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Residential Wealth Distribution in Rio de Janeiro

Overlooking the wealthy beachfront neighborhood of São Conrado, Rio de Janeiro's Rocinha favela is one of the city's largest informal settlements.

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Housing is an important component of both a household's net worth and aggregate national wealth or stock of residential capital. Aggregate residential wealth is the sum of the values of all housing units. In Brazil, residential structures represent about one-third of total net fixed capital, so their value is important for economic and social policy. This analysis asks: What variables determine the stock values of residential property? How do location and neighborhood conditions affect these values? What is the aggregate residential wealth in the Rio de Janeiro Metropolitan Region (Metro Rio)? What is its distribution among household income and housing value groups? In other words, what generates residential wealth? How much residential wealth is there? Who holds it? Where is it located? (Vetter, Beltrão, and Massena 2013.)

Methodology for Estimating Residential Wealth

To address these questions, we first calibrated a hedonic residential rent model with sample micro-

data from the 2010 population census conducted by the Brazilian Institute of Geography and Statistics (IBGE). The units of analysis are households living in private, permanent housing units in urban areas of Metro Rio. The total number of households in 2010 was 3.9 million, and our sample is 223,534 (5.7 percent). We used the 41,396 renters in the sample to calibrate our model and then estimated the rents for homeowners and the landlords of rent-free units. Finally, we transformed the actual and imputed rents into housing values by dividing them by the monthly discount rate of 0.75 percent (9.38 percent annual rate), as is standard practice for Brazilian residential wealth studies (Cruz and Morais 2000, Reiff and Barbosa 2005, and Tafner and Carvalho 2007).

The underlying assumption in these studies is that the hedonic prices of the characteristics in the model and the discount rate are similar for rental and nonrental units. These are strong but necessary assumptions for the application of the methodology with the existing census microdata. The sum of estimated housing values is our measure of residential wealth. The objective is to estimate the aggregate value of all housing units and their average values.

In calculating average housing prices for these groups, we do not control for housing size or other characteristics, as would be done for hedonic housing price indices. Using census microdata, we can also estimate the residential wealth by household income as well as for smaller spatial units within municipalities, such as neighborhoods or districts. Even though the sample of rental units is relatively large, sample size drops rapidly as rents and household incomes rise, and the variances are particularly high for the open group at the top end of the distribution. Because we do not have data on the value of mortgages, our measure is of gross rather than net residential wealth.

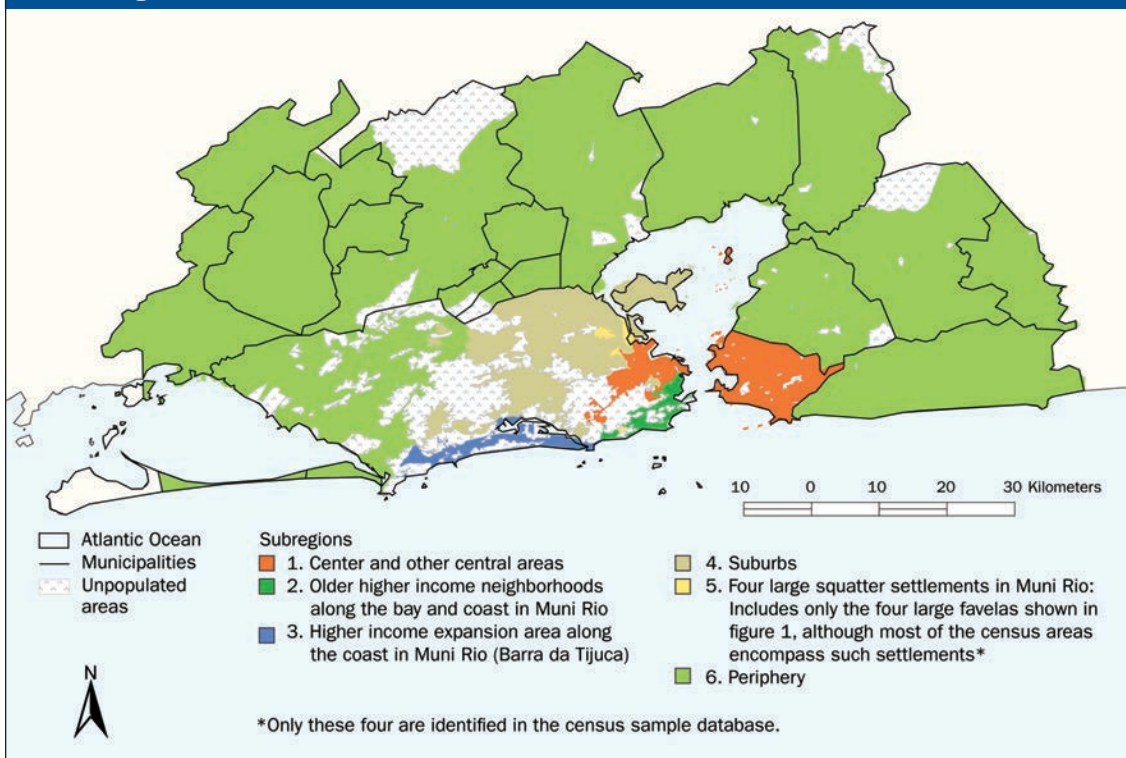
Using rents from the census or a household survey compares favorably with other commonly used methods for estimating residential wealth for the Brazilian national accounts and related studies (Garner 2004), such as asking homeowners to estimate the selling price or monthly rent of their homes, using the asking prices for home sales, or using the prices registered when recording the sale. Whereas renters know their monthly rent payment, the informants may have little understanding of current trends in housing prices, and the original asking price is often higher than the

final sale price. In Rio de Janeiro, the municipal government uses its own estimates of the sale prices based on asking prices, rather than the value registered in calculating the real estate transfer tax, because buyers and sellers often register lower prices.

In our hedonic residential rent model, the dependent variable is a vector of residential rents, and the independent variables are matrices of the structural characteristics of the housing unit, access to employment, and neighborhood characteristics, including indicators of access to urban infrastructure and services. The variables used are for the household per se and also for the census area in which it is located. Figure 1 shows Metro Rio's 336 census areas and the larger municipal boundaries grouped into six subregions based on indicators analyzed in this and previous studies (Lago 2010).

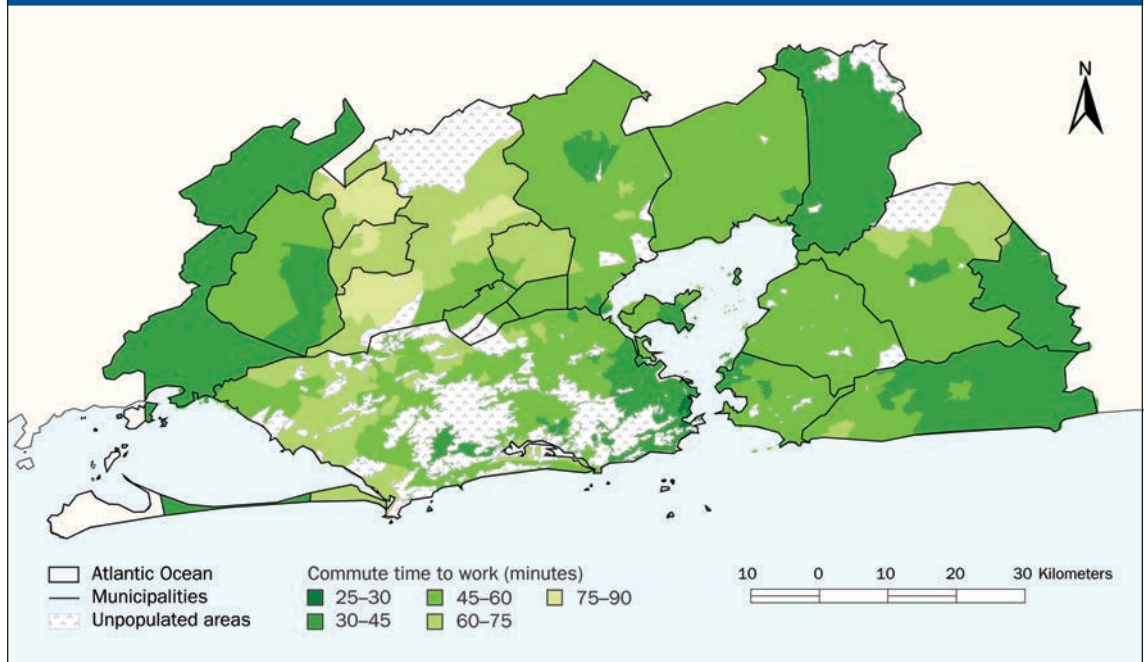
The indicator for access to employment measures the average commute time to work for residents in each of the census areas. Figure 2 (p. 16) shows that the average commute time increases with distance from the center, but not by as much as one might expect—partly due to increased traffic congestion in all areas and to the fact that Metro

FIGURE 1
Six Subregions of Metro Rio



Source: Based on the authors' analysis and previous studies.

FIGURE 2
Average Commute Times for Metro Rio Census Areas, 2010



Source: Authors' calculations with 2010 Census microdata.

Rio is polycentric with many subordinate centers.

The indicators of the quality of neighborhood infrastructure and services include the household's access to the public sewer and water systems, garbage collection, and block conditions (e.g., street paving and drainage). As these indicators are highly intercorrelated, the component scores from a principal components analysis serve as the independent variables in the hedonic model. Component 1 explains 46.6 percent of the variance and shows high positive loadings on adequate block conditions and infrastructure, and high negative loadings on inadequate block conditions (e.g., garbage in the street and open sewers), indicating which areas have a higher level of attractiveness or desirability (figure 3). Although the lowest scores are clearly concentrated in the outlying areas, the patterns of attractiveness vary considerably. As with commute times, the distribution pattern of the attractiveness scores reveals the complexity of Metro Rio's spatial structure.

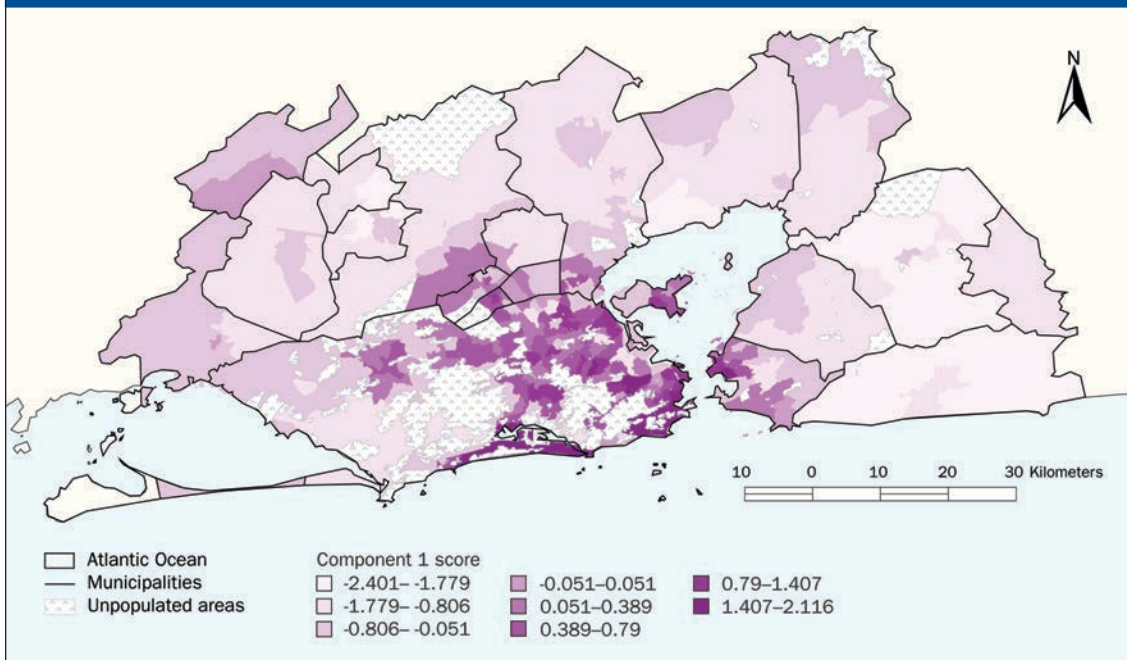
Our hedonic model explains 73 percent of the variance of residential rent. The key independent variables are statistically significant; neighborhood quality and access to employment explain nearly two-thirds of the variance, while the structural characteristics of the housing explain only about one-third of the variance. In other words, the bulk

of housing value is the capitalized value of access to employment and to neighborhood infrastructure and services, all of which are determined in large part by public expenditures. Figure 4 (p. 18) shows the distribution of average estimated housing values for census areas in US\$ determined by our methodology. (The average exchange rate for 2010 is US\$1=R\$1.76.) These values tend to be highest in areas affording relatively low commute times and good access to urban infrastructure and services.

Distribution of Residential Wealth

How much residential wealth is the property of homeowners versus the landlords of rental properties and rent-free units used by employers, family members, or others? Our estimate of Metro Rio's aggregate residential wealth of both occupied and unoccupied units in 2010 is US\$155.1 billion (94.2 percent of Metro Rio's 2010 GDP of US\$164.4 billion) and US\$140.2 billion for occupied units only (84.2 percent of Metro Rio's GDP). Among total occupied units, 74.8 percent of this residential wealth (about US\$105 billion) belongs to owner-occupied units, and the rest belongs to landlords of rented and rent-free units. In the case of lower-income households, the landlords could be another lower-income family.

FIGURE 3
Metro Rio Census Area Scores for Component 1: High Neighborhood Attractiveness, 2010



Source: Authors' calculations with 2010 Census microdata.

Table 1 shows that the percent of homeowners is quite similar for all household income groups. For example, homeowners occupy nearly three-quarters of the households in the lowest household income group (with fewer than two minimum salaries or an average annual income of only US\$4,407). A key reason for these high homeownership levels is that those living in *favelas*, squatter settlements, or other types of informal housing can declare themselves homeowners, even if they do not legally own the land on which their home is located. The 2010 Census showed more than 520,000 households (more than 15 percent of the total private permanent urban households) living in these types of settlements in Metro Rio. Land ownership in these settlements is a complex legal question on which even lawyers may not agree, since the chances of removal (at least removal without compensation) are quite low, and those living on land without a legal title may be eligible for squatter's rights after five years under Brazilian law.

Although 25.3 percent of total households earned less than two minimum salaries (US\$ 6,960 per year), the homeowners in this group held only 15.3 percent of the aggregate residential wealth of all homeowners. By contrast, only 15.6 percent of households earned 10 or more minimum salaries

(US\$34,800 per year), but homeowners in this income group held 34.5 percent of the aggregate residential wealth. Nonetheless, lower income households have more residential wealth than one might expect, in part because they are often homeowners in informal settlements.

Figure 5 (p. 19) shows the Lorenz Curve for the distribution of aggregate residential wealth of homeowners by housing value groups. This

TABLE 1
Key Indicators by Household Income Groups in Metro Rio, 2010

Income Group/ Number of Minimum Salaries ¹	Average Annual Household Income (US\$)	Percent of Homeowners	Percent of Total Households	Percent of Total Residential Wealth for Homeowners ²
Less than 2	4,407	74.9	25.3	15.3
2 to 4	9,986	76.1	32.1	22.8
4 to 6	17,239	76.6	14.7	13.2
6 to 8	24,462	76.6	7.5	8.1
8 to 10	31,547	77.0	4.7	6.1
10 or more	86,743	77.8	15.6	34.5
Total	23,766	76.2	100.0	100.0

Source: Authors' calculations with 2010 Census microdata.

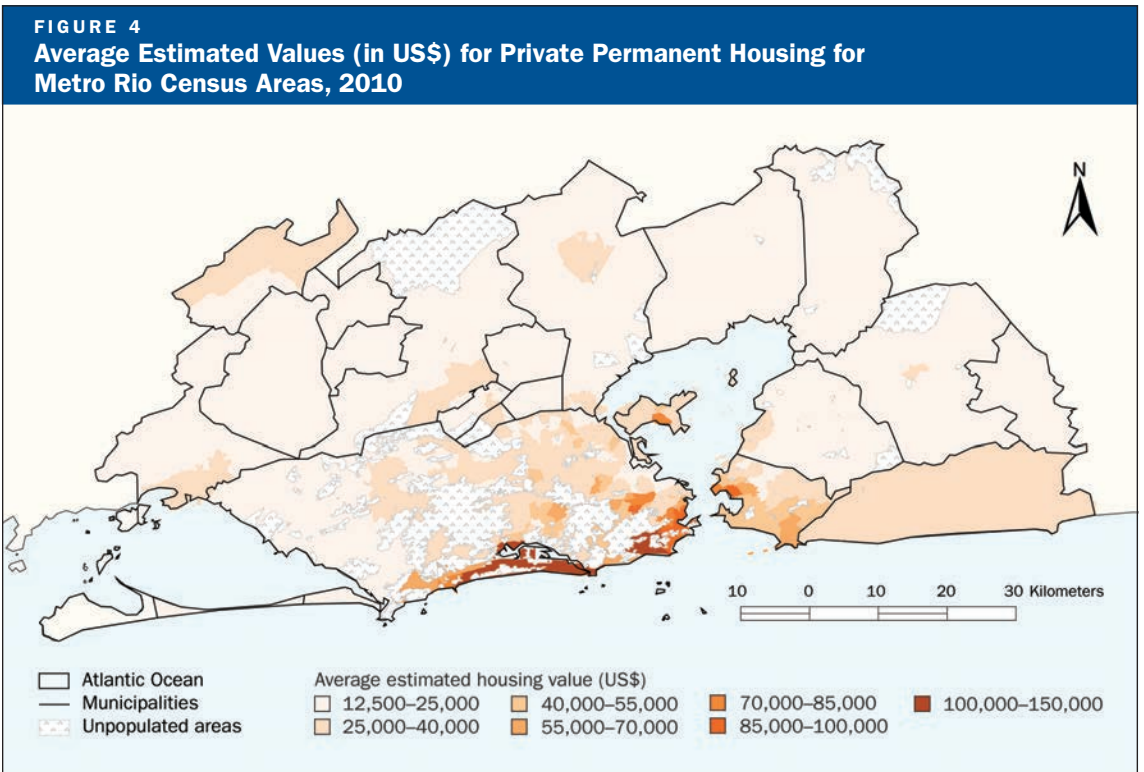
1. The value of a monthly minimum salary in 2010 would be US\$290.

2. Excludes households that declare no income (5.9 percent of total households) and those missing a value for the independent variables of the model.



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The Cinelandia subway station serves Rio's center.



Source: Authors' calculations with 2010 Census block conditions and sample data.

distribution is quite unequal, because the nearly 23.7 percent who are not homeowners have no such wealth (as shown where the Lorenz curve runs along the bottom of the axis) and because those living in higher-priced housing have greater residential wealth.

Distribution of Residential Wealth by Subregions

The bulk of aggregate residential wealth is held by those living in the suburbs and periphery around Metro Rio, although the average value of their housing units is lower. Table 2 shows that those subregions (4 and 6) together represent 79 percent of Metro Rio’s total households (3.1 million) and 58.1 percent of aggregate residential wealth (US\$80.9 billion). Subregion 2 (the older, higher-income neighborhoods along the bay and coast) holds only 6.3 percent of Metro Rio’s households (about 242,000) and 19.0 percent of its residential wealth.

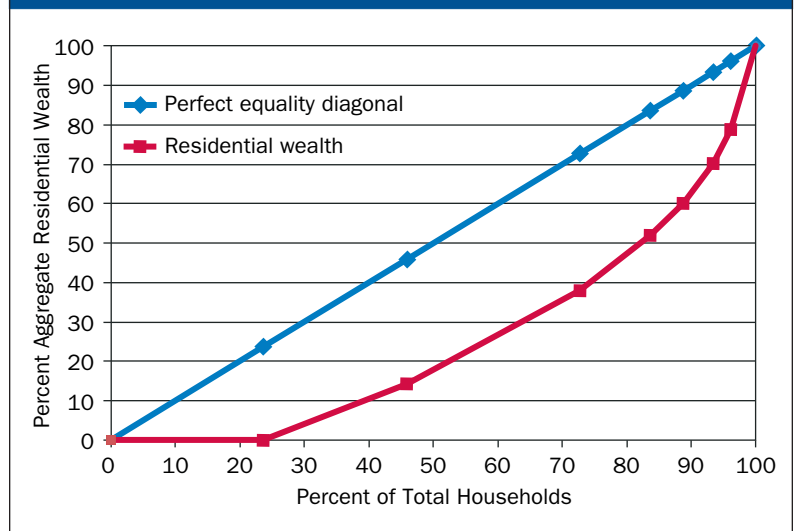
The percentage of renters is highest in the large squatter settlements (subregion 5), at 28.6 percent, with an additional 2.7 percent of rent-free units. Homeownership rates are highest (80.4 percent) in the periphery (subregion 6), where many owners live on land for which they do not have full legal title, though these areas generally are not squatter settlements as defined by IBGE.

Spatial Distribution of Household Income

One result of the interplay of market forces that shape residential rent and housing prices is that the distribution of aggregate household income tends to mirror the distribution of aggregate residential wealth. In other words, there is a relatively high residential segregation by income groups, with lower-income families concentrated in the large squatter settlements and in the suburbs and periphery (subregions 4, 5, and 6). High spatial concentration of higher-income households generates higher aggregate income and demand in areas that support higher-level services—in turn making these areas more attractive to higher-income homebuyers and renters. Figure 6 (p. 20) shows that the average annual household incomes for the census areas in 2010 reflect to a large extent the distribution of average housing values (figure 4), commute times (figure 2), and neighborhood attractiveness (figure 3).

In 2010, the high-income Barra da Tijuca area (subregion 3) held only 2.1 percent of total households in Metro Rio but 8.1 percent of aggregate household income and 7.6 percent of aggregate residential wealth. By comparison, the four large

FIGURE 5
Lorenz Curve of the Distribution of Residential Wealth by Housing Value Groups in Metro Rio, 2010

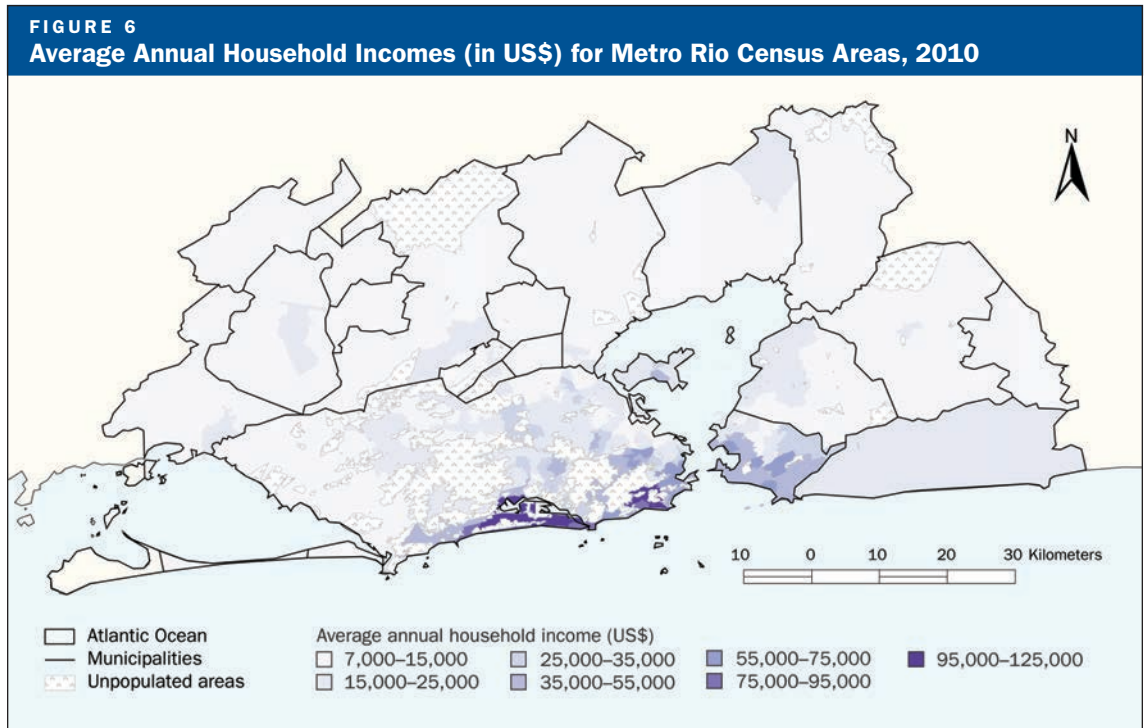


Source: Authors’ calculations with 2010 Census block conditions and sample data.

TABLE 2
Residential Wealth and Annual Household Income in Metro Rio, 2010

Six Subregions	Percent of Homeowners	Percent of Total Households	Percent of Aggregate Residential Wealth	Percent of Aggregate Annual Household Income
1 Center and other central areas	71.4	10.2	13.8	17.0
2 Older, higher-income areas along the bay and coast	65.7	6.3	19.0	19.0
3 Higher-income expansion area along the coast	70.8	2.1	7.6	8.1
4 Suburbs	73.8	27.9	25.4	25.7
5 Large squatter settlements in Muni Rio	68.7	2.5	1.4	1.0
6 Periphery	80.4	51.1	32.7	29.2
Total	76.2	100.0	100.0	100.0

Source: Authors’ calculations with 2010 Census block conditions and sample data.



Source: Authors' calculations with 2010 Census block conditions and sample data.

TABLE 3
Indicators of Aggregate Residential Wealth and Household Income in Subregions 3 and 5 of Metro Rio, 2010

Indicators	Subregion 3: Higher Income Expansion Area/ Barra da Tijuca	Subregion 5: Four Large Squatter Settlements
Number of households	80,659	97,013
Percent of homeowners	70.8	68.7
Percent of total households in Metro Rio	2.1	2.5
Percent of aggregate residential wealth in Metro Rio	7.6	1.4
Percent of aggregate annual household income in Metro Rio	8.1	1.0
Aggregate residential wealth (US\$ billions)	10.65	2.02
Average housing value (US\$)	132,262	20,954
Average annual household income (US\$)	87,194	9,349
Aggregate annual household income (US\$ billions)	7.0	0.9
Average commute time to work (minutes)	56.8	42.0
Average Score on Component 1	1.4	(1.0)

Source: Authors' calculations with 2010 Census block conditions and sample data.

squatter settlements of subregion 5 held 2.5 percent of total households but only 1.0 percent of aggregate household income and 1.4 percent of residential wealth. Nonetheless, the aggregate residential value in these four squatter settlements was nearly US\$2 billion, and the average housing value was almost US\$21,000. These results show a relatively high spatial concentration of both aggregate household income and residential wealth that is tempered slightly by the homeownership rate in squatter settlements.

Implications for Methodology and Policy Decisions

The methodology used in this analysis provides interesting insights into the macroeconomic and social importance of residential wealth; the variables that generate it; its distribution among household tenure, income, and housing value groups; and its allocation among subregions ranging from high-income neighborhoods to squatter settlements. The strong assumptions required in using the methodology must be taken into account when interpreting the results. Data from property registries or other sources with more detailed information on unit size could eventually be used to complement this methodology.

Government services, investments, and regulatory actions can result in benefits (e.g., access to

employment, urban services, and amenities) and costs (e.g., taxes, fees, and negative environmental impacts) that are capitalized into the value of housing in the affected neighborhoods. For homeowners, positive net benefits from government actions increase their residential wealth, because they are capitalized in the value of their housing. However, for renters and new homebuyers, these same government actions can cause rents and housing prices to rise along with the net benefits. Some households, especially the lower-income renters and homebuyers, may have to leave the benefited area, and other potential new owners may be unable to locate in the area. Thus, housing tenure is important in determining whether or not a household receives the net benefits of government investments and regulatory actions.

Capitalization of the net benefits of government actions would clearly be an issue for the more than 30 percent of households in the four large squatter settlements that are not homeowners, as well as for those entering the housing market. Although there are no reliable data on housing turnover, we know that the total number of urban households in Metro Rio increased more than 20 percent, by almost 657,000, between 2000 and 2010. This increment was 14 percent higher than the total number of households in the Municipality of Curitiba (the state capital of Paraná) in 2010 and well over twice the number in Washington, D.C. All these new households, plus all the renters (about one-fifth of total households) and homeowners wishing to move, would be subject to increased rents and housing prices generated by the net benefits of government actions.

These results demonstrate a need for policies to ensure that rising rents and housing prices do not exclude some households from areas where public services and infrastructure are being improved. For example, financial assistance for home purchases could be part of the improvement program. One way of financing the needed lower-income housing and investment programs would be to capture part of the value being generated by infrastructure investments from higher-income households. Capturing part of the value generated by urban investments could help finance additional housing subsidies for lower-income families, as well as added investment, thereby providing a kind of investment multiplier. **L**



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Barra da Tijuca encompasses 2.1 percent of Metro Rio's households but 8.1 percent of aggregate household income and 7.6 percent of aggregate residential wealth.

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