Jobs to People or People to Jobs? Levering public housing programs to support the formation of economic sub centres in South Africa

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A central debate in the South African policy sphere today is whether current South African housing program risks repeating the mistakes of apartheid, housing thousands of poor people in areas disconnected from jobs and services. This paper provides the set of first estimates of the effect of RDP housing on property prices in Cape Town, South Africa. The findings reveal that despite an average negative effect, public housing investments in the poorer areas raise the value of housing assets in those neighborhoods. In contrast, public housing in better off areas reduced property prices. Given the path dependence of housing structures and neighborhood composition, there may be need to rethink the policy narrative from one focusing on the *location* of housing to the provision of complementary investments in neighborhood amenities to develop employment sub centres. This will help in generating agglomeration economies and reduce commuting times.

1. Introduction

A central debate in the South African policy sphere today is whether current South African fully subsidized housing program risks repeating the mistakes of apartheid, housing thousands of poor people in areas disconnected from jobs and services. At the heart of this debate is the question of whether policy should focus on bringing people to jobs, or jobs to people. In this paper, we argue that policy makers should not fully dismiss the second. Indeed, we show that the number of public houses registered in Cape Town had a positive effect on the median housing price in neighborhoods where informal housing constitutes the majority of dwelling type. This stems from the fact that public housing investments in informal neighborhoods have not only brought decent, formal housing to people, but these have been accompanied by investments in infrastructure and public services, raising the value of housing assets. In contrast, public housing in better off areas reduced property prices. Given the path dependence of housing structures and neighborhood composition, there may be a need

to rethink the policy narrative from one focusing on the *location* of housing to the provision of complementary investments in neighborhood amenities to develop employment sub centres. This will help in generating agglomeration economies and reduce commuting times.

The 1994 Housing White Paper made the ambitious promise to provide one million homes within 5 years to the poorest of the poor. As of today, the government's Reconstruction and Development Program (RDP) and the Breaking New Ground (BNG) policy have delivered close to 4 million houses and serviced a million sites, reaching more than 20 million South Africans; a remarkable accomplishment by international standards.

But the pace of delivery struggles to keep up with demand, especially in urban areas. In 2016, 2.2 million households (13 percent) are still living in shacks[2] (Community Survey 2016), with lower access to basic services such as water, sanitation and electricity, facing health and safety issues. In the six major metropolitan areas included in this paper – Johannesburg, Pretoria, Ekurhuleni, eThekwini, Cape Town and Nelson Mandela Bay[3] , the number of households living in informal dwellings increased from about 920 thousand to more than one million between 2001 and 2016 as a result of growing cities, accommodating about 450,000 new urban dwellers every year. In response to the 1996 Constitution, reflected in the 2013 Spatial Planning and Land Use Management Act, which provides South African citizens with "the right of access to adequate housing which includes an equitable spatial pattern and sustainable human settlements", increasing discontent due to falling rate of delivery and increasing urbanization, various housing mega projects have been proposed by the Department of Human Settlements (DHS) to address the remaining housing backlog and improve the lives of the people living in the remaining 13 percent informal dwelling (Turok 2015; Stats SA 2001, 2011, 2016). Housing project of this kind are politically appealing as they resonate with the electorate. Given the current unmet need, the affordable housing delivery needs speed and scale. Two major programs

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are delivering more than 90 percent of housing: the fully subsidized housing program, under which the above mentioned mega project falls, and the informal settlement upgrading (Gardner and Graham 2017).

A fundamental point that critics of fully subsidized housing projects have raised is that given their size, these mega housing projects will be developed on greenfield sites at the periphery, going against the densification and urban concentration principles, shown to improve economic efficiency. They argue that not only these would cause loss in economic efficiency, but these are unlikely to lift people out of poverty given their location. But path dependence has entrenched the spatial allocation of land inherited from the apartheid, and cities have been built under these institutions; trying to overthrow this legacy completely will be very difficult given the strength of market forces. In addition, once housing decisions are made, the structures and infrastructure laid out are long lived. In a Nth best world in which politics matters and decisions have been made, focusing on improving the process instead of reversing it is likely to have the biggest impact. It does not mean that only catalytic housing project should be built and densification should be abandoned; the affordable housing segment of the market also needs "massive small" in-situ upgrading, as argued by Gardner and Graham (2017). It is not either or.

In this paper, we will focus exclusively on the delivery of subsidized housing units has affected transaction prices of neighborhoods. Prices link to demand for housing; and reflect welfare as a poor family's house is likely to be their most valuable asset. Franklin (2015) also shows that households having received of public houses saw their income increase. He argues that the subsidy increased wage employment among women, previously bearing the cost of living without electricity, running water and in dwellings prone to hazards.

We argue that housing projects sites should not be confined in a role of housing provider. Instead, if accompanied by coordinated and complementary policies and investments such as targeted subsidies or improvements in infrastructure, housing sites can achieve the density required to form efficient sub centres of economic activity, as observed in many large cities in the world. High commuting costs makes it more efficient to have various clusters of jobs and residence, where firms, workers and consumers take advantage of proximity. Such cities have evolved from monocentric structures to more decentralized configurations[4]. Rapidly growing cities actually need multiple sub centres of activity, that benefit from localization economies, encourage specialization, and reduce transport costs. South African cities already feature a polycentric form. Could policy support the emergence of Sandton-like sub centres further South of Johannesburg's downtown? What does a polycentric city form mean in terms of *"convenient access to economic opportunities as well as health, educational and social amenities" (White Paper)*?

The key challenge for policymakers at the National, Provincial and Municipal level is to identify the set of interventions (policy, regulatory, institutional and investment, etc.) that are best suited to realize development potential of sub centres and reduce the large and persistence spatial disparities in living standards within cities. Figure 1 outlines a set of policy instruments that have been used to support sub national development in a wide range of countries, including South Africa. These include *place based policies* such as Special Economic Zones and transport corridors, and *people based policies* such as skills accumulation, provision of basic public services and health and education. Identifying and prioritizing to identify a sharp set of complementary instruments is particularly important as persistent spatial disparities can adversely affect national unity and social cohesion and foster political instability. However, in designing and implementing these interventions, it is essential to recognize that efforts focusing on leaving no place behind does not equal to "doing the same everywhere." Further, the choice of place based policies should be informed by their net benefits to national growth and welfare as well as their practical feasibility given fiscal and political constraints.
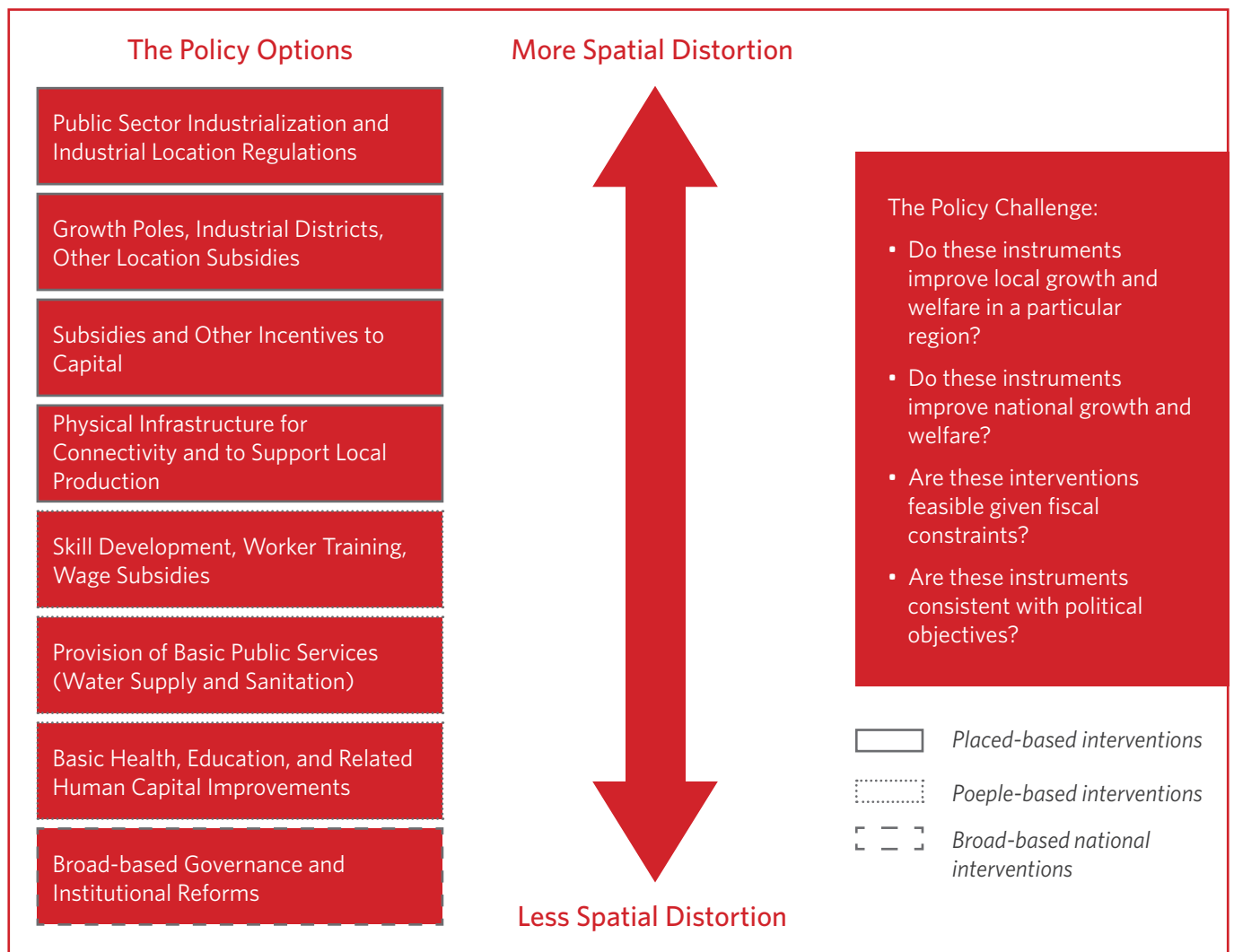
Any place based policy need to be complemented by investments in basic services and human development to foster a stronger business environment and wider welfare gains. Not only servicing the housing projects is essential, but also investing in equalizing the access to quality education and health clinics are essential to encourage mobility and density around housing projects. Improving connectivity between sub centres will be equally important to foster linkages between them, but cities' form and density have implications for the provision public transportation – as mass transit requires density of demand and scale to be efficient and consistent with fiscal constraints (Boex 2017).

The seminal work of Schelling (1971) suggests that *"people get separated along many lines and in many ways"*. While the South Africa's rich sorts by income in centrally located areas, others could sort in places that are further away by existing social networks. Seen as "escalator areas", informal settlements can encourage skills accumulation by enabling new comers to acquire relevant skills and contacts through interactions with successful entrepreneurs, which have emerged in townships (Turok 2017). Such existing networks benefits could be complemented by investments to improve schooling and health provision quality, and tax incentives to ease business and job creation or training supporting young entrepreneurs. Government has a role to play in supporting sub centre formation in housing project sites in providing the right intensives for such development to happen at *scale* in order to achieve the dual objective of economic efficiency and social equity, and the emergence of a black African middle class.

To deliver on their promises, mega project investments

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[4] See Goswami and Lall 2015 for a discussion on the internal structure of cities and its evolution.

Figure 1 : Policy instruments to bridge the spatial divide

The Policy Options

More Spatial Distortion

- Public Sector Industrialization and Industrial Location Regulations
- Growth Poles, Industrial Districts, Other Location Subsidies
- Subsidies and Other Incentives to Capital
- Physical Infrastructure for Connectivity and to Support Local Production
- Skill Development, Worker Training, Wage Subsidies
- Provision of Basic Public Services (Water Supply and Sanitation)
- Basic Health, Education, and Related Human Capital Improvements
- Broad-based Governance and Institutional Reforms

The Policy Challenge:

- Do these instruments improve local growth and welfare in a particular region?
- Do these instruments improve national growth and welfare?
- Are these interventions feasible given fiscal constraints?
- Are these instruments consistent with political objectives?

Placed-based interventions

Poeple-based interventions

Broad-based national interventions

Less Spatial Distortion

Source: Lall 2009

will have to deliver not only in quantity, but also in quality in housing standards and service delivery (Lodge 2003). These projects are highly politicized, and were mired by controversy around accountability and transparency issues, in particular in the selection and allocation process. Discrepancies in numbers were also pointed out as it appears that the DHS does not have an accurate record on the number of houses that were actually built, and not all houses have been formally registered on the Deeds (SERI 2013). Government should improve the institutional mechanisms through which information on RDP (construction, maintenance, registration) is transmitted from municipalities – responsible to undertake the housing function – to the DHS. More clarity and transparency in the process can certainly help to address concerns over the alleged levels of wrongdoing, fraud and corruption.

The paper proceeds as follows. Section 2 provides an assessment of South Africa's current subsidized housing program by discussing the effect of fully subsidized housing investments on property prices in Cape Town[5] , and more describes the determinants of housing prices in South Africa, gauging the various forces at play. Section 3 reviews international experience on the emergence of sub centres of economic activity, and discusses policy implication for South African cities. Section 4 concludes.

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[5] Cape Town was the only city where fully subsidized housing location was recorded. The data was made available thanks to the Centre for Affordable Housing in Africa (CAHF). The terms fully subsidized housing, public housing and RDP are interchangeably used in the remaining of the paper.

2. Assessment of South Africa's current subsidized housing program

2.1 Data

AHousing transaction prices were computed from the Deeds office data for 2001 and 2011 (sales recorded between January and December of each year). The median transaction price by neighborhood is for freehold titles, which correspond to houses where the household owns the entire plot. An example is freestanding homes in residential areas. Not having any information on the house itself, such as the number of room or the area, we assume that houses are similar within neighborhoods (which are on average 2.5 km square).

Some neighborhoods did not record any transaction. In 2001 (resp. 2011), 30 percent (resp. 25 percent) of neighbourhoods recorded no transaction; 21 percent showed no transaction both years. The excluded segment of the housing market is constituted mostly of South African historical townships. In Cape Town, 36 percent of the total number of neighborhoods have registered both RDP and transactions. The excluded segment includes the same share of neighborhood with and without RDP. Most in situ upgrading (where the entire settlement is replaced) are therefore likely to be excluded.

For each neighborhood, we computed household characteristics and local amenities from the census data, available for both years. Neighborhoods' socio-economic profile is derived from monthly household income, skills, unemployment and race (these are all very correlated). We also computed the share of formal housing (as defined by Stats SA[6]), and other amenities such as access to electricity for lighting, cooking and heating, piped water and sanitation.

From the census data, monthly income per household was calculated based on the proxy values assigned by Stats SA to the income categories collected during the census, converted in months and divided by the number of households. The skill ratio is the sum of the individuals that have completed secondary or started higher education, divided by the individuals that have no schooling, primary or some secondary education.

Public services include the number of teachers and students, police stations (including neighbourhoods within their boundaries) and medical staff per hospital within a 30-kilometer radius (including doctor, nurses, specialists and dentists). These were computed based on the population in each neighborhood, the SNAP Survey of Ordinary Schools, the South African Police service reports, and the South Africa hospital survey. These external data sources were not available for both census years. The hospital survey is only available for 2013, the police stations catchment area dates from 2011. Since both have a certain catchment area, we assumed that they could be used for both years as it is unlikely that important changes happened. The school data was collected from 2005 until 2013, 2005 was therefore used for 2001. The distance to the Central Business District (CBD) is computed as the crow flies using the Haversine formula (locations are shown in Figure 1)[7]. Descriptive statistics are reported in Table 1.

Neighborhoods are the unit of observation and extensive GIS work has been done such that all datasets have been mapped to the Chief Surveyor General boundaries and are comparable across time.

The median housing prices available for this analysis do not allow to distinguish between subsidized housing or not. It is important to note that there are no publicly available data on land and housing values and transaction prices. In particular, information on the construction and sales of publicly subsidized houses, their quantities and location within cities are not systematically recorded and largely absent from cities' records, despite the policies and systems in place. Centralized demand databases were established to capture housing demand, help planner on deciding the components of the housing project, and assist with the allocation process. In practice, lack of coordination between the municipalities (who have the authority), and the provincial and national level and shifts in approaches across political terms or regions have created confusion (see SERI 2013 for a deeper discussion on *"systemic problems with policies and processes"*).

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[6] *See metadata of the census 2011.*
  http://www.statssa.gov.za/census/census_2011/census_products/Census_2011_Metadata.pdf
[7] *In the absence of the spatial distribution of employment, this analysis will be limited to one job centre despite the fact that Joubert (2017) shows that there are multiple.[3] Buffalo city and Mangaung did not have enough neighborhoods with housing transactions to conduct the analysis.*

Figure 2: Central Business District in each metropolitan area

(a) Gauteng metros
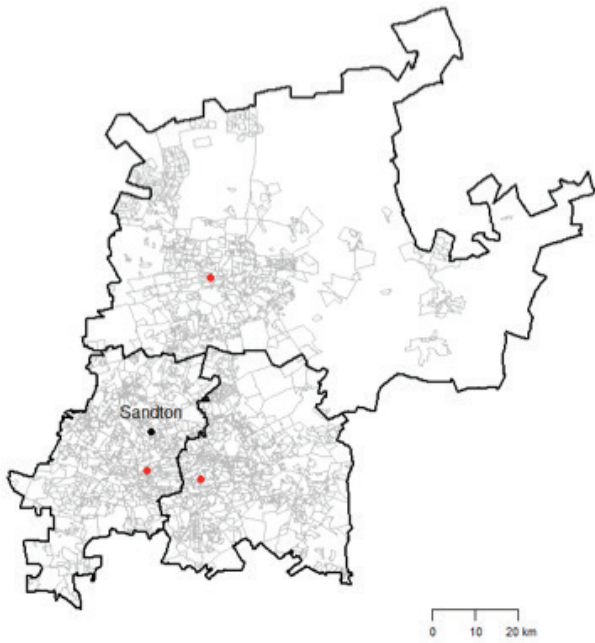
(b) Cape Town

(c) Nelson Mandela Bay

(d) eThekwini

Table 1: Summary Statistics

	2001				2011			
	Mean	Sd.	Min	Max	Mean	Sd.	Min	Max
Johannesburg								
Median Housing price	421,824	843,433	1,000	7,410,000	1,444,074	1,529,936	9,628	11,000,000
Distance to CBD	11.36	7.13	0.96	38.45	11.36	7.13	0.96	38.45
Distance to Sandton	12.07	7.67	0.92	48.11	12.07	7.67	0.92	48.11
Share formal dwelling	0.94	0.10	0.24	1.00	0.95	0.10	0.13	1.00
Median number of room	5.23	1.18	2.00	8.00	5.35	1.27	2.00	9.00
Pupils to teacher ratio	24.22	8.82	5.40	44.91	23.53	8.36	6.70	45.47
Police Station	1.27	4.49	0.02	60.61	1.27	4.49	0.02	60.61
Medical staff per hospital	11.83	0.74	9.69	13.99	11.83	0.74	9.69	13.99
No. person per room	0.72	0.37	0.40	4.43	0.64	0.24	0.31	1.56
Real monthly income per hh	18,114	10,343	2,285	46,651	12,522	8,632	780	38,421
Share of Black African	0.38	0.24	0.06	1.00	0.45	0.26	0.12	1.00
Skill ratio	1.88	1.03	0.28	5.13	1.64	0.81	0.31	5.43
Unemployment rate	0.14	0.15	0.01	0.64	0.11	0.10	0.02	0.43
Observations	233							
Tshwane								
Median Housing price	250,312	311,625	500	3,100,000	818,716	768,052	10,000	6,500,000
Distance to CBD	14.86	10.47	2.01	54.53	14.86	10.47	2.01	54.53
Share formal dwelling	0.90	0.19	0.13	1.00	0.95	0.09	0.45	1.00
Median number of room	5.15	1.14	2.00	8.00	5.56	1.19	3.00	10.00
Pupils to teacher ratio	25.62	8.51	4.55	49.98	24.90	8.03	6.75	58.28
Police Station	0.46	0.58	0.02	4.37	0.46	0.58	0.02	4.37
Medical staff per hospital	15.74	2.41	9.60	23.04	15.74	2.41	9.60	23.04
No. person per room	0.72	0.23	0.33	1.54	0.63	0.20	0.36	1.42
Real monthly income per hh	15,998	9,506	2,083	44,506	9,569	6,357	860	28,157
Share of Black African	0.41	0.38	0.04	1.00	0.48	0.36	0.08	1.00
Skill ratio	2.52	1.81	0.20	7.60	2.09	3.97	0.30	46.84
Unemployment rate	0.16	0.17	0.01	0.54	0.14	0.13	0.02	0.47
Observations	137							
Ekurhuleni								
Median Housing price	172,845	242,626	1,068	2,679,400	789,224	2,213,894	3,500	28,500,000
Distance to CBD	16.18	8.83	0.45	41.90	16.18	8.83	0.45	41.90
Share formal dwelling	0.92	0.15	0.22	1.00	0.95	0.09	0.47	1.00
Median number of room	5.10	1.13	2.00	9.00	5.35	1.11	3.00	8.00
Pupils to teacher ratio	28.68	7.80	6.07	49.87	27.12	7.20	7.12	45.90
Police Station	1.59	9.59	0.04	121.21	1.59	9.59	0.04	121.21
Medical staff per hospital	12.22	1.65	7.47	16.43	12.22	1.65	7.47	16.43
No. person per room	0.74	0.24	0.37	1.89	0.72	0.30	0.43	3.30
Real monthly income per hh	12,723	7,157	1,030	46,531	7,153	4,725	661	20,944
Share of Black African	0.43	0.37	0.05	1.00	0.50	0.35	0.07	1.00
Skill ratio	1.45	0.88	0.17	4.06	1.24	0.52	0.25	2.45
Unemployment rate	0.20	0.18	0	0.62	0.16	0.12	0.02	0.45
Observations	168							

Table 1: Summary Statistics (Cont.)

	2001				2011			
	Mean	Sd.	Min	Max	Mean	Sd.	Min	Max
Cape Town								
Median Housing price	252,648	336,754	6,000	3,525,000	868,070	975,749	7,800	8,400,000
Distance to CBD	20.01	10.72	0.75	50.30	20.01	10.72	0.75	50.30
Distance to Sandton	0.91	0.17	0.04	1.00	0.91	0.15	0.33	1.00
Share formal dwelling	4.71	1.14	0	8.00	5.09	1.13	2.00	9.00
Median number of room	26.77	7.36	5.33	41.76	27.18	7.68	4.09	41.00
Pupils to teacher ratio	1.30	4.09	0.02	43.48	1.30	4.09	0.02	43.48
Police Station	65.13	4.41	59.08	96.00	65.13	4.41	59.08	96.00
Medical staff per hospital	0.86	0.37	0.40	2.62	0.75	0.35	0.34	4.36
No. person per room	13,860	10,717	1,879	49,603	7,841	6,606	702	35,440
Real monthly income per hh	0.14	0.28	0	1.00	0.20	0.27	0.01	1.00
Share of Black African	2.06	2.23	0	12.56	1.43	1.19	0.11	7.40
Skill ratio	0.16	0.15	0	0.60	0.14	0.11	0	0.49
Unemployment rate	310	0.15	0.01	0.64	0.11	0.10	0.02	0.43
Observations	233							
Nelson Mandela Bay								
Median Housing price	143,471	188,812	2,075	1,837,500	555,913	699,164	12,756	4,514,000
Distance to CBD	17.67	8.91	1.49	46.51	17.67	8.91	1.49	46.51
Share formal dwelling	0.87	0.18	0.17	1.00	0.89	0.15	0.21	1.00
Median number of room	4.72	0.96	2.00	7.00	5.02	1.18	2.00	8.00
Pupils to teacher ratio	27.53	7.11	0	55.25	27.62	7.58	8.40	82.80
Police Station	0.57	0.87	0.03	7.26	0.57	0.87	0.03	7.26
Medical staff per hospital	14.31	3.03	2.23	21.76	14.31	3.03	2.23	21.76
No. person per room	0.94	0.32	0.44	3.59	0.79	0.24	0.39	1.41
Real monthly income per hh	9,363	6,321	973	35,508	5,179	4,699	663	21,516
Share of Black African	0.44	0.37	0.01	1.00	0.51	0.36	0.03	1.00
Skill ratio	1.12	0.84	0.18	3.98	1.01	0.52	0.21	2.54
Unemployment rate	0.29	0.20	0.02	0.70	0.21	0.14	0.03	0.57
Observations	269							
eThekwini								
Median Housing price	117,066	111,676	2,335	620,000	420,254	359,390	5,161	1,700,000
Distance to CBD	13.07	8.75	0.90	32.57	13.07	8.75	0.90	32.57
Share formal dwelling	0.91	0.14	0.32	1.00	0.93	0.12	0.34	1.00
Median number of room	4.96	1.13	2.00	8.00	5.23	1.08	3.00	7.00
Pupils to teacher ratio	26.10	6.67	9.24	38.66	26.42	6.98	9.10	44.84
Police Station	0.69	0.70	0.02	4.28	0.69	0.70	0.02	4.28
Medical staff per hospital	18.63	0.96	15.16	20.76	18.63	0.96	15.16	20.76
No. person per room	0.84	0.32	0.46	2.03	0.69	0.25	0.37	1.58
Real monthly income per hh	10,144	6,237	2,239	26,681	5,527	4,534	587	16,450
Share of Black African	0.32	0.39	0	1.00	0.36	0.37	0.02	1.00
Skill ratio	1.37	1.31	0.12	4.97	1.07	0.77	0.10	3.58
Unemployment rate	0.28	0.25	0.02	0.75	0.22	0.19	0.01	0.60
Observations	97							

2.2 Towards measuring the impact of housing investment on property prices

Do units of public housing affect neighbouring property values? Citizens have recently raised their voice over affordable housing programs, fearing that their house would lose value or they would have difficulty to sell it if public houses are built nearby. In the more informal areas, subsidized housing is seen as an asset. Houses have been accompanied by the extension of infrastructure and the provision of services. These neighbourhoods transitioned from crowded to dense in capital (Lall, Henderson and Venables 2017).

Evidence from the United States has been mixed, with impact varying based on the type and scale of project, who runs it, and the characteristics of the place where it is located (Agnew 2010). From a policy perspective, a successful affordable housing program is one that is flexible and meets the various needs of low-income households, and recognizes the trade-off between housing and transportation expenditures, the two major expenditures of many lower-income families. While addressing these market failures, it should not lower the price of existing houses, which are valuable assets to their residents.

In theory, one would like to compare how the evolution of prices in, for example, one of the neighbourhoods in Khayelitsha, had there been no public housing. This is obviously impossible. A second best would be to look at neighbourhoods with or without public housing, before and after the investment, and purge the impact estimate from pre-existing differences between these neighbourhoods. Unfortunately, we only have the census data for 2001 and 2011, and RDP houses registered[8] yearly from 2007 to 2015 (which spatial distribution in Cape Town in 2011 is shown in Figure 3) while the RDP program started when Apartheid ended.

We identify two alternatives to ex-post policy evaluation: the first is a nearest neighborhood matching approach, which will match neighborhoods in pairs based on their characteristics, pairs which will be composed of one neighborhood with RDP housing, and one without. The second will be based on comparing neighborhoods in 2001 and in 2011 and look at the effect of the number of registered houses between the two censuses.

Figure 3: RDP houses registered in Cape Town (2011)
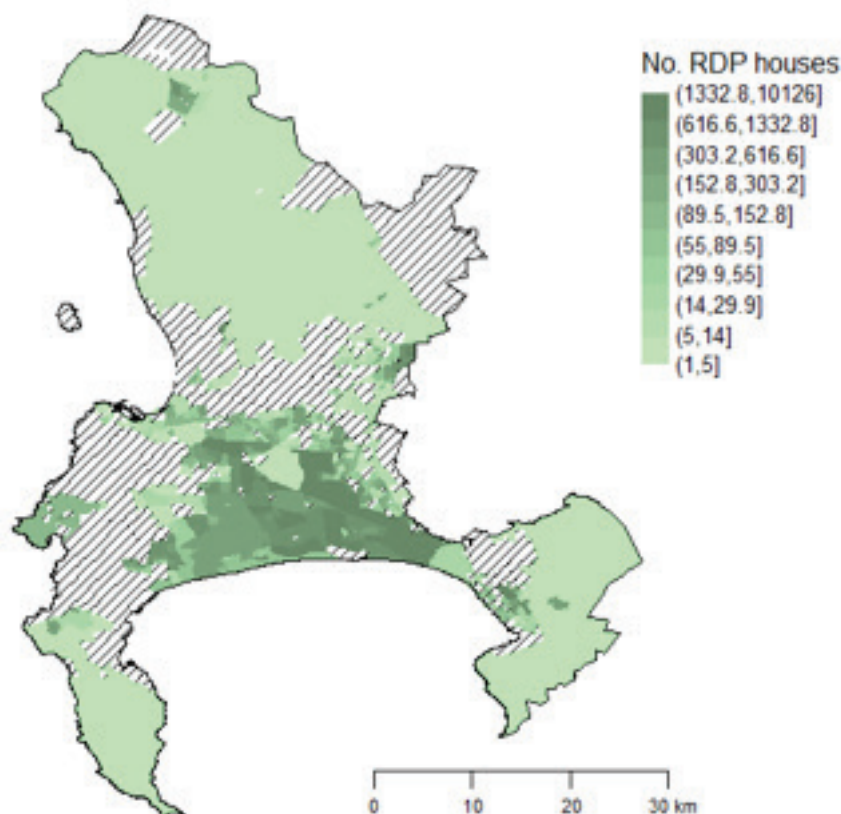
Source: Centre for affordable housing finance in Africa (CAHF)
Notes: the dashed areas are places where no RDP house was built

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[8] *The records reflect that the properties were registered on the deeds registry, not necessarily built. The common practice is to register all the deeds at once, even for larger projects. In practice, most of the properties are occupied as they are built (Centre for Affordable Housing Finance in Africa).*

2.3 Nearest neighborhood matching

Based on the assumption that RDP location decision is based on a set of observable characteristics, one approach is to match neighborhoods based on an estimated propensity (to build) score, and then to compare housing price based on whether the neighborhood was chosen for the program or not. (The outcome is therefore binary.)

In a first step, we estimate the probability for RDP houses to be placed in a neighborhood. We assume that the main determinants of placement are the share of formal housing in 2001, the median number of rooms in 2001, the pupils to teacher ratio, the number of police station, the staff per hospital and the monthly household income in 2001. The density distribution of these predictions can be plotted for each group (RDP or no RDP) to identify what is referred as common support, or where in their distribution, both types of neighborhoods are represented allowing for a comparison of comparable neighbourhoods. Finally, to evaluate the quality of the matches, we check whether among matched neighbourhoods, there are no remaining significant differences between the previously identified characteristics. Figure 4 shows the difference in these characteristics among the unmatched and match neighbourhoods, the closest to the zero line, the better. There are no remaining significant differences between predictors (formality, number of rooms, income etc.) when comparing matched neighborhoods with RDP housing and without.

Figure 4: Evaluation of the quality of matching
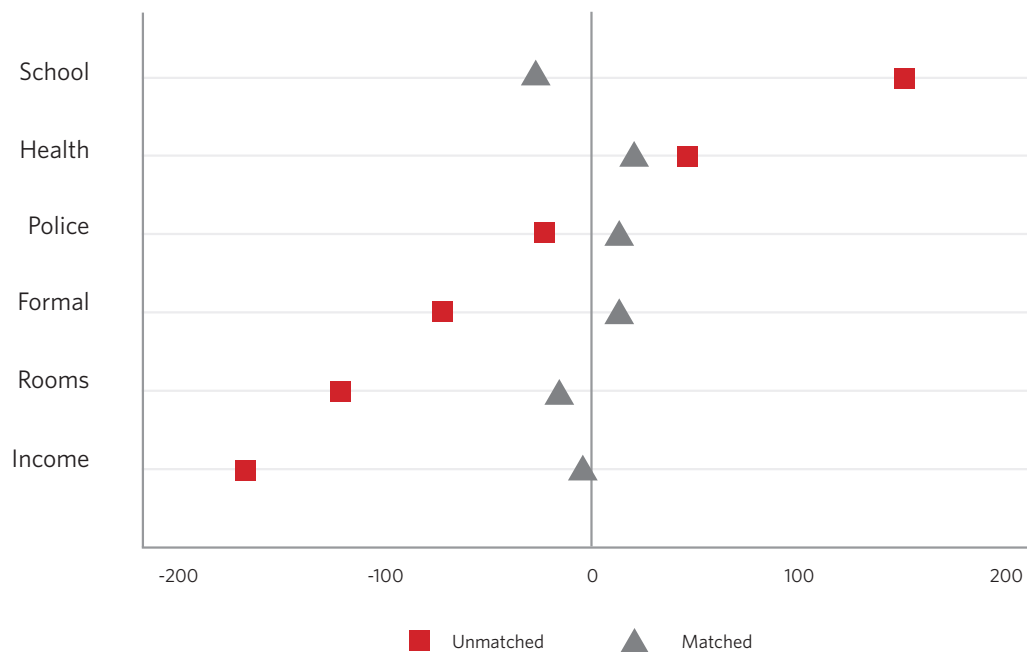
The model estimates that housing prices in neighborhoods where RDP housing has been registered in 2011 are 19% cheaper (p-value < 0.05). Very few RDP houses have been sold legally[9], so it is unlikely that they are part of the transactions recorded by the deeds (and have been accounted for in the estimate).

This method needs to be complemented to account for the size of the project and account for the neighborhoods with the highest probability to get RDPs, for which no other neighborhood was similar enough in 2001 to constitute a good counterfactual. These correspond to where most of the RDP houses have been built (Figure 5). This is likely to be due to the fact that there are many unobservable determinants of RDP location choice.

The next section seeks to address the previously mentioned limitation: getting to the effect of the size of the project and address the unobservable determinant bias to have a more comprehensive picture.

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[9] https://mg.co.za/article/2015-06-08-govt-seeks-to-discipline-those-selling-rdp-houses

Figure 5: Location of comparable neighbourhoods
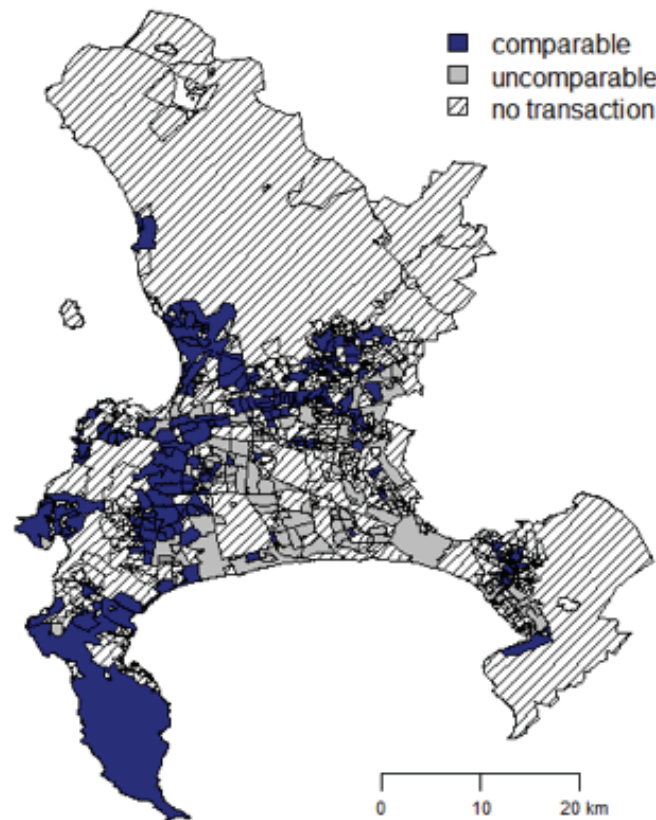
2.4 Accounting for the size of the project

The size of the project should not be forgotten as research suggests that the small projects have been shown to perform the best, while large housing project have had mixed results in the United States (Agnew 2010). We also investigate whether RDP houses affect prices differently based on the degree of informality in the neighborhood.

As discussed previously, there might be many unobservable factors that determine public housing location. Relying on the panel dimension of the data, we can estimate a fixed-effect model, which removes the time invariant unobservable effects.[10] We find that, controlling for population density, the number of RDP houses registered has a positive impact on property transaction prices in neighborhood that are poorer, or more informal.

We estimate the following fixed effect regression:

$$p_{i,t} = Z_{i,t}\beta_i + \alpha_i + u_{it}$$

where α_i captures the characteristics of the neighborhood that do not change across time. With two years of data, this model estimates the difference between each year and eliminate the time-constant unobservable α_i.

The estimations are presented in Table 2. In column (1), a formality premium is present. Increasing the formal share of housing by 10% would be associated with a 10.4% increase in housing prices. In the remaining columns, we assume that the effect of RDP housing will depend on the share of formal housing (resp. income) in the neighborhood and assign the neighborhoods into two groups: low vs high share of informal (resp. income) corresponds to lower based on the median of share of households living in formal housing (income) in 2001. The effect of RDP housing in informal settlements is positive for the houses in which formal housing is below Cape Town's median share in 2001. The higher the share of informal housing, the higher the housing prices. This stems from the fact that RDP houses – more formal – are built in these neighbourhoods and increase the value of other housing there. This holds for the households living in the poorest areas. Inversely, RDP housing can be perceived as a disamenity in more formal neighbourhoods, where it will be associated with a decrease in housing prices.[11] In particular, the formality premium is lower than the negative effect of RDP on price.

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[10] In the absence of data before 2007, the variation in the number of RDP houses is the difference between the 2007 and 2011. The effect could vary both ways depending on how the spatial distribution of RDP housing varied.

[11] This holds if our assumption that no transaction of RDP house has been transacted and, and the sale recorded in the deeds.

	(1) All	(2) Low Formal	(3) High Formal	(3) Low Income	(4) High Income
No. RDP housing (st.)	-0.018 (0.056)	0.220*** (0.081)	-0.501*** (0.116)	0.295*** (0.086)	-0.301*** (0.067)
Share of formal dwelling	0.014* (0.008)	0.010 (0.009)	0.330*** (0.112)	0.003 (0.009)	0.036* (0.020)
Population density (log)	0.963*** (0.122)	1.114*** (0.234)	0.601*** (0.159)	0.775*** (0.254)	1.070*** (0.158)
Constant	3.324** (1.317)	1.154 (2.303)	-24.165** (11.090)	4.354* (2.532)	1.816 (2.426)
N	620	295	325	311	309
R2	0.17	0.24	0.29	0.17	0.37
Average no. transactions	73	77	71	73	73

Notes: Fixed effect regression model. The dependent variable is the median freehold transaction price. Low (High) share of informal corresponds to lower (higher) share of households living in informal housing. The average number of transaction per neighborhood is indicated in the last row, and N is the total number of neighbourhoods. Estimates are reported for Cape Town. Robust standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

These results are consistent with Agnew (2010)'s review of the literature in the United States, highlighting that large project have the most benefits on housing prices in low-income neighbourhoods while having mixed impacts in richer places.

3. Are there other determinants?

By restricting the model to 2011, we can gauge the effect of other determinants of housing prices. We rely on hedonic methods, an approach that has been used widely in the literature seeking to estimate the value of public amenities and services. It assumes that housing price is not only a function the house physical attributes (e.g. number of bedrooms) but also of the provision of public services in the area (e.g. health centres), locational advantages (e.g. distance to the central business district (CBD)) and neighborhood socio-economic characteristics such as income, race or unemployment.[12] Individuals might have different preference and different willingness to pay for these different characteristics. In the absence of household data, our estimations will only give us insights on the average marginal willingness to pay by neighborhood.[13]

We estimate two hedonic models looking at the correlates of prices. In the first one, only amenities are included, that is, the share of formal housing, the pupil to teacher ratio, the number of police stations per 1,000 and the number of medical staff per hospital within a 30-km

radius. We control for population density. The literature suggests that an area closer to opportunities (proxied by the distance to the central business district[14]), with more and better amenities will be a more expensive place to live (Glaeser and Gottlieb 2009). Empirically, this locational attribute has been shown to account for a large share of the variation in prices at a given time. We then add socio-economic characteristics: income, skills, unemployment rate and the share of Black African.

a) The hedonic model

For each city c, and the neighborhood i, the empirical specification of the hedonic model is given by the following equation:

$$p_{c,i} = Z_{c,i}\beta_c + u_{c,i}$$

where $p_{c,i}$ denotes the vector of N observed median housing prices, deflated by the median number of rooms, $Z_{c,i}$ denotes an $N \times K$ matrix of explanatory variables describing neighborhood characteristics in terms of location, provision of infrastructure, local amenities, public services, demographic and socio-economic characteristics of its inhabitants; β is a $K \times 1$ vector of parameters to be estimated; and u is an $N \times 1$ error term.

The literature on spatial econometrics has shown that estimates of hedonic housing might be biased in presence of spatially correlated errors or if spatial correlation exists between the prices in contiguous neighbourhoods, among others because of herding (Baltagi and Bresson 2015; Anselin et al. 2010). Hence, the ordinary least square estimation of equation (2) will perform poorly.

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[12] See among others Kuminof, Smith and Timmins 2013 for an exhaustive review of sorting models.
[13] If individual house data was available, we could have examined the heterogeneity in the estimated marginal willingness to pay based on individual characteristics (such as income, education or race).
[14] In absence of employment data, we assumed the distance to the city centre to be a good proxy.

To take spatial dependence into account, we can include a spatial lag, such that equation (2) becomes

$$p_{c,i} = \lambda W p_{c,-i} + Z_{c,i}\beta_c + u_{c,i}$$

where W is a matrix of spatial weights, such that the matrix elements w_{ij} is the inverse of the distance between neighbourhoods i and j and $p_{c,-i}$ are the prices in non i neighbourhoods. This model accounts for the fact that *"Everything is related to everything else, but near things are more related than distant things"* (Tobler, 1970). Based on distance, spatial weights for places that are closer from one another are higher than the ones for places that are far apart. This accounts for the fact that the price in one neighborhood depends on close-by neighbourhoods.

An alternative correction considers spatial autocorrelation, which reflects non-constant error variance across space. The model is described as follows:

$$p_{c,i} = Z_{c,i}\beta_c + u_{c,i}$$

$$u_{c,i} = \rho W u_{c,-i} + \varepsilon_{c,i}$$

We estimate a model combining both, referred to as a spatial autoregressive model with autoregressive disturbances (SARAR) following Kelejian and Prucha (1998):

$$p_{c,i} = Z_{c,i}\beta_c + \lambda W p_{c,-i} + u_{c,i}$$

$$u_{c,i} = \rho W u_{c,-i} + \varepsilon_{c,i}$$

b) Insights from Cape Town

In Table 3, column (1) starts with a baseline regression, with the estimated correlation between housing prices and amenities, public services and distance to downtown. In column (2), we add the (standardized) number of RDP houses for each neighborhood. It shows that on average, an additional standard deviation of RDP house registered – which corresponds to 700 – is associated to housing prices that are 19.4% cheaper. In column (3), we re-investigate whether RDP houses might affect prices differently based on the degree of informality. This model therefore adds an interaction term between the share of formal dwelling and the number of RDP houses. The interaction term is negative and significant, the share of formal housing associated coefficient increases and the coefficient estimate of RDP housing drops and turns out to be insignificant. What it means is that neighbourhoods in the extreme scenario of no formal housing, the effect of RDP houses is positive but not significant (p-value = 0.14). But if we consider the other extreme, a neighborhood that is 100% formal, RDP housing will go against the positive effect of being a formal neighborhood. RDP houses lower the benefits of formality.

We also find that as expected, the usual determinants of prices – local amenities, public services and proximity to the CBD – are significantly associated with higher housing prices.

Everything else equal and on average, a house in a neighborhood that is one kilometer further from Cape Town CBD is predicted to be 10% cheaper. This is in the same ballpark that estimates for Shanghai, where Chen and Hao (2008) found that price decreased by 5% as moves one kilometer further from the CBD. Households living in a neighborhood that has a larger share of formal housing are more expensive. If formality increases by 10 percentage point, the model predicts price to be 17% higher. The median number of room is also positively associated to housing prices, as is the number of police stations and the medical staff. Pupil to teacher ratio is used here as a proxy for better education in absence of scores. Research in the US shows that households are willing to pay more for better education but this mostly reflects sorting of wealthier, better educated households (Bayer et al 2007).

Population density is negatively associated with housing prices, which differ from elsewhere. In South Africa, higher population densities are mostly seen in informal settlements rather than in the downtown area, like in most monocentric cities. And Cape Town has population densities increasing with the distance from the centre (Wainer 2015). Cape Town's urban form is already structured around different population sub centres, as shown in Figure 6. It plots hotspots based on commercial vehicle activities[15] and suggests that there are different clusters of activities.

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[15] *In the absence of data on the spatial distribution of employment within cities, Figure 6 draws on the an index of closeness centrality based on tracking trucks movement, which measures relative importance of a node in the network.*

Figure 6: Cape Town closeness centrality shows economic hotspots as a function of commercial vehicle activities
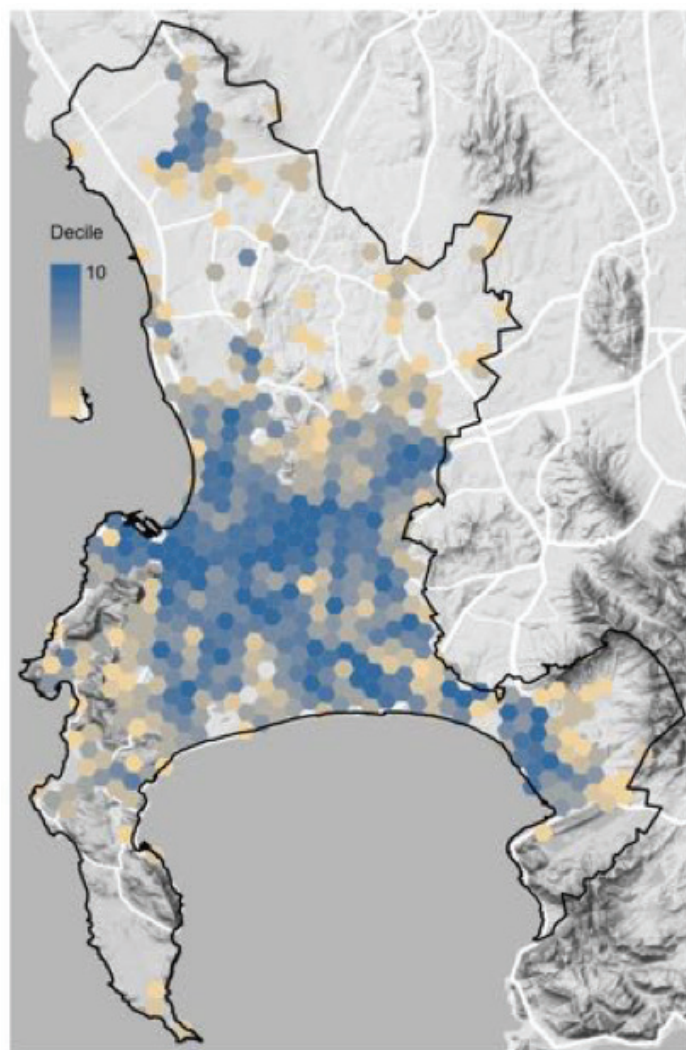
Source: Joubert 2017

Table 3: How does the presence of RDP housing affect housing prices in Cape Town (cross-sectional estimates)

Dependent variable: Median housing price 2011 (log)

	(1) All	(2) Low Formal	(3) High Formal
Distance to CBD	-0.114*** (0.026)	-0.110*** (0.026)	-0.103*** (0.025)
Distance to CBD (sq.)	0.002*** (0.001)	0.001*** (0.001)	0.001** (0.001)
Share formal dwelling	0.018*** (0.003)	0.013*** (0.003)	0.017*** (0.004)
Median no. of rooms	0.237*** (0.042)	0.224*** (0.041)	0.198*** (0.042)
Pupils to teacher ratio	-0.026*** (0.006)	-0.024*** (0.006)	-0.024*** (0.006)
Police Stations per 1,000	-0.026** (0.010)	-0.025** (0.010)	-0.027*** (0.010)
Medical staff per hospital	-0.017 (0.013)	-0.015 (0.013)	-0.013 (0.013)

	(1) All	(2) Low Formal	(3) High Formal
Population density (log)	-0.449*** (0.051)	-0.423*** (0.050)	-0.427*** (0.050)
No. RDP Housing (st.)		-0.194*** (0.048)	0.216 (0.148)
Formal dwelling X RDP			-0.006*** (0.002)
Constant	17.430*** (1.111)	17.517*** (1.082)	17.076*** (1.077)
λ Constant	-0.001 (0.001)	295	325
ρ Constant	0.093*** (0.004)	0.24	0.29
σ^2 Constant	0.359*** (0.029)	77	71
N	310	310	310
AIC	596.79	583.10	576.66
Average no. transactions	54	54	54

Notes: SARAR ML regression model; The dependent variable is the median freehold transaction price. The square of the distance to CBD is added to account for the non-linear relationship between price and distance. The average number of transaction per neighbourhood is indicated in the last row, and N is the total number of neighbourhoods. Akaike information criterion (AIC) is a measure of the goodness of fit of the model relative to others, the lower the better. Estimates are reported for Cape Town. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

3.1 Evidence from other South African cities

We can estimate the previous model for each city to assess whether the forces at play are different in other South African metropolises. We will do so for both years and test whether the sign and magnitude of the effects have changed over time.
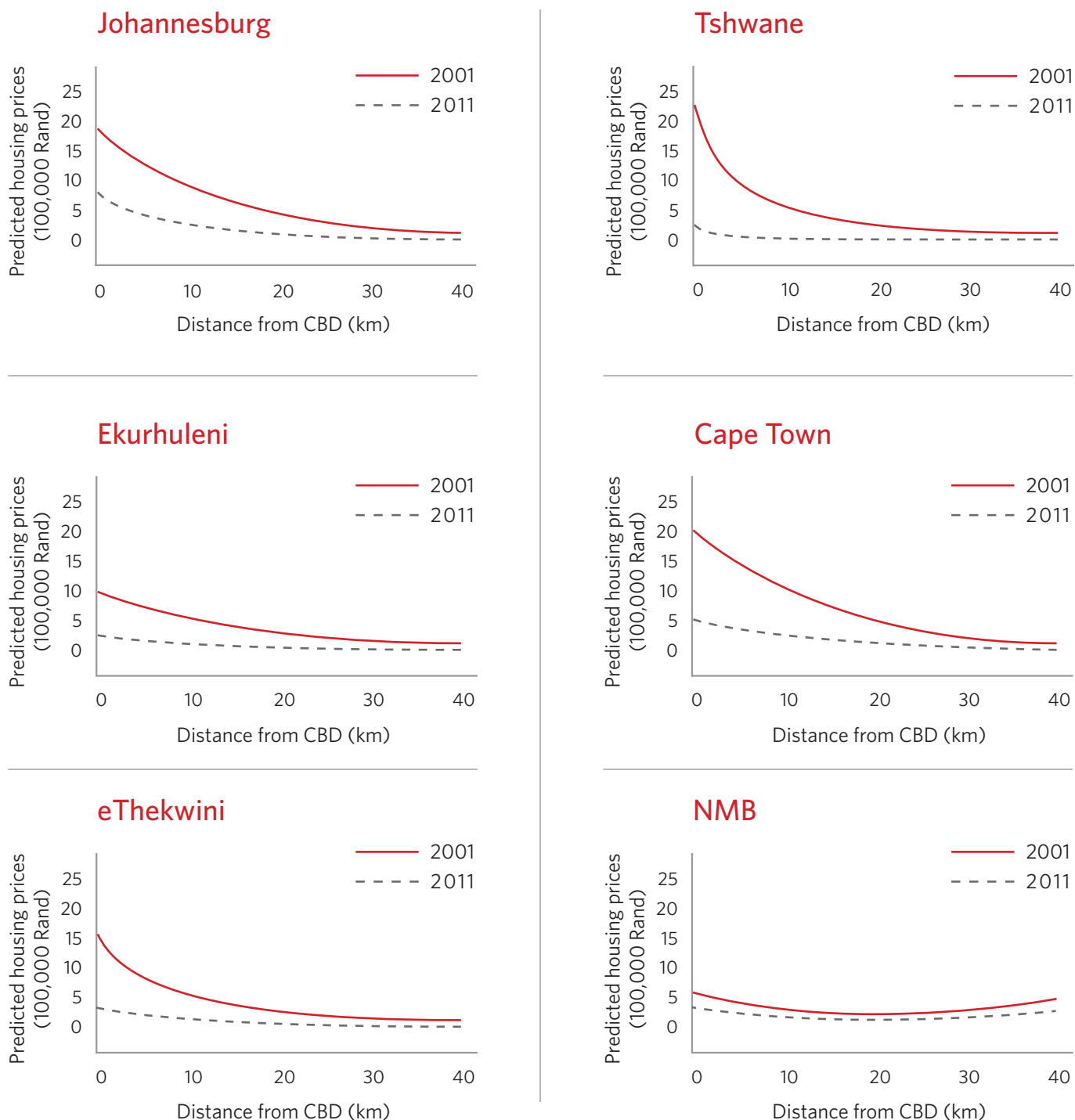
The results are similar than in Cape Town. Amenities, public services and distance to downtown matter in determining property prices. Population density is the only determinant that differs from expectations.

a) Distance & opportunities

We find that in all cities but Johannesburg, distance to downtown matters. Considering, instead of downtown Johannesburg, the distance to Sandton, the city's major economic hub, the effect of distance turns out to be significant and following the pattern of the other cities[16]. The further away, the lower housing prices. On average, a house in a neighbourhood that is one kilometre further from the CBD is predicted to be 6 to 9% cheaper. From a statistical perspective, the effect does not vary across cities. The burden of distance has increased significantly over time in all metropolitan areas, as shown on Figure 7.

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[16] *Sandton will be referred as downtown Johannesburg in the remaining of the paper.*

# Figure 7 : The effect of distance on prices has increased over time[17]

Johannesburg — Predicted housing prices (100,000 Rand) vs Distance from CBD (km). Legend: 2001 (solid), 2011 (dashed).

Tshwane — Predicted housing prices (100,000 Rand) vs Distance from CBD (km). Legend: 2001 (solid), 2011 (dashed).

Ekurhuleni — Predicted housing prices (100,000 Rand) vs Distance from CBD (km). Legend: 2001 (solid), 2011 (dashed).

Cape Town — Predicted housing prices (100,000 Rand) vs Distance from CBD (km). Legend: 2001 (solid), 2011 (dashed).

eThekwini — Predicted housing prices (100,000 Rand) vs Distance from CBD (km). Legend: 2001 (solid), 2011 (dashed).

NMB — Predicted housing prices (100,000 Rand) vs Distance from CBD (km). Legend: 2001 (solid), 2011 (dashed).

Source: Authors' calculation based on the model estimated by city. These are linear predictions assuming one employment centre. The curve would have multiple modes if there were to be more job centres.

We also find that the size of the classes is negatively linked to housing prices in the neighborhoods. Overcrowded class with sometimes up to 80 students per class, are affecting learning abilities. Further, education achievements decrease as neighbourhoods are further away from downtown, and the size of classrooms tend to increase highlighting disparities in skills and access to good education (Figure 8). Access to opportunities is also very unequal, as unemployment rates increase with distance from downtown. But unemployment has decreased between 2001 and 2011 (Figure 9). As a corollary, Figure 10 shows that the lowest households' monthly income is the furthest away from the CBD.

17 *Confidence intervals not shown for sake the sake of clarity.*

Figure 8 : Education outcomes and the size of classes are worse as distance from the downtown increases
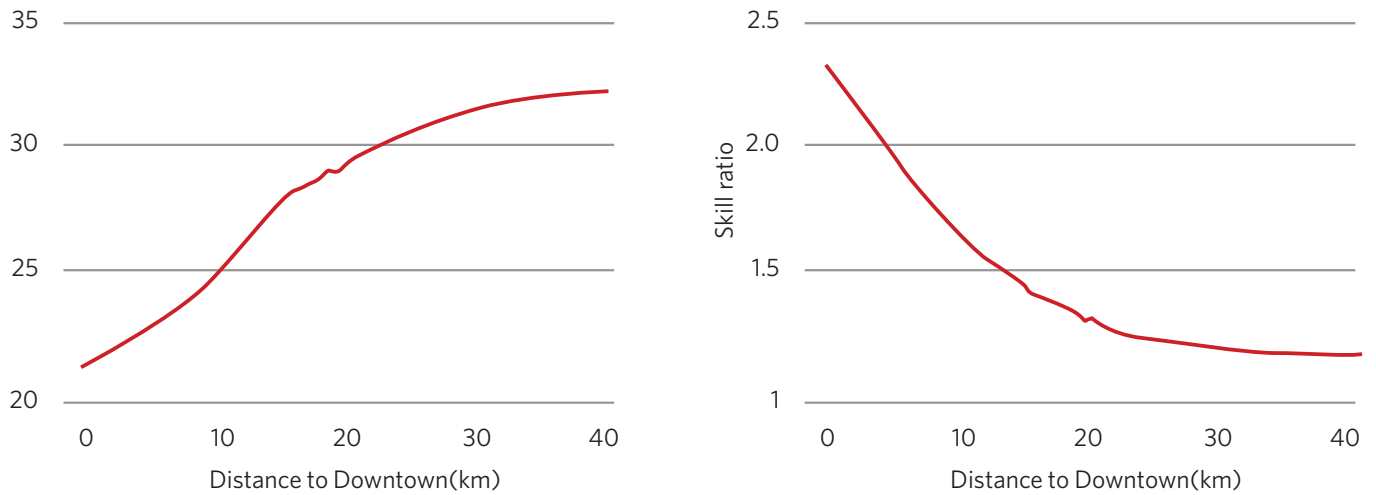
Source: Authors' calculations based on the census 2011 and the SNAP survey.
Note: Smooth lines are based on locally weighted regressions. The skill ratio is the sum of the individuals that have completed secondary or started higher education, divided by the individuals that have no schooling, primary or some secondary education. All cities show the same trends.
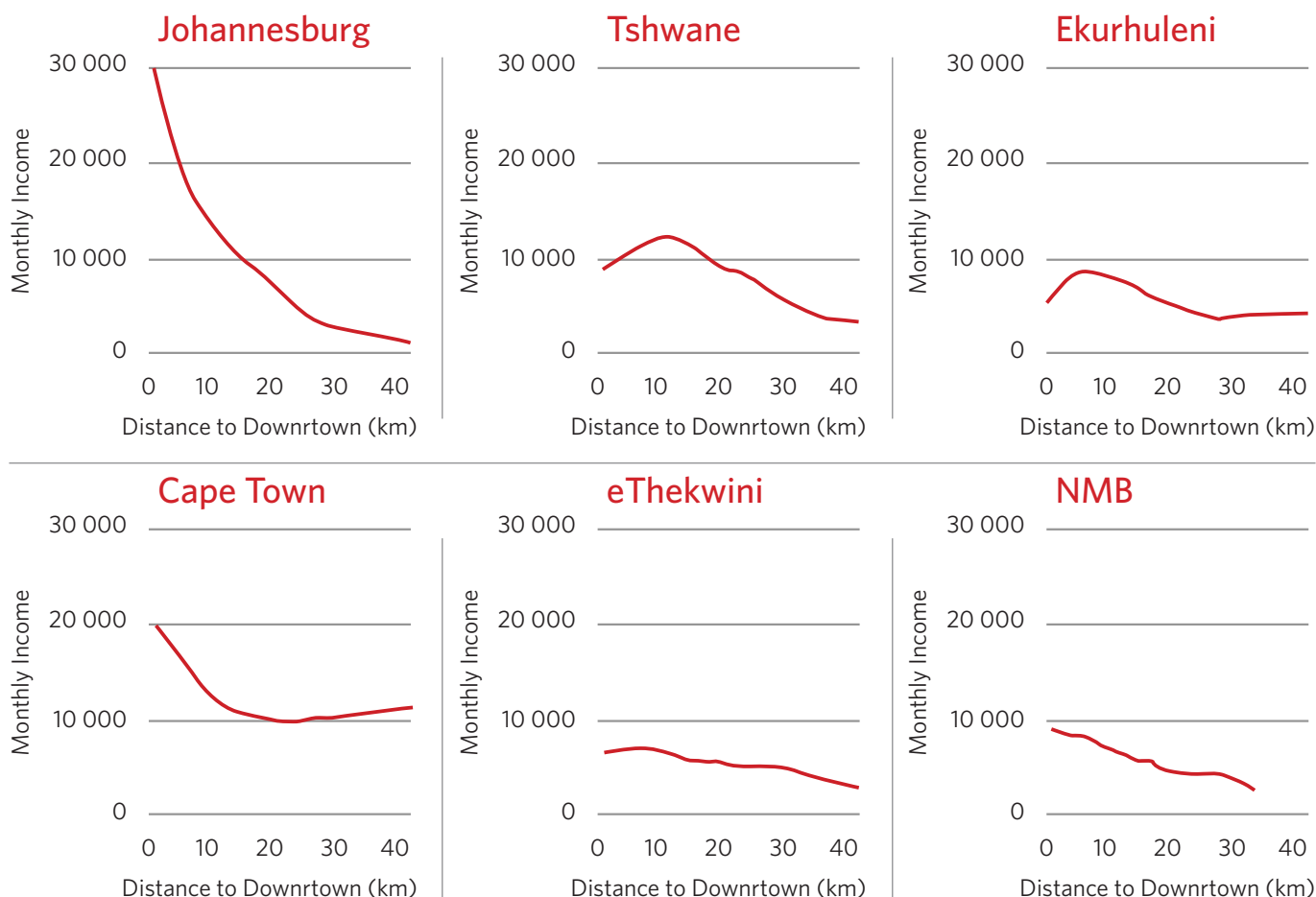
Figure 9: Unemployment has decreased in 10 years, more so far from downtown
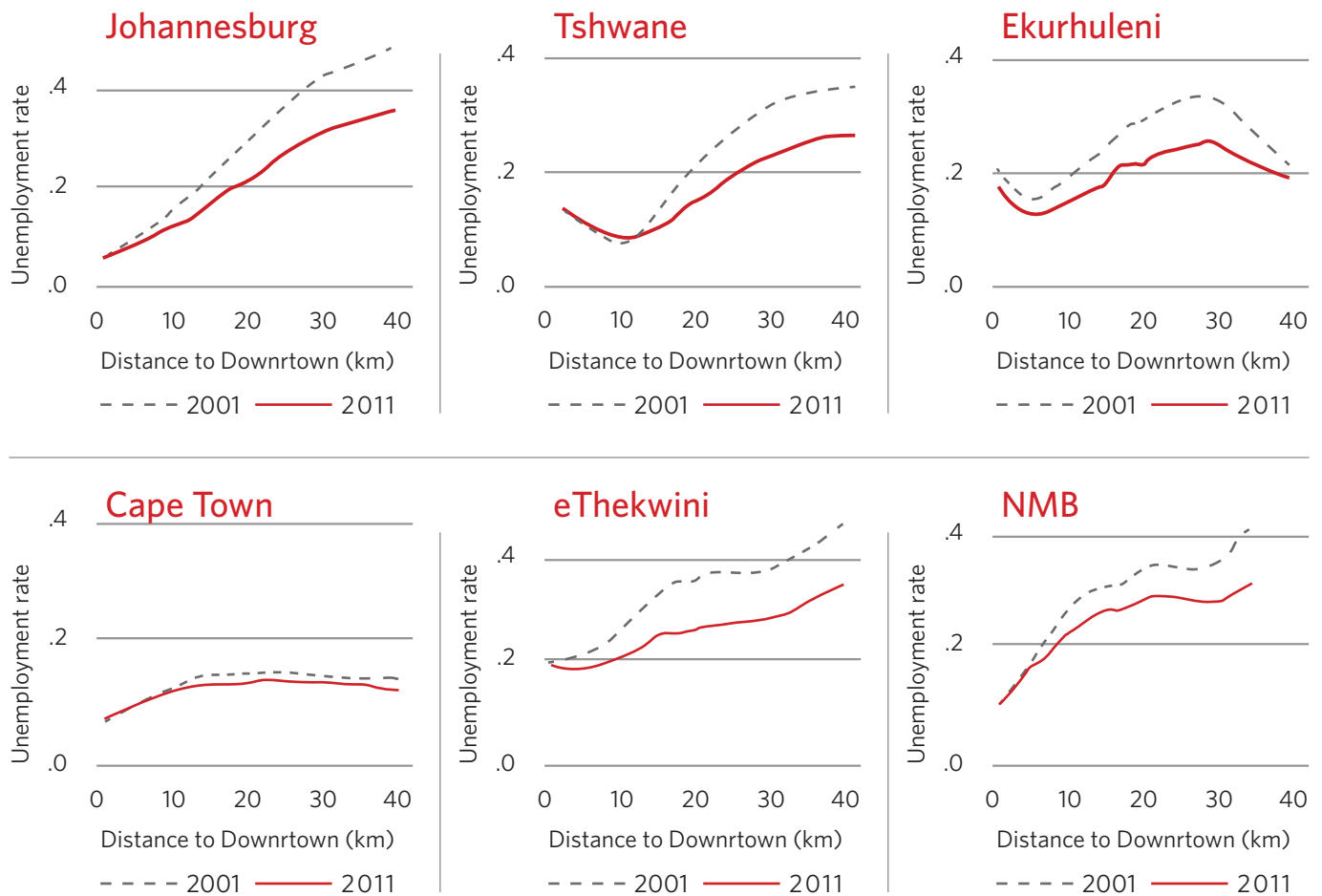
Source: Authors' calculations based on the census 2001 and 2011.
Note: Smooth lines are based on locally weighted regressions.

Figure 10: Average incomes in 2011 are the lowest at the periphery, but some of the poor live close to downtown, except in Cape Town

Source: Authors' calculations based on the census 2011.
Note: Smooth lines are based on locally weighted regressions.

Apart from amenities and public services, the socio-economic characteristics of a neighborhood might affect housing preferences and prices. The share of unemployment in the neighbourhoods has a very strong effect on prices, a one standard deviation increase – 13% in 2011 – is associated with a 61.1% decrease in housing prices. As a corollary, taking two neighbourhoods with a difference in household income of ZAR 6,800 per month in 2011, the predicted housing prices would be 37.5% higher on average.[18]

eThekwini records the stronger link between housing prices and income, and the lowest vis-à-vis unemployment. The price elasticity to skills is also relatively higher in eThekwini. Both income and skill ratio effect are relatively lower in Tshwane, and the latter has significantly decreased between 2001 and 2011. On the contrary, in Ekurhuleni and Cape Town, the more skilled neighbourhoods have seen relatively prices significantly increase between 2001 and 2011.

b) Informality & population density

Unsurprisingly, the formality premium exists everywhere – it is smaller and not significant in eThekwini in 2011 but otherwise, the housing price differential between a neighbourhood that has no informal dwelling and one that is fully formal is predicted to be on average ZAR 400,000 in 2011, and it has largely increase between 2001 and 2011 (Figure 11).

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[18] *Tables are not shown here for the sake of concision.*

Figure 11 : Housing prices are increasing with formality (2011)
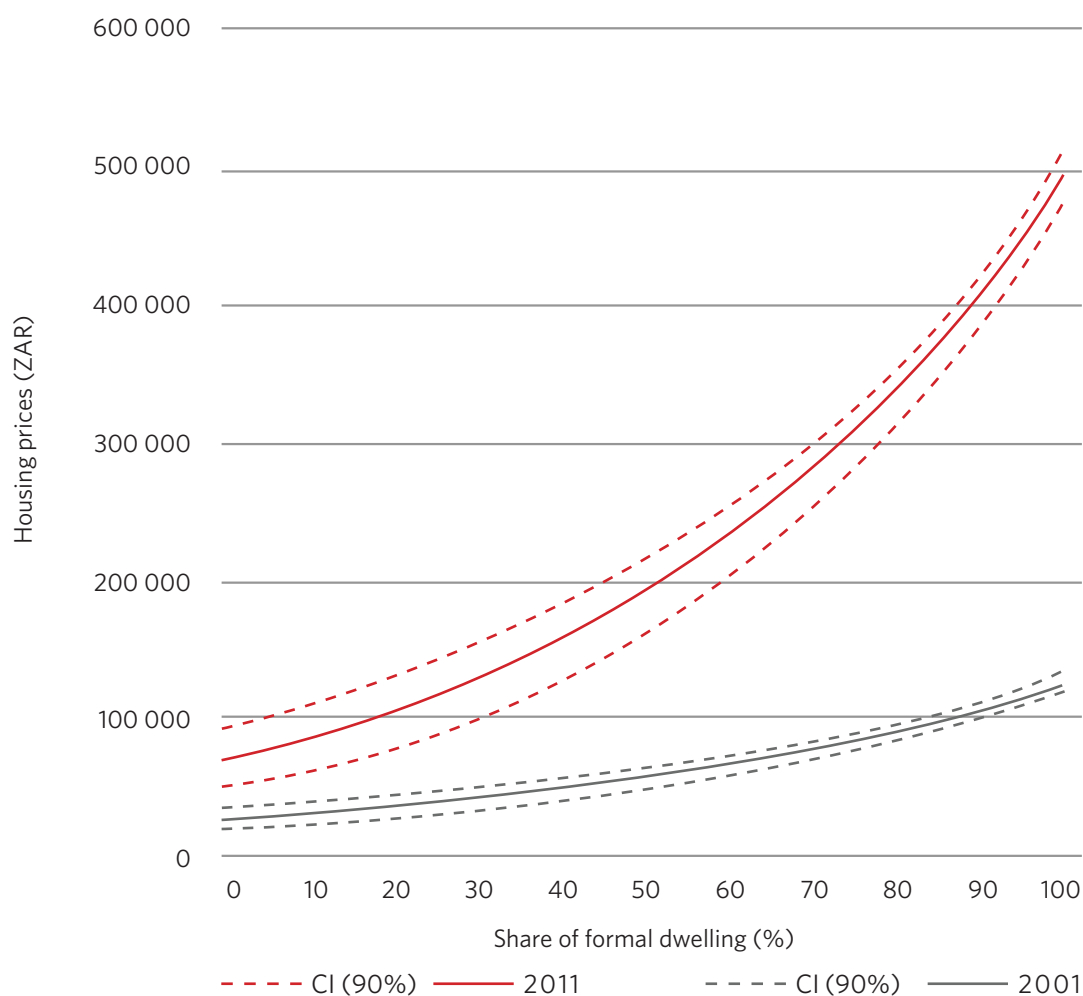
Source: Authors calculation based on the model estimated on all the cities pooled.

Other potential downwards drivers of prices are neighborhood characteristics such as the share of Black Africa or the number of people per room. The share of Black African became an insignificant factor in Johannesburg and Tshwane between 2001 and 2011.

Ekurhuleni remains the city where it matters the most in driving prices down. As the number of people per room, its negative effect is only significant outside Gauteng.[19]

Table 4 : What are the determinants of housing price in other cities? (2011)

Dependent variable: Median housing price 2011 (log)

	(1) Joburg	(2) Tshwane	(3) Ekurhuleni	(4) Cape Town	(5) eThekwini	(6) Nelson Mandela Bay
Distance to CBD	-0.061*** (0.021)	-0.165*** (0.045)	-0.068*** (0.023)	-0.114*** (0.026)	-0.168*** (0.040)	-0.115*** (0.035)
Distance to CBD (sq.)	0.000 (0.000)	0.003*** (0.001)	0.001* (0.001)	0.002*** (0.001)	0.002*** (0.001)	0.003*** (0.001)
Share formal dwelling	0.020*** (0.005)	0.040*** (0.006)	0.027*** (0.007)	0.018*** (0.003)	0.004 (0.004)	0.036*** (0.007)
Median no. of rooms	-0.002 (0.035)	0.156*** (0.048)	0.218*** (0.065)	0.237*** (0.042)	0.454*** (0.052)	0.695*** (0.113)
Pupils to teacher ratio	-0.024*** (0.006)	-0.008 (0.009)	-0.035*** (0.009)	-0.026*** (0.006)	-0.039*** (0.007)	-0.017 (0.014)

19 Tables are not shown here for the sake of concision.

	(1) Joburg	(2) Tshwane	(3) Ekurhuleni	(4) Cape Town	(5) eThekwini	(6) Nelson Mandela Bay
Police Stations per 1,000	0.025** (0.010)	-0.204** (0.088)	0.014** (0.006)	-0.026** (0.010)	0.037 (0.065)	-0.248* (0.128)
Medical staff per hospital	-0.002 (0.071)	0.021 (0.036)	-0.045 (0.039)	-0.017 (0.013)	0.086** (0.039)	0.019 (0.100)
Population density (log)	-0.415*** (0.059)	-0.237*** (0.091)	-0.368*** (0.070)	-0.449*** (0.051)	-0.175** (0.081)	-0.236** (0.111)
Constant	15.934*** (1.012)	11.635*** (1.422)	13.887*** (1.142)	17.430*** (1.111)	14.546*** (1.277)	7.813*** (2.500)
λ Constant	0.001 (0.001)	0.001 (0.004)	0.002 (0.002)	-0.001 (0.001	-0.005*** (0.002)	0.003 (0.003)
ρ Constant	0.206*** (0.005)	0.218*** (0.014)	-0.005 (0.041)	0.093*** (0.004)	0.094*** (0.010)	-0.078 (0.064)
σ^2 Constant	0.322*** (0.030)	0.253*** (0.031)	0.400*** (0.044)	0.359*** (0.029)	0.531*** (0.046)	0.431*** (0.063)
N	233	137	168	310	269	97
AIC	420	227	347	597	620	220
Average no. transactions	79	70	66	54	38	55

Notes: SARAR ML regression model; The dependent variable is the median freehold transaction price. The square of the distance to CBD is added to account for the non-linear relationship between price and distance. The average number of transaction per neighbourhood is indicated in the last row, and N is the total number of neighbourhoods. Akaike information criterion (AIC) is a measure of the goodness of fit of the model relative to others, the lower the better. Estimates are reported by city. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 5 : What are the determinants of housing price in other cities? (2001)

Dependent variable: Median housing price 2001 (log)

	(1) Joburg	(2) Tshwane	(3) Ekurhuleni	(4) Cape Town	(5) eThekwini	(6) Nelson Mandela Bay
Distance to CBD	-0.128** (0.052)	-0.074*** (0.024)	-0.087* (0.045)	-0.120*** (0.028)	-0.139*** (0.036)	-0.099 (0.062)
Distance to CBD (sq.)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.002*** (0.001)	0.002** (0.001)	0.003 (0.002)
Share formal dwelling	0.021*** (0.005)	0.044*** (0.005)	0.015*** (0.004)	0.011*** (0.003)	0.007* (0.004)	0.025*** (0.005)
Median no. of rooms	0.100** (0.048)	0.133** (0.068)	0.289*** (0.061)	0.420*** (0.041)	0.413*** (0.077)	0.470*** (0.074)
Pupils to teacher ratio	-0.024*** (0.007)	-0.028*** (0.010)	-0.032*** (0.009)	-0.023*** (0.007)	-0.034*** (0.009)	-0.047*** (0.013)
Police Stations per 1,000	0.043*** (0.011)	-0.002 (0.093)	0.003 (0.006)	0.025*** (0.009)	0.025 (0.069)	0.058 (0.093)
Medical staff per hospital	0.088 (0.101)	-0.106*** (0.026)	-0.129** (0.053)	-0.028** (0.013)	0.101** (0.042)	0.035 (0.096)
Population density (log)	-0.267*** (0.065)	-0.249*** (0.081)	-0.251*** (0.062)	-0.228*** (0.041)	-0.050 (0.082)	-0.165** (0.078)
Constant	12.481*** (1.477)	11.618*** (1.001)	13.796*** (1.269)	14.297*** (1.069)	12.066*** (1.271)	8.266*** (2.121)

	(1) Joburg	(2) Tshwane	(3) Ekurhuleni	(4) Cape Town	(5) eThekwini	(6) Nelson Mandela Bay
λ Constant	0.000 (0.002)	0.003 (0.002)	-0.000 (0.004)	0.000 (0.001)	-0.007*** (0.002)	0.004 (0.004)
ρ Constant	0.108*** (0.008)	0.730*** (0.032)	0.112*** (0.009)	0.094*** (0.004)	0.066*** (0.007)	0.102*** (0.021)
σ^2 Constant	0.471*** (0.044)	0.616*** (0.076)	0.434*** (0.048)	0.377*** (0.030)	0.716*** (0.062)	0.330*** (0.047)
N	233	137	168	310	269	97
AIC	515	312	365	613	701	194
Average no. transactions	126	181	113	93	68	89

Notes: SARAR ML regression model; The dependent variable is the median freehold transaction price. The square of the distance to CBD is added to account for the non-linear relationship between price and distance. The average number of transaction per neighbourhood is indicated in the last row, and N is the total number of neighbourhoods. Akaike information criterion (AIC) is a measure of the goodness of fit of the model relative to others, the lower the better. Estimates are reported by city. * p < 0.05, ** p < 0.01, *** p < 0.001.

As in Cape Town, population density is negative in all cities. This is against international experience which suggests that higher population density leads to higher demand for land and bids up housing prices. But South African cities are not dense by international standards. Comparing peak densities in 265 cities in Africa, Asia and Latin America, Cape Town, Durban, Johannesburg and Pretoria are in the bottom of the density distribution based on their population (Figure 12). Another difference is that instead of denser city centres, the densest neighborhood in South Africa are the informal settlements, which explains the associated lower prices (Figure 13). It is important to note that the highest densities remain very far from what can be observed in slums in Asia, where population density can reach 250,000.

Figure 12: South African cities' population densities are relatively low

Source: Henderson and Nigmatulina 2016

Figure 13 : Population density is the highest in informal settlements

X-axis: Share of formal dwelling (0 - 20, 20 - 40, 40 - 60, 60 - 80, 80 - 100)
Y-axis: 0 to 20 000
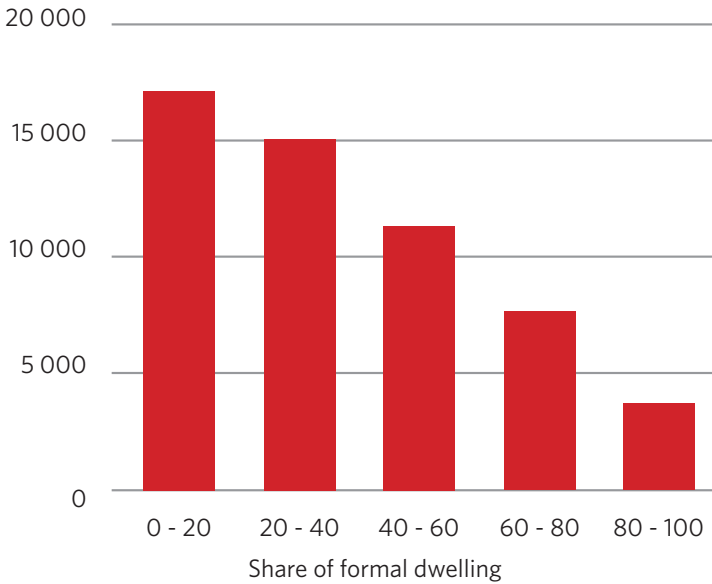
Source: Census 2011

# 4. Encouraging density and the formation of employment sub centres

BUrban form in South Africa has been critically shaped by regulations on land use during the apartheid. Densities do not show a standard homogenous decay as one moves from the city centre, like in Nairobi for example (on Figure 14a) but various peaks such as in Cape Town (Figure 14b). Density gradient tend to flatten as countries get richer (Figure 14, c and d).

Figure 14 : Population density as one moves away from the city centre

(a) Nairobi
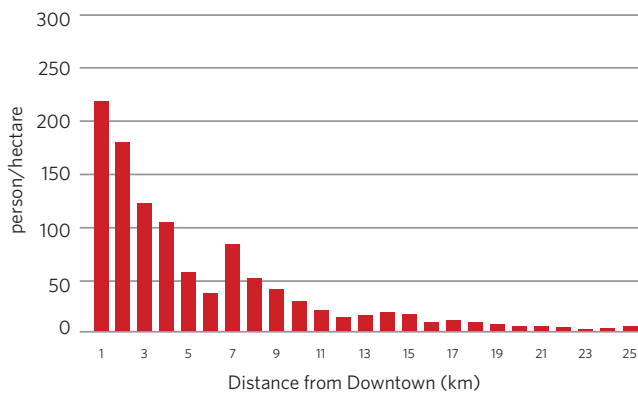
(b) Cape Town
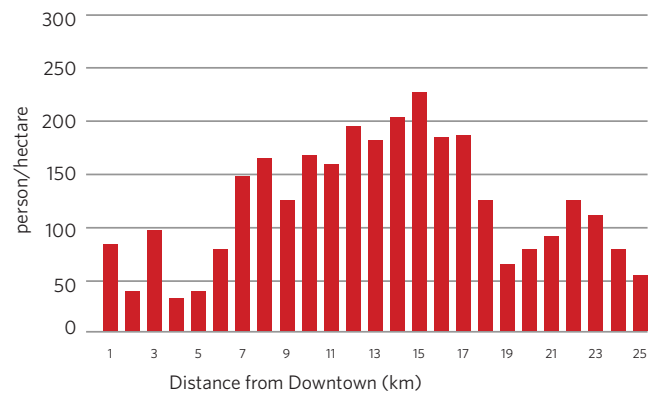
(c) Paris
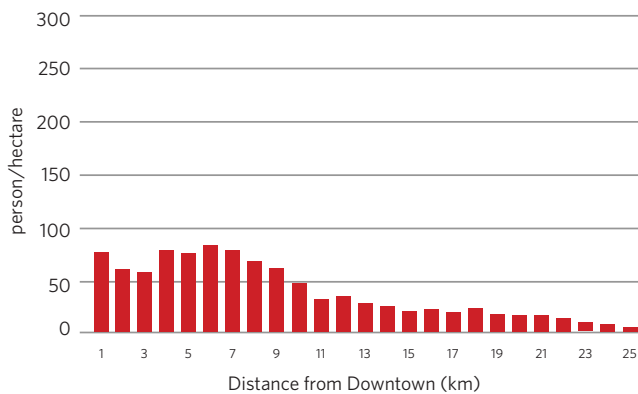
(d) Seoul
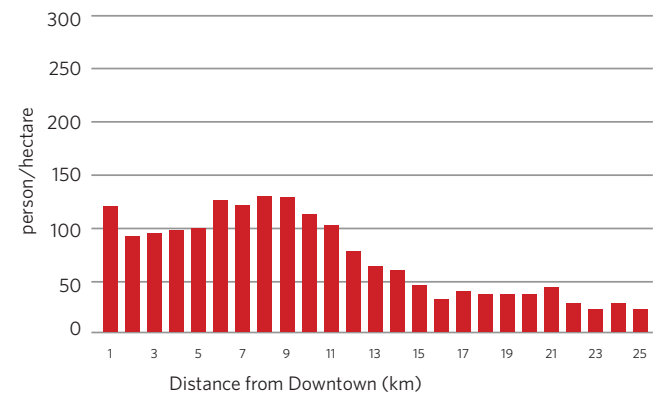
Source: Lall et al. (2017)

Research has shown that as cities grow, the monocentric model becomes untenable, and progressively evolves in a polycentric structure (Bertaud 2003). Clusters of activities emerge, in particular when transport costs fall and connectivity improves. Better connectivity can incentivize workers to move to the suburbs (Alonso 1964; Muth 1969; Mills 1972). Besides pushing workers out from the city centre, improved connectivity pushes manufacturing firms farther out, to the urban periphery (where land and labour are cheaper) while keeping services (which require less space and benefit more from localized agglomeration spillovers) downtown (Baum-Snow (2007) for the United States and Baum-Snow and others (2016) for China). Cheaper commute costs also make the CBD accessible to firms located in farther locations. Thus, when transport costs fall, some firms that do not need to be centrally located for their day to day operations can easily move out of CBD because the CBD would still be accessible to them even from farther locations.

Empirical work in Spain, the US, Japan and China supports the theory that decentralization and suburbanization of jobs benefit non-central locations near the transport infrastructure (see Goswami and Lall 2015 for a review). In Indonesia, the process of decentralization of industrial production from the urban CBD has been facilitated by the building of a highway linking the city to nearby hinterlands (Henderson and Kuncoro 1996). Advances in communication and computing technologies have also facilitated the fragmentation of tasks and activities of firms across various sites. Finally, innovations in electronic infrastructure largely explain the migration of back-office jobs to suburbs.

There is extensive evidence today to support the idea that polycentrism is the reality of urban settlements in many countries (Goswami and Lall 2015). In the US metropolitan areas, only about 25% employees worked within 5 km of their CBD (Glaeser and Kahn 2001).

In theory, sub centres will emerge endogenously, their location being picked by the market. In the case of the mega projects, the location might not be optimal. In such Nth best, complementary zoning regulation (land use, minimum building height, etc.) can help achieved the necessary employment density for the emergence of sub centres and the maximization of indirect benefits and welfare. This also includes policies that calls for investment to upgrade and increase the amenities around housing projects.

Another set of policies relates to improving connectivity and the public transport system across sub centres, and between them and the original downtown to decrease commuting times. Joubert (2017) shows that the hub-and-spoke public transport network provides inconvenient connections for poor people who commute from the periphery as it requires them to transfer in the CBD. Productivity at the periphery is largely dependent on effective public transit and private cars that allow worker to reach jobs. In South Africa, car ownership is relatively

high but only among the wealthier population, although poor people are likely to buy an old and cheap car as soon as they can (Joubert 2017). Authorities therefore want to focus on policies that improve public transportation and connective infrastructure to encourage economic activity to concentrate in the centre and sub centres, and labour mobility to and from such centres. Policies promoting metropolitan-wide connectivity and those that permit speedier and longer commuting would to aid agglomeration of firms and relocation of workers within tolerable commute range (Goswami and Lall 2015). Different transport modes (minibus, buses, BRT) should be considered to respond to variety in demand. This will require sectoral coordination between municipal, provincial and national authorities in transport, land use and housing.

Importantly, the above interventions need to happen on top of solid foundations. The importance of strong institutions, well-functioning of land markets and a skilled workforce cannot be underestimated for housing projects to bring expected returns to beneficiaries and deliver on social promises.

The government also ought to make subsidies "portable" and allow low income households to make the trade-off between transport and housing costs. As such, the current lack of full property right for a period of 5 or 8 years and the pre-emptive right hold by government on the sale of the property should be reconsidered to allow household to make that choice. With time, improvements in connectivity encourage households to relocate. Full property right on these houses would also incentivize households to better maintain and even invest in their dwelling, increasing their value and legalize rental. A deed title would further facilitate access to credit. According to the Centre for Affordable Housing Finance in Africa, 15,096 government-sponsored houses allowed leveraging over R4 billion in loans between 2007 and 2015.

5. Conclusion

This paper provides a first set of estimates of the effect of RDP housing on prices in Cape Town, South Africa. The findings reveal that despite an average negative effect, public housing investments in the poorer areas raise the value of housing assets in these neighborhoods.

Our findings further suggest that the housing market forces are at play in South Africa. Housing prices are consistently lower in the neighborhoods located further from downtown, when land is cheaper. The households living there are trapped: they are far from opportunities, unemployment rates are the highest and education levels and quality are the lowest. Economic distance therefore adds to physical distance, increasing inequalities between the urban core and the periphery. These forces are sharp and have adverse distributional consequences, but policy attempts working against market forces are generally not cost effective. Boex (2017) adds that in South Africa,

"major investments in inclusive urban housing and public transportation would not only be costly, but they would also be unlikely to decisively alter urban spatial form in the short- to medium term".

Assuming a polycentric form, housing mega-projects, if accompanied by a complementary package of investments (including other housing programs) and incentives coordinated across sectors, have the potential to become employment sub centres that are sufficiently large to benefits from agglomeration, and allow to reduce commuting costs and high nominal wages compensating for costs and long commutes. This will ultimately increase productivity and livability in South African cities. Housing on its own will not address the challenges faced by the poorest in remote location. Coordination might add to the costs of investment in the short term, but long-term benefits of such coordinated effort will to pay off.

To address societal concerns about the lack of affordable housing, the backlog in housing delivery, and the suspicions of corruption, there needs to be more transparency and clear information on the processes involved; and to improve coordination among level of governments.[20]

South Africa has a lot to offer: it is ideally located at the world markets gateway, has a growing and diversified economy, a growing middle class and a stable political environment compared to the rest of the continent. As cities will have to accommodate 450,000 new urban dwellers per year in the next 15 years, decision makers have an important role to play in making sure that the housing challenge is met for cities to deliver on their promises.

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[20] This will be discussed more in depth into the housing policy chapter.

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