. Producing B_j units requires $\frac{B_j^{\eta_j}}{\eta_j b_j^{\eta_j - 1}}$ units of the final good, where $\eta_j > 1$ governs the convexity of housing production and b_j is the local housing-supply shifter. Taking rents as given, landlords solve

$$\max_{B_j} \left\{ r_j B_j - \frac{B_j^{\eta_j}}{\eta_j b_j^{\eta_j - 1}} \right\}. \tag{16}$$

Landlords are absentee and consume only the final good. Section 7 examines alternative ownership structures.

3.5 Market Clearing and Equilibrium

An equilibrium is a collection of public-good vectors $\{\mathrm{g}_j\}_{j=1}^J$, tax rates $\{t_j\}_{j=1}^J$, rents $\{r_j\}_{j=1}^J$, housing supplies $\{B_j\}_{j=1}^J$, populations $\{L_{ij}\}_{i,j}$, and private choices $\{c_{ij}, h_{ij}\}_{i,j}$ such that:

- Given rents, tax rates, and public-good provision, households choose private consumption and housing to maximize (4) subject to (10).
- Each household type chooses locations according to (11), and the resulting populations satisfy $\sum_j L_{ij} = L_i$ for every type i.
- In every municipality, the tax rate and expenditure shares form a Kramer–Shepsle equilibrium and satisfy the municipal budget constraint (13).
- Given rents, landlords choose housing supply according to (16).

- Every local housing market clears:

$$B_j = H_j = \sum_{i=1}^{I} L_{ij} h_{ij} \qquad \text{for every } j. \tag{17}$$

- The central-government budget is balanced:

$$\sum_{j=1}^{J} T_j = \tau \sum_{j=1}^{J} \sum_{i=1}^{I} y_{ij} L_{ij}. \tag{18}$$

- The final-good market clears:

$$\sum_{j=1}^{J} \sum_{i=1}^{I} y_{ij} L_{ij} = \sum_{j=1}^{J} \left[\sum_{i=1}^{I} c_{ij} L_{ij} + \sum_{p=1}^{P} g_{pj} + \frac{B_j^{\eta_j}}{\eta_j b_j^{\eta_j - 1}} + c_j^A \right], \tag{19}$$

where landlord consumption is $c_j^A = r_j B_j - \frac{B_j^{\eta_j}}{\eta_j b_j^{\eta_j - 1}}$.

4 Properties of the Decentralized Equilibrium

In this section, we characterize the households' optimal private consumption given prices and the collective decision about the provision of local public goods. Finally, we derive the optimal migration decision of households.

4.1 Private Consumption of Housing and Final Goods

The unit elasticity of substitution between housing and the final good implies that households devote a share $\omega_h(v)$ of private expenditure to housing.

Lemma 1 (Private Goods)**.** *The optimal allocation of private expenditure satisfies*

$$(1 + t_j) r_j h_{ij} = \omega_h(v_{ij}) y_{ij} (1 - \tau), \tag{20}$$

$$u_{ij} = \frac{y_{ij}(1 - \tau)}{p_j(v_{ij})}, \qquad p_j(v) = [r_j(1 + t_j)]^{\omega_h(v)}. \tag{21}$$

where the second equation defines u, the private indirect utility, only implicitly as the solution to a non-linear equation. In the special case with homothetic housing

$\nu_h = 0$, we can solve for the indirect private utility explicitly:

$$(1+t_j)r_j h = \frac{\alpha_h}{\alpha_h+1} y(1-\tau) \quad \text{and} \quad u = \frac{y(1-\tau)}{(r(1+t))^{\frac{\alpha_h}{\alpha_h+1}}}.$$

4.2 Provision of Public Goods and Taxes

We now turn to the characterization of the political equilibrium bundle of public goods and the tax rate, the most novel aspect of our model. We proceed in two steps. We first derive expressions for the optimal allocation of public revenues across different public services and for the optimal tax rate for each type of household. We then show that under some conditions, the political-equilibrium bundle of public goods and tax rate is the median voter's ideal bundle.

What is the optimal allocation of public revenues across public goods from the perspective of households of type i in municipality j? Recall from the definition of the public utility (3) and the budget constraint (15) that their objective is

$$\max_{s_{pj}} \left(\sum_{p=1}^{P} \omega_p(v)^{\frac{1}{\gamma_g}} \left(L_j^{-\rho_p} s_p \right)^{1-\frac{1}{\gamma_g}} \right)^{\frac{\gamma_g}{\gamma_g - 1}} \quad \text{with} \quad s_{1j} = 1 - \sum_{p=2}^{P} s_{pj} \tag{22}$$

The following lemma characterizes the optimal expenditure shares on each public good $\{s_{pj}\}_p$ from the perspective of type-i households.

Lemma 2 (Expenditure Shares on Public Goods)**.** *Define the function*

$$\bar{g}(s_{2j}, ...s_{Pj}) = \left(\omega_1(v)^{\frac{1}{\gamma_g}} \left(L_j^{-\rho_1} \left(1 - \sum_{p=2}^{P} s_{pj} \right) \right)^{1-\frac{1}{\gamma_g}} + \sum_{p=2}^{P} \omega_p(v)^{\frac{1}{\gamma_g}} \left(L_j^{-\rho_p} s_{pj} \right)^{1-\frac{1}{\gamma_g}} \right)^{\frac{\gamma_g}{\gamma_g-1}}$$

1. *The function $\bar{g}(s_{2j}, ...s_{Pj})$ is strictly concave in each component s_{pj} for $p = 2, \ldots, P$.*

2. *The optimal allocation of public spending for a household of type i is given by*

$$s_{pj} = \left(\frac{\alpha_p}{\alpha_1} v_{ij}^{\nu_p - \nu_1} \right) L_j^{(\rho_p - \rho_1)(1-\gamma_g)} s_{j1} \quad \textit{with} \quad s_{1j} = 1 - \sum_{p=2}^{P} s_{pj} \tag{23}$$

The expression (23) gives important intuition about how households would like to allocate municipal revenues across different public goods. The first term, $\frac{\alpha_p}{\alpha_1}$ captures the preference for good p relative to public good 1 that is common across all households. The second term, $v_{ij}^{\nu_p-\nu_1}$, captures the non-homotheticity of preferences: if good p is less basic than good 1 $\nu_p > \nu_1$ and as a household's welfare improves, it is willing to shift more spending to good p. The third term, $L_j^{(\rho_p-\rho_1)(1-\gamma_g)}$, captures the congestion forces. When $\gamma_g < 1$, an increase in population makes it more expensive to provide a given level of enjoyment of the public good. Suppose that good p is more rival than good 1 such that $\rho_p > \rho_1$, then households would optimally spend relatively more on good p as population increases.

The first bullet point of the lemma is important for the proof of the median voter's theorem. The fact that the public utility (22) is strictly concave in each of its components means that households' preferences are single-peaked in each dimension of public goods.

Given an allocation of local revenues across public goods, we now turn to the optimal level of local tax rate from the perspective of households i. Using the notation introduced in lemma 2, the utility derived by household i from public spending in j can be written as $g_{ij} = \frac{t_j r_j H_j + T_j}{q_{ij}}$ where $q_{ij} = 1/\bar{g}_i(s_{2j}, ...s_{Pj})$ should be interpreted as the price index for public goods, which varies across households. This price index is a generalized mean of the prices of public goods. Importantly, it reflects the average degree of congestion, $L_j^{\rho_p}$, across public goods. The stronger the congestion for a specific public good, the higher its price and the lower the public utility g_{ij} for a given level of municipal revenues. In addition, the weights in the price index are a combination of the shares of municipal revenues spent on good p, s_{pj}, and of a household's specific tastes, $\omega_p(v_i)$. The closer the effective weights are to the households' tastes, the lower the price index. In proposition 2, we give an explicit expression of the price index when the local composition of public goods perfectly coincides with the preferences of the median voter.

From the definition of the upper-tier utility (2) and the indirect private utility (21), the problem for a voter is thus to choose t_j to maximize

$$\bar{v}_i(t_j) = \left(\omega_{gj}(v)^{\frac{1}{\gamma}} \left(\frac{t_j r_j H_j + T_j}{q_{ij}} \right)^{1-\frac{1}{\gamma}} + (1-\omega_{gj}(v))^{\frac{1}{\gamma}} \left(\frac{y(1-\tau)}{(r(1+t))^{\omega_h(v)}} \right)^{1-\frac{1}{\gamma}} \right)^{\frac{\gamma}{\gamma-1}} \tag{24}$$

The following lemma characterizes the optimal tax rate from the perspective of type-i households.

Lemma 3 (Tax Rate)**.**

1. *The function $\bar{v}_i(t_j)$ is strictly concave.*

2. *The optimal tax rate for a household of type i satisfies*

$$\left(t_j + \frac{T_j}{r_j H_j}\right) = \frac{\alpha_g v_{ij}^{\nu_g}}{\omega_h(v_{ij})} \left(\frac{q_{ij}(v_{ij})}{p_j(v_{ij})} \frac{\omega_h(v_{ij}) y_{ij}(1-\tau)}{r_j H_j}\right)^{1-\gamma} \tag{25}$$

where $r_j H_j = \sum_i L_{ij} \omega_h(v_{ij}) y_{ij} \frac{(1-\tau)}{1+t_j}$ denotes total spending on housing in location j.

The proof is in Appendix D.1. The formula for the optimal tax rate (25) is intuitive. The optimal tax rate increases with the voter's general preference for public goods $\frac{\omega_g}{1-\omega_g} = \alpha_g v^{\nu_g}$, but decreases with its preference for housing $\omega_h(v) = \frac{\alpha_h v^{\nu_h}}{\alpha_h v^{\nu_h}+1}$. The terms α_g and α_h capture the preference for public goods relative to housing that is common across households. The terms v^{ν_g} and v^{ν_h} capture the non-homotheticity of preferences. Whether the tax rate increases or decreases with v will depend on which one is more basic than the other.

In the same way that we underlined that preferences were single-peaked in the expenditure shares on each good in lemma 2, lemma 3 establishes that the upper-tier utility function is strictly concave in the tax rate t_j and that preferences are also single-peaked in the tax rate dimension. This leads us directly to the most important result of this section: the median voter's theorem.

Proposition 1 (Median Voter)**.**

1. *The equilibrium expenditure shares $\{s_{pj}\}_p$ are the ideal bundle of public goods for the household with the median utility v_{Mj} in j.*

2. *The equilibrium tax rate t_j is the ideal tax rate of the median voter.*

   - *The median voter is also the household with median utility v_{Mj} in j if $\gamma = 1$ and $\nu_h = 0$.*

Proof. Lemma 2 and 3 establish that the preferences of each household are single-peaked in each separate dimension of the vote, the $P-1$ expenditure shares and the tax rate t_j, respectively. From the traditional median voter theorem, we know that the median voter's ideal expenditure shares on public goods and tax rate form the unique equilibrium of the pairwise majority vote in each dimension. In addition, it follows from lemma (2) that the median voter is also the voter with the median v.

A sufficient condition to ensure that the median voter in the tax dimension is also the household with median utility v is that the optimal tax rate, solution to equation (25), is monotonic in v. This is true if $\gamma = 1$ and $\nu_h = 0$ since the ratio $\frac{\omega_g}{\omega_h(1-\omega_g)} = \frac{\alpha_g}{\alpha_h^\gamma} v^{\nu_g - \gamma\nu_h}(1+\alpha_h v^{\nu_h})^\gamma$ simplifies to $\frac{\alpha_g}{\alpha_h} v^{\nu_g}(1+\alpha_h)$ which is monotonic in v. $\square$

This sufficient condition guarantees that both the tax rate and the allocation of spending reflect the preferences of a single type of households, the household with median utility. Without this condition, the tax rate could reflect the preference of one type of household and the composition of public goods could reflect the preference of another type. However, while this condition is sufficient, it is far from necessary. Intuitively, what needs to be true is simply that the right-hand side of equation (25) be monotonic in v which is likely to be true if non-homotheticities in the preference for housing ω_h are not too strong and the elasticity of substitution γ is close to 1, thereby ensuring that the households' heterogeneous price indices for the public goods q_{ij} and private goods p_{ij} do not play an important role in determining their favorite tax rate.

Given that the bundle of public goods is the ideal bundle of the household with median v we solve more explicitly for its indirect public utility and the associated price index for public goods in the following proposition.

Proposition 2 (Public Utility for the Median Voter)**.** *The public utility of the median voter is*

$$g_{ij} = \frac{t_j r_j H_j + T_j}{q_{ij}} \quad \textit{with} \quad q_{ij} = \left(\sum_{p=1}^{P} \omega_p(v_{Mj}) \left(L_j^{-\rho_p} \right)^{\gamma_g - 1} \right)^{\frac{1}{1-\gamma_g}} \tag{26}$$

This price index is the optimal price index for this household type in the sense that it maximizes the utility of this household for a given level of municipal revenues. This formula will be useful when estimating the model, in section 5.

4.3 Migration and Housing Supply

We conclude this section with two important equilibrium conditions governing the migration of households and the supply of housing. From the assumption that preference shocks are EV1 distributed, the probability that a household of type i locates in j is given by

$$\pi_{ij} = \frac{\exp\left(V_{ij}/\mu\right)}{\sum_{l=1}^{J} \exp\left(V_{il}/\mu\right)} \tag{27}$$

Finally, after taking the first-order condition of landlords with respect to the supply of housing B_j, we obtain the following upward-sloping supply curve:

$$B_j = b_j r_j^{\frac{1}{\eta_j - 1}} \tag{28}$$

where $\frac{1}{\eta_j - 1}$ should be interpreted as the local housing-supply elasticity.

4.4 Efficiency Considerations

There are several sources of inefficiency in the decentralized economy. They create a meaningful trade-off for decentralization policies. First, the property tax rate distorts the optimal allocation of private spending between the final good and housing, leading to under-consumption of the latter. Second, there is a free-riding problem associated with the setting of the tax rate since the median voter understands that a marginal increase in the tax rate will apply to everyone's property values, not only theirs. This problem is particularly acute in neighborhoods where the median voter is low-skilled, since it is tempting for them to free ride on the larger property values of high-skilled, thus richer, households (Calabrese, Epple and Romano, 2012). Finally, the property tax and the composition of the public goods bundle are chosen through voting which may not result in a local welfare-maximizing outcome. Instead, it maximizes the median voter's welfare.

5 Calibration

We combine externally calibrated elasticities with parameters estimated to match municipal fiscal choices, incomes, rents, and population. We first use a local approximation to highlight the parameters that govern the welfare effects of decentralization, then describe the external and internal calibration.

5.1 First-Order Welfare Effects and Key Parameters

Let $\mathbf{x}$ collect the tax rates and the $P-1$ independent expenditure shares in every municipality. Consider an arbitrary change in the local tax rates and spending shares, $d\mathbf{x}$ around a common-policy centralized allocation in which the tax rate $\bar{t}$ and spending shares $\bar{s}_p$ are the solution to the median individual maximization problem. Denote $\overline{T/rH}$ the transfers to housing spending ratio in the median individual's location. At first order, the change in social welfare is given by

$$dW = \sum_j \sum_i \pi_{ij} \left(1 + \frac{V_{ij}}{\mu}\right) \nabla_{\mathbf{x}_j} V_{ij} \; \cdot \; d\mathbf{x} \tag{29}$$

where the change in a type-i household utility located in j is given by

$$\nabla_{\mathbf{x}} V_{ij} d\mathbf{x} = \Gamma_{ij} \left[\omega_g(v_{ij}) A_{ij} \left[\frac{1}{\gamma_g} \ln \frac{v_{ij}}{\bar{v}} \sum_{p=2}^{P} \left(\nu_p - E_{\omega_p(\bar{v})}\left[\nu_p\right]\right) ds_{pj} + \frac{L_j - \bar{L}}{\bar{L}} \sum_{p=2}^{P} \rho_p \left(\frac{1}{\gamma_g} - 1\right) ds_{pj} \right] \right. \tag{30}$$

$$\left. + (1 - \omega_g(\bar{v_{ij}}))\omega_h \left(\nu_g \ln \frac{v_{ij}}{\bar{v}} - \frac{\left(\frac{T_j}{r_j H_j} - \overline{\left(\frac{T}{rH}\right)}\right)}{\bar{t} + \overline{\left(\frac{T}{rH}\right)}} \right) dt_j + GE_{ij} \right] \tag{31}$$

where $\Gamma_{ij}, A_{ij}, GE_{ij}$ are defined in Appendix D.3.

The decomposition highlights four groups of parameters. First, the migration elasticity $1/\mu$ determines how strongly households relocate toward places where policy changes raise ex post utility. Second, the non-homotheticity parameters $\{\nu_p\}_p$ govern the gains from adapting the public-good mix to local preferences. These gains are larger where residents' utility differs more from that of the household represented by the common-policy centralized policy $\ln v_{ij}/\bar{v}$. Third, the rivalry parameters $\{\rho_p\}_p$ govern the gains from adapting the mix to municipal population. Its strength depends on the distance of a municipality's population size from the median $L_j - \bar{L}$. Fourth, ν_g governs heterogeneity in desired tax rates through the valuation of public relative to private consumption. The effects are stronger when public goods receive a larger utility weight and are less substitutable. The general equilibrium effects gathered in the GE_{ij} term and reported in Appendix D.3 include the change in the income tax rate τ required to balance the general government's budget and the effects of the local tax rates t_j through rents r_j.

5.2 Externally Calibrated Parameters

Table 3 lists the externally calibrated parameters. We set the migration elasticity to 3, within the range used in static models of residential choice (Diamond, 2016; Monte, Redding and Rossi-Hansberg, 2018). We set the elasticity of substitution across public goods to $\gamma_g = 0.9$, following estimates of substitution across broad expenditure categories (Herrendorf, Rogerson and Valentinyi, 2014; Atalay, 2017; Farhi and Baqaee, 2019). We abstract from non-homotheticity in housing, $\nu_h = 0$. We also set the elasticity of substitution between public and private goods to one, $\gamma = 1$. Finally, we set the housing-supply elasticity to 0.5, corresponding to $\eta = 3$, in line with the mean estimate across French metropolitan areas in Chapelle, Eyméoud and Wolf (2023).

Table 3: Externally Calibrated Parameters

Parameter	Description	Value	Source
γ_g	Elasticity of substitution across public goods	0.90	Herrendorf, Rogerson and Valentinyi (2014)
$1/\mu$	Migration elasticity	3	Diamond (2016); Monte, Redding and Rossi-Hansberg (2018)
$1/(\eta - 1)$	Housing-supply elasticity	0.50	Chapelle, Eyméoud and Wolf (2023)

5.3 Internally Calibrated Parameters

The internal calibration has three blocks. First, municipal expenditure shares and tax burdens discipline preferences over the composition and level of public goods. Second, mean and median income discipline productivity by household type and municipality. Third, rents and population by type discipline local housing-supply shifters and amenities. Table 4 lists the parameters and empirical targets.

Table 4: Internally Calibrated Parameters and Empirical Targets

Parameter	Description	Empirical target	Source
α_h	Preference for housing	Housing expenditure share	Family Budget Survey
$\{\alpha_p\}_{p=1}^{P}$	Baseline preferences across public goods	Intercepts in expenditure shares regression	DGFiP municipal accounts
$\{\nu_p\}_{p=1}^{P}$	Non-homotheticity within the public-good basket	Elasticity of expenditure shares to median utility	DGFiP; Filosofi
$\{\rho_p\}_{p=1}^{P}$	Rivalry of public goods	Elasticity of expenditure shares to population	DGFiP; Population Census
α_g, ν_g	Preference for public relative to private consumption and its non-homotheticity	Municipal tax burdens and transfers relative to the model-consistent housing tax base	DGFiP; Filosofi
$x_H, \{z_j\}_j$	Income components by household type and municipality	Mean and median household income and the local share of high-skilled households	Filosofi; Population Census
$\{b_j\}_j$	Municipality-specific housing-supply shifters	Municipal rents	Breuillé, Grivault and Le Gallo (2020); Filosofi; Population Census
$\{a_{ij}\}_{i,j}$	Amenities by household type and municipality	Municipal population by household type	Population Census
τ	National income tax rate	Aggregate central-government transfers to municipalities	DGFiP municipal accounts

Notes: The table reports the parameters calibrated internally and the empirical objects used to identify them. Several parameters are jointly identified; the table indicates the empirical objects that are most informative about each parameter or group of parameters.

5.3.1 Preferences for Public Goods

To calibrate the parameters of the public utility, α_p, ν_p and ρ_p we start from the optimality condition (22) and take logs, which gives:

$$\ln\left(\frac{s_{pj}}{s_{1j}}\right) = \ln\frac{\alpha_p}{\alpha_1} + (\nu_p - \nu_1)\ln v_{jM} + (1-\gamma_g)(\rho_p - \rho_1)\ln L_j. \tag{32}$$

where v_{Mj} denotes the indirect utility of the median-income household in location j. To estimate the parameters of the upper-tier utility, α_g and ν_g, we rearrange the first-order condition with respect to taxes (25), using the calibrated value $\gamma = 1$ and $\nu_h = 0$, which gives

$$\ln\left(t_j + \frac{T_j}{r_j H_j}\right) = \ln\left[\frac{\alpha_g(1+\alpha_h)}{\alpha_h}\right] + \nu_g \ln v_{Mj}. \tag{33}$$

The preference parameters are jointly estimated by generalized method of moments. We take the median-income household to be the median voter in each municipality and verify after estimation that indirect utility is monotone in income within every municipality. Because v_{Mj} depends on the parameters being estimated, we construct it from observed income, rents, taxes, transfers, population, and the model-implied public-good price index. Starting from a parameter guess, we compute q_{Mj} and v_{Mj}, estimate equations (32) and (33), and iterate until the parameters converge (see Appendix E.3 for more details).

The statutory French tax system includes several local tax instruments and assessed property values differ from current market values. We therefore construct the effective model-consistent rate and tax base that reproduces observed local tax revenue. Since model housing expenditure is $\omega_h \text{Income}_j/(1+t_j)$, the model-consistent rate is $t_j = \text{Tax Revenue}_j/[\omega_h \text{Income}_j - \text{Tax Revenue}_j]$, with $r_j H_j = \omega_h \text{Income}_j/(1+t_j)$ (see Appendix E.3 for more details).

We estimate the preference system on municipalities with more than 3,500 inhabitants and complete expenditure data. Confidence intervals are based on 200 cluster-bootstrap replications to account for the sampling uncertainty propagated through the construction of v. To identify all coefficients, we normalize $\alpha_1 = 1,$, $\nu_1 = 0$ and we set $\rho_1 = .02$ equal to the elasticity of the share of spending on Administrative—our reference category corresponding to $p = 1$—with respect to population. Figure E.12a reports the estimates of $\{\nu_p\}_p$ and Figure E.12b the estimates of $\{\rho_p\}_p$.

Our estimates for $\{\nu_p\}_p$, which govern the degrees of non-homotheticity over components of the public goods basket, largely corroborate our stylized findings presented in Section 2. Relative to administrative services, a 1% increase in median household welfare is associated with a roughly 3.7% increase in relative spending on family services. On the other hand, the same increase is associated with a

0.6% decline in relative spending on social services. Our estimates for the population elasticities $\{\rho_p\}_p$, which are also relative to the elasticity for administrative services and are scaled by one minus the elasticity of substitution across sectors $(1-\gamma_g) = .1$, are presented in Figure E.12b. Family services again exhibit the highest elasticity, where a 1% increase in population is associated with just over a 0.8% increase in relative spending. This is followed by social services, economic services, and cultural services. At the upper tier, $\widehat{\nu}_g = -1.995$, implying that public consumption is more basic than private consumption (Table E.12).

5.3.2 Income by Household Type and Municipality

We observe mean and median income as well as the share of high-skilled households by municipality, but not income separately for each household type. Recall our assumption that $y_{ij} = x_i z_j$, where x_i is a type component and z_j a municipality component. We assume there are two types $i = L, H$ for low- and high-skilled, normalize $x_L = 1$ and choose x_H to match the population-weighted average differences between mean and median income across municipalities. We then recover the municipality component by matching the local median income $z_j = y_j^M / x_j^M$, where x_j^M is the type component of the median household.

In the data, we categorize individuals into high and low types based on their socio-professional categories. The high type includes individuals in managerial, professional, and higher-skilled occupations, who generally have higher income and education levels. Conversely, the low type comprises individuals in lower-skilled, manual, or service-related occupations with relatively lower income and education levels. Appendix E.2 provides more details.

5.3.3 Housing Supply, Amenities, and the National Income Tax

The remaining parameters are recovered by inversion. Given the calibrated housing-supply elasticity, observed rents and housing demand identify b_j through market clearing $b_j = \frac{\sum_{i=1}^{I} L_{ijt}\omega_h(v_{ij})y_{ij}(1-\tau)}{(1+t)r_j^{1+\frac{1}{\eta_j-1}}}$. Intuitively, a municipality with lower rent r_j should have a larger supply of land b_j everything else equal. To measure rent in each city, r_j, we use gross rents per square meter (including utilities) at the municipality level developed by Breuillé, Grivault and Le Gallo (2020). These rental prices are derived from listings on three major online platforms in France, covering the period 2015-2019. Rents are standardized using a hedonic model estimated for spatially clustered zones across France, considering various measures of housing quality (e.g., surface area, number of rooms, type of housing).

Type-specific amenities a_{ij} are chosen so that the model matches the observed population of each household type in every municipality. Finally, τ balances the central-government budget given observed municipal transfers, according to equation 18. Appendix Figure F.13 reports the distributions of the municipality-level parameters implied by the model inversion.

5.4 Validation with Municipal Election Data

We now assess whether the calibrated model generates meaningful predictions for municipal elections.

Data. We use official municipality-level results from the 2020 and 2026 French municipal elections, published by the French Ministry of the Interior.[3] The data report, for each commune and electoral list, vote totals and shares, turnout, candidates, and election-round outcomes, which we harmonize across the two elections to measure electoral competition and changes in incumbent support.

Preference disagreement and electoral competition. We consider two predictions. First, we test whether greater disagreement among residents over the composition of public spending is associated with varying degrees of electoral competition. For each household type, the model implies a preferred spending allocation $\mathbf{s}^*_{ij}$. We measure disagreement within municipality j by the population-weighted utility loss from replacing each type's preferred allocation with the median voter's preferred allocation $\mathbf{s}^M_j$:

$$C_j = \sum_i \frac{L_{ij}}{L_j} \left[\log g_{ij}\left(\mathbf{s}^*_{ij}\right) - \log g_{ij}\left(\mathbf{s}^M_j\right)\right]. \tag{34}$$

This measure is larger when disagreement over the spending mix is greater among local voters.

Figure 3 shows that municipalities with greater model-implied preference disagreement have a broader range and more fragmented elections: the effective

[3]The data can be found here and here.

number of lists, defined as the inverse Herfindahl index of list vote shares, rises from approximately 1.96 in the lowest disagreement decile to 2.74 in the highest. Elections also become more competitive. The vote-share margin between the first- and second-place lists declines from approximately 46 percentage points in the lowest disagreement decile to 26 percentage points in the highest. Thus, municipalities in which the model predicts greater disagreement over public-good composition exhibit both a wider range of political alternatives and more competitive elections.

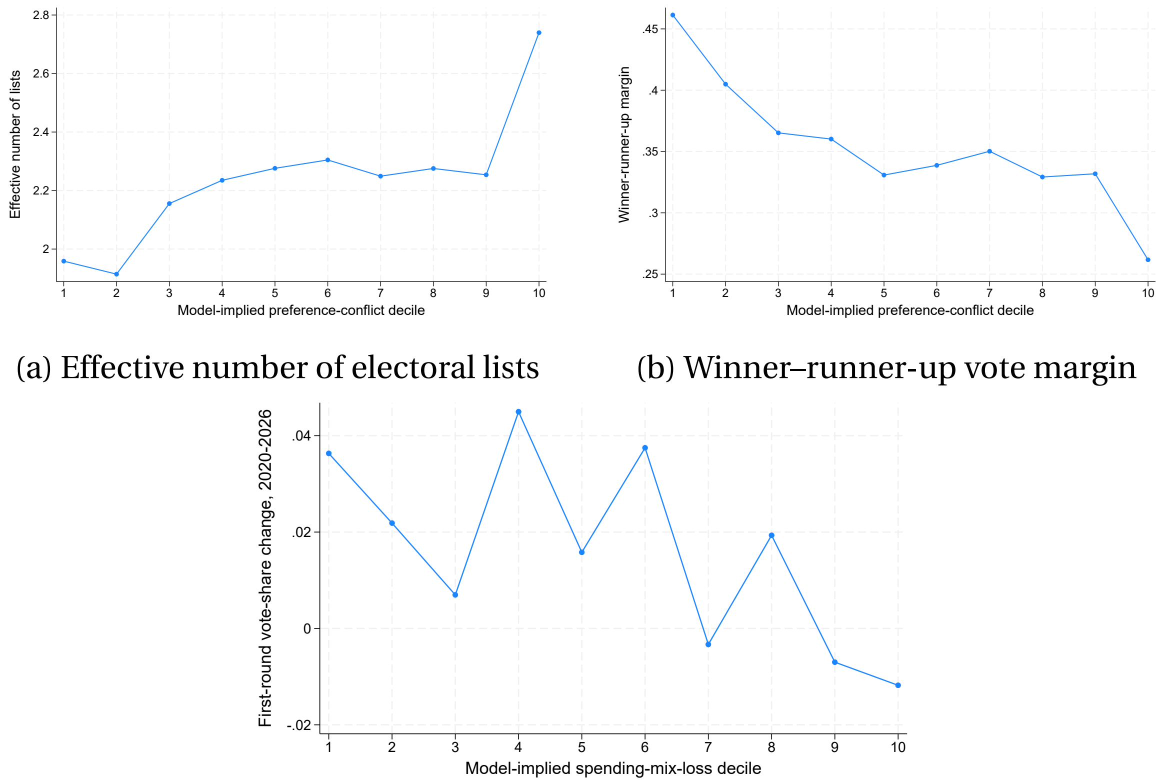
Spending-mix alignment and incumbent performance. Our second exercise asks whether incumbent performance is weaker when observed spending is poorly aligned with the preferences recovered by the model. We define the median voter's spending-mix loss as

$$D_j = \log g_{Mj}\left(\mathbf{s}_j^M\right) - \log g_{Mj}\left(\mathbf{s}_j^{\text{data}}\right), \tag{35}$$

where $\mathbf{s}_j^{\text{data}}$ denotes the observed spending allocation. We then follow the winning municipal list in 2020 into the 2026 election and, among incumbent lists that run again, calculate the change in its first-round vote share.

Figure 3 shows that incumbent electoral performance deteriorates as model-implied spending misalignment increases. Incumbent lists in the lowest loss decile increase their first-round vote share by approximately 3.6 percentage points between 2020 and 2026, whereas those in the highest loss decile lose approximately 1.2 percentage points. Although the relationship is not monotonic across every intermediate decile, its broad negative gradient is consistent with weaker incumbent performance when spending composition is further from their model-implied preferred allocation.

Taken together, these results provide support for the calibrated preference structure. The preference differences that the model recovers from municipal spending choices predict political fragmentation, electoral competitiveness, and changes in incumbent support. Their consistency across distinct electoral outcomes suggests that the calibrated measures capture economically and politically meaningful variation in preferences over local public goods.



(a) Effective number of electoral lists

(b) Winner–runner-up vote margin

(c) Change in incumbent vote share

Figure 3: Electoral Validation of Model-Implied Local Preferences

Notes: The figure presents three validation exercises using the 2026 municipal elections. Municipalities are grouped into deciles according to the model-implied measure indicated on the horizontal axis. Panel (a) reports the effective number of electoral lists. Panel (b) reports the first-round vote-share margin between the winning and second-place lists. Panel (c) reports the change in the incumbent's first-round vote share between the 2020 and 2026 elections. Points represent decile means. Vertical bars, when reported, denote 95 percent confidence intervals.

6 A Quantitative Analysis of Decentralization

We now use the calibrated model to evaluate the aggregate and distributional effects of decentralizing the choice of local public goods, and more specifically to assess the importance of letting local communities choose the *mix* of public goods. Decentralization involves several competing forces. Local discretion allows municipalities to tailor taxation and public-good provision to local preferences and population size. At the same time, property taxation distorts housing demand and generates free-riding across household types, collective choices reflect the preferences of the median voter rather than those of the average resident, and welfare inequality across households may increase. The calibrated model allows us to quantify the balance of these forces.

6.1 Welfare Gains from Decentralization

We compare the observed decentralized equilibrium with a counterfactual in which both the property-tax rate and the allocation of expenditure across public goods are centralized and common across municipalities. We set these common policies to their mean values across municipalities in the decentralized equilibrium. All exogenous fundamentals remain unchanged. In particular, amenities a, transfers T, productivities z and x, and housing-supply parameters b are held fixed. Population, rents, housing quantities, tax bases, and welfare adjust endogenously.[4]

Column (2) of Table 5 shows that decentralization produces large aggregate welfare gains. Following decentralization, we see an increase of 3.79% in ex post welfare, which is evaluated after households have sorted across municipalities. To get a sense of the magnitude, it is equivalent to a 90.9% increase in median municipal revenue per household or approximately €869 per household.[5]

6.2 The Composition of Public Goods

Our central hypothesis is that the composition of the public-good basket is a major source of welfare gains from fiscal decentralization. To assess this hypothesis, we consider two partial counterfactuals. In the first, municipalities choose their own property-tax rates, while expenditure shares remain common across municipalities. In the second, municipalities choose the composition of public spending, while the tax rate remains common. Because these are separate general-equilibrium exercises, their effects need not sum to the total effect of decentralization.

Although both margins generate positive welfare gains, the composition mar-

[4] Section 7.2 shows that allowing transfers to respond endogenously to municipal population and income has little effect on the results.

[5] The revenue equivalent measure of welfare is defined as the increase in local public revenue per household required to raise welfare in the centralized counterfactual to the level observed in the actual decentralized equilibrium.

Table 5: Welfare Effects of Decentralization

	Tax and Composition		Tax Rate Only		Composition Only	
	No mobility	Mobility	No mobility	Mobility	No mobility	Mobility
	(1)	(2)	(3)	(4)	(5)	(6)
Aggregate welfare						
Ex ante welfare change (%)	1.31	1.48	0.22	0.54	1.14	0.97
Ex post welfare change (%)	1.24	3.79	0.20	1.42	1.09	2.42
Revenue eq. (€/household)	221	869	33	258	192	484
Revenue eq. (% of revenue)	23.1	90.9	3.5	26.9	20.1	50.6
Ex post welfare by type						
High-skilled	1.21	3.48	0.01	0.87	1.23	2.61
Low-skilled	1.26	4.04	0.37	1.86	0.98	2.27

Notes: Welfare changes are expressed as percentages relative to the common-policy centralized equilibrium. Ex ante welfare is evaluated before households' idiosyncratic preferences over locations are realized. Ex post welfare refers to systematic welfare after households have selected their locations. Welfare changes by household type are ex post. The revenue equivalent is based on the aggregate ex post welfare change and gives the uniform increase in municipal resources per household that would be required in the centralized equilibrium to generate the same welfare gain. It is reported in euros per household and as a percentage of median municipal revenue per household. The partial counterfactuals are separate general-equilibrium exercises and therefore need not add to the total effect.

gin is quantitatively more important (Columns 4 and 6). Decentralizing tax rates produces an ex post revenue equivalent of 26.9%. Thus, in the current calibration, the benefits of adapting local taxation to local preferences and tax bases outweigh the distortions associated with property taxation.[6] Allowing municipalities to tailor expenditure shares generates an even larger ex post revenue equivalent of 50.6%, approximately twice the effect of decentralizing tax rates alone.

The predominance of the composition margin has important implications for quantitative evaluations of fiscal decentralization. Models that represent local public services as a single aggregate good capture the benefits and distortions associated with decentralized taxation and the overall level of spending, but cannot capture the gains from tailoring the mix of public goods. Our results indicate that this

[6]The fact that welfare for high-skilled households in the tax-only no-mobility scenario remains unchanged is consistent with the notion that decentralizing property taxation doesn't always increase welfare.

omitted margin accounts for a substantial part of the welfare benefits of decentralization.

6.3 The Amplifying Role of Household Mobility

Household mobility allows residents to respond to the local policies made possible by decentralization. A municipality that adopts a more attractive combination of taxes and public goods can gain population. As shown in equation (29), the ability of people to relocate can amplify the benefit of decentralization.

To quantify this mechanism, we recompute the decentralized equilibria while holding the spatial distribution of households across municipalities fixed at its common-policy centralized allocation. Municipalities can adjust their policies, but households cannot relocate across municipalities.

We find that mobility is a powerful amplification mechanism for fiscal decentralization (Columns 1 and 2). Without mobility, the revenue-equivalent gain from full decentralization is 23.1%. Allowing households to relocate raises it to 90.9%, multiplying the gain by almost four. For the composition-only counterfactual, mobility raises the ex post revenue equivalent from 20.1% to 50.6%. The tax-only margin is also strongly amplified, from 3.5% without mobility to 26.9% with mobility. The ex ante results are more muted: the gain rises from 24.3% without mobility to 28.0% with mobility under full decentralization.

6.4 Better Tailoring to Population Size

Why do municipalities benefit from choosing different public-good bundles? Equation (23) points to two sources of heterogeneity. First, municipalities differ in the welfare of their median voter, v_j^M. With non-homothetic preferences, these differences generate heterogeneity in the preferred composition of public spending. Second, municipalities differ substantially in population, L_j. Because public goods differ in their degree of rivalry, municipal size changes their relative effective prices and hence the cost-minimizing composition of the public-good basket.

We isolate these channels through two counterfactuals without mobility. In the first, municipalities tailor their spending shares to their median voter while assuming that they all have the same population size, equal to the median population size. In the second, they tailor their spending shares to their actual population size while assuming that they all have the same median voter, equal to the median voter in the country. These exercises isolate, respectively, median-voter and population size heterogeneity. As in the previous decomposition, their effects need not sum to the total effect of decentralization without mobility, as these two dimensions interact.

Table 6: Sources of Welfare Gains from Heterogeneity

Source of heterogeneity retained	Ex post revenue equivalent (percentage change)
Median-voter welfare, v_j^M	-4.2
Municipal population, L_j	21.5

Notes: Entries are revenue-equivalent welfare changes expressed as percentages of median municipal revenue per household. Both counterfactuals hold municipal populations fixed. They are separate counterfactual exercises and do not constitute an additive decomposition of the total welfare effect.

Table 6 shows that population heterogeneity is the principal source of gains. Allowing spending composition to respond to municipal population generates an ex post revenue equivalent gain of 21.5%. By contrast, allowing it to respond only to heterogeneity in median-voter welfare generates a revenue equivalent of -4.2%. The negative contribution of median-voter heterogeneity may come from two sources: considering a common population prevents municipalities from tailoring their spending composition to their actual scale and the resulting bundle need not maximize even the median voter's welfare; even if the bundle were optimal for the median voter, it need not maximize the average welfare of all residents.

The importance of tailoring to population size stems from differences in rivalry across public goods. Under centralization, all municipalities are constrained to use the same expenditure shares. Large municipalities therefore allocate the same share of their budgets to low-ρ_p goods—those that are less congestible or less rival—as smaller municipalities. Because the cost of providing these goods can be spread across a larger population, this common allocation assigns them a larger budget share than large municipalities would choose on their own. Following decentralization, large municipalities redirect expenditure toward more congestible services.

Small municipalities adjust in the opposite direction. Because they cannot spread the cost of relatively non-rival goods over as many households, they optimally devote a larger share of their budgets to those goods and a smaller share to more congestible services. Thus, municipalities at both ends of the size distribution benefit from departing from the common centralized composition, but they do so through opposite reallocations of their budgets.

These adjustments reduce the effective public-good price index. As shown in Panel 4a, the reduction is smallest around the middle of the municipal-size distribution, at approximately 1.7%, and becomes larger toward both tails. It reaches roughly 5.9% among the smallest municipalities and 15.1% in the largest-population bin.

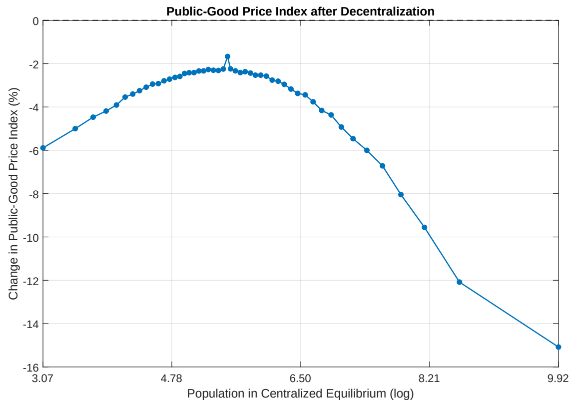
The decline in the public-good price index makes the largest municipalities more attractive and induces population reallocation. Panel 4b shows that the largest-population bin grows by approximately 3.8%, while most other bins contract by around 2.5–3.2%. Because the figure reports the change in the total population contained in each bin, these movements are consistent with a constant national population. Because population is very concentrated in larger cities, the gains in the upper tail offset the reductions across the much larger number of smaller municipalities.

The ex post welfare gains in Panel 4c show a consistent picture and mirror the change in the public-good price index and in population. Welfare rises throughout the distribution, but the increase is especially pronounced in the upper tail. Municipalities with the highest initial welfare experience substantially larger gains, consistent with the sharp price-index improvement and population response among the largest and initially most attractive municipalities.[7]

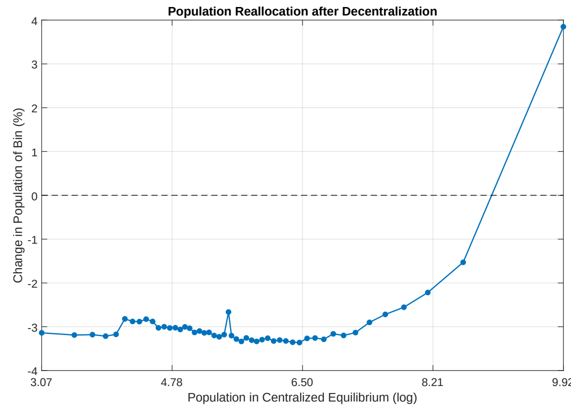
6.5 Implications for Inequality

A common concern with decentralization policies is that they increase spatial disparities. We find support for the idea that decentralization leads to an increase in welfare inequality. However, it is driven entirely by the increase in inequality be-

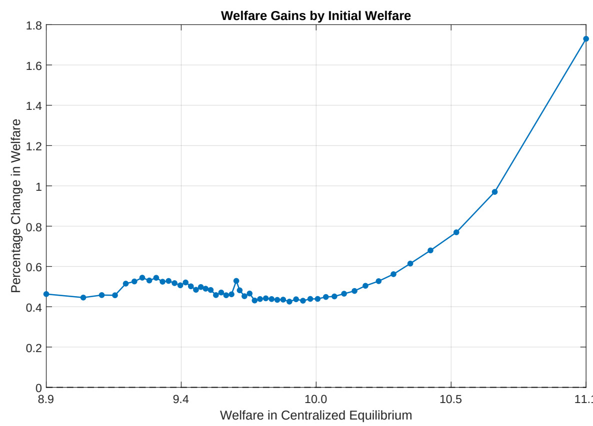
[7] Appendix F provides more details of underlying adjustments. The eight-panel figures trace changes in population, rents, housing quantities, tax bases, tax rates, public resources, the public-good price index, and ex post welfare across bins of initial population, median income, and welfare gains.



(a) Public-good price index



(b) Population reallocation



(c) Welfare gains by initial welfare

Figure 4: Mechanisms of Decentralization

Notes: Panels (a) and (b) group municipalities into 50 equal-count bins based on their population in the centralized equilibrium. The horizontal coordinate is the log of mean population within the bin. Panel (a) reports the population-weighted mean change in the public-good price index. Negative values denote a decline in the effective price of public goods. Panel (b) reports the percentage change in the total population contained in each bin. Panel (c) groups municipalities by initial ex post welfare and reports the mean municipality-level welfare gain.

tween small and large cities. We find little evidence for an increase in inequality across household types, nor do we find evidence of increased sorting by types.

Spatial welfare inequality. Most municipalities gain from decentralization, but the magnitude of the gain varies considerably across them, as shown in Figure 5.

The map reveals very uneven gains across space and confirms the finding that larger cities experience larger gains. Using the population-weighted Theil index of ex post welfare as a measure of inequality across municipalities, we find that it increases by 0.01 between the centralized and decentralized equilibria. Decentralization therefore widens the dispersion of ex post welfare across places.

Generally, the further away is a municipality from the median in terms of median income and population size, the more substantial the welfare gains (Appendix Figure F.17). The gains are U-shaped both in household median income and in population size, indicating that cities that are farthest from the median experience the most significant benefits from decentralization.

Public resources across municipalities. In contrast with the concern that decentralization leads to greater inequality in local public resources across space, we find it is accompanied by a more equal distribution of public resources. The Theil index of municipal public spending declines by 0.0086. Relative to centralization, public resources per household increase by approximately 10% in the lowest initial-income decile but decline by approximately 39% in the highest decile (Figure F.15).

The adjustment operates partly through local tax choices. Municipalities in the lower initial-income decile raise their effective property-tax rate by approximately 4.8 percentage points relative to the centralized rate, whereas those in the highest decile reduce it by approximately 6.6 percentage points. Decentralization therefore allows lower-income municipalities to sustain greater public resources despite their smaller tax bases, while higher-income municipalities choose lower taxation and expenditure. This mechanism explains why the distribution of municipal resources becomes more equal even as the distribution of welfare becomes more dispersed.

Inequality across household types. While the increase in spatial welfare dispersion implies a rise in welfare inequality across households, it does not translate into a widening welfare gap between household types. Under full mobility, average ex post welfare rises by approximately 3.48% for high-skilled households and 4.04% for low-skilled households. If anything, the average welfare gap between the two types narrows. Consistent with this finding by skill types, Figure

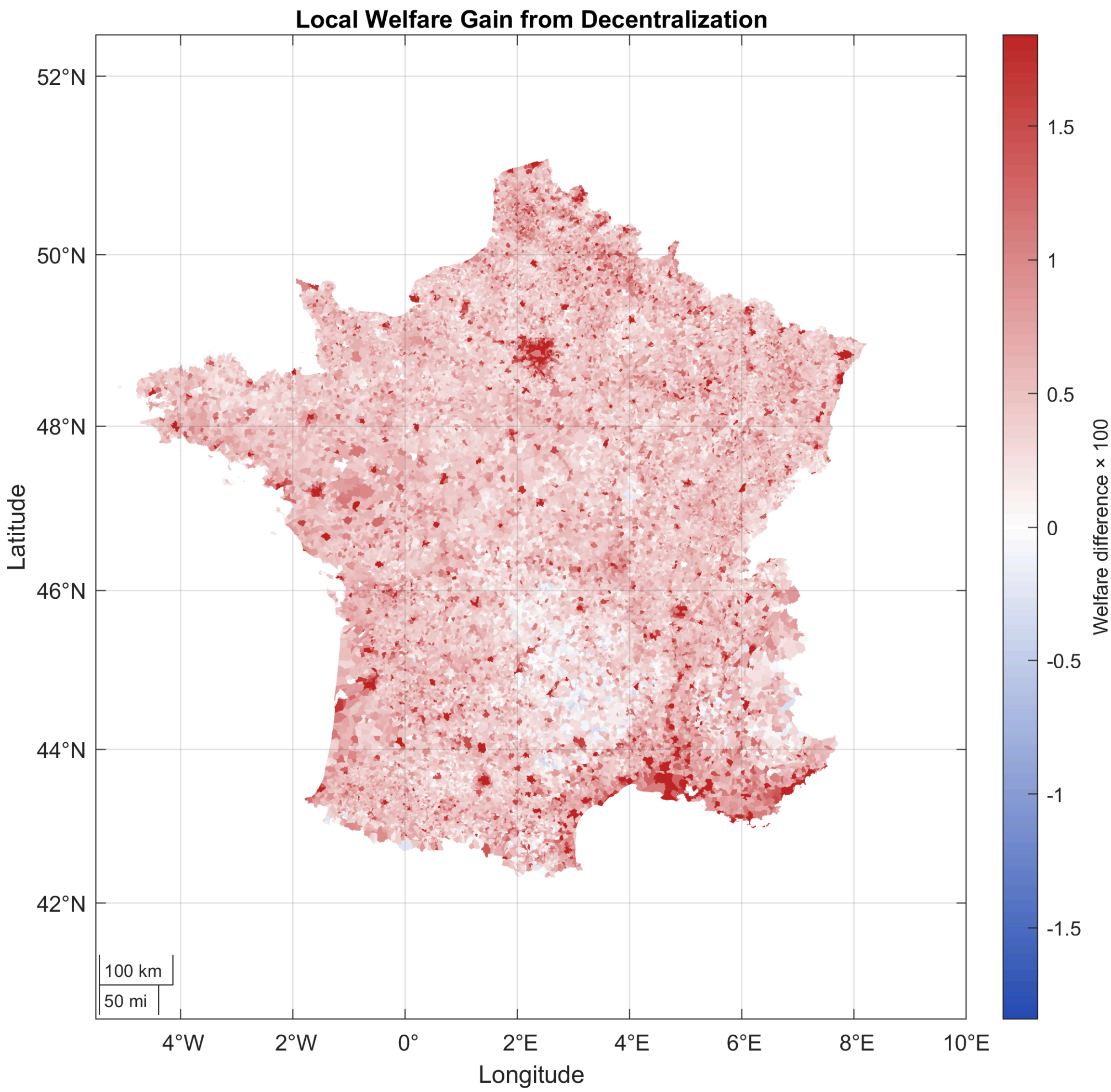


Figure 5: Municipality-Level Welfare Gains from Decentralization

Notes: The map reports the municipality-level percentage change in ex post welfare between the centralized and decentralized equilibria. Positive values indicate welfare gains from decentralization.

F.15 shows that households with lower income in the centralized equilibrium experience larger welfare gains with decentralization than higher-income households.

Finally, decentralization produces little additional spatial sorting by skill types.

Following Diamond and Gaubert (2022), we measure sorting using the exposure index $\sum_j \frac{L_j^H \mu_j^H}{\sum_k L_k^H} - \sum_j \frac{L_j^L \mu_j^H}{\sum_k L_k^L}$, where L_j^H and L_j^L denote the populations of high- and low-skill households and μ_j^H is the high-skill share in municipality j. The exposure index declines slightly, by approximately 0.0008. Low-skill households therefore do not become more spatially isolated from high-skill households. This is consistent with some low-skill households moving toward municipalities offering more attractive combinations of public services and local taxes.

Overall, decentralization creates a nuanced distributional trade-off. It raises welfare for both household types and equalizes municipal public resources, but the magnitude of the welfare gain differs across places. Its principal distributional consequence is therefore greater spatial dispersion in welfare, especially between small and large cities, rather than greater inequality between high- and low-skill households or stronger residential sorting by type.

7 Robustness Analysis

We examine the robustness of our quantitative conclusions along three dimensions. First, we vary the parameters governing household mobility, the strength of non-homothetic public-good preferences, and heterogeneity in public-good rivalry. Second, we allow central-government transfers to respond endogenously to changes in municipal population and income. Third, we relax the assumption that landlords are absentee. In every exercise, we recompute the relevant decentralized and centralized equilibria rather than evaluating alternative parameters while holding equilibrium allocations fixed.

7.1 Sensitivity to Key Elasticities

Our baseline results depend on three sets of parameters that govern the central mechanisms of the model. The migration elasticity determines the strength of households' residential responses. The coefficients ν_p determine how preferences over different public goods vary with household welfare. Finally, the parameters ρ_p govern differences in rivalry across public goods and therefore the extent to which the cost of provision varies with municipal population.

We consider one lower and one higher value for each mechanism. We vary the migration elasticity by 25% in either direction. We scale the degree of non-homotheticity according to

$$\nu_p(\lambda_\nu) = \lambda_\nu \widehat{\nu}_p, \qquad \lambda_\nu \in \{0.9, 1.1\}, \tag{36}$$

and vary the dispersion in rivalry around its cross-good mean according to

$$\rho_p(\lambda_\rho) = \overline{\rho} + \lambda_\rho \left(\widehat{\rho}_p - \overline{\rho}\right), \qquad \lambda_\rho \in \{0.9, 1.1\}. \tag{37}$$

For each specification, we recalibrate the economy's fundamentals and resolve the decentralized, centralized, tax-only, and composition-only equilibria.

Table 7: Sensitivity to Key Parameters

		Ex post welfare			Ex ante welfare		
Parameter	Multiplier	Total	Tax	Composition	Total	Tax	Composition
Baseline	1.00	90.9	26.9	50.6	28.0	9.4	17.5
Migration elasticity	0.75	101.7	30.2	56.0	29.0	9.9	18.2
Migration elasticity	1.25	82.5	24.2	46.3	27.1	9.0	17.0
Non-homotheticity	0.90	61.8	14.0	42.5	19.8	5.2	14.5
Non-homotheticity	1.10	114.8	55.6	37.0	37.5	19.9	15.3
Rivalry heterogeneity	0.90	136.6	37.1	35.6	37.8	14.5	13.4
Rivalry heterogeneity	1.10	107.1	24.8	65.8	32.5	8.7	22.3

Notes: Entries are revenue-equivalent welfare gains expressed as percentages of median municipal revenue per household. 'Total" compares full decentralization with full centralization. 'Tax" decentralizes only the property-tax rate, while "Composition" decentralizes only the allocation of expenditure across public goods. These partial counterfactuals are separate equilibrium exercises and need not add to the total effect.

Table 7 shows that the aggregate welfare gain from decentralization remains positive and economically substantial in all six alternative specifications. The revenue equivalent ranges from 61.8% to 136.6% of median municipal revenue, compared with 90.9% in the baseline. The corresponding ex ante measure ranges from 19.8% to 37.8%, compared with 28.0% in the baseline.

The composition margin is also positive and sizable in every specification. Its revenue equivalent ranges from 35.6% to 65.8%, while its ex ante equivalent ranges from 13.4% to 22.3%. The composition margin exceeds the tax margin in four of the six alternative specifications. The exceptions are the specifications with stronger non-homotheticity and lower rivalry heterogeneity, in which the tax margin exceeds the composition margin. The broader conclusion remains that allowing municipalities to tailor their public-good mix is an important source of the gains from decentralization and is not an artifact of the baseline parameterization.

7.2 Endogenous Central-Government Transfers

The baseline counterfactual holds municipal transfers fixed at their observed levels. In practice, transfers respond to municipal characteristics, including population and fiscal capacity (see Appendix Table G for details). Population movements induced by centralization could therefore generate an endogenous fiscal response that is absent from the baseline exercise.

To assess this concern, we estimate the following reduced-form transfer rule:

$$\log T_{jt} = \alpha_P \log L_{jt} + \alpha_M \log y_{jt}^A + \gamma_j + \gamma_t + \varepsilon_{jt}, \tag{38}$$

where L_{jt} is municipal population, y_{jt}^A is mean household income, and γ_j and γ_t denote municipality and year fixed effects. As reported in Table H.14, the estimated population elasticity is 1.533 and the mean-income elasticity is -0.393. Transfers therefore rise more than proportionally with population and decline with local income, consistent with their redistributive role.

We then recompute the centralized equilibrium while allowing transfers to adjust according to equation (38). The municipality-specific component of transfers is calibrated to reproduce observed transfers in the decentralized allocation. Consequently, this exercise changes transfers only through the endogenous responses of population and mean income.

Allowing transfers to adjust has little effect on the results. The revenue equivalent increases from 90.9% to 97.4% of median municipal revenue, while the ex ante equivalent changes only from 28.0% to 28.5%. In euro terms, the ex ante revenue equivalent rises from approximately €267 to €272 per household. Thus, the estimated welfare gains are not driven by holding transfers fixed as households relocate across municipalities.

Table 8: Robustness to Endogenous Transfers

	Ex post welfare		Ex ante welfare	
Centralized benchmark	€/household	% revenue	€/household	% revenue
Fixed transfers	869	90.9	267	28.0
Endogenous transfers	932	97.4	272	28.5

Notes: Each row reports the revenue-equivalent welfare gain from decentralization relative to the corresponding centralized benchmark. "% revenue" denotes the equivalent as a percentage of median municipal revenue per household.

7.3 Alternative Landlord Ownership

The baseline model assumes that landlords are absentee, so changes in rental income do not enter resident household income. We consider two alternative ownership structures.

In the first specification, all households hold shares of a national portfolio aggregating rental income from the entire economy (Desmet and Rossi-Hansberg, 2013). Total revenues of the national portfolio are given by $\sum_{j=1}^{J} r_j H_j$. They are distributed in proportion to each household's income, y_{ij}. We denote τ_1 the implied proportional income subsidy such that the budget constraint is now given by $y_{ij}(1+\tau_1)(1-\tau) = c + r_j(1+t_j)h$. The value of the rate of subsidy is given by

$$\tau_1 = \frac{\sum_{j=1}^{J} r_j H_j}{\sum_{j=1}^{J}\sum_{i=1}^{I} y_{ij}(1-\tau)L_{ij}} \tag{39}$$

In the second specification, local rents are distributed locally to residents (Redding and Sturm, 2024). Total revenues at the local level are given by $r_j H_j$. They are distributed among local residents in proportion to each household's income, y_{ij}. We denote τ_{2j} the place-specific proportional income subsidy. The value of the rate of subsidy is given by

$$\tau_{2j} = \frac{\sum_{i=1}^{I} r_j h_{ij} L_{ij}}{\sum_{i=1}^{I} y_{ij}(1-\tau)L_{ij}} \tag{40}$$

Landlord ownership affects the equilibrium allocation, so we recompute both the decentralized equilibrium and its corresponding centralized benchmark under each ownership regime. Each row of Table 9 shows the welfare changes due to decentralization holding the ownership structure fixed.

Table 9: Robustness to Alternative Landlord Ownership

	Ex post welfare		Ex ante welfare	
Ownership regime	€/household	% revenue	€/household	% revenue
Absentee landlords	869	90.9	267	28.0
National rental portfolio	1,038	108.5	298	31.2
Local ownership	751	78.5	298	31.2

Notes: Each decentralized equilibrium is compared with a centralized benchmark solved under the same landlord-ownership assumption. Revenue equivalents are expressed in euros per household and as percentages of median municipal revenue per household.

The welfare gain from decentralization remains positive and large under both alternatives. Based on ex post utility, the revenue equivalent is approximately 108.5% under a national rental portfolio and 78.5% under local ownership, compared with 90.9% under absentee ownership. The ex ante results are more stable: the revenue equivalent is approximately 31.2% under either alternative, compared with 28.0% under absentee ownership.

8 Conclusion

The provision of local public goods and the sorting of households with diverse preferences are closely intertwined. We present new facts that shed light on the relationships between public goods provision, household median income, and population size. We then build a tractable spatial general equilibrium model in which households' residential choices are influenced by and in turn shape the local tax rates and local public goods through local voting. Given the heterogeneity in demand for public services, we find large welfare gains for decentralizing the provision of public goods to local municipalities, in contrast with prior literature which has focused on a single local public good. Tailoring the composition of public goods generates the largest gains, primarily because municipalities differ in population size.

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Appendix

A Taxonomy of Public Goods

Our classification of public goods is closely tied to public accounting rules for municipalities known as M14. The M14 is a system of classifying public expenditures that a municipality uses to categorize and report budgetary operations. The M14 requires municipalities above 3,500 inhabitants to classify spending and revenue according to type of activity. The purpose of this classification is to provide elected officials with knowledge about the amount of financial resources devoted annually to different municipal services. This classification is done based on a "functional nomenclature" that uses a three-digit code to standardize the classification of activities.

We aggregate these classifications into ten broad categories of public spending based on the first digit of this code. We sometimes split this category when it encompasses distinct municipal services that each have significant budget shares. Table A.10 presents our classification. The first column is the public good categories used in the paper. The second and third columns provide sub-functions that these categories are based on. The final column, titled "Details", provides the fully disaggregated functions that make up the category.

In analyzing the fiscal data of local governments, we must distinguish between budgetary transactions that reflect actual economic activity and those that reflect accounting adjustments. The dataset includes variables that capture both types of operations. We calculate real spending by subtracting non-cash budgetary operations (`OOBDEB`) from net budgetary debits (`OBNETDEB`). We do the same for revenue. This approach aligns with the methodology adopted by the Direction de l'Évaluation de la Statistique et des Études Locales (DESL) since 2012.

Table A.10: Taxonomy of Public Goods

Function	Code	Sub-function	Details
Administrative	02	General Administration	General administration of the community; local assemblies; general administration on behalf of the State; information, communication, advertising; festivals and ceremonies; aid to unclassified associations; cemeteries and funeral homes; decentralized projects with foreign authorities.
	03	Justice	Courts and courthouses; municipal jails; penitentiary services; youth detention centers; legal counsel and victim support.
Safety	11	Security	National policy; municipal police; firefighters and rescue services; other civil security services.
	12	Hygiene and Sanitation	Specific actions related to public safety, such as rat extermination or emergency interventions on buildings in danger.
Education	21	Primary Education	Preschool; primary schools. Excluding teachers.
	22	Secondary Education	Middle schools; technical education; apprenticeships; high schools; maritime schools. Excluding teachers.
	23	Higher Education	Higher education establishments; fine arts schools; architecture schools; teacher trainer colleges; nursing schools; other professional schools. Excluding teachers.
	24	Continuing Education	Vocational training centers; continuing education centers.
	25	Additional Services	Accommodations and cafeterias; school transport; school sports; school nurses; other ancillary services.
Culture	31	Arts	Musical, lyrical, choreographic activities (e.g., orchestras); plastic arts; exhibitions; theaters; cinemas and performance halls.
	32	Cultural Institutions	Libraries and media centers; museums; archives; maintenance of cultural heritage (e.g., restoration of monuments); other cultural activities.

Recreation	41	Sports and Recreation	Sports centers and gymnasiums; stadiums; pools; other sports and leisure equipment; sporting events.
	42	Youth Services	Youth leisure clubs; youth centers; camps; other youth services (e.g., playgrounds).
Social	51	Health Services	Clinics and other health establishments; other health services (e.g., family planning centers).
	52	Social Services	Social services for the disabled; social services for children and adolescents; assistance for individuals in need; other services (e.g., services in favor of refugees).
Family	61	Elder Services	Retirement homes; centers for the elderly; home care; senior citizens clubs.
	62	Maternity Services	Miscellaneous benefits related to maternity.
	63	Family Support	Miscellaneous benefits for families.
	64	Nurseries and Daycares	Nurseries; kindergartens; support for childcare at home.
Infrastructure	70–73	Housing	General housing services; private sector housing services; rental assistance; construction assistance.
	81	Urban Services	Water and sewage; sanitation; waste management; hygiene; public lighting; transit.
	82	Urban Planning	Road equipment (e.g., traffic lights); municipal road infrastructure; other urban development projects (e.g., renovation of neighborhoods).
	83	Environment	Water systems (e.g., dams, management of rivers); control of pollution; conservation of natural areas.
Parks	823	Outdoor Spaces	Public parks and gardens; urban green spaces; public squares; landscaping (*villes fleuries*).
Economic	91	Markets	Covered markets; spaces for wholesale trade.
	92	Agricultural Sector	Land development; agro-food industries (e.g., fisheries, slaughterhouses).
	93	Manufacturing and Energy	Power stations, gas pipelines, electricity transmission.
	94	Commerce	Retailers; measurement of commercial activities.
	95	Tourism	Winter resorts; collection of tourism tax; hotels; holiday villages.

96	Public Services	Maintenance of miscellaneous public services (e.g., post office).

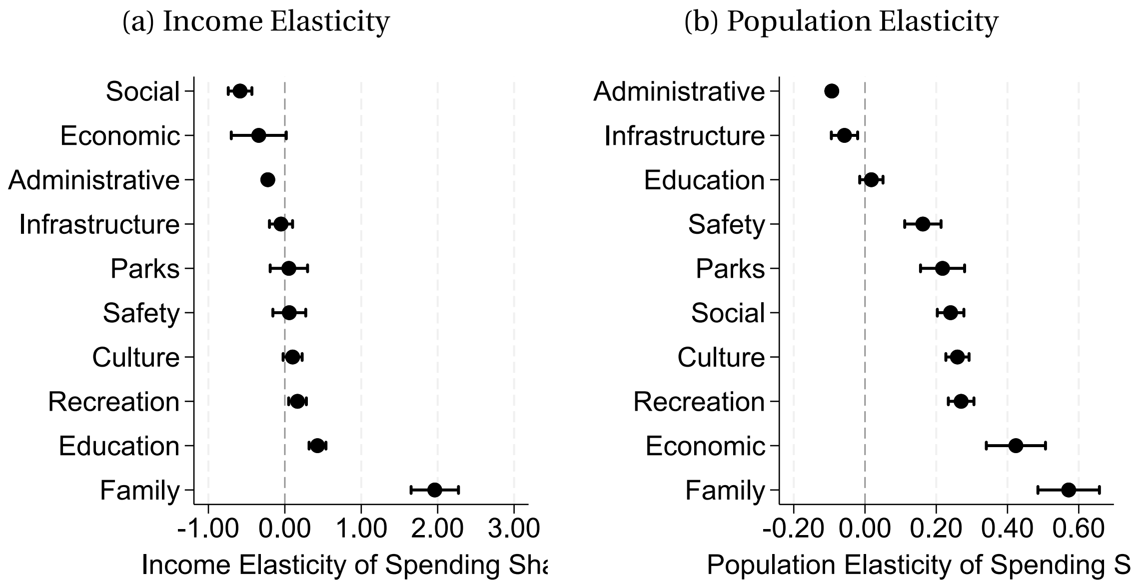
B Sample Summary Statistics

Table B.11: Characteristics of Municipalities

	Engel Sample	Full Sample
Revenue per HH (€)	2,256	1,629
Mean Income (€)	27,861	26,336
Median Income (€)	22,151	21,695
Population	14,514	1,759
Area (km^2)	2703.1	1557.6
Rent Index (€/sqm/month)	10.38	7.58
Effective Tax Rate (%)	0.65	0.51
N Communes	2,542	35,327
Total Population (M)	36.76	61.23

C Robustness exercises

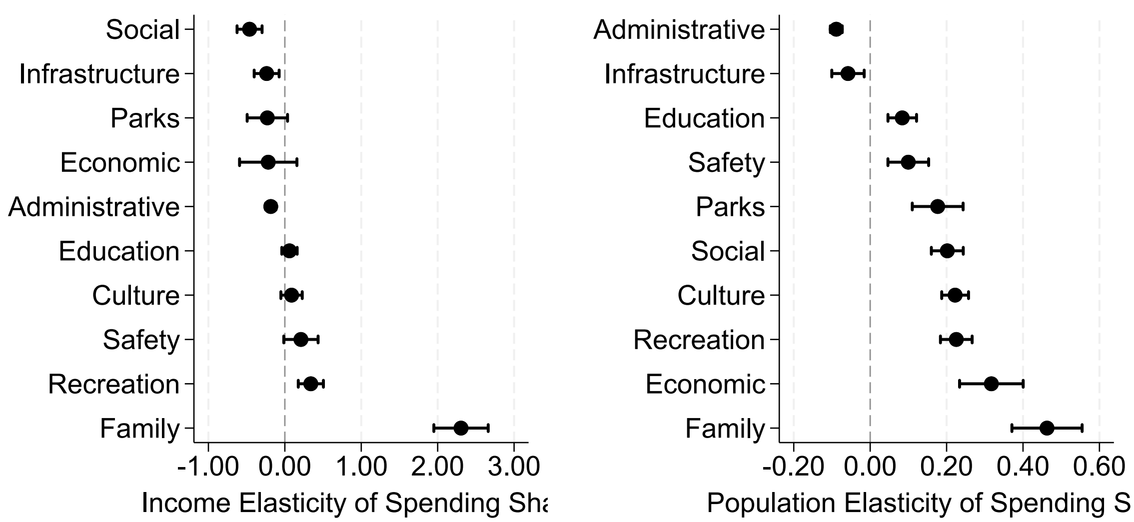
Figure C.6: Elasticities with Family and Age Structure Controls



Notes: The figure reports elasticities of municipal expenditure shares with respect to median household income and municipal population. The regression controls for the shares of residents under age 18 and age 65 or older, the share of households belonging to families with children, and mean household size. These controls are interacted with public-good-category indicators. The regression also includes category-specific income and population terms and public-good-category fixed effects. Points denote coefficient estimates; bars report 95% confidence intervals based on standard errors clustered by municipality.

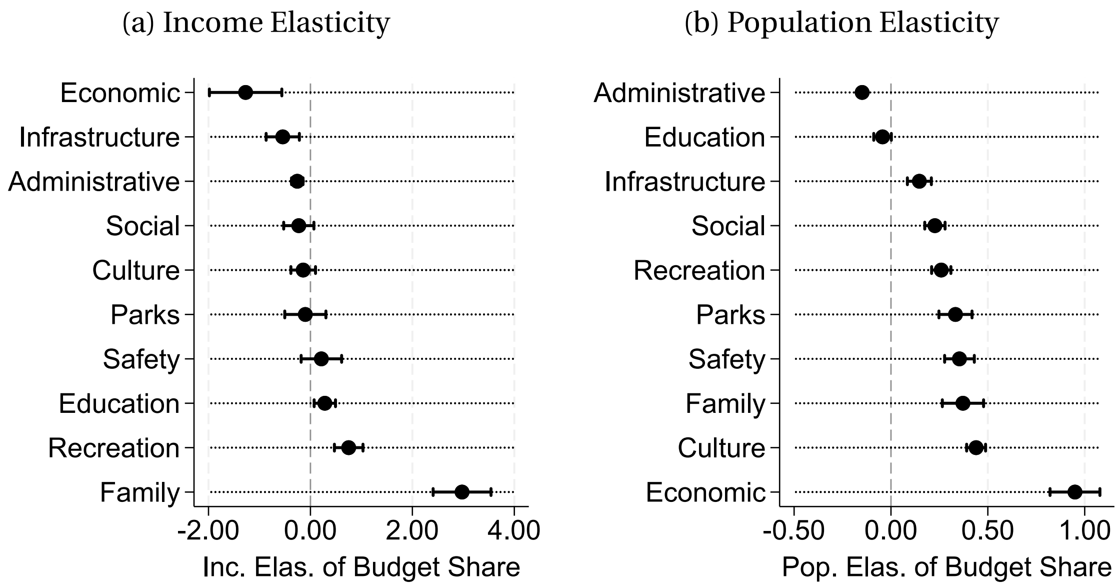
Figure C.8: Elasticities with Home Ownership Controls

(a) Income Elasticity (b) Population Elasticity



Notes: The figure reports category-specific elasticities of municipal expenditure shares with respect to median household income and municipal population. The regression controls for the municipal home-ownership rate and the share of second homes, each interacted with public-good-category indicators. The regression also includes category-specific income and population terms and public-good-category fixed effects. Points denote coefficient estimates; bars report 95% confidence intervals based on standard errors clustered by municipality.

Figure C.10: Elasticity of Public Goods Spending Share (IV)



Notes: The figures report the estimated elasticities of municipal expenditure shares with respect to median household income and population for each public-good category. The dependent variable is the log expenditure share, and the regressions include public-good-category fixed effects. Median income is instrumented with the 1968 "cadre" share and municipality size with 1876 population. Bars report 95% confidence intervals based on standard errors clustered by municipality.

D Model: Proofs

D.1 Optimal tax rate

The first-order condition is given by

$$\omega_{gij}^{\frac{1}{\gamma}} \frac{1}{q_{ij}} \left(r_j H_j - \frac{t_j r_j H_j}{1+t_j} \right) \left(\frac{t_j r_j H_j + T_j}{q_{ij}} \right)^{-\frac{1}{\gamma}} v_{ij}^{\frac{1}{\gamma}} = \left(\frac{y_{ji}(1-\tau)}{p_{ij}} \right)^{-\frac{1}{\gamma}} \frac{y_{ji}(1-\tau)}{p_{ij}^2} \frac{\partial p_{ji}}{\partial t_j} (1-\omega_{gij})^{\frac{1}{\gamma}} v_{ij}^{\frac{1}{\gamma}}$$

where we used the fact that when choosing the tax rate, the government understands that it will also affect the base, the household's spending on housing, equal to $rH = \frac{\sum_i \omega_h(v_i) y_{ji}(1-\tau)}{1+t_j}$ which gives $\frac{\partial rH}{\partial t} = -\frac{rH}{1+t_j}$. Using the fact that $\frac{\partial p_{ji}}{\partial t_j} = \omega_h(v)(1+t_j)^{-1} p_{ji}$. Substituting this expression and simplifying gives

$$\omega_{gij}^{\frac{1}{\gamma}} \left(r_j H_j - \frac{t_j r_j H_j}{1+t_j} \right) (t_j r_j H_j + T_j)^{-\frac{1}{\gamma}} = \left(\frac{q_{ij} y_{ji}(1-\tau)}{p_{ij}} \right)^{1-\frac{1}{\gamma}} \omega_h(v)(1+t_j)^{-1} (1-\omega_{gij})^{\frac{1}{\gamma}}$$

$$\left(\frac{\omega_{gij}}{1-\omega_{gij}} \right)^{\frac{1}{\gamma}} (r_j H_j)^{1-\frac{1}{\gamma}} \left(t_j + \frac{T_j}{r_j H_j} \right)^{-\frac{1}{\gamma}} = \left(\frac{q_{ij} y_{ji}(1-\tau)}{p_{ij}} \right)^{1-\frac{1}{\gamma}} \omega_h(v)$$

Using the fact that $\omega_{gij}/(1-\omega_{gij}) = \alpha_g v_{ij}^{\nu_g}$, further simplifying and raising both sides by the exponent $-\gamma$ gives

$$\left(\alpha_g v_{ij}^{\nu_g}\right)^{-1} \left(t_j + \frac{T_j}{r_j H_j} \right) = \left(\frac{q_{ij} y_{ji}(1-\tau)}{r_j H_j p_{ij}} \right)^{1-\gamma} \omega_h(v)^{-\gamma}$$

$$\left(t_j + \frac{T_j}{r_j H_j} \right) = \frac{\alpha_g v_{ij}^{\nu_g}}{\omega_h(v)} \left(\frac{q_{ij} \omega_h(v) y_{ji}(1-\tau)}{r_j H_j p_{ij}} \right)^{1-\gamma}$$

which gives equation (25).

D.2 Public good CES price index

We first show that $g = L^{-\rho_p} \left(\frac{\omega_p}{g_p} (trH + T)^{\gamma_g} \right)^{\frac{1}{\gamma_g - 1}}$ for any p.

Proof. We seek to minimize $\sum_p g_p$ subject to the constraint $g = \left(\sum_{p=1}^{P} \omega_p(v)^{\frac{1}{\gamma_g}} \left[g_{pj} L_j^{-\rho_p} \right]^{1-\frac{1}{\gamma_g}} \right)^{\frac{\gamma_g}{\gamma_g - 1}}$. Denote the Lagrange multiplier associated with this constraint λ. The F.O.C. is given by $1 = \lambda \left(L^{-\rho_p}\right)^{1-\frac{1}{\gamma_g}} \omega_p(v)^{\frac{1}{\gamma_g}} \left(\frac{g}{g_p}\right)^{\frac{1}{\gamma_g}}$. Multiplying both sides by g_p and summing over p allows to solve for λ, which is equal to: $\lambda = \frac{\sum_p g_p}{g} = q_{ij}$. We can thus solve for q by raising $1 = \lambda \left(L^{-\rho_p}\right)^{1-\frac{1}{\gamma_g}} \omega_p(v)^{\frac{1}{\gamma_g}} \left(\frac{g}{g_p}\right)^{\frac{1}{\gamma_g}}$ to the γ_g and summing over p, which gives

$$q_{ij} = \left(\sum_p \omega_p \left(L^{-\rho_p}\right)^{\gamma_g - 1}\right)^{\frac{1}{1-\gamma_g}}$$

$\square$

D.3 Approximation to Welfare Change

We start with differentiating the social welfare function with respect to an arbitrary change in local spending shares and tax rates $\mathbf{x}$:

$$dW = \sum_j \sum_i \left(\pi_{ij} \times \nabla_{\mathbf{x}} V_{ij} \ \cdot \ d\mathbf{x} + V_{ij} \times \nabla_{\mathbf{x}} \pi_{ij} \ \cdot \ d\mathbf{x}\right)$$

We now find an expression for $\nabla_{\mathbf{x}} \pi_{ij}$. Given that $\pi_{ij} = \frac{\exp(V_{ij}/\mu)}{\sum_{l=1}^{J} \exp(V_{il}/\mu)}$ we get

$$\nabla_{\mathbf{x}} \pi_{ij} = \frac{1}{\mu} \left(\pi_{ij}(1-\pi_{ij}) \nabla_{\mathbf{x}} V_{ij} - \sum_{j' \neq j} \pi_{ij} \pi_{ij'} \nabla_{\mathbf{x}} V_{ij'}\right)$$

Consistent with a first-order approximation and the fact that there are a very large number of locations in France, we can ignore the second-order terms in π_{ij}^2 and $\pi_{ij}\pi_{ij'}$. This gives

$$\nabla_{\mathbf{x}} \pi_{ij} = \frac{1}{\mu} \pi_{ij} \nabla_{\mathbf{x}} V_{ij}$$

Replacing into the expression for dW we get

$$dW = \sum_j \sum_i \pi_{ij} \left(1 + \frac{V_{ij}}{\mu}\right) \nabla_{\mathbf{x}_j} V_{ij} \ \cdot \ d\mathbf{x}$$

We now turn to the computation of $\nabla_{\mathbf{x}} V_{ij}$. The value V_{ij} depends on the vector of local populations π through three channels: changes in the aggregate income tax rate τ through the government budget constraint, changes in local rents through the local housing market clearing condition and the local public-good price index due to the non-rivalry of public goods. This gives:

$$\nabla_{\mathbf{x}} V_{ij} = \nabla_{\mathbf{x}} V_{ij}\big|_{\pi} + \frac{\partial V_{ij}}{\partial \tau}\nabla_{\mathbf{x}}\tau + \frac{\partial V_{ij}}{\partial r_{ij}}\frac{\partial r_j}{\partial \pi_j}\nabla_{\mathbf{x}}\pi_{ij} + \frac{\partial V_{ij}}{\partial q_{ij}}\frac{\partial q_j}{\partial \pi_j}\nabla_{\mathbf{x}}\pi_{ij}$$

We can ignore the last two terms which are second order since $\nabla_{\mathbf{x}}\pi_{ij} = \frac{1}{\mu}\pi_{ij}\nabla_{\mathbf{x}} V_{ij}$ is linear in π_{ij} and would then multiply π_{ij} in the expression for dW.

When computing $\nabla_{\mathbf{x}_j} V_{ij}$, we can thus only consider the direct effect through the tax rates and spending shares as well as τ, but we can ignore the second-order feedback effects of changes in populations. It is worth noting that we do account for the first-order effects of changes in population on social welfare.

Recall that $V_{ij} = \ln(a_{ij}v_{ij})$. Together with the assumption that $\gamma = 1$, we get

$$\begin{aligned}
\nabla_{\mathbf{x}} V_{ij} &= \nabla_{\mathbf{x}} \ln v_{ij} = \nabla_{\mathbf{x}}\left(\omega_g(v_{ij})\ln g_{ij} + (1-\omega_g(v_{ij}))\ln u_{ij}\right) \\
&= \omega_g(v_{ij})\nabla_{\mathbf{x}}\ln g_{ij} + (1-\omega_g(v_{ij}))\nabla_{\mathbf{x}}\ln u_{ij} + \nabla_{\mathbf{x}}\omega_g(v_{ij})\ln\left(\frac{g_{ij}}{u_{ij}}\right)
\end{aligned}$$

We compute each of the three derivatives separately, starting with $\nabla_{\mathbf{x}_j}\omega_g(v_{ij})$. Given that $\omega_g(v) = \frac{\alpha_g v^{\nu_g}}{\alpha_g v^{\nu_g}+1}$, we have

$$\nabla_{\mathbf{x}}\omega_g(v_{ij}) = \nu_g\omega_g(v_{ij})(1-\omega_g(v_{ij}))\nabla_{\mathbf{x}}\ln v_{ij}$$

Given that $u = \frac{y(1-\tau)}{(r(1+t))^{\omega_h}}$, we have

$$\begin{aligned}
\nabla_{\mathbf{x}}\ln u_{ij}d\mathbf{x} &= \frac{\partial\ln(1-\tau)}{\partial L_j}\nabla_{\mathbf{x}}L_j d\mathbf{x} - \omega_h\left(\frac{\partial\ln r_j}{\partial t_j}\Big|_{L_j}dt_j + \frac{\partial\ln r_j}{\partial L_j}\nabla_{\mathbf{x}}L_j d\mathbf{x} + \frac{1}{1+t_j}dt_j\right) \\
&= \frac{\partial\ln(1-\tau)}{\partial L_j}\nabla_{\mathbf{x}}L_j d\mathbf{x} - \omega_h\left(\frac{\partial\ln r_j}{\partial t_j}\Big|_{L_j} + \frac{1}{1+t_j}\right)dt_j
\end{aligned}$$

where we can ignore the second-order effect of population on rents. The remaining effects are the change in the income tax rate, the indirect effect of the tax rate through rents, and the direct effect of the tax rate on the cost of housing.

We next compute $\nabla_{\mathbf{x}_j} \ln g_{ij}$:

$$\begin{aligned}\nabla_{\mathbf{x}_j} \ln g_{ij} d\mathbf{x} &= \nabla_{\mathbf{x}_j} \ln(t_j r_j H_j + T_j) d\mathbf{x} - \nabla_{\mathbf{x}_j} \ln q_{ij} d\mathbf{x} \\ &= \frac{r_j H_j + t_j \frac{\partial r_j H_j}{\partial t_j}}{t_j r_j H_j + T_j} dt_j - \frac{1}{q_{ij}} \frac{\partial q_{ij}}{\partial t_j} dt_j - \sum_{p=2}^{P} \frac{1}{q_{ij}} \frac{\partial q_{ij}}{\partial s_{pj}} ds_{pj}\end{aligned}$$

We start with grouping the first term in that last expression in this last equation with the term $\omega_h \left(\frac{\partial \ln r_j}{\partial t_j}\Big|_{L_j} + \frac{1}{1+t_j} \right)$ in the derivative of u since we recognize the first-order condition of the median voter in the decentralized economy. This gives

$$\omega_g(v_{ij}) \frac{r_j H_j + t_j \frac{\partial r_j H_j}{\partial t_j}}{t_j r_j H_j + T_j} - (1 - \omega_g(v_{ij}))\, \omega_h \frac{1}{1+t_j}$$

Given that $\frac{\partial r_j H_j}{\partial t_j} = -\frac{r_j H_j}{1+t_j}$ we then get

$$\omega_g(v_{ij}) \frac{r_j H_j - t_j \frac{r_j H_j}{1+t_j}}{t_j r_j H_j + T_j} - (1 - \omega_g(v_{ij}))\, \omega_h \frac{1}{1+t_j} = \omega_g(v_{ij}) \frac{1}{t_j + \frac{T_j}{r_j H_j}} - (1 - \omega_g(v_{ij}))\, \omega_h$$

To make progress, we then consider a first order approximation of $\omega_g(v)$ around $\omega_g(\bar{v})$, i.e. around the median individual's value $\ln v = \ln \bar{v}$. Given that $\omega_g(v) = \frac{\alpha_g v^{\nu_g}}{1+\alpha_g v^{\nu_g}}$, we obtain

$$\omega_g(v) = \omega_g(\bar{v}) + \omega_g(\bar{v})(1 - \omega_g(\bar{v}))\nu_g \ln \frac{v}{\bar{v}}.$$

We also consider an approximation of the transfers over housing spending ratio $T_j/(r_j H_j)$ around the median individual level $\overline{T/(r_j H_j)}$. Replacing in the equation above and given the assumption that the tax rate in the centralized allocation $\bar{t}$ are the solution to the median individual's local maximization problem, we obtain

$$\left(\omega_g(\bar{v}) + \omega_g(\bar{v})(1-\omega_g(\bar{v}))\nu_g \ln\frac{v}{\bar{v}}\right)\frac{1}{\bar{t}+\overline{\left(\frac{T}{rH}\right)}} - \frac{\omega_g(\bar{v})}{\left(\bar{t}+\overline{\left(\frac{T}{rH}\right)}\right)^2}\left(\frac{T}{rH} - \overline{\left(\frac{T}{rH}\right)}\right)$$

$$-\left(1-\omega_g(\bar{v}) - \omega_g(\bar{v})(1-\omega_g(\bar{v}))\nu_g \ln\frac{v}{\bar{v}}\right)\omega_h\frac{1}{1+\bar{t}}$$

$$\left(\omega_g(\bar{v})(1-\omega_g(\bar{v}))\nu_g \ln\frac{v}{\bar{v}}\right)\left(\frac{1}{\bar{t}+\overline{\left(\frac{T}{rH}\right)}} + \omega_h\frac{1}{1+\bar{t}}\right) - \frac{\omega_g(\bar{v})}{\left(\bar{t}+\overline{\left(\frac{T}{rH}\right)}\right)^2}\left(\frac{T}{rH} - \overline{\left(\frac{T}{rH}\right)}\right)$$

$$\left(\omega_g(\bar{v})(1-\omega_g(\bar{v}))\nu_g \ln\frac{v}{\bar{v}}\right)\left(\frac{1}{\bar{t}+\overline{\left(\frac{T}{rH}\right)}} + \frac{\omega_g(\bar{v})}{1-\omega_g(\bar{v})}\frac{1}{\bar{t}+\overline{\left(\frac{T}{rH}\right)}}\right) - \frac{\omega_g(\bar{v})}{\left(\bar{t}+\overline{\left(\frac{T}{rH}\right)}\right)^2}\left(\frac{T}{rH} - \overline{\left(\frac{T}{rH}\right)}\right)$$

$$\frac{\omega_g(\bar{v})}{\bar{t}+\left(\frac{\bar{T}}{rH}\right)}(1-\omega_g(\bar{v}))\nu_g \ln\frac{v}{\bar{v}}\left(1+\frac{\omega_g(\bar{v})}{1-\omega_g(\bar{v})}\right) - \frac{\omega_g(\bar{v})}{\left(\bar{t}+\overline{\left(\frac{T}{rH}\right)}\right)^2}\left(\frac{T}{rH} - \overline{\left(\frac{T}{rH}\right)}\right)$$

$$(1-\omega_g(\bar{v}))\omega_h\left[\nu_g \ln\frac{v}{\bar{v}} - \frac{1}{\left(\bar{t}+\overline{\left(\frac{T}{rH}\right)}\right)}\left(\frac{T}{rH} - \overline{\left(\frac{T}{rH}\right)}\right)\right]$$

We next compute $\sum_{p=2}^{P}\frac{1}{q_{ij}}\frac{\partial q_{ij}}{\partial s_{pj}}$. We start by noting that $q_{ij} = 1/\bar{g}_{ij}$ hence

$$\frac{1}{q_{ij}}\frac{\partial q_{ij}}{\partial s_{pj}} = \frac{1}{\bar{g}_{ij}}\frac{\partial \bar{g}_{ij}}{\partial s_{pj}}$$

with

$$\bar{g}(s_{2j},...s_{Pj}) = \left(\omega_1(v)^{\frac{1}{\gamma_g}}\left(L_j^{-\rho_1}\left(1-\sum_{p=2}^{P}s_{pj}\right)\right)^{1-\frac{1}{\gamma_g}} + \sum_{p=2}^{P}\omega_p(v)^{\frac{1}{\gamma_g}}\left(L_j^{-\rho_p}s_{pj}\right)^{1-\frac{1}{\gamma_g}}\right)^{\frac{\gamma_g}{\gamma_g-1}}$$

We can thus compute $\frac{\partial \bar{g}_{ij}}{\partial s_{pj}}$.

$$\frac{\partial \bar{g}_{ij}}{\partial s_{pj}} = \bar{g}_{ij}^{1/\gamma_g}\left(s_{pj}^{-\frac{1}{\gamma_g}}\omega_p(v)^{\frac{1}{\gamma_g}}\left(L_j^{-\rho_p}\right)^{1-\frac{1}{\gamma_g}} - s_{1j}^{-\frac{1}{\gamma_g}}\omega_1(v)^{\frac{1}{\gamma_g}}\left(L_j^{-\rho_1}\right)^{1-\frac{1}{\gamma_g}}\right) + \frac{\partial \bar{g}_{ij}}{\partial \ln(v_{ij})}\frac{\partial \ln(v_{ij})}{\partial s_{pj}}$$

We start with the derivative holding v constant.

To make progress, we then consider a first order approximation of $\omega_p(v)^{1/\gamma_g}$ around $\omega_p(\bar{v})^{1/\gamma_g}$, i.e. around the median individual's value $\ln v = \ln \bar{v}$. Given that

$\omega_p(v) = \frac{\alpha_p v^{\nu_p}}{1+\sum_{p'=2}^P \alpha_{p'} v^{\nu_{p'}}}$, that is given by

$$\begin{aligned}
\omega_p(v)^{1/\gamma_g}\left(L_j^{-\rho_p}\right)^{1-\frac{1}{\gamma_g}} &= \omega_p(\bar{v})^{1/\gamma_g}\left(\bar{L}^{-\rho_p}\right)^{1-\frac{1}{\gamma_g}} + \frac{\alpha_p^{1/\gamma_g}\frac{\nu_p}{\gamma_g}\ln\frac{v}{\bar{v}} v^{\nu_p/\gamma_g}\left(\sum_{p'=1}^P \alpha_{p'} v^{\nu_{p'}}\right)^{1/\gamma_g}}{\left(1+\sum_{p'=2}^P \alpha_{p'} v^{\nu_{p'}}\right)^{2/\gamma_g}}\left(\bar{L}^{-\rho_p}\right)^{1-\frac{1}{\gamma_g}} \\
&- \frac{\alpha_p^{1/\gamma_g} v^{\nu_p/\gamma_g}\left(\sum_{p'=2}^P \alpha_{p'}\ln\frac{v}{\bar{v}}\frac{\nu_{p'}}{\gamma_g} v^{\nu_{p'}}\right)\left(1+\sum_{p'=1}^P \alpha_{p'} v^{\nu_{p'}}\right)^{1/\gamma_g-1}}{\left(1+\sum_{p'=2}^P \alpha_{p'} v^{\nu_{p'}}\right)^{2/\gamma_g}}\left(\bar{L}^{-\rho_p}\right)^{1-\frac{1}{\gamma_g}} \\
&- \rho_p\omega_p(\bar{v})^{1/\gamma_g}\left(1-\frac{1}{\gamma_g}\right)\bar{L}^{-\rho_p\left(1-\frac{1}{\gamma_g}\right)}\frac{L_j-\bar{L}}{\bar{L}} \\
&= \omega_p(\bar{v})^{1/\gamma_g} + \frac{\nu_p}{\gamma_g}\omega_p(\bar{v})^{1/\gamma_g}\ln\frac{v}{\bar{v}} - \omega_p(\bar{v})^{1/\gamma_g}\sum_{p'=2}^P\frac{\nu_{p'}}{\gamma_g}\omega_{p'}(\bar{v})^{1/\gamma_g}\ln\frac{v}{\bar{v}}\left(\bar{L}^{-\rho_p}\right)^{1-\frac{1}{\gamma_g}} \\
&- \rho_p\omega_p(\bar{v})^{1/\gamma_g}\left(1-\frac{1}{\gamma_g}\right)\bar{L}^{-\rho_p\left(1-\frac{1}{\gamma_g}\right)}\frac{L_j-\bar{L}}{\bar{L}} \\
&= \omega_p(\bar{v})^{1/\gamma_g} + \frac{\nu_p}{\gamma_g}\omega_p(\bar{v})^{1/\gamma_g}\left[1-\sum_{p'=2}^P\frac{\nu_{p'}}{\nu_p}\omega_{p'}(\bar{v})^{1/\gamma_g}\right]\ln\frac{v}{\bar{v}}\left(\bar{L}^{-\rho_p}\right)^{1-\frac{1}{\gamma_g}} \\
&- \rho_p\omega_p(\bar{v})^{1/\gamma_g}\left(1-\frac{1}{\gamma_g}\right)\bar{L}^{-\rho_p\left(1-\frac{1}{\gamma_g}\right)}\frac{L_j-\bar{L}}{\bar{L}}
\end{aligned}$$

Replacing in the equation above and given the assumption that the spending shares in the centralized allocation are solutions to median individual's local maximization problem, we obtain

$$\begin{aligned}
\frac{\partial\bar{g}_{ij}}{\partial s_{pj}} &= \frac{\nu_p}{\gamma_g}\ln\frac{v}{\bar{v}}\bar{g}_{ij}^{1/\gamma_g}\omega_p(\bar{v})^{1/\gamma_g}\left[1-\sum_{p'=2}^P\frac{\nu_{p'}}{\nu_p}\omega_{p'}(\bar{v})^{1/\gamma_g}\right]s_{pj}^{-\frac{1}{\gamma_g}}\left(\bar{L}^{-\rho_p}\right)^{1-\frac{1}{\gamma_g}} \\
&- \rho_p\bar{g}_{ij}^{1/\gamma_g}\omega_p(\bar{v})^{1/\gamma_g}s_{pj}^{-\frac{1}{\gamma_g}}\left(1-\frac{1}{\gamma_g}\right)\bar{L}^{-\rho_p\left(1-\frac{1}{\gamma_g}\right)}\frac{L_j-\bar{L}}{\bar{L}} \\
&+ \frac{\partial\bar{g}_{ij}}{\partial\ln(v_{ij})}\frac{\partial\ln(v_{ij})}{\partial s_{pj}}
\end{aligned}$$

Using the FOC of the individual with $\ln \bar{v}$ gives

$$
\begin{aligned}
\frac{\partial \bar{g}_{ij}}{\partial s_{pj}} = & \frac{\nu_p}{\gamma_g} \ln \frac{v}{\bar{v}} \bar{g}_{ij}^{1/\gamma_g} \omega_1(\bar{v})^{1/\gamma_g} \left[1 - \sum_{p'=2}^{P} \frac{\nu_{p'}}{\nu_p} \omega_{p'}(\bar{v})^{1/\gamma_g}\right] s_{1j}^{-\frac{1}{\gamma_g}} \left(\bar{L}^{-\rho_1}\right)^{1-\frac{1}{\gamma_g}} \\
& - \rho_p \bar{g}_{ij}^{1/\gamma_g} \omega_1(\bar{v})^{1/\gamma_g} \left(1 - \frac{1}{\gamma_g}\right) s_{1j}^{-\frac{1}{\gamma_g}} \bar{L}^{-\rho_1\left(1-\frac{1}{\gamma_g}\right)} \frac{L_j - \bar{L}}{\bar{L}} \\
& + \frac{\partial \bar{g}_{ij}}{\partial \ln(v_{ij})} \frac{\partial \ln(v_{ij})}{\partial s_{pj}}
\end{aligned}
$$

Summing over all $P-1$ goods, we obtain

$$
\begin{aligned}
\sum_{p=2}^{P} \frac{1}{q_{ij}} \frac{\partial q_{ij}}{\partial s_{pj}} ds_p = & \ln \frac{v}{\bar{v}} \bar{g}_{ij}^{1/\gamma_g - 1} \sum_{p=2}^{P} \frac{\nu_p}{\gamma_g} \omega_1(\bar{v})^{1/\gamma_g} \left[1 - \sum_{p'=2}^{P} \frac{\nu_{p'}}{\nu_p} \omega_{p'}(\bar{v})\right] s_{1j}^{-\frac{1}{\gamma_g}} \left(\bar{L}^{-\rho_1}\right)^{1-\frac{1}{\gamma_g}} ds_p \\
& - \frac{L_j - \bar{L}}{\bar{L}} \bar{g}_{ij}^{1/\gamma_g - 1} \sum_{p=2}^{P} \rho_p \left(1 - \frac{1}{\gamma_g}\right) \omega_1(\bar{v})^{1/\gamma_g} s_{1j}^{-\frac{1}{\gamma_g}} \left(\bar{L}^{-\rho_1}\right)^{1-\frac{1}{\gamma_g}} ds_p \\
& + \sum_{p=2}^{P} \frac{\partial \bar{g}_{ij}}{\partial \ln(v_{ij})} \frac{\partial \ln(v_{ij})}{\partial s_{pj}} ds_p \\
\sum_{p=2}^{P} \frac{1}{q_{ij}} \frac{\partial q_{ij}}{\partial s_{pj}} ds_p = & \ln \frac{v}{\bar{v}} \bar{g}_{ij}^{1/\gamma_g - 1} s_{1j}^{-\frac{1}{\gamma_g}} \left(\bar{L}^{-\rho_1}\right)^{1-\frac{1}{\gamma_g}} \omega_1(\bar{v})^{1/\gamma_g} \sum_{p=2}^{P} \frac{\nu_p}{\gamma_g} \left[1 - \sum_{p'=2}^{P} \frac{\nu_{p'}}{\nu_p} \omega_{p'}(\bar{v})\right] ds_p \\
& - \frac{L_j - \bar{L}}{\bar{L}} \bar{g}_{ij}^{1/\gamma_g - 1} \sum_{p=2}^{P} \rho_p \left(1 - \frac{1}{\gamma_g}\right) \omega_1(\bar{v})^{1/\gamma_g} s_{1j}^{-\frac{1}{\gamma_g}} \left(\bar{L}^{-\rho_1}\right)^{1-\frac{1}{\gamma_g}} ds_p \\
& + \sum_{p=2}^{P} \frac{\partial \bar{g}_{ij}}{\partial \ln(v_{ij})} \frac{\partial \ln(v_{ij})}{\partial s_{pj}} ds_p \\
\sum_{p=2}^{P} \frac{1}{q_{ij}} \frac{\partial q_{ij}}{\partial s_{pj}} ds_p = & A_{ij} \left[\frac{1}{\gamma_g} \ln \frac{v}{\bar{v}} \sum_{p=2}^{P} \left(\nu_p - E_{\omega_p(\bar{v})}\left[\nu_p\right]\right) + \frac{L_j - \bar{L}}{\bar{L}} \sum_{p=2}^{P} \rho_p \left(\frac{1}{\gamma_g} - 1\right)\right] ds_p \\
& + \sum_{p=2}^{P} \frac{\partial \bar{g}_{ij}}{\partial \ln(v_{ij})} \frac{\partial \ln(v_{ij})}{\partial s_{pj}} ds_p \\
\text{with} \quad A_{ij} = & \bar{g}_{ij}^{1/\gamma_g - 1} s_{1j}^{-\frac{1}{\gamma_g}} \left(\bar{L}^{-\rho_1}\right)^{1-\frac{1}{\gamma_g}} \omega_1(\bar{v})^{1/\gamma_g} \\
E_{\omega_p(\bar{v})}\left[\nu_p\right] = & \sum_{p'=1} \nu_{p'} \omega_{p'}(\bar{v})
\end{aligned}
$$

We next solve for the derivative of $\frac{\partial \bar{g}_{ij}}{\partial s_{pj}}$ through v, which corresponds to the term $\frac{\partial \bar{g}_{ij}}{\partial \ln(v_{ij})} \frac{\partial \ln(v_{ij})}{\partial \mathbf{x}_j} d\mathbf{x}_j$.

$$
\begin{aligned}
\frac{\partial \bar{g}_{ij}}{\partial \ln(v_{ij})}\frac{\partial \ln(v_{ij})}{\partial s_{pj}} &= \frac{\partial \ln(v_{ij})}{\partial s_{pj}} \sum_{p=2}^{P} \frac{\nu_p}{\gamma_g - 1} \bar{g}_{ij}^{1/\gamma_g} \omega_p(\bar{v})^{1/\gamma_g} \left[1 - \sum_{p'=2}^{P} \frac{\nu_{p'}}{\nu_p} \omega_{p'}(\bar{v})\right] s_{pj}^{1-\frac{1}{\gamma_g}} \left(\bar{L}^{-\rho_p}\right)^{1-\frac{1}{\gamma_g}} \\
&= \frac{\partial \ln(v_{ij})}{\partial s_{pj}} \sum_{p=2}^{P} \frac{\nu_p}{\gamma_g - 1} \bar{g}_{ij}^{1/\gamma_g} \omega_1(\bar{v})^{1/\gamma_g} \left[1 - \sum_{p'=2}^{P} \frac{\nu_{p'}}{\nu_p} \omega_{p'}(\bar{v})\right] s_{pj} s_{1j}^{-\frac{1}{\gamma_g}} \left(\bar{L}^{-\rho_1}\right)^{1-\frac{1}{\gamma_g}} \\
&= \frac{\partial \ln(v_{ij})}{\partial s_{pj}} \frac{\bar{g}_{ij}^{1/\gamma_g}}{\gamma_g - 1} \omega_1(\bar{v})^{1/\gamma_g} s_{1j}^{-\frac{1}{\gamma_g}} \left(L_j^{-\rho_1}\right)^{1-\frac{1}{\gamma_g}} \sum_{p=2}^{P} \nu_p \left[1 - \sum_{p'=2}^{P} \frac{\nu_{p'}}{\nu_p} \omega_{p'}(\bar{v})\right] s_{pj} \\
&= \frac{\partial \ln(v_{ij})}{\partial s_{pj}} \frac{\bar{g}_{ij}^{1/\gamma_g}}{\gamma_g - 1} \omega_1(\bar{v})^{1/\gamma_g} s_{1j}^{-\frac{1}{\gamma_g}} \left(\bar{L}^{-\rho_1}\right)^{1-\frac{1}{\gamma_g}} \sum_{p=2}^{P} \nu_p (s_{pj} - \omega_p(\bar{v}))
\end{aligned}
$$

We obtain a similar expression for the derivative with respect to t_j :

$$
\frac{\partial \bar{g}_{ij}}{\partial \ln(v_{ij})}\frac{\partial \ln(v_{ij})}{\partial t_j} = \frac{\partial \ln(v_{ij})}{\partial t_j} \frac{\bar{g}_{ij}^{1/\gamma_g}}{\gamma_g - 1} \omega_1(\bar{v})^{1/\gamma_g} s_{1j}^{-\frac{1}{\gamma_g}} \left(\bar{L}^{-\rho_1}\right)^{1-\frac{1}{\gamma_g}} \sum_{p=2}^{P} \nu_p (s_{pj} - \omega_p(\bar{v}))
$$

Hence

$$
\begin{aligned}
\frac{\partial \bar{g}_{ij}}{\partial \ln(v_{ij})}\frac{\partial \ln(v_{ij})}{\partial \mathbf{x}_j} &= B_{ij} \nabla_{\mathbf{x}_j} \ln(v_{ij}) \\
\text{with} \quad B_{ij} &= \frac{\bar{g}_{ij}^{1/\gamma_g}}{\gamma_g - 1} \omega_1(\bar{v})^{1/\gamma_g} s_{1j}^{-\frac{1}{\gamma_g}} \left(\bar{L}^{-\rho_1}\right)^{1-\frac{1}{\gamma_g}} \sum_{p=1}^{P} \nu_p (s_{pj} - \omega_p(\bar{v}))
\end{aligned}
$$

We are now ready to put everything together.

$$
\begin{aligned}
\nabla_{\mathbf{x}} V_{ij} &= \Gamma_{ij} \left[\omega_g(v_{ij}) \nabla_{\mathbf{x}} \ln g_{ij} + (1 - \omega_g(v_{ij}))\, \nabla_{\mathbf{x}} \ln u_{ij}\right] \\
\text{with} \quad \Gamma_{ij} &= \frac{1}{1 - \nu_g \omega_g(v_{ij})(1 - \omega_g(v_{ij})) \ln\left(\frac{g_{ij}}{u_{ij}}\right) - B_{ij}\omega_g(v_{ij})}
\end{aligned}
$$

$$
\begin{aligned}
\nabla_{\mathbf{x}} V_{ij} d\mathbf{x} &= \Gamma_{ij} \left[\omega_g(v_{ij}) \nabla_{\mathbf{x}} \ln g_{ij} + \left(1 - \omega_g(v_{ij})\right) \nabla_{\mathbf{x}} \ln u_{ij} \right] d\mathbf{x} \\
\nabla_{\mathbf{x}} V_{ij} d\mathbf{x} &= \Gamma_{ij} \Bigg[\omega_g(v_{ij}) A_{ij} \left[\frac{1}{\gamma_g} \ln \frac{v}{\bar{v}} \sum_{p=2}^{P} \left(\nu_p - E_{\omega_p(\bar{v})} \left[\nu_p \right] \right) + \frac{L_j - \bar{L}}{\bar{L}} \sum_{p=2}^{P} \rho_p \left(\frac{1}{\gamma_g} - 1 \right) \right] ds_p \\
&\quad + (1 - \omega_g(\bar{v})) \omega_h \left[\nu_g \ln \frac{v_{ij}}{\bar{v}} - \frac{1}{\left(\bar{t} + \overline{\left(\frac{T}{rH} \right)} \right)} \left(\frac{T_j}{r_j H_j} - \overline{\left(\frac{T}{rH} \right)} \right) \right] dt_j \\
&\quad + \underbrace{(1 - \omega_g(v_{ij})) \left(\frac{\partial \ln(1-\tau)}{\partial L_j} \nabla_{\mathbf{x}} L_j d\mathbf{x} - \omega_h \frac{\partial \ln r_j}{\partial t_j} \big|_{L_j} dt_j \right)}_{GE_{ij}} \Bigg]
\end{aligned}
$$

with $GE_{ij} = (1 - \omega_g(v_{ij})) \left(\frac{\partial \ln(1-\tau)}{\partial L_j} \nabla_{\mathbf{x}} L_j d\mathbf{x} - \omega_h \frac{\partial \ln r_j}{\partial t_j} \big|_{L_j} dt_j \right)$.

E Calibration Details

E.1 Elasticity Estimates

Table E.12: Estimates for α_g and ν_g

	$\ln\left(t_j + \frac{T_j}{r_j H_j}\right)$
$\ln v^{median}$	-1.995***
	(0.0973)
Constant	17.74***
	(0.986)
N	2465

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Bootstrap standard errors in parentheses.

Sample: urban municipalities, 2018.

E.2 Income: Details

Next, we estimate the income in each location by household type. If we observed average income by type in each location, we could estimate y_{ij} directly. Unfortunately, we observe only average and median income. Given these data, we assume that income of type i in location j is given by the product of a type-specific effect (x_i) and a location-specific effect (z_j):

$$y_{ij} = x_i z_j. \tag{41}$$

Our approach to estimate this set of $I + J$ parameters is to express the average and median income as a function of the average and median individual type in each place:

$$y_j^M = z_j x_j^M \quad \text{with} \quad x_j^M(\mathbf{x_j}) = \sum_{i \in I} \mathbf{1}_{\text{i is median in j}} x_i$$
$$y_j^A = z_j x_j^A \quad \text{with} \quad x_j^A(\mathbf{x_j}) = \sum_{i \in I} \mu_{ij} x_i$$

where μ_{ij} and whether type i is median in j are observable. We then eliminate z_j by taking the ratio and estimate the following linear relation with nonlinear least square; $\mathbf{x} = \text{argmin}_{x_H} \sum_{j=1}^J w_j \left(\ln \left(\frac{y_j^A}{y_j^M} \right) - \ln \left(\frac{x_j^A(\mathbf{x})}{x_j^M(\mathbf{x})} \right) \right)^2$ where w_j are the population weights. Given that there is one degree of freedom, we normalize the low-education type, $x_L = 1$. We then estimate z_j by matching the median income

$$z_j = \frac{y_j^M}{x_j^M}.$$

E.3 Construction of Model-Consistent Objects

Model-consistent indirect utilities, v_{Mj}. To bring these regressions to the data, we need to identify the households with median utility in each commune and then construct its indirect utility, v_{Mj}. A natural candidate for the median voter is the household with median income. This is however true only if the function $v_{jM}(y)$ is strictly monotonic in y. A sufficient condition would for example be that the weight on the public goods is small $\omega_g \simeq 0$ so that private utility and hence income dominates over the utility for public goods. Our approach is to guess that this condition holds and to verify that it is true in the estimated model.

Guess 1. *The household with median indirect utility v_j is also the household with median income.*

We then construct v_{jM} in a model-consistent way. Using the expression of the utility given by (24) and the optimal price index for the public good of the median household given by (26), the following lemma reports the expression for the median indirect utility in terms of observable variables and parameters.

Lemma 4. *In equilibrium, the indirect utility of the median-income household in* *location j, v_{Mj}, is given by*

$$v_{Mj} = \left(\frac{t_j r_j H_j + T_j}{q_{Mj}}\right)^{\hat{\omega}_g} \left(\frac{y_{Mj}(1-\tau)}{((1+t_j)r_j)^{\omega_h}}\right)^{1-\hat{\omega}_g} \tag{42}$$

$$\textit{with} \quad \hat{\omega}_{gj} = \frac{\omega_h(t_j r_j H_j + T_j)}{r_j H_j + \omega_h(t_j r_j H_j + T_j)} \tag{43}$$

$$q_{Mj} = \left(\sum_{p=1}^{P} \omega_p(v_{Mj}) \left(L_j^{-\rho_p}\right)^{\gamma_g - 1}\right)^{\frac{1}{1-\gamma_g}} \tag{44}$$

where our estimate for $\omega_g(v_{Mj})$, given by equation (43), comes from the optimality condition of the median voter.

To address the issue that the expression for v_{Mj} also depends on the parameters we seek to estimate α_p, ν_p and ρ_p, our estimation strategy is akin to GMM. We start with a guess for these parameters. We construct q_{Mj} and v_{Mj} accordingly, and we run the two regressions (32) and (33). We use the estimates of these regressions to update our guess and we iterate until convergence. In practice, convergence is very fast since these parameters only affect the price index.

Model-consistent tax rates. When mapping property tax rates in France to our model, two key challenges arise. The first challenge stems from the existence of two separate tax instruments: a residential tax that applies to all households and a property tax that exempts renters. While both effectively tax housing, our model, for the sake of tractability, assumes a single instrument and ignores the household's decision to rent or own. By assuming that the property tax burden is entirely passed on to renters, we can consolidate these two instruments into a single tax, consistent with our model's assumptions.

The second challenge is that the tax base in the model is the spending on housing (a flow) while it is the value of the property in the data (a stock). An additional complication is that the property value considered for tax purposes is not the actual market value but property assessments dating back from the 1970s. These assessments have not been updated since, except for municipality-level and nationwide adjustments. As a result, the tax base is likely to be unrepresentative of current housing values, leading to a discrepancy between statutory tax rates and the effective tax rates experienced by households.

To address these challenges, we construct a model-consistent tax rate which ensures that tax revenues in the model are equal to those in the data: $\text{Tax Revenues}_j = t_j r_j H_j = \frac{t_j}{1+t_j}[(1+t_j)r_j H_j] = \frac{t_j}{1+t_j}\omega_h \times \text{Total Household Income}_j$. This gives

$$t_j = \frac{\text{Tax Revenues}_j}{\omega_h \text{Total Household Income}_j - \text{Tax Revenues}_j} \tag{45}$$

and the model-consistent tax base is given by

$$r_j H_j = \frac{\omega_h \times \text{Total Household Income}_j}{1+t_j}$$

F Additional Model Figures

This appendix provides additional evidence on the equilibrium adjustments underlying the welfare effects of decentralization. Figures F.14–F.16 report changes in population, housing-market outcomes, local public finances, the public-good price index, and ex post welfare across municipalities grouped by initial population, initial median income, and welfare gains. Figure F.17 presents the joint relationship between welfare gains, municipal population, and median income.

G Allocation of Municipal Transfers in France

Table G.13: Structural Components of France's Municipal Transfer System (DGF)

Component	Allocation Rules	Measurement	Reforms/Exclusions
Flat-Rate Endowment	- Universal entitlement - Progressive reduction for FP >85% national avg - Population weighting: DGF pop = Census + 2nd homes	- Annual population updates (INSEE + cadastral data) - FP = 3-yr avg taxable resources per household - Curtailing: Logarithmic reduction above threshold	2015: Component consolidation 2023: CPS transfer to EPCI Annual indexation formula
Urban Solidarity (DSU)	- 5k-9,999 pop: Top 10% SI - $\geq$10k pop: Top 67% SI - Exclusion: RPU >2.5× stratum avg - SI = 0.3FP + 0.25Inc + 0.3HA + 0.15SH	- FP: Rolling 3-yr fiscal capacity - Inc: Median taxable household income - HA: Recipients/Total population - SH: Social units/Housing stock	2017: SI reweighting (Inc$\uparrow$) 2016: Threshold tightening Progression guarantees
Rural Solidarity (DSR)	- Town-centers - Equalization: FP <2x stratum avg - Target: Synthetic index (0.7FP + 0.3Inc) - <10k pop (exceptions per L.2334-22-2)	- Service centrality: 15% canton pop - FP: Departmental comparisons - 3-yr income mobility adjustment	2011: Target fraction added 2022: Rural exception for >10k 90-120% allocation bounds
National Equalization (DNP)	- Standard: FP $\leq$105% + TE $\geq$100% - Cities >10k: FP $\leq$85% + TE $\geq$85% - Derogations: Max tax rates - Main vs. increase shares	- FP: Post-reform tax capacity - TE = (Collections/Potential)/Avg - Progressivity: 0.5-1.0 multipliers	2004: DNP integration 2010: Post-TP reform adjustments Dual allocation rates

Key: FP = Financial Potential, Inc = Mean Household Income, HA = Housing Assistance, SH = Social Housing, SI = Synthetic Index, TE = Tax Effort, RPU = Own Resources, EPCI = Intercommunal Entities.
Sources: CGCT Articles L.2334-20 to L.2334-22-2; Finance Laws 2010-2023; DGCL technical guides

H Transfers rule

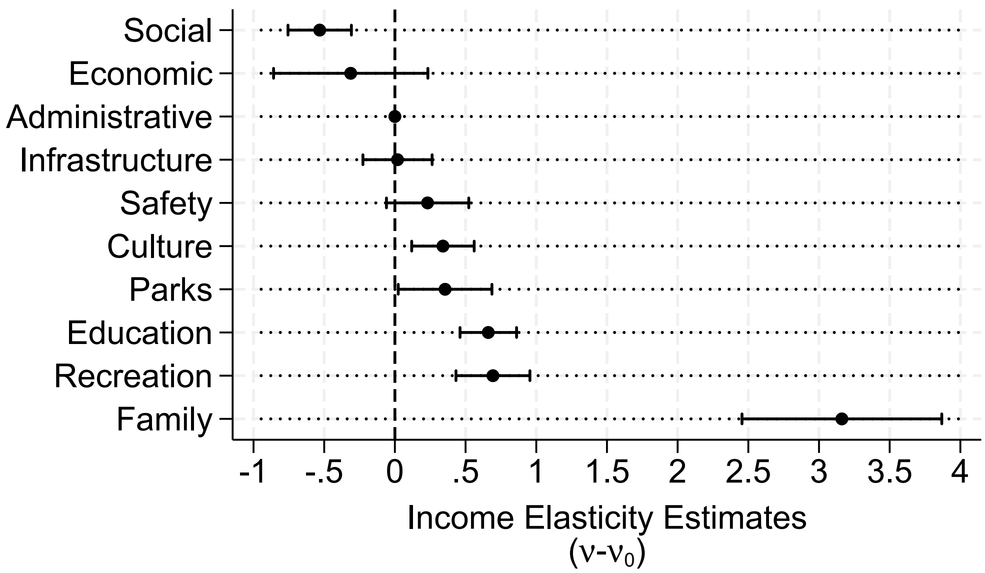
Table H.14: Reduced-form Transfer Rule

	(1)
	Log Transfer
Log Population	1.533***
	(0.0277)
Log Mean Income	-0.393***
	(0.0174)
Constant	4.253***
	(0.276)
Municipality FE	✓
Year FE	✓
Observations	66,506

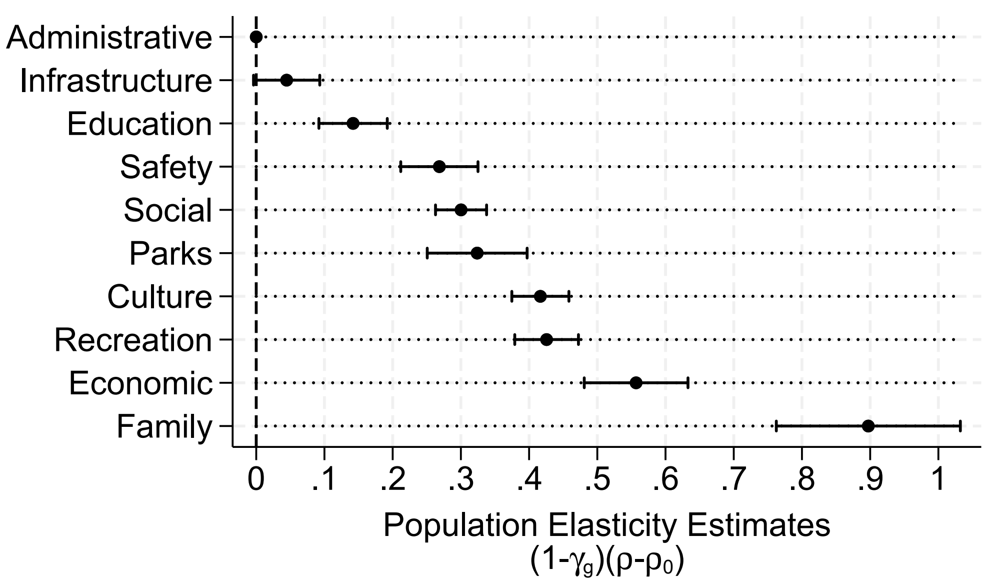
* $p<0.10$, ** $p<0.05$, *** $p<0.01$. Robust standard errors (clustered at the municipality level) in parentheses. Sample period: 2018–2024.

Figure E.12: Elasticity Estimates

(a) Income Elasticities



(b) Population Elasticities



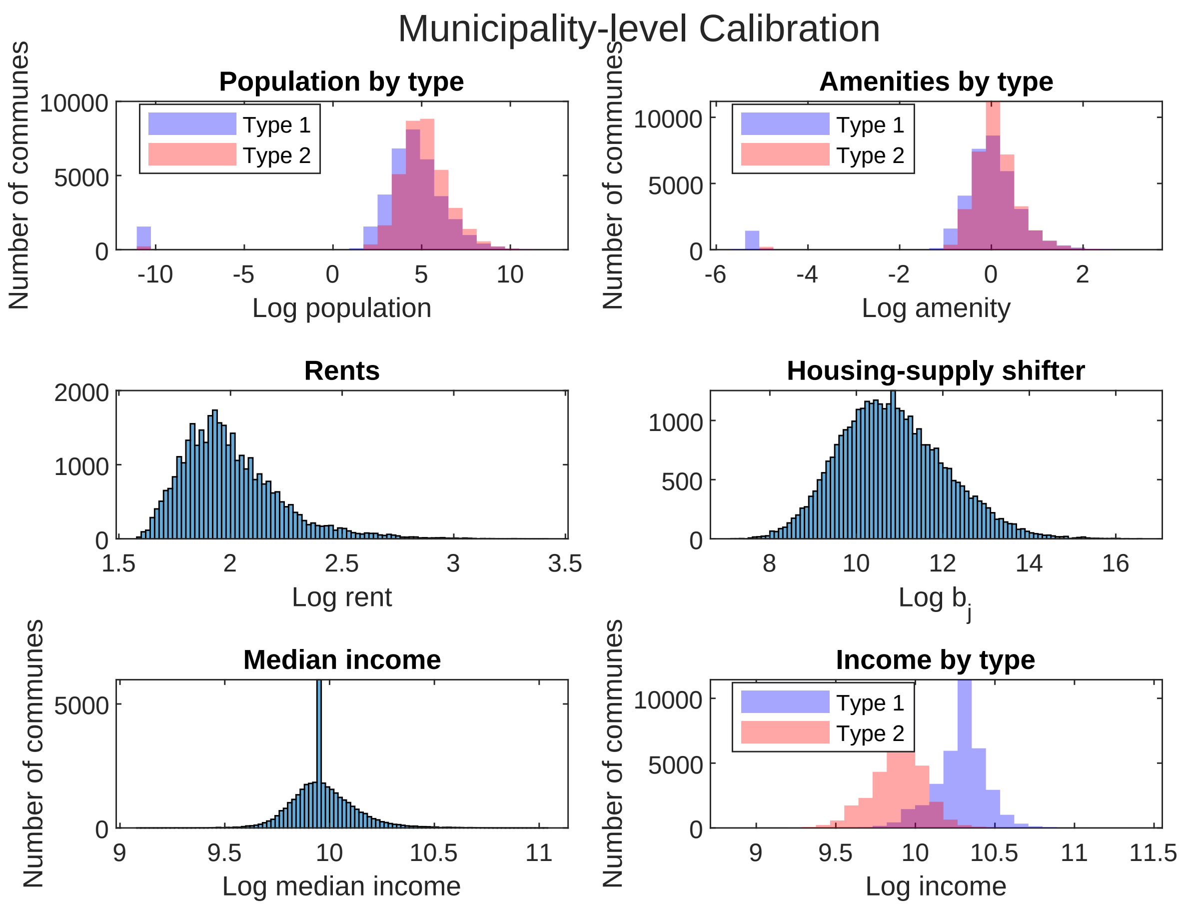


Figure F.13: Calibrated Parameter Distributions

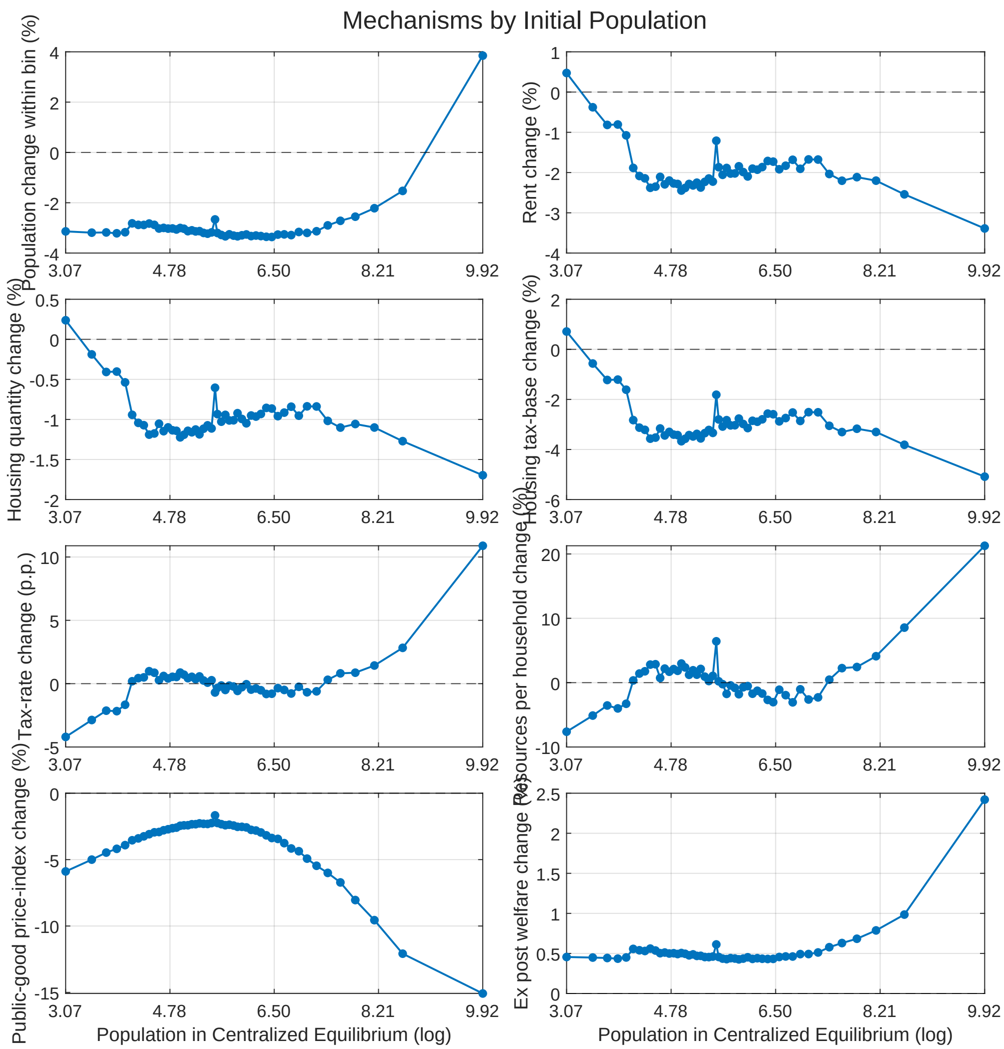


Figure F.14: Equilibrium Adjustments by Initial Municipal Population

Notes: Municipalities are grouped into 50 equal-count bins based on their population in the centralized equilibrium. The horizontal coordinate is the log of mean initial population within each bin. The population panel reports the percentage change in the total population of the bin. All other panels report initial-population-weighted mean changes within each bin. Changes in rents, housing quantities, housing tax bases, public resources per household, and welfare are expressed in percent; changes in property-tax rates are expressed in percentage points. Public resources are defined as property-tax revenue plus transfers per household.

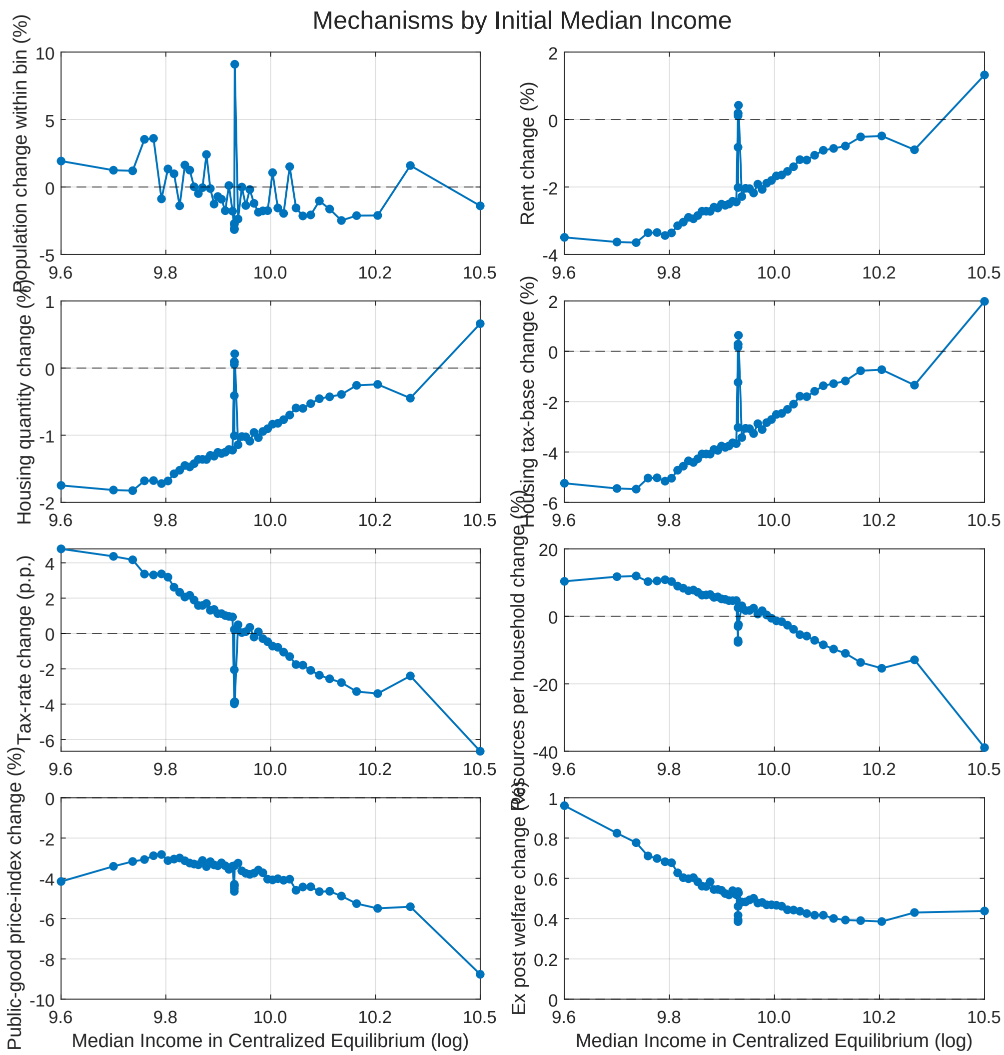


Figure F.15: Equilibrium Adjustments by Initial Median Income

Notes: Municipalities are grouped into 50 equal-count bins based on median income in the centralized equilibrium. The horizontal coordinate is the log of mean initial median income within each bin. The population panel reports the percentage change in the total population of the bin. All other panels report unweighted municipality-level mean changes within each bin. Changes in rents, housing quantities, housing tax bases, public resources per household, and welfare are expressed in percent; changes in property-tax rates are expressed in percentage points. Public resources are defined as property-tax revenue plus transfers per household.

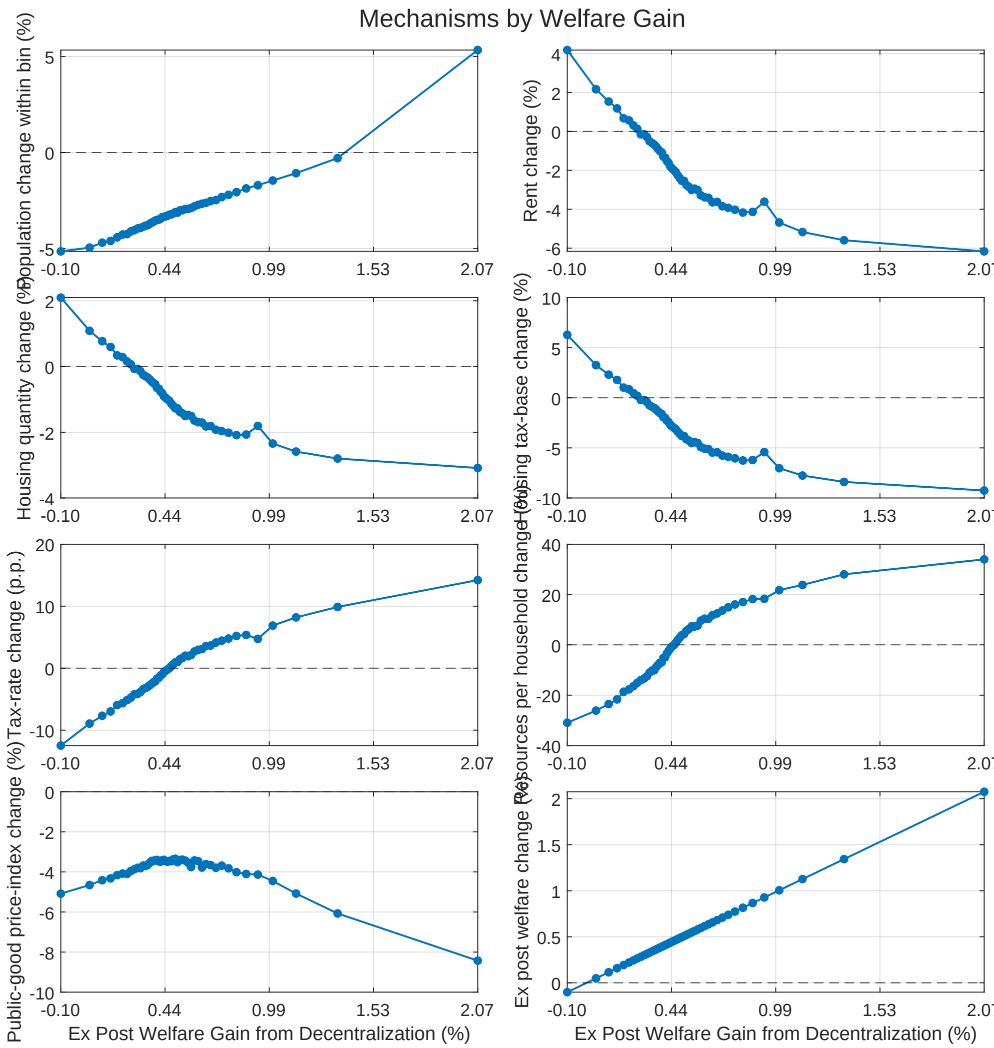


Figure F.16: Equilibrium Adjustments by Municipality-Level Welfare Gain

Notes: Municipalities are grouped into 50 equal-count bins based on their ex post welfare gain from decentralization. The horizontal coordinate is the mean welfare gain within each bin. The population panel reports the percentage change in the total population of the bin. All other panels report unweighted municipality-level mean changes within each bin. Changes in rents, housing quantities, housing tax bases, public resources per household, and welfare are expressed in percent; changes in property-tax rates are expressed in percentage points. Public resources are defined as property-tax revenue plus transfers per household.

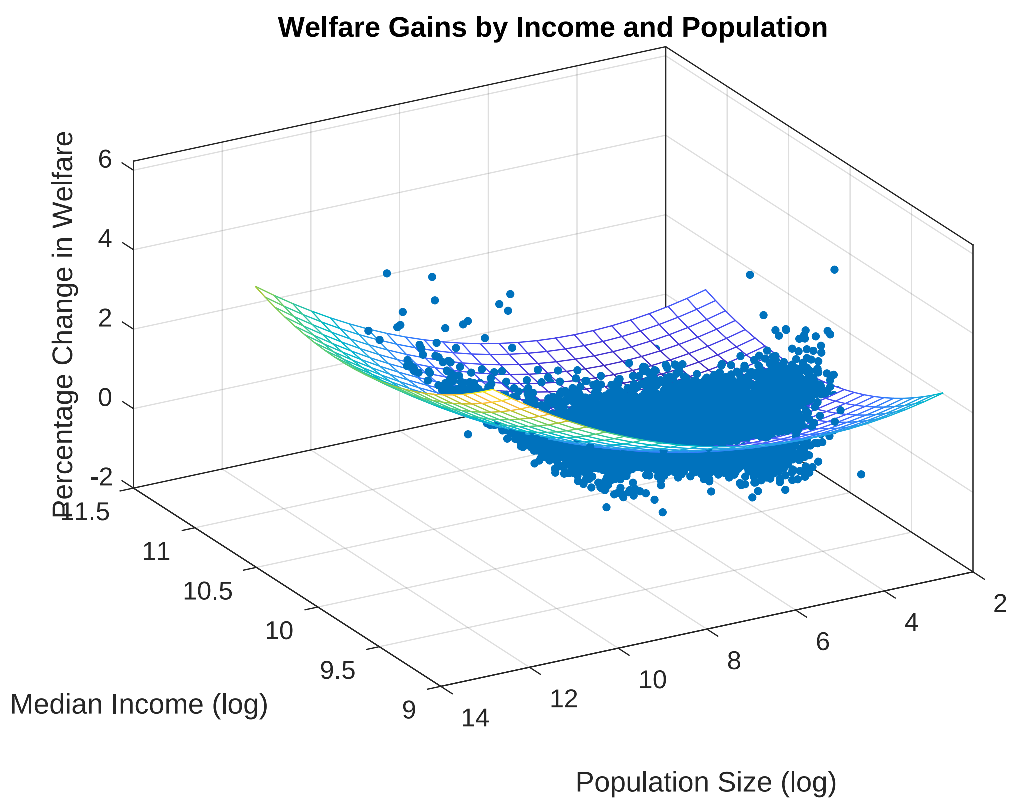
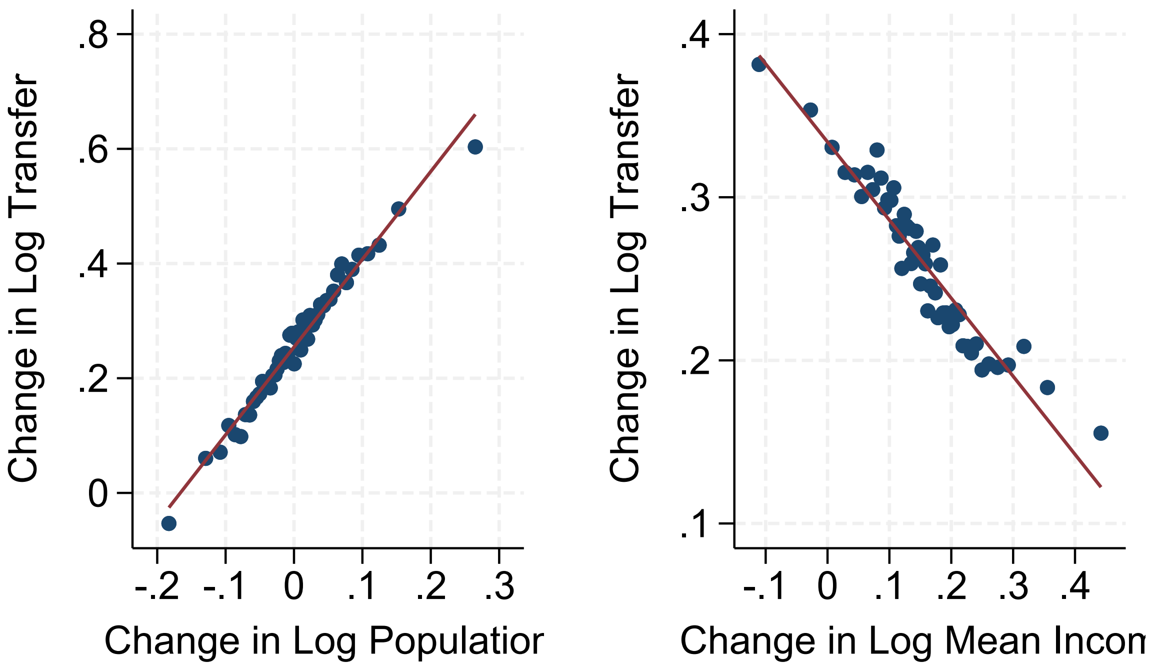


Figure F.17: Welfare Gains by Municipal Population and Median Income

Notes: Each point represents a municipality. The vertical axis reports the municipality-level ex post welfare gain from decentralization. The two horizontal axes report log median income and log population. The mesh displays the fitted quadratic relationship between welfare gains, log median income, and log population, including separate squared terms for income and population.

Figure H.18: Partial Regression Plots for Transfer Rule



Note: These figures illustrate the relationship between changes in municipal transfers and changes in population (left) and mean income (right). Each plot presents a binned scatterplot, where both axes reflect residualized values after controlling for year fixed effects, municipality fixed effects, and the excluded explanatory variable.