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On the Impact of Public Housing on Income Segregation in France

Kevin Beaubrun-Diant and Tristan-Pierre Maury

ABSTRACT This article provides a geographic analysis of the contribution of public housing to income segregation in France from 1999 to 2015. The analysis is conducted with several segregation indices and at different geographic scales. Surprisingly, it appears that while home tenure (public vs. private housing) segregation has been decreasing, income segregation has been rising. With segregation decomposition techniques, we provide evidence that this is partly due to an increasing concentration of low-income households in public housing, which cancels out the effect of the spatial dispersion of public housing. Indeed, while public housing has become more homogeneously distributed geographically, which should help to reduce income segregation, the distribution of income within public (and private) housing has changed: households living in public housing were poorer in 2015 than in 1999. We also provide evidence of a sorting effect—the process of allocating public housing that is not random—so that the richest neighborhoods or municipalities receive wealthier-than-average public tenants.

KEYWORDS Income segregation • Public housing • Spatial decomposition • Poverty • Home tenure

Introduction

Socioeconomic segregation refers to the separation of populations into different districts or neighborhoods according to their socioeconomic characteristics. A high level of segregation means that households live in neighborhoods with a socioeconomic profile similar to their own. By contrast, a low level of segregation indicates that populations with different socioeconomic profiles are living together, in the same neighborhoods. The geographic clustering of individuals with common features is a well-known phenomenon that has been documented in many countries. An abundant literature has focused on interpreting the rise and fall of socioeconomic segregation and, notably, income segregation. In the United States, several articles document the evolution in income segregation since the beginning of the 1970s (Bischoff and Reardon 2014; Jargowsky 1996; Massey and Eggers 1993; Rothwell and Massey 2010; Watson 2009; or more recently, Logan et al. 2018; Logan et al. 2020; Reardon et al. 2018). In France, while many studies assess the residential segregation of occupational categories

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(Préteceille 2006) or immigrants (Safi 2006, 2009; Shon 2009), we are aware of only two large-scale studies dealing with income segregation: a longitudinal study in large French cities (Vincent et al. 2015) and a French–U.S. comparison in large cities (Quillian and Lagrange 2016). Their main conclusion is that income segregation in France is low (compared to the United States) and relatively stable.

Several factors may be related to the observed levels of income segregation and could contribute to differences in segregation across cities or countries, including racial or ethnic neighborhood segregation (Massey and Denton 1993), household income inequality (Reardon and Bischoff 2011), and age or educational attainment (Bischoff and Reardon 2014). Other important factors may be found in the large U.S. literature on urban or housing policies and their impact on inequality, neighborhood change, and poverty concentration. Two types of policies are particularly important: zoning laws and subsidized housing. Researchers have examined whether zoning laws contribute to neighborhood change. Density zoning limits housing supply and has a strong impact on the structure of the housing stock (e.g., lower supply of multifamily housing; Owens 2015) and on household mobility (e.g., exclusion of low-income families; Gyourko et al. 2008). Hence, local income is strongly positively related to the degree of local land use regulation (Pendall et al. 2006), with affluent households being more likely to live in the most heavily regulated areas. Density zoning therefore raises income segregation (Lens and Monkkonen 2016; Rothwell and Massey 2010).

Government housing assistance programs are another factor contributing to income segregation. In the United States, housing assistance typically takes two forms: public housing development and housing vouchers, but the latter became much more popular as public housing development came to be seen as a potentially segregationist tool (Ellen et al. 2016; Massey and Kanaiaupuni 1993; Owens 2016; Tach and Dwyer Emory 2017). In France, the situation is rather different: public housing development remains a key policy objective. More than 15% of French households live in public housing, and this share has been stable for the last 20 years (while no more than 5% of American households receive housing assistance). Moreover, a national law came into force in December 2000 requiring large French municipalities with few public housing units to build more of them to reduce socioeconomic segregation (see Bono et al. 2013). Thus, in France, public housing is seen as an effective tool for combating segregation. However, despite the importance of public housing, very few studies have sought to measure its impact on socioeconomic segregation. Some studies have focused on the impact of public housing on immigrant segregation (e.g., Verdugo 2011), while others have measured home tenure segregation (the geographic separation of public vs. private housing) (Gobillon and Vignolles 2016; Verdugo and Toma 2018). Notably, none measure the contribution of public housing to income segregation. Our study is the first contribution attempting to address this issue.

We aim to assess to what extent income segregation in France is related to the spatial distribution of public housing. We work with exhaustive administrative data and use several rank-order segregation indices, which are strongly decomposable and can be broken down into subgroups. We split our analysis into several geographic levels: the national level, a medium level (departments and municipalities), and a small-scale level (land registry units). Segregation is measured at each level, and the contribution of the medium- and small-scale levels to the national segregation level is assessed.

There are several ways public housing could shape income segregation. First, supposing that relative income per sector (public vs. private) remains the same, a public

housing construction policy may affect income segregation. If new housing is built in wealthier areas (*public housing dispersion*), this reduces segregation, unless we observe a flight effect of wealthy households from these areas. If new public housing is concentrated in already poor areas, this may leave segregation unaffected, or may even increase it. Second, we need to measure changes in public tenants' income relative to the private sector. If the public housing policy has been targeted to accommodate wealthier households, then its impact will depend on the geography of public housing: if the (richer) newcomers are housed in rich neighborhoods, then the policy may ultimately reinforce segregation. In parallel, a general impoverishment of public housing (*public housing residualization*) can have contrasting effects on segregation, depending on the nature of public housing dispersion. If the impoverishment primarily concerns the new richer or the old poorer neighborhoods, segregation will decrease or increase. It is therefore crucial to determine how these different effects (*dispersion*, *residualization*) interact to understand the evolution of segregation.

In the current study, we first measure the evolution of home tenure segregation (public vs. private) and find that it has decreased significantly since 1999. Public tenants are increasingly exposed to the rest of the population (through *public housing dispersion*). Then, we measure *income* segregation and show that it has slightly increased. This rise is more pronounced if we focus on low-income households: they are increasingly isolated from the rest of the population. We are therefore confronted with an apparent contradiction: public tenants are increasingly spread throughout France's national territory, while poor households are increasingly concentrated in certain areas.

In a third step, we proceed with a cross-analysis of home tenure and income segregation, using decomposition techniques to understand the contradiction between rising income segregation and falling home tenure segregation. We measure the contribution of public housing to income segregation and provide evidence that it doubled between 1999 and 2015. Neighborhoods are specializing according to their share of public housing: those without public housing are becoming richer, and those that have public housing are getting poorer, while impoverishment accelerates with the share of public housing. Public housing is becoming increasingly homogeneous and poor in France, and this exacerbates segregation. Despite its dispersion, public housing remains unevenly distributed throughout the country. Low-income households in public housing are still more likely to live with many other public tenants in their neighborhoods, and the impoverishment of public housing creates segregation because of this nonhomogeneous distribution. If public housing were distributed evenly, the drop in income would be geographically homogeneous and would not create additional segregation. But because of the remaining (though decreasing) home tenure segregation, the impoverishment of public housing contributes to the emergence of enclaves of poverty and thus raises segregation. The two effects conflict with each other: on the one hand, the number of neighborhoods with an overconcentration of public housing is decreasing (*public housing dispersion*); on the other hand, these neighborhoods are increasingly separated from the rest of the country in terms of income (*public housing residualization*). We show that quantitatively the second effect is at least as important as the first, contributing to an overall increase in income segregation. These results are in line with those obtained in other countries (Pearce and Vine 2014): the segregative consequences of residualization have already been described in the literature (Andersson and Magnusson Turner 2014).

Moreover, we identify a *sorting* effect that has also contributed to an increase in segregation. Public housing allocation processes have slowed the mixing of populations

with different incomes. To assess this effect, we reallocate tenants within the public housing stock with simulation techniques. Movers into public housing are randomly reallocated to another public housing unit; this reallocation procedure is made at different geographic levels. All simulations, even local ones, lead to a significant reduction in segregation. The public housing allocation procedures are therefore not random and contribute to segregation. Hence, our overall conclusion is that the combination of the homogenization/impoverishment and sorting effects have prevented public housing from contributing to the reduction of income segregation.

Data and Context

Data

We use an exhaustive administrative data source—FILOCOM (dwelling files per municipality, CGDD-SDES/DGFiP Filocom)—based on tax files, which provides nearly complete information on individual household characteristics between 1999 and 2015: income,[1] composition, home tenure, and location and characteristics of the dwelling. Data are available for all odd-numbered years from 1999 to 2015. We rarely use household income directly, but rather income per consumption unit in order to take the household size into account.[2] Regarding the home tenure status, we focus on the binary distinction between public tenants and the rest of the population (private tenants and owner-occupiers are considered together).

In 2015, the average annual income per consumption unit in France was €21,199. The top 10% of households correspond to an income above €46,578 per consumption unit, while the bottom 10% correspond to an income below €7,025. The 10%/90% ratio was therefore equal to 6.63. This measure of income inequality was rather steady over the 1999–2015 period (it was 6.5 in 1999).

We work with three nested geographic levels: the department (*département*), the municipality (*commune*), and the land registry unit (*section cadastrale*). The department (the broadest level) is an administrative division of France, as well as being a local authority.[3] Part of the subsidies for the construction of public housing are financed by the departments. The municipalities are the intermediate level of our analysis; France comprises more than 36,000 municipalities. As explained in the following, municipalities are key players in public housing policy. Studying segregation at the intermunicipal level is therefore particularly relevant: some municipalities may "specialize" in public housing, while others provide only private housing, thereby reinforcing segregation. Finally, the smallest geographic scale we study is the land registry unit (LRU). An LRU is an administrative submunicipal division designed to ease the process of collecting local taxes. The boundaries of an LRU are demarcated by natural or artificial limits (roads, railways, rivers, etc.), and on average, an LRU consists of about 300 inhabitants.

[1] Exact gross income is reported by each household to the tax authorities before taxes and transfers.

[2] Using the income per consumption unit is fully consistent with the previous literature on the French context (see, for instance, Goux and Maurin 2012). We use the EUROSTAT scale to calculate the number of consumption units in a household: 1 point for the first adult in the household, an additional half point for each person over 14 years old, and an additional 0.3 points for each person aged 14 or younger.

[3] Metropolitan France is made up of nearly 100 *départements*, with an average population of 650,000.

The LRU does not correspond to any political authority. This smallest scale allows us to assess the evolution of segregation *within a municipality*. For example, one could envisage situations whereby a municipality, to comply with the obligations set by the State, decides to build public housing within the municipality, but in a specific zone (one or several contiguous LRUs that already have a high proportion of public housing). If the municipality had previously little public housing compared to the national average, then the intermunicipal segregation would be lowered by this decision, but intramunicipal segregation would grow, as public tenants are concentrated in a given area of the municipality. In this case, the total effect on segregation is uncertain, and it is therefore crucial to distinguish the intermunicipal level from the intramunicipal level.

The French Context

Public housing is particularly important in France, accommodating between 15% and 16% of the population. By public housing, we mean here exclusively public rental housing, that is, dwellings with capped rents. Eligibility for public housing and the maximum rent applicable are determined by national rules that depend on household characteristics (maximum income depending on household size) and the dwelling location. Given the cost ceilings in public housing, rents are much lower than those in the private sector. In 2017, for instance, rents in public housing were approximately 30% lower than in the private sector for comparable dwellings.

In France, the construction and financing of public housing rely on a number of actors: the French State (i.e., central government), the departments, the municipalities, and social landlords. Social landlords may be public or private organizations and are responsible for the construction and management of public housing. For building public housing, they receive financing from a public state bank at very attractive subsidized interest rates. In exchange for such support and other tax exemptions, they incur public service obligations.

While social landlords are key players in the construction of public housing, the role played by municipalities should not be neglected (Chapelle and Ramond 2018). Municipalities draw up Local Urban Plans (PLUs), which contain guidelines for a municipality's development over the next 10 years, in particular through the processing of building and demolition permits. In addition, municipalities have a preemptive power: they have the authority to buy up properties currently on the market and to convert them into public housing. Moreover, municipalities often act as guarantors of the loans granted to landlords (in which case they have a right of control over housing programs financed by such loans).

The State and the departments also play a role in the construction of public housing. The State may decide to grant tax cuts (reduced VAT and tax exemptions) for public housing construction programs, and departments participate in the construction of public housing through direct subsidies to social landlords. Departments (or municipalities) may also ensure the distribution of State funds (i.e., they are delegated to exercise State authority).

The criteria for accessing public housing are rather complex: the household must apply to a social landlord or municipality, whereupon the applicant's eligibility will be determined on the basis of income (via income ceilings depending on household size). Until the application is filled, the household will be placed on a waiting list. The decisions

concerning the allocation of public housing are fragmented: one third of newly built public housing is assigned to municipalities' quotas (i.e., they decide which households these housing units are assigned to), another third is assigned to the State (and sometimes delegated to the departments), and the last third is assigned to social landlords. This allocation fully justifies our decision to analyze the evolution of segregation in France at different geographic levels simultaneously: national, departmental, and municipal.

Methods

Our methodological approach is essentially descriptive. We identify the main trends in segregation (home tenure and income) and break it down for different geographic levels. We use new decomposition and simulation techniques to identify correlative patterns between variables related to public housing and income segregation. While descriptive, these innovative techniques nevertheless allow us to discuss the role of certain variables or processes on segregation (e.g., the mode of allocation of public housing). Our main causal analysis will discuss the effect of the Law on Solidarity and Urban Renewal (SRU Law; *Loi Solidarité et Renouvellement Urbain*): we exploit the geographic discontinuities of the SRU Law to assess its impact on income segregation.

There are many segregation indices, the characteristics of which may strongly differ. For the purposes of this study, we have very specific needs regarding the desirable properties of the segregation index. First, we rely on rank-order income segregation indices (Reardon and Bischoff 2011). Income is a continuous variable that may be broken down into ordered groups, and we wish to build an income segregation index that integrates the ordered nature of these groups. Second, we want to study segregation at several levels simultaneously, so we must take into account the decomposability properties of the index.

For a given year, let N be the total number of households in France. This population is divided into K units (i.e., K LRUs) with N^k the number of households in unit k ($k = 1, \ldots, K$). Let p denote the income percentile rank. For each value of p, we dichotomize the income distribution and calculate the segregation between households with income rank less than p and households with income rank greater than p. h_p is the entropy level:

$$h_p = p \ln\left(\frac{1}{p}\right) + (1-p)\ln\left(\frac{1}{1-p}\right). \tag{1}$$

We compute the mutual information index at rank-level p, M_p:

$$M_p = h(p) - \sum_{k=1}^{K} \frac{N^k}{N} h(p^k), \tag{2}$$

where p^k is the proportion of households with income rank less than p in unit k. M_p summarizes the evenness of distribution of the two groups (those below p and those above p): it compares the local distribution of the two groups (in each unit) to their national counterpart (p and $1 - p$ by construction). The M_p index will be zero in the absence of segregation, that is, if the size of the two groups is p and $1 - p$ everywhere. By contrast, the index will have its maximum value if segregation is total, that is, if

all the neighborhoods accommodate only one group. The main advantage of the M_p index is that it can break down segregation into different groups in an additive way. For instance, we may decompose the income segregation in France according to the share of public housing in each neighborhood. In this way, we can measure the contribution of public housing to income segregation. The M_p index will be computed for different values of p: 10%, 20%, 50%, 80%, and 90%. $M_{10\%}$ or $M_{20\%}$ measures the segregation of the poor (*poverty indices*): the extent to which low-income (bottom 20%) or very-low-income (bottom 10%) households are evenly distributed. $M_{80\%}$ or $M_{90\%}$ measures the segregation of high-income households (the richest 20% or 10%) (*affluence indices*). $M_{50\%}$ measures the extent to which the poorest 50% live separated from the richest 50%.

In addition to the mutual information indices, we calculate the rank-order information theory index H^R (Reardon and Bischoff 2011):

$$H^R = 2\ln(2)\int_0^1 M^*(p)\,dp, \tag{3}$$

where $M^*(p)$ is the equivalent of the formula for M_p given in Eq. (2), but with base-2 logs instead of natural logs (in Eq. (1)). The H^R index is therefore very close to the mutual information indices, but it summarizes them in a single measurement over the entire spectrum of the p percentiles. The normalized H^R index is 0 if there is no segregation and equal to 1 if segregation is maximal. Given that the mutual information indices are decomposable, it is easy to show that the H^R index is also decomposable. We use H^R as our benchmark, which we will complement with the various mutual information indices, the latter allowing us to zoom in on certain income groups.

We use two other complementary indices. First, the Atkinson A_p index, which also measures the degree of evenness of the income distribution. This index is not decomposable, but it is *composition invariant* (CI), which M_p and H^R are not (Frankel and Volij 2011). The CI property ensures that the time evolution of A_p is interpretable. Second, we consider the exposure index E_p, which is an index of exposure (or, conversely, isolation) instead of evenness. E_p measures to what extent members of a given group are exposed to their own group rather than to members of other groups.

Results

Descriptive Findings

In 2015, there were 28.56 million primary residences in France. Of these, 4.36 million were public rental dwellings (15.22%). The remaining 84.78% was made up of private rental dwellings (around 27%) and owner-occupier homes (around 58%). The rate of public housing has hardly changed in 16 years: the percentage of public tenants was 15.91% in 1999.

Table 1 describes the evolution of income distribution (per decile) according to home tenure from 1999 to 2015 (in waves of four years). The share of private tenants and homeowners in the bottom 10% of incomes is much lower than the share of public tenants (8.17% vs. 19.58% in 1999); the gap was even wider in 2015 (7.37% vs. 24.65%). Public tenants thus became relatively poorer over the time period considered.

Table 1 Income distribution according to home tenure, France, 1999–2015

	1999		2003		2007		2011		2015	
Decile	Public Tenant	Private Sector	Public Tenant	Private Sector	Public Tenant	Private Sector	Public Tenant	Private Sector	Public Tenant	Private Sector
D1	19.58	8.17	20.94	7.99	21.50	7.97	22.73	7.85	24.65	7.37
D2	16.15	8.79	16.99	8.67	17.31	8.67	18.04	8.61	19.62	8.32
D3	13.68	9.27	13.75	9.28	13.92	9.27	14.02	9.28	14.20	9.22
D4	11.74	9.65	11.85	9.64	11.77	9.66	11.55	9.71	11.42	9.73
D5	10.49	9.89	10.69	9.87	10.70	9.87	10.26	9.94	9.51	10.08
D6	9.44	10.11	8.90	10.20	8.59	10.25	8.14	10.32	7.51	10.45
D7	7.62	10.47	7.09	10.55	6.86	10.57	6.40	10.62	5.76	10.77
D8	5.93	10.80	5.25	10.90	5.02	10.91	4.73	10.91	4.14	11.06
D9	3.80	11.22	3.21	11.28	3.07	11.26	2.94	11.23	2.53	11.36
D10	1.57	11.63	1.34	11.62	1.25	11.58	1.19	11.53	1.02	11.63

Notes: D1 means below the first decile, D2 means between deciles 1 and 2, et cetera. Private sector indicates private tenants plus owners-occupiers. For example, in 1999, the share of public tenants with income per consumption unit below the first decile was 19.58%.

Meanwhile, their share in the top 10% declined from 1.57% to 1.02%: the latter public housing tenants have been gradually replaced by new, poorer tenants. The share of public tenants in the bottom 10% increased continuously after 1999, and this process may be linked to the evolution of the housing market, with rises in prices and rents in the private sector and the retrenchment of the poorest households into public housing. Moreover, a slight acceleration of this trend can be observed after 2007. The share of the first decile in public housing increased by 1.23 percentage points between 2007 and 2011, and by almost 2 percentage points between 2011 and 2015, compared to 0.56 percentage points between 2003 and 2007. This trend might also be attributed to a new DALO law introduced in France in 2007 (*Droit au Logement Opposable*), concerning the enforceable right to housing: households experiencing difficulties in finding decent housing can sue the French State to assert their right to housing. Since 2007, the public housing quota reserved for the State has often been used to enforce this law and thus allocate public housing to severely deprived households. The willingness of some municipalities (and social landlords) to help the most deprived households after the 2009 economic crisis by offering them public housing can also explain this impoverishment in the public sector (Desage 2013).

Home Tenure Segregation

In this section, we evaluate home tenure (public vs. private) segregation at different geographic scales. We show that it has decreased significantly since 1999, particularly at the municipal and LRU levels.[4]

We use the three indices previously presented: the mutual information index M, the Atkinson index A, and the exposure index E (exposure to households living in

[4] Additional results (on home tenure and income segregation) are available in the online technical appendix.

Table 2 Home tenure segregation from 1999 to 2015 with small-sample bias correction

Segregation Index	Geographic Level	Year					
		1999	2003	2007	2011	2015	Δ(1999/2015)
M	Department	.0107	.0127	.0128	.0141	.0139	29.90%
	Municipality	.0629	.0608	.0599	.0584	.0584	–7.15%
	Land Registry Unit	.1534	.1477	.1441	.1360	.1366	–10.95%
M^s	*Simulation (within-municipality)*	*.0772*	*.0751*	*.0747*	*.0721*	*.0720*	*−6.73%*
A	Department	.0243	.0255	.0255	.0340	.0343	41.15%
	Municipality	.1754	.1708	.1695	.1650	.1638	–6.61%
	Land Registry Unit	.4559	.4432	.4402	.4240	.4218	–7.48%
A^s	*Simulation (within-municipality)*	*.1867*	*.1820*	*.1807*	*.1785*	*.1768*	*−5.30%*
E	Department	.0256	.0266	.0268	.0333	.0336	31.25%
	Municipality	.1367	.1351	.1342	.1316	.1301	–4.83%
	Land Registry Unit	.4263	.4086	.3991	.3800	.3781	–11.31%
E^s	*Simulation (within-municipality)*	*.1404*	*.1398*	*.1396*	*.1391*	*.1391*	*−0.93%*

Notes: A simulation (within-municipality random reallocation of home tenure) was conducted to control for small-sample issues. For example, the segregation level (*M* index) in 1999 at the LRU level is .1534, and the change in percentage in the *M* index at the LRU level between 1999 and 2015 is equal to −10.95%. A zero value for each of the three indices would mean no segregation (even spatial distribution of public and private housing). The higher the value of the indices, the higher the home tenure segregation.

public housing). For the LRU level, we also calculate the level of segregation (M^s, A^s, E^s) when households are randomly reallocated into LRUs within the municipality they live in (with *simulation techniques*) to control for small-unit bias. The results are summarized in Table 2.

In 1999, using the index *M*, the level of segregation was .0107 across departments, .0629 across municipalities, and .1534 between LRUs. Thanks to the decomposability property of *M*, these three values may be compared to each other. Seventeen percent (.0107 / .0629) of segregation at the municipal level is explained by differences *across departments*, while the rest (83%) is due to differences between municipalities within the same department. Segregation at the LRU level may be split into three components: an interdepartment component (7%), an intermunicipal/intradepartment component (34%), and an inter-LRU/intramunicipality component (59%). This analysis can be refined to incorporate the *small-unit bias* with LRU-level segregation. The gap between segregation at the municipality level and at the LRU level is not entirely due to intramunicipality segregation, but also stems partly from small-unit bias. A random reallocation of households across LRUs within the same municipality would typically generate some deviation from evenness and raise segregation (segregation at the LRU level would be higher than .0629, even with a pure random reallocation), because of the small average size of municipalities. With simulation techniques, we estimate this small-unit bias (.0772) and subtract it from our within-municipalities measure of segregation (.0629). If we drop this component, we get the following split of segregation: 7.69% between departments, 45.22% between municipalities (within-departments), and 47.09% between units (within-municipalities). Thus, almost half of the segregation is local, that is, attributable to differences in the public/private distribution across LRUs in the same municipality. There is more discrepancy between the public housing shares of two randomly selected units in the same municipality

than between two randomly selected municipalities or departments. Housing segregation is therefore a local phenomenon in France. We get similar results using the indices A and E.

Home tenure segregation fell sharply between 1999 and 2015 at all geographic levels, departments excepted. If measured with M, segregation between municipalities has decreased by more than 7% since 1999 (from .0629 to .0584). The decline is even bigger—almost 11%—at the LRU level (from .1534 to .1366). These results are confirmed using the Atkinson index, which satisfies the composition invariance property and, hence, can be interpreted longitudinally. Over the period 1999–2015, the decline in segregation is relatively regular, but with a more marked decline between 1999 and 2003, and especially between 2007 and 2011 (segregation is then stable after 2011).

This general decrease in segregation may be linked to the SRU Law (see later section for a causal analysis of the effects of this law). Local disparities have narrowed, and the local rate of public housing has come closer to the national average. Municipalities initially below the national average built more public housing, and those above the average built relatively less, resulting in a more homogeneous geographic distribution of public housing. The law appears to have avoided a trap: municipalities falling short of the objectives of the law could have tried, while building public housing, to distribute these new dwellings unevenly within their jurisdiction, with the new public housing clustered in a part of the municipality and private housing in another part. Our results show that this is not the case: segregation between LRUs of the same municipality has decreased sharply since 1999.

Income Segregation

In this section, we measure income segregation at several geographic scales. We show that, unlike home tenure segregation, income segregation has increased slightly since 1999, especially segregation of low-income households. The results with the different segregation indices are summarized in Table 3.

As observed with home tenure segregation, income segregation is mostly a local phenomenon. The bulk of it comes from income gaps across neighboring municipalities or LRUs. In 2015, we find that 23.55% (i.e., .0288) of total bias-corrected income segregation with H^R occurs across departments, 36.57% (i.e., $.0582 - .0228$) across municipalities (within-departments), and 39.88% (i.e., $.1047 - .0661$) across LRUs (within-municipality). This effect is even more pronounced for low-income segregation ($M_{10\%}$), where 43.69% of segregation is due to differences across LRUs.

Segregation increased between 1999 and 2015 (except at the department level). According to the H^R index, segregation increased very slightly since 1999 at the municipal level (+1% approximately) and slightly more at the LRU level (+3%). These increases may seem modest over a 16-year period, but they contrast with the fact that meanwhile public tenants are more evenly distributed across the country. The increase is more pronounced with the poverty indices $M_{10\%}$ and $M_{20\%}$. At the LRU level, $M_{10\%}$ (respectively, $M_{20\%}$) rose from .0282 (.0413) in 1999 to .0355 (.0452) in 2015, for an increase of 18.79% (respectively, 9.44%). This marked increase suggests that low-income households are increasingly living in poor neighborhoods, and that there

Table 3 Income segregation from 1999 to 2015 with small-sample bias correction

Segregation Index	Geographic Level	Year					
		1999	2003	2007	2011	2015	Δ(1999/2015)
H^R	Department	.0278	.0277	.0244	.0231	.0228	–17.99%
	Municipality	.0578	.0581	.0577	.0575	.0582	0.69%
	Land Registry Unit	.1016	.1025	.1024	.1022	.1047	3.05%
$H^{R,s}$	*Simulation (within-municipality)*	*.0659*	*.0661*	*.0660*	*.0659*	*.0661*	*0.30%*
$M_{10\%}$	Department	.0039	.0037	.0031	.0027	.0030	–23.08%
	Municipality	.0128	.0138	.0138	.0137	.0165	28.90%
	Land Registry Unit	.0282	.0300	.0309	.0307	.0335	18.79%
$M^s_{10\%}$	*Simulation (within-municipality)*	*.0170*	*.0179*	*.0180*	*.0180*	*.0207*	*21.76%*
$M_{20\%}$	Department	.0070	.0066	.0054	.0048	.0048	–31.42%
	Municipality	.0201	.0201	.0195	.0190	.0218	8.45%
	Land Registry Unit	.0413	.0420	.0421	.0414	.0452	9.44%
$M^s_{20\%}$	*Simulation (within-municipality)*	*.0242*	*.0243*	*.0245*	*.0240*	*.0259*	*7.02%*
$M_{50\%}$	Department	.0177	.0172	.0146	.0136	.0125	–29.38%
	Municipality	.0361	.0361	.0335	.0322	.0326	–9.69%
	Land Registry Unit	.0618	.0627	.0607	.0585	.0608	–1.62%
$M^s_{50\%}$	*Simulation (within-municipality)*	*.0401*	*.0401*	*.0375*	*.0363*	*.0366*	*−8.73%*
$M_{80\%}$	Department	.0200	.0205	.0193	.0192	.0186	–7.00%
	Municipality	.0364	.0374	.0365	.0363	.0369	1.38%
	Land Registry Unit	.0591	.0603	.0593	.0586	.0602	1.86%
$M^s_{80\%}$	*Simulation (within-municipality)*	*.0405*	*.0414*	*.0401*	*.0400*	*.0401*	*−0.99%*
$M_{90\%}$	Department	.0155	.0160	.0157	.0158	.0159	2.58%
	Municipality	.0282	.0287	.0289	.0290	.0301	6.74%
	Land Registry Unit	.0461	.0463	.0465	.0466	.0478	3.69%
$M^s_{90\%}$	*Simulation (within-municipality)*	*.0322*	*.0328*	*.0333*	*.0333*	*.0343*	*6.52%*

Notes: A simulation procedure (within-municipality and across-LRUs random reallocation of households) was conducted to control for small-sample issues. For example, in 1999, the segregation level as measured by the rank-order information theory index at the department level is .0278, and the percentage change in this index between 1999 and 2015 is −17.99%. A zero value for each of the indices H^R or M would mean no segregation (even spatial distribution of the different income groups). The higher the value of the indices, the higher the income segregation.

is a growing territorial separation between low-income households and middle- and high-income households. We do not observe such an increase in segregation for the high-income households, where the increase in $M_{80\%}$ or $M_{90\%}$ is rather modest. There is no strong increase in the tendency for high-income households to live among themselves.

It therefore seems that a significant part of the segregation observed across the entire income distribution (H^R) is due to a growing spatial separation between poor households and the rest of the population. However, poor households often live in public housing, and we saw previously that public housing is becoming more homogeneously distributed across the country. There is, therefore, an ostensible paradox here: the decrease in public housing segregation should have benefited primarily low-income households. The following section will help us shed some light on this.

The period 1999–2015 can be broken down into three parts. The 1999–2003 period, which corresponds to the implementation of the SRU Law, is marked by a

slight increase in segregation (particularly of the poorest). This seems to suggest that the implementation of the law did not have the expected anti-segregation effects (we return to this in the next section). Then, after a period of relative stability between 2003 and 2011, segregation starts to rise again significantly. As explained earlier, this could be linked to the delayed effects of the 2007 DALO Law, or to the consequences of the 2009 economic crisis, which led to a willingness on the part of municipalities, especially the poorest ones, to house the most deprived (Desage 2013; Weill 2013). This possible sorting effect may have led to an increase in segregation, as a result of a reconcentration of poverty in the public sector.

The Consequences of the SRU Law

We evaluate the causal effects of the SRU Law on income segregation with a difference-in-differences econometric analysis. We show that the SRU Law has had no effect on segregation.

Enacted on December 14, 2000, the SRU Law's objective was to achieve a general increase in public housing in France, with a view to reducing residential segregation and meeting the needs of low-income households. The law requires that municipalities with more than 3,500 inhabitants (1,500 inhabitants in Paris) belonging to urban areas with more than 50,000 inhabitants must have at least 20% public housing. In all, just over 1,000 municipalities are affected by the SRU Law. The foregoing results provide evidence of a decrease in home tenure segregation and a slight rise in income segregation. However, these results are purely descriptive and do not establish any causal relationship. Here, we conduct an econometric exercise to determine whether the SRU Law had a causal impact on income segregation.

In line with Bono et al. (2013) and Gobillon and Vignolles (2016), our identification strategy is a combination of a difference-in-differences analysis and a regression discontinuity design. We compare income segregation in targeted and nontargeted municipalities, before and after the implementation of the SRU Law. We restrict our analysis to the subset of municipalities whose size is just below or just above the threshold that determines the scope of the law. We select municipalities whose size was between 800 and 5,000 inhabitants in the Paris region, and between 2,500 and 5,000 inhabitants in the rest of the country, in 1999. We obtained a sample of 2,071 municipalities, of which 588 are targeted by the SRU Law.

We estimate the following equation:

$$Y_{i,2015} - Y_{i,1999} = \alpha T_i + X_i \beta' + \theta_{r(i)} + \varepsilon_i, \tag{4}$$

where $Y_{i,t}$ is the LRU-level intramunicipality income segregation level in municipality i, at time t. T_i is the treatment dummy variable ($T_i = 1$ if municipality i falls within the scope of the SRU Law and with a public housing rate initially below the required threshold, and 0 otherwise). X_i is a set of explanatory variables (considered in 1999): the number of inhabitants of the municipality, the share of public housing, and the size of the urban unit. $\theta_{r(i)}$ is a regional fixed effect; ε_i is the error term; and α is the interest parameter. For $Y_{i,t}$, we use the H^R index and exploit its decomposability properties: for each municipality, we calculate the intramunicipality level of segregation

(i.e., the segregation level across LRUs for each municipality). Hence, segregation levels are not based on the national distribution but rather on municipal distributions. We are therefore not working with the levels of segregation presented in Table 3, but with only a fraction of them: the inter-LRU/intramunicipal level. Results show that estimators of α are nonsignificant (estimator is .00019, SE is .00318, and $\overline{R}^2 = 5.15\%$ for the benchmark specification).

Compared with Bono et al. (2013), who detected a significant rise in the construction of public housing caused by the SRU Law, and Gobillon and Vignolles (2016), who reported a significant lowering of home tenure segregation, our results show that intramunicipal income segregation was not significantly affected by the SRU Law. There was no significant gap in the evolution of income segregation between municipalities targeted by the law and comparable but nontargeted municipalities. These comparative results are perfectly in line with those of Table 2, which shows a fall in home tenure segregation, and Table 3, which shows no decrease in income segregation. There are two possible explanations for this. First, SRU-targeted municipalities have built more public housing, but may have selected households according to their income (sorting effect). New entrants in public housing in SRU-targeted municipalities may be relatively richer than in non-SRU municipalities, which limits the desegregation effects of the law. Second, the arrival of new public tenants could generate outflows of low-income households from private housing in SRU municipalities. This would mean that low-income private tenants have been replaced by low-income public tenants. For instance, Desage (2013) argued for the role of the public housing allocation process: municipalities select applicants for public housing on the basis of their income and location, and wealthy municipalities will tend to favor households already living in the municipality, which are therefore wealthier than other applicants. Weill (2013) also demonstrated the discrimination experienced by the poorest applicants for public housing. We will now refine our segregation decomposition analysis to get further insights for these results.

Income Segregation Decomposition According to Home Tenure

In this section, we decompose income segregation by home tenure. First, we measure segregation in each sector separately (public and private) and show that it has declined sharply. Then, we find that income segregation is increasingly related to public housing: neighborhoods with much public housing are getting relatively poorer, thereby reinforcing the impact of public housing on segregation (the residualization effect). Finally, we show, with a multistep decomposition, that the observed overall increase in income segregation is due to this residualization effect, outweighing the opposite effect of public housing dispersion.

We use the decomposability property of the H^R and M indices to break down income segregation according to home tenure. We first estimate income segregation within each sector separately. The results are summarized in Table 4. Interestingly, income segregation is declining in each sector. If we consider public tenants, income distribution was more homogeneous across LRUs in 2015 than in 1999. The drop in segregation was equal to 13.31% with the H^R index (and of comparable magnitude with other indices). We observe the same phenomenon of spatial homogenization of income for private housing, although the decline was less pronounced than in the

Table 4 Income segregation decomposition according to home tenure, by land registry unit

	Year	
	1999	2015
H^R		
Segregation within private sector	.0972	.0922
Segregation within public sector	.1044	.0905
$M_{20\%}$		
Segregation within private sector	.0362	.0332
Segregation within public sector	.0629	.0550
$M_{80\%}$		
Segregation within private sector	.0594	.0594
Segregation within public sector	.0391	.0333

Notes: Total segregation is measured within the public housing sector and within the private housing sector. For example, in 1999, the segregation level (H^R index) in the private sector is .0972. A zero value for each index in either sector would mean no segregation. The higher the value of the indices, the higher the income segregation.

public sector (−5% approximately between 1999 and 2015). While segregation rose overall (Table 3), it decreased significantly if we consider the households living in the public and in the private sectors separately. This suggests a growing homogeneity within each sector and a growing heterogeneity across sectors.

To verify this, we break down segregation and examine whether income segregation is related to the share of public housing at the LRU level. We constitute 10 groups of LRUs according to their proportion of public tenants—from 0% to more than 40%. Does the amount of public housing in a neighborhood determine whether the local population is homogeneous in terms of income? Results provided in Table 5 show that, increasingly, the answer is yes. The share of income segregation explained by differences in the proportion of public housing has increased tremendously, from 10.90% in 1999 to 20.30% in 2015, according to H^R. The increase is even more pronounced for the segregation of low incomes (from 13.35% to 29.68% with $M_{10\%}$). The income distributions between LRUs with few public housing units and LRUs with many public housing units are thus increasingly dissimilar. Moreover, the local structure of the housing stock is increasingly correlated with income. While home tenure segregation has decreased (see Table 2), its impact on income segregation has increased through a specialization effect: neighborhoods with a lot of public housing accommodate a growing share of poor households and those without public housing host a growing share of rich households.

Several contradictory effects seem to be at play. First, public housing has become more homogeneously distributed geographically, which should help to reduce income segregation. Indeed, if the distribution of income in public and private housing had remained the same, then the public housing dispersion would mechanically lead to a reduction in segregation. Second, the distribution of income within public (and private) housing has changed. Households living in public housing were poorer in 2015 than in 1999 (see Table 1). If public housing were randomly distributed among neighborhoods, then the fall in public tenants' income would not per se contribute

Table 5 Income segregation decomposition according to the share of public housing in land registry units

	Year	
	1999	2015
H^R		
Total segregation in France	.1016	.1047
Segregation according to share of public housing	.0111	.0213
	(10.90%)	(20.30%)
$M_{10\%}$		
Total segregation in France	.0282	.0335
Segregation according to share of public housing	.0037	.0099
	(13.35%)	(29.68%)
$M_{20\%}$		
Total segregation in France	.0413	.0452
Segregation according to share of public housing	.0051	.0132
	(12.41%)	(29.28%)
$M_{50\%}$		
Total segregation in France	.0618	.0608
Segregation according to share of public housing	.0060	.0116
	(9.66%)	(19.13%)
$M_{80\%}$		
Total segregation in France	.0592	.0602
Segregation according to share of public housing	.0061	.0074
	(10.36%)	(12.35%)
$M_{90\%}$		
Total segregation in France	.0461	.0478
Segregation according to share of public housing	.0049	.0050
	(10.55%)	(10.36%)

Notes: There are 10 groups of LRUs according to their proportion of public tenants: 0%, [0%–5%], [5%–10%], [10%–15%], [15%–20%], [20%–25%], [25%–30%], [30%–35%], [35%–40%], and more than 40%. For example, in 1999, total segregation is .1016 with H^R; 10.90% of it is due to differences across the 10 groups, and the remaining 89.10% is due to within-group segregation. A zero value for this percentage would mean that income distribution is the same in each of the 10 groups, and a 100% value would mean no *within-group* segregation.

to rising income segregation. However, public housing is not randomly distributed geographically (see Table 2). The new low-income public tenants are not randomly distributed, but are spatially clustered to some extent. This contributes to reinforcing income segregation.

To estimate the consequences of these two opposite effects on income segregation, we proceed with a multistep decomposition. We focus on the $M_{10\%}$ and $M_{20\%}$ indexes because, as Table 4 shows, they are the most sensitive to the share of public housing and complement the analysis with the composition-invariant Atkinson indexes $A_{10\%}$ and $A_{20\%}$.

We start from the situation observed in 1999. p_{99} is the share of low-income households in France in 1999 (the 10% or 20% bottom). Let $p_{pub,99}$ (respectively, $p_{priv,99}$) be the share of low-income households in public (private) housing in 1999. $p^k_{pub,99}$ and $p^k_{priv,99}$ are their equivalents in unit (municipality or LRU) k. Then, $N_{pub,99}$ ($N_{priv,99}$) is the number of households living in the public (private) sector. $N^k_{pub,99}$ and $N^k_{priv,99}$ are their equivalents in unit k.

Step 1: Isolating the Residualization Effect

First, we adjust the *share of low-income households* so that it matches the one observed at the national level in 2015 in each sector (public and private):

$$p^k_{pub}(\text{Step 1}) = p^k_{pub,99} \times \frac{p_{pub,15}}{p_{pub,99}}, \tag{5}$$

$$p^k_{priv}(\text{Step 1}) = p^k_{priv,99} \times \frac{p_{priv,15}}{p_{priv,99}}. \tag{6}$$

We know that the proportion of low-income households increased significantly in public housing between 1999 and 2015. So, we reallocate low-income households from private housing to public housing. With manipulations (5) and (6), we raise (reduce) uniformly the share of low-income households in public (private) housing, *without modifying their spatial distribution within each of the two sectors*. With this method, we isolate the impact of a greater proportion of poor households in public housing in general, but neutralize the fact that this increase has been geographically heterogeneous. In addition, we keep the size of the sectors within each unit ($N^k_{pub,99}$ and $N^k_{priv,99}$) unchanged. The variations in public housing shares between spatial units observed between 1999 and 2015 are therefore neutralized.

Step 2: Isolating the Sorting of Poor Households Within Each Sector

Then, we adjust the share of low-income households to the levels observed in 2015 *in each municipality*:

$$p^k_{pub}(\text{Step 2}) = p^k_{pub,15}, \tag{7}$$

$$p^k_{priv}\left(\text{Step 2}\right) = p^k_{priv,15}. \tag{8}$$

The national shares of poor households in each sector remain the same compared to Step 1, but here we isolate the impact of the heterogeneous evolution of the shares of poor households across units. In the public sector, the share of poor households may have increased more sharply in some municipalities or LRUs than in others, and the contribution of this effect on segregation is what we wish to single out in this step. Again, we keep the size of the sectors within each unit ($N^k_{pub,99}$ and $N^k_{priv,99}$) unchanged.

Step 3: Isolating the Public Housing Dispersion

Then, we build on the previous step and adjust the share of public housing to the levels observed in 2015 in each spatial unit:

$$N^k_{pub}\left(\text{Step 3}\right) = N^k_{pub,15}, \tag{9}$$

$$N^k_{priv}\left(\text{Step 3}\right) = N^k_{priv,15}. \tag{10}$$

Table 6 Decomposing the effect of public housing on income segregation (with percentage increase in segregation compared to the previous step in parentheses)

Geographic Level	Index	1999	Step 1	Step 2	Step 3	2015
Municipality	$M_{10\%}$	.0128	.0138	.0170	.0163	.0165
			(+7.6%)	(+23.1%)	(−4.1%)	(+1.2%)
	$M_{20\%}$	.0201	.0212	.0230	.0218	.0218
			(+5.6%)	(+8.3%)	(−5.3%)	(+0.2%)
	$A_{10\%}$	.0368	.0399	.0480	.0459	.0460
			(+8.4%)	(+20.2%)	(−4.3%)	(+0.1%)
	$A_{20\%}$	.0324	.0343	.0368	.0348	.0348
			(+5.9%)	(+7.1%)	(−5.4%)	(+0.0%)
LRU	$M_{10\%}$	.0282	.0302	.0357	.0334	.0335
			(+7.2%)	(+18.1%)	(−6.4%)	(+0.2%)
	$M_{20\%}$	.0413	.0426	.0464	.0452	.0452
			(+3.1%)	(+8.8%)	(−2.6%)	(+0.1%)
	$A_{10\%}$	.0563	.0594	.0708	.0676	.0677
			(+5.6%)	(+19.1%)	(−4.5%)	(+0.1%)
	$A_{20\%}$	.0555	.0585	.0621	.0589	.0589
			(+5.5%)	(+6.1%)	(−5.2%)	(+0.0%)

Notes: The third column gives the level of segregation as observed in 1999. Step 1: segregation estimates with the share of low-income households uniformly adjusted to the 2015 national level by sector. Step 2: segregation estimates with the share of low-income households adjusted to the 2015 level by sector for each unit. Step 3: segregation estimates with the share of public housing adjusted to the 2015 level (building on Step 1 and 2 changes). The last column gives the level of segregation as observed in 2015. $M_{10\%}$ segregation is .0165 in 2015 (municipality level). For example, the rise in $M_{10\%}$ segregation due to Step 1 is +7.6% (over the 1999 situation); the rise in segregation due to Step 2 is 23.10% (over the Step 1 situation); and the fall in segregation due to Step 3 is –4.2% (over the Step 2 situation).

We keep the shares of poor households in each sector set in Step 2 and focus on the effect of the change in the share of public and private housing. So, Step 3 isolates the public housing dispersion effect, which we expect to lower segregation.

After these three steps, we almost reach the 2015 situation, except that some municipalities or LRUs have disappeared, while others have been created since 1999. Moreover, their relative sizes have changed. This explains the very slight differences between the levels of segregation observed after Step 3 and those observed in 2015. The results are presented in Table 6.

As expected, the overall and geographically homogeneous impoverishment of public housing isolated in Step 1 contributes to raising income segregation. The segregation effect is even stronger for very-low-income households (+7.2% with $M_{10\%}$ and +5.6% with $A_{10\%}$, against +3.1% with $M_{20\%}$ and +5.5% with $A_{20\%}$ at the LRU level). This is because public housing is not evenly distributed throughout France. Bearing in mind that low-income households were already more present in the public than in the private sector in 1999, a further homogeneous increase in the share of poor households in public housing contributes to accentuating spatial separatism. Poor public tenants live alongside other public tenants whose incomes have fallen since 1999: this contributes to creating and aggravating the poverty and income gaps

between public and private sectors of these areas. Hence, for a given structure of the housing stock, the relative impoverishment of public housing creates segregation (*public housing residualization*).

In addition to this impoverishment effect, it appears that the increase in share of low-income households in public housing (and the decrease in private housing) has not been homogeneous across the country. Some municipalities have accommodated more new poor households than others. We isolate this effect in Step 2. *Ex ante*, we do not know whether this will contribute positively or negatively to segregation. If the initially wealthy municipalities have accommodated relatively more low-income public tenants, then this should contribute to reducing segregation. By contrast, if the poorest municipalities have done so, then this should raise segregation. In Step 2, segregation increases substantially compared to Step 1, especially the segregation of very-low-income households (+23.1% for $M_{10\%}$). Municipalities (or LRUs) that were initially poor have accepted a larger share of new poor households. Note that this "sorting" effect is not specific to public housing. The change in the share of low-income households between municipalities within private housing also affects income segregation. So, in the next section, we propose a procedure to discuss the "sorting" effects in the public housing sector only.

Finally, Step 3 makes it possible to isolate the impact of the public housing dispersion. As expected, this contributes to reducing segregation: new public tenants (less wealthy on average) more frequently have neighbors living in private housing (who therefore were wealthier) in 2015 than in 1999. However, this effect appears to be quantitatively limited (especially for $M_{10\%}$ and $A_{10\%}$) and is slightly smaller (in absolute value) than the residualization effect identified in Step 1. The dispersion of public housing in the period was not therefore sufficient to compensate for the segregation effect of public housing residualization.

The Role of Allocation Processes

We now turn to the question of the role of public housing allocation processes. We randomly reallocate households moving to public housing (at different geographic levels) and compare the resulting income segregation level to the one observed in the data. Simulated segregation is much lower, suggesting a segregation effect of the allocation processes (Table 7).

We analyze the household mobility and distinguish between "movers" and "stayers" over the period studied (movers are households that have relocated at least once since 1999). We investigate if the public housing allocation process has contributed to lowering segregation (with poor movers being given a home randomly or, even more, preferentially in a richer district) or, on the contrary, if it has hampered the curbing of segregation, through a sorting effect (with poor movers being given public housing in relatively poor districts and rich movers obtaining public housing in richer districts). To answer this question, we conduct a counterfactual simulation exercise: we randomly reallocate the households of "movers into public housing":[5]

[5] Note that the share of movers since 1999 represents approximately 80% of public tenants in 2015.

Table 7 Random allocation of public tenants (movers) by geographic level, according to segregation index

Geographic Level	H^R	$M_{10\%}$	$M_{20\%}$	$M_{50\%}$	$M_{80\%}$	$M_{90\%}$
Whole Country	.0925	.0262	.0368	.0539	.0571	.0465
Within-Department	.0959	.0280	.0385	.0549	.0578	.0468
Within-Municipality	.0989	.0305	.0417	.0585	.0595	.0475
Observed Value	.1047	.0335	.0452	.0608	.0602	.0478

Notes: Households that moved to a new public housing unit since 1999 were randomly reallocated to another public housing unit (from another mover) in their municipality, department, or the country. For example, in 2015, the H^R index obtained with a "whole country" simulation is .0925, which should be compared with the actual observed value of H^R, .1047. With the H^R index, within-municipality simulated segregation (.0989) is lower than the observed value, suggesting a nonrandom and segregative effect of the public tenants allocation process.

- across the national territory (movers are reallocated within the national stock of public housing occupied by movers)—*Whole Country*;
- in their department (reallocation within the department's stock)—*Within-Department*; or
- in their municipality (reallocation within the municipality's stock)—*Within-Municipality*.

So, each mover is reallocated within the public housing of another mover within the municipality or department or throughout the national territory. Our objective is to see what would have been the impact on segregation of a blind system of public housing allocation with fully mobile applicants. As mentioned earlier, the State, departments, and municipalities participate on the allocation boards. Each has lists of applicants for public housing, which they can therefore allocate within their geographic territory, within the limits of the quotas at their disposal. It therefore makes sense to randomly reallocate public tenants (movers) within these three geographic levels and compare the simulated outcomes to the current situation.[6]

The results show unequivocally that a purely random assignment would have led to a *significantly lower income segregation*. If the allocation of movers had been done randomly throughout France since 1999, then the income segregation using the H^R index would have been only .0925 instead of .1047—that is, it would have been 11.65% lower. The fall in income segregation is even more pronounced with the $M_{10\%}$ (21.79%) and $M_{20\%}$ (18.58%) indices. The effects are much less pronounced with top income indices ($M_{80\%}$ and $M_{90\%}$) as high-income households more rarely live in public housing. Because a random reallocation of households across the entire country is quite unlikely, we may refocus on narrower levels of reallocation; however, even if the random reallocation process is limited to the department or municipality level, the decrease in segregation remains nonnegligible. The H^R index would have been equal to .0989 instead of .1047 if the commissions had randomly allocated public housing within the municipality. These results show the nonrandom nature of allocation

[6] This simulation exercise does not concern households living in private housing, nor public tenants who have stayed in their dwelling since 1999.

commissions and their nonnegligible effect on income segregation; this *sorting effect* is another contributing factor to the observed rise in income segregation. This is further evidence of the role of public housing in income segregation: a random allocation of public housing since 1999 would have led to a decrease in income segregation instead of the observed increase (.0989 for the within-municipality reallocation in 2015, compared with .1016 in 1999, i.e., a 2.66% decrease in segregation).

Conclusion

This article focuses on an apparent contradiction: while public tenants are becoming poorer in France and are increasingly evenly distributed across the country, income segregation is not decreasing, and is even increasing if we focus on the poorest. We highlight a possible explanation for the fact that public housing has not reduced segregation: public housing has become poorer (a *residualization effect*), especially in the initially poorest areas (a *sorting effect*). This increase in the concentration of poverty offsets the effect of the greater spatial dispersion of public housing.

The literature has clearly identified that this increase in the share and dispersion of public housing was largely caused by the 2000 SRU Law. Our econometric analysis complements these results but shows that the SRU Law has had no impact on income segregation, despite its effects on public housing. Further analyses, based on decomposition and simulation techniques, show that this is related to residualization and sorting effects. This impoverishment of public housing (especially in already poor areas) might be related to several factors, such as legal obligations to accommodate the most disadvantaged since 2007, but also a willingness of local authorities to help low-income households following the 2009 economic crisis. Whatever the cause, the situation highlights the need for government to focus on this recent homogenization of income profiles in public housing, as it seems to proceed faster than the spatial dispersion of public housing. Public attention should be focused on promoting a diversity of profiles within public housing, as well as the need to accommodate middle-income groups, especially in the poorest neighborhoods. Simply building more public housing is not sufficient—it is also necessary to preserve deliberately a certain social mix in this sector.

This study was limited to a measure of income segregation through the filter of public housing. But other factors also contribute to segregation—demographic changes, income inequality, and education—and some are related to housing; the role of private-sector regulation or residential mobility should be given further consideration. All of these areas of research merit future study. ■

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Kevin Beaubrun-Diant (corresponding author)
kevin.beaubrun@dauphine.psl.eu

Beaubrun-Diant • Université Paris–Dauphine, PSL University, CNRS, Paris, France; https://orcid.org/0000-0002-1852-5417

Maury • Edhec Business School, Lille, France; https://orcid.org/0000-0003-3799-7185