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GRATTAN
Institute

Remarkably adaptive
Australian cities in a time of growth

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Overview

Australia's biggest cities face a challenge. On one hand, larger cities have significant economic advantages over smaller centres, and offer people a greater range and diversity of jobs, leisure and cultural activities. On the other hand, fast-growing cities come with growing congestion that requires people to adapt.

The challenge is particularly acute in times of rapid change. Over the five years to 2016, Sydney and Melbourne's populations grew at rates among the highest in the developed world, by 1.9 per cent and 2.3 per cent each year. There was strong population growth from the Gold Coast to the Sunshine Coast, and in Canberra and Darwin.

So far, the impact of rapid population growth on commuting distances and times has been remarkably benign, despite regular media coverage claiming the opposite. The average commute distance barely increased over the five years to the most recent Census in 2016, and there has been little or no change in the duration of commutes.

The benign impact of population growth is due in no small part to the spread of jobs across cities. It's a common misconception that jobs are centred in CBDs which get harder to access as cities grow. In reality, fewer than two in ten people work in CBDs, whereas three in ten work just a suburb away from home. The importance of suburban 'employment centres' is similarly overblown; Parramatta, for instance, is the location of only 2.3 per cent of Sydney's jobs. Instead, three quarters of jobs are dispersed all over Australia's major cities, in shops, offices, schools, clinics, and construction sites.

Even though commutes are not getting much worse, the level of congestion in cities is still a problem. There is overcrowding on public transport, and commuting times can be unreliable. While most drivers are delayed no more than five minutes getting to work, this number can be much higher on bad routes.

But the situation is not spiralling out of control; migration has not brought cities to a standstill. People adapt: some change job or worksite, and working from home is on the rise. Some people move house, or even leave the city; and some change their method of travel, leaving the car at home and catching the train or bus to work. Other people simply accept a longer commute – at least for a time – particularly if they earn a high income.

This is not to suggest that population growth has left everybody better off. Some people elect not to take a new job that's too far from home; some pay higher rent or cannot afford a place they once could have. But it is to emphasise that people are not hapless victims of population growth, depending for their wellbeing on governments building the next freeway or rail extension. Cities have coped even though major infrastructure projects like WestConnex, Melbourne Metro and Cross River Rail have not yet been completed. We should be sceptical of "congestion-busting" election pledges. Building new infrastructure is far from the only way to cope with population growth.

Governments should not announce any projects before rigorously establishing their net benefits to the community. They should also focus on facilitating the natural adaptations people make. This means removing barriers to people and firms locating where they want to be. It means phasing out stamp duty, which effectively locks people into staying put when they otherwise might move house. And it means introducing congestion charges, so that drivers are encouraged to stay off the most congested roads at peak times.

With these changes, the benefits that draw people to live and work close together can outweigh the congestion and crowding that trigger demands to shut new people out.

Recommendations

Governments should tread lightly on people's decisions

Stop penalising people for moving house

All states and the Northern Territory should phase out stamp duty on the transfer of residential property, and replace it with a broad-based land tax.

Stop locking out new residents from their preferred locations

Treasurers in all states should introduce a scheme that combines a reduction in zoning restrictions on residential density and business locations with an increase in the clarity and assignment of related parking rights, including a right to trade them.

In addition, the federal Treasurer should ask the Productivity Commission to assess the costs, both direct and indirect, and the benefits of heritage protections embedded in planning regulations.

Design and implement congestion pricing schemes for Sydney and Melbourne

The Victorian and NSW governments should introduce time-of-day congestion pricing in the most congested central areas of each capital city, charging a low rate at peak periods in return for a freer-flowing road. The cost to drivers should be offset by a discount on vehicle registration, with revenue from the congestion charge earmarked to spending on public transport improvements.

Governments should spend smarter on infrastructure

Only spend public money on infrastructure that has been properly assessed

The Commonwealth Government should amend the National Land Transport Act to prohibit the provision of funding to state governments for infrastructure projects unless a full business case has been prepared, and then evaluated by Infrastructure Australia, and the business case and evaluation have been tabled in Parliament. For all projects valued at $50 million or more, the government should also ask Infrastructure Australia to publish a reliability rating of the business cases within a month of their tabling.

Devote more resources to identifying modest-sized transport projects

State departments of transport should devote more resources to identifying modest-sized transport infrastructure proposals with higher net benefits than large and very large projects.

Adopt more realistic assumptions for cost-benefit analysis

The Commonwealth Minister for Infrastructure should ask Infrastructure Australia to develop more realistic assumptions for cost-benefit analysis, acknowledging the widespread adaptation that occurs under the base-case scenario used to quantify a project's benefits, particularly arising from changes in land-use.

Learn from experience of completed projects

The Commonwealth Minister for Infrastructure should ask Infrastructure Australia to review and make public the benefits and costs of each completed project, and the reviews should be made public.

Table of contents

1   The tension in growing Australian cities

Australia's population is growing rapidly. The major cities of Sydney and Melbourne, in particular, are booming. Many people are asking whether the growth rates of the past decade are sustainable, or whether Australia has reached a tipping point where congestion and other downsides of growth outweigh the upsides of a more dynamic economy and vibrant society.

This report answers the question by analysing where people live, where they work, how they get between home and work, and how this has changed over time.[1] It finds that, contrary to public perception, Australian cities have adapted well (see Figure 1.1).[2] Governments impede adaptation; they should do more to enable it.

1.1   A time of change in Australian cities

Australia's population grew by 1.9 million between 2011 and 2016, with most of the increase in the major cities. Melbourne's population grew from 4.0 million to 4.5 million and Sydney's from 4.4 million to 4.8 million. Table 1.1 on the next page shows growth rates for Australia's 20 largest cities. The growth rates for Sydney, Melbourne and Brisbane are very high by global standards.

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1.   This report focuses on the five years from 2011 to 2016 as this allows the use of the richest available data, which is from the Australian Census. For most variables of interest, data from the 2006 Census is not available at a sufficiently detailed level to make comparisons with the 2011 and 2016 Censuses.
2.   The findings of this report mirror those of two US studies: Angel, S. and Blei, A. M. (2016a). "The spatial structure of American cities: The great majority of workplaces are no longer in CBDs, employment sub-centres, or live-work communities". *Cities* 51, pp. 21–35 and Angel, S. and Blei, A. M. (2016b). "The productivity of American cities: How densification, relocation, and greater mobility sustain the productive advantage of larger U.S. metropolitan labor markets". *Cities* 51, pp. 36–51.

Figure 1.1: Most Sydney residents don't live very far from where they work, and this is not changing
Beeline distance to work (kilometres)
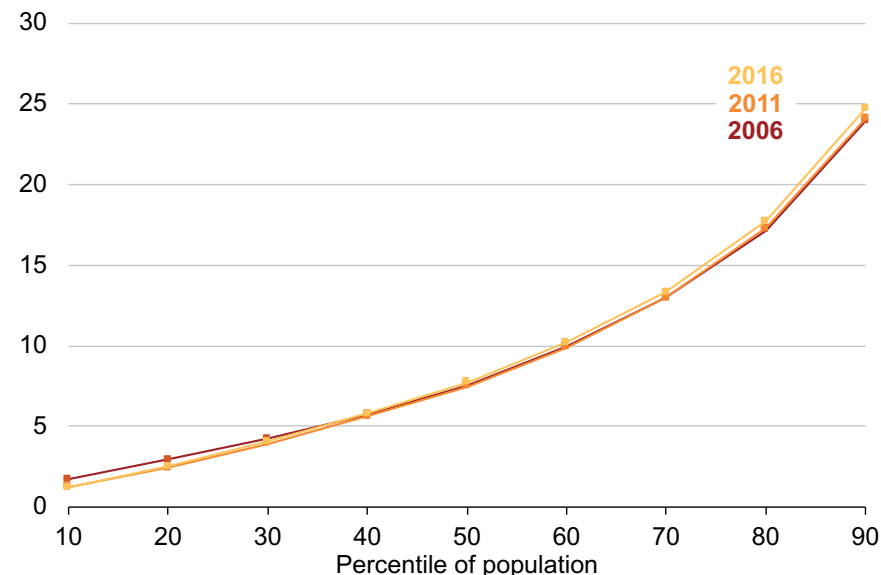
Notes: *Distance is the beeline distance, or "as the crow flies". For a comparison to road distances, see Appendix A.4. The ABS statistical geography classification changed between 2006 and 2011, which may have an impact on the calculation of very small distances.*

Source: *Grattan analysis of ABS (2016a), ABS (2011a) and ABS (2006).*

Table 1.1: Some Australian cities have grown very fast
Population in 2016, and average annual compound growth rate from 2011-2016

	City	Population, 2016	Growth
Big cities	Sydney	4,824,000	1.9%
	Melbourne	4,485,200	2.3%
Mid-sized cities	Brisbane	2,270,800	1.9%
	Perth	1,943,900	2.4%
	Adelaide	1,295,700	1.1%
Smaller cities	Gold Coast	624,300	2.3%
	Newcastle	463,100	1.2%
	Canberra	396,900	2.2%
	Sunshine Coast	307,500	2.6%
	Wollongong	285,700	1.2%
	Geelong	247,500	2.1%
	Hobart	222,400	1.0%
	Townsville	173,800	1.4%
	Cairns	144,800	1.6%
	Darwin	136,800	2.6%
	Toowoomba	130,700	1.3%
	Ballarat	99,900	1.7%
	Bendigo	94,400	1.9%
	Albury-Wodonga	89,000	1.6%
	Launceston	84,200	0.5%

Notes: Capital city numbers are based on the ABS 'Greater Capital City' classification – for Canberra, this means the entire ACT. The numbers for other cities are based on the ABS 'Significant Urban Areas (SUA)' classification. The Geelong, Toowoomba and Newcastle SUAs expanded between Censuses, so growth figures are calculated relative to the population residing in the expanded SUA in 2011. Central Coast (population 320,000 and growth rate 1.0 per cent) has been excluded because it is part of the ABS definition of Greater Sydney.

Sources: ABS (2016a) and ABS (2011a).

Growth in Sydney and Melbourne has occurred mainly through overseas migration. Australian residents have been leaving Sydney and going to Melbourne, Brisbane, the non-capital cities and the regions (Figure 1.2).

Figure 1.2: Most overseas migrants have settled in Sydney or Melbourne
Population change, 2016-17
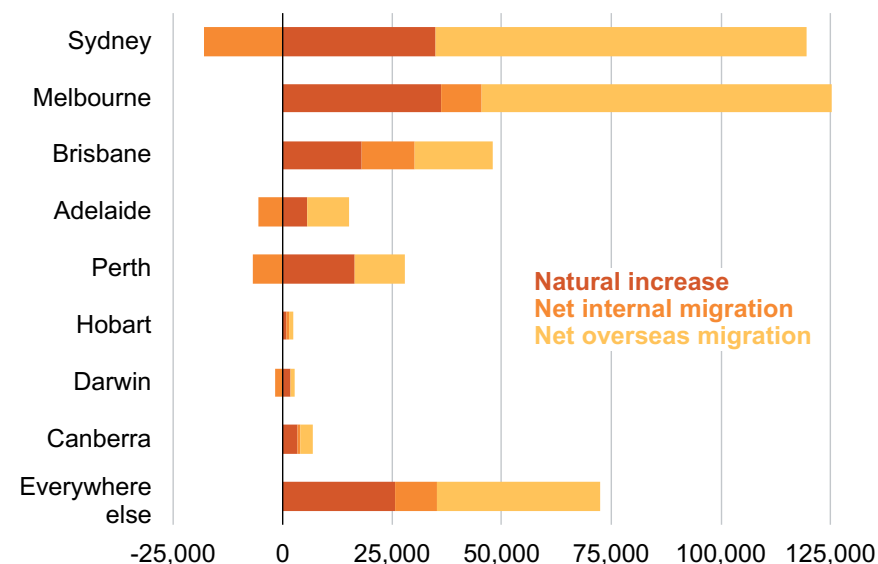
Note: The ABS periodically revises these estimates. Data for Canberra covers the entire ACT.

Source: Grattan analysis of ABS (2018a).

Many people migrate to Australia for work, and Australia accepts more migrants when the economy is strong (see Figure 1.3). Net overseas migration rates have averaged 200,000 people per year since 2005, hitting a high of 300,000 in 2008-09.[3] Large numbers of temporary migrants also come to study, and some of them eventually migrate permanently.

Australia's three mid-sized cities, Brisbane, Perth and Adelaide, have grown at varying rates. Perth has grown fastest, averaging 2.4 per cent a year over the five-year period between Censuses. It grew very fast in the first half, at 3.0 per cent, and much more slowly in the second half, at 1.0 per cent – as the mining construction boom and its passing affected people's decisions about where to live. Brisbane has grown strongly, at 1.9 per cent a year, substantially fuelled by overseas and domestic migration (see Figure 1.2 on the preceding page). Adelaide has had slower growth, at around 1.1 per cent a year.

Australia has a further 12 cities with a population of 100,000 or more.[4] Several of these smaller cities have grown rapidly over the five years from 2011 to 2016, notably Darwin (averaging 2.6 per cent a year), the Sunshine Coast (2.6 per cent), the Gold Coast (2.3 per cent), and Canberra (2.2 per cent).

Of course, rapid population growth creates a tension: on the one hand, larger cities have significant economic advantages over smaller centres, and offer people a greater range and diversity of jobs, leisure and cultural activities. But, on the other hand, fast-growing cities come with more crowding and growing congestion that requires people to adapt.

Crowding and congestion are costly and frustrating, not only for commuters but for everyone else travelling about the city. Crowding

Figure 1.3: Migration tends to move with the economic cycle
Net annual migration (thousands)   Employment rate (per cent)
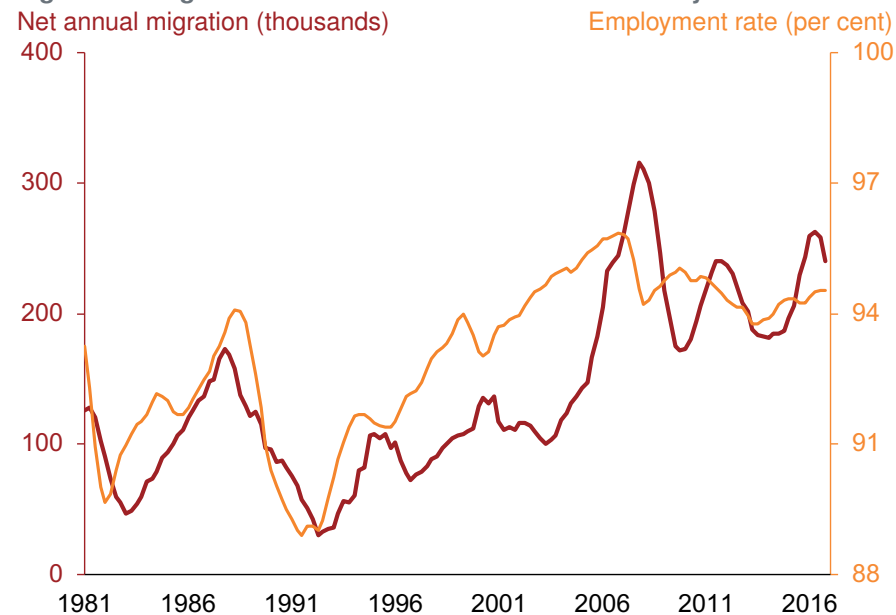
Notes: The rate of natural increase in population (births) is relatively steady through the economic cycle. The rate of overseas arrivals is much more strongly correlated with the economic cycle than is the rate of overseas departures, and so it is arrivals that drive changes in net migration. Net annual migration includes temporary migrants who have resided in Australia for at least 12 out of the 16 months since their arrival.
Sources: ABS (2018b) and ABS (2018c).

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3.   ABS (2018b).
4.   Ballarat's population exceeded 100,000 residents in 2017: ABS (2018d).

also leads to pollution, noise and elevated demand for health, housing and education services. But these costs and aggravations should not lead policy makers to overlook the clear benefits of larger cities as a source of economic opportunity and productivity growth.

The next section of this chapter explains the economic upside of growing cities, and the final section considers the extent to which this is being compromised by crowding and congestion.

1.2   The upside: bigger cities mean a richer country

The more Australians choose to live in cities, the wealthier the country can expect to be. Countries with more of their population in cities tend to have higher incomes, and as more of the population moves to the cities, countries tend to become wealthier.[5] And within countries, those in the larger cities have higher incomes than those living elsewhere.[6] Cities grow because more and more people want to take advantage of these opportunities.[7]

Australia's five largest cities are more productive than the smaller cities and regional areas. This is evident from the fact that employers are prepared to pay higher wages in bigger cities (Figure 1.4), people are prepared to pay higher rents in the larger centres (Figure 1.5), and the average city-dweller contributes more to GDP.[8,9]

This report focuses on one of the most important advantages of large cities: large employment markets. The mechanisms by which large employment markets enable people to be more productive in cities are sometimes described as "agglomeration economies", and can be summarised as matching, sharing and learning.[10]

For workers, matching is perhaps the most important source of advantage. In the city, people are more likely to find a job that they are willing and able to do, and if they lose their job, to find another one quickly. It is more worthwhile to specialise, and working with specialists also helps people to develop more specialist skills themselves.[11]

Employers reap matching benefits in finding staff, and they also gain from the matching opportunities that cities offer if their business relies on passing trade.

Sharing means less idle capacity for either workers or businesses. Idle capacity can be under-used rail yards or car-parks, or shopkeepers waiting around for a customer, or doctors in casualty wards managing the ebbs and flows of patient demand. With less idle capacity, bigger cities can support more efficient ports and road networks.

Learning opportunities tend to be greater in bigger cities, as workers see what others are doing and imitate it. Much know-how is informal, and people are more likely to share informal knowledge face-to-face than through channels that operate at a distance.[12] Because job turnover is faster in cities, people take their knowledge with them to new jobs more quickly than in smaller places.

Sharing, matching and learning can occur in two distinct ways. In some cases, they arise where there are many firms in one industry, such as finance industry firms in Sydney, or mining businesses in Perth.

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5.   Gibbons and Graham (2018) and Romer (2015).
6.   Angel and Blei (2016b, p. 38).
7.   See, for example, O'Flaherty (2005) and E. L. Glaeser (2008).
8.   Angel and Blei (2016b, p. 3); and E. L. Glaeser and Gottlieb (2009, pp. 160–161).
9.   SGS Economics and Planning (2017) find higher GDP per capita in cities.

10.   This terminology was coined by Duranton and Puga (2004).
11.   Moretti (2012, pp. 126–127).
12.   The learning aspect of agglomeration appears to be an important productive advantage, even though the mechanisms by which it operates are not well understood theoretically (Duranton and Puga (2004, pp. 2098–2110)) and generally hard to identify empirically (Rosenthal and Strange (2004, pp. 2148–2152) and Gibbons and Graham (2018, pp. 2–3)).

Figure 1.4: Workers command higher incomes in larger cities
Estimated median weekly household income ($) by location, 2016
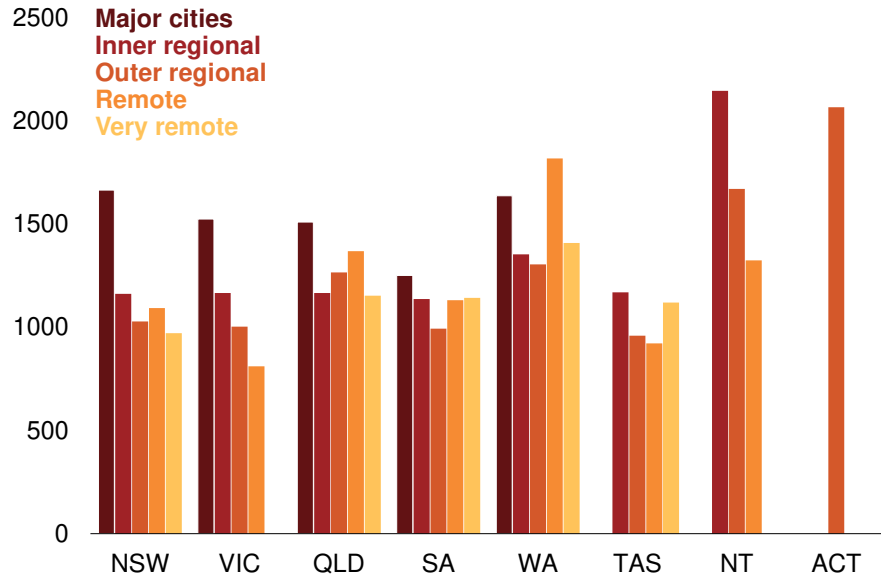
Notes: Median values have been estimated because income is reported by bracket. Categories based on the ABS Census Remoteness Areas. Victoria does not have a 'Very remote' category. Tasmania does not have a 'Major cities' category. NT and ACT have been omitted because the ABS data omits several categories for the territories.
Source: Grattan analysis of ABS (2016a).

Figure 1.5: People value land more highly in larger cities
Estimated median weekly rent ($) by location, 2016
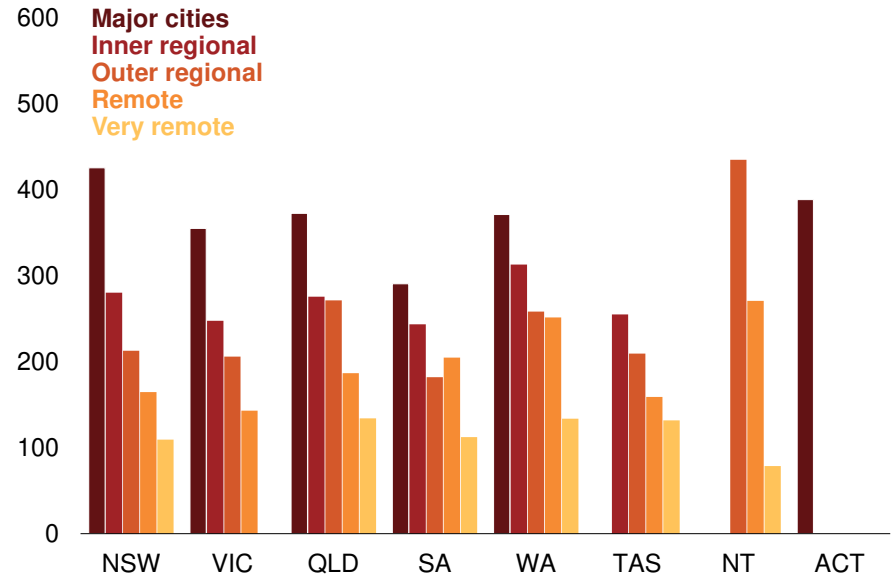
Note: Categories based on the ABS Census Remoteness Areas, as described in Figure 1.4.
Source: Grattan analysis of ABS (ibid.).

In other cases, these agglomeration benefits arise from having many people located together, regardless of their industry;[13] for example, only Melbourne, Sydney, Brisbane and Perth are large enough to support heart and lung transplant centres.[14]

These economic advantages make larger cities more productive than smaller cities, but they are accompanied by higher crowding and higher costs for people to get to their jobs and for firms to reach suppliers and customers.

1.3 The downside: crowding and congestion in large cities

Even as people gather together to enjoy the enormous benefits of cities, they are confronted with the downside. Density means crowding: people argue about how late bars can stay open, access to on-street parking, and the height of new apartment buildings. There's competition for everything from road space to uninterrupted views, from tickets to sporting events to a seat on the train in peak hour. And from this comes higher prices for the best-located land, creating an impetus for people to move outwards.

Crowding is a reality in all of Australia's cities. There were more people per square kilometre living in the centres of the five largest cities in 2016 than there were five years earlier.[15] The increase in population density was particularly obvious in Melbourne, where it increased by 46 per cent, and in Sydney, where it increased by 23 per cent.[16]

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13. O'Flaherty (2005, pp. 12–33) and Gordon and Lee (2015, pp. 87–88).
14. ANZCOTR (2017).
15. Central city areas refers to the ABS's SA3 regions. As an example of their size, in Sydney it takes in Zetland to the south, The Rocks to the north, and Surry Hills and Camperdown to the east and west.
16. Brisbane's population density increased by 17 per cent, Perth's by 10 per cent, and Adelaide's by 12 per cent (Grattan analysis of ABS (2016a) and ABS (2011a)).

But the media focus on commuters from outer suburbs – victims of urban sprawl, travelling ever-greater distances to get to work – creates a false impression. Grattan Institute's 2017 report, *Stuck in traffic: road congestion in Sydney and Melbourne*, found that most commuters in 2017 experienced only very modest delays on their way to work. This report builds on that insight by examining change over time.

The reality is that the length and time of commutes barely changed in Australia's biggest cities during the exceptionally rapid population growth between 2011 and 2016.

In Sydney, Melbourne, Brisbane and Perth, commute distances in 2016 were almost indistinguishable from 2011 (Figure 1.6).

Figure 1.6: Commuting distances have barely changed in Australia's biggest cities
Beeline distance to work (kilometres)
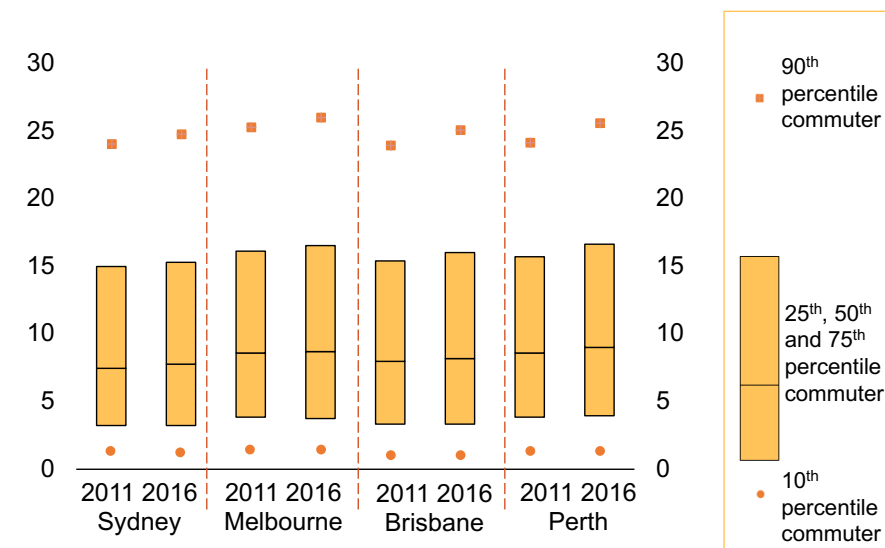
Source: Grattan analysis of ABS Census: ABS (2016a) and ABS (2011a).

Nor have commute times changed much overall in the 12 years from 2004 to 2016 (Figure 1.7 on the following page).[17] Times have only crept up a little, mainly for longer commutes.[18] This could be seen as an instance of the "Marchetti constant", the phenomenon that people are generally willing to travel for 60 minutes a day, or slightly more, on average.[19]

Of course, there are limits to how much big cities can absorb population growth before the quality of commutes is affected. While delays are typically small for most motorists travelling to work by car, the delays on a range of routes into the Sydney and Melbourne CBDs at peak times are often twice as long as the same trip in off-peak conditions.[20]

Overcrowding of public transport and related impacts on service reliability also continue to be issues for the bigger cities.[21] In 2016 almost all trains arriving at Central Station in Sydney between 8am and 9am on the T4 Illawarra Line were over-crowded by the time they reached Sydenham station, around 8 kilometres from the CBD. Once a train is filled to 135 per cent of seated capacity, passengers feel crowded and the train can run late because it has to dwell longer at stations.[22]

And the available data suggests many of Sydney and Melbourne's key road links have hit capacity. The total volume of traffic on the Eastern Distributor (the toll road linking Sydney's CBD and airport), for example, has not changed since 2011.[23] Similarly, volumes on many of Melbourne's key arterial roads are largely unchanged since 2014.[24]

Yet the remarkable fact is that rapid population growth has had very little impact on commuting distances and times. This highlights a critical quality of cities that is often overlooked: city-dwellers are extremely adaptive.

Understanding the *process* of urban adaption – how city-dwellers have responded to fast population growth – is important if Australia is to continue to manage growth effectively in the years and decades ahead.

The following three chapters explain three major ways people have adapted to growing cities. Chapter 2 describes the role of workplace location, Chapter 3 focuses on changes to the transport network, and Chapter 4 highlights the many adaptations that individuals make every day, week, month and year. The final chapter recommends actions for governments to work with, not against, this powerful force.

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17. The commute times data is from HILDA (2016), a nationally representative survey of Australian households. BITRE (2016) finds that the travel times reported by HILDA respondents are quite similar other measures of travel times.
18. Grattan analysis of commuting data for Melbourne using Transport for Victoria (2018) and Transport for Victoria (2007) also found relatively little change in commute times.
19. The Marchetti constant is based on empirical observation and is supposed to have held since prehistoric times and over different geographies. See Zahavi (1973), Zahavi (1979), Zahavi and Ryan (1980), Zahavi and Talvitie (1980), Marchetti (1994), Schafer and Victor (1997), Ausubel et al. (1998) and Ausubel and Marchetti (2001).
20. Terrill et al. (2017).
21. O'Sullivan (2018), Jacks (2018), Bathersby and Herald (2018).
22. Transport for NSW (2017, March 2016).

23. Transport for NSW (2018).
24. VicRoads (2018a). This includes, for example, Hoddle Street and Punt Road, Elliot Avenue in Parkville, City Road in Southbank, and Dynon Road in West Melbourne, among others.

Figure 1.7: Commuting times have been fairly stable since 2004, but the trend is slightly up
Commute time, minutes
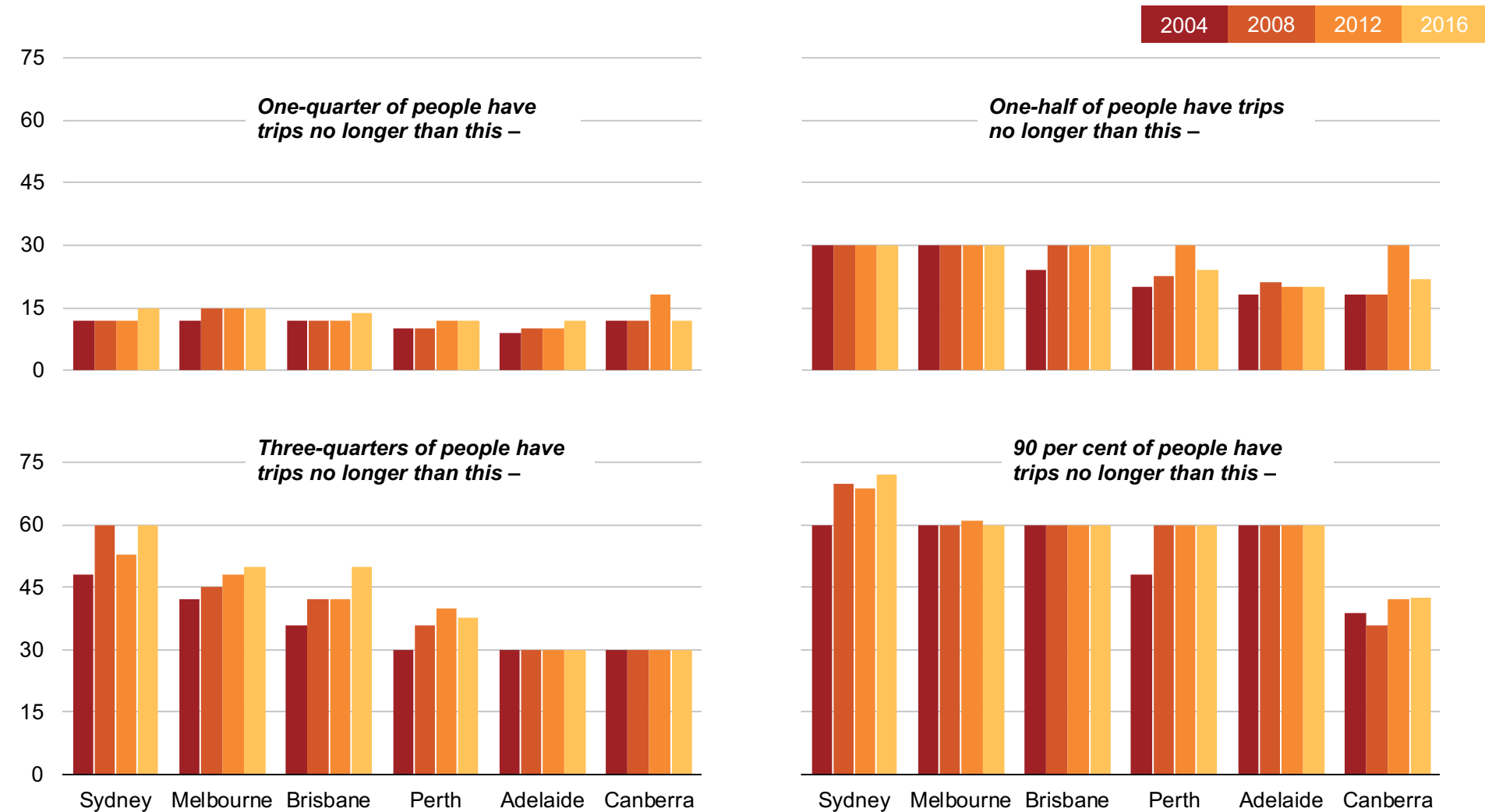
Notes: Working-age respondents to the HILDA survey report commuting times for a typical week. These are converted here to times for an individual trip. Canberra refers to the entire ACT. HILDA uses sample of around 13,000 respondents, with new households introduced in 2011. Each year's respondents are weighted to ensure that the sample is representative of Australian society. BITRE (2016) finds that the travel times reported by HILDA respondents are quite similar to other measures of travel times. Source: Grattan analysis of HILDA (2016).

2   The dispersion of jobs has helped city-dwellers adapt to population growth

It is often asserted that employment and employment growth is concentrated in CBDs and a small number of key employment centres.[25] The implication is that this makes population growth harder to manage, as people travel to work on ever-more-crowded routes.

But while CBDs have grown rapidly in Sydney and Melbourne, there is much more to the story. Only in Sydney, Melbourne and Canberra are CBDs growing at all.[26] Despite governments' longstanding plans, major suburban employment centres have not in fact been a significant source of jobs. Rather than being located in CBDs or employment sub-centres, the overwhelming majority of workplaces are widely dispersed across metropolitan areas. This characteristic is one reason Australia's cities are managing to adapt to growing populations.

2.1   Australia's major CBDs typically contain around 15 per cent of jobs

Many people assume Australia's major cities are mono-centric (the left-hand panel of Figure 2.1 on the next page), with the majority of workers converging on the CBD for work. But the reality is that the CBD in most Australian cities contains around 15 per cent of the city's workforce (Table 2.1).

The Sydney CBD grew strongly over the five years to 2016, increasing its share of Greater Sydney's workforce from 13.7 per cent to 14.5 per cent. Melbourne's CBD (including Docklands and Southbank) increased its share of Greater Melbourne's workforce from 14.8 per

Table 2.1: CBDs are growing in Sydney and Melbourne but shrinking in mid-sized cities

	CBD's share of the entire city's workforce	Annual growth of the CBD workforce	Annual growth of the entire city's workforce
Sydney	14.5%	3.3%	2.0%
Melbourne	15.5%	3.2%	2.3%
Brisbane	11.8%	-0.4%	1.2%
Perth	16.2%	-1.0%	1.2%
Adelaide	19.2%	-0.1%	0.1%
Canberra	15.6%	0.4%	1.1%

Notes: The figures here differ from those in ABS Census Table Builder, as explained in Appendix A.3. Figures for Sydney CBD include Haymarket and The Rocks (which are all part of a single SA2 region). Figures for Melbourne CBD include Docklands SA2 and Southbank SA2. While defining a CBD is subject to some judgement, the approach here is based on contiguous SA2s (suburbs) where a person could reasonably walk from one part of the CBD to another without leaving a job-dense area (characterised by skyscrapers). The difference in geographic size between the SA2 CBD regions is another reason for this adjustment. Canberra's CBD job share is relative to the entire ACT. Tables in Appendix B.1 present the size and growth of the 20 suburbs with the greatest employment in the major capitals. Growth figures are compound annual growth rates from 2011 to 2016.

Source: Grattan analysis of ABS (2016a) and ABS (2011a).

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25. For example, Maddock (2018): "most of [Melbourne's] job growth is in the CBD, yet most of its population growth is at the far extremes of the city. It's the same in other big Australian cities, like Sydney"; similarly Smeerdijk (2018).
26. For Canberra, the CBD jobs growth has been slower than the city-wide jobs growth, so the CBD has a declining share of the overall jobs.

Figure 2.1: Employment in Australia's biggest cities is mostly randomly dispersed

The mono-centric city
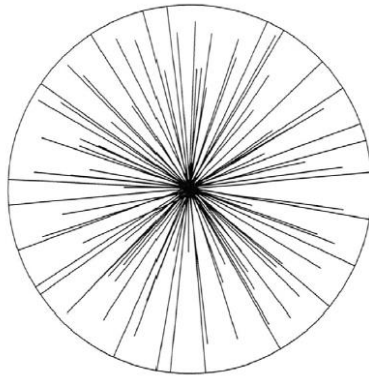
Jobs are concentrated in the Central Business District and workers – living in concentric rings at greater and greater distances from the CBD – commute on radial routes to their jobs in the CBD.

This model describes the reality for about **15%** of workers

The poly-centric city
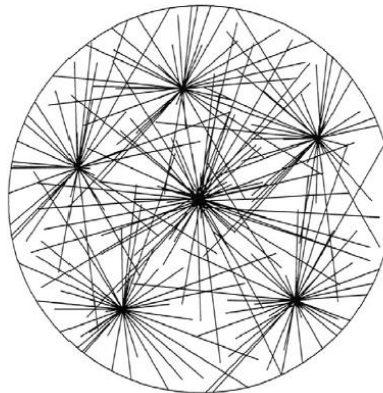
Workers commute to a discrete set of identifiable employment sub-centres located throughout the metropolitan area.

This model describes the reality for about **10%** of workers

The randomly-dispersed city
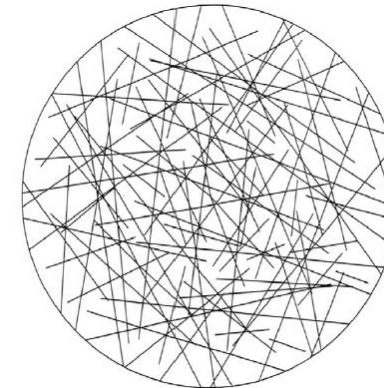
Jobs are not drawn into CBDs or significant sub-centres; instead they are dispersed in a random pattern.

This model describes the reality for about **75%** of workers

Note: These percentages are approximate.

Sources: Angel and Blei (2016a) and Grattan analysis of ABS (2016a).

cent to 15.5 per cent, although the CBD itself just kept pace with jobs growth across the city.

In both cities, the centre of intense economic activity is expanding outwards. In Sydney, the share of employment within 2 kilometres of the CBD increased slightly over the five years, by 0.4 percentage points.[27] There has been strong growth in areas neighbouring the CBD, including Pyrmont/Ultimo, Surry Hills and Newtown (Table 2.2 on the following page).

In Melbourne, the share of employment within 2 kilometres decreased slightly, by 1 percentage point, offset by increases in employment between 2 and 4 kilometres from the CBD.[28] Parkville, Richmond and South Melbourne all grew more quickly than the city-wide average (Table 2.3 on page 18).

The jobs growth in the CBDs of Sydney and Melbourne has been matched with residential growth, particularly international students. In Sydney, international students accounted for 32 per cent of residents living in the CBD in 2016, up from 28 per cent in 2011. In Melbourne the increase has been even bigger: 35 per cent in 2016, up from 25 per cent in 2011. The number of international students in Melbourne's CBD grew by an average of 20 per cent a year over the five years. More generally, people who are not Australian citizens (both students and others) increased as a proportion of inner-city residents in Melbourne, from 53 per cent to 64 per cent.[29]

In marked contrast, the CBDs of Brisbane, Perth, Adelaide, Darwin and Hobart have declined both in the proportion of jobs in the CBD

and the actual number of such jobs. In Brisbane, Perth and Adelaide, there were relatively sharp falls in the share of employment located in the inner areas, with the new jobs predominantly located in outer urban areas (see Figure 2.2 on page 19).

The inner-city areas of the larger cities are changing rapidly as places to live and study as well as work. Even though CBDs are the biggest job centres, they contain small shares of each city's jobs.

2.2 Sub-centres contain less than 10 per cent of jobs in Sydney and Melbourne

Governments repeatedly promote the growth of non-CBD employment centres, saying such places "can boost productivity, support economic growth, make the most of infrastructure and promote urban renewal".[30]

The Greater Sydney Commission says Sydney should become much more poly-centric, with a Harbour City (the existing centre), a River City (centred on Parramatta) and a Parkland City (Badgerys Creek). The plan seeks a renewed focus on a 2005 NSW Government objective, that around half of all Sydney's jobs are to be in "major centres", with public transport services helping to create a "30-minute city".[31]

Melbourne's urban planning documents also promote poly-centric growth. *Plan Melbourne 2017–2050*, for example, emphasised the role that "employment and innovation clusters" would play in moving jobs closer to where people live.[32]

But only a small proportion of people in Australia's large and mid-sized cities work in a non-CBD employment centre. In Sydney and Melbourne, less than 10 per cent of workers work in an employment centre

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27. Loader (2018), see Figure B.7 in Appendix B.4.
28. Loader (ibid.), see Figure B.7 in Appendix B.4. The decreasing share within two kilometres reverses the trend of the previous five years, when the share of Melbourne's employment that was 0–2 kilometres from the city centre grew, as noted in Daley (2016, p. 6).
29. Grattan analysis of ABS (2016a) and ABS (2011a).

30. Hansen et al. (2012, p. 54).
31. Greater Sydney Commission (2017, p. 29). For Sydney as a whole, the median commute time in 2016 was already 30 minutes.
32. DELWP (2017, p. 25).

Table 2.2: The 20 largest employment centres in Sydney
Suburbs where employment grew more slowly than the citywide average are highlighted

	Workforce, 2011	Proportion of total city employment, 2011	Workforce, 2016	Proportion of total city employment, 2016	Average workforce growth, 2011-2016
Sydney – Haymarket – The Rocks	273,300	13.7%	320,800	14.5%	3.3%
Parramatta – Rosehill	46,300	2.3%	50,200	2.3%	1.6%
North Sydney – Lavender Bay	46,800	2.3%	49,000	2.2%	0.9%
Macquarie Park – Marsfield	42,000	2.1%	48,400	2.2%	2.9%
Pyrmont – Ultimo	32,300	1.6%	36,800	1.7%	2.7%
Surry Hills	25,400	1.3%	29,800	1.3%	3.3%
St Leonards – Naremburn	28,000	1.4%	29,400	1.3%	1.0%
Chatswood (East) – Artarmon	23,900	1.2%	27,700	1.3%	3.0%
Homebush Bay – Silverwater	24,600	1.2%	26,500	1.2%	1.5%
Erskineville – Alexandria	20,900	1.0%	23,600	1.1%	2.5%
Baulkham Hills (West) – Bella Vista	19,000	1.0%	23,600	1.1%	4.4%
Liverpool – Warwick Farm*	20,400	1.0%	23,000	1.0%	2.4%
Mascot – Eastlakes	22,700	1.1%	22,400	1.0%	-0.3%
Newtown – Camperdown – Darlington	18,300	0.9%	20,600	0.9%	2.4%
Blacktown (East) – Kings Park	19,300	1.0%	20,200	0.9%	0.9%
Penrith	18,600	0.9%	20,100	0.9%	1.6%
Concord West – North Strathfield	16,600	0.8%	19,800	0.9%	3.6%
Gosford – Springfield	18,600	0.9%	18,800	0.9%	0.3%
Campbelltown – Woodbine	16,400	0.8%	18,300	0.8%	2.2%
Prospect Reservoir	14,500	0.7%	18,000	0.8%	4.4%
City Total	**1,997,100**	**100.0%**	**2,209,300**	**100.0%**	**2.0%**

Notes: An asterisk (*) indicates that the SA2 was split up in 2016, and the figures are for the workforce within the 2011 SA2 (i.e. a sum of multiple 2016 SA2s). The figures here differ from those in ABS Census Table Builder, as explained in Appendix A.3. Growth figures are compound annual growth rates.

Source: Grattan analysis of ABS (2016a) and ABS (2011a).

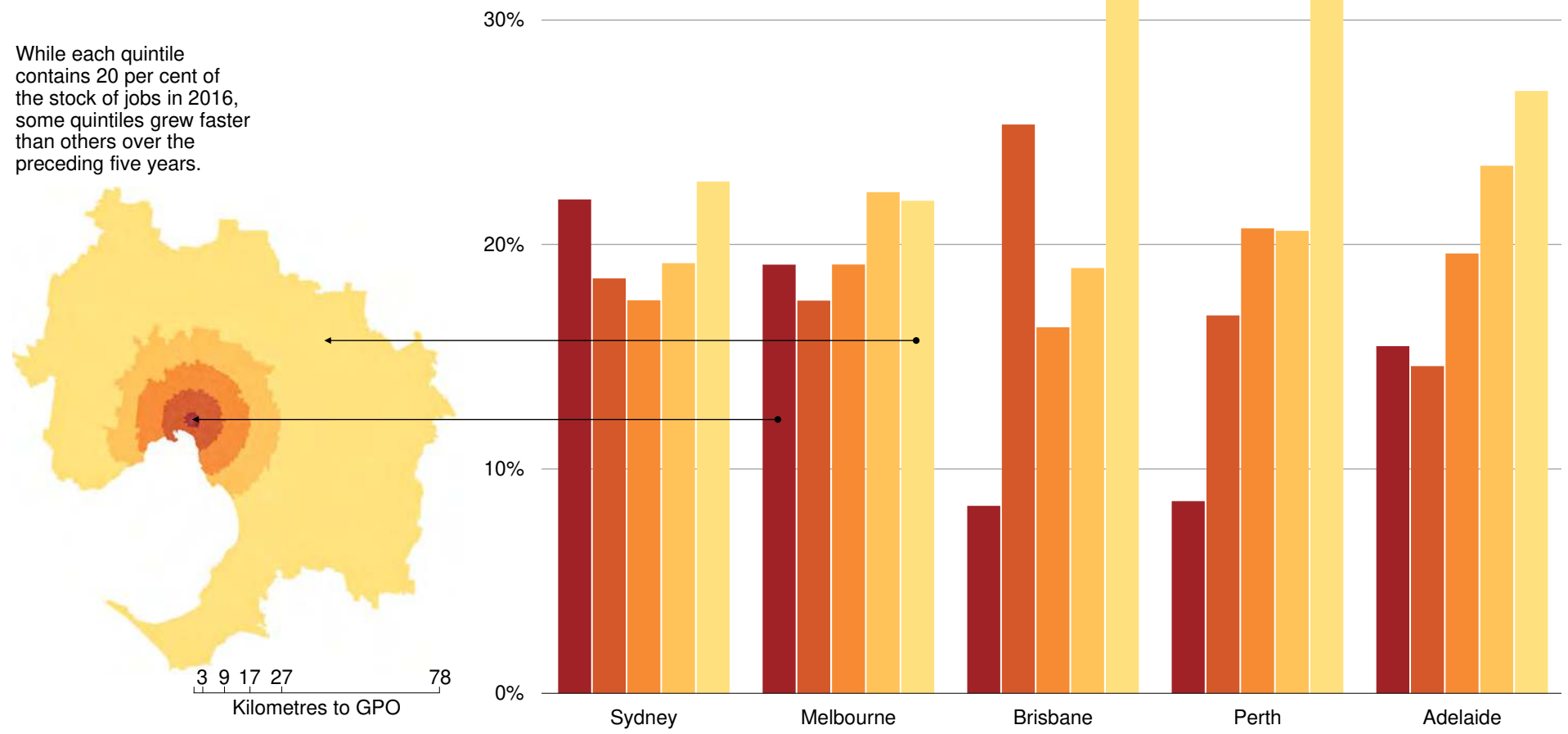**Table 2.3: The 20 largest employment centres in Melbourne**
Suburbs where employment grew more slowly than the citywide average are highlighted

	Workforce, 2011	Proportion of total city employment, 2011	Workforce, 2016	Proportion of total city employment, 2016	Average workforce growth, 2011-2016
Melbourne^	199,900	10.9%	221,100	10.8%	2.0%
Dandenong	58,200	3.2%	65,700	3.2%	2.4%
Docklands^	34,400	1.9%	57,600	2.8%	10.8%
Southbank^	36,500	2.0%	38,800	1.9%	1.2%
Richmond	32,200	1.8%	36,800	1.8%	2.7%
Clayton	31,000	1.7%	34,200	1.7%	2.0%
Parkville	23,300	1.3%	28,200	1.4%	3.9%
South Melbourne	22,600	1.2%	26,000	1.3%	2.9%
Campbellfield – Coolaroo	21,400	1.2%	23,100	1.1%	1.5%
Port Melbourne Industrial	20,200	1.1%	22,800	1.1%	2.4%
Mulgrave	20,100	1.1%	21,200	1.0%	1.1%
East Melbourne	21,600	1.2%	19,900	1.0%	-1.6%
Laverton	16,700	0.9%	19,300	0.9%	2.9%
Box Hill	18,300	1.0%	19,000	0.9%	0.7%
Preston*	17,600	1.0%	19,000	0.9%	1.5%
Keilor	14,600	0.8%	17,500	0.9%	3.7%
Albert Park	16,600	0.9%	16,500	0.8%	-0.1%
South Yarra – West	15,000	0.8%	16,100	0.8%	1.5%
Melbourne Airport	14,900	0.8%	15,900	0.8%	1.3%
Carlton	16,200	0.9%	15,700	0.8%	-0.7%
City Total	**1,826,300**	**100.0%**	**2,046,200**	**100.0%**	**2.3%**

Notes: An asterisk (*) indicates that the SA2 was split up in 2016, and the figures are for the workforce within the 2011 SA2 (i.e. a sum of multiple 2016 SA2s). A circumflex (^) indicates that the SA2 was used as part of the definition of the CBD in Table 2.1 on page 14. The figures here differ from those in ABS Census Table Builder, as explained in Appendix A.3. Growth figures are compound annual growth rates.

Source: Grattan analysis of ABS (2016a) and ABS (2011a).

Figure 2.2: In mid-sized cities, more new jobs are in outer urban areas
Percentage of total job growth 2011-2016, based on quintiles of worker location in 2016

While each quintile contains 20 per cent of the stock of jobs in 2016, some quintiles grew faster than others over the preceding five years.

Kilometres to GPO

3 9 17 27 78

30%

20%

10%

0%

Sydney   Melbourne   Brisbane   Perth   Adelaide

Notes: The five bars for each city add up to 100 per cent of the new jobs added between 2011 and 2016. Each bar (one quintile) is based on a ring around the city centre that contains 20 per cent of all jobs in 2016. Maps of the other cities are included in Appendix B.3.

Source: Grattan analysis of ABS Census: ABS (2016a) and ABS (2011a).

that accounts for at least 1.5 per cent of the city's jobs. In Brisbane, Perth and Adelaide, around 10-15 per cent of workers work in one of the five biggest employment suburbs other than the CBD.[33]

Some employment centres grew more quickly than the city-wide average from 2011 to 2016, while others grew more slowly. In Sydney, Macquarie Park and Pyrmont grew more quickly than the city-wide average of 2.0 per cent, but Parramatta and North Sydney grew more slowly. In Melbourne, Dandenong and Richmond grew more quickly than the city-wide average of 2.3 per cent, but Clayton grew more slowly (Table 2.2 and Table 2.3).

Government plans typically lack important detail about employment sub-centres. For instance, Plan Melbourne states that the employment 'centre' at Monash has 75,000 jobs – but it doesn't clarify that these are spread across about 80 square kilometres.[34] It is not clear in what sense Monash can be described as a single, integrated cluster rather than an area encompassing nine separate suburbs that between them contain a hospital, university, business park and shopping centre.

Similarly, the pathway to a fully-formed urban centre, such as the "aerotropolis" at Badgerys Creek in Sydney, is unclear. It has taken a long time in Melbourne: Tullamarine airport is nearly 50 years old and more than 30 kilometres closer to the CBD than Badgerys Creek, but Melbourne's airport precinct today contains just 0.8 per cent of the city's jobs.[35]

None of this is new: in Melbourne, the failure to meet job targets for employment sub-centres dates back as far as the 1954 Metropolitan

Melbourne Planning Scheme.[36] In any case, metropolitan planning documents are not binding – they set an aspiration, but there is limited means to give effect to that aspiration (Box 1 on the following page).

2.3 Three quarters of jobs are widely dispersed

Beyond the quarter of jobs in CBDs and other employment centres are the three quarters of jobs that are dispersed all over the city (Figure 2.3 on the next page and Figure 2.4 on page 22).

In Sydney, 15 of the 20 biggest suburbs for employment each contain just 0.8 per cent to 1.4 per cent of the city's total workforce (Table 2.2). In Melbourne, the same is true for 14 of the 20 biggest suburbs for employment (Table 2.3).[37]

And jobs are becoming more dispersed. This is clearest in the mid-sized and smaller capital cities, where jobs growth is particularly strong on the city perimeter (Figure 2.2).

In Sydney and Melbourne, the distance from the CBD of the average workplace increased a little between 2011 and 2016, from 17.7 kilometres to 17.8 kilometres in Sydney, and from 15.6 kilometres to 15.9 kilometres in Melbourne.[38] Figure 2.5 shows employment growth in Sydney and Melbourne over those five years. Many of the areas of fastest growth are outer urban areas.[39]

The geographic dispersion of jobs and jobs growth has been a crucial mechanism by which Australia's cities have adapted to population growth.

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33. There is no hard-and-fast rule for what comprises an employment 'sub-centre'. The definition used in this report for big cities captures sub-centres that are commonly identified elsewhere, such as Parramatta and Macquarie Park in Sydney, and Dandenong and Clayton in Melbourne.
34. ABS (2016b) and DELWP (2017, p. 27).
35. Davies (2017).

36. Whitzman (2011).
37. Data for other cities are presented in Appendix B.1.
38. The median distance in Melbourne increased from 13.4 kilometres to 13.7 kilometres, and the median distance in Sydney increased from 13.1 kilometres to 13.3 kilometres (Grattan analysis of ABS (2016a) and ABS (2011a)).
39. See Figure B.8 on page 80 for a map with absolute numbers of new jobs.

Box 1: Parramatta and Monash – failure to launch

Monash in Melbourne and Parramatta in Sydney are each about 20 kilometres from the CBD. For many years governments have planned for them to absorb larger proportions of their city's employment growth.[a]

Parramatta in particular has come to have a reputation as Sydney's second CBD.[b] Yet it had only 2.3 per cent of Sydney's total jobs in 2011, and that figure remained unchanged over the five years to 2016 (Table 2.2 on page 17).

Some smaller employment centres in Sydney did grow strongly over those five years. Macquarie Park, Chatswood, Baulkham Hills and Liverpool all grew faster than the rest of the city. But others – St Leonards and Homebush – grew by less than the city-wide average. Considered together, the biggest employment sub-centres outside the CBD area contributed less than 10 per cent of Sydney's jobs growth.

Melbourne's south-eastern suburb of Clayton is home to both Monash University and Monash medical precinct, and has been held up an exemplar economic cluster.[c] But its share of Melbourne's total jobs has not grown: it had 1.7 per cent in 2011, and still had 1.7 per cent in 2016. And the jobs share of the broader Monash region – which contains nine suburbs and most of Melbourne's largest "national employment and innovation cluster" – fell from 5.3 per cent to 5.1 per cent over those five years.

a.   Dunn (2016).
b.   Visentin (2017).
c.   DELWP (2017).

Figure 2.3: Employment in Sydney is very dispersed
Journeys to work, beeline distance between origin and destination, 2016

Parramatta

20 km
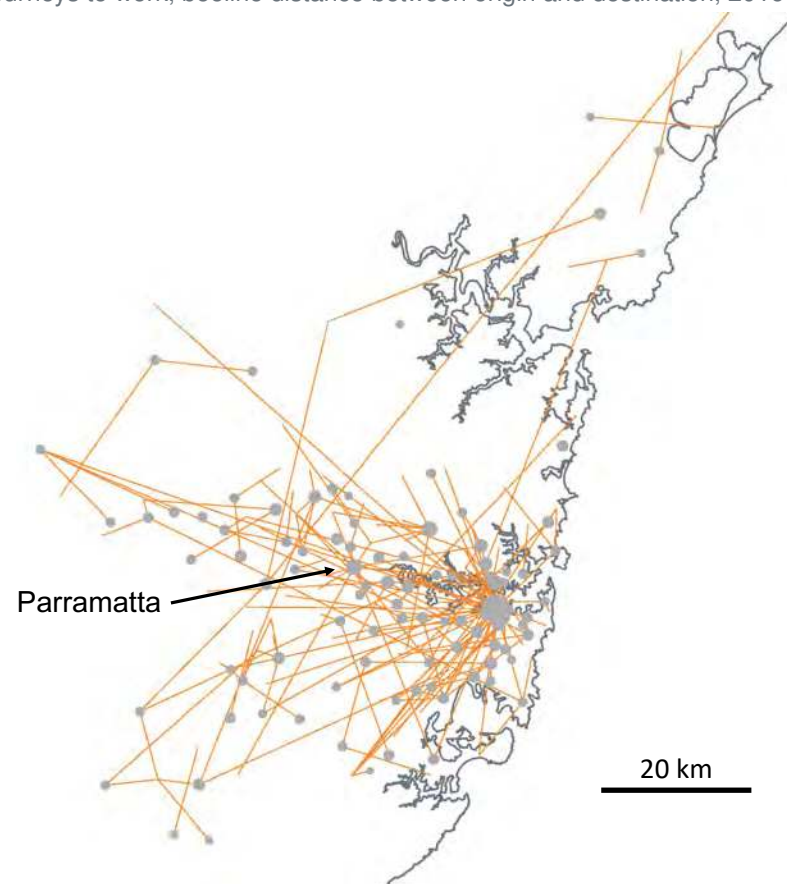
Notes: This chart shows 200 randomly selected journeys to work in Sydney. Each line represents a journey, and grey dots are workplaces. The size of the dot represents the relative number of jobs at that destination. Some lines have one end with no grey dots, which means there are homes but no jobs in that area in the sample. Where lines start and end on grey dots, jobs and homes exist on both ends of the journey. Some dots have no lines, which means people live and work in the same area. This chart is robust to changes in the random sample. For more information see Appendix A.2.

Source: Grattan analysis of ABS (2016a).

Figure 2.4: As in Sydney, employment in Melbourne and Brisbane is very dispersed
Journeys to work, beeline distance between origin and destination, 2016

Melbourne

Brisbane

Dandenong

20 km

20 km
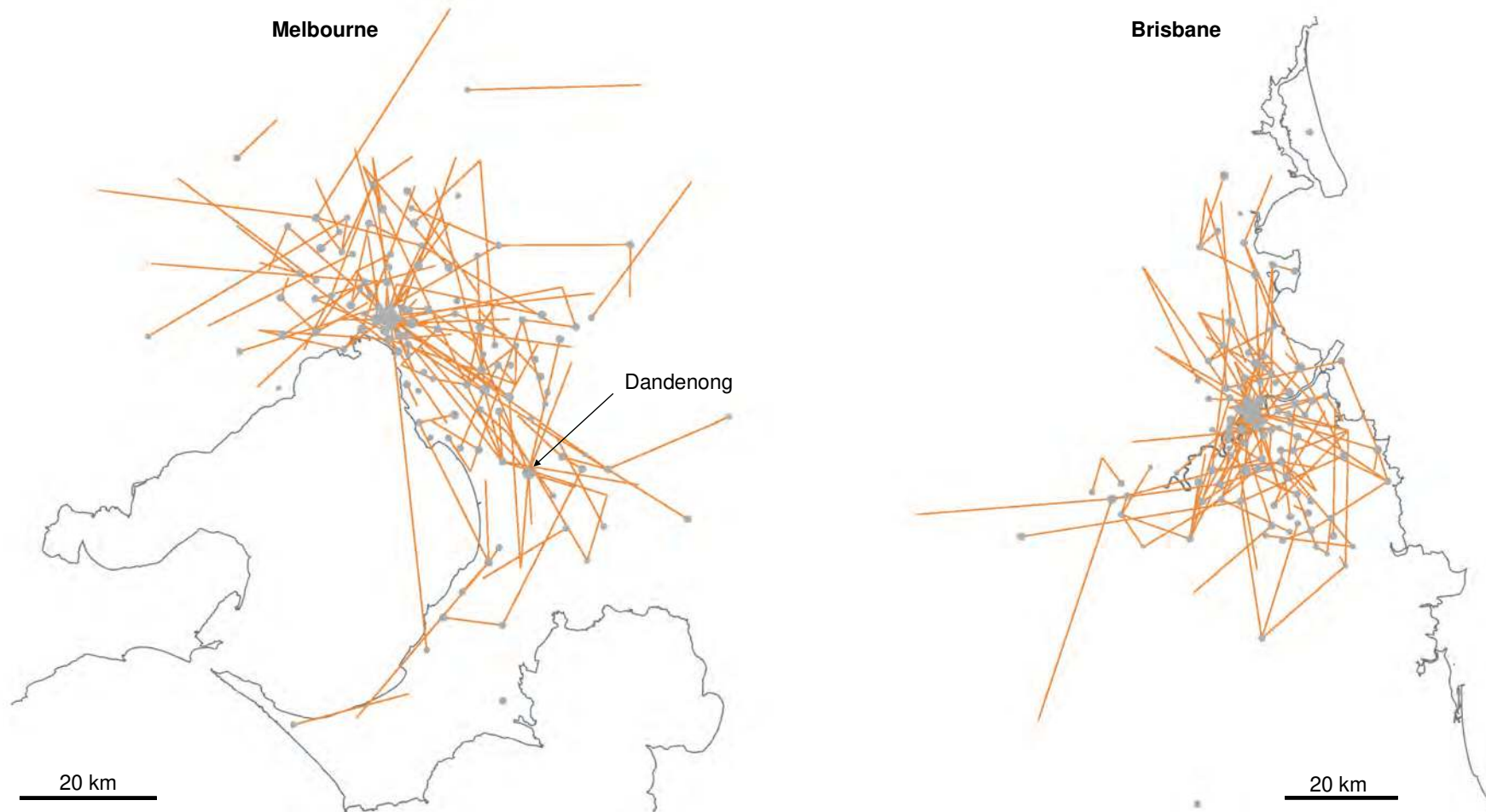
Notes: These charts show 200 randomly selected journeys to work in Melbourne and Brisbane. Each line represents a journey, and grey dots are workplaces. The size of the dot represents the relative number of jobs at that destination. Some lines have one end with no grey dots, which means there are homes but no jobs in that area in the sample. Where lines start and end on grey dots, jobs and homes exist on both ends of the journey. Some dots have no lines, which means people live and work in the same area. These charts are robust to changes in the random sample. For more information see Appendix A.2.

Source: Grattan analysis of ABS (2016a).

Figure 2.5: In Sydney and Melbourne, jobs have grown in the CBD and central areas, but they've grown fastest in the outer areas
Average annual employment growth, 2011 to 2016, SA3
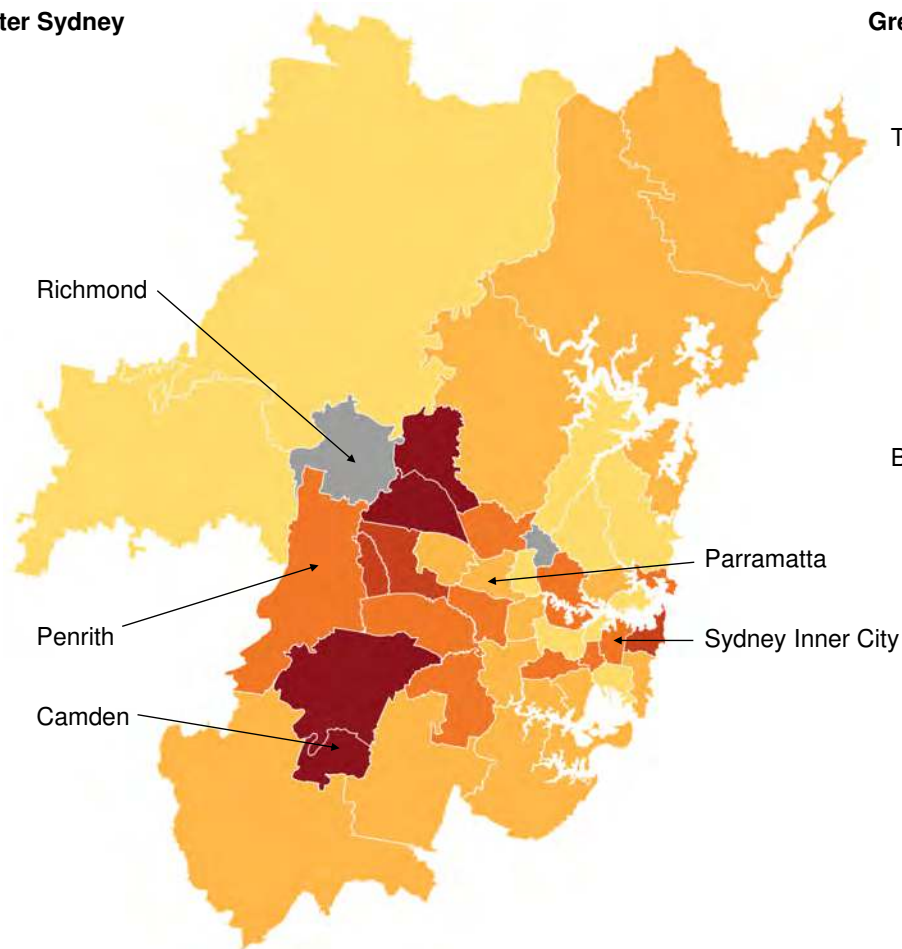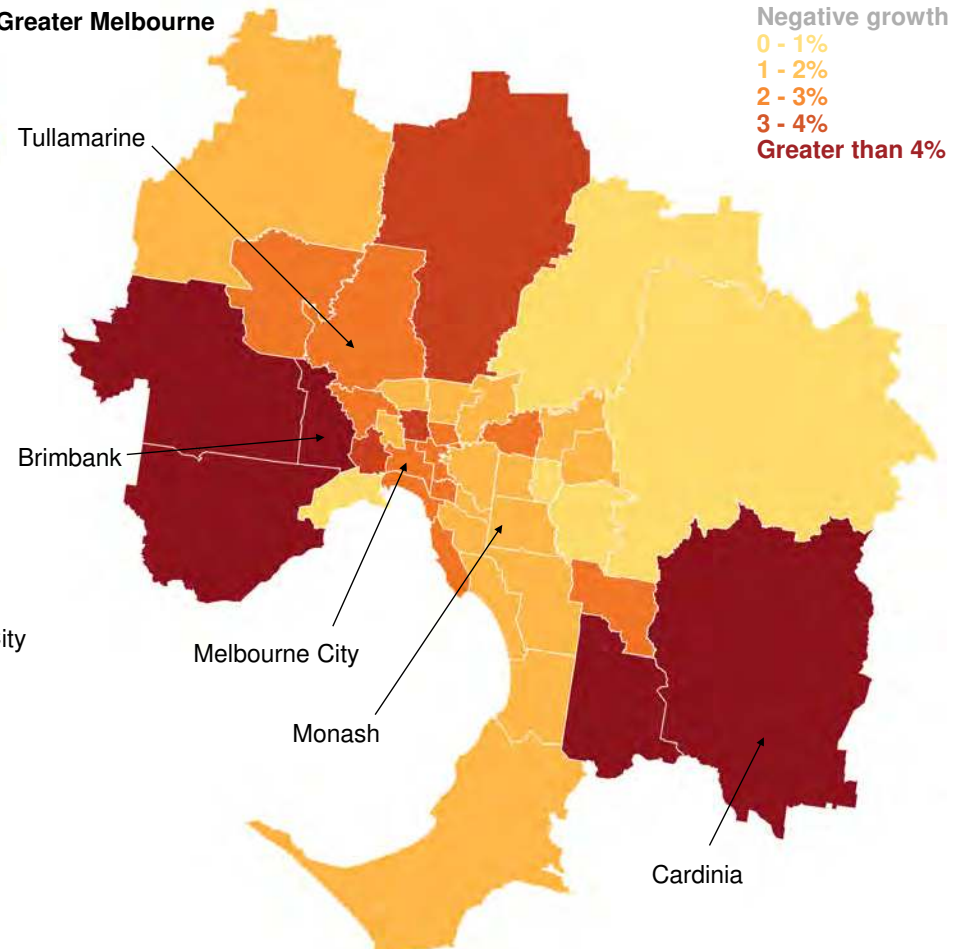
Notes: The calculation of growth between censuses relies on the methodology in Appendix A.3. In Sydney, Richmond is the label for the 'Richmond-Windsor' SA3; its growth rate was determined to be -0.1 per cent per year, which, although negative, is close to zero and so the possibility of very low positive growth cannot be excluded. In Melbourne, Tullamarine is the label for the 'Tullamarine-Broadmeadows' SA3. An equivalent map with net jobs rather than growth rate is available in Appendix B.4. Figure B.8 demonstrates that the fast growth rate in outer areas is not just the result of a low base in 2011 – the stock of jobs in outer areas also grew significantly over this period. The 'Blue Mountains' SA3 region in Greater Sydney has been omitted due to very low sample size (it contained just 16 jobs in 2016, up from 5 jobs in 2011).

Source: Grattan analysis of ABS (2016a) and ABS (2011a).

3   The modest role of new infrastructure

When cities are growing, the media, local communities and politicians (especially at election time) often call for new building as a way to deal with mounting congestion.

Transport infrastructure is important, but many people see it as the *sole* mechanism enabling effective links between workers and their jobs in a growing city. The recent experience of Australian cities suggests this view is wrong.

Section 3.1 shows how little new infrastructure has come into operation since 2011, even though the population growth in that period might have been expected to cause longer commutes.

Section 3.2 explains that we haven't seen a blowout in commutes because the need for infrastructure does not grow at the same rate as population growth.

3.1   Cities have adapted despite only modest new transport infrastructure

Large construction programs are underway in Australia's three biggest fast-growing cities, Sydney, Melbourne and Brisbane, but most of the new transport infrastructure will not come into operation for years. For instance, Sydney's WestConnex Stage 3 is not due to be opened until 2023, and Melbourne Metro is not scheduled to carry passengers until 2025.[40]

In Australia's biggest cities, the road stock has increased by much less than population growth. In Sydney, the road stock increased by 2.4 per cent over the five years to 2015, significantly less than the

population increase of 8.7 per cent.[41] New infrastructure included the Hills M2 Upgrade (which cost $700 million) and capacity upgrades on the F5 and M5 motorways (which cost around $116 million and $400 million, respectively).[42] Beyond roads, the South West Rail Link opened in February 2015 at a cost of $1.8 billion, giving some residents an alternative to driving.[43]

In Melbourne, the road stock increased by 4.3 per cent over the five years to 2015, significantly less than the population increase of 11.9 per cent.[44] The $1.3 billion CityLink Tullamarine Widening project recently finished and the $8.3 billion Level Crossing Removal Project is more than half completed, but these road projects are too new to help explain the stability of commuting times in Melbourne.[45]

In Brisbane, the road stock increased by just 1.1 per cent over the five years to 2015, while the population increased by 9.9 per cent.[46] The

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40. WestConnex (2015); and Premier of Victoria (2018).

41. BITRE (2017a, p. 37) and ABS (2018e). Measure is total lane kilometres. Road stock data is only available up to 2015, hence the focus on the five years to 2015.
42. Transurban (2014); NSW Government (2011); and NSW Government (2014).
43. NSW Government (2015). Significantly more infrastructure is due to be completed in the next five years: the $3 billion NorthConnex (NorthConnex (2016)); the remainder of the $16.8 billion WestConnex (WestConnex (2015)); the $2 billion Moorebank Intermodal Terminal, which is expected to take 3,000 trucks off the roads each day (Australian National Audit Office (2017)); Stage 1 of the $8.3 billion Sydney Metro project (Sydney Metro (2016)); and the $2.1 billion Sydney Light Rail (Acciona Australia (2018)).
44. BITRE (2017a) and ABS (2018e).
45. Infrastructure Australia (2014) and Victorian Auditor-General's Office (2017). The $2.1 billion Western Roads Upgrade is due for completion in 2020 (VicRoads (2018b)), the $6.7 billion West Gate Tunnel in 2022 (Department of Treasury and Finance (2017)), and the $15.8 billion North East Link in 2027 (Victorian Government (2018)). The $10.9 billion Melbourne Metro is scheduled to start taking passengers in 2025 (Victorian Government (2016)).
46. BITRE (2017a) and ABS (2018e).

two biggest urban road projects finished in recent years are the $4.8 billion Airport Link, completed in 2012, and the $1.5 billion Legacy Way, completed in 2015.[47]

Of course, not every dollar spent yields the same increase in useful infrastructure. Sometimes a modest outlay can alleviate a local bottleneck with substantial benefits, but it's also possible for new infrastructure to reduce the overall capacity of the network.[48] And politicised decision-making is no substitute for rigorously assessed infrastructure options to address important network problems.[49]

Nevertheless, these new projects now operating or in the pipeline are intended to increase functional capacity, and some of the forthcoming projects are enormous. But even a very large new road or railway line forms only a tiny increase to the stock. For example, WestConnex, Australia's largest-ever freeway project, will add around 0.3 per cent to Sydney's lane kilometres of road,[50] and Melbourne Metro, Victoria's biggest-ever rail project, will add 1.9 per cent to the track kilometres of Melbourne's rail network.[51]

3.2 Fast-growing populations don't need fast-growing infrastructure

Australia's fastest-growing cities have added to their stock of roads, but not as fast as they have added to their stock of people.

There is no simple formula for how many lane kilometres of road or track kilometres of rail, or how many trains or buses, are needed per person.[52] But recent Australian experience indicates that bigger cities can make do with less infrastructure per person and still keep commutes stable (Figure 3.1).[53]

Figure 3.1: Living in a large capital city in Australia does not mean travelling much further than living in a smaller capital
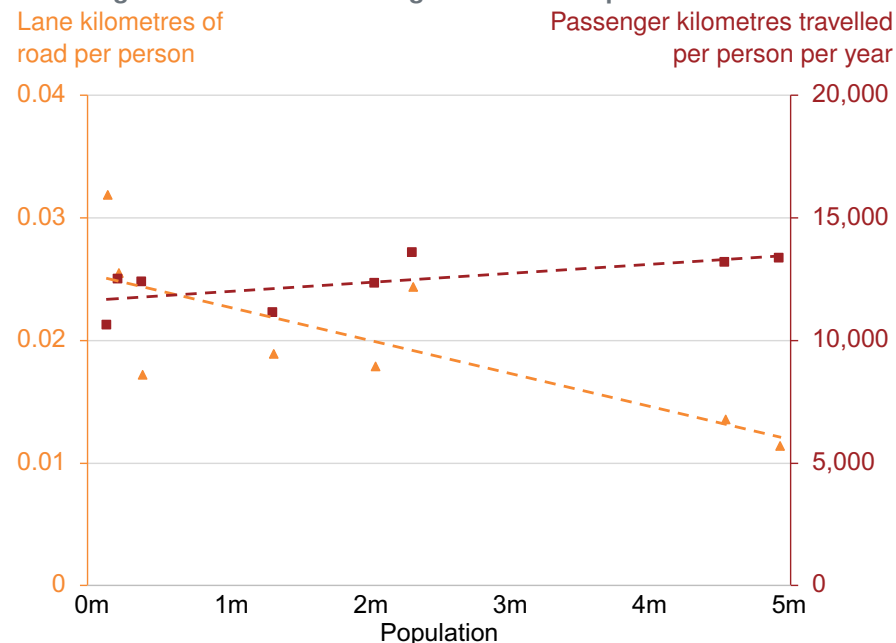
Notes: Data is for 2015. Chart shows Australia's capital cities. Dashed lines are lines-of-best-fit. Canberra's lane length is for the entire ACT.

Source: Grattan analysis of BITRE (2017b) and BITRE (2017a).

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47. John Holland (2018) and Brisbane City Council (2010). The $5.4 billion Cross River Rail project (Building Queensland (2017)), the $944 million Brisbane Metro (Brisbane City Council (2017)) and the $650 million Kingsford Smith Drive Upgrade (Brisbane City Council (2015)) are due to open in the coming decade.
48. An example is where the addition of new capacity leads drivers to choose a route that appears best for them but in combination with others choosing the same route leads to longer travel times (known as Braess' paradox – see Woodcock (2015)).
49. Terrill et al. (2016b).
50. Grattan analysis of BITRE (2017a) and WestConnex (2015, pp. 146–153).
51. Metro Trains (2018) and Victorian Government (2016). Melbourne Metro will also ameliorate bottlenecks in the rail network as a whole.
52. Although sometimes even experts infer that infrastructure needs to increase linearly with population, *e.g.* KPMG Economics (2017) and Evans (2018).
53. The same is true around the world (West (2017, pp. 269–324)).

A city with double the population of another does not have double the commute times or distances. Average commute times and distances in Melbourne and Brisbane are similar, even though Melbourne has twice the population of Brisbane. People in Canberra spend longer and travel further than people in Adelaide, even though Canberra has only a third of Adelaide's population (Figure 3.2).

Figure 3.2: Double the population does not mean double the commute
Median commute distance (km)   Median commute duration (mins)
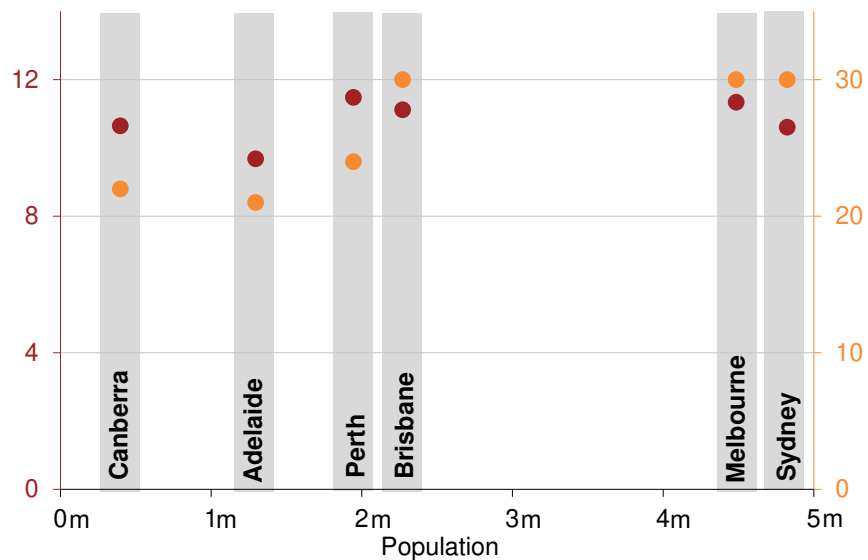
Note: Figures for Canberra are for the entire ACT.
Source: Grattan analysis of ABS (2016a) and HILDA (2016).

In all of Australia's biggest cities, average commute distances have grown at a slower rate than the population. It is particularly striking how commute distances in Sydney and Melbourne have remained stable while the population has grown strongly (see Figure 3.3).

Figure 3.3: Commute distances have grown more slowly than the population in all cities – especially Melbourne and Sydney
Annual change in commute distance
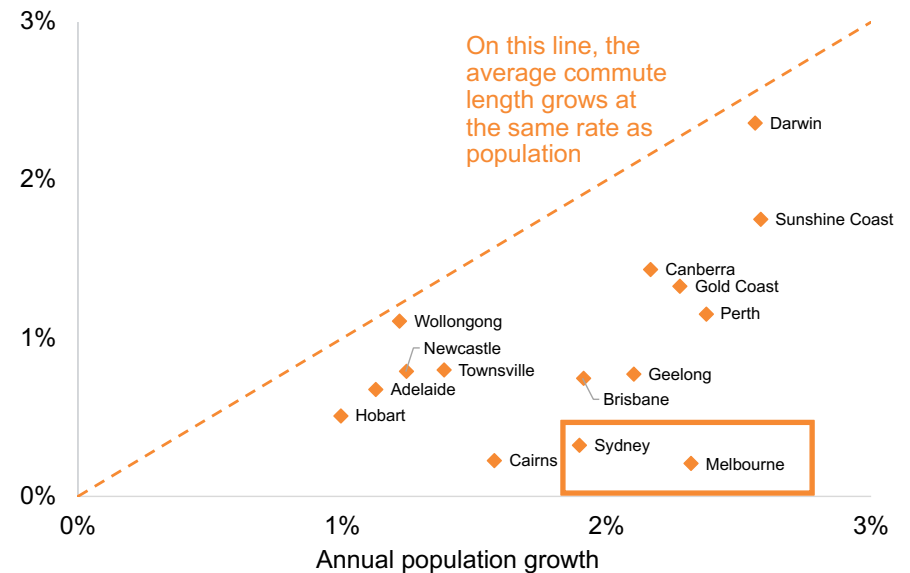
Notes: Data for capital cities comes from the ABS Census definition 'Greater Capital City Statistical Areas'. For other cities, 'Significant Urban Area' was used, except for Geelong and Newcastle (where boundaries were redrawn between censuses, and for which the 2011 population was determined from the number of people residing in the boundaries of the 2016 SUA in 2011).
Source: Grattan analysis of ABS (2016a) and ABS (2011a).

These findings should not be surprising. High-school geometry shows that if a city doubles in population while maintaining the same distribution of homes and workplaces across the urban area, the average beeline distance of a typical trip would be only 40 per cent longer (see Box 2).

What is surprising is that average commute lengths in Australia's three biggest cities have grown even more slowly than the theory in Box 2 would suggest (see Table 3.1). This indicates that cities are becoming denser as employers and households reorganise and relocate.

Table 3.1: In the biggest cities, commute distances are growing much more slowly than might be expected
Annual average growth, 2011 to 2016

	Sydney	Melbourne	Brisbane
Population growth	1.90%	2.32%	1.91%
Expected commute growth	0.94%	1.15%	0.95%
Actual commute growth	0.32%	0.20%	0.75%

Notes: Expected commute growth is explained in Box 2.

Source: Grattan analysis of ABS (2011a) and ABS (2016a).

In smaller cities, population growth can have much more impact on commute distances. In Australia, cities with fewer than a million people have had the biggest increases in commute distances as their populations have grown (Figure 3.4 on the next page).

Box 2: Why average trip lengths don't double when a city's population doubles

Imagine that a city's population were to double, and that the city retained the same density and distribution of homes and workplaces. The expected trip length would increase by around 40 per cent, not 100 per cent.[a]

In a simplified example, if a circular city with a radius of 1 kilometre doubled in area, the radius of the circle would rise from 1 kilometre to 1.4 kilometres – with 1.4 being the square root of two, the growth factor. Trip lengths in general would increase by the square root of two (or the square root of one plus the percentage growth).

Of course, in reality, cities are not perfect circles – they may be on a coast line, or alongside a mountain range, or constrained by a national park. Nor do growing cities retain exactly the same density and distribution of homes and workplaces.

Take Melbourne as an example. Its population grew by 2.3 per cent each year between 2011 and 2016 – that's a factor of 1.023 each year. The theory above suggests that the average commute should grow by the square root of 1.023 each year: 1.14 per cent.

In fact, Melbourne's average commute length grew even more slowly, by only 0.20 per cent each year. This suggests that people changed where they lived and where they worked, and that the city's density increased over this time, rather than staying fixed. As a result, commute distances grow by a much smaller factor than the rate of population growth.

a. Angel and Blei (2016b, p. 42); and O'Flaherty (2005, p. 13).

Figure 3.4: Population growth can have a bigger impact on commute distances in small cities than in mid-sized or large cities

Increase in commute length as a proportion of change in population, 2011-2016
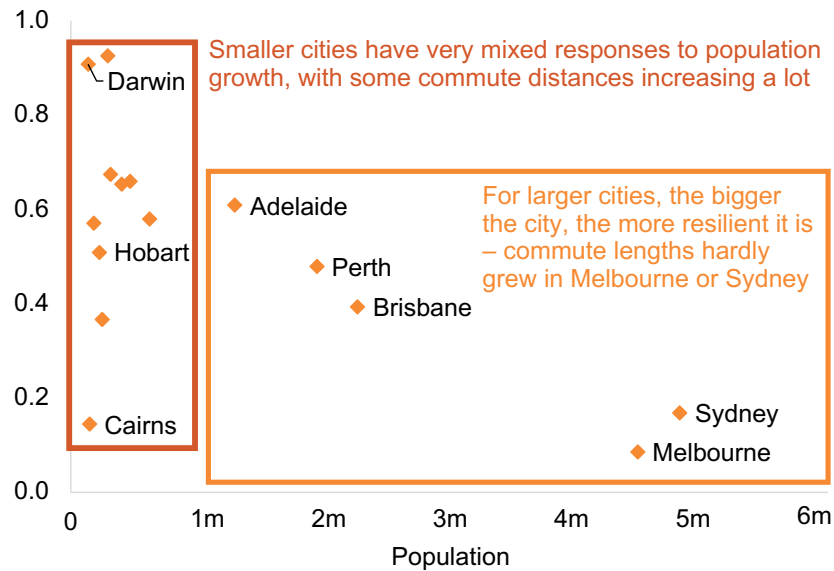
Note: All cities have values less than one, indicating that the average commute length grew more slowly than population over the five years from 2011 to 2016.

Source: Grattan analysis of ABS (2016a) and ABS (2011a).

4   People find many ways to adapt to population growth

One of the recurring concerns about growing cities is urban sprawl, and how an expanding boundary forces outer-suburban dwellers to drive ever further to get to work.

Long, slow commutes by car may not be particularly appealing, but they're much less common in Australia's big cities than media reports make out.[54] And people make many more choices than simply whether to drive to work in the CBD or not. People make housing choices taking into account the cost of housing and the home and neighbourhood characteristics, the income they can earn, the time and money costs of travel to work, and the circumstances of household and family members. And they find many ways to adapt so as to keep their commutes tolerable.

Section 4.1 of this chapter highlights a step up in working from home, and Section 4.2 looks at the barriers to people adapting by moving home. Section 4.3 details changes people have made to the method by which they get to work, whether that is by car, public transport or walking or cycling (often described as "active transport"). And the final section examines those people who accept, or at least put up with, a longer commute.

4.1   People are increasingly working from home

Encouraging more people to work from home is often suggested as a way to ease congestion. At present, only about 5 per cent of people work from home in Sydney, Melbourne and Brisbane, and around 4 per cent in Perth and Adelaide.[55]

But the trend is clearly up: in each of Australia's five largest cities, the rate of working from home increased by about half a percentage point between 2011 and 2016.[56]

The trend is particularly apparent among those people who were living and working in Australia in both 2011 and 2016.[57] These "established workers" were more likely to work from home in 2016 than they had been in 2011, by a full percentage point over the five years.

Governments have limited scope to influence firms' commercial decisions about whether their employees can work from home, and under what circumstances. It is clear, though, that working from home is one way that people adapt to urban growth.

4.2   Moving house is another way of adapting

Some people change where they live to improve their commute, sometimes linked to a change in work location. But governments make moving hard. They provide very significant concessions to encourage home ownership, and impose a very significant tax on moving from a purchased home.

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54. Terrill et al. (2017, p. 18).
55. See Appendix B.2, Figure B.1 on page 73.

56. Grattan analysis of ABS (2016a) and ABS (2011a).
57. Workers living in Australia in both 2011 and 2016 are identified through the Australian Census Longitudinal Dataset (ACLD), which follows a sample of roughly 5 per cent of the population (around 1.2 million Australians) from one census to the next. Our analysis using the ACLD examines *changes to methods of travel*, which requires sampling only those workers who were living and working in Australia in both 2011 and 2016. These workers are referred to throughout this chapter as "established workers". This subset of workers excludes, by definition, the (net) "new workers" who joined the workforce between 2011 and 2016 – comprised of *migrants from abroad* and *new workforce entrants and re-entrants*, less those who exited the workforce by 2016.

The most valuable tax concession to home ownership is the failure to tax imputed rent. While renters pay their rent out of post-tax income, homeowners in effect rent their home to themselves and 'pay' that rent out of untaxed income. This concession is extremely substantial. In addition, there is no capital gains tax payable on owner-occupied housing; this, too, is a very substantial concession. Owner-occupied housing is also treated more favourably in the social security assets test than the same value of assets held in other vehicles.

People who take advantage of these concessions to homeownership are penalised if they opt to sell up and buy a different home. Stamp duties are imposed in all states and the Northern Territory, and currently cost the median home-buyer more than $43,000 in Sydney and more than $45,000 in Melbourne.[58]

Moving is not as hard for renters. Renters do not get the benefits of subsidies to home ownership, but neither do they experience the 'lock-in' effect of those subsidies.

These tax and transfer settings – particularly stamp duty – are a powerful deterrent to homeowners moving home.[59] And homeowners are moving home less than they were in the early 2000s.[60]

The impact of discouraging people from moving home is that people commute longer than they otherwise would,[61] may not take up better job opportunities that they might have, or may reduce how much they

work so as to keep their commuting times within a tolerable range.[62] Governments should reduce the deterrents to mobility for homeowners.

4.3 Many people change the way they get to work

Even though the proportion of people driving and the proportion using other ways to get to work has not changed significantly in aggregate,[63] around one-quarter of established workers in Australian cities have, in fact, changed their method of travel over the five years to 2016 (Table 4.1).[64]

Table 4.1: Over five years, around one-quarter of established workers changed the way they get to work
Proportion of established workers who changed method of travel

	2006-2011	2011-2016
Melbourne	24%	25%
Sydney	29%	29%
Brisbane	25%	24%
Perth	23%	23%
Adelaide	20%	19%
Canberra	24%	24%
Hobart	20%	20%
Darwin	23%	24%

Notes: Established workers are identified through the Australian Census Longitudinal Dataset, as explained in Section 4.1. Canberra figures are for the entire ACT.

Source: Grattan analysis of ABS (2011b) and ABS (2016c).

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58. Figures based on median house prices as of December 2017 (Grattan analysis of NSW Treasury (2018) and CoreLogic (2018)).
59. For example, Leigh and Davidoff (2013) find a 10 per cent increase in stamp duty lowers turnover by 3 per cent in the first year and 6 per cent if sustained over three years. Hilber and Lyytikainen (2017) find a difference in mobility in the UK of 37 per cent between homeowners just above and just below the stamp duty threshold.
60. Leal et al. (2017, pp. 22–23).
61. BITRE (2016).

62. A "place of work" variable is not available as part of the Australian Census Longitudinal Dataset, so analysis of people's commutes pre- and post- moving home is not possible.
63. ABS (2011a) and ABS (2016a). See Figure B.1 on page 73.
64. Section 4.1 explains how established workers are identified through the Australian Census Longitudinal Dataset.

This section looks at these changes. Section 4.3.1 shows that the dominant method of getting to work, driving, was largely unchanged or had become even more prevalent by 2016 among established workers in the five major capital cities. Section 4.3.2 shows public transport is especially important for new workers. And Section 4.3.3 shows there has been a widespread decline in walking and cycling to work.

4.3.1 Driving remains the preferred method of travel to work

Around 74 per cent of workers in Australian cities drive to work. The proportion is higher in smaller centres and lower in the largest cities.[65]

In Sydney and Melbourne, driving rates are not only lower than in other cities, they are also declining. In Sydney, they declined from 67 per cent to 64 per cent of commuting trips over the five years to 2016, and in Melbourne from 74 per cent to 72 per cent. This continued the downward trend from the previous five years.[66]

In most of the mid-sized cities, driving to work became *more* popular over the five years to 2016. While the same proportion of workers drove to work in Adelaide in 2011 and 2016, in Brisbane driving increased from 75 per cent to 76 per cent, and in Perth from 78 per cent to 79 per cent. This contrasts with the previous five years, when commuters in Brisbane and Perth tended to move away from driving.[67]

But these relatively stable overall trends mask a significant amount of change in method of travel. Figure 4.1 on the next page, Figure 4.2 on page 33, and Figure 4.3 on page 34 show the travel methods of

established workers; they do not include new migrants from abroad who arrived between the Censuses, or people who entered or left the workforce during that five-year period.

In Sydney, there was a slight decline in driving to work among established workers – from 68.1 per cent to 67.3 per cent. In Melbourne, the decline was even smaller, from 75.3 per cent to 75.0 per cent. In both cities, around 14 per cent of established workers who drove to work in 2011 had shifted to another method by 2016, often moving onto public transport. However, this shift to public transport was matched by a similarly sized group who made the opposite switch, from public transport to car.[68]

As the next section shows, it's new workers who are pushing up the overall share of public transport use in Sydney and Melbourne.

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65. ABS (2016a). Calculated for the 20 largest cities as listed in Table 1.1 on page 7. 'Driving' includes the categories 'Car, as driver', 'Car, as passenger', 'Truck', 'Taxi' and 'Motorcycle'. 'Workers' include people who work from home – excluding these people increases the proportion that drive to 78 per cent. See Figure B.1 on page 73 for the mode share in the five major capitals.

66. ABS (ibid.), ABS (2011a) and ABS (2006).

67. ABS (2016a), ABS (2011a) and ABS (2006).

68. ABS (2016c). Similar adaptations occurred between 2006 and 2011, as shown in Appendix B.2.

Figure 4.1: Many established workers in Sydney and Melbourne changed the way they travelled to work between 2011 and 2016
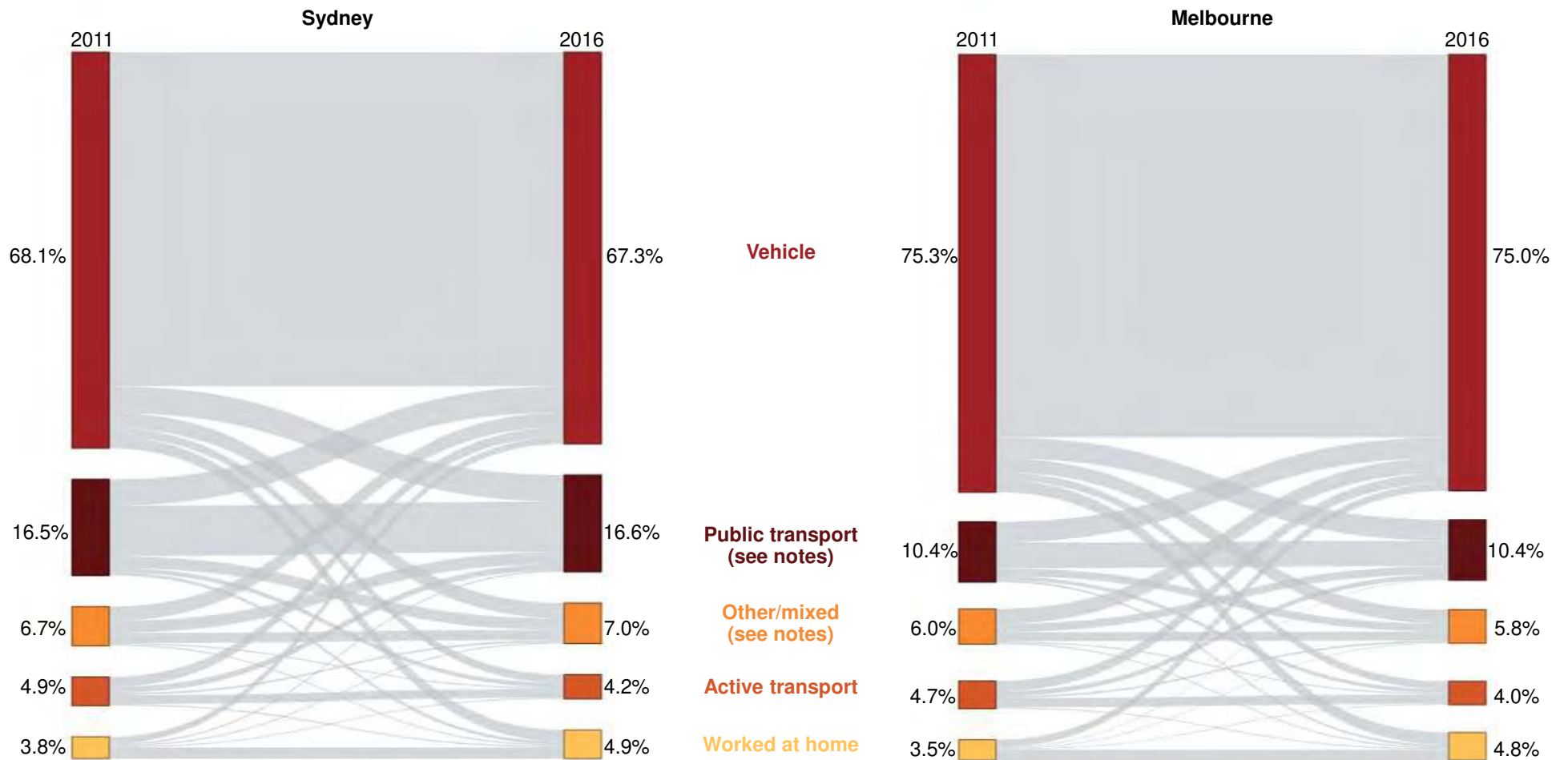
Notes: This analysis uses the Australian Census Longitudinal Dataset, which is a weighted 5 per cent sample of the population. Percentages are based on workers who were employed at Census time in both 2011 and 2016. The 'vehicle' category includes people who travelled to work by car (as a driver or passenger), motorbike or scooter, taxi or truck. The 'public transport' category includes people who travelled to work by bus, ferry, train or tram. 'Active transport' users walked or rode a bicycle to work. The 'other/mixed' category includes people who travelled to work by a combination of methods, or another method.

Source: Grattan analysis of ABS (2016c).

Figure 4.2: Established workers in Brisbane and Perth have shifted away from public transport and towards driving
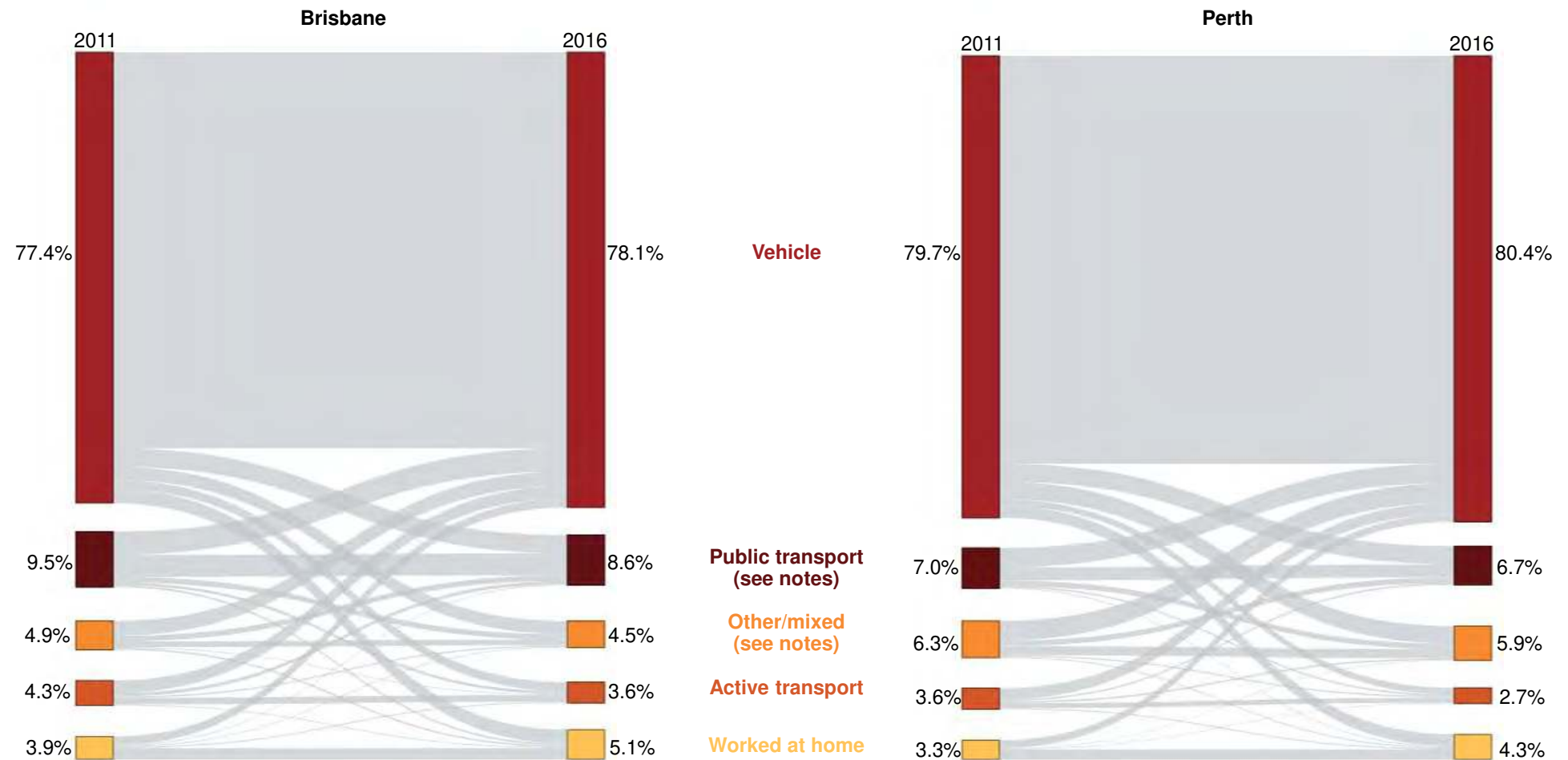
Notes: This analysis uses the Australian Census Longitudinal Dataset, which is a weighted 5 per cent sample of the population. Percentages are based on workers who were employed at Census time in both 2011 and 2016. The 'vehicle' category includes people who travelled to work by car (as a driver or passenger), motorbike or scooter, taxi or truck. The 'public transport' category includes people who travelled to work by bus, ferry, train or tram. 'Active transport' users walked or rode a bicycle to work. The 'other/mixed' category includes people who travelled to work by a combination of methods, or another method.

Source: Grattan analysis of ABS (2016c).

Figure 4.3: Established workers in Adelaide have shifted away from walking or cycling to work
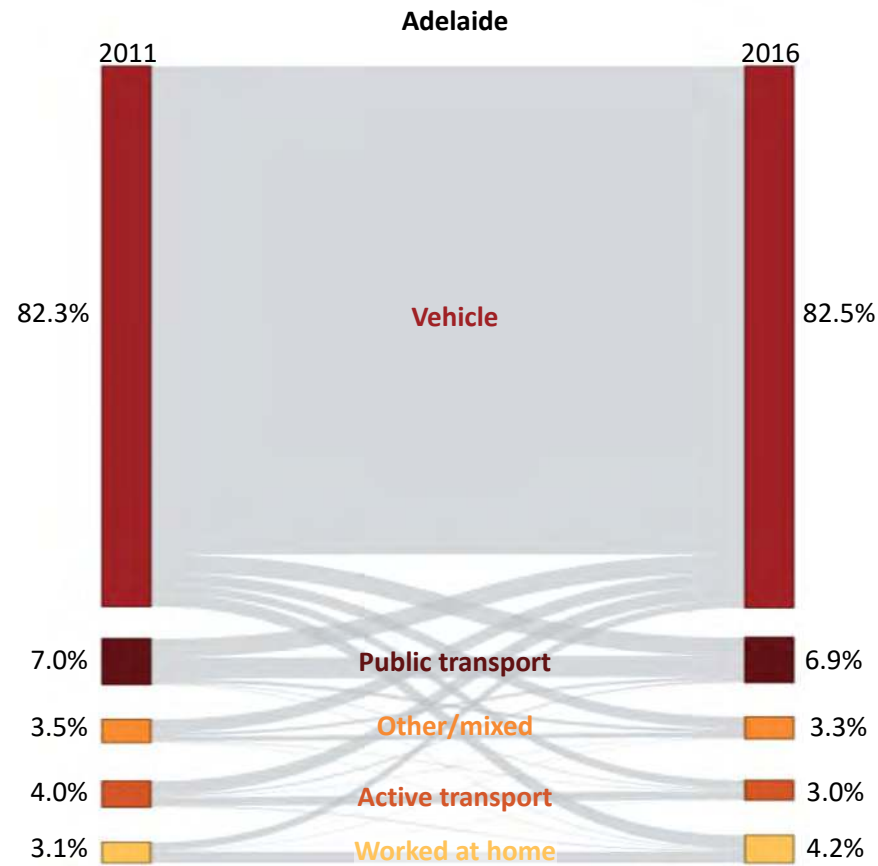
Adelaide

Notes: This analysis uses the Australian Census Longitudinal Dataset, which is a weighted 5 per cent sample of the population. Percentages are based on workers who were employed at Census time in both 2011 and 2016. Method of travel categories are explained in charts notes for Figure 4.1 and Figure 4.2.

Source: Grattan analysis of ABS (2016c).

4.3.2 Public transport is on the rise in Sydney and Melbourne

Australian cities are very car dependent, and the great majority of workers commute by car. Even in suburbs well-served by public transport, only a minority of people use it to get to work (Figure 4.4).

Sydney has the highest rate of public transport use. About 22 per cent of commutes in Sydney in 2016 were by public transport, up from 19 per cent in 2011.[69] Melbourne has the next highest rate of public transport use, but it lags well behind Sydney. About 14 per cent of commutes in Melbourne in 2016 were by public transport, up from 13 per cent in 2011.[70]

In the mid-sized cities, a smaller proportion of people use public transport to get to work. In Brisbane, 10 per cent of commuting trips are by public transport. In Perth it's 9 per cent, and Adelaide 8 per cent. There has been a small decline in Brisbane, but the other two cities have broadly stable rates of public transport commuting.[71]

As with driving, there are differences in the use of public transport by established and new workers.

In Sydney, slightly more than half of established workers who used public transport in 2011 still did so in 2016. But around one-quarter of established workers who used public transport in 2011 had switched into cars by 2016 (Figure 4.1) – with this shift matched by a similar number making the opposite switch, from cars to public transport. Overall, therefore, the apparent stability of the share of established

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69. ABS (2016a), ABS (2011a).
70. These figures are the percentage of commutes that identify only public transport as their method of travel to work. About 25 per cent of Sydney residents and 17 per cent of Melbourne residents use public transport in combination with another method of travel.
71. ABS (2016a), ABS (2011a).

Figure 4.4: A minority of Sydney and Melbourne residents use public transport to get to work, including those who live close to the CBD
Proportion of journeys to work that are undertaken by public transport, 2016

Sydney

0-25%
25-50%
50-100%
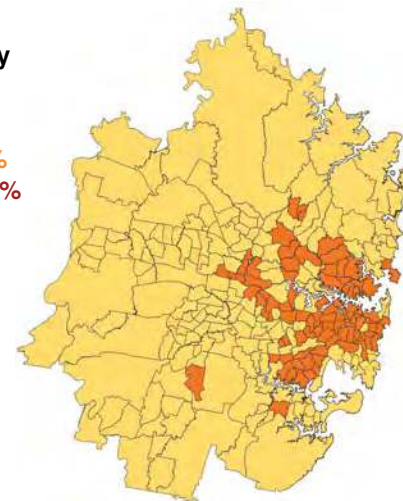
Melbourne
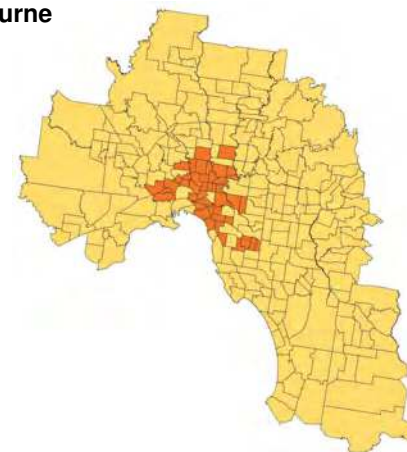
Notes: Proportions are calculated for SA2 regions.
Source: Grattan analysis of ABS (2016a).

workers using public transport in fact masks considerable change by individual commuters.[72]

In Melbourne, less than half of established workers who used public transport in 2011 still did so in 2016. And, as with Sydney, similar numbers of established workers switched from car to public transport as did the opposite. In Melbourne, too, the apparent stability of the proportion of established workers using public transport disguises the extent of adaptation and change by individual travellers between 2011 and 2016.[73]

Some established workers in mid-size cities switched to public transport between 2011 and 2016 (Figure 4.2). But in Brisbane and Perth, the net effect among established workers has still been in favour of car travel. The proportion of established workers using public transport fell from 9.5 per cent to 8.6 per cent in Brisbane, and from 7.0 per cent to 6.7 per cent in Perth. In Adelaide, the proportion of established workers using public transport remained fairly constant between 2011 and 2016 (Figure 4.3).[74]

In all five of the big Australian capitals, it is new workers – both migrants from abroad and new workforce entrants and re-entrants – who account for the overall stability or increase in public transport commuting.[75]

This is particularly the case for migrants from abroad. They are a smaller group than new workforce entrants and re-entrants,[76] but they are more likely to use public transport than established workers.[77]

Particularly in their first year after arriving, migrants from abroad live and work closer to the city centre than the established population (Figure 4.5 on the next page and Figure 4.6 on page 38). Five years on, that remains the case.[78]

### 4.3.3   Cycling and walking are losing popularity in most cities

Only a small minority of commuters use active transport. In the two largest cities, around 5 per cent of trips to work are by active transport. In the three mid-sized cities, the figure ranges from 3.5-to-4.5 per cent.[79]

And in most cities, the trend is clearly downwards.[80] Only in Melbourne has the share of commutes that are by active transport remained steady. In the other major capitals, the proportion of commutes that were by active transport fell by between 0.2-to-0.4 percentage points

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72. ABS (2016c).
73. Ibid.
74. Ibid.
75. As explained in Section 4.1, "new workers" comprise new workforce entrants and re-entrants *and* new migrants from abroad, less those who exited the workforce by 2016.

76. Grattan analysis of ABS (2016a) and ABS (2016c).
77. For example, of the migrants arriving in Sydney between 2011 and 2016, nearly half used public transport to get to work, while only a third drove. For those who worked in Melbourne, a third used public transport and less than half drove. Migrants are more likely than the general population to commute by public transport in the mid-sized cities as well, with 16-to-21 per cent of migrants using it to get to work (ABS (2016a)). New workforce entrants and re-entrants also have slightly higher rates of public and active transport commuting than established workers, but their methods of commuting are much more similar to established workers than migrants' methods of commuting (ABS (ibid.)).
78. Grattan analysis of ABS (ibid.) and ABS (2011a).
79. See Figure B.1 on page 73.
80. This trend cannot be explained by Census-day weather. The Census-day weather in most major capitals was *more* conducive to people taking active transport in 2016 than 2011. The exception was Perth, which had 2.4mm more rain on Census day in 2016 than it had on Census day in 2011 (Bureau of Meteorology (2018)).

Figure 4.5: New overseas migrants to Sydney live and work much closer to the centre than the general population
Journeys to work, beeline distance between origin and destination, 2016

First-year migrants   **Established population**

Notes: Chart shows 200 randomly selected journeys to work in Sydney. Each line represents a journey, and grey dots are workplaces. The size of the dot represents the relative number of jobs at that destination. Some lines have one end with no grey dots, which means there are homes but no jobs in that area in the sample. Where lines start and end on grey dots, jobs and homes exist on both ends of the journey. Some dots have no lines, which means people live and work in the same area.

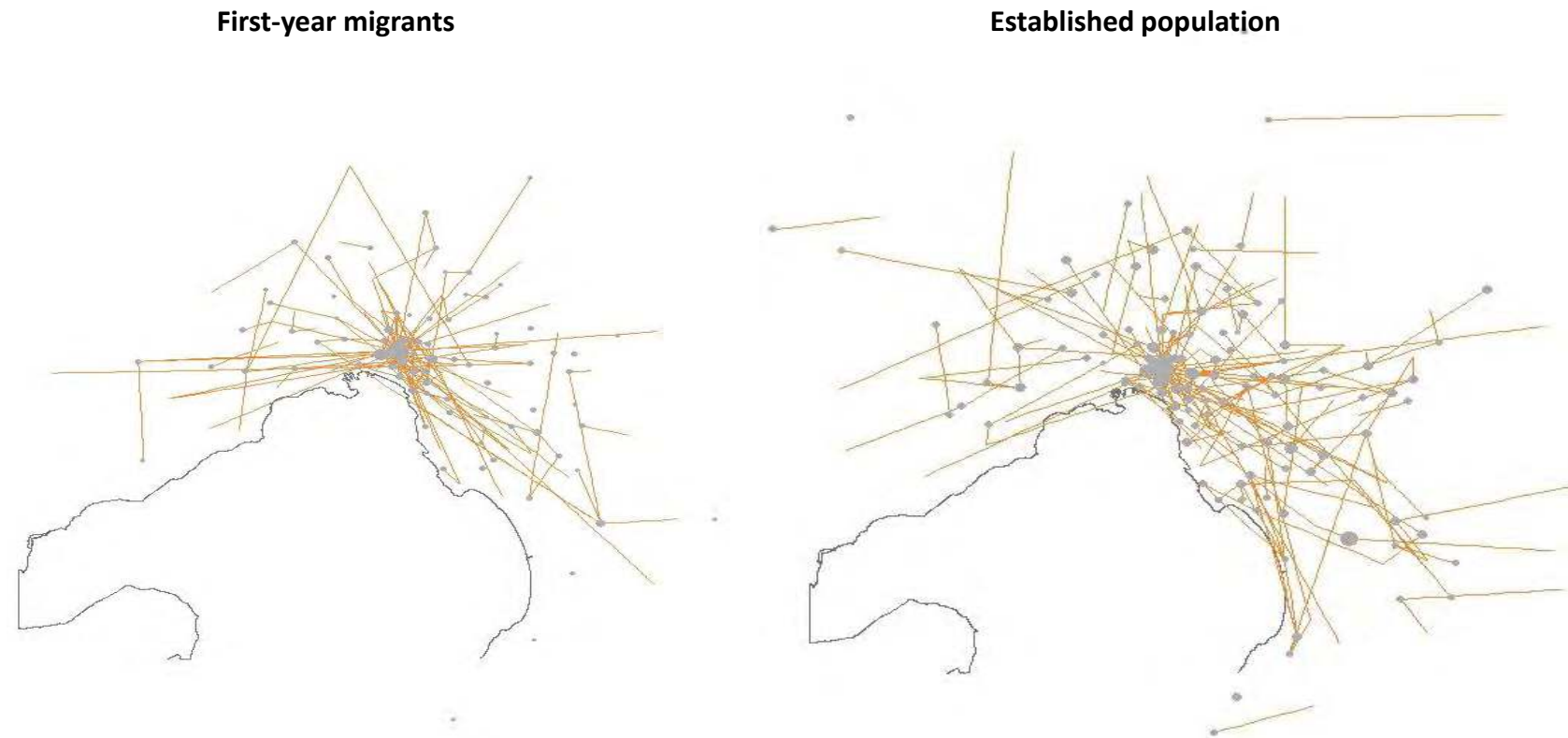Source: Grattan analysis of ABS Census: ABS (2016a).

Figure 4.6: New overseas migrants to Melbourne live and work much closer to the centre than the general population
Journeys to work, beeline distance between origin and destination, 2016

First-year migrants   **Established population**

Notes: As for Figure 4.5.
Source: Grattan analysis of ABS Census: ABS (2016a).

between 2011 and 2016.[81] The fall was particularly pronounced for established workers; that is, those who lived and worked in Australia in both 2011 and 2016. It has been new workers who are stemming the flow away from active transport. Established workers' reliance on active transport declined by between 0.7 and 1.0 percentage points over the five years to 2016 (see Figure 4.1, Figure 4.2 and Figure 4.3).

This is partly because established workers aged five years between 2011 and 2016, and older people are less likely than young people to take public transport or active transport.[82] Established workers who abandoned active transport were more likely to move to cars than to public transport.[83]

The decline in active transport may also partly be explained by a slight decline in the proportion of people who live very close to their work (Table 4.2).

Table 4.2: A slightly declining share of people work in the suburb where they live, or in a neighbouring suburb

	2011	2016
Sydney	31%	29%
Melbourne	30%	28%
Brisbane	29%	29%
Perth	30%	29%
Adelaide	34%	33%

Note: These figures are based on SA2 regions as a proxy for suburbs, given that suburb-level data is not available.

Source: Grattan analysis of ABS (2011a) and ABS (2016a).

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81. Even though active transport's share of trips has declined, population growth has increased the total number of workers who commute by walking or cycling in Sydney, Melbourne and Brisbane over the five years to 2016: by 7,900 in Sydney, 10,800 in Melbourne and 1,100 in Brisbane (ABS (2016a)).
82. Ibid.
83. ABS (2016c).

This slight decline suggests that the emphasis placed by official planning documents on 20-minute and 30-minute cities[84] appears not to reflect people's choices.[85]

4.4   Some workers accept a longer commute

It takes time for people to adjust to urban growth, and some people feel the impact initially in the form of a longer commute. Over time they may make a variety of adjustments, or they may persist with a longer commute because they care more about their home or neighbourhood, or their housing costs, than they do about their commute.

While commute times in cities have been broadly stable over time, that appears to be less true for commutes that are already long (see Figure 1.7 on page 13). In some cities, there has been a slight rise in the proportion of people doing long commutes.

Longer commute times are not necessarily a concern for all who take them. It is typically higher-income earners who have longer commutes. They are exercising a choice that is well-remunerated. People with annual incomes above $150,000 have commutes that are nearly 10 minutes longer each way than people with incomes below $40,000.[86]

Contrary to the common perception that the typical long commute is by an outer-suburban dweller with poor public transport hacking into the city by car, in fact longer commutes are much more likely than shorter commutes to be by public transport.[87] Car travel is very dominant for

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84. For example, DELWP (2017) and Greater Sydney Commission (2017). The definition of 20-minute cities in DELWP (2017) is unclear – it includes access to *some* local jobs but also notes that many people will need to leave a 20-minute city for work.
85. For a more extensive list of shortcomings with metropolitan planning, see COAG Reform Council (2011), Whitzman (2011), Davies (2017), Mees (2011), and Dodson (2009).
86. BITRE (2016, p. 115).
87. Ibid.

commutes of up to one hour, but public transport and cars account for similar numbers of trips that take longer than that (Figure 4.7).

And for some, a longer commute is a choice well worth making for a better living environment. The smaller cities where commute distances have increased the fastest are typically coastal cities. These include the Gold Coast and the Sunshine Coast (Figure 4.8 on the next page), along with Wollongong and to some extent Newcastle. People appear to accept a slightly longer commute to enjoy being close to the beach.

In summary, aggregate figures on method of transport mask a substantial degree of adaptation by individual commuters. It's clear that the length of commutes people are willing to make varies widely, as they trade off the time and money they spend on travel, the cost and character of their home, the kind of work they do and their household situation.

Figure 4.7: In Melbourne, the longest commutes tend to be on public transport
Number of commutes on an average weekday (thousands), 2012-16
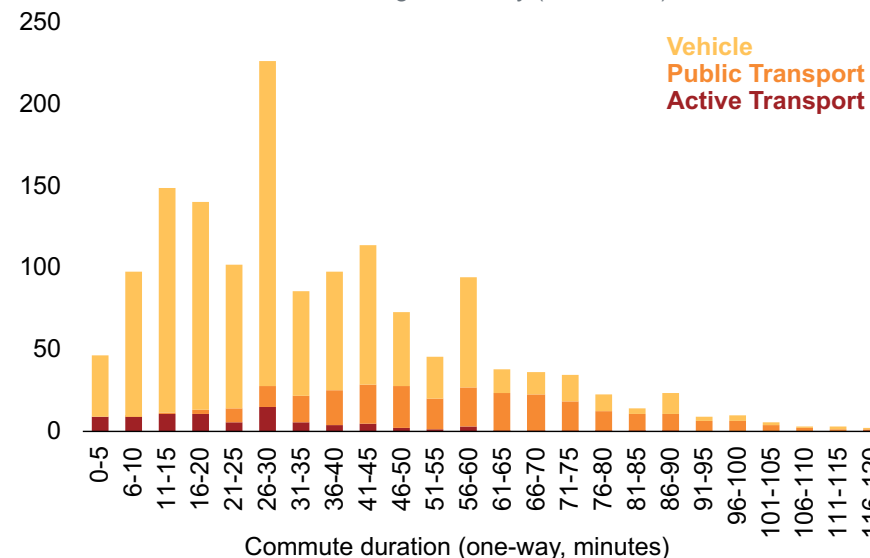
Notes: Data is from the Victorian Integrated Survey of Travel and Activity, covering data collected between 2012 and 2016. Journeys greater than 120 minutes one-way were excluded (less than 1 per cent of all journeys). 'Vehicle' includes travelling by car as driver or passenger, and by motorcycle or taxi. Note that motorcycles and taxis together account for less than 1 per cent of all journeys.
Source: Grattan analysis of Transport for Victoria (2018).

Figure 4.8: People appear to accept a slightly longer commute to enjoy being close to the beach
Beeline distance between origin and destination, 2016

Gold Coast   Sunshine Coast
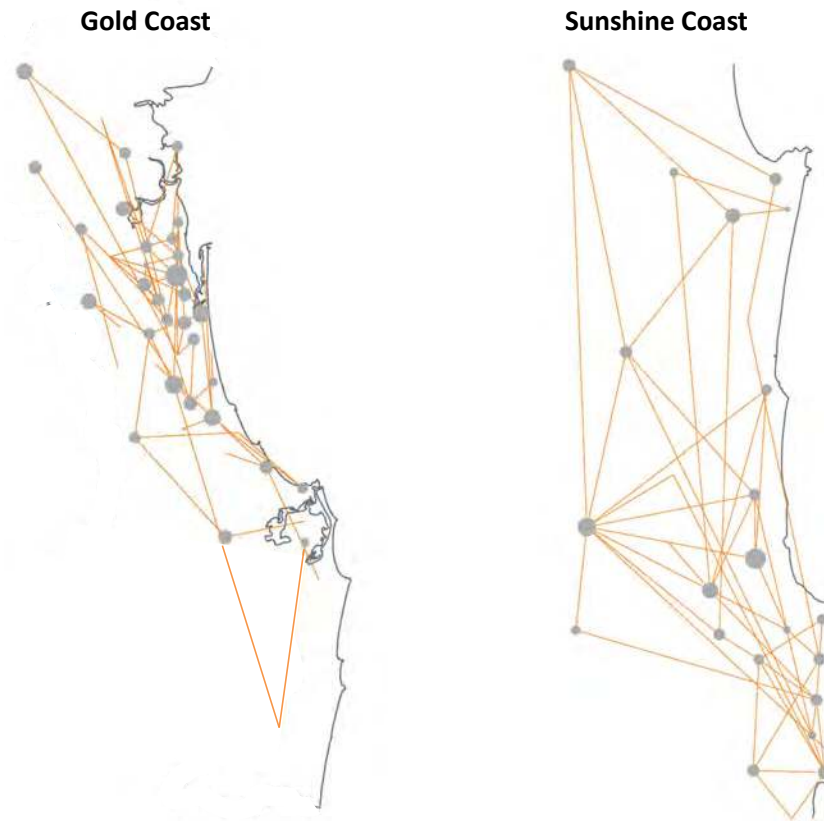
Notes: Chart shows 80 randomly selected journeys to work on the Gold Coast and the Sunshine Coast. Each line represents a journey, and grey dots are workplaces. The size of the dot represents the relative number of jobs at that destination. Some lines have one end with no grey dots, which means there are homes but no jobs in that area in the sample. Where lines start and end on grey dots, there are jobs and homes at both ends of the journey. Dots with no lines appear where people live and work in the same area. This chart is robust to changes in the random sample. For more details, see Appendix A.2.

Source: Grattan analysis of ABS (2016a).

5 How governments can help people adapt

Australians are voting with their feet. Even though cities can be expensive places to live, and even though commuting can be time-consuming and costly, more people than ever are choosing city life. Around the world, bigger cities are growing more quickly than smaller ones, and smaller cities are growing more quickly than towns.

People adapt to growing cities in a variety of ways. Some care most about living a short commute from work; others place a high value on being close to public transport; still others care more about a bigger or nicer home or the reputation of the local school. Everyone makes choices that reflect what they care most about.

This is not to suggest that population growth has left everybody better off. Some people elect not to take a new job that's too far away from home; sometimes people decide against venturing out so as to avoid peak-hour traffic; and some either pay higher rent or cannot afford to live in as nice a place as they used to or could once have afforded.

But it is to emphasise that people are not hapless victims of population growth, dependent for their wellbeing on governments building the next freeway or rail extension. While new infrastructure will be needed when cities grow substantially, there are many adaptations that people can and do make in both the short and long term, as shown in Chapter 4.

These adaptations do not occur on a blank sheet. People's decisions about work, home and travel are influenced by a plethora of taxes and subsidies, rules and regulations. Some of these arrangements aim to improve equity across the community, such as the progressive rate structure of personal income tax on wages and salaries. Some are designed to improve liveability for existing residents, such as restrictions on where heavy industry can operate, or who is allowed

to park on-street and when. And some are simply designed to raise revenue, such as stamp duty on property purchase.

This chapter focuses on two approaches governments can take to enable people to adapt to growing cities in ways that respect individuals' values and tastes, while constraining the negative impacts on others. Section 5.1 focuses on ameliorating those taxes, subsidies and regulations that have the worst impacts on work, home and travel. Section 5.2 highlights ways in which governments could make smarter decisions in those situations where new infrastructure is required.

5.1 Tread lightly on people's decisions

The most fruitful taxes, subsidies and regulations to focus on are those that lead people to change their decisions in important ways. These changes matter because these are the situations where people are furthest from doing what they would really like to do, whether that is living in a part of town that they like, moving to a new house when they change job, or earning higher take-home pay by working longer at their job.

In particular, governments should minimise the extent to which they lock people out or reduce their choices. Section 5.1.1 and Section 5.1.2 highlight two critical ways governments affect where people live: by making it hard to move house, and by excessively constraining their access to preferred locations.[88]

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88. Although labour taxes affect whether and how much people work, this report does not recommend changing them, because higher-income earners, who are most affected by such taxes, appear to be relatively unresponsive to the tax rate (Breunig et al. (2008) and Dandie and Mercante (2007, p. 43)).

The flip side of people changing their behaviour in response to government policies is when there is no government policy to correct a problem but there should be. A clear case is congestion: each new driver on the road contributes to the congestion that others suffer, but they don't personally suffer from their own contribution – just from everyone else's. Situations like these are harmful to the community, because each person is inclined to drive more than they would if they truly faced the cost of their own small contribution to the delay of others. Section 5.1.3 highlights ways in which governments could address this situation.

5.1.1 Stop making it so hard to move house

Governments encourage people to become homeowners. They do this by providing huge concessions to home ownership, but they also impose very substantial penalties on selling up and moving.

The largest single concession to home ownership is the Commonwealth's failure to tax imputed rent; in other words, homeowners in effect rent their home to themselves and, unlike commercial home renters, 'pay' that rent out of pre-tax dollars. A second massive concession to home ownership is that the family home is not subject to capital gains tax when it is sold.[89]

In addition to these two subsidies is the favourable treatment of an income support recipient's own home in the social security assets test, by comparison with a non-homeowner with the same value of assets held in other vehicles.

But having taken advantage of these benefits to buy and own a home, people are penalised severely if they sell up and buy a different home. Stamp duties are imposed on people buying a property, whether residential or commercial. The average rate of stamp duty in Sydney and Melbourne is about 4.7 per cent of the sale price of the median property.[90]

Stamp duty is a particularly pernicious tax, in that it operates as a strong deterrent to people buying and selling homes. Stamp duty reduces welfare by 70-to-80 cents for every additional dollar of revenue it raises.[91] This is much more distorting than other taxes, such as income tax on people's employment, or the GST. Land taxes, by contrast, are the least distorting taxes, in that they have very limited impacts on people's decisions such as whether or not to relocate.[92]

There is nothing new about the idea of abolishing stamp duty. The ACT is already doing so, replacing it with a broad-based land tax levied via municipal rates, and phased in over 20 years.

There are several steps governments could take to reduce the combined impact of subsidising home ownership and penalising homeowners for moving house. What is important is that these measures should, first and foremost, reduce the barrier to mobility that arises from a high tax on selling a home.

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89. These two provisions – not taxing imputed rent and exempting owner-occupied housing – are deviations from the comprehensive income tax benchmark. They substantially outweigh the prohibition on deducting mortgage interest, which would also be permitted if the benchmark were applied more rigorously (Wood et al. (2010, pp. 13–19)).

90. The effective rate of stamp duty on the median dwelling sale price is 4.0 per cent in Sydney and 5.3 per cent in Melbourne (NSW Treasury (2018)).

91. Cao et al. (2015, pp. 41–52).

92. Estimates of the marginal excess burden range from approximately -0.1 to +0.1 (see Cao et al. (Ibid., pp. 41–45)).

<div style="border:1px solid orange; padding:10px;">

Recommendation 1: Stop penalising people for moving house

All states and the Northern Territory should phase out stamp duty on the transfer of residential property, and replace it with a broad-based land tax.

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5.1.2 Stop locking out new residents from their preferred locations

People's housing options are highly constrained by planning regulation. Planning regulation can take the form of zoning, heritage-related restrictions, or the way the relevant building code governs building heights and setbacks and the proportion of a plot of land that may be occupied by a building.

Zoning restrictions play a significant role in restricting residential development in Australia[93] and overseas.[94] While local planning restrictions benefit local landowners, studies assessing the costs and benefits of restricting building generally conclude that the benefits of restrictive regulation are not large enough to justify the costs.[95]

Zoning restrictions are imposed in different ways in different cities, but the results can be quite strange. In Sydney, for instance, the suburb of

Rozelle has just 18 dwellings per hectare, in contrast with Newtown, with 37, and Petersham, with 31. All three suburbs are a similar distance from the CBD. In the five years to 2016, Newtown became far denser, adding six dwellings per hectare, while Rozelle added just one per hectare.[96]

In Melbourne, inner-city suburbs such as Fitzroy North, less than 3 kilometres from the CBD, are dominated by one- and two-storey dwellings and enormously wide streets (Figure 5.1 on the following page). It is striking to see that at the border between two suburbs, Carlton North and Brunswick East, around 3.5 kilometres from the CBD, one- and two-storey buildings give way to high-rise buildings – with the greater density in the suburb further from the CBD.

Heritage protection is a particular form of planning regulation that slows down development or stops it altogether. Protecting certain sites under heritage restrictions may be important to the extent that they enrich our understanding of history. But it is often done with little acknowledgement of the direct costs of conserving heritage sites.[97]

Research from the US has identified an over-emphasis on heritage considerations as a significant barrier to development.[98]While the precise magnitude of the barrier in Australian cities is unclear – no similar study has yet been undertaken – examples regularly come to light. For instance, a proposal to build a 20-storey office and apartment tower across a railway in the inner Melbourne suburb of Windsor was knocked back by the planning tribunal – not due to traffic or parking, but on the grounds it would be an uncomfortable fit with the existing

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93. Kendall and Tulip (2018), Daley et al. (2018) and Lees (2017). Shoory and Rosewall (2017) note evidence that the complexity of the planning system has made redevelopment in established areas less attractive compared to development on the fringes of major cities.

94. Hilber and Vermeulen (2015), E. Glaeser and Gyourko (2018). In a review of the literature, Gyourko and Molloy (2015) conclude that while the benefits of land use planning rules are difficult to quantify, 'recent studies suggest that the overall efficiency losses from binding constraints on residential development could be quite large'.

95. See Cheshire and Sheppard (2002), E. Glaeser et al. (2005) and Turner et al. (2014), as cited in Daley et al. (2018, p. 57).

96. Grattan analysis of ABS (2016a) and ABS (2011a), based on analysis of SA2 regions.

97. Productivity Commission (2006).

98. Been et al. (2014).

streetscape.[99] Such cases are more likely in Melbourne, which has more extensive heritage restrictions than any other Australian city.[100]

State and local governments face a difficult situation in balancing the rights and desires of existing homeowners with the rights and desires of potential future homeowners in the area. Established residents are generally reluctant to see their neighbourhood change. People react negatively to *any* changes that would bring higher residential density, or put at risk their freedom to park outside their home, or that might encourage a different kind of neighbour to the established population. Any of these could lessen the value of their home – in financial or neighbourhood amenity terms – without a commensurate benefit to them.

Because established homeowners want to avoid such losses, they tend to oppose change and development. And current planning and zoning arrangements do not define clearly all of the property rights that homeowners feel are theirs. While one might technically buy just a home, people tend to operate on the assumption that that includes a right to park on-street outside it and a neighbourhood that is substantially as it was at the time of purchase.

Governments encourage homeowners to think this way. For example, one inner-Melbourne council provides up to two free-parking permits to residents of a dwelling, with the option of purchasing a third for a modest annual fee. But if a landowner increases the number of dwellings on a site by more than one, they lose their entitlement to any parking permits at all.[101] This policy explicitly forbids trading of permits. The policy gives much greater weight to the needs and wishes of existing residents than newcomers, and prevents newcomers who

Figure 5.1: Fitzroy North, less than 3 kilometres from the CBD

Source: Google Maps street view.

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99. The tribunal ruled that the local area, which is 'mildly grungy but also pleasantly edgy', would be uncomfortable with the tower (Heagney (2018)).
100. Productivity Commission (2006, p. 23).
101. City of Stonnington (2018).

would be willing to buy a permit from doing so. Such provisions contrast with the recent lessening of the obligation to provide visitor parking to new residential developments that are within walking distance of public transport.[102]

There are two changes that governments could make to ameliorate the situation and to stop locking out new residents from their preferred locations. One is to explicitly consider the costs as well as the benefits of locking out new residents, through the three types of regulations that we have considered: zoning, heritage and parking regulations. This is important to the Commonwealth as well as state governments, because the Commonwealth relies on the personal and company income tax revenues that are predominantly generated in cities.

The second is to address the most tractable of the poorly-defined property rights – on-street parking. If established homeowners had a legal right to the parking space outside their home, for example, they could trade it if they could find a willing buyer. Governments and councils could codify who owns what parking rights, and allow people who value the rights most highly to own them. They could do this by legally assigning rights, either to established owners, or to themselves, and encouraging trading from those people who don't value the right to park in a particular spot very highly to those who do.[103]

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102. Amendment VC148 to the Victorian Planning Provisions was gazetted on 31 July 2018.
103. The initial assignment of property rights makes no difference to whether parties can achieve an efficient outcome (at least, in the absence of transaction costs). See Coase (1960).

> **Recommendation 2: Stop locking out new residents from their preferred locations**
>
> Treasurers in all states should introduce a scheme that combines a reduction in zoning restrictions on residential density and business locations with an increase in the clarity and assignment of related parking rights, including a right to trade them.
>
> In addition, the federal Treasurer should ask the Productivity Commission to assess the costs, both direct and indirect, and the benefits of heritage protections embedded in planning regulations.

5.1.3 Stop making motorists pay for congestion through delays and unreliability

With population growth and bigger cities comes traffic congestion. For many people, it's one of the biggest downsides of city life.

Driving on the roads may appear to be free, but drivers pay with their time and frustration. But rather than being a simply unavoidable part of city life, the costs of congestion can be minimised under the right policy settings.[104]

Building new infrastructure to address congestion works best in under-developed cities or areas, where there simply isn't enough road space for the task. In most parts of Australian cities, this is not the case. There is plenty of road capacity, which is heavily used for a small proportion of the day but mostly has a relatively free flow of vehicles.

Mid-sized and larger cities can both benefit from strategies to manage congestion. Parking taxes that make it more expensive to park in busy places at busy times of day have been implemented with some success

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104. O'Flaherty (2005, p. 4).

in the CBDs of Sydney and Melbourne. More differentiation of public transport fares by time of day would encourage people who can take their trip outside of peak hour to save money by doing so.

By themselves, each small policy may not go far toward alleviating congestion, but in combination these policies can together make considerable impact.[105]

But in Australia's two biggest cities, Sydney and Melbourne, the case is mounting for a more thorough policy approach, as has been successfully applied in a number of cities overseas. In Sydney and Melbourne, road-user charging now looks like the policy with the greatest potential to reduce congestion at the lowest cost.[106]

As each new driver ventures out, they feel everyone *else's* contribution to congestion, but not their own. This situation is harmful to the community because each person drives more in busy times and places than they would if they took into account their own small contribution to slowing the whole network down. If drivers were confronted with the delay they impose on others in the form of a financial charge, many would still drive but some would do so at a different time or travel by a different method.

Congestion charges would also encourage a more compact urban footprint.[107] Without any meaningful price on congestion, Sydney and Melbourne residents have been encouraged to live in more distant, lower-density locations.

In the long run, allowing a city's size and shape to adjust in response to both congestion charges *and* planning reforms has a bigger impact than either scheme would on its own. That's because while some

people respond to a congestion pricing scheme by changing their travel habits, others do so by changing where they live.[108]

To date, congestion charging has been formulated at an abstract level, with little serious thought about how to translate principles into practical policy on the ground.[109] Overseas experience shows that congestion charging schemes may be viewed with suspicion at first but come to be accepted and supported once implemented.[110] Substantial design work is needed to create a suitable scheme for each city, and a future Grattan Institute report will contribute to this work. Recommendation 3 proposes the end point of this work.

> **Recommendation 3: Design and implement congestion pricing schemes for Sydney and Melbourne**
>
> The Victorian and NSW governments should introduce time-of-day congestion pricing in the most congested central areas of each capital city, charging a low rate at peak periods in return for a freer-flowing road. The cost to drivers should be offset by a discount on vehicle registration, with revenue from the congestion charge earmarked to spending on public transport improvements.

5.2 Governments should spend smarter on infrastructure

Australian governments are building more transport infrastructure than they used to (Figure 5.2 on the next page). Over the decade to mid-2018, the value of construction work done on new transport projects for

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105. Arnott et al. (2005, p. 10).
106. Terrill et al. (2017).
107. Langer and Winston (2008).

108. Langer and Winston (2008); and Arnott et al. (2005).
109. This is a long-standing issue, as noted by Arnott et al. (2005, p. 5).
110. Terrill et al. (2017, p. 42).

the public sector was more than $180 billion.[111] But much of this money has not been well spent.[112]

There are two ways that governments can spend smarter on infrastructure, drawing on the evidence about adaptation presented in this report. First, recognising that new infrastructure is not the sole way for cities to adapt, governments should commit only to projects that are supported by transparent analysis of a demonstrated need. And second, governments can make the evaluation of projects more realistic by explicitly recognising the extent of individual adaptation.

5.2.1 Don't keep reaching for mega projects

Governments now have a large pipeline of projects underway or in planning. But, in the meantime, cities have absorbed increased population with substantially the same infrastructure as served a smaller population. Governments continue to pursue the "build first" and "build big" solutions as if they were the only means of adaptation. As this report shows, this is not the case.

Infrastructure projects can be hugely expensive, and each new announcement seems to trump the previous record. Yet projects are often chosen before a business case has been conducted, or without careful consideration of alternative ways to address an identified need. Projects chosen before analysis has been completed are often poor choices, built before they are needed, and at elevated risk of overrunning their budget. And there is usually very limited scrutiny or accountability to the public.[113]

Figure 5.2: Governments are investing more in transport infrastructure than they used to
Engineering construction work done for the public sector as a proportion of GDP

Note: Includes work done by the private sector for the public sector.
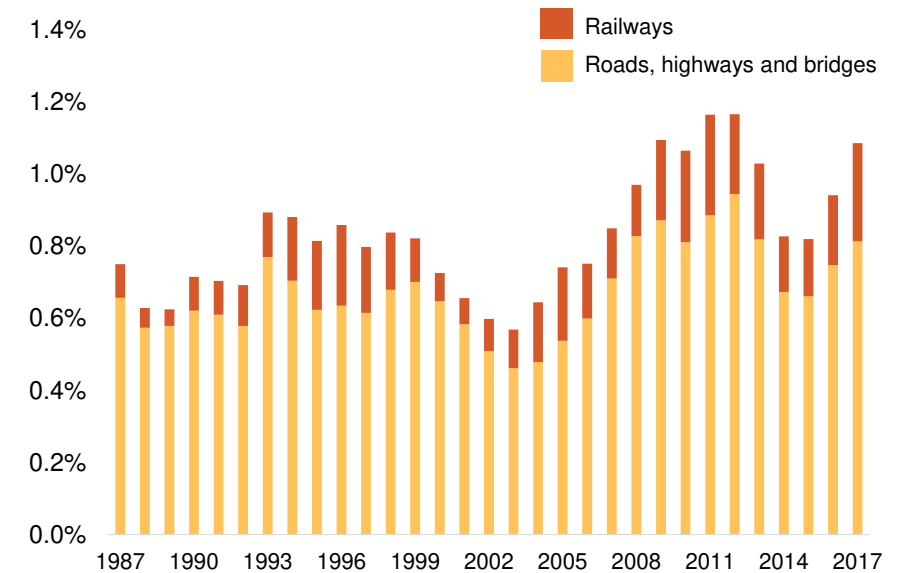Sources: ABS (2018g) and ABS (2018f).

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111. Grattan analysis of ABS (2018f). This amount is in real 2018 dollars and includes expenditure on road, railway, bridge and harbour projects. It does not include the cost of land or maintenance.
112. See Terrill et al. (2016b), Terrill et al. (2016a).
113. Ibid.

In fact, poor project identification, assessment and selection can create a self-fulfilling cycle. The construction of big new infrastructure projects typically creates significant disruption to transport networks. In turn, this disruption can exacerbate the feeling that cities have insufficient infrastructure.

For instance, governments have recently promised to build a railway line to Tullamarine airport in Melbourne, in advance of the analysis needed to assess the value of this investment. As freeway-widening works were done on Melbourne's Tullamarine Freeway, people travelling to and from the airport experienced slower and more unreliable travel. Politicians responded to public frustration by committing billions of dollars, despite the absence of a business case demonstrating the project's value for money, and just months before the improvements to the freeway flow were due to be completed.[114] Similarly, governments promised to build rail to the future Western Sydney airport, even though a scoping study found that the project would not be needed to cater for travellers and workers at the airport until 2036 at the earliest.[115]

Big infrastructure projects may seem more exciting than small ones, to politicians and the public. But they are also more risky and more likely to exceed their budgets.[116] The preference for big projects over small fails to recognise the highly dispersed nature of employment and the highly adaptive behaviours of city-dwellers, even in times of rapid population growth. Governments should do more to identify the myriad small potential projects with high net benefits that may be dispersed all over the city.

Recommendations 4 and 5 propose ways for governments to improve the efficiency of public infrastructure spending.

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114. Batrouney (2018).
115. Commonwealth of Australia, State of New South Wales (2018, p. 6).
116. Terrill et al. (2016a).

Recommendation 4: Only spend public money on infrastructure that has been properly assessed

The Commonwealth Government should amend the National Land Transport Act to prohibit the provision of funding to state governments for infrastructure projects unless a full business case has been prepared, and then evaluated by Infrastructure Australia, and the business case and evaluation have been tabled in Parliament. For all projects valued at $50 million or more, the government should also ask Infrastructure Australia to publish a reliability rating of the business cases within a month of their tabling.

Recommendation 5: Devote more resources to identifying modest-sized transport projects

State departments of transport should devote more resources to identifying modest-sized transport infrastructure proposals with higher net benefits than large and very large projects.

5.2.2 Evaluate transport projects more realistically

When the impacts of a new piece of infrastructure are assessed, they are compared with a "base case" which entails doing nothing, or only a minimum.[117] This creates two problems.

First, evaluations do not acknowledge that there is a reasonably predictable minimum spend each year. Over the past decade, for example, annual expenditure on new transport infrastructure in NSW was never less than $5.7 billion; in Victoria never less than $2 billion;

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117. Transport and Infrastructure Council (2018, pp. 9–10).

and in Queensland never less than $2.7 billion.[118] Because there is effectively a minimum amount that governments spend each year on transport infrastructure, assessing projects against a world in which no more infrastructure is built (or only the "minimum" of already committed projects are built) means that projects are compared against an unrealistically low level of future infrastructure capacity. Assuming so little capacity to meet future demand makes the assessment of a project's impact appear larger than it actually will be.

The Victorian Government does better on this score. It compares prospective projects against a base case that includes a broader set of future projects, known as the 'reference case' set of projects. The reference case is an attempt to set out the list of projects that are expected to be built over the period of the economic evaluation, based on historical infrastructure expenditure levels.[119] This approach is not yet a requirement of project proposals submitted to Infrastructure Australia.[120]

The second problem is that the impacts of new infrastructure are based on *today's* projections of where people will live and work in the future. But today's official population forecasts do not, of course, consider how future changes to infrastructure capacity might impact on population trends. This report has shown that things change, and this insight is important to evaluating new infrastructure proposals. It is wrong to assume nothing changes; the reality is that cities and the people in them constantly adapt.

It is difficult to forecast how people and businesses might change locations as a result of new infrastructure. Cost-benefit analysis for very large infrastructure projects should require analysis of the different scenarios that may unfold as a result of the new infrastructure, rather than a simple comparison of a world with, and without, the prospective project. Developing scenarios is a challenging undertaking, but it is necessary to present the public and decision-makers with the most realistic set of possible outcomes that may arise from an investment.

To this end, governments would make much better decisions if they learnt from experience. A major shortcoming with existing evaluation processes is that governments do not learn from past projects about how individuals, households and firms adapt over time. Recommendation 6 offers a way to improve the methodology for assessing project proposals by explicitly recognising the extent of adaptation. Recommendation 7 proposes a way that governments could enable learning from past experience.

> **Recommendation 6: Adopt more realistic assumptions for cost-benefit analysis of proposed transport projects**
>
> The Commonwealth Minister for Infrastructure should ask Infrastructure Australia to develop more realistic assumptions for cost-benefit analysis, acknowledging the widespread adaptation that occurs under the base-case scenario used to quantify a project's benefits, particularly arising from changes in land-use.

> **Recommendation 7: Learn from experience of completed projects**
>
> The Commonwealth Minister for Infrastructure should ask Infrastructure Australia to review the benefits and costs of each completed project, and the reviews should be made public.

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118. Grattan analysis of ABS (2018f). These amounts are in real 2018 dollars. They do not include the cost of land or maintenance. There are, of course, potential scenarios where infrastructure spending might not reflect recent historical trends. This situation can and should be dealt with through sensitivity testing of a business case's core findings.
119. Victorian Government (2016, p. 178).
120. Infrastructure Australia (2018, p. 21).

Appendix A: Methodology

Each section in Appendix A provides information and assurance about the methodological decisions that underpin components of the analysis in this report.

Appendix A.1 explains the decision to use the ABS's Greater Capital City Area boundaries for the analysis in Chapter 2.

Appendix A.2 demonstrates that the journey-to-work 'dandelion' charts presented in Chapter 2 are robust to changes in the underlying random sample.

Appendix A.3 explains how the 2011 ABS Census data needs to be adjusted in order to appropriately assess the total quantity of jobs in each city.

Appendix A.4 explains the relationship between two measures of distance to work. The first is the distance measured using a beeline between an origin and a destination. The second measures the estimated distance between origins and destinations *by road*, the data for which was made available for the first time in ABS (2016a).

A.1   Urban boundaries

In this report, analysis of the share of employment in different urban regions is based on the ABS classifications of greater capital city (GCC) areas. GCC areas are larger than many readers may think. For example, the ABS classifies "Greater Sydney" as an area extending from Wyong in the north to Picton in the south and Katoomba in the west. On this basis, readers may think the percentages of jobs in various SA2 regions is underestimated.

This section explains that using this classification makes little difference to the overall results. To do this we calculate the percentage of jobs in various SA2 regions, with the denominator being a smaller region that is closer to what we regard as city boundaries as commonly understood.

For Sydney, the "alternative boundaries" extend from Palm Beach in the north to Campbelltown in the south and Penrith in the west (see Figure A.1). For Melbourne, our alternative boundary extends from Frankston in the south-east to Craigieburn in the north and Hoppers Crossing in the south-west (see Figure A.2).

A comparison of these boundaries is presented in Table A.1 and Table A.2 on page 54.

Table A.1: The percentage of workers in various SA2 regions of employment is robust to the choice of Sydney's boundary
Percentage of city workers

	Alternative city boundary		ABS city boundary	
	2011	2016	2011	2016
Sydney – Haymarket – The Rocks	14.9	15.8	13.7	14.5
Parramatta – Rosehill	2.5	2.5	2.3	2.3
North Sydney – Lavender Bay	2.6	2.4	2.3	2.2
Macquarie Park – Marsfield	2.3	2.4	2.1	2.2
Pyrmont – Ultimo	1.8	1.8	1.6	1.7
Surry Hills	1.4	1.5	1.3	1.3
St Leonards – Naremburn	1.5	1.4	1.4	1.3
Chatswood (East) – Artarmon	1.3	1.4	1.2	1.3
Homebush Bay – Silverwater	1.3	1.3	1.2	1.2
Erskineville – Alexandria	1.1	1.2	1.0	1.1
Baulkham Hills (West) – Bella Vista	1.0	1.2	1.0	1.1
Liverpool – Warwick Farm*	1.1	1.1	1.0	1.0
Mascot – Eastlakes	1.2	1.1	1.1	1.0
Newtown – Camperdown – Darlington	1.0	1.0	0.9	0.9
Blacktown (East) – Kings Park	1.1	1.0	1.0	0.9
Penrith	1.0	1.0	0.9	0.9
Concord West – North Strathfield	0.9	1.0	0.8	0.9
Campbelltown – Woodbine	0.9	0.9	0.9	0.9
Prospect Reservoir	0.8	0.9	0.8	0.8

Note: This table is intended to present an alternative to Table 2.2. Gosford–Springfield is not included because it is outside the alternative city boundary. The asterisk indicates the SA2 that was split up in 2016, and the figures are for the workforce within the 2011 SA2 (i.e. a sum of multiple 2016 SA2s).

Source: Grattan analysis of ABS (2016a) and ABS (2011a).

Figure A.1: Only a small portion of workers are based outside the core city of Sydney, so including them does not affect the analysis very much

Greater capital city
Core city alternative

8% of jobs

92% of jobs

50 km
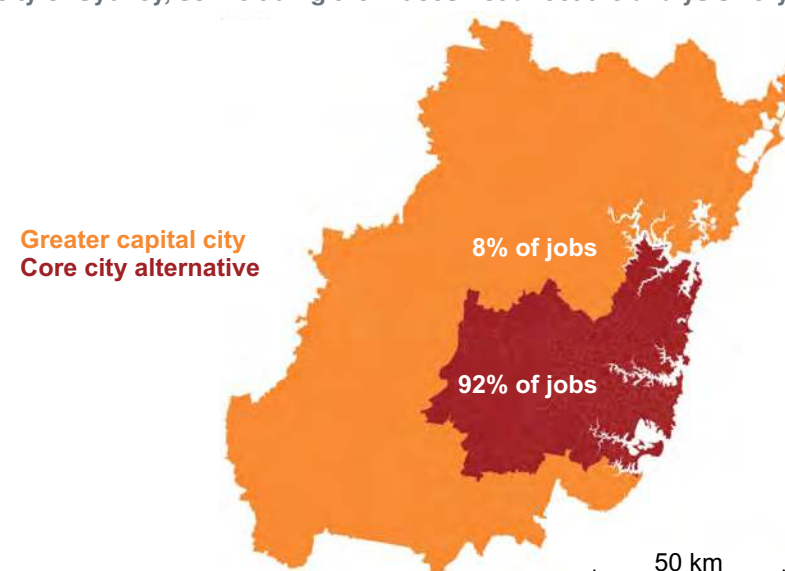
Source: Grattan analysis of ABS (2016a).

Table A.2: The percentage of workers in various SA2 regions of employment is robust to the choice of Melbourne's boundary
Percentage of city workers

	Alternative city boundary		ABS city boundary	
	2011	2016	2011	2016
Melbourne	11.7	11.5	10.9	10.8
Dandenong	3.4	3.4	3.2	3.2
Docklands	2.0	3.0	1.9	2.8
Southbank	2.1	2.0	2.0	1.9
Richmond	1.9	1.9	1.8	1.8
Clayton	1.8	1.8	1.7	1.7
Parkville	1.4	1.5	1.3	1.4
South Melbourne	1.3	1.4	1.2	1.3
Campbellfield – Coolaroo	1.3	1.2	1.2	1.1
Port Melbourne Industrial	1.2	1.2	1.1	1.1
Mulgrave	1.2	1.1	1.1	1.0
East Melbourne	1.3	1.0	1.2	1.0
Laverton	1.0	1.0	0.9	0.9
Box Hill	1.1	1.0	1.0	0.9
Preston*	1.0	1.0	1.0	0.9
Keilor	0.9	0.9	0.8	0.9
Albert Park	1.0	0.9	0.9	0.8
South Yarra – West	0.9	0.8	0.8	0.8
Melbourne Airport	0.9	0.8	0.8	0.8
Carlton	1.0	0.8	0.9	0.8

Note: This table is intended to present an alternative to Table 2.3. The asterisk indicates the SA2 that was split up in 2016, and the figures are for the workforce within the 2011 SA2 (i.e. a sum of multiple 2016 SA2s).

Source: Grattan analysis of ABS (2016a) and ABS (2011a).

Figure A.2: Only a small portion of workers are based outside the core city of Melbourne, so including them does not affect the analysis very much
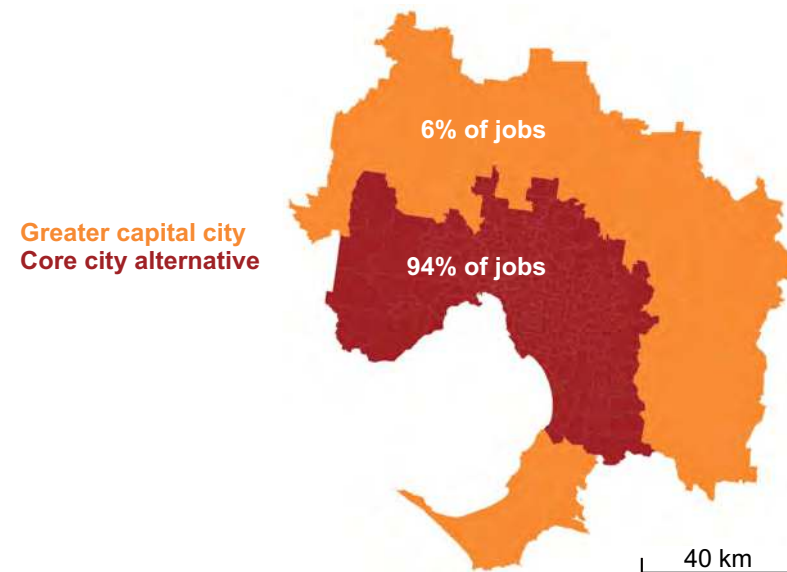
Source: Grattan analysis of ABS (2016a).

A.2 Journey-to-work 'dandelion' charts

The "dandelion" maps of journeys-to-work presented in Chapter 2 present a random sample of 200 journeys, using a "beeline" between the origin and destination. This appendix explains that these maps are robust to changes in the underlying random sample.

Figure A.3 on the next page presents four versions of the dandelion map for Sydney, each made using a different random sample. While there are, as expected, minor differences in the origin-destination pairs in each map, there is no change in the overall pattern of dispersion across any of the samples.

Figure A.4 on page 57 presents four versions of dandelion map for Melbourne, with the same result.

Figure A.5 on page 58 presents dandelion maps for a range of smaller Australian cities.

Figure A.3: The Sydney journey-to-work maps are robust to changes in the underlying random sample
Journeys to work, beeline distance between origin and destination, 2016
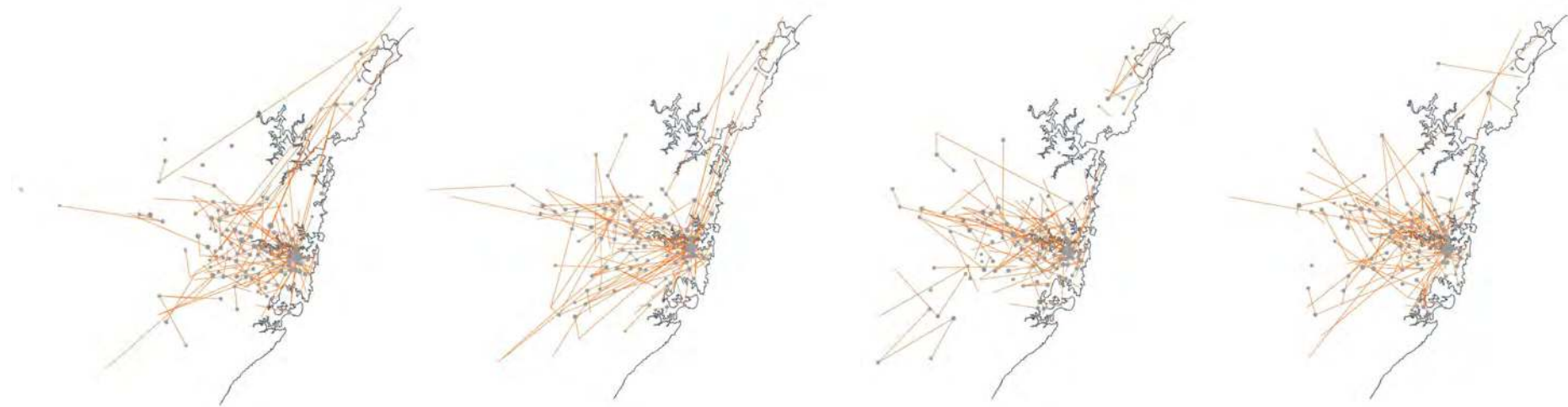
Note: Charts show samples of 200 randomly selected journeys to work in Sydney.
Source: Grattan analysis of ABS census: ABS (2016a).

Figure A.4: The Melbourne journey-to-work maps are robust to changes in the underlying random sample
Journeys to work, beeline distance between origin and destination, 2016
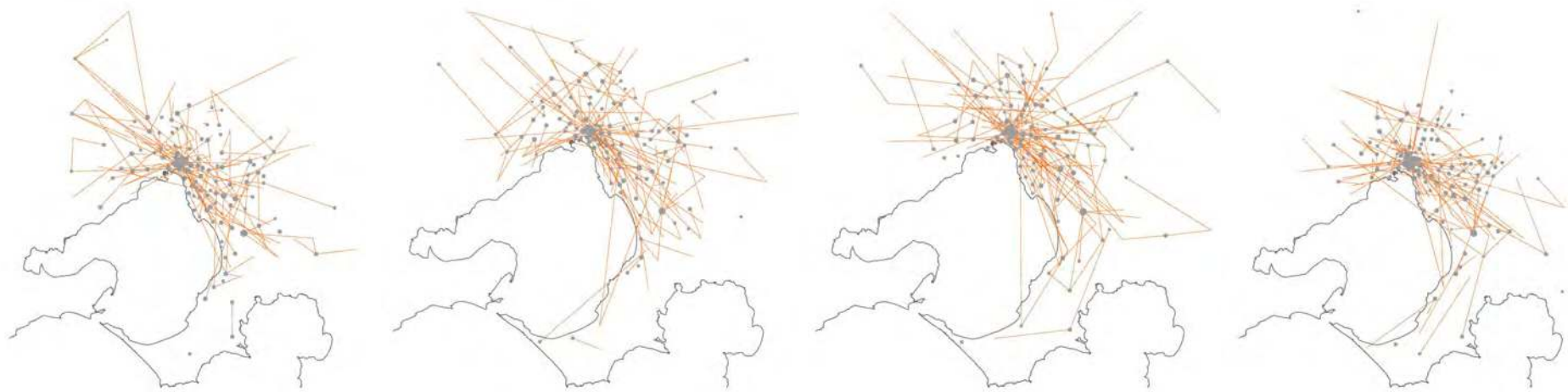
Note: Charts show samples of 200 randomly selected journeys to work in Melbourne.
Source: Grattan analysis of ABS census: ABS (2016a).

Figure A.5: Smaller cities are different – 'dandelion' maps for a range of smaller Australian cities
Journeys to work, beeline distance between origin and destination, 2016
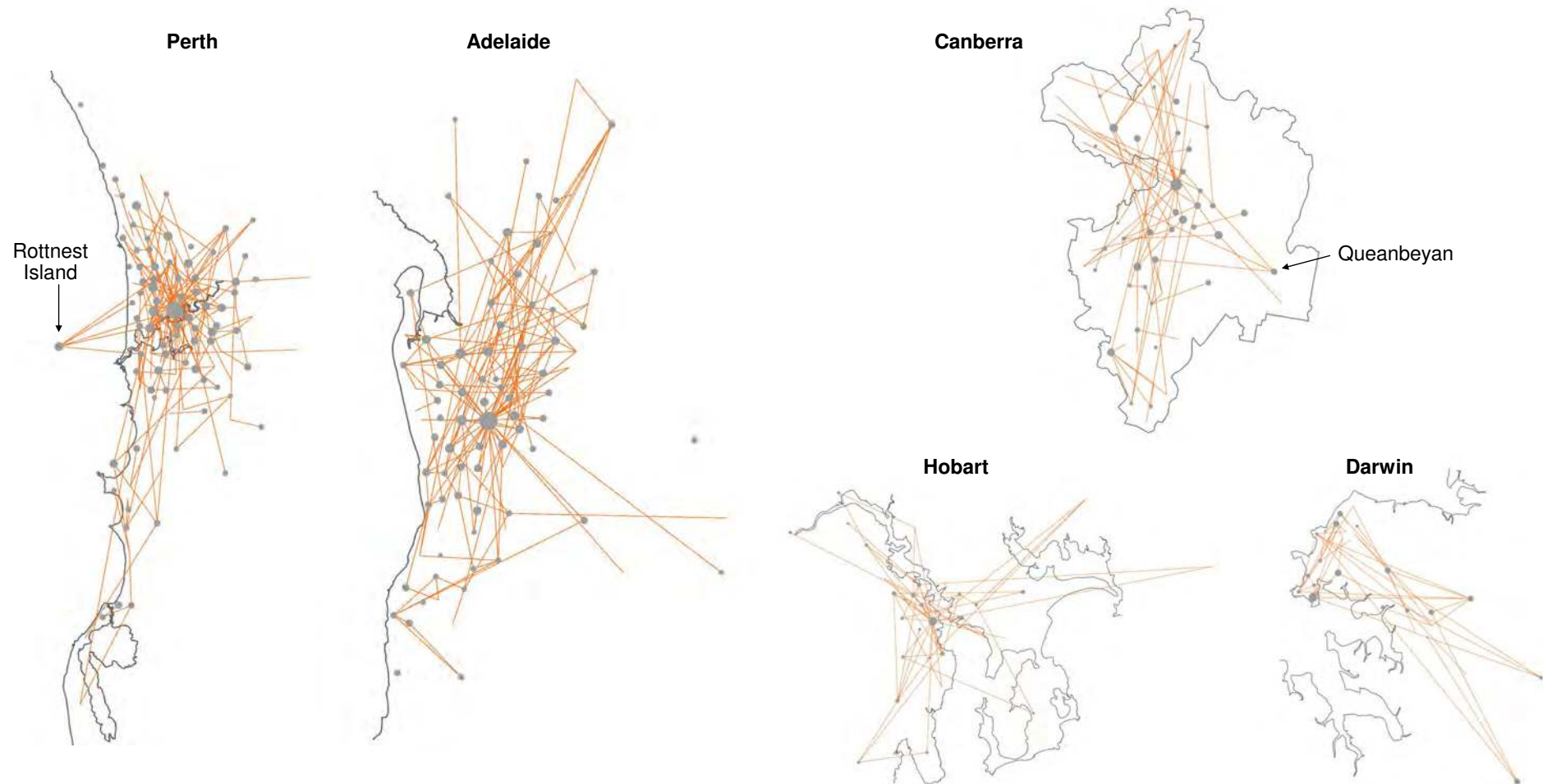
Note: Charts show a random sample of 200 journeys to work for Perth and Adelaide, 80 journeys for Canberra and Hobart, and 50 journeys for Darwin.
Source: Grattan analysis of ABS (2016a).

A.3   How the 2011 and 2016 Census employment data differ

This section explains why and how the 2011 Census data for employment has been adjusted to provide a more accurate depiction of employment trends in Australian cities.

Proportion estimates in 2011 are too low

In 2011, when an employed person answered the Place of Work (POW) question on the Census, they were assigned as accurate a location as possible based on the following categories:

1. Ideally, they were coded to a Destination Zone (DZN).

2. If this was not possible, they were assigned to the closest SA2.

3. If their POW was not specific enough to be coded to an SA2, but did suggest that they worked in a particular capital city, they were coded as 'Capital city undefined (Greater Melbourne)', for example.

4. If they provided only enough details to be assigned a state, they were coded as 'State/Territory undefined (Vic.)', for example.

5. Lastly, if they provided no details about their POW, they were coded as 'not stated'.[121]

Take Melbourne as an example. When calculating job numbers for the Greater Capital City 'Melbourne', Census TableBuilder provides a sum of the people in the first three categories. However, when calculating job numbers for individual DZNs, only the first category of people are included, and for SA2s only the first two categories are included.

This is why the sum of workers in all SA2s in Melbourne does not equal the total number of workers in Melbourne. The difference is the people in the third category.

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121. This is explained in ABS (2011c) and ABS (2016d).

As a result, direct calculations of the proportion of Melbourne's workers employed in any given SA2 in 2011 will produce an estimate that is too low. This is because the numerator does not include those people in the third category, 'Capital city undefined (Greater Melbourne)', who do in fact work in a specific SA2.

Job numbers in 2011 are depressed relative to 2016 due to imputation

In 2016, when an employed person answered the Place of Work (POW) question on the Census, they were assigned a DZN based on their response. If their response was not precise enough, an imputed DZN was determined based on their answers to other Census questions. As a result, every single worker was coded to a DZN.

This means that categories 2-5 in the 2011 Census do not appear in the 2016 Census. One way of thinking about it is that the people in categories 2-5 have been mathematically distributed among the DZNs.

This makes it impossible to make direct comparisons between the two censuses on any sub-national geographical scale. Take the Melbourne SA2 area of Clayton as an example. In 2011, job figures for Clayton include everyone coded to a DZN within the Clayton SA2, as well as everyone who provided enough details to be coded to the Clayton SA2 but not a specific DZN (*i.e.* categories 1 and 2). In 2016, job figures for Clayton include everyone coded to the Clayton DZN, plus a portion of people from each of the remaining categories who were assigned an imputed DZN within Clayton's boundary. In other words, the 2016 job figure includes everyone from category 1 and 2, as well as subset of people from categories 3, 4 and even 5. Even a person who does not provide a POW location may still be coded to a DZN in the Clayton SA2 based on their other Census responses.

The effect of this difference is that job figures appear depressed in 2011, leading to inflated estimates of growth between the two Census years.

Addressing this issue required bench-marking to the ABS Labour Force Survey

To address this issue, a reference value for the actual job growth in capital cities between 2011 and 2016 was sourced from the ABS Labour Force Survey's monthly time series of employment numbers in those cities.[122] Take Melbourne as an example. To determine the reference value, it was necessary to calculate the annual growth in Melbourne for five-year periods beginning at different months (*e.g.* annual growth over Feb 2011-Feb 2016, then over Mar 2011-Mar 2016, and so on). These values were then smoothed by selecting the 12-month centred average from Feb 2011 to Jan 2012. The Census was conducted on August 9 in 2011 and 2016, so selecting the average over the 12 commencing months Feb-Jan places August 9 closer to the centre than selecting Jan-Dec or Mar-Feb. A 12-month average was used to mitigate seasonal effects (see Table A.3).

Having derived a reference growth value of 2.3% p.a., the total number of workers in Melbourne in 2011 was set to 1.826 million, because this would be consistent with 2.3% growth when compared to the 2016 jobs number of 2.046 million.

The rationale: it is unclear how many of the people in categories 4 and 5 of the 2011 Census work in Melbourne, so effectively a portion of them have been assigned to the city to give it a sensible growth value.

The sum of 2011 categories 1 and 2 in Melbourne is 1.701 million. To go from 1.701 million to 1.826 million, the citywide jobs figure has been inflated by a factor of 1.0739. The number of jobs in each SA2 of Melbourne was therefore inflated by the same factor.

The rationale: it is assumed that the proportion of people who could not be categorised into at least an SA2 does not differ throughout

Table A.3: An example: bench-marking Melbourne's jobs growth rate

Five-year period commencing:	Average annual growth	12-month centred average	Smoothed using:
Jan-11	1.75%		
Feb-11	2.23%		
Mar-11	1.94%		
Apr-11	2.07%		
May-11	2.09%		
Jun-11	2.16%		
Jul-11	2.28%	2.24%	Jan-11 to Dec-11
Aug-11	**2.54%**	**2.30%**	**Feb-11 to Jan-12**
Sep-11	2.19%	2.36%	Mar-11 to Feb-12
Oct-11	2.40%		
Nov-11	2.63%		
Dec-11	2.60%		
Jan-12	2.53%		
Feb-12	2.96%		

Source: ABS (2018c).

Melbourne. Another way of saying this is that across the city, the same proportion of census-completers failed to adequately state their POW. Therefore, by inflating the jobs numbers in each SA2 by the same factor, the proportion of Melbourne's workers in each SA2 has been preserved while ensuring that the sum of all SA2s is now equal to the total job number of Melbourne (consistent with a 2.3% citywide annual growth rate). Effectively, a subset of the category 3, 4 and 5 people have been proportionally allocated to an SA2. This now allows 2011 SA2 job figures to be directly compared to 2016 SA2 job figures.

This approach has been applied to all Greater Capital City areas to generate estimates of changes in employment at the SA2 level.

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122. ABS (2018c). Job growth for Greater Capital City Statistical Areas was used in all instances except Darwin, for which job growth in the 'Darwin' SA4 was used.

A.4 Beeline distances – how reliable is this measure?

Frequently, this report has analysed trips to work using beeline distances, or distance "as the crow flies". The 2016 Census contains data on 'road distances' (*i.e.* the shortest distance between home and work travelling via roads), but the 2011 Census lacks such data, preventing any direct comparisons between the two years with respect to road distances.

It is inevitable that beeline distances will underestimate the actual length of any given commute. However, they tend to underestimate in a consistent manner, depending on a city's 'circuity factor' – the typical ratio between road distances and beeline distances.[123]

Taking Sydney as an example, beeline distances show a very similar trend to road distances (Figure A.6). Apart from at the shortest commutes (the 10th percentile), the ratio of road distance to beeline distance is between 1.33 and 1.38.

For the five largest cities Australia (the capitals with populations greater than one million), the ratio differs by no more than 0.09 within each city over the 20th to 90th percentiles. The 10th percentile may be underestimated by our beeline analysis because the most granular geographical unit we have used is Destination Zones (whereas the ABS has access to Mesh Block data, enabling much more precise calculations over small distances).

While it would be ideal to rely solely on road distances, the consistency of the road distance to beeline distance ratio within cities makes beeline distances an acceptable proxy for all but the shortest trips.

Figure A.6: In Sydney, road distances exceed beeline distances in a very consistent way for all but the shortest journeys
Circuity factor (vertical axis, LHS), commute distance in km (vertical axis, RHS), percentile of commuters (horizontal axis)
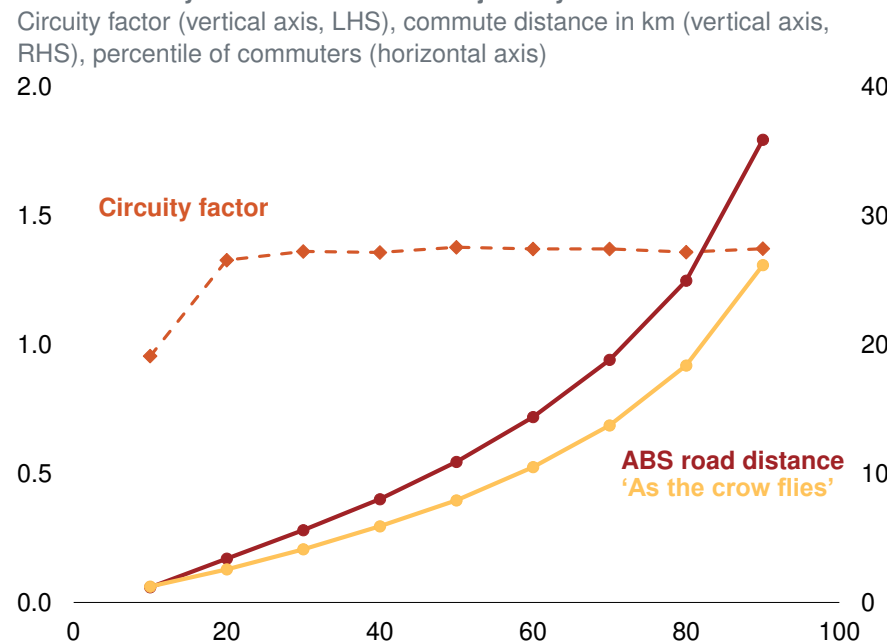
Notes: Circuity factor has been calculated as the ratio between the road distance and beeline distance at each decile. This is the correct definition under the assumption that a person at the median for beeline distances is also at the median for road distances. This assumption holds only approximately (the median person on one measure is likely to be very close to the median on the alternative measure but may not match exactly), and therefore the circuity factors listed are all approximations.

Source: Grattan analysis of ABS (2016a).

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123. Ballou et al. (2002).

Figure A.7: Melbourne's story closely resembles Sydney's
Circuity factor (vertical axis, LHS), commute distance in km (vertical axis, RHS), percentile of commuters (horizontal axis)
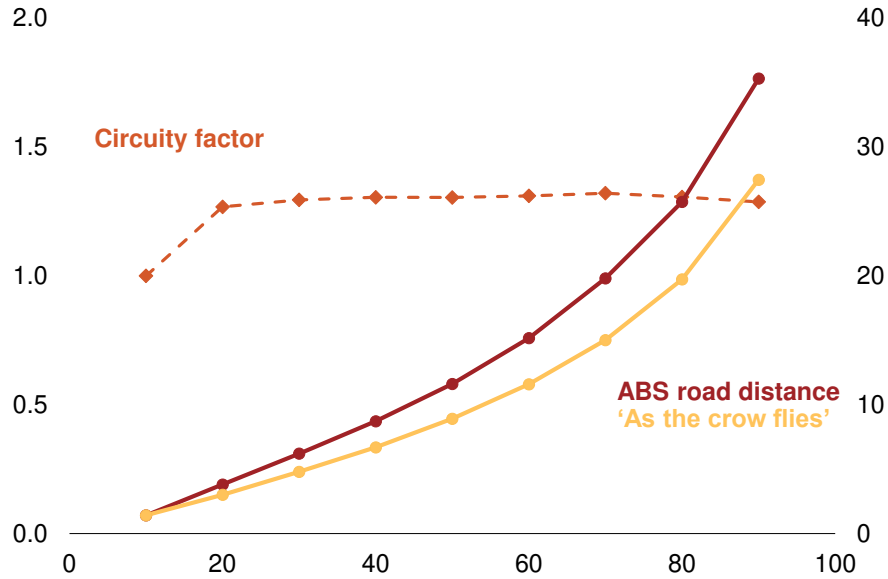
Note: Circuity factor has been calculated as described in Figure A.6 on the preceding page.
Source: Grattan analysis of ABS (2016a).

Figure A.8: Brisbane has a fairly constant ratio across all journeys
Circuity factor (vertical axis, LHS), commute distance in km (vertical axis, RHS), percentile of commuters (horizontal axis)
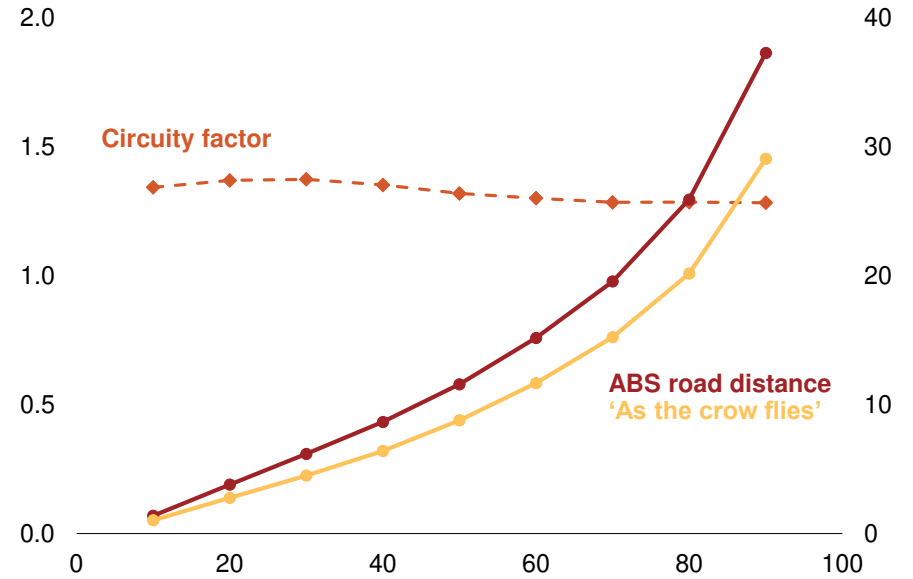
Note: Circuity factor has been calculated as described in Figure A.6.
Source: Grattan analysis of ABS (ibid.).

Figure A.9: Perth's story closely resembles Sydney's
Circuity factor (vertical axis, LHS), commute distance in km (vertical axis, RHS), percentile of commuters (horizontal axis)

Circuity factor

ABS road distance
'As the crow flies'
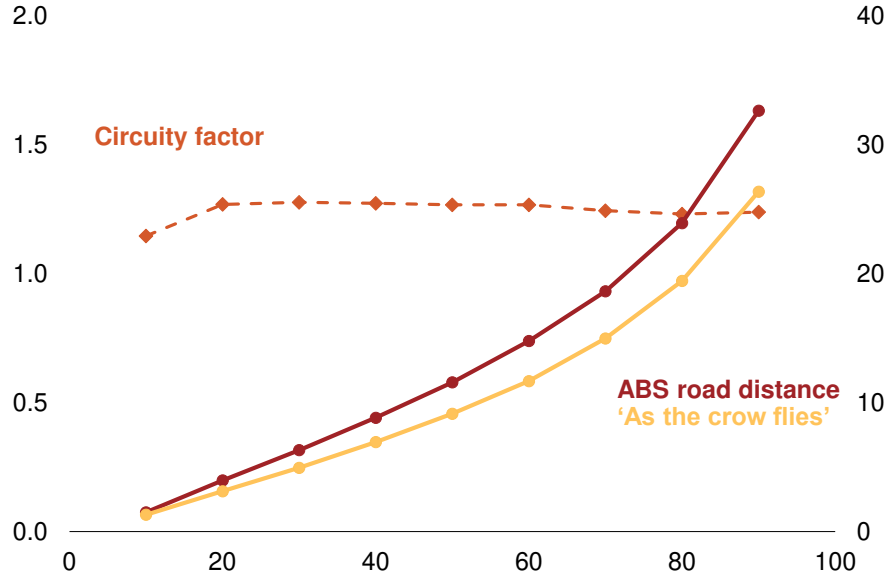
Note: Circuity factor has been calculated as described in Figure A.6 on page 61.

Source: Grattan analysis of ABS (2016a).

Figure A.10: Adelaide's story closely resembles Sydney's
Circuity factor (vertical axis, LHS), commute distance in km (vertical axis, RHS), percentile of commuters (horizontal axis)

Circuity factor

ABS road distance
'As the crow flies'
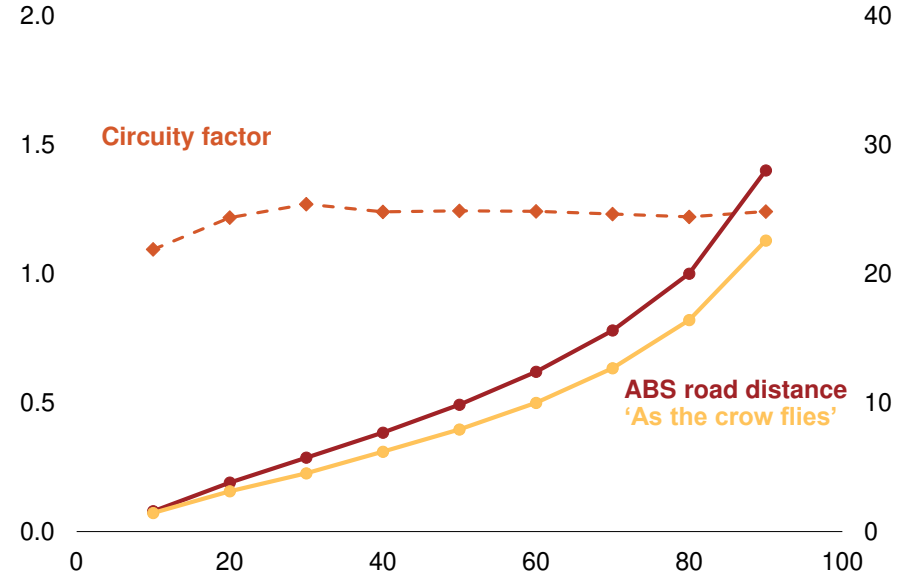
Note: Circuity factor has been calculated as described in Figure A.6 on page 61.

Source: Grattan analysis of ABS (ibid.).

Appendix B: Additional analysis: method of travel and job location

This appendix presents some additional information and analysis that may be of interest to readers.

Appendix B.1 sets out the number, share and growth of jobs in the 20 largest suburbs in each capital city.

Appendix B.2 sets out additional analysis of method of travel to work, complementing the analysis in Chapter 4. There are two parts to this. The first part sets out the mode split in the major Australian capital cities for 2011 and 2016. The second part complements the analysis of the Australian Census Longitudinal Dataset in Figure 4.1, Figure 4.2 and Figure 4.3 by providing trends for the period 2006-2011.

Appendix B.3 presents the distribution of jobs in the major capitals by quintiles, to complement the analysis in Figure 2.2. Figure B.7 shows the distribution of jobs by distance from the city centre in 2011 and 2016.

Appendix B.4 presents the net job growth at the SA3 level for Sydney, Melbourne and Brisbane, to complement the growth rate map in Figure 2.5.

B.1   Employment growth in the biggest 20 suburbs for jobs in Australia's capital cities

The following tables list employment statistics at the suburb (SA2) level for capital cities.

Table B.1: The 20 largest employment centres in Sydney
Suburbs where employment grew more slowly than the citywide average are highlighted

	Workforce, 2011	Proportion of total city employment, 2011	Workforce, 2016	Proportion of total city employment, 2016	Average workforce growth, 2011-2016
Sydney – Haymarket – The Rocks	273,300	13.7%	320,800	14.5%	3.3%
Parramatta – Rosehill	46,300	2.3%	50,200	2.3%	1.6%
North Sydney – Lavender Bay	46,800	2.3%	49,000	2.2%	0.9%
Macquarie Park – Marsfield	42,000	2.1%	48,400	2.2%	2.9%
Pyrmont – Ultimo	32,300	1.6%	36,800	1.7%	2.7%
Surry Hills	25,400	1.3%	29,800	1.3%	3.3%
St Leonards – Naremburn	28,000	1.4%	29,400	1.3%	1.0%
Chatswood (East) – Artarmon	23,900	1.2%	27,700	1.3%	3.0%
Homebush Bay – Silverwater	24,600	1.2%	26,500	1.2%	1.5%
Erskineville – Alexandria	20,900	1.0%	23,600	1.1%	2.5%
Baulkham Hills (West) – Bella Vista	19,000	1.0%	23,600	1.1%	4.4%
Liverpool – Warwick Farm	20,400	1.0%	23,000	1.0%	2.4%
Mascot – Eastlakes	22,700	1.1%	22,400	1.0%	-0.3%
Newtown – Camperdown – Darlington	18,300	0.9%	20,600	0.9%	2.4%
Blacktown (East) – Kings Park	19,300	1.0%	20,200	0.9%	0.9%
Penrith	18,600	0.9%	20,100	0.9%	1.6%
Concord West – North Strathfield	16,600	0.8%	19,800	0.9%	3.6%
Gosford – Springfield	18,600	0.9%	18,800	0.9%	0.3%
Campbelltown – Woodbine	16,400	0.8%	18,300	0.8%	2.2%
Prospect Reservoir	14,500	0.7%	18,000	0.8%	4.4%
City Total	**1,997,100**	**100.0%**	**2,209,300**	**100.0%**	**2.0%**

Notes: The figures here differ from those in ABS Census Table Builder, as explained in Appendix A.3. Growth figures are compound annual growth rates.

Source: Grattan analysis of ABS (2016a) and ABS (2011a).

Table B.2: The 20 largest employment centres in Melbourne
Suburbs where employment grew more slowly than the citywide average are highlighted

	Workforce, 2011	Proportion of total city employment, 2011	Workforce, 2016	Proportion of total city employment, 2016	Average workforce growth, 2011-2016
Melbourne	199,900	10.9%	221,100	10.8%	2.0%
Dandenong	58,200	3.2%	65,700	3.2%	2.4%
Docklands	34,400	1.9%	57,600	2.8%	10.8%
Southbank	36,500	2.0%	38,800	1.9%	1.2%
Richmond	32,200	1.8%	36,800	1.8%	2.7%
Clayton	31,000	1.7%	34,200	1.7%	2.0%
Parkville	23,300	1.3%	28,200	1.4%	3.9%
South Melbourne	22600	1.2%	26,000	1.3%	2.9%
Campbellfield – Coolaroo	21,400	1.2%	23,100	1.1%	1.5%
Port Melbourne Industrial	20,200	1.1%	22,800	1.1%	2.4%
Mulgrave	20,100	1.1%	21,200	1.0%	1.1%
East Melbourne	21,600	1.2%	19,900	1.0%	-1.6%
Laverton	16,700	0.9%	19,300	0.9%	2.9%
Box Hill	18,300	1.0%	19,000	0.9%	0.7%
Preston*	17,600	1.0%	19,000	0.9%	1.5%
Keilor	14,600	0.8%	17,500	0.9%	3.7%
Albert Park	16,600	0.9%	16,500	0.8%	-0.1%
South Yarra – West	15,000	0.8%	16,100	0.8%	1.5%
Melbourne Airport	14,900	0.8%	15,900	0.8%	1.3%
Carlton	16,200	0.9%	15,700	0.8%	-0.7%
City Total	**1,826,300**	**100.0%**	**2,046,200**	**100.0%**	**2.3%**

Notes: The figures here differ from those in ABS Census Table Builder, as explained in Appendix A.3. Growth figures are compound annual growth rates. The asterisk indicates the SA2 that was split up in 2016, and the figures are for the workforce within the 2011 SA2 (i.e. a sum of multiple 2016 SA2s).

Source: Grattan analysis of ABS (2016a) and ABS (2011a).

Table B.3: The 20 largest employment areas in Brisbane
Suburbs where employment grew more slowly than the citywide average are highlighted

	Workforce, 2011	Proportion of total city employment, 2011	Workforce, 2016	Proportion of total city employment, 2016	Average workforce growth, 2011-2016
Brisbane City	125,200	12.8%	122,500	11.8%	-0.4%
South Brisbane	24,500	2.5%	27,500	2.6%	2.3%
Rocklea – Acacia Ridge	25,900	2.6%	23,300	2.2%	-2.1%
Fortitude Valley	21,700	2.2%	22,100	2.1%	0.4%
Brisbane Airport	18,000	1.8%	21,400	2.1%	3.5%
Newstead – Bowen Hills	16,600	1.7%	20,300	2.0%	4.2%
Kelvin Grove – Herston	17,900	1.8%	16,700	1.6%	-1.3%
Paddington – Milton	18,100	1.8%	16,400	1.6%	-1.9%
Woolloongabba	14,000	1.4%	15,600	1.5%	2.2%
Strathpine – Brendale	13,900	1.4%	14,600	1.4%	0.9%
Chermside	13,300	1.4%	14,200	1.4%	1.4%
Caboolture	11,000	1.1%	12,900	1.2%	3.2%
Spring Hill	15,700	1.6%	12,600	1.2%	-4.2%
Ipswich – Central	10,500	1.1%	11,900	1.2%	2.6%
Eagle Farm – Pinkenba	11,800	1.2%	11,900	1.1%	0.3%
Murarrie	11,400	1.2%	11,800	1.1%	0.7%
Capalaba	10,300	1.0%	10,600	1.0%	0.6%
Upper Mount Gravatt	9,200	0.9%	10,600	1.0%	2.7%
North Lakes – Mango Hill	5,500	0.6%	10,300	1.0%	13.3%
Wacol	9,700	1.0%	10,200	1.0%	0.9%
City Total	**977,300**	**100.0%**	**1,037,900**	**100.0%**	**1.2%**

Notes: The figures here differ from those in ABS Census Table Builder, as explained in Appendix A.3. Growth figures are compound annual growth rates.

Source: Grattan analysis of ABS (2016a) and ABS (2011a).

Table B.4: The largest 20 employment areas in Perth
Suburbs where employment grew more slowly than the citywide average are highlighted

	Workforce, 2011	Proportion of total city employment, 2011	Workforce, 2016	Proportion of total city employment, 2016	Average workforce growth, 2011-2016
Perth City	144,400	18.0%	137,400	16.2%	-1.0%
Subiaco – Shenton Park	23,700	3.0%	22,900	2.7%	-0.7%
Osborne Park Industrial	22,600	2.8%	22,000	2.6%	-0.5%
Nedlands – Dalkeith – Crawley	19,000	2.4%	20,300	2.4%	1.3%
Joondalup – Edgewater	16,000	2.0%	18,500	2.2%	3.0%
Madeley – Darch – Landsdale	14,700	1.8%	18,400	2.2%	4.6%
Welshpool	19,300	2.4%	17,200	2.0%	-2.3%
Fremantle	18,900	2.4%	16,600	2.0%	-2.6%
Malaga	16,600	2.1%	16,000	1.9%	-0.8%
Midland – Guildford	12,600	1.6%	14,600	1.7%	3.0%
Canning Vale Commercial	15,900	2.0%	14,600	1.7%	-1.7%
Belmont – Ascot – Redcliffe	13,200	1.6%	13,900	1.6%	1.1%
Rockingham	12,900	1.6%	13,900	1.6%	1.5%
Murdoch – Kardinya	7,800	1.0%	13,600	1.6%	11.9%
Victoria Park – Lathlain – Burswood	11,600	1.5%	12,900	1.5%	2.0%
Perth Airport	10,800	1.3%	12,800	1.5%	3.6%
Bentley – Wilson – St James	12,300	1.5%	12,700	1.5%	0.7%
Balcatta – Hamersley	11,600	1.5%	11,500	1.4%	-0.3%
Wembley	9,000	1.1%	10,400	1.2%	2.9%
Cannington – Queens Park	8,400	1.0%	9,300	1.1%	2.0%
City Total	**801,300**	**100.0%**	**850,200**	**100.0%**	**1.2%**

Notes: The figures here differ from those in ABS Census Table Builder, as explained in Appendix A.3. Growth figures are compound annual growth rates. 'Wembley' refers to the Wembley – West Leederville – Glendalough SA2 region.

Source: Grattan analysis of ABS (2016a) and ABS (2011a).

Table B.5: The largest 20 employment areas in Adelaide
Suburbs where employment grew more slowly than the citywide average are highlighted

	Workforce, 2011	Proportion of total city employment, 2011	Workforce, 2016	Proportion of total city employment, 2016	Average workforce growth, 2011-2016
Adelaide	108,300	19.4%	107,600	19.2%	-0.1%
The Parks	19,800	3.5%	18,600	3.3%	-1.2%
Richmond	19,600	3.5%	18,500	3.3%	-1.2%
Plympton	15,000	2.7%	14,600	2.6%	-0.5%
Enfield – Blair Athol	12,900	2.3%	13,600	2.4%	1.1%
Pooraka*	12,400	2.2%	12,200	2.2%	-0.3%
Salisbury North	11,400	2.1%	12,100	2.2%	1.1%
Norwood (SA)	13,200	2.4%	12,000	2.1%	-1.8%
Port Adelaide	10,200	1.8%	11,700	2.1%	2.8%
Unley – Parkside	12,200	2.2%	11,300	2.0%	-1.4%
Elizabeth	11,100	2.0%	10,600	1.9%	-0.9%
Toorak Gardens	9,800	1.7%	10,300	1.8%	1.0%
Hope Valley – Modbury	9,500	1.7%	10,000	1.8%	1.1%
North Adelaide	9,900	1.8%	10,000	1.8%	0.2%
Hindmarsh – Brompton	10,500	1.9%	9,600	1.7%	-1.7%
Bellevue Heights	9,000	1.6%	9,200	1.6%	0.4%
Salisbury	8,400	1.5%	8,400	1.5%	-0.1%
Goodwood – Millswood	7,400	1.3%	8,100	1.4%	1.7%
Glenelg (SA)	7,800	1.4%	7,800	1.4%	0.0%
Woodville – Cheltenham	7,100	1.3%	7,700	1.4%	1.5%
City Total	**558,100**	**100.0%**	**560,300**	**100.0%**	**0.1%**

Notes: The figures here differ from those in ABS Census Table Builder, as explained in Appendix A.3. Growth figures are compound annual growth rates. The asterisk indicates an SA2 that was split up in 2016, and the figures are for the workforce within the 2011 SA2 (i.e. a sum of multiple 2016 SA2s).

Source: Grattan analysis of ABS (2016a) and ABS (2011a).

Table B.6: The largest 20 employment areas in Canberra
Suburbs where employment grew more slowly than the citywide average are highlighted

	Workforce, 2011	Proportion of total city employment, 2011	Workforce, 2016	Proportion of total city employment, 2016	Average workforce growth, 2011-2016
Civic	33,600	16.1%	34,400	15.6%	0.4%
ACT – East*	15,400	7.4%	15,800	7.1%	0.5%
Kingston – Barton*	12,500	6.0%	14,300	6.5%	2.8%
Belconnen	13,200	6.3%	13,500	6.1%	0.4%
Phillip	14,200	6.8%	12,400	5.6%	-2.6%
Campbell*	11,100	5.3%	12,000	5.4%	1.6%
Greenway	10,200	4.9%	10,400	4.7%	0.2%
Majura*	7,400	3.5%	8,800	4.0%	3.6%
Acton*	6,600	3.2%	6,400	2.9%	-0.8%
Garran	5,400	2.6%	6,400	2.9%	3.5%
Bruce	5,600	2.7%	6,200	2.8%	2.0%
Deakin	5,100	2.5%	6,100	2.7%	3.4%
Parkes (ACT)	7,100	3.4%	5,200	2.4%	-6.0%
Mitchell	4,300	2.0%	4,900	2.2%	3.0%
Braddon	3,900	1.9%	4,100	1.9%	1.1%
Gungahlin	2,500	1.2%	3,900	1.7%	9.1%
Forrest	1,900	0.9%	3,700	1.7%	14.4%
Griffith (ACT)	3,000	1.4%	3,300	1.5%	2.0%
Dickson	3,700	1.8%	3,200	1.5%	-2.5%
Hume	2,500	1.2%	3,000	1.3%	3.5%
City Total	**209,000**	**100.0%**	**220,600**	**100.0%**	**1.1%**

Notes: The figures here differ from those in ABS Census Table Builder, as explained in Appendix A.3. Growth figures are compound annual growth rates. An asterisk indicates an SA2 that was split up in 2016, and the figures are for the workforce within the 2011 SA2 (i.e. a sum of multiple 2016 SA2s).

Source: Grattan analysis of ABS (2016a) and ABS (2011a).

Table B.7: The largest 20 employment areas in Hobart
Suburbs where employment grew more slowly than the citywide average are highlighted

	Workforce, 2011	Proportion of total city employment, 2011	Workforce, 2016	Proportion of total city employment, 2016	Average workforce growth, 2011-2016
Hobart	38,100	37.9%	36,400	36.7%	-0.9%
Sandy Bay	5,600	5.6%	5,400	5.5%	-0.7%
Moonah	5,200	5.2%	5,200	5.2%	-0.2%
Derwent Park – Lutana	5,100	5.1%	5,100	5.1%	-0.1%
Glenorchy	5,000	5.0%	4,700	4.8%	-1.1%
Kingston – Huntingfield	4,900	4.9%	4,600	4.6%	-1.4%
Bellerive – Rosny	4,100	4.1%	4,200	4.2%	0.3%
Cambridge	3,400	3.4%	4,000	4.0%	3.2%
New Town	3,700	3.7%	3,700	3.7%	0.1%
Sorell – Richmond	2,300	2.3%	2,400	2.4%	0.5%
Mornington – Warrane	2,400	2.4%	2,100	2.1%	-2.3%
New Norfolk	1,700	1.7%	1,800	1.8%	0.8%
Lenah Valley – Mount Stuart	1,500	1.5%	1,800	1.8%	2.6%
Claremont	1,800	1.8%	1,600	1.6%	-2.2%
Bridgewater – Gagebrook	1,500	1.5%	1,600	1.6%	1.5%
South Hobart – Fern Tree	1,400	1.4%	1,500	1.6%	1.3%
Lindisfarne – Rose Bay	1,400	1.4%	1,400	1.4%	0.3%
Margate – Snug	1,200	1.2%	1,400	1.4%	3.3%
Kingston Beach – Blackmans Bay	1,200	1.2%	1,200	1.2%	-0.2%
Howrah – Tranmere	1,100	1.1%	1,100	1.1%	-1.5%
City Total	**100,500**	**100.0%**	**99,400**	**100.0%**	**-0.2%**

Notes: The figures here differ from those in ABS Census Table Builder, as explained in Appendix A.3. Growth figures are compound annual growth rates, and are calculated from workforce numbers that have not been rounded.

Source: Grattan analysis of ABS (2016a) and ABS (2011a).

Table B.8: The largest 20 employment areas in Darwin
Suburbs where employment grew more slowly than the citywide average are highlighted

	Workforce, 2011	Proportion of total city employment, 2011	Workforce, 2016	Proportion of total city employment, 2016	Average workforce growth, 2011-2016
Darwin City	12,900	20.8%	12,700	17.7%	-0.2%
Weddell	900	1.5%	7,500	10.4%	52.5%
Woolner – Bayview – Winnellie	6,500	10.4%	6,400	8.9%	-0.2%
Brinkin – Nakara	4,600	7.4%	4,900	6.7%	1.1%
Berrimah	5,100	8.2%	4,800	6.7%	-1.0%
Howard Springs	4,000	6.5%	4,700	6.5%	3.1%
Tiwi	3,600	5.7%	3,900	5.4%	1.8%
Palmerston – North	3,300	5.4%	3,400	4.7%	0.2%
East Arm	1,200	2.0%	2,000	2.7%	9.7%
Fannie Bay – The Gardens	1,700	2.8%	1,800	2.5%	0.6%
Humpty Doo	1,300	2.2%	1,500	2.0%	1.7%
Darwin Airport	2,000	3.2%	1,400	2.0%	-6.5%
Durack – Marlow Lagoon	1,300	2.1%	1,400	2.0%	2.0%
Ludmilla – The Narrows	600	1.0%	1,400	1.9%	16.4%
Parap	1,100	1.7%	1,300	1.8%	3.9%
Larrakeyah	1,400	2.2%	1,300	1.7%	-1.6%
Stuart Park	1,100	1.8%	1,100	1.6%	-0.3%
Malak – Marrara	1,200	1.9%	1,000	1.4%	-3.6%
Coconut Grove	800	1.3%	900	1.2%	1.6%
Nightcliff	900	1.4%	900	1.2%	0.4%
City Total	**62,000**	**100.0%**	**72,100**	**100.0%**	**3.1%**

Notes: The figures here differ from those in ABS Census Table Builder, as explained in Appendix A.3. Growth figures are compound annual growth rates, and are calculated from workforce numbers that have not been rounded.

Source: Grattan analysis of ABS (2016a) and ABS (2011a).

B.2   Changes to the way commuters got to work in Australia's major cities

In Figure B.1, each mode of travel's share of total journeys to work is presented. This appendix also provides the same transport method-change information as in Chapter 4, but for the preceding five-year period of 2006-2011. These are set out in Figure B.2, Figure B.3, and Figure B.4.

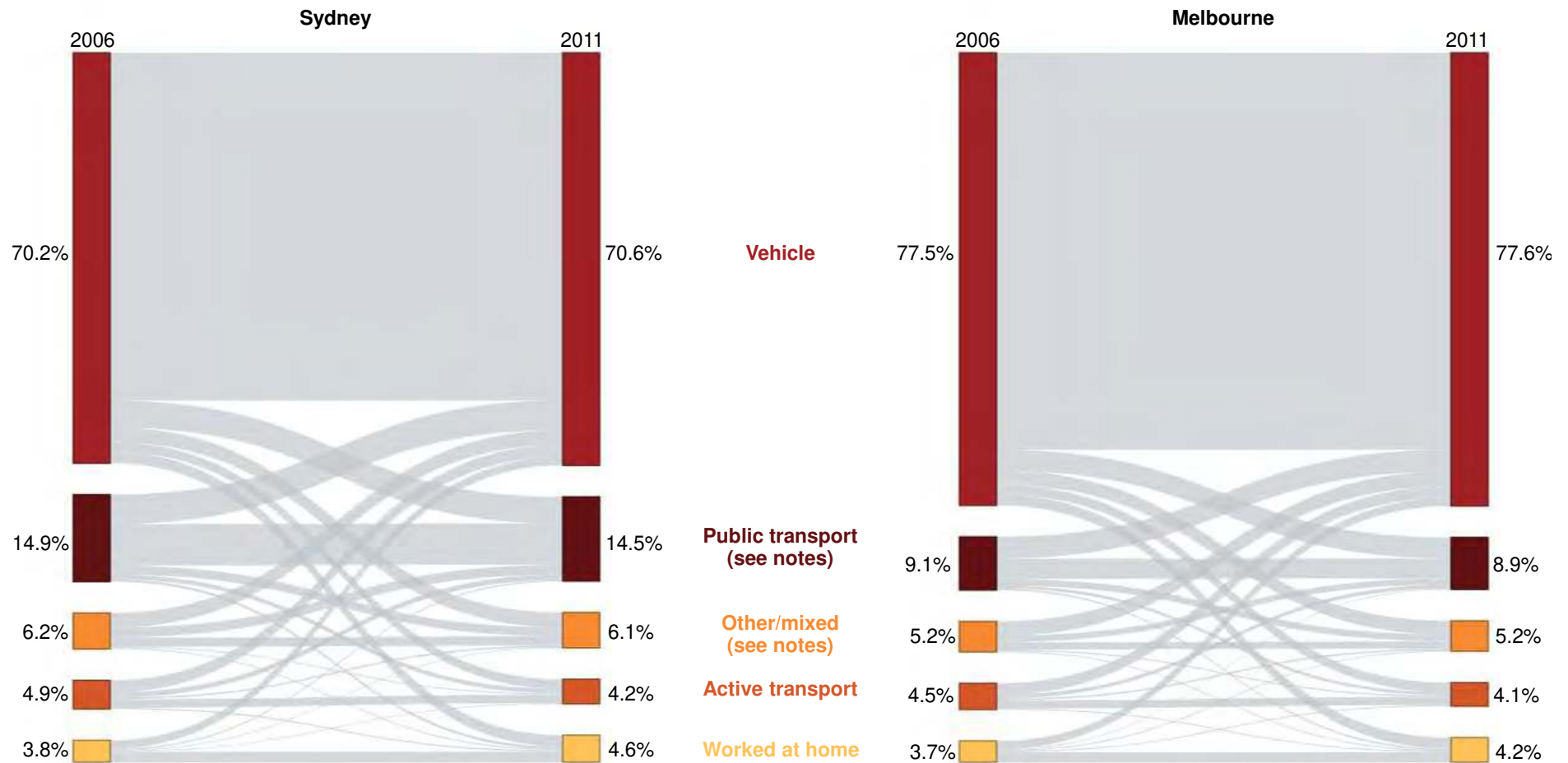**Figure B.1: Most Australians drive to work**
Each mode of travel's share of total journeys to work
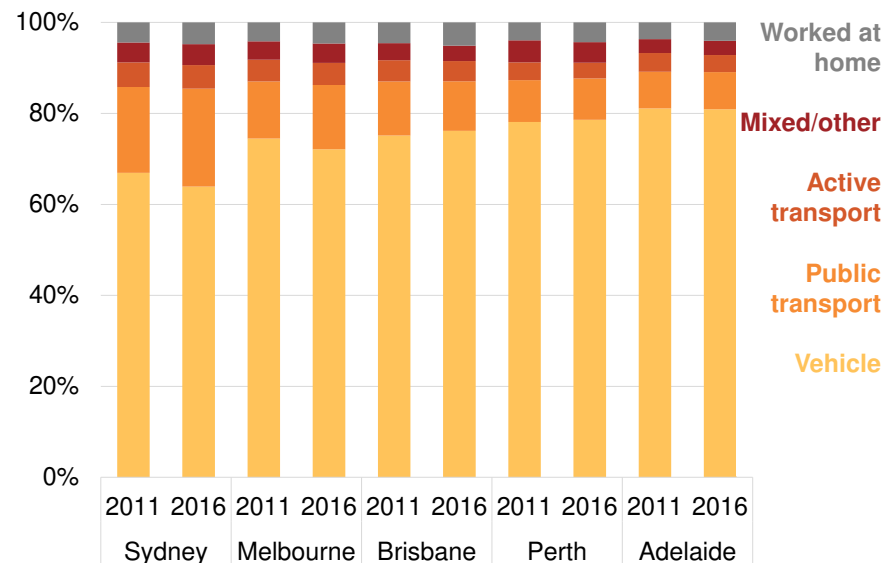
Notes: Based on analysis of ABS Census 2011 and 2016 responses to Method of Travel to Work, for Greater Capital City Statistical Areas. 'Vehicle' includes the categories 'Car, as driver', 'Car, as passenger', 'Truck', 'Taxi' and 'Motorcycle/scooter'. 'Public transport' includes 'Train', 'Bus', 'Tram' and 'Ferry', and any combination of these four methods. 'Active transport' includes 'Walked only' and 'Bicycle'. 'Mixed/other' includes all remaining combinations. The categories 'Not stated', 'Not applicable' and 'Did not go to work' have been excluded.

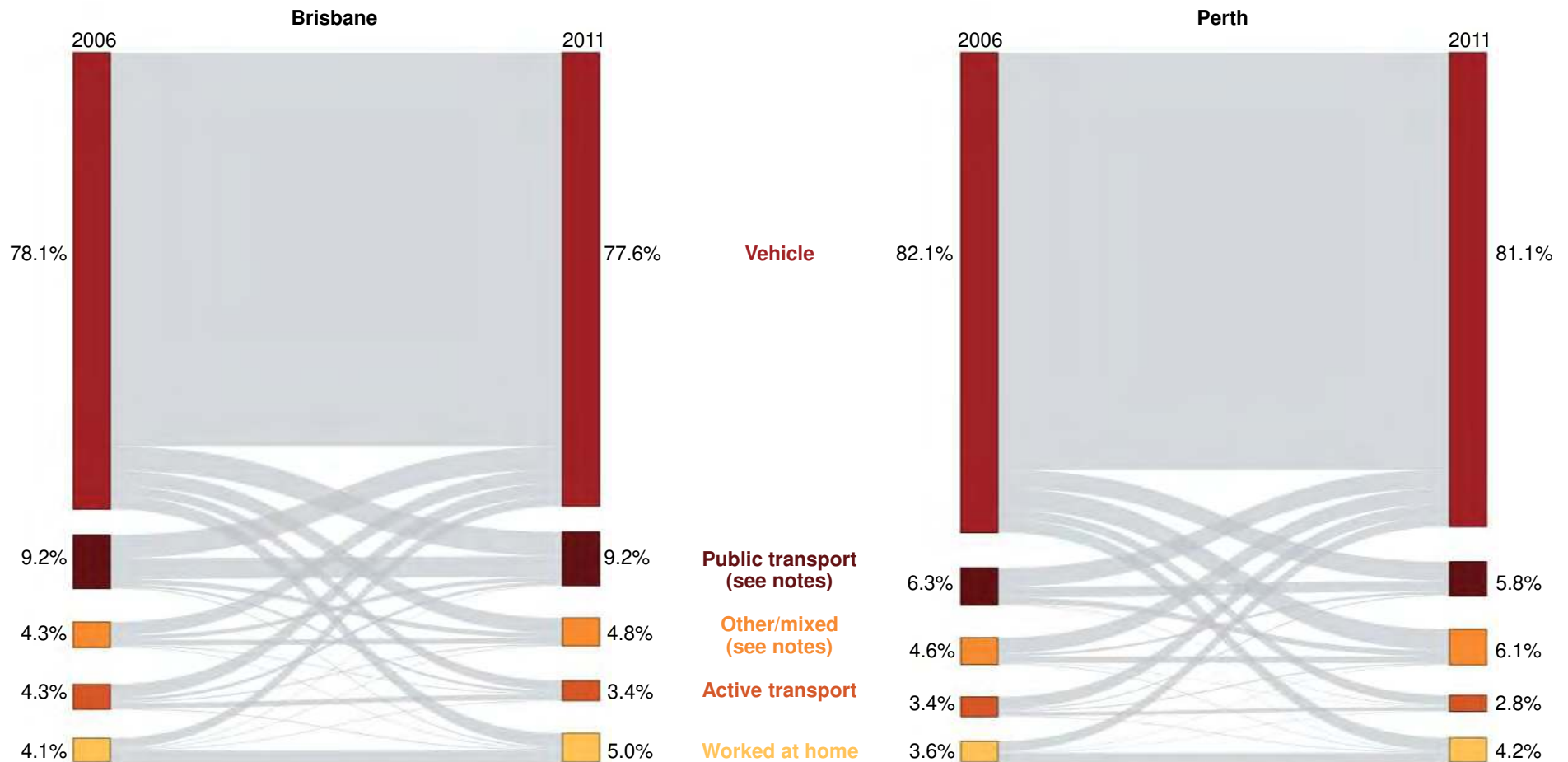*Source: Grattan analysis of ABS (2016a) and ABS (2011a).*

Figure B.2

Sydney — 2006 / 2011

	2006	2011
Vehicle	70.2%	70.6%
Public transport (see notes)	14.9%	14.5%
Other/mixed (see notes)	6.2%	6.1%
Active transport	4.9%	4.2%
Worked at home	3.8%	4.6%

Melbourne — 2006 / 2011

	2006	2011
Vehicle	77.5%	77.6%
Public transport	9.1%	8.9%
Other/mixed	5.2%	5.2%
Active transport	4.5%	4.1%
Worked at home	3.7%	4.2%

Notes: Percentages are based on workers who were employed at Census time in both 2006 and 2011, and who lived in the city in 2011. The 'vehicle' category includes people who travelled to work by car (as a driver or passenger), motorbike or scooter, taxi or truck. The 'public transport' category includes people who travelled to work by bus, ferry, train or tram. 'Active transport' users walked or rode a bicycle to work. 'Other/mixed' includes people who travelled to work in a combination of modes, or another mode. The ACLD does not allow for distinction between commuters who use 'mixed' public transport (e.g. train and bus) and a mix of modes (e.g. car and train). As a result, some commuters who use public transport exclusively will be counted in the 'Other/mixed' category rather than the 'Public transport' category.

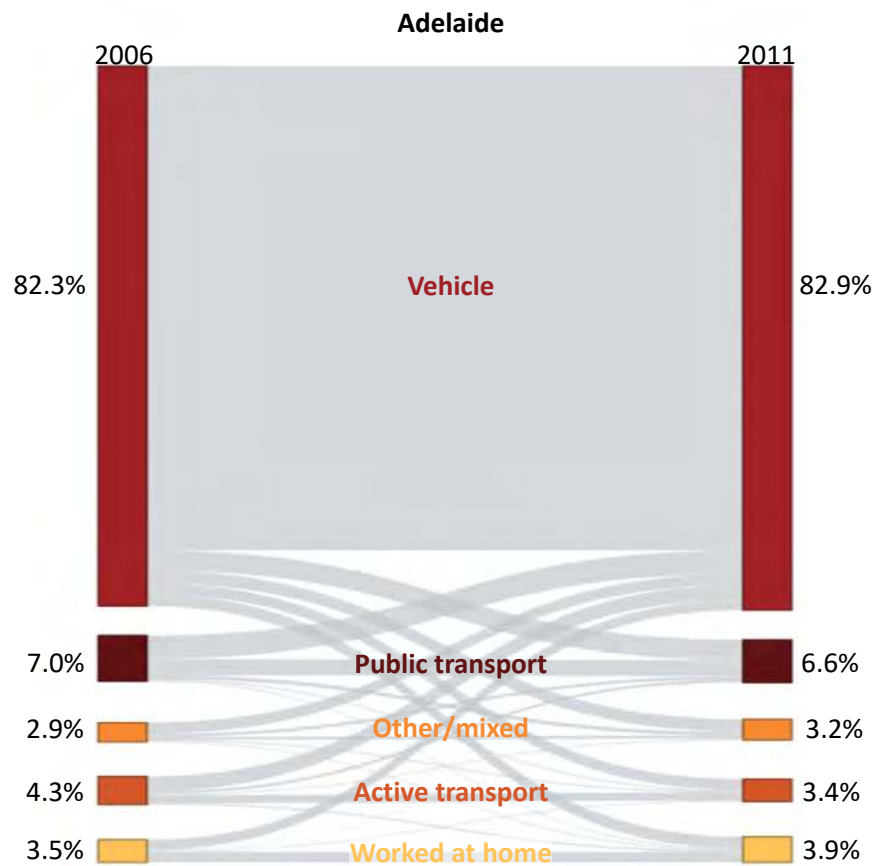Source: Grattan analysis of ABS (2011b).

Figure B.3

Notes: Percentages are based on workers who were employed at Census time in both 2006 and 2011. The 'vehicle' category includes people who travelled to work by car (as a driver or passenger), motorbike or scooter, taxi or truck. The 'public transport' category includes people who travelled to work by bus, ferry, train or tram. 'Active transport' users walked or rode a bicycle to work. 'Other/mixed' includes people who travelled to work in a combination of modes, or another mode. The ACLD does not allow for distinction between commuters who use 'mixed' public transport (e.g. train and bus) and a mix of modes (e.g. car and train). As a result, some commuters who use public transport exclusively will be counted in the 'Other/mixed' category rather than the 'Public transport' category.

Source: Grattan analysis of ABS (2011b).

Figure B.4

Adelaide

2006   2011

82.3%   **Vehicle**   82.9%

7.0%   **Public transport**   6.6%

2.9%   **Other/mixed**   3.2%

4.3%   **Active transport**   3.4%

3.5%   **Worked at home**   3.9%

Notes: *These figures have been calculated in the same way as Figure B.2.*

Source: *Grattan analysis of ABS (2011b).*

B.3   Quintiles of total jobs in major capitals

This section provides additional information about Figure 2.2, the presentation of quintiles of total jobs in major capitals.

Figure B.5 shows the geographic area of Sydney and Melbourne broken into 5 parts, each containing 20 per cent of the city's jobs.

Figure B.6 presents the same for Brisbane, Perth and Adelaide.

Figure B.7 shows the distribution of jobs by distance from the city centre in 2011 and 2016 in Sydney and Melbourne.

Figure B.5: Each ring contains close to 20 per cent of the total city jobs in 2016
Quintiles of jobs in 2016, by distance from city centre – Sydney and Melbourne

Sydney

Melbourne

20 km

20 km
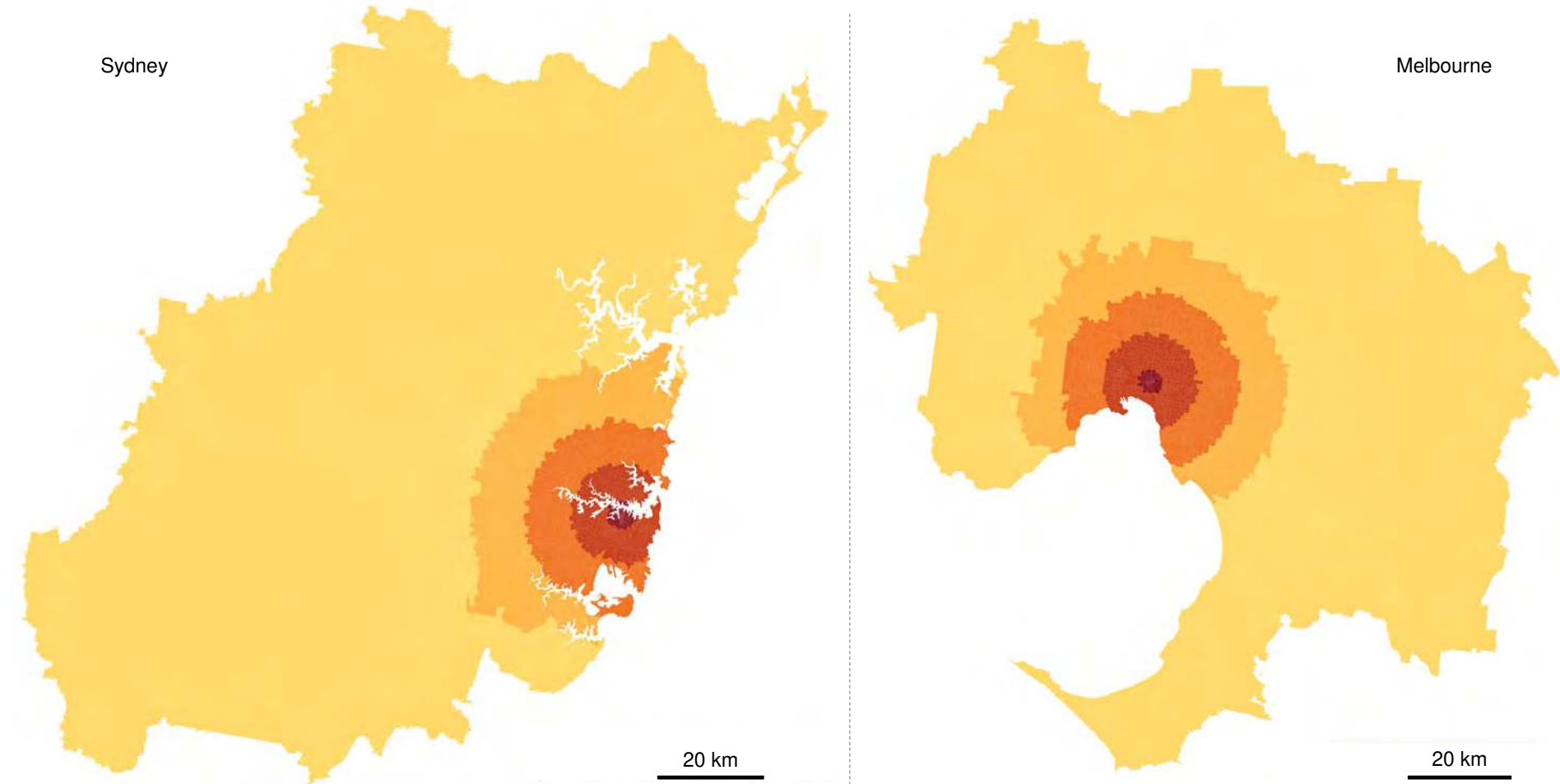
Note: The percentage of jobs in each ring is within 0.3 percentage points of 20 per cent.
*Source: Grattan analysis of ABS Census: ABS (2016a).*

Figure B.6: Each ring contains close to 20 per cent of the total city jobs in 2016
Quintiles of jobs in 2016, by distance from city centre – Brisbane, Perth and Adelaide

Note: The percentage of jobs in each ring is within 0.3 percentage points of 20 per cent for Brisbane, and within 0.8 percentage points for Perth and Adelaide.

Source: Grattan analysis of ABS Census: ABS (2016a).

Figure B.7: The location of jobs in Sydney and Melbourne in 2016 was similar to 2011
Share of employment (per cent) by distance from city centre (kilometres)
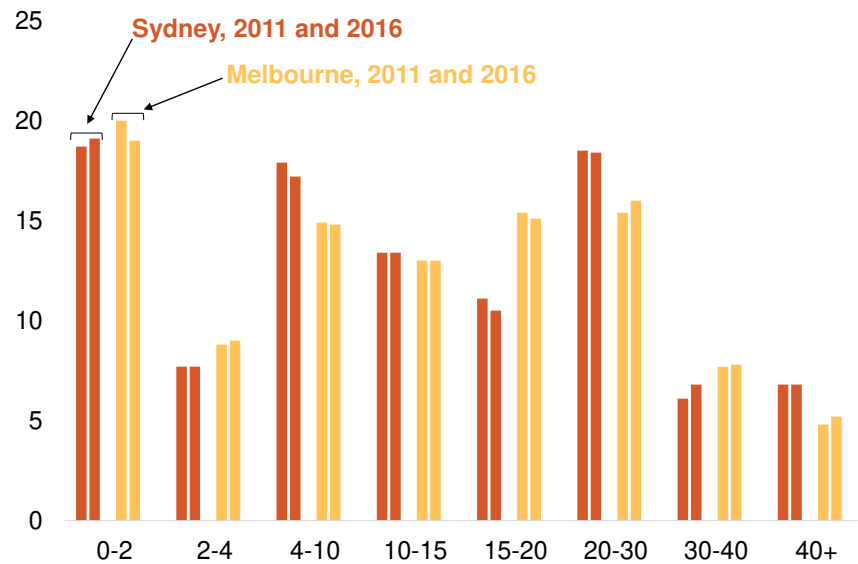
Source: Grattan analysis of Loader (2018).

B.4 Net job gain across Sydney and Melbourne

This section provides additional information about Figure 2.5, illustrating the number of new jobs rather than the growth rate.

Figure B.8: In Sydney and Melbourne, new jobs are concentrated in the city centre and selected outer regions; Brisbane's city centre is shrinking
Net jobs growth, 2011 to 2016
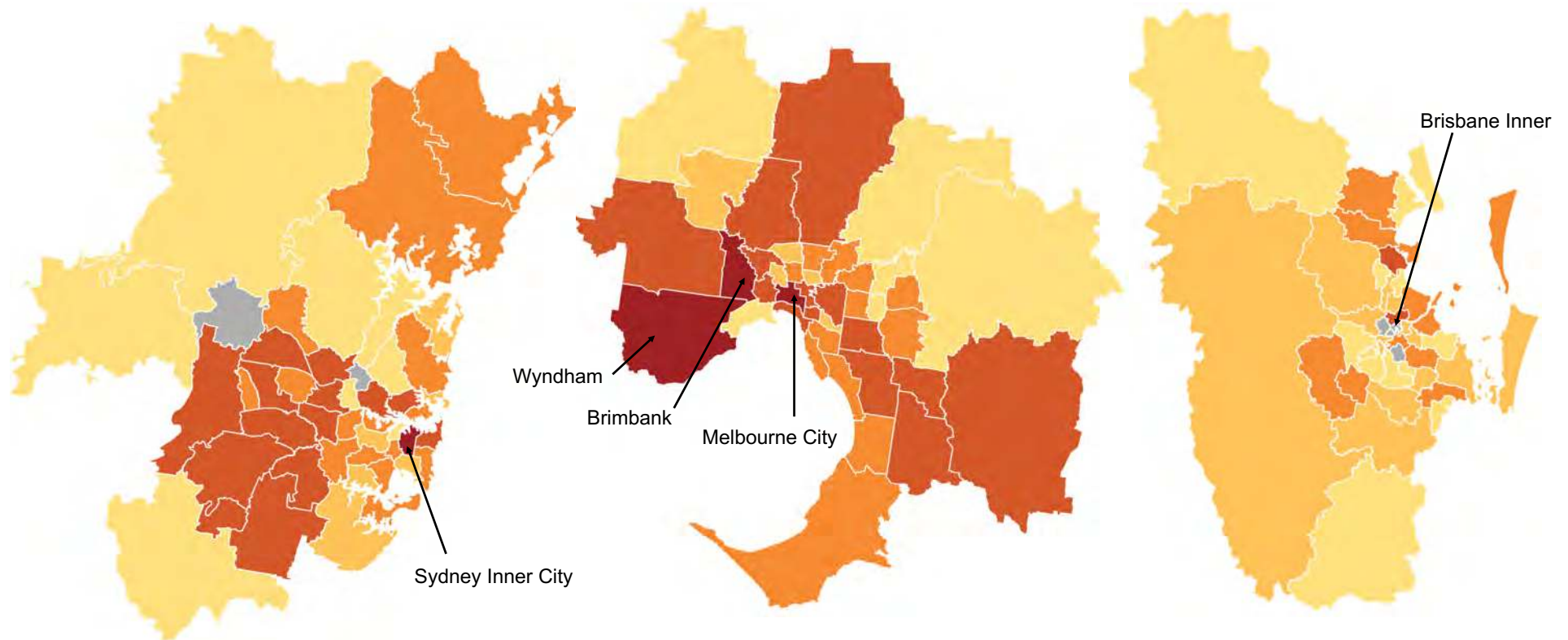
Negative growth
0-1,000
1,000-2,000
2,000-4,000
4,000-10,000
Over 10,000

Notes: The 'Sydney Inner City' SA3 grew by 66,800 jobs. The 'Melbourne City' SA3 grew by 48,500 jobs, Brimbank grew by 10,200 jobs and Wyndham by 16,600 jobs. This map shows that the fast fringe growth of Figure 2.5 is not just the result of a low base in 2011. The 'Blue Mountains' SA3 region in Greater Sydney has been omitted due to very low sample size (it contained just 16 jobs in 2016, up from 5 jobs in 2011).

Source: Grattan analysis of ABS (2016a) and ABS (2011a).

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