Improved public transport services supporting city productivity growth: an Australian city case study
Policy Paper 9
Improved public transport services supporting city productivity growth: an Australian city case study

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Abstract

Australian cities are generally pursuing more compact settlement patterns based on a polycentric growth pattern.

This Paper explores the opportunities to use urban structure to promote productivity growth, examining the contribution of population and employment density and travel times. There is a particular focus on how improved public transport services can support productivity growth in our cities. An Australian city case study is presented that underlines the need for land use transport integration in our inner/middle suburbs to enhance the sustainability and productivity growth of our cities. The Paper supports the arguments presented in BIC’s previous Policy Papers 4 (the 20 minute neighbourhood) and 5 (the vital role of Australia’s forgotten inner/middle suburbs).

A major part of this Paper, is a Melbourne case study of six high-tech/knowledge-based clusters (National Employment and Innovation Clusters), chosen to support productivity growth and wide access to the benefits there-from. An analysis of the six clusters is provided, examining productivity and travel time performance and looking at how density and travel times might support future cluster productivity. Public transport catchment travel times are shown to be an important driver of productivity outcomes, underlining the importance of good Public Transport (PT) service provision for cluster development.
Foreword

This research Policy Paper is part of a policy series of publications aimed at decision and policy makers, academics and students.

This Policy Series focuses on land transport, land use, integrated planning and urban development challenges in Australia.

The Policy Series has been developed by the Bus Industry Confederation (BIC) of Australia and the Institute of Transport and Logistics Studies, Business School, University of Sydney, and addresses specific subject matters and issues raised in the BIC's previous reports: “Moving People - Solutions for a Growing Australia” and “Moving People - Solutions for a Liveable Australia.” Both publications are available at www.ozebus.com.au.

Acknowledgements

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Contents

Abstract 1
Foreword 2
Acknowledgements 2
1. Context 4
2. Urban economic productivity 6
   2.1 International evidence 6
   2.2 The 12 “rules” of economic development for Australian cities 6
3. Job numbers and productivity growth - the relationship with land use transport integration 8
   3.1 Melbourne’s ‘National Employment and Innovation Clusters’ 8
   3.2 Influence of transport infrastructure on NEIC catchments in Melbourne 11
   3.3 Morning peak travel times to Melbourne’s NEICs 12
4. The transport/productivity connection 14
   4.1 Impact of transport improvements to encourage productivity growth across Melbourne 14
   4.2 A ‘base case’ for analysis of options to improve NEIC productivity in Melbourne 16
5. Land use transport infrastructure improvement options 18
   5.1 Accessibility improvements through reducing AM peak travel times 18
   5.2 Increased residential and employment densities 18
6. Case Study Conclusions 19
References 20

Figures

Figure 1: Location of NEICs as defined by SA2 data 9
Figure 2: Catchment productivity versus GRP in 2011 10
Figure 3: Catchment productivity growth 2001-11, versus catchment productivity in 2001 10
Figure 4: Cumulative travel time curves for NEIC AM peak trips by car (proportion of trips) 13
Figure 5: Cumulative travel time curves for NEIC AM peak trips by PT (proportion of trips) 13

Tables

Table 1: NEIC performance indicators 9
Table 2: Descriptive data for Melbourne 2011 SA2 productivity analysis 15
Table 3: SA2 productivity model, based on travel catchment analysis 15
Table 4: SA2 productivity growth and public transport 15
Table 5: Projected base case AM peak trip volumes to NEICs and mode shares: 2011 and 2031 17
Table 6: Estimated impact of ‘scale/density’ and travel time changes on NEIC economic outcomes to 2031 17
Table 7: Impacts of a six per cent improvement in NEIC AM peak catchment travel times between 2011 and 2031 18
1. Context

Australia's major cities are pursuing broadly similar land use development directions, aimed at increasing economic productivity and social inclusion and reducing their environmental footprints. Most cities globally pursue similar broad goals. To a greater or lesser extent, mainly related to city size, Australia's major cities are doing this by pursuing more compact urban settlement patterns, based on a polycentric development pattern. In the case of Melbourne, for example, the emerging urban structure of this city of 4.5 million people, growing at nearly 2 per cent annually at present, is anchored by:

- the central area and close surrounds (called the Central Business District (CBD) hereafter), because of the wider economic benefits (in production and consumption) that flow therefrom (drawing, for example, on work by Graham 2007)
- a small number of high-technology/knowledge-based inner/middle urban activity clusters, which form the basis for a polycentric city and focal points for inner/middle urban growth. These clusters are called National Employment and Innovation Clusters (NEICs) in Melbourne because of their regional export orientation. They form a new element in the city's land use transport plan, Plan Melbourne (DTPLI 2014) and its recent update Plan Melbourne 2017–2050 (DELWP 2017). The basic idea is the pursuit of agglomeration economies in a small number of areas within the metropolitan area, additional to the CBD
- major public transport corridors, including corridors that join the major clusters to the CBD, to each other and/or to major residential areas. These strategic transit corridors are a focus for growth in jobs and housing, building on Vancouver's successful approach (Burchfield and Kramer 2015)
- major urban renewal areas (e.g. in locations that have lost large numbers of manufacturing jobs)
- supportive mixed use activity centres, that mainly provide a sub-regional population-serving role
- a series of constituent 20 minute neighbourhoods (intended to provide access opportunities to most, but not all, things needed for a good life, within 20 minutes by foot, bicycle or on public transport – see BIC's Moving People Policy Paper 4, 2015 for more detail).

This land use development direction is similar to that being pursued by many cities globally, building on work (for example) by Ewing and Cervero (2010), although the Melbourne focus on seeking to promote growth of high-technology/knowledge-based inner/middle urban clusters is not common. Its Melbourne origins are outlined in Section 2.

Supportive transport development directions are an essential part of delivering these land use directions, broadly along the following lines (Stanley et al., 2017; ACOLA 2015; Stanley and Brain 2015):

- ensuring strong radial public transport to the central area, to support agglomeration economies
- good arterial roads across the entire city, supporting radial and circumferential movement of people and goods
- fast and frequent trunk radial and circumferential public transport services to support inner/middle urban nodes/corridors
- better public transport connections from outer suburbs, where much population growth continues to be concentrated, to areas of employment/activity concentration (recognising that job creation in Australian outer suburbs is very difficult to accomplish at anything greater than about 300 jobs per 1000 population, much less than is needed to provide local jobs for all who want them)
- supportive local public transport opportunities, which is hardest in low density outer metropolitan settings and
- priority to walking and cycling throughout the whole city.

The basis for designating a small number of high-tech/knowledge-based inner/middle urban activity clusters (NEICs) was established in research undertaken by two of the authors (from NIEIR) for the Ministerial Advisory Committee, which advised the Victorian Planning Minister on Plan Melbourne. The third and coordinating author is a member of that Committee. High-tech/knowledge-based industries are those that create, design or utilize complex technologies embodied in capital equipment (such as advanced electronics, computing, robotics or pharmaceuticals) and/or utilize high level skills, with high-tech/knowledge-based service industries employing a high proportion of professionally skilled people (e.g. financial services, engineering,
architecture, software development, tertiary education, health services). Such activities accounted for a major proportion of the economic growth in Melbourne (and Sydney) over recent decades (as summarised in Section 2.2, point (v)). In spatial terms, these jobs have been tending to centralise within Australia’s cities such as Melbourne, Sydney and Brisbane, while residential growth has remained strong on the urban fringe, where jobs are relatively scarce. The productivity differential between the inner city and urban fringe is substantial and has widened over the past two decades.

Promoting development of a small number of middle urban high-tech/knowledge-based clusters, as key elements in a polycentric urban development pattern, was seen as an opportunity to jointly pursue two of Melbourne’s urban planning goals:

1. promoting growth in the productivity of the Melbourne metropolitan area overall and
2. enabling the benefits of this growth to be shared more widely among residents, including residents of the fast growing outer suburbs.

The focus of the current Paper is on the productivity dimension. Successful delivery is also expected to contribute to a lower environmental footprint, such as flow-on benefits from slowing Melbourne's continuing urban sprawl.

The idea of the polycentric city as a model for urban development has been around for some time and been a major urban development focus for many European cities since about the 1980s (Metrex 2010). Mori (2017) points out that the first modelling work on a polycentric city was developed by Fujita and Ogawa (1982), about two decades after Alonso (1964), Mills (1967, 1972) and Muth (1969) had pioneered formal modelling of urban spatial structure with the monocentric city. In Australia, Sydney led the planning focus on a polycentric urban structure with its City of Cities approach (DoP 2005). Australian delivery, however, has not been strong and the basis of the case for an Australian polycentric model, thus far, has not been explicitly linked to productivity growth in non-CBD based high-tech/ knowledge-based clusters but rather to developing and providing more general higher order commercial/retail activity centres. Plan Melbourne (DTPLI 2014) and its recent update Plan Melbourne 2017-2050 (DELWP 2017) has shifted the focus to the opportunity to use urban structure to promote productivity growth and better sharing of its benefits.

The emergence of a polycentric urban structure is generally understood as reflecting, inter alia, competing influences of agglomeration economies and transport costs/congestion. The current Paper seeks to explore the roles that increased population and employment densities and improved travel times might play in supporting successful development of a more polycentric Melbourne in coming years, by facilitating growth of high productivity middle-urban activity nodes (the NEICs). In particular, the intent is to identify how density and travel times support urban productivity growth, with a particular focus on the role that public transport service improvements might play in supporting productivity growth.

Section 2 summarises some international evidence on urban productivity and links to polycentric urban structure. It also sets out the key research findings from which the Melbourne strategic land use transport planning focus on non-central clusters was derived, which have been distilled as ‘rules’ of Australian capital city economic development.

Section 3 describes some characteristics of the Melbourne NEICs, with a particular focus on AM peak travel times and catchment scales and productivity.

Section 4 describes modelling undertaken on the relationship between transport and urban productivity across Melbourne. This modelling is used in Section 5 to explore the way density and travel time affect economic performance, with a particular focus on the importance of public transport for cluster productivity and growth therein. Section 6 presents the Paper’s conclusions.
2. Urban economic productivity

2.1 International evidence

An extensive body of research has emerged over the past three decades on cities and productivity growth. Melbourne's strategic land use development directions for NEICs drew on this research, which builds on ideas that extend back to Marshall (1890) and even Adam Smith (1776). The origins of such productivity gains have been understood for some time (see, for example, Puga 2010). They include sources such as improved access to inter-industry information flows (information spillovers), thick labour markets, better access to specialized services (for example, legal services, design and testing, financial services) and to locally transmitted ideas, together with improved access to public infrastructure. Economies of scale may also accrue to individual firms.

Productivity increases of 3-8 per cent from doubling city size (Rosenthal and Strange 2004) and 4.5-6 percent from doubling employment density (Ciccone and Hall 1996; Ciccone 2002) are widely cited. Ciccone and Hall (1996) suggest that density is more important than size for determining urban productivity advantages, which is important for thinking about the possible role of urban clusters. The meta-analysis by Melo et al. (2009), drawing on 729 elasticity estimates from 34 studies, suggests a mean elasticity value of 6% across all its reviewed studies. More recent research has tended to lower the elasticity range somewhat, as issues such as firm selection and sorting have been recognised. Behrens et al. (2014) suggest that, at the top end of the range for productivity gain, about 5 percentage points is due to agglomeration per se. Relative output increases in service industries, including knowledge-intensive industries, many of which tend to concentrate in CBDs and other urban hubs, are typically at the high end of the elasticity range. Melo et al. (2009) for example, report an elasticity of urban agglomeration for service industries of about 8 percentage points. Abel et al. (2012) find that doubling a metropolitan area's density increases productivity by 2-4 per cent and that the effect is strongest in cities with a higher density of human capital, as is found in knowledge-intensive sectors.

A much smaller research base explores productivity in a polycentric urban setting, with much of this research being on the productivity benefits of networked centres within a polycentric regional setting (individual cities within a region ‘borrowing’ from each other’s sizes to capture some scale benefits, sometimes described as network economies (Boix and Trullén 2007)), rather than on productivity performance within a polycentric city or metropolitan area. Meijers and Burger (2010), for example, note the urgent need for more research on how monocentricity, compared to polycentricity, affects metropolitan performance. They suggest, however, that polycentricity can enhance labour productivity.

Focusing on intra-metropolitan structure, the general expectation is that a polycentric city shape may confer some of the benefits of agglomeration but with a lesser degree of the external costs associated with a high level of monocentricity, such as congestion, air pollution and noise. Support for the idea that non-CBD clusters may produce agglomeration economies is found in the work of Kohalase and Xi (2007), from their research on Houston. Within a polycentric Houston, they identified agglomeration benefits in two broad industry groupings: finance, insurance and real estate; and services. Building on this, in terms of the present study, support for the idea that improved (fast) public transport can promote suburban sub-centre employment growth has been provided by Garcia-Lopez et al (2016), from researching the Paris growth experience between 1968 and 2010. Metrex (2010), however, recognizes potential risks of a net loss of agglomeration economies city-wide from a polycentric structure, as compared to a more monocentric structure, if growth in industry sectors with high agglomerative potential is diverted from the centre to less productive non-central clusters.

2.2 The 12 “rules” of economic development for Australian cities

Building on such international evidence, economic research by NIEIR underpinning Melbourne’s new strategic land use transport plan (DTPLI 2014) focused on high-tech/ knowledge-based activities and how they might be a focus for increasing urban productivity in Melbourne. The Melbourne research was subsequently replicated by NIEIR for Sydney and Brisbane, with strikingly similar results, leading to the formulation of what might be thought of twelve ‘rules of economic development’ for current Australian capital cities (ACOLA 2015; Stanley and Brain 2015).

The 12 “Rules”

1. Spatial inequality. In the absence of intervention, there is a tendency for increasing inequality between regions within a city, especially between fringe regions and regions closer to the centre. The productivity gap between inner and outer urban parts of Melbourne and Sydney, for example, widened over the period from 1992 to 2010, primarily due to the much stronger growth in central/inner area output from high-tech/knowledge-based businesses. Without strong policy intervention, increasing spatial inequality is expected, with the general rule being that the greater the distance a sub-region is from the central city, the greater the increase in inequality.

2. A region's household income is directly related to level of economic activity. The greater the level of economic activity located within a region's catchment, the greater the economic benefit to residents within the catchment. In other words, the level of income received by a region's households from work is determined by the level of economic activity generated in the region's catchment (as determined by acceptable travel times).

3. Cumulative regional investment (the capital stock per capita installed in a region) is a core factor that determines the level of economic activity. Econometric analysis shows a strong relationship between construction capital stock installed in a local government area’s (LGAs) catchment and the LGA catchment level of economic activity1.

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1 Melbourne has 31 LGAs.
4. **The scale of the metropolitan region**, measured by population size or by the scale of labour market/economic catchment of individual sub-regions (as determined by travel times), is a key driver of productivity and of the ability of residents to capture hours of work. This reflects agglomeration economies.

5. **Identify the successful industries driving economic growth.** Some industries are more important and effective, per $1m value-added, in driving regional economic development than others. In 1992 the share of high-tech/knowledge-based industry value added at factor cost, in total of all industry value added, was 34 per cent for Melbourne. This share had increased to 41 per cent by 2012, high-tech/knowledge-based industry directly explaining about 46 per cent of total Melbourne industry growth (excluding dwelling surplus) between 1992 and 2012, with this share increasing to over 60 per cent allowing for modest multiplier impacts.

6. **Regional clustering of organisations.** Due to the importance of economies of scale and scope and the indirect benefits that can be captured from innovation by others, high-tech/knowledge-based organisations want to cluster together, either in the central region or in regions not too far from the central region. Thus productivity, measured as Gross Regional Product (GRP) per hour worked, declines as distance from the Central Business District of Melbourne increases. Sydney’s pattern is very similar but with typical productivity levels a little higher than for Melbourne throughout the distance range from the centre.

7. **Employment opportunities.** An important reason for outer fringe regions having poor economic outcomes, in terms of hours of work available per working age resident and/or dollars earned per hour of work, is a lack of high-tech/knowledge-based employment opportunities within their labour market catchments.

8. **Catchment diversity.** A strategy to improve the economic performance of outer regions is to enhance and expand high value added employment precincts within commuting range of these regions (i.e. the National Employment and Innovation Clusters), and/or increase catchment diversity, by reducing travel times and/or increasing catchment population densities (especially in those catchments with the best characteristics in terms of scale and high-technology industry activity).

9. **Expansion of existing or developing clusters not redistribution.** The enhancement of high-tech/knowledge-based industry capacity further away from the central area should not come by redistributing activity away from existing or developing precincts (recognising the risks noted by Metrex 2010). Compared to major cities overseas, the existing high-tech/knowledge-based clusters found in Australian cities are of a relatively small scale. It is therefore important that existing clusters, including the central region, are also encouraged to expand.

10. **Skilled jobs.** The skills of households within a region’s catchment are core drivers of the region’s economic performance. This is particularly the case for high-tech/knowledge-based industry activity.

11. **High-tech/knowledge-based industries require sustained innovation to be competitive.** These industries will prefer to locate where there is strong knowledge-creation infrastructure within a region's catchment. There is a high correlation between high-tech/knowledge-based industry concentration and the availability of tertiary education, advanced health and advanced business services. Given the validity of this Rule, resource allocation decisions about location of knowledge-creation infrastructure (e.g. where universities, hospitals, research institutions are placed and their rate of expansion) can help facilitate the concentration of high-tech/knowledge-based industry activity within a region and therefore determine which regions will have superior economic performance outcomes.

12. **Location of high-tech/knowledge-based industry within the catchment area of skilled households.** Skilled households locate in regions where strong cultural and community infrastructure is available within the region’s catchment. The thesis is that high-tech/knowledge-based industry has to locate within the catchment of where high-skilled households want to reside. There is a strong correlation between community and cultural services availability and the regional concentration of skilled households. This correlation suggests that instruments of metropolitan land use plan implementation, to the extent that they influence the distribution of community (health, education) and cultural (entertainment, recreation) infrastructure/services, can also influence the location and scale of high-tech/knowledge-based industries.
3. Job numbers and productivity growth - the relationship with land use transport integration

3.1 Melbourne’s ‘National Employment and Innovation Clusters’

Figure 1 shows the location of the six high-tech/knowledge-based clusters that have been designated in Plan Melbourne and its update Plan Melbourne 2017-2050, three of which (Parkville, Monash and South Dandenong) are existing clusters and three (Sunshine, La Trobe and Werribee East) are potential future clusters. Melbourne CBD is immediately south of the Parkville cluster.

For the purposes of the current Paper, each NEIC has been aligned with areas categorised as Statistical Area Level 2 (SA2) by the Australian Bureau of Statistics. This is the lowest level of the Australian Statistical Geography Standard structure for which Estimated Resident Population, Health and Vitals and other non-Census ABS data is available. There are 275 SA2s in the Melbourne area. For purposes of the current Paper, Parkville and La Trobe NEICs were each equated with two SA2s, Sunshine with four and Monash, Dandenong South and Werribee East with one each.

Analysis by the Victorian Department of Economic Development, Jobs, Transport and Resources (DEDJTR), using journey to work travel data, suggests that the employment catchment of each NEIC is primarily comprised of the LGA in which the NEIC is located and neighbouring LGAs. Monash NEIC has a relatively large catchment, perhaps reflecting the historically better transport accessibility of that part of Melbourne, in relative terms (e.g. a good grid arterial road system, without fragmentation by river valleys). Conversely, DEDJTR analysis shows that people who work in Inner Melbourne come from a much more widely dispersed set of residential locations, suggesting that Parkville is different to the other NEICs in this regard. The accessibility advantages of the central location of Parkville, compared to the other five clusters, will be a key contributor to this different journey to work pattern.

NEIC Performance Indicators (refer Table 1).

> By way of context, total resident population across the six NEICs in 2011 was almost 150,000, a relatively small 3.6% of Melbourne’s total population.

> Population numbers in the Parkville, Monash, La Trobe and Dandenong South clusters, each grew faster than metro Melbourne overall for the 2001-14 period (26.8 per cent for Melbourne overall), particularly Parkville (+64.6%) and Monash (+42.1%).

> Population growth in East Werribee NEIC was low but was amongst the highest population growth rates in Australia in surrounding areas (not shown in Table 1).

In employment terms, East Werribee (97.7%), Parkville (67.7%) and Sunshine (52.0%) grew much more strongly between 2001 and 2014 than Melbourne as a whole (29.0%), with employment growth in Monash (15.9%) and La Trobe (8.5%) lagging considerably. The divergence between population growth rates and job growth rates in the Monash and La Trobe NEICs, in particular, is of concern in terms of developing a successful NEIC strategy.

> Total job numbers in the six NEICs equalled about 190,000 in 2011, equal to 8.7% of the metropolitan total. Job numbers in Docklands, Melbourne and Southbank, which basically define the CBD, were about twice this total, at about 17.7% of Melbourne’s total job numbers in 2011.

> The jobs/1000 population ratio across all six NEICs was 1290, almost three times larger than the 463 for Melbourne as a whole. However, jobs densities, as measured by this ratio, were even higher in Dandenong South (2364), Parkville (2360) and Monash (2121). The CBD ratio was over 7500. Sunshine NEIC, with a lower ratio of jobs/1000 population to Metropolitan Melbourne as a whole, is relatively short of current jobs within the cluster, compared to population numbers.2

> In terms of having a strong employment presence in high-tech/knowledge-based activities (shortened to the words ‘high-tech’ in Table 1), Parkville (55.9 per cent of cluster jobs) and Monash (44.5 per cent) stand out. Dandenong South has a lower share in this category, at 25.8 per cent, but this share still accounts for over 18,000 jobs. These data underline the importance of the three existing clusters within the set of six.

2 Arguably jobs/population ratios should be calculated for wider catchments than the NEIC SA2s, recognizing labour market catchments. The numbers are only presented as a first order measure of relative scale.
Table 1: NEIC performance indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Monash (1 SA2)</th>
<th>Parkville (2 SA2s)</th>
<th>Dandenong South (1 SA2)</th>
<th>Sunshine (4 SA2s)</th>
<th>East Werribee (1 SA2)</th>
<th>La Trobe (2 SA2s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NEIC Population</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; in 2011</td>
<td>18319</td>
<td>19802</td>
<td>26826</td>
<td>43859</td>
<td>10966</td>
<td>25993</td>
</tr>
<tr>
<td>&gt; in 2014</td>
<td>20237</td>
<td>24462</td>
<td>29859</td>
<td>46276</td>
<td>11639</td>
<td>26107</td>
</tr>
<tr>
<td>&gt; growth 2001-14 (%)</td>
<td>42.1</td>
<td>64.6</td>
<td>32.7</td>
<td>9.9</td>
<td>19.4</td>
<td>34.7</td>
</tr>
<tr>
<td><strong>NEIC Employment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; in 2011</td>
<td>37025</td>
<td>46733</td>
<td>63436</td>
<td>17168</td>
<td>8795</td>
<td>14902</td>
</tr>
<tr>
<td>&gt; in 2014</td>
<td>37889</td>
<td>49691</td>
<td>70806</td>
<td>20692</td>
<td>10856</td>
<td>15162</td>
</tr>
<tr>
<td>&gt; growth 2001-14 (%)</td>
<td>15.9</td>
<td>67.7</td>
<td>23.7</td>
<td>52.0</td>
<td>97.7</td>
<td>8.5</td>
</tr>
<tr>
<td>&gt; ‘high-tech’ in 2014</td>
<td>16869</td>
<td>27780</td>
<td>18301</td>
<td>4165</td>
<td>1929</td>
<td>5003</td>
</tr>
<tr>
<td>&gt; ‘medium tech’ in 2014</td>
<td>12179</td>
<td>11405</td>
<td>28309</td>
<td>9087</td>
<td>4241</td>
<td>6290</td>
</tr>
<tr>
<td>&gt; ‘low tech’ in 2014</td>
<td>8840</td>
<td>10507</td>
<td>24195</td>
<td>7440</td>
<td>4685</td>
<td>3869</td>
</tr>
<tr>
<td>&gt; Jobs/1000 pop. 2011</td>
<td>2021</td>
<td>2360</td>
<td>2364</td>
<td>392</td>
<td>2626</td>
<td>673</td>
</tr>
<tr>
<td><strong>NEIC (SLAs only) Productivity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; in 2014 (GRP/hr)</td>
<td>57.3</td>
<td>60.8</td>
<td>51.4</td>
<td>52.9</td>
<td>58.2</td>
<td>52.5</td>
</tr>
<tr>
<td>&gt; growth 2001-14 (%)</td>
<td>19.5</td>
<td>20.9</td>
<td>13.4</td>
<td>18.3</td>
<td>24.7</td>
<td>17.7</td>
</tr>
</tbody>
</table>

Source: NIEIR data bank.
Figure 2: Catchment productivity versus GRP in 2011

Source: Authors’ analysis.

Figure 3: Catchment productivity growth 2001-11, versus catchment productivity in 2001

Source: Authors’ analysis.
3.2 Influence of transport infrastructure on NEIC catchments in Melbourne

A key purpose of this Paper is to gain insight into how transport infrastructure investments, in particular, would impact the spatial pattern of industry activity across Melbourne.

This requires, inter alia, estimates of productivity at SA2 level. NEIC productivity data (measured as GRP at factor cost per hour worked) was estimated on two bases:

1. for the SA2s that are being used to represent each NEIC, as shown in Table 1; and
2. for each NEIC catchment, defined by road and public transport travel times and respective trip numbers (weighted) for 2011, as shown in Figure 2. These catchments were defined from morning peak journeys, which are mainly work and educational trips. The core data base consisted of:

a. peak car and public transport trips and associated travel times for 2011 between SA2 regions (supplied by Infrastructure Victoria); Morning (AM) peak travel data was used because it was seen as the best single indicator of (NEIC) labour catchments, important for both the productivity and equity goals for the NEICs; and
b. gross product generated within each SA2 boundary by 86 2-digit ANZSIC industries along with estimates for total hours worked within each SA2. These estimates were prepared by NIEIR. The estimates are available quarterly, however, the only data used were for the Census benchmark years of 2001, 2011 and estimates for 2015.

Areas (SA2s) that are more distant from an NEIC can generally be expected to be of less significance in terms of forming a part of that NEICs labour catchment, than closer areas. Travel times were used in this analysis to derive “decay” coefficients, for defining the catchment for a given area (e.g. NEIC or LGA). Catchment GRP (gross regional product), for a given SA2, is defined in equation [1].

The $d_{ij}$ co-efficient values range between 0 and 1 and are weighted values, where the weights for any SA2 are based on car and public transport travel volumes between that SA2 and its various catchment SA2s. For car travel, the $d_{ij}$ values for each SA2 were estimated from AM peak trip-travel time data. After 90 per cent of the trips into an SA2 had been accounted from all other SA2s, the $d_{ij}$ was assigned a value of 0.

For public transport, access/egress and waiting time accounts for a significant proportion of trip time, additional to in-vehicle time, and many trips are ‘forced’, in the sense that the traveller has little choice. Based on analysis of NEIC AM peak public transport catchments, as reflected later in Figure 5, a functional catchment in terms of public transport in-vehicle travel times was therefore defined by equation [2].

Using the narrower basis for looking at NEICs first (NEIC SA2s only), Table 1 shows that Parkville and Monash had relatively higher productivity levels and (similar) strong productivity growth rates over the 2001-14 period (at around 20 per cent). The NEICs with a more industrial base (Dandenong South, Sunshine and La Trobe) had lower estimated productivity but the estimated productivity growth rate in Sunshine was close to that of Monash and Parkville. East Werribee had relatively high estimated productivity and good growth therein, but from a low base. The absolute scale of Dandenong South stands out, in terms of jobs, notwithstanding its relatively low estimated productivity and productivity growth rate.

Productivity at a broader catchment level in 2011 shows three of the NEIC catchments with GRP/hour worked valued at over $65/hour and three being below $60/hr (Figure 2). Catchment scale productivity for the three clusters valued at over $65/ hour is noticeably higher than for them as narrowly defined clusters. This effect can be attributed to the wider catchment scale bringing the high productivity central/inner area within the labour catchment and productivity calculation for these particular NEICs.

Dandenong South has the lowest estimated catchment productivity level, by some margin, reflecting economic structure and pressures confronting many manufacturing businesses within the catchment. Taking this point a little further, the data suggests that Parkville and Sunshine had similar productivity levels in 2011 at catchment scale, somewhat unexpected. Closer investigation indicated that the Melbourne SA2 and Docklands only accounted for $44b/$138b of the GRP for the wider Parkville catchment, as defined. Older industrial areas also come within this wider catchment (areas such as Preston, Brunswick, Moonee Ponds and Essendon), which tends to lower the Parkville productivity catchment. Conversely, bringing high productivity inner areas within the Sunshine catchment tends to increase its catchment productivity. The apparent flattening of the data points in Figure 2, at a productivity level of about $65<75 per hour, reflects the preponderance of SA2s in close proximity to Melbourne’s central core. In a sense they define the broad central activity cluster.

Figure 3 shows that the SA2s with higher productivity levels in 2001 tended to have faster rates of productivity growth over the ensuing decade. By implication, if the objective was simply to maximise total urban productivity growth, it would be best to invest in those NEICs that already have relatively higher productivity levels. However, equity suggests spreading opportunities more broadly. Figures 3 and 4 suggest Dandenong South as the NEIC of most concern in a productivity/equity trade-off sense.

**Equation 1:**

\[
\text{GRP}_i = \sum_{j=1}^{279} d_{ij} \times \text{GRP}_j
\]

Where:

- \(\text{GRP}_i\) = the catchment GRP for SA2 \(i\) in $2014 million.
- \(d_{ij}\) = decay co-efficient for SA2 \(i\) for \(j\) catchment.
- \(\text{GRP}_j\) = gross regional product of SA2 \(j\) in $2014 million.

**Equation 2:**

If \(ttij < 45\) minutes, \(d_{ij} = 1\).

If \(ttij > 85\) minutes, \(d_{ij} = 0\).

Otherwise, \(d_{ij} = 1 - (ttij - 45)/40\)

Where:

- \(ttij\) = total travel times between SA2 \(i\) and \(j\) in minutes by public transport.

---

3 Melbourne SA2s, for example, has a productivity measure estimated at $87/hr, considerably higher than the comparable measure for each of the NEICs. Including part of this high productivity level within the catchment of an NEIC, such as Sunshine, has the effect of increasing the relevant estimated NEIC (catchment) productivity.
3.3 Morning peak travel times to Melbourne’s NEICs

Figure 4 shows data on cumulative AM peak (7.00-9.00am) travel times by car to each NEIC, reflecting the car data that was used to calculate the various \(d_{ij}\) values in equation \([1]\) for each NEIC. Curves that are lower and more to the right have relatively longer travel times. It shows that the newest urban centre, East Werribee, has the shortest AM peak travel times, reflecting a more localised catchment for work and school trips in particular (given the data is for the AM peak). This was apparent for the workforce in Figure 1. The more established middle urban clusters to the north (La Trobe) and east (Monash) have larger catchments and longer travel times, reflected for AM peak car travel in Figure 4. Parkville has the longest AM peak car trips (lowest travel time curve in Figure 4), indicating the most extensive catchment. The South Dandenong and Sunshine catchments are more localised than those for La Trobe and Monash but less so than for Werribee East. Figure 4 suggests that the Monash and La Trobe catchments are similar in terms of their AM peak car travel time distributions.

Figure 5 shows AM public transport peak travel times to the NEICs, including access, egress and wait/transfer time components (called access/egress hereafter), also reflecting data that was used to calculate the various \(d_{ij}\) values in equation \([1]\). The access/egress components explain the substantial flat sections in each NEIC’s cumulative AM peak public transport trip time distribution, to the left of the figure, typically at around 30-40 minutes. This is recognised positively in some discussions, as the healthy incidental daily exercise that accompanies public transport use, in contrast to driving. Parkville has the shortest and lowest flat section, indicative of the higher PT frequencies to the central/inner city and dense inner urban PT networks. Trip times by public transport are typically longer by public transport than by car, partly because of the access/egress components. Figure 5 shows that the 90\(^{th}\) percentile for AM peak trips is greater than 100 minutes in all cases by PT, including access/egress stages, while the 50\(^{th}\) percentile is in the 60-80 minutes range. The comparable car times are 15-60 minutes for the 90\(^{th}\) percentile and 10-30 minutes for the 50\(^{th}\) percentile, longer AM peak work trips offset somewhat by shorter trips to educational institutions.

The La Trobe and Monash PT travel time curves in Figure 6 are generally the lowest of the set, indicating that PT access is relatively most difficult for those NEICs. This will be partly a function of relatively large catchments but also reflects less direct longer distance trunk public transport travel opportunities; for example, the (large) universities in each cluster lack direct rail access, usually necessitating transfers between rail and bus if rail is used. These curves suggest public transport improvements should potentially be an important infrastructure focus for these two NEICs: due to planning and delivery times, this will necessarily be bus in the short term but may involve rail (heavy or light) in the longer term. The Sunshine travel time curve, in contrast, sits to the left of the others across much of the time range, suggesting better PT access, consistent with its improved rail hub status, resulting from recent major PT network improvements.

In terms of trips made in the AM peak to the NEICs, the modelled mode share accounted for by public transport is a solid 49.8% for Parkville but falls away very substantially to 10.0% for Monash, 8.6% for La Trobe, 6.5% for Sunshine, 5.7% for Dandenong South and 2.6% for Werribee East. An inescapable conclusion is that public transport in Melbourne has concentrated very heavily on access to/from the CBD and surrounds, with little attention paid to the need for public transport services to support development of middle urban activity centres, which form the basis for a polycentric city.

The low PT mode shares for all NEICs except Parkville draws attention to the major role currently played by cars in serving access needs of NEICs and underlines the importance of good arterial road access being ensured in coming years, including to support improved operation of road-based public transport (which will be central to improving PT access to/from NEICs). However, such support for improved road access should be accomplished in such a way that it does not drive further urban sprawl or generate substantial additional vehicle kilometres of car travel, the external costs of which are widely recognised (see, for example, Duranton and Taylor 2010; Stopher and Stanley 2014).
Figure 4: Cumulative travel time curves for NEIC AM peak trips by car (proportion of trips)

![Cumulative travel time curves for NEIC AM peak trips by car](image1)

Source: Authors' analysis.

Figure 5: Cumulative travel time curves for NEIC AM peak trips by PT (proportion of trips)

![Cumulative travel time curves for NEIC AM peak trips by PT](image2)

Source: Authors' analysis.
4. The transport/productivity connection

4.1 Impact of transport improvements to encourage productivity growth across Melbourne

To provide an understanding of the way transport improvements might contribute to productivity growth across Melbourne, the relationship between the productivity of a given SA2 catchment and the scale of the catchment, as defined in equation [1], was tested. Catchment scale was based on weighted car and PT catchments and the public transport catchment was also included as a stand-alone variable, to test whether this might have any separable influence on NEIC catchment productivity. The model was estimated in log form so that the respective co-efficients are directly interpretable as elasticities. Table 2 sets out SA2 summary data and Table 3 shows the modelling results. The adjusted $R^2$ for the equation was 0.90 and all independent variables are highly significant.

Table 3 shows key elasticity values (the unstandardized B co-efficients) of 0.086 and 0.035 respectively for SA2 catchment productivity with respect to (1) weighted car and PT travel time and (2) PT travel time. In other words, reducing weighted car and PT travel times to an SA2 (or NEIC) by 10% would generally be expected to increase SA2 catchment productivity by 0.86%. Reducing PT travel times in the catchment by 10% would have a separate effect of increasing GRP by 0.35%.

Because of the importance of this model for testing the link between transport and productivity outcomes, it was also estimated using pooled data for 2001, 2011 and 2015 to test for stability. The key coefficient estimates were stable, with the two key elasticity values reducing only marginally, from 0.086 to 0.079 for weighted car and PT travel time and from 0.035 to 0.029 for the PT effect. These values are almost identical to the estimates for the same coefficients found from Sydney SA2 data in other work undertaken by NIEIR, suggesting similar relative productivity responses in each city, from improved catchment travel times.

A key question is, why should the public transport catchment be found to be significant over and above its value in the total GRP catchment variable? One explanation is that it is not simply peak travel times (particularly to work) that are important as productivity drivers, but also intra-day travel times within the catchment.

Recalling the connection between catchment productivity level and subsequent catchment productivity growth, as shown in Figure 3, a further equation was developed to estimate the impact of the increase in productivity from Table 3 on future GRP catchment growth. This equation was evaluated from the data between 2001 and 2011, with productivity growth between 2001 and 2011 expressed as $GRPT_{i} = GRPT_{2011,i} / GRPT_{2001,i}$.

Table 4 sets out the result (adjusted $R^2 = 0.84$). All variables are again in log format, so the co-efficient values can be read as elasticities.

The estimated equation indicates that productivity growth will be higher in an SA2 that starts with higher productivity levels and that has a higher PT share of AM peak trips.

Our interpretation of the PTSi elasticity from Table 4 is that the more diverse the public transport infrastructure is in a given SA2, the more likely businesses within that SA2 catchment will use any increase in productivity to invest the gains to drive future increases in productivity and/or expand their businesses.
Table 2: Descriptive data for Melbourne 2011 SA2 productivity analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Units</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity (Prodi)</td>
<td>$GRP/hr</td>
<td>60.2</td>
<td>7.7</td>
<td>273</td>
</tr>
<tr>
<td>Catchment size all modes (weighted; GRPTi)</td>
<td>$GRPm</td>
<td>39390</td>
<td>29758</td>
<td>273</td>
</tr>
<tr>
<td>Catchment size PT (GRPPTi)</td>
<td>$GRPm</td>
<td>54391</td>
<td>32100</td>
<td>273</td>
</tr>
</tbody>
</table>

Table 3: SA2 productivity model, based on travel catchment analysis

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>2.845</td>
<td>.028</td>
<td>100.417</td>
<td>.000</td>
</tr>
<tr>
<td>Log GRPTi = log $GRP weighted by AM peak car and public transport catchment trips for SA2 i.</td>
<td>.086</td>
<td>.004</td>
<td>.618</td>
<td>20.292</td>
</tr>
<tr>
<td>Log GRPPTi = log $GRP for AM peak public transport catchment for SA2 i.</td>
<td>.035</td>
<td>.003</td>
<td>.304</td>
<td>9.973</td>
</tr>
<tr>
<td>Log OD = log of outlier dummy variable for 2011.4</td>
<td>.115</td>
<td>.005</td>
<td>.490</td>
<td>25.068</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Log of productivity (Log Prod)

Table 4: SA2 productivity growth and public transport

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-.168</td>
<td>.037</td>
<td>-4.475</td>
<td>.000</td>
</tr>
<tr>
<td>Log PROD_{2001,i} = log of productivity in 2001</td>
<td>.093</td>
<td>.009</td>
<td>.320</td>
<td>10.369</td>
</tr>
<tr>
<td>Log PTSi = log of AM peak PT trip share to SA2</td>
<td>.016</td>
<td>.001</td>
<td>.483</td>
<td>15.641</td>
</tr>
<tr>
<td>Log OD = log of outlier dummy variable</td>
<td>.033</td>
<td>.001</td>
<td>.596</td>
<td>24.779</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Log of productivity growth (Log GRPTG)

4 This outlier dummy variable was applied after estimating the equation without dummies and identifying residuals. Where residuals exceeded +/-10%, a dummy of +/-1 was applied, to reflect exogenous influences in the productivity equation, and the model was re-estimated. The re-estimation made little difference to coefficient values.
4.2 A ‘base case’ for analysis of options to improve NEIC productivity in Melbourne

Infrastructure Victoria (2016) sets out a list of projects, particularly major transport projects, that are assumed to be in place in Melbourne by 2031 and the organisation made available projected socio-economic data, origin-destination matrices for AM peak travel and travel times for cars and public transport as at that date, all based at SA2 level. These sources provided the base case for the current analysis. Table 5 sets out some key trip projections that were embedded in the data provided, comparing 2031 and 2011.

Total AM peak trips to each NEIC are projected to increase by between 32.4% (South Dandenong) and 149.5% (East Werribee), these data being one way to look at projected NEIC catchment growth over the period. After East Werribee, which is growing from a small base, the largest relative increases in trip numbers are projected for Monash (58.2%) and La Trobe (50.2%). These projections are relatively modest in terms of NEIC growth potential and arguably the NEICs will need to play a more prominent role in Melbourne’s future growth, to support urban productivity growth and sharing of the benefits thereof, while reducing urban sprawl.

Table 6 shows that AM peak car trips are projected to increase by almost 12,000 to East Werribee, ~7,000 to each of the Monash and South Dandenong NEICs and ~5,000 to each of Sunshine and La Trobe NEICs. This will mean increased congestion levels, particularly for the Monash and East Werribee catchments. AM peak car trips to Parkville are projected to decline slightly (by about 1,000).

Public transport mode shares are projected to increase for AM peak travel to each of the six NEICs, with Parkville projected to increase from the 2011 share of 49.9% to 67.2% in 2031. This increase reflects expected gains flowing from initiatives such as the (under-development) $11 billion Melbourne Metro project, $6 billion level crossing abolition program and high capacity signalling, which add to rail capacity and improve safety, comfort, speeds and reliability. Monash NEIC PT mode share (AM peak) is projected to increase from 10.0% to 17.4% and La Trobe from 8.6% to 14.0% but the PT mode share for AM peak trips to the remaining three NEICs is projected to be around 10% or less, with East Werribee at a very small 3.6%. Apart from Parkville, none of the PT mode shares seems to reflect any sense that substantial NEIC growth will require PT to play a much bigger role in relative terms. The analysis of improvement options below (drawing inter alia on equation (2)), however, suggests that PT plays an important role in supporting stronger catchment productivity growth, a role that suggests seeking to expand its modal share beyond what is implied in the base projections.

NEIR used the models set out above to estimate how density increases between 2011 and 2031, and travel time changes over the same period, as embodied in the base case, might affect NEIC productivity and GRP estimates as at 2031. ‘Density’ here is intended to include the influence of factors that affect the scale of the NEIC, particularly increases in SA2 catchment population and jobs to 2031, as reflected in this analysis through catchment AM trip numbers (provided by Infrastructure Victoria).

To isolate a density effect, travel times were assumed unchanged as NEIC catchment scale increased, travel time impacts being separately modelled. Table 6 summarises the key results. It shows that the increased scale/density that is projected within the NEIC catchments between 2011 and 2031 will support GRP growth of between 38% (Parkville) and 82% (East Werribee, from its smaller base), with Monash, La Trobe and Sunshine all around 50%-+/-. Productivity levels in 2013 (GRP/hr worked) increase by between 6 and 9% across the NEICs due to this scale/density effect. While Parkville has the lowest percentage increase in catchment GRP associated with increased catchment density (38%), this converts to the biggest estimated increase in absolute GRP in 2031 ($4b in $2014 prices), because of catchment scale. The impacts on GRP in 2031 are undiscounted, so could be multiplied by about 10 to give a rough (conservative) present value equivalent at 3% real discount rate, such that GRP gains from density increases are probably valued at about $100b in the Parkville case, nearly $60b for Sunshine and $40-50b for Monash and La Trobe respectively.

Travel speeds by car across Melbourne have been declining by about 1 per cent annually over the past decade or so. Table 6 indicates that the projected growth in trips to NEICs, associated mode choice projections and continued deterioration in travel times in the base case leads to a negative impact on NEIC catchment GRP and productivity for each NEIC except Parkville, which is the beneficiary of substantial public transport upgrades. The adverse travel time impact is particularly marked for East Werribee, La Trobe and Monash, with projected declines in catchment GRP of 45%, 24% and 20% respectively estimated to derive from adverse changes in travel times in the base case. The implication is that these NEICs should be a focus for evaluating the value from additional transport infrastructure to tackle deteriorating travel times. The adverse impacts of travel times on NEIC catchment GRP, which the right hand column of Table 6 shows are up to $2.2b in 2031 (in $2014 prices; or about ten times the numbers shown in present value terms) are not large enough to negate the strong positive impacts on GRP and productivity from scale/density increases, highlighting the key role of increasing density in a more productive city. However, they are large enough to require attention to improve future urban productivity.
Table 5: Projected base case AM peak trip volumes to NEICs and mode shares: 2011 and 2031

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Monash</th>
<th>Parkville</th>
<th>Dandenong South</th>
<th>Sunshine</th>
<th>East Werribee</th>
<th>La Trobe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car trips 2011</td>
<td>15799</td>
<td>16714</td>
<td>27759</td>
<td>17104</td>
<td>7853</td>
<td>11717</td>
</tr>
<tr>
<td>PT trips 2011</td>
<td>1763</td>
<td>16644</td>
<td>1665</td>
<td>1193</td>
<td>212</td>
<td>1107</td>
</tr>
<tr>
<td>PT mode share 2011</td>
<td>10.0%</td>
<td>49.9%</td>
<td>5.7%</td>
<td>6.5%</td>
<td>2.6%</td>
<td>8.6%</td>
</tr>
<tr>
<td>Car trips 2031</td>
<td>22931</td>
<td>15698</td>
<td>35092</td>
<td>22297</td>
<td>19408</td>
<td>16565</td>
</tr>
<tr>
<td>PT trips 2031</td>
<td>27777</td>
<td>32153</td>
<td>3857</td>
<td>2523</td>
<td>715</td>
<td>2698</td>
</tr>
<tr>
<td>PT mode share 2031</td>
<td>17.4%</td>
<td>67.2%</td>
<td>9.9%</td>
<td>10.2%</td>
<td>3.6%</td>
<td>14.0%</td>
</tr>
<tr>
<td>Increase in total trips 2011-31</td>
<td>58.2%</td>
<td>43.4%</td>
<td>32.4%</td>
<td>35.7%</td>
<td>149.5%</td>
<td>50.2%</td>
</tr>
</tbody>
</table>

Source: Derived from trip tables provided by Infrastructure Victoria.

Table 6: Estimated impact of ‘scale/density’ and travel time changes on NEIC economic outcomes to 2031

<table>
<thead>
<tr>
<th>NEIC</th>
<th>Catchment GRP change (%)</th>
<th>Catchment productivity increase by 2031 (%)</th>
<th>GRP gain in $b in 2031 ($2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Density</td>
<td>Travel time</td>
<td>Density</td>
</tr>
<tr>
<td>Monash</td>
<td>56</td>
<td>-20</td>
<td>9.0</td>
</tr>
<tr>
<td>Parkville</td>
<td>38</td>
<td>4</td>
<td>6.3</td>
</tr>
<tr>
<td>Dandenong South</td>
<td>43</td>
<td>-9</td>
<td>8.1</td>
</tr>
<tr>
<td>Sunshine</td>
<td>53</td>
<td>-7</td>
<td>8.0</td>
</tr>
<tr>
<td>Werribee East</td>
<td>82</td>
<td>-45</td>
<td>9.3</td>
</tr>
<tr>
<td>La Trobe</td>
<td>48</td>
<td>-24</td>
<td>6.7</td>
</tr>
</tbody>
</table>

Source: Authors’ estimates.
5 Land use transport infrastructure improvement options

Taking the base case as a point of departure, the types of land use transport infrastructure improvement options assessed in this Paper are generic options that increase:

- the accessibility of NEICs, by reducing catchment travel times to/from those NEICs, partly to help repair the adverse productivity impacts of deteriorating travel times that are apparent in the base case (except for Parkville)
- residential and employment densities within the NEIC catchments, particularly along strategic transit corridors (another way to increase accessibility), building on the positive findings about the role of scale/density in the base case.

To test these categories of option, arbitrary perturbations have been assumed and their impact on productivity assessed. This is one important input in decision-making about possible NEIC prioritisation for infrastructure investment.

5.1 Accessibility improvements through reducing AM peak travel times

Accessibility improvement is widely recognized as a key requirement for supporting NEIC growth. Travel times to/from the NEICs are central in this regard. It was arbitrarily assumed that the AM peak travel times to each NEIC improve at a rate of 3 per cent per decade over the two decades from 2011 to 2031, as compared to the base case. Key policy measures that might support this travel time outcome are trunk bus service upgrades with on-road priority, enhanced rail service, arterial road network upgrades and road pricing reform (to make road users more accountable for the external costs of their travel choices). Table 7 sets out the main results. The analysis ends at 2031. This means that post-2031 productivity gains implied by Figure 3 are not captured in the analysis.

Transport initiatives that deliver a 6% improvement in AM peak travel times by 2031, as compared to times in the base case, are projected to deliver a strong boost to NEIC catchment GRP. East Werribee, which had the strongest negative travel time effect in the base case, recovers this loss. Given the small scale of this catchment relative to the NEIC, however, means that the absolute increase in car travel volumes on travel times to the East Werribee NEIC.

To make road users more accountable for the external costs of their travel choices. Table 7 sets out the main results. The analysis ends at 2031. This means that post-2031 productivity gains implied by Figure 3 are not captured in the analysis.

Table 7: Impacts of a six per cent improvement in NEIC AM peak catchment travel times between 2011 and 2031

<table>
<thead>
<tr>
<th>NEIC</th>
<th>Catchment GRP change in 2031 (%)</th>
<th>Catchment productivity increase by 2031 (%)</th>
<th>GRP gain in $b in 2031 ($2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monash</td>
<td>13.6</td>
<td>1.7</td>
<td>0.6</td>
</tr>
<tr>
<td>Parkville</td>
<td>7.1</td>
<td>0.9</td>
<td>1.5</td>
</tr>
<tr>
<td>Dandenong South</td>
<td>11.2</td>
<td>1.5</td>
<td>0.6</td>
</tr>
<tr>
<td>Sunshine</td>
<td>9.8</td>
<td>1.2</td>
<td>0.8</td>
</tr>
<tr>
<td>East Werribee</td>
<td>56.6</td>
<td>4.9</td>
<td>0.3</td>
</tr>
<tr>
<td>La Trobe</td>
<td>13.4</td>
<td>1.6</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Source: Authors’ estimates.
6. Case Study

Conclusions

Plan Melbourne (DTPLI 2014) and its update Plan Melbourne 2017-2050 (DELWP 2017), have taken a new approach to shaping Melbourne’s land use for the future, by prioritising development of a small number of high-tech/knowledge-based clusters (NEICs). This polycentric urban structure is being pursued to enhance aggregate metropolitan productivity, with transport improvements being used to support the productivity gains and help share the expected benefits there-from. Productivity is the focus of the current Paper and such a polycentric urban structure is not without risks in terms of a potential loss of agglomeration economies from the central city. The Paper considers the way increased catchment densities and improved catchment travel times can be used to support NEIC productivity and, by extension, to reduce risks of agglomeration losses in the urban core.

The analysis suggests that, from a productivity perspective, Melbourne’s NEICs can probably be considered in five categories.

1. Parkville is dominant in terms of scale and has high productivity. It will benefit considerably from transport improvements embedded in the base case, relative to other NEICs, but its scale and position mean that it can benefit from further improvements.

2. Monash and La Trobe emerge from this analysis as probably having the most pressing transport needs, with potential for significant GRP and productivity gains from lowering travel times, particularly public transport travel times.

3. Sunshine does relatively well in coming years from the base case, travel times only contributing a small negative to future GRP growth. There are opportunities to lift GRP and productivity from further transport improvements for this NEIC catchment.

4. South Dandenong has relatively low productivity, compared to the other NEICs, given its scale, but has opportunities to improve its level of economic activity and productivity if well planned travel time improvements are delivered. The large scale of this NEIC is its strongest argument, together with its location close to growth suburbs, for whom it provides some important job opportunities, an equity argument in its favour.

5. East Werribee, the newest cluster, is small and faces large travel time challenges from rapid catchment population growth. Improving its transport infrastructure can deliver relatively large gains in GRP.

This Paper has shown that increasing density within cluster (NEIC) catchments, as defined by AM peak travel times, supports productivity gains, as does improving peak travel times within cluster catchments. An important finding is that public transport can be a significant independent contributor to NEIC productivity growth, with a beneficial impact that increases over time. This suggests that increasing PT mode shares can support cluster agglomeration economies. Meeting NEIC PT access needs requires attention to both radial and circumferential movements, taking account of expected user-benefits and implementation costs in addition to the agglomeration dividend that the present Paper suggests may be achievable.
References


Department of Planning (2005), Metropolitan Strategy: City of Cities. Sydney: Department of Planning.


Metrex (2010), Intra-metropolitan polycentricity in practice - Reflections, challenges and conclusions from 12 European metropolitan areas: Final report of the METREX - Expert Group on Intra-Metropolitan Polycentricity, Glasgow: Metrex (The Network of European Metropolitan Regions and Areas),


Mills, E (1072), Studies in the structure of the urban economy, Baltimore MD: Johns Hopkins University Press.


Policy Paper 9
Improved public transport services supporting city productivity growth: an Australian city case study

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