City sizes and economic inequality: role for urban planning?

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Abstract: Recent research shows that city size can be used as a predictor for many of its socio-economic attributes. Recent work has also found that as Australian cities have grown, so has their income inequality. Census data for the Significant Urban Regions (SUAs) of Australia demonstrated that the larger the city population, the proportion of highest income earners aggregating in that city is disproportionally higher, whereas the proportion of income earners in the middle and lower categories is only proportional or lower than proportional. In this paper, we examine the scaling of the numbers of people in Australian Bureau of Statistics (ABS) defined rent and mortgage classes against city size, and find the same trend echoed: highest rent and mortgage payers accumulate disproportionately in the largest cities of Australia. This trend, coupled with qualitative observations on rising housing prices and affordability pressures in large Australian cities, raises concerns on how the economic and social quality of life in large urban areas may be preserved/raised for all sections of society, as opposed to only the highest earning brackets. In this paper, we present a reflective and critical analysis of the main causal mechanisms of why such a scaling may be becoming a stable trend for Australian cities. We then present some urban planning strategies that may help to counter such inequality producing mechanisms. Larger economic forces, beyond the reach of planning, play a large role in the production and maintenance of economic inequality in large cities. However, this paper specifically focuses on what urban planning can achieve given the constraints set by the wider economic geographic environment in which urban areas are situated.

Key words: *City size; Inequality; Urban allometry; Scaling; Disadvantage; Agglomerations.*

Introduction

Economic, income and wealth inequality are rising concerns worldwide and for Australia (Fletcher and Guttmann, 2013; Leigh 2013; ACOSS 2015). However, one connection remains on the margin in all discussions on inequality: the connection between city size, urbanization, and inequality. The ABS Regional Population Growth, Australia 2011-12 series (ABS, 2012a) shows that about 85% of the population is urbanized and located in the 101 Significant Urban Areas. Parallel capital city calculations show that about 60% of the *total population* is located in the 5 capital cities (Sydney, Melbourne, Brisbane, Perth, and Adelaide), making them home to 70% of the *total urban population*. The statistics of inequality, in parallel, is equally striking: according to the ABS Household Income and Income Distribution of Australia (ABS, 2012b), "the wealthiest 20% of households in Australia account for 61% of the total household net worth, with an average net worth of $2.2 million per household, whereas the poorest 20% of all households account for just 1% of the total household net worth, with an average net worth of $31,605 per household". If national inequality trends are a growing concern, then the presently unexplored but deep relationships between urban growth and inequality warrant close attention. These Australian trends are echoed by worldwide trends of rising urbanization as well as inequality: with more than 54% of the world population already urbanized, and inequality sharply rising (Piketty, 2014; Atkinson, 2015; Stiglitz, 2012). What factors, processes and dynamics connect high/rising urbanization with high/rising inequality?

Answers to this question are relevant for informing urban growth policies. Income and its distribution within and between cities directly affects the wellbeing of citizens and by extension the health, wellbeing and productivity of an entire society. The primary effect of population agglomeration in large urban centres is that more and more numbers of jobs, housing, and amenities also agglomerate in these centres. Differences of living costs, accessibility to amenities, the geography of poverty and wealth, and the physical/spatial implications emergent from these factors interacting with each other drive and shape the locational arrangements of housing, social and public infrastructure in cities, and may emerge as quite different for large and small cities. This is particularly visible in the way that large cities produce spatial segregation and polarization of different economic groups. It could be hypothesized that a resilient city would at least be an equitable one, since unequal societies may not be the most resilient (Wilkinson and Pikett, 2009). Thus, a fundamental theory and policy question arises: as sizes of cities grow, what policies would couple increasing or positive returns to scale on wealth and innovation with more equitable distributions of opportunities and outcomes?

Urban Allometry

It has recently been proposed that the size of a city, as characterised by its population, is a predictor of many of its socio-economic attributes, following allometric laws of the form (Bettencourt et al. 2007a, 2007b; Bettencourt 2010):

$$y = \alpha X^{\beta},$$

where y is either a measure of economic, social or cultural output of a city (e.g., number of patents filed, gross domestic product, total income, innovations, etc.) or a measure of the resource inputs that go in to create and maintain a city (e.g., volume of infrastructure, lengths of roads and rails, etc.). Then, by the allometric scaling law stated above, y depends on X, which is the population of the city, a measure of its size. The specific functional form suggested by the scaling law implies different qualitative behaviours when the exponent β lies in the linear ($\beta = 1$), sub-linear ($\beta < 1$), or super-linear ($\beta > 1$) regimes. Studies performed across data from multiple countries showed that while all economic inputs scaled sub-linearly, all economic outputs scaled super-linearly. This implies that as the size of a city grows, the per capita cost of maintaining the city rises lower than proportionally, whereas per capital outputs rise more than proportionally. This empirical finding in one sense goes back to the original agglomeration hypothesis (Marshall, 1890): cities form and continue to exist because it is advantageous for them to exist; they show disproportionately higher wealth and output agglomeration for progressively lower inputs, resulting in a more efficient, innovative and productive system.

In some senses this finding is not new: it dates back to years of research in economics, urban studies and quantitative geography, proposing that cities get richer on average as they increase in size (a good review is in [Batty, 2013]). However, the way in which the scaling formulation brings out the relationship of the size of a system to its behaviour and attributes is quite powerful (we may call it the *Bettencourt-West law*, or *Marshall's law* for brevity). If this is true, that is, if larger cities make citizens wealthier on average, then there is a powerful urban growth and policy implication that arises naturally: putting more and more resources into larger and larger cities. Since larger is better, more efficient, wealthier, create ever larger systems. This is not simply a theoretical implication. For example, the Bettencourt-West law implications on efficiency and productivity are increasingly being accepted by policy makers and planners as the basis for urban growth policies (Hill, 2016). This is echoed by arguments, economic or social, that put forth the theory of how large cities are attractors precisely because they are skill-agglomerators and wealth and opportunity generators, and therefore have a flow effect on all classes, generating relatively more for all (Glaeser, 2012; Florida, 2004). Since the allometric scaling findings are also deemed to be universal, i.e., a characteristic shared by all urban systems, and not specific to any particular type of urban system, they also challenge the specificity, historic trajectories, and path dependence that is empirically observed and characterises urban growth in different parts of the world. It is as if New York or Mumbai or Sau Paulo will behave similarly and show similar economies of scale on account of the agglomeration opportunities they represent, regardless of the specific historic trajectories and social and economic systems that lie as a generative root.

However, in two directions the literature is more or less silent: (i) the diseconomies of scale, and (ii) the distribution question. Some diseconomies have been discussed by the allometric scaling literature. For example, as wealth rises with city size, so does crime, congestion, or pollution (Bettencourt 2010b; Louf, 2014). But, when the diseconomies aspect crosses with the distribution aspects, a new hypothesis emerges: rising inequality. If larger cities are wealthier on average, how is the spread or distribution of this wealth effected? Who is becoming better off with the extra wealth? Are larger cities wealthier, but also more unequal? Recent research, from economics and urban sciences including allometric scaling perspectives, suggests this to be true: as cities grow, so, it appears, does economic inequality, with the largest cities showing a disproportionate agglomeration of the highest income categories, economic agents and incomes (Baum-Snow and Pavan 2013; Sarkar et al. 2016; Cottineau et al. 2016). While popular literature has now in earnest started to talk about the intra-city effects of this inequality in the form of segregation, polarisation and inequalities (Florida, 2017), the deeper scientific question of why and how urban, regional and national (or even international/global) dynamics unfold to causally affect the urban size hierarchy (i.e., inter-city size distributions) and the production and maintenance of inequality is very much an open question.

Income distributions scaling for Australia

In this paper, findings on the scaling of income distributions in Australia with city size found in previous work are reviewed (Sarkar et al., 2016). The distribution of economic agents and incomes in separate ABS defined income categories from the 2011 census was analysed against the population sizes of all the 101 Significant Urban Areas (SUAs) of Australia. It was found that the larger the city population, the proportion of highest income earners aggregating in that city is disproportionally higher than expected, whereas the proportion of income earners in the middle and lower categories is only proportional or lower than proportional. Going back to the basic scaling equation:

$$y = \alpha X^{\beta},$$

and taking log on both sides,

$$\ln y = \ln \alpha + \beta \ln X,$$

we can now use linear regression to solve for the parameters α and β. The value of the exponent β now becomes the slope of the least squares line: if it is more than 1, the behaviour is super-linear, if less than 1, then sub-linear.

For example, Figure 1(a) shows the scaling of the number of persons in the third ABS income category against the total population, and Figure 1(b) shows the same for the highest ABS income category. Each city is represented by one dot, and the x-axis value represents its population and the y-axis value represents the number of persons in the specific income category. The sub-linear to linear performance of the lower income category can be seen against the clearly super-linear signature of the highest income category (the grey dotted line shows the 45° line with slope 1).

Figure 1: Scaling of income earners in specific categories against city size: (a) ABS income category $15,600 - $20,799 per annum, 2011 Census, (b) ABS income category >$104,000 per annum, 2011 Census (from Sarkar et. al, 2016).

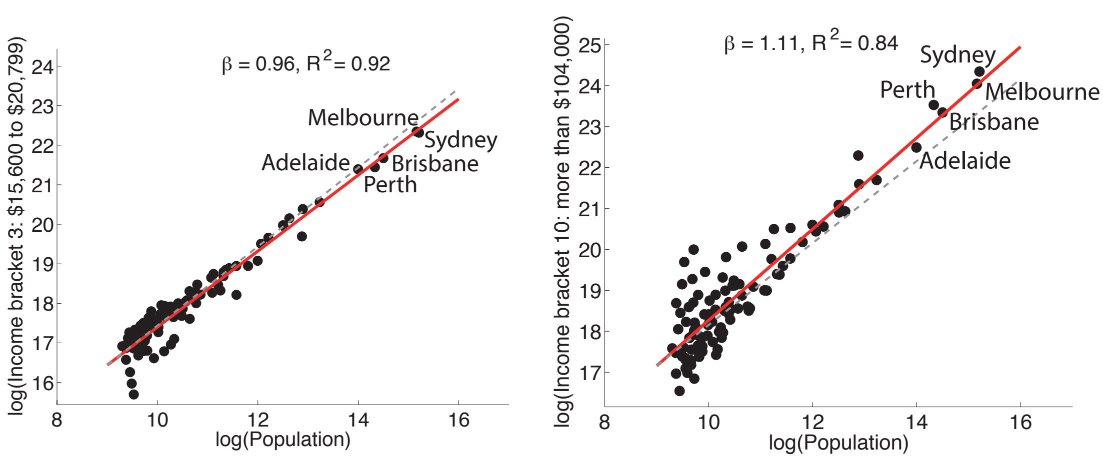
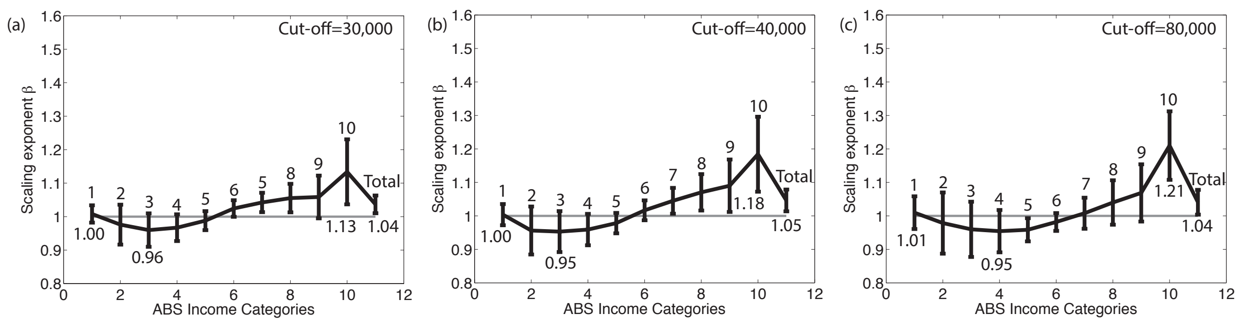


Figure 2 shows the estimated exponent value β for all the ABS income categories, along with the error bars capturing the spread of the β (95% confidence interval). First, it is easily observed that the effect holds as a stable one: smaller income categories scale linearly or sub-linearly, whereas larger income categories tend to be super-linear, with a trend: the larger the income, the higher the β exponent value estimated.

It can also be seen that when population cut-offs are used, (i.e., the analysis is considered over larger and larger cities, in effect, excluding from analysis cities smaller than a certain size), the trend becomes even more pronounced, since the value of the exponent β rises even further. A third interesting effect is seen in the fact that larger income categories on average show higher variability (error bars are larger even though they lie fully above the $\beta = 1$ line). The qualitative interpretation is that while larger cities do show agglomeration of highest income categories, under special conditions, some cities may have specific economic functions (e.g. Canberra with its government, education and administrative role, or the mining towns) which may result in higher income categories to agglomerate in these. Thus, it is possible that some smaller cities show disproportionate agglomeration of the highest income earners too, making the spread of uncertainty around the estimate of β larger.

Figure 2: Estimated exponent β for systems of cities with population cut-offs, progressively excluding smallest cities (from Sarkar et al., 2016). Behaviour is classified as sub-linear (super-linear) when the complete error bar lies below (above) the 1-line.



Critiques on the analysis of allometric scaling models

While the previous analysis brings out the effect clearly, and has found some corroboration for city systems in other parts of the world [see (Baum-Snow and Pavan, 2013) for the USA and (Cottineau et al., 2016) for France], there are two critiques offered that challenge the statistical analysis.

City boundary definitions can affect the value of the scaling exponent

Defining the exact spatial extent of a city may not be easy. It has been shown that when the original findings of Bettencourt and West (2007) were tested against thousands of city definitions based on journey to work commuter flows and population densities in the UK, the findings did not hold (Arcaute et al., 2015). A similar result was found in the case of CO2 emissions: the value of β fluctuated between the sub- and the super-linear regimes depending on whether city proper boundaries or metropolitan area boundaries were used (Louf and Barthelemy, 2015).

The Australian case provides a very interesting case study in this regard. The issue of city size definitions and how the Significant Urban Areas (SUAs) of Australia are defined on the basis of a contiguous spatial and functioning social and economic unit defined on the basis of population cut-offs and journey to work flows is discussed in (Sarkar et al., 2016). However, the most interesting observation perhaps is that because of the distinctive characteristic of a highly urbanised population concentrated into a very small number of urban centres in an otherwise sparsely populated continent, the definition of cities becomes more or less clear in the Australian case. This is distinctly different from the USA or the UK, where urban centres and agglomerations are more uniformly distributed across the national and regional landscape. As Figure 2 shows, the scaling findings for Australia hold when population or density cut-offs applied in defining Australian cities.

Model assumptions and linear regression on log transformed model need to be tested against alternate models

The findings from the scaling laws have also been challenged on the statistical front. When we look at a distribution of data, the scaling law model is only one of the possible statistical models. That is, since we do not know what underlying model generated the data, there is a need to test alternate hypotheses and test for the statistical significance of the assumed model. Several papers have tested alternate models and have found insufficient evidence for the statistical significance of estimated β values, and as a result for the scaling law assumption (Shalizi, 2011; Leitao et al., 2016). Specifically, the work of Shalizi (2011) tested the scaling hypothesis with extensive (the variation of aggregate or total incomes and outputs with city size) as well as intensive variables (the variation of per capita incomes or outputs with city size), along with several other possible model forms (for example, augmenting the scaling model with an additional linear term that captures the effects of concentrations of various industries).

Further the work of Leitao et al. (2016) proposed a principled and rigorous model comparison approach based on maximum likelihood estimation to test for evidence for $\beta \neq 1$. The work discusses how the linear regression over the log transformed model approach (as described above for previous work on this topic) may be problematic when there are dependencies and fluctuations in the data. Thus, the authors propose a more systematic and intuitive framework:

1. Run a maximum-likelihood algorithm for estimating β, and record the p-value (probability value testing for statistical significance of the scaling model). See Leitao et al., 2016 for details of the models.
2. Test if the scaling model is rejected or not rejected (i.e., p-value > 0.05). If the p-value is higher than 0.05, it is likely that the data are compatible with the model.
3. Record the Bayesian Information Criteria (BIC) for the model.
4. If p-value is less than 0.05, run the algorithm again by fixing $\beta = 1$ and record the BIC for this model.
5. Compute $\Delta BIC = BIC_{\beta=1} - BIC_{\beta}$. If $\Delta BIC < 0$, there is evidence for linear scaling. If $0 < \Delta BIC < 6$, there is inconclusive evidence for either non-linear or linear scaling. If $\Delta BIC > 6$, there is evidence for non-linear scaling in the data.

We outline these steps here because for the analysis done in this paper we use the steps described above to estimate β, to avoid the problems associated with the linear regression based estimation. The sections below describe the estimation of β based on the Python code provided by the authors (Leitao et al., 2016).

Housing markets and inequality

A primary manifestation as well as driver of wealth inequality in urban Australia is the housing market. Australian capital cities are characterized by rising housing prices, decreasing affordability for first home owners, a rising rental crisis, the inability of younger people to enter the housing market, housing debts and long loan terms, widening gaps between the rates of rises in house prices and rises in income, frequent discussions on the role of supply, complex interactions between demand and supply, and the role played by current taxation laws in strengthening patterns of wealth inequality through the housing market (Beer et al., 2007; Beer and Forster, 2002; Yates, 2008). Much of this plays out most acutely in the largest cities, especially Sydney and Melbourne. If the connection between economic inequality and city size is to be tested, therefore, the housing market would be a good place to start since housing forms a principal component of personal wealth in Australia beyond its primary function of shelter. Is there a relationship between the spatial distributions of renters and mortgage payers by city sizes? What does this distribution look like, not when measured at an intra-city level or at a national level, but at the level of the urban hierarchy (i.e., regions and across all urban areas of the nation)? Similar to the income distribution analysis previously described, we start by testing for the distribution of the number of people in ABS defined rental and mortgage categories against city size.

Rents scaling for Australia

Using the maximum likelihood estimation approach proposed by Leitao et al. (2016), as described above, we analyse the numbers of people in the ABS defined rental categories against population size of the Significant Urban Areas (SUAs) as before, using the 2011 Census data. Figure 3 shows that the β values for all the lower rental categories, ranging from \$1 to \$249 per week, are sub-linear, showing that as city size increases, the number of people in the lower rent categories are disproportionately lower. This provides empirical evidence towards lack of affordable rental dwellings in the largest cities (a person cannot be in a low rental category if there are no rental dwellings available with rents in that category). A couple of the middle rental categories, around \$250 to \$299 per week, show linear behaviour: the number of people in these categories scales proportionally with city size. For higher rental categories, from \$300 to \$650 and over per week, the β values are super-linear. This suggests that with growth in city size, the number of people in the higher rental categories is disproportionately higher in the larger cities. This super-linear behaviour also points to the lack of affordable rental dwellings in the largest cities.

Figure 3: Scaling analysis for population of SUAs against numbers of people in ABS rental categories

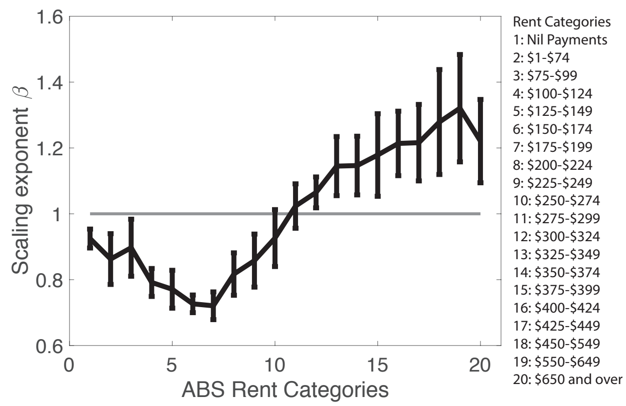


Table 1 shows the actual β values for each rent category, along with the errors. The conclusion on super-linear, sub-linear or linear behaviour is based on the methodology described above: an exponent is sub-linear or super-linear when the Bayesian Information Criteria (BIC) measure for the scaling model is significantly lower than the corresponding BIC for the linear model (when the β value is fixed to 1), or when the scaling model emerges as statistically significant (i.e., p-value > 0.05). It is worth noting that the p-values are larger than 0.05 providing support for the scaling hypotheses for three of the very high rent categories (marked with an asterisk).

Table 1: Scaling analysis for population of SUAs against numbers of people in ABS rental categories: exponents, errors and system behaviour. When $\Delta BIC < 0$, behaviour is classified as linear. When $0 < \Delta BIC < 6$,, behaviour is classified as inconclusive. When $\Delta BIC > 6$, behaviour is classified as super-linear or sub-linear. When the β value is statistically significant (i.e. $p > 0.05$), and model is not rejected, the value has a star next to it. Note that three of the highest rent categories show statistically significant behaviour in confirmation of super-linear scaling.

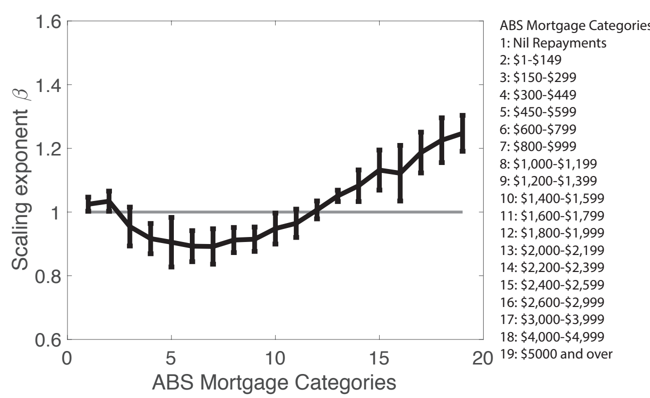
Rent Categories	Beta	Error	Behaviour
Nil Payments	0.92	0.03	sub-linear
$1-$74	0.86	0.08	sub-linear
$75-$99	0.90	0.09	inconclusive
$100-$124	0.79	0.04	sub-linear
$125-$149	0.77	0.06	sub-linear
$150-$174	0.73	0.03	sub-linear
$175-$199	0.72	0.04	sub-linear
$200-$224	0.82	0.06	sub-linear
$225-$249	0.86	0.08	inconclusive
$250-$274	0.93	0.09	linear
$275-$299	1.02	0.07	linear
$300-$324	1.06	0.05	inconclusive

$325-$349	1.14	0.09	super-linear
$350-$374	1.15	0.09	super-linear
$375-$399	1.18	0.13	super-linear
$400-$424	1.21*	0.10	super-linear
$425-$449	1.22*	0.12	super-linear
$450-$549	1.28*	0.16	super-linear
$550-$649	1.32	0.16	super-linear
$650 and over	1.22	0.13	super-linear

Mortgage scaling for Australia

Using the same methods of maximum likelihood analysis (Leitao et al., 2016), we also analyse the numbers of people in the ABS defined mortgage categories against population size of the Significant Urban Areas (SUAs) as before, using the 2011 Census data. The findings are very similar in pattern to the rental category scaling findings. Figure 4 shows that the β values for all the lower mortgage categories, ranging from $1 to $1,999 per month, are sub-linear or linear, showing that as city size increases, the number of people in the lower mortgage categories are disproportionately lower. This provides empirical evidence towards lack of lower priced affordable dwellings in the largest cities. For higher mortgage categories, from $2,000 to $5,000 and over per month, the β values are super-linear. This suggests that with growth in city size, the number of people in the higher mortgage categories is disproportionately higher in the larger cities. This super-linear behaviour also points to the lack of affordable dwellings in the largest cities.

Figure 4: Scaling analysis for population of SUAs against numbers of people in ABS mortgage categories



Two important differences are seen when the mortgage scaling is compared to the rental category scaling. First, in the case of the rental categories, the β values for the highest rental categories are larger as compared to the mortgage. That is, the scaling is more acute for rents than mortgages. Second, in the case of the rental categories, the errors or the spread around the β values is also higher, and it is comparitively lower for the mortgage categories.

Table 2 shows the actual β values for each mortgage category, along with the errors. Again, the conclusion on super-linear, sub-linear or linear behaviour is based on the methodology described above: an exponent is sub-linear or super-linear when the Bayesian Information Criteria (BIC) measure for the scaling model is significantly lower than the corresponding BIC for the linear model (when the β value is fixed to 1), or when the scaling model emerges as statistically significant (i.e., p-value > 0.05). It is worth noting that the p-values are larger than 0.05 providing support for the scaling hypotheses for two of the very high mortgage categories (marked with an asterisk).

Table 2: Scaling analysis for population of SUAs against numbers of people in ABS mortgage categories: exponents, errors and system behaviour. When $\Delta BIC < 0$, behaviour is classified as linear. When $0 < \Delta BIC < 6$,, behaviour is classified as inconclusive. When $\Delta BIC > 6$, behaviour is classified as super-linear or sub-linear. When the β value is statistically significant (i.e. $p > 0.05$), and model is not rejected, the value has a star next to it. Note that two of the highest mortgage categories show statistically significant behaviour in confirmation of super-linear scaling.

Mortgage Categories	Beta	Error	Behaviour
Nil Repayments	1.02	0.02	linear
$1-$149	1.03	0.03	linear
$150-$299	0.95	0.06	linear
$300-$449	0.92	0.05	inconclusive
$450-$599	0.91	0.08	sub-linear
$600-$799	0.89	0.05	sub-linear
$800-$999	0.89	0.06	sub-linear
$1,000-$1,199	0.91	0.04	sub-linear
$1,200-$1,399	0.91	0.04	sub-linear
$1,400-$1,599	0.95	0.05	inconclusive
$1,600-$1,799	0.96	0.04	linear
$1,800-$1,999	1.01	0.03	linear
$2,000-$2,199	1.05	0.02	super-linear
$2,200-$2,399	1.08	0.05	super-linear
$2,400-$2,599	1.13	0.06	super-linear
$2,600-$2,999	1.12*	0.09	super-linear
$3,000-$3,999	1.19*	0.06	super-linear
$4,000-$4,999	1.23	0.07	super-linear
$5000 and over	1.25	0.06	super-linear

Planning implications and conclusions

Both the rental and mortgage scaling results show a clear pattern for housing cost behaviours by city size: as city size increases, there is disproportionate growth of higher rents or mortgages, signalling a lack of affordable or lower priced rental dwellings or dwellings to own in larger cities. A critical observation is that the super-linear β values for the highest rent and mortgage categories are higher than the super-linear β values for the income distribution categories, suggesting that housing costs in the largest cities could be growing faster as compared to the superlinear behaviours of income agglomeration. Further, the super-linear β values for rental distributions emerges higher than the super-linear β values for the mortgage distribution, suggesting that stresses caused by rental housing costs in the largest cities may be more acute as compared to mortgage (though both are higher than the income distribution β values). Further, the sub-linear behaviour is equally important at establishing the trend as the super-linear aspects: the sub-linear behaviour of the lower categories point implicitly to a lack of low rent and low mortgage opportunities, and by extension low housing cost dwellings in the largest cities. Even if a person is a low-income earner in a larger city, they could still be in a higher rent or mortgage category: it may not be possible for them to be in a lower cost bracket, since few dwellings at a lower affordable cost may be available in that city. This could explain why the super-linear β values for rents and mortgages is coming out higher than the super-linear β values for the income distribution patterns.

The political economy of housing in Australia plays a role in generating more acute super-linear behaviour of housing costs agglomeration than of income agglomeration. For example, rapid population growth in the biggest four cities, in association with increasing spatial centralisation and importance of knowledge economy jobs, increasing controls on outward urban expansion and community resistance to increasing inner and middle city densities, has meant that increased demand for higher density development closer to city centres has caused residential land prices to escalate faster than incomes. This has helped cause developers to focus more on higher income residential markets (Troy, 2017), and more generally cause rents to rise faster than incomes. There has been no countervailing tendency to rebalance the housing market by increasing stocks for lower income people. The inflated land costs in the big cities have accrued largely to existing residential owners who have reinvested much of their gains back into higher value properties, with no capital gains tax payable on the sale of taxpayers' prime residences (and thus less public revenue available to address problems arising from higher property prices). Developers are only levied to provide small amounts of affordable housing in a very limited number of locations, with a strong developer lobby opposing policies that might limit their profits in any way (Gurran and Phibbs, 2015). Construction of new public housing has virtually ceased with an ideological shift to subsidising housing renters and new owners, which has in turn caused housing prices to increase because housing supply has a low elasticity in relation to price changes.

Considering the journey to work angle, SUA definitions include the whole of the metropolitan area of the largest cities (for example, the SUA of Sydney incorporates the whole of the contiguously defined metropolitan area of Sydney and not just the city proper, etc.). The spatial implications of this are that on average, the larger the city, the higher will be the journey to work travel costs and time, since the areal spread of the city increases, whereas economic functions are typically concentrated around the principal CBD or some of the other main economic zones. Thus, to access jobs in a larger city, one would also pay much higher costs of living: one would typically pay higher rents or higher mortgages as well as higher costs and time for traveling to work. Under the same allometric framework, whether this cancels out the premium that is gained by say a higher paying job in a larger city is an area for future analysis. What are some of the implications for planning?

Inter-city relationships

We return to the urban growth policies discussion in the introductory section of this paper. Our findings show that the current focus in urban growth policies on the "big get bigger is better" phenomenon should shift to (a) how spatial planning policies could ensure a more equitable distribution of housing, social and public infrastructure so that large sections of the population are not spatially disadvantaged in the largest cities (Randolph and Tice, 2016), and (b) how smaller regions and cities could be turned into attractors, offering socio-economic wellbeing and quality of life and cancelling out the diseconomies observed in the largest cities. In other words, instead of committing all the resources into planning for a Sydney of 10 million people, it would perhaps be equally important to plan for the regional cities with access to good jobs, affordable housing, lower transport requirements, and lower socio-spatial polarisation. The effect of size is critical here: the larger a system gets, the harder or more complex it will be to manage, showing that a focus of growth of smaller cities in terms of committed resources should be as important as the commitment of resources to the growth and management of the largest cities.

Nevertheless, there are lessons from history and economics that indicate the difficulty of achieving such an outcome. The 1972-75 Australian Labor Government instigated a new cities program in which it provided funding to the states to purchase land and provide infrastructure to develop new urban areas of more than 100,000 people outside the metropolitan areas. Two (Albury-Wodonga and Macarthur) were eventually established, but the program was abandoned with the ending of the post-war long boom and fiscal pressures on the national budget. In economic terms, the issue is whether subsidies to set up such centres would be less than net negative externalities (such as congestion) arising from metropolitan development, which a cost-effective program would require. This immediately raises the wider issue of whether the externalities of metro development are in fact negative, as was argued to justify the 1972-75 new cities program. In practice, it could be argued that any negative externalities are offset by the higher productivity that is generated by big city development, thus producing net social gains from increased city size. Existing research is far from conclusive on this issue, but it is clear that distributional aspects and a focus on arising diseconomies should form an active part of the discussion along with higher economic productivity. Future research will focus on extending the Australian analysis, but also performing comparative analysis across the city systems for the USA, UK or Canada.

Intra-city relationships

Secondly, even in the largest cities, housing and planning policy focus would need to shift from a pure short-term, targets-based focus (e.g., X number of affordable dwellings, Y number of people to be transported to work each day) to planning for the actual spatial distribution of these dwellings and longer term reductions in commuting to work distances. A polycentric city implies that employment be distributed as a hierarchy of centres across the city, along with a good mix of dwelling types, encouraging a good social mix and reducing transportation requirements. A provision of more affordable dwellings or social housing in the already poor and most dense areas of a city may actually entrench and further strengthen patterns of observed inequalities. Instead, proposed affordable housing targets in all areas of the city could choose to focus on the reality of the current patterns of jobs distribution: every high-powered finance and investment organisation is housed in a building that also needs cleaners and café workers, and the children of cleaners and café-workers need to go to schools and to early childhood carers as do the children of investment bankers. Thus, expecting the cleaner or café-worker to travel for long hours while not having the same expectation from the investment banker, as current spatial organisation governs, would not only entrench and further strengthen the inequality patterns of income, rental and mortgage distributions observed and reported, they also result in new forms of lived inequality and reduced well-being that we cannot at this date even measure. In other words, supporting the entire “network of economic relationships that is embedded spatially” to encourage growth of a healthy economy may be more desirable for the stability of the system, instead of supporting the needs of individual sections or classes of the society governed by their current economic worth (e.g. a banker’s economic worth being more than a school teacher’s, for example, leading to differences in affordability is a flawed skills and productivity debate, since the attribution of this economic worth itself may be problematic in the first place). This, for example, implies that the northern and eastern suburbs of Sydney need the same density in absolute numbers of affordable dwellings (not percentages of total dwellings) as do the western suburbs if the segregation and polarisation gaps are to be ever reduced.

The inequality literature often discusses within-group and between-group patterns of inequality at multiple spatial scales (Bradbury, 2017). At the regional, inter-city scale, both within and between group excessive inequality patterns are deemed undesirable (i.e., excessive inequalities between regions and cities in the same region). Thus, urban growth policy focussed on the regional or national scale would need to aim for policies that reduce these gaps. At the local, intra-city scale, while excessive between group inequalities are undesirable (i.e., socio-spatial segregation and polarisation between different parts of the city as observed in Randolph and Tice, 2016), within-group inequalities could actually be desirable (i.e., a mix of social and economic groups within a single suburb for example), since they could actually work to promote overall equity, health and well-being indices of areas.

More generally, future scientific and policy work should uncover the answer to how large cities may grow before the diseconomies of distribution at the human scale become manifest and entrenched by the very forces that generate wealth and innovation in economic terms.

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