Working from Home in Australia in 2020: Positives, Negatives and the Potential for Future Benefits to Transport and Society

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Abstract

The year 2020 has been marked by the most extraordinary event we have witnessed since World War II. While other health threats and geographical disasters have occurred, none have been on the global scale of COVID-19. Although many countries have experienced more than one wave of the pandemic throughout 2020, Australia has been largely able to contain the impact of the virus. While there are many reasons for this, a key component of reducing transmission has been restrictions on movement, and the widespread adoption of working from home (WFH) by those who can. In describing the experience Australian's have had with working from home across 2020, via three waves of data collection, we find that WFH become a positive unintended consequence in contributing to the future management of the transport network, especially in larger metropolitan areas. Evidence suggests that support for WFH will be continuing in the form of a hybrid work model with more flexible working times and locations, linked to largely positive experiences of WFH during 2020, an improved wellbeing of employees, and no loss of productivity to the economy. We highlight potential future benefits of WFH to society, including significant implications for congestion and crowding, concluding that WFH is a formidable transport policy lever that must become embedded in the psyche of transport planners and decision makers so that we can gain some benefit from the pandemic.

Key Words: COVID-19, working from home, Australian experience in 2020, employer and employee support, implications on the performance of the transport network, longitudinal data

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1. Introduction

The COVID-19 global pandemic has brought sweeping disruption to travel and activity on a global scale. At the time of writing (early January 2021), there have been more than 80 million confirmed cases, and over 1.8 million deaths attributable to the disease (OWD 2021). In terms of global movements, in May 2020 air passenger travel fell by 91% relative to the same time last year and is not expected to return to pre-COVID-19 levels until 2024 (IATA 2020). Even now in Australia, international borders remain closed. Cities also witnessed similar seismic shifts in transit as activities were curtailed and in many instances the home became the main place of work.

It is important to note that Australia has had a markedly different experience with COVID-19 on a global scale. For example, total deaths per million are estimated at 57 in Australia compared to: 2,028 in the United Kingdom; 2,152 in the United States; 1,125 in Germany; 745 in Canada; and 143 in Japan (OWD 2021). There are structural advantages facilitating the relative success of supressing COVID-19, such as not having to share borders with other countries, and a manageable number of state governments working largely in unison via a specially formed National Cabinet[1]; but decisive and effective policy making has been equally important. For such policy to work, there has been the need for strong public-private collaboration: collaboration that is not only transferable and repeatable in other economies, but collaboration that will also likely mean that the trajectory of impacts due to COVID-19 will continue to differ in Australia as compared to other economies.

A key component of the policy response has been the requirement to work from home (WFH), which lasted for most of the year. In Victoria it was November 30, 2020 when office workers were able to return to the workplace, albeit with a limit of 25% of staff being allowed onsite, and in New South Wales it was only on December 14, 2020, when the public health order requiring employers to allow employees to work from home (where it is reasonably practicable to do so) was fully repealed. The upshot of these measures is a reduction in time spent at the workplace (Figure 1).

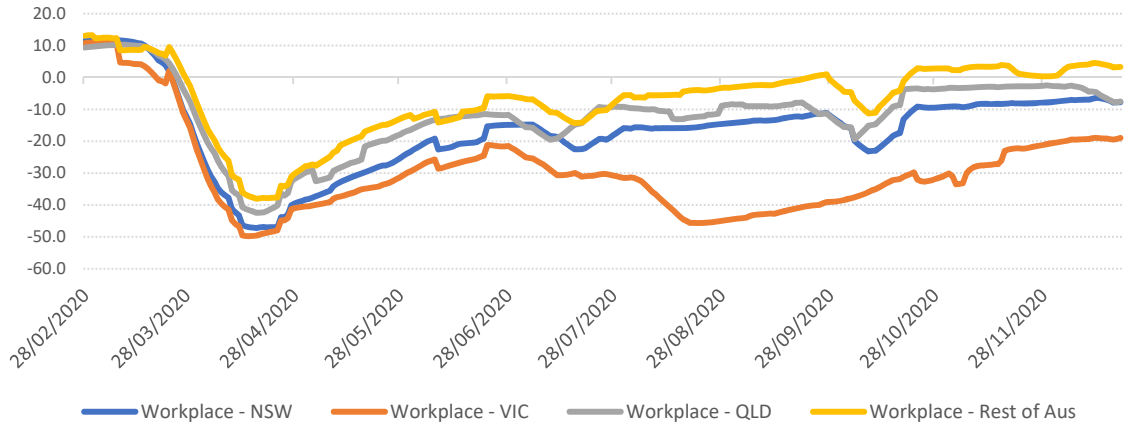

Figure 1: Time Spent at Workplace (Google Mobility Data)

In understanding the experiences with, and future impacts of, working from home, this paper is structured as follows. We begin with a brief overview of some of the literature on telecommuting and

[1] National Cabinet is a forum comprising of the Prime Minister, Premiers and Chief Ministers, established on 13 March 2020 to facilitate a collaborative and nationwide pandemic response.

its links to travel. In Section 3 we introduce the ongoing waves of data collection and summarise the composition of each of the three initial waves of data; in Section 4 we examine nine different aspects of the WFH experience in Australia; and in Section 5 we draw insight from the analysis and summarise what the experiences might mean moving forward, especially for the transport network and commuter activity. In Section 6 we in turn discuss what future research is required and what might be next for policy and planning with regards to WFH and commuting. Finally, in Section 7 we provide concluding remarks. This paper builds on the contributions of Beck and Hensher (2020a,b) where the focus was on the early days under restriction (Wave 1) and under easing of restrictions (Wave 2), by now also including a time point where many freedoms had returned to individuals but WFH home remained a defining feature (Wave 3).

2. Telecommuting and Transportation

From a transportation perspective, working from home represents a long-discussed policy lever for reducing congestion (e.g., Nilles et al. 1976). Several earlier studies focussed on the role of telecommuting in the white-collar sector (Salomon and Salomon 1984) and the challenges that this type of work might engender such as lack of social interaction, inability to separate home from work, and lack of visibility for advancement (Salomon 1986, Hall 1989, Mokhtarian 1991), along with potential benefits such as greater flexibility in time management (Nilles 1988, Olszewski and Mokhtarian 1994). Research has also explored the societal benefits that might accrue with increased working from home, including improved traffic flows (Kitamura et al. 1990; Maynard 1994) and reductions to energy consumption (Mokhtarian 1991) and air pollution and CO_2 emissions (Nilles 1988)[2]. Many forms of telecommuting have been explored; working at different times of the day, from different locations, changes to the frequency or proportion of work time and duration, and type of employment (Mokhtarian and Salomon 2005, Pratt 2000), noting that home-based businesses and overtime work should not be considered telecommuting due to the small impact such behaviour would have on commuting (Mokhtarian 1991).

Some studies have shown the potential for significant benefits related to telecommuting. For example, the potential for time savings of up to 44 hours per year for the telecommuter (Lari 2012), and reductions of between 7-to-11% in congestion and cost savings in a city like Tokyo, equivalent to up to 26% of annual spending on public transportation (Mitomo and Jitsuzumi 1999). Reduced work-life conflict is another benefit that an individual might accrue due to working from home (Hayman 2009), with benefits also being enjoyed by business in the form of capacity for longer work hours (Hill et al. 2010). Overall, the availability of flexible work arrangement leads to greater enrichment from work which, in turn, is associated with higher job satisfaction and lower turnover intentions (McNall et al. 2009).

Irrespective of the benefits or the different rates of uptake, the growth of telecommuting pre-COVID-19 has been marginal. Mokhtarian (2009) provides 12 possible reasons why, with the ongoing spread of ever-improving technologies, travel and congestion continue to increase. These include noting that not all activities have a telecommuting (work from home) counterpart, and even when feasible telecommuting may not always be a desirable substitute. When looking to identify what might

[2] Although it has been suggested that energy consumption at home has increased due to greater presence and notably higher computer use time. See for example Cheshmehzangi (2020) who suggests that "the impact on household entertainment is likely to increase in the longer term, with a potential increase in computing entertainment that became more popular in recent months. Hence, we anticipate steady and higher energy consumption for household entertainment activities", and a report by WSP (2020) that suggests that due to home heating inefficiencies the carbon production of a WFH employee could be more than an office worker.

facilitate more flexible work, it is common place to find that management trust of employees, the ability to secure the technology involved, and a rational workplace culture which emphasises human resources and member participation, facilitate telecommuting (Harrington and Ruppel 1999).

In Australia prior to COVID-19, the number of people who have worked from home regularly since 2001 was 4.6%, and only for an average of 11 hours per week (DSS 2019). A report by the Productivity Commission found that rising demand for telecommuting was effectively stymied by incompatible management practices and cultural norms in workplaces, rather than technology barriers (PC 2014). An Australian study conducted prior to COVID-19 showed the existence of a positive attitude toward anywhere working (work conducted anywhere outside of the traditional office that formal work might be done), regardless of the amount of time spent the participant commuting each day (Hopkins and McKay 2019). Importantly, the authors also found that the desire for 'anywhere' working grew stronger once workers had participated in remote work themselves.

3. Overview of Data

The data is comprised of three waves of data collection *throughout 2020*. *Wave 1* was completed in *March* immediately after National Cabinet announced restrictions on travel and activities. *Wave 2* was in field from the *May 23 to June 15*, after a relatively sustained period of low new case numbers and just prior to the second wave of infection in Victoria. It built upon the Wave 1 survey and started to examine work from home behaviour in more detail as it became increasingly apparent that the disruption to where work was done was large and ongoing. *Wave 3*, the most recent data, was collected across the *August 4 to October 10*: a period that saw the second wave in Victoria (VIC) result in significant lockdowns (including border closures between States) while the rest of Australia had either practically eliminated COVID-19 or had experienced low rates of community transmission (almost exclusively in Sydney).

While some questions were asked in all three waves, differing combinations of questions were deployed, which places limits on what can be compared across all waves. Wave 1 was conducted extremely early in the pandemic, going to field before it was really known what the impact would be. From this, and in each subsequent wave, we developed a greater understanding of key issues, in particular the need to explore the change in work in more detail. In this paper, we focus only on the working from home questions asked over the three waves. To accommodate the multifaceted nature of the survey, some questions were also asked on a rotational basis, a common approach in large panel-like surveys.

The online survey company PureProfile was engaged to randomly sample respondents across Australia. Table 1 provides an overview of the sample composition in each of the three waves. Quotas were not introduced on those completing the survey, other than ensuring representation from all states and territories. The impact of COVID-19 is sufficiently widespread that no demographic can escape the disruption caused.

Table 1: Overview of National Sample in Each Wave

	Wave 1	Wave 2	Wave 3
Female	52%	58%	58%
Age	46.3 (σ = 17.5)	48.2 (σ = 16.2)	48.2 (σ = 16.2)
*Income**	$92,826 (σ = $58,896)	$92,891 (σ = $59,320)	$62,551 (σ = $46,964)
Have children	32%	35%	35%
Number of children	1.8 (σ = 0.8)	1.7 (σ = 0.9)	1.8 (σ = 0.8)
*# Workers***	714	916	741
Total Sample	1074	1457	956
New South Wales	22%	32%	31%
Aust. Capital Territory	2%	2%	1%
Victoria	28%	24%	24%
Queensland	22%	18%	22%
South Australia	11%	11%	9%
Western Australia	11%	10%	10%
Northern Territory	1%	1%	1%
Tasmania	2%	3%	1%

** In Wave 1 and 2 household income was asked, in Wave 3 personal income was asked.*

*** A worker is defined as anyone who was working at least 1 day prior to COVID-19 restrictions.*

4 Results

4.1. Changes to Work and Working from Home

Figure 2 shows the dual impact of COVID-19 and associated restrictions on the availability of work and the nature of working from home. During Wave 1, the 25% of respondents who employed prior to COVID-19 (i.e., reported working one or more per week prior to COVID-19), were no longer working (i.e., reported 0 days of work in the last week). During Waves 2 and 3 this number started to return towards the pre-COVID-19 levels of employment. Interestingly, in the early stage of the pandemic, younger respondents and those on lower incomes were impacted more heavily, working significantly fewer days per week on average than other age and income groups. However, in the Wave 3 data, the only broad socio-demographic difference identifiable is that older respondents, on average, work fewer days per week in Wave 3; but this group also worked fewer days per week prior to COVID-19. In Victoria, where the entire state was placed in lockdown (including curfews in place in Melbourne restricting the hours a person was allowed outside their home), unemployment had moved back towards the highs of Wave 1.

In Wave 1 almost half of the respondents (47%) indicated they could WFH, a result more prevalent among those on higher incomes and/or those middle-aged. This trend, including the differences by age and income, held through to Wave 3 where 29% of respondents indicated that all their work could be done from home, and a further 33% that some of their work could be done from home. There are also broad geospatial differences in terms of the type of employment where work can be done from home, with regional respondents more unable to WFH (46%) versus those in metropolitan areas (32%). Over the waves, we see that as the rate of infection is brought under control, people work from home less, albeit at a rate that remains significantly higher than before COVID-19 (average of 1.5 days

across the sample in Wave 3, versus 0.8 before COVID-19). The outlier is Victoria, where the reintroduction of restrictions resulted in WFH home levels returning to those observed in Wave 1.

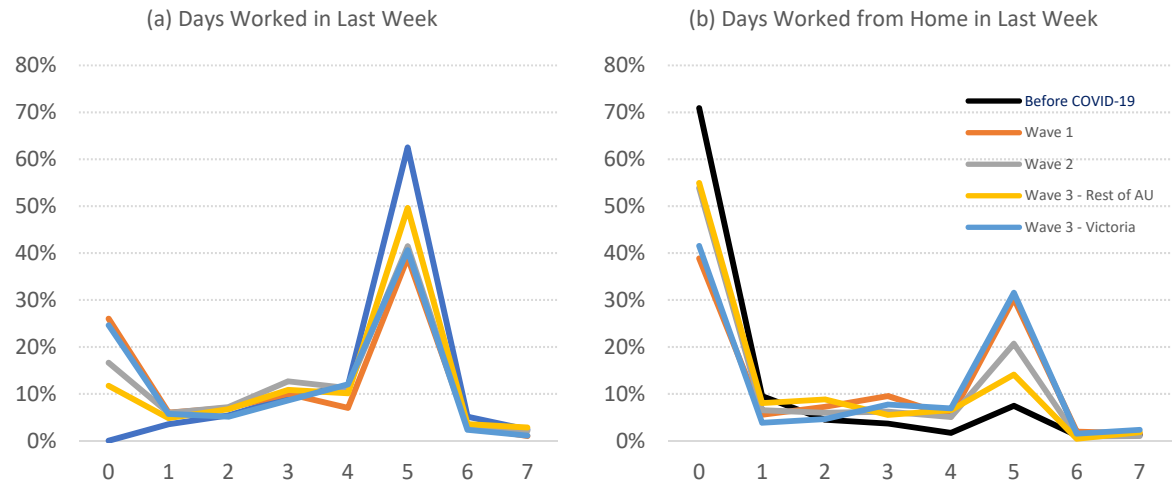

Figure 2: Changes to Work and Work from Home in the Last Week

Unsurprisingly, the ability to WFH differs based on the occupation of the individual[3]. White-collar workers are more likely to either be directed to WFH or given the choice during the pandemic (Table 2). For a large majority of blue-collar workers, the workplace policy towards WFH remains restrictive (Table 3). As a result, those in white-collar occupations work significantly more days from home than others (4.2 days on average compared to 1.5 for blue-collar). These differences exist through each wave of data collection.

Table 2: Workplace Work from Home Policy by Occupation (Wave 3)

	No Plans to WFH	Cannot WFH	Choice to WFH	Directed to WFH	Workplace Closed
White Collar	31%	16%	24%	27%	2%
Blue Collar	40%	45%	10%	4%	1%

Table 3: Change in Workplace Work from Home Policy by Occupation (Wave 3)

	None before, none now	Could before, same now	More now allowed	Less now allowed
White Collar	40%	16%	39%	4%
Blue Collar	84%	9%	5%	2%

[3] As per the Australian Bureau of Statistics ANZSCO major occupation groupings, white collar workers include Managers, Professionals, Community and Personal Service Workers, Clerical and Administrative Workers, and Sales Workers. Blue collar workers are those categorised in ANZSCO as Technicians and Trades Workers, Machinery Operators and Drivers, and Labourers.

4.2. Benefits and Challenges of Working from Home

As part of the Wave 2 data collection (primarily in June 2020; 3 months after the initial COVID-19 outbreak in March 2020), a series of questions were asked to identify the challenges and potential benefits experienced while WFH. As shown in Figure 3, the most beneficial aspect of WFH is not having to commute (particularly the case among younger and middle-aged respondents), followed by having a more flexible work schedule (also more prevalent among younger and middle-aged respondents, along with females). Spending more time with family, while relatively lower in terms of the perceived benefit, is significantly more important among those respondents with children. Interestingly, there are no differences in the perceived benefits of WFH between metropolitan and regional areas.

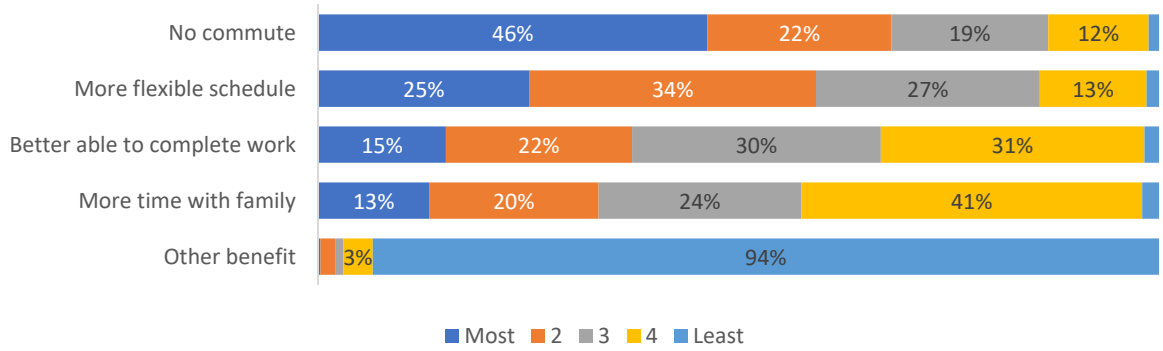

Figure 3: Most Important Benefits of Working from Home (Wave 2)

Figure 4 shows that the greatest challenges in WFH are interruptions from family and children during working hours (data confirms that it is a significantly greater challenge for those with children as expected), followed by being able to concentrate on work. The challenges are largely the same across gender, age, income and regional versus metropolitan areas: although younger respondents were less likely to rate "dealing with email and communication" as one of their most or second most challenging aspects of WFH. On a similar theme, Figure 5 shows that respondents found online meetings to be, on average, just as effective on average as normal face-to-face meetings. Data also revealed that, during Wave 2, respondents had an average of 3 online meetings per week ($\sigma = 6$).

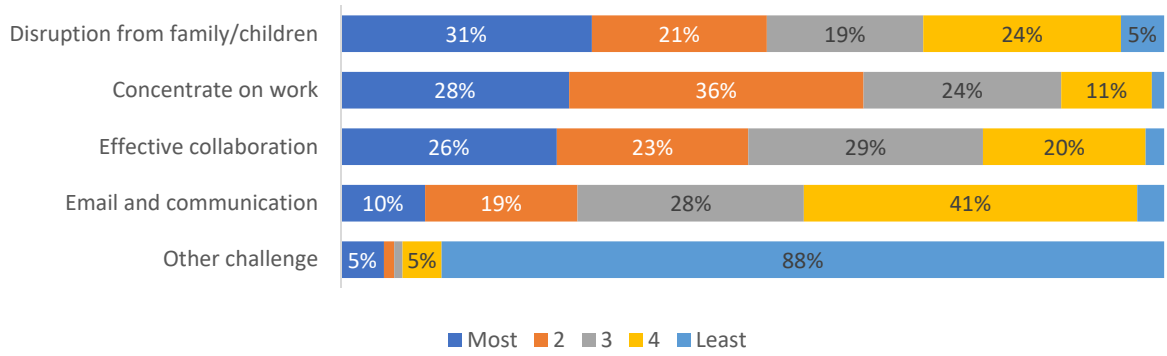

Figure 4: Most Challenging Aspects of Working from Home (Wave 2)

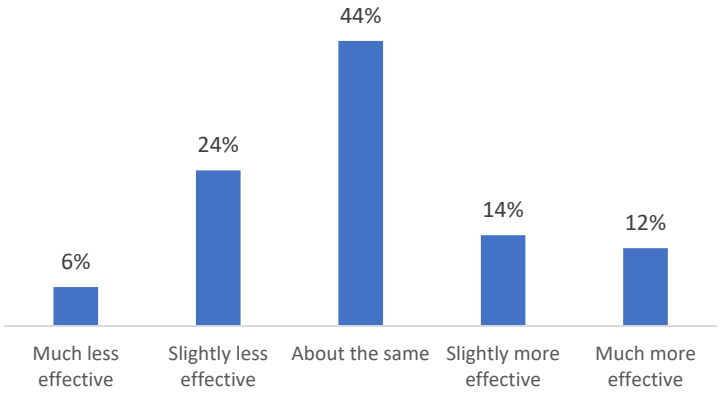

Figure 5: Relative Effectiveness of Online Meetings (Wave 2)

4.3. The Experience of Working from Home

In Waves 2 and 3 we examined how the current WFH experience might be perceived and how that might translate into desires for changes to working arrangements in the future. Figure 6 shows that from 3 months after (June 2020) the initial outbreak in March 2020, to 9 months after (September 2020), attitudes towards the WFH experience unchanged and overall positive when taking all factors into account. For each attitudinal statement, there is no difference in the average scores from each wave between those who WFH at least before COVID-19 and those who did not in normal pre-COVID-19 week, indicating that relative inexperience with WFH has not made the experience less positive.

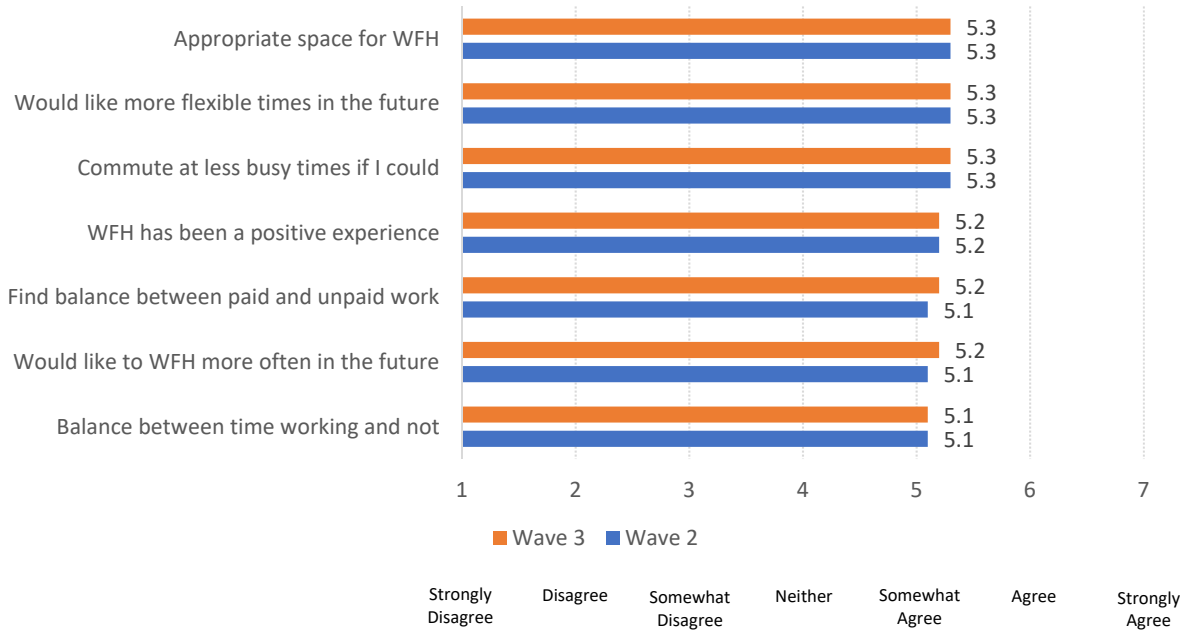

Figure 6: Evaluation of the Work from Home Experience (Wave 2 and Wave 3)

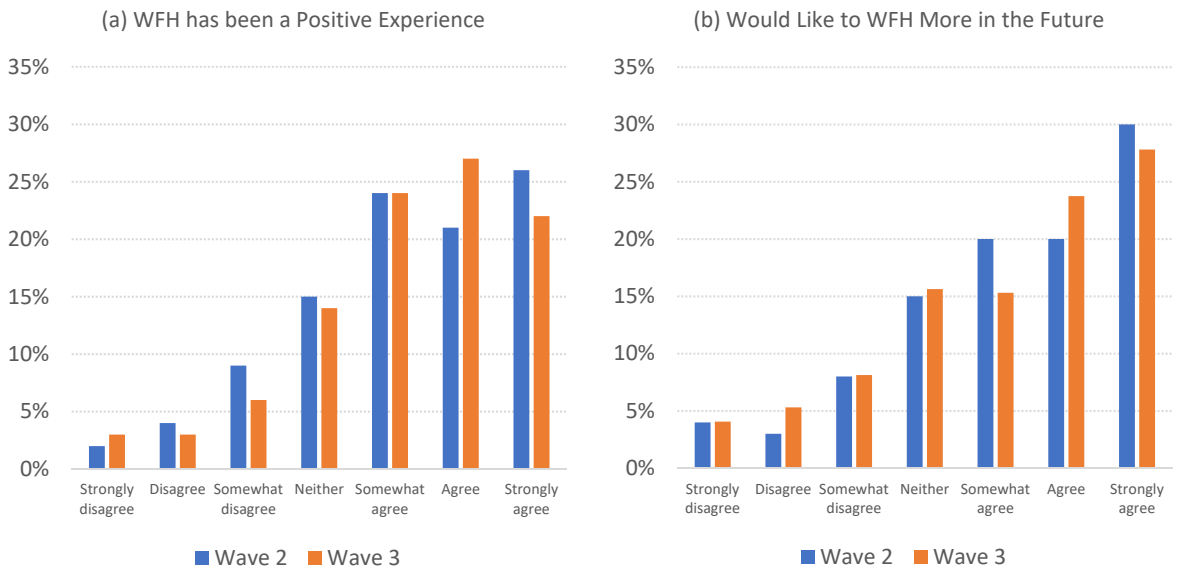

Figure 7: Current Work from Home Experience and Preference for Future (Wave 2 and Wave 3)

We also sought to understand the overall evaluation of the WFH experience (Figure 7a), and if the experience meant they would like to WFH moving forward (Figure 7b). The overall numbers of respondents agreeing to the statements substantially exceeds those who disagree. Additionally, there is a significant and strong positive correlation (r = 0.78) between the two statements suggesting that the more positive the experience, the more likely someone would want to WFH more in the future. Looking at the most recent data (Wave 3), there are significant, albeit weak, positive correlations between the number of days WFH in the last week and how positive the experience has been (r = 0.17), and the desire to WFH in the future (r = 0.24), indicating the WFH has seemingly been more positive for those who WFH to a greater extent. Unsurprisingly, white-collar workers report significantly higher agreement with both statements.

4.4. Working from Home and Commuting

Figure 8 shows that the number of commuting trips more than halved in Wave 1 compared to the average number of one-way trips conducted before COVID-19 (a 53% fall). There was a reduction in all modes, but it was particularly pronounced for train (92% below pre-COVID-19 levels) and bus (78% lower). In Wave 2 we saw an uptick in commuting as restrictions eased and more people returned to work at the office (41% below pre-COVID-19), which appeared to have stabilised for all states by Wave 3, excluding Victoria. In Wave 2 (r = -0.51) and Wave 3 (r = -0.60) there are significant and strongly negative correlations between the number of commuting trips made per week and the number of days WFH, as expected. Bio-security risks associated with public transport remain despite the effort by government to move away from the initial messaging (in the Wave 1 and 2 periods) to not use public transport, to Wave 3 where the message was that with social distancing and recommended mask wearing, it was now safe to use these modes. Hensher et al. (2021a) found that biosecurity concern associated with using public transport was a statistically significant positive influence on the increased probability of WFH.

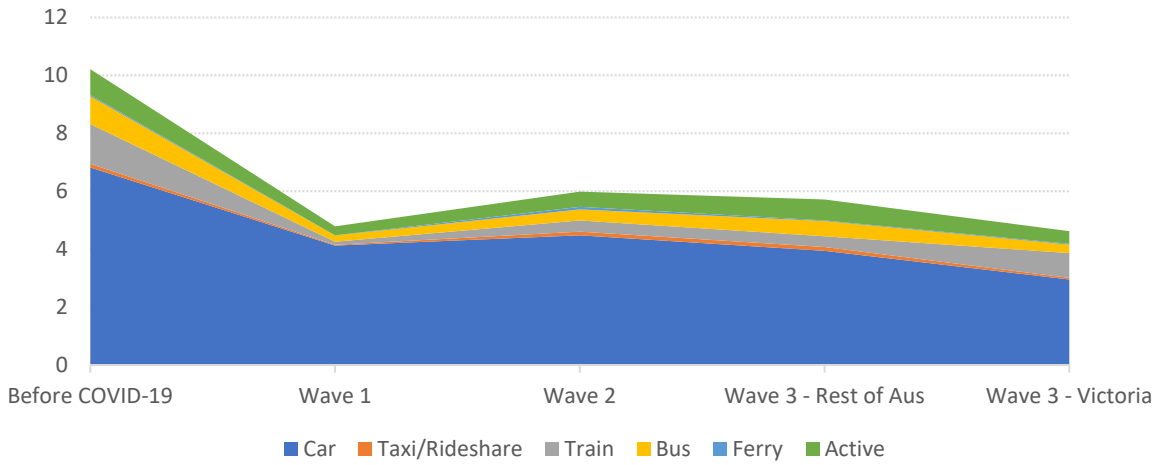

Figure 8: Commuting Activity by Mode (Wave1, Wave 2, and Wave 3)

Figure 9 shows that WFH behaviour is relatively consistent across the working week, with approximately 30% of respondents working only from home on any one day, with just over half travelling for work. Figure 9 does not consider when travelling might be occurring for those that do travel. It might be the case that with increased ability to WFH, people might also be taking this opportunity to stagger their working hours, so that when they do travel for work, they can do so outside of peak periods and thus avoid traffic congestion or crowding on public transport.

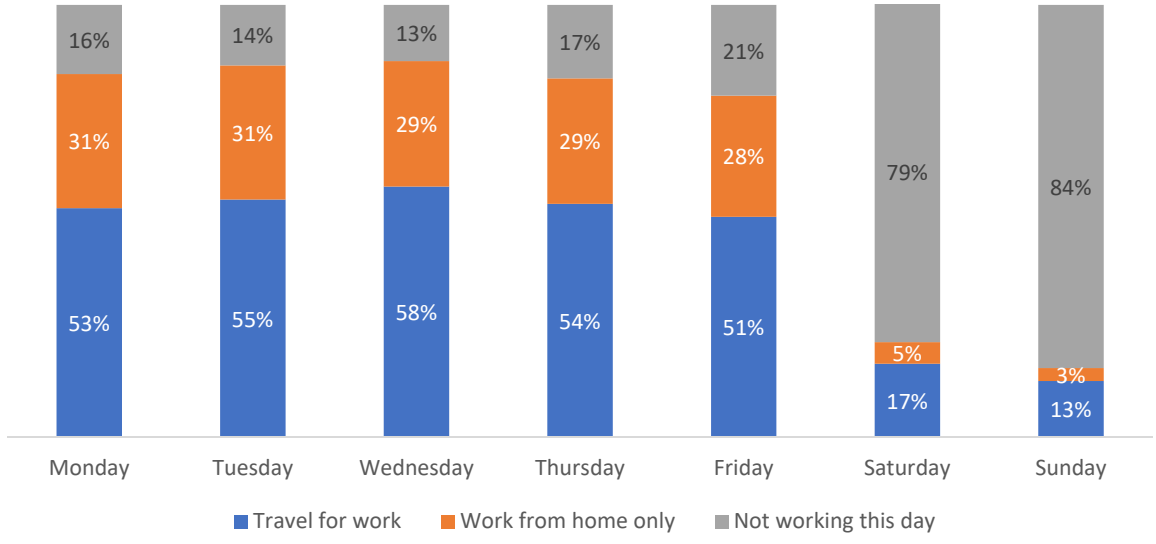

Figure 9: Commuting / Work Travel and Working from Home by Day of Week (Wave 3)

4.5. Relative Productivity of Work from Home

An important component of WFH is the extent to which employees can be productive while doing so. Starting in Wave 2, we asked respondents to assess how productive they felt they had been in the last week while WFH, relative to their normal place of work. Figure 10 shows that employees perceive

their WFH productivity to equal to that of their normal work environment prior to COVID-19. In fact, the sample average of this measure is significantly greater than the neutral point (3 = about the same) for both Wave 2 (3.11) and in Wave 3 (3.23), noting that the while statistically significant the difference is only slight. That aside, the data indicates that productivity remains relatively unchanged, and there is the potential that people may well become more productive as WFH becomes entrenched and new norms are developed. Indeed, there is a weakly positive (but significant) correlation between relative productivity and: the number of days WFH prior to COVID-19 (r = 0.12); and the number of days WFH in Wave 3 (r = 0.11), providing some suggestion that the more you WFH, the more productive you find the experience to be. There are no differences in productivity across occupation, gender, age, gender, or income.

To complement the qualitative assessment, we developed an ordered logit model[4] to investigate the drivers of increased vs same or decreased perceived productivity. The key findings focussed on the elasticities, suggest that the direct elasticities are typically, for all significant influences, in the range of (-) 0.2 to 0.5 with a noticeable probability of perceived productivity being increased compared to pre-COVID-19 (i) as age and income increases, (ii) occupation is a manager, (iii) distance to work from home increases, (iv) persons living at home enrolled in a tertiary institution such as a University, (v) the ability to balance work and non-work time more, and (vi) a preference to WFH even more in the future. The Pseudo R^2 for this model is 0.173.

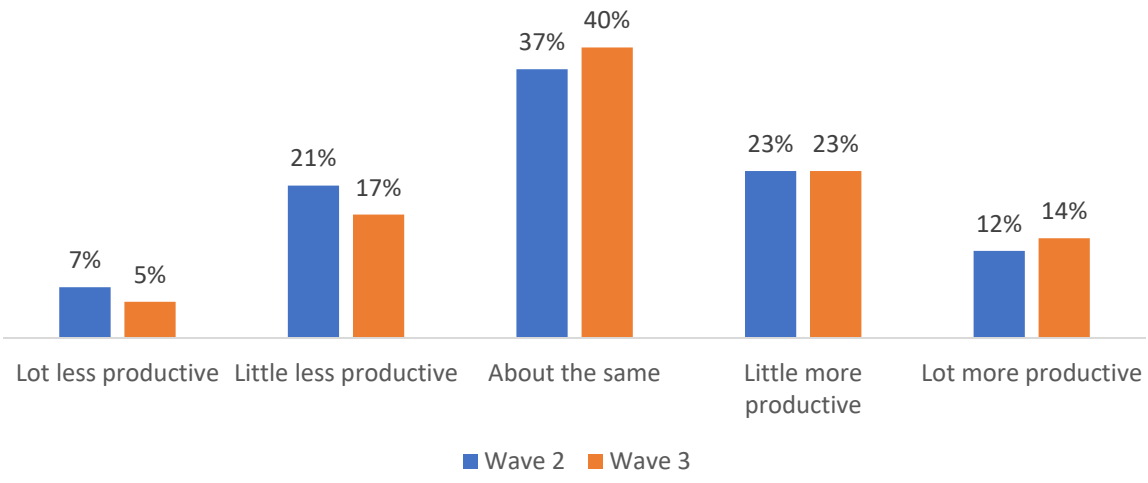

Figure 10: Relative Productivity while Working from Home (Wave 2 and Wave 3)

4.6. Adding an Employer Perspective

The random sample of respondents across Australia means that the sample also contains respondents who are employers and managers[5] (Wave 2 = 106, Wave 3 = 125). With regards to the risk that COVID-19 presents in the workplace, employers and managers are no less concerned than employees; however, employers and managers in larger companies of 20 or more employees appear to be significantly more concerned about the risk than those who are in smaller businesses.

[4] Available on request

[5] Importantly, many employees in an organisation act in an employer-like role in terms of any advice and decisions being made about the support or otherwise for employees to be able to WFH more flexibly.

With regards to future policy towards WFH, Figure 11 shows that between Wave 2 (June 2020) and Wave 3 (September 2020) there was an increase in the number of employers who would adopt a flexible work policy whenever COVID-19 restrictions were to end. The response from employees in Wave 3 highlights a potential mismatch between what they might think is the policy their workplace would adopt versus what an employer or manager might support; specifically, there is the potential that employers might be more supportive of increased WFH than an employee might think. This is a finding that Brewer and Hensher (2000) found many years ago when interviewing employers and employees on telecommuting options.

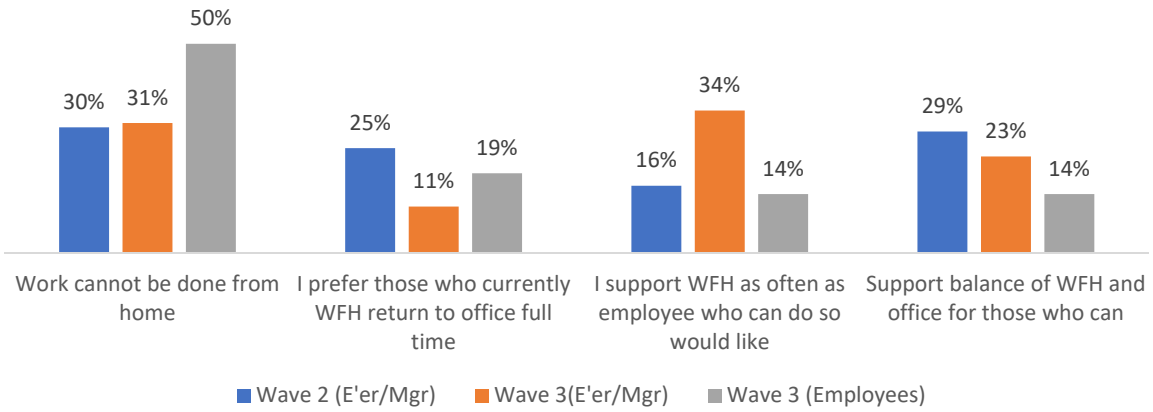

Figure 11: Views on Work from Home Policy when Restrictions End (Wave 2 and Wave 3)

Figure 12 shows the number of days that an employer and manager think are appropriate for staff to WFH. The results are very similar in Wave 2 and Wave 3, with no significant difference in the average number of days thought to be appropriate; however, managers and employers provide an average number of days of WFH that is higher than what an employee states that they would like. There is no difference in the average number of days based on size of business however, managers in white collar roles support a higher average number of days WFH in the future.

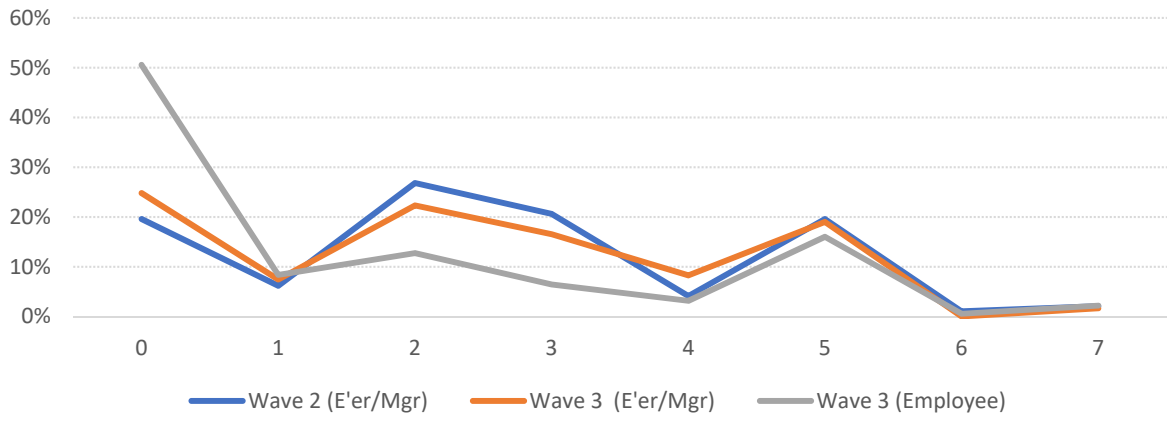

Figure 12: Number of Days Appropriate for Staff to Work from Home when Restrictions End (Wave 2 and Wave 3)

In Wave 2 we asked employers and managers to justify the number of days they felt were appropriate for staff to WFH. Those arguing for high levels of work from home did so because it works, it minimises office space or they believe staff like it. Those advocating for a balance tended to cite reasons around maintaining collegiality, keeping connections, generating value through interaction, the need for face-to-face meetings, and mentoring. In Wave 3 we repeated the question, and the nature of the responses is similar. Those who state that employees cannot WFH cite the nature of the job restricting ability to do so; and those advocating a mix do so because of the ability of an employee to concentrate while working from home, but still needing the interaction of colleagues for team building, collaboration and working on complex problems. Interestingly several employer's state that while most of their work cannot be done from home, some can be done from home and thus one day a week might be appropriate moving forward. On the other hand, a small number also state that an employee could WFH as often as they would like, so long as productivity is not diminished.

With regards to productivity of staff, Figure 13 similarly shows that the perspective of employers and managers has been stable from Wave 2 to Wave 3, with the general view being that productivity of staff is unchanged. Female employers/managers report significantly higher average productivity scores for staff. There is a significant positive correlation between productivity and the number of days that an employer/manager thinks appropriate for a staff member to work from home once restrictions end. There are no differences based on metropolitan versus regional responses.

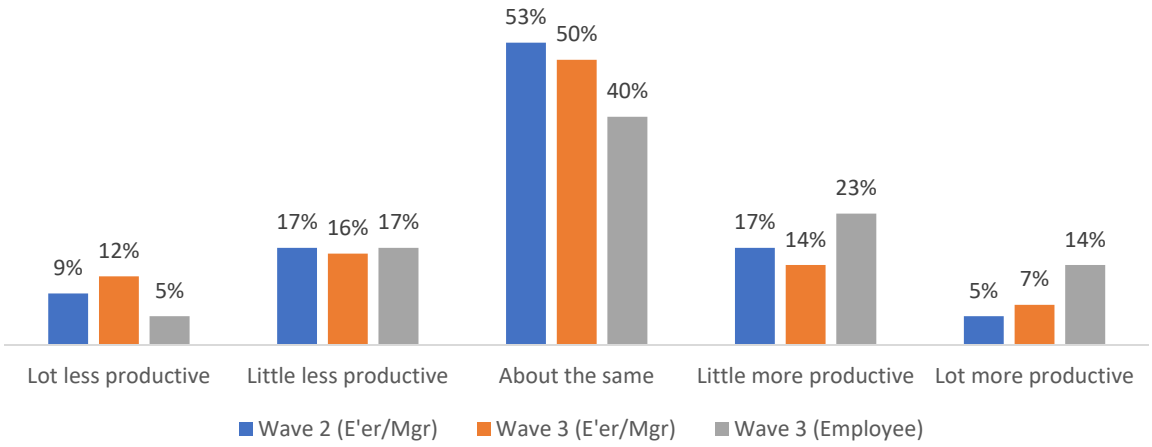

Figure 13: Relative Productivity of Staff while Working from Home (Wave 2 and Wave 3)

5. Discussion of Policy Implications

In this section we draw on the descriptive overview of how employees and employers have responded to the COVID-19 pandemic with a particular focus on working from home. The focus is on benefits to an individual, benefits to employers and wider societal implications.

51. Benefits to the Individual

Rather than having to imagine the future of WFH we may already be seeing that future state now, given that future WFH intentions have been shown to closely match the current levels of working from home that are observed during Wave 3 (September 2020). If this is the case, then future with a more flexible use of WFH would mean that on any given weekday there would be 30% of people WFH

resulting in significantly lower number of commuting trips and thus commuters on the road or public transport networks. Using evidence presented in Hensher et al. (2021b), assuming the average person works 48 weeks of the year (with 4 weeks of annual leave), this equates to 90 hours of saved time or just over two and a half standard working weeks (there are 38 hours per standard working week in Australia). This is not an insignificant amount of time that a person could spend in ways that offer themselves, or their family, higher levels of utility. Given that a large percentage of Australians have been WFH at a consistent high level for what has now been an extended period, it is reasonable to assume that new habits towards WFH have developed, and people have begun to embed routines that will see them be able to productively WFH at the level they prefer.

5.2. Benefits to the Employer

Although there are time savings benefits that accrue to the employee who is WFH, there are also benefits for employers. Most directly, there is the potential for significant cost savings on rent. For example, in the Sydney CBD the average commercial rent is $1,075 per square metre per annum (Lenaghan 2020), with an estimated 8-12 square metre needed for each employee (Calautti 2019). By having more staff WFH, with less office space required overall, the potential savings to the business quickly add up, typically between $8,500 to $13,000 per employee per year. There is also the indirect benefit of staff who are WFH having more time to spend on work; many of our respondents indicated that the time saved on the commute was of benefit because it allowed them to reinvest that time into more hours of work[6]. The research in the literature review also strongly indicates that WFH and flexible working arrangements lead to better staff retention and create a more attractive employment offer which is particularly important for attracting highly skilled workers.

The recent experiences of both staff and employers/managers indicate that flexibility can be given without any loss to productivity. Both groups indicated that, in the face of a non-marginal change to the nature of work, relative productivity has remained *unchanged*. The results suggest that management should be more amenable to allowing staff to WFH more often in the future, potentially to the extent currently observed in Wave 3 (September 2020). There are a growing number of reports of large organisations already embracing increased WFH in a significant way (e.g., Bleby 2020, Smith 2020), essentially as a hybrid model.

Many employees express reservations about their workplace and the risk of COVID-19. At the time of writing, a cluster in Sydney is emerging, with one of the more the concerning hotspots being an inner-suburb bottle-shop where a close contact of a hotel quarantine worker infected a staff member in the store, who in turn infected another staff member, and as a result over 2,000 customers are now being asked to get tested and self-isolate. Workplaces, particularly large white-collar workplaces that are often indoors and in shared spaces and represent a risk for forming such a COVID-19 cluster. As such, any organisation seeking to manage risk should be looking at policies such as rotating staff through the office on different days, to minimise the impact on the business should one staff member develop the disease. Additionally, a public relations reality is that should a cluster emerge within in organisation, having a robust COVIDSafe plan to point to will be beneficial.

5.3. Wider Economic Benefits

While WFH benefits confer more fully to segments of the working population, such as those in white-collar jobs, typically on higher incomes, in middle or younger age groups, and living in metropolitan areas, there are non-trivial wider economic benefits that can be shared, if people who are able to WFH successfully are able to do so more often.

[6] Later surveys (already conducted) seek to explore where that saved time is invested in more detail.

Infrastructure Australia highlighted that in the six largest capital cities and neighbouring satellite cities, the total annual cost of road congestion (pre-COVID-19) was $19 billion in 2016, and the cost of public transport crowding was estimated at $175 million (IA 2019). By 2031 this was projected to grow to forecast total annual cost of road congestion of $39 billion, and $837 million for public transport crowding. During the height of the pandemic, private vehicle use plummeted with aggregate indicators such as the Apple Mobility Trends showing car use falling by up to 60% (Apple 2020). Global GPS firm TomTom also publishes data via their Global Traffic Index (TomTom 2020), wherein they construct a metric termed the Congestion Level index. An index level of 100 percent means that a 30-minute trip takes an hour to complete (i.e., due to traffic on the network, travel time doubles). During a typical pre-COVID-19 weekday, peak Sydney records a congestion level of approximately 80, but throughout April 2020 it went above 30 on only two days. These results indicate a very large reduction in congestion.

While car use was never expected to stay at the low levels observed during March/April 2020, it has rebounded strongly: SCATS (Sydney Coordinated Adaptive Traffic System) data shows that car use is now tracking 5-6% below that of a similar time last year (MySydney 2020). The fact that it remains some percentage lower is still important in gaining significant improvements in traffic flow. For example, Infrastructure Victoria (2016) indicated that if just five per cent of drivers change their behaviour, driving conditions on Melbourne's road network would be the same as in the school holidays, every day of the week.

There has been an even bigger and sustained reduction in public transport patronage. During April 2020, Opal Card data reveals that monthly trips on public transport fell by 80% compared to the same period in 2019. As of November 2020, total trips on all public transport modes remain 45% below the same period last year, and over 2020 public transport patronage has more than halved on the year, down 54% (TfNSW 2020). While much of this reduction (and subsequent rebound in car use) can be explained by the concerns people have towards the risk of COVID-19 on public transport (Beck and Hensher 2020a, 2020b), encouraging WFH as restrictions ease is a viable and cost-effective measure for transport authorities to ease crowding during the peak. Reduced crowding will have significant positive dividends for those individuals who have no choice but to commute to work, given that negative crowding events are memorable (Abenoza et al. 2017) and may be the main driver of public transport dissatisfaction (Börjesson and Rubensson 2019).

There are also potential benefits to regional areas in terms of growth in economic activity. Recent media reports highlight the strong growth in regional house prices, which have risen at a higher annual rate than in capital cities for the first time in more than 15 years (Terzon 2020). It is speculated that part of the reason for the 7% average increase across all regional marketplaces (compared to 2% in cities) is the desire for urban dwellers to leave the city because of COVID-19 and the associated ability to WFH[7]. While it is hard to disentangle if the interest in regional areas is due to prior growth in the regions, or the desire to move out of an urban environment because of COVID-19 itself; the disruption and consequent uptake of digital work solutions cannot be ignored as a factor in making working outside of capital cities a more tenable proposition. If the increase in property prices is a leading

[7] This is linked in part to the continuing low interest rates with a lower threshold for a minimum home deposit together with a significant increase in the shortage of housing in regional areas as more people locate there in part attributed to the ability to WFH and hence less need to commute to a major Centre. It is also possible that COVID-19 has prompted many to consider a lifestyle change due to greater flexibility. Indeed, in early June 2021 in Australia, a national advertising campaign has launched encouraging movement to regional areas (in part funded by the Federal Government - http://www.regionalaustralia.org.au/home/move-to-more/).

indicator of potential growth and thus improved economic activity in regional areas, there are positive long-term implications for jobs, accessibility, and amenity[8]. Growth in regional areas is a noted strategic objective (DIRDC 2017), especially given that 51% of the national population is in the three capital cities of Sydney, Melbourne, and Brisbane (ABS 2020).

6. Directions for Future Policy and Research

COVID-19 has been a crippling event, but WFH has the potential to be an unintended positive consequence of the widespread disruption. There are benefits to the individual employee, to employers and businesses, and to the wider economy, including the transport network. Our data indicates that those who WFH have found the experience to be positive and would like to continue doing so to a greater extent than they did before. Additionally, the data also shows that productivity remains relatively unchanged, and that employees are potentially becoming more productive as WFH becomes entrenched and new norms are developed. The benefits are great and should not be ignored in any ambition to the return to pre-COVID 19 'normality'.

Even where there may be pressure from certain circles for employees to return to the office en masse, to do so would not only ignore the inherent risks that remain with larger indoor gatherings, but also the redistributive impact of WFH on more localised or suburban economic activity. While the impact on central business districts (CBDs) is currently large, a greater balance between WFH and the office is likely still enough activity to revitalise much of the business in the supply chain that is currently suffering. While traffic has been quick to rebound, there is currently lower CBD focused congestion, but this may return quickly if the uplift in second-hand car purchases (IA 2020), combined with the concern about public transport, indicates that a higher car mode share may persist for some time. To avoid congestion at levels which would be *worse* than before COVID-19, authorities and policy makers should do everything in their power to facilitate the choice to WFH rather than the choice to drive to work. Government policy to support more WFH will likely be a more popular strategy than what has been the politically unpalatable option of road pricing.

While there are limited sociodemographic differences that have emerged in our analysis thus far, highlighting just how widespread disruption has been, it does not mean that such differences or inequalities will not arise or become embedded in the future. This is something the transport community, and indeed social scientists more broadly, need to be keenly aware of such that we do not further embed income or social exclusion inequalities, or give rise to new forms of inequality (such as technology accessibility for example).

A barrier that might exist to ongoing WFH is the position of management within organisations. Research cited in the literature review shows that managerial resistance is perhaps the biggest barrier to flexible work practices. However, the widespread and extended nature of the COVID-19 disruption is such that this barrier may have been broken. Our empirical evidence suggests that employers and managers show favourable attitudes to increased WFH, which have remained stable over the multiple periods of data collection. That said, research has shown that many managers express low self-confidence in their ability to manage workers remotely which in turns undermines their support for WFH (Parker et al. 2020). Rather than reduce WFH due to a lack of managerial confidence, organisations should seek to equip managers with new skills to boost their ability to manage in a

[8] We would also suggest that the relevance of physical connectivity that is the cornerstone of agglomeration economies (also known as effective employment density) is no longer as relevant with a growing use the digital connectivity. Hence the ability to undertake business from a geographically more disperse location is expected to change the meaning and metric of agglomeration economy.

technologically advanced environment. This is especially true as a meta-analysis of 46 telecommuting studies proves the benefits on job satisfaction, performance, employee turnover and stress that WFH can have (Gajendran and Harrison 2007). There is more work required to understand the response of employers to COVID-19.

While we use the term "working from home" within this paper, there is also the concept of the third office, or "anywhere working" (Blount and Gloet 2017) which covers any space where work might be completed that is outside of the traditional office environs. There is contemporary anecdotal evidence which suggests that individuals conduct paid work from public locations such as coffee shops, parks, and libraries, yet no documented evidence of the rate of use of these alternative locations was found outside of one study that found a small percentage of telecommuters worked from summer cottages or from 'elsewhere' (Helminen and Ristimaki 2007). More research should be undertaken to determine exactly where people have been doing work from, and how productive that work has been, and thus facilitate a conversation about how remote working can be more than just WFH[9].

There is also the need to continue to investigate increased levels of WFH as either a complement or substitute for non-commuting trips. In many jurisdictions, the current data being collected on travel activity may not yet be appropriate for such analysis, as it is likely that travel activity is still suppressed, to varying degrees. However, in the research prior to COVID-19 the evidence on this relationship is mixed. Mokhtarian et al. 1995 find a reduction in both commute and non-commute-based trips, and Mokhtarian et al. 2004 find that while telecommuter have long average commute distances when they do travel, they telecommute often enough to compensate for longer one-way commutes. Choo et al. (2004) find that while telecommuting reduces vehicle-miles travelled by a small amount on the surface, it appears to be far more effective policy than public infrastructure expenditure. Others have found that telecommuting can increase personal travel and non-commute activity (Zhu 2012, Kim et al. 2015). In unpublished research on Wave 3, we have found that WFH has resulted in less commuting, work related, and home-based education trips, but that home-based shopping and personal business trips have not been impacted. We continue to investigate this moving forward.

7. Conclusion

Working from home is not and should not be seen as an all or nothing affair: there is no expectation that people will either work only from home or only from the office. Analysis herein indicates that respondents (for whom it is possible) would like a mix of work where WFH is a greater percentage of the mix than it was before (referred to in mainstream media in Australia as a hybrid model whose adoption is gaining popularity). Even without all work being WFH, simply *more* WFH than was the case before COVID-19 (i.e., more people who can do so, working more flexibly) would have significant positive dividends. We fully acknowledge that not every worker is able to WFH, nor that the widespread increase in WFH that has meant that the barriers to WFH have disappeared. To that end, policies that support formal childcare resources could relieve the family-to-work conflict and encourage people to work at home (Zhang et al. 2020); direct financial support for telecommuting facilities or a subsidy for firms adopting telecommuting could be considered (Mitomo and Jitsuzumi 1999); and even rethinking the opening hours of shops and leisure facilities (Saleh and Farrell 2005). As a formidable transport policy lever, WFH must become embedded in the psyche of transport

[9] Remote or satellite offices remain an interesting part of the remote working toolkit, as an effective way of holding meetings with other members of staff or clients. Travel to such sites should not be an issue if carefully planned. Indeed, it not only avoids the need to meet at someone's home if the traditional office location has been downsized, and the flexibility of space enables the location to be booked to suit the group attending. Indeed, there may even be a new Office-Space-as-a-Service model that emerges.

planners and decision makers as well as the tools they use to arrive at a future that can benefit from the unfortunate imposition of a virus pandemic. This is the challenge that we all should work on as we seek to understand what the new priorities might be for the future delivery and maintenance of and efficient and effective transport network that aligns with the aspirations of society.

Author Contributions:

Matthew Beck: Conceptualization; Data curation; Funding acquisition; Formal analysis; Investigation; Methodology; Visualization; Writing - original draft; Writing - review & editing.

David Hensher: Conceptualization; Data curation; Funding acquisition; Project administration; Resources; Writing - original draft; Writing - review & editing.

References

Abenoza, R.F., Cats, O., and Susilo, Y.O. (2017) Travel Satisfaction with Public Transport: Determinants, User Classes, Regional Disparities and Their Evolution, *Transportation Research Part A: Policy and Practice*, 95, 64-84.

ABS (2020) *Regional Population*, Australian Bureau of Statistics, https://www.abs.gov.au/statistics/people/population/regional-population/latest-release, accessed 06/01/21.

Apple (2020) *Mobility Trends Report*, https://covid19.apple.com/mobility, accessed 02/01/21.

Beck, M.J. and Hensher, D.A. (2020a) Insights into the Impact of Covid-19 on Household Travel, Work, Activities and Shopping in Australia – the early days under restrictions, *Transport Policy*, 96, 76-93.

Beck, M. and Hensher, D.A. (2020b) Insights into the impact of COVID-19 on household travel and activities in Australia – the early days of easing restrictions, *Transport Policy*, 99, 95-119.

Bleby, M. (2020) AECOM cuts Sydney office footprint as staff work from home, *Financial Review* 19/10/20, https://www.afr.com/property/commercial/aecom-cuts-sydney-office-footprint-as-staff-work-from-home-20201019-p566fq, accessed 06/01/21.

Blount, Y., & Gloet, M. (Eds.) (2017). *Anywhere working and the new era of telecommuting*. Hershey, PA: Business Science Reference. https://doi.org/10.4018/978-1-5225-2328-4

Börjesson, M. and Rubensson, I. (2019) Satisfaction with Crowding and Other Attributes in Public Transport, *Transport Policy*, 79, 213-222.

Brewer, A. and Hensher, D. A. (2000) distributed work and travel behaviour: the dynamics of interactive agency choices between employers and employees, *Transportation*, 27 (1), 117-148.

Calautti, L. (2019) How much office space do I need?, *Commercial Real Estate* 17/04/19, https://www.commercialrealestate.com.au/advice/how-much-office-space-do-i-need-57459/, accessed 06/01/21.

Cheshmehzangi, A. (2020) COVID-19 and household energy implications: what are the main impacts on energy use? *Heliyon*, 6, e05202, https://doi.org/10.1016/j.heliyon.2020.e05202.

Choo, S., Mokhtarian, P.L. and Salomon, I. (2005) Does telecommuting reduce vehicle-miles traveled? An aggregate time series analysis for the US, *Transportation*, 32, 37-64.

DIRDC (2017) *Regions 2030: Unlocking Opportunity*, Department of Infrastructure, Regional Development and Cities, https://www.regional.gov.au/regional/publications/files/regions-2030.pdf , accessed 06/01/21.

DSS (2020) *Household, Income and Labour Dynamics in Australia*, Department of Social Services, https://www.dss.gov.au/national-centre-for-longitudinal-data/household-income-and-labour-dynamics-in-australia-hilda-fact-sheet, accessed 13/08/20.

Gajendran, R. S., & Harrison, D. A. (2007) The good, the bad, and the unknown about telecommuting: Meta-analysis of psychological mediators and individual consequences, *Journal of Applied Psychology*, 92(6), 1524-1541.

Hall, D.T. (1989) *Telecommuting and the management of work-home boundaries*. Paper prepared for the Annual Review of Communications and Society, a joint project of the Aspen Institute and the Institute for Information Studies. Boston University, August.

Harrington, S.J. and Ruppel, C.P. (1999) Telecommuting: a test of trust, competing values, and relative advantage, *IEEE Transactions on Professional Communication*, 42(4), 223-239.

Hayman, J.R. (2009) Flexible work arrangements: exploring the linkages between perceived usability of flexible work schedules and work/life balance, *Community, Work & Family*, 12(3), 327-338.

Helminen, V., and Ristimäki, M. (2007) Relationships between commuting distance, frequency and telework in Finland. *Journal of Transport Geography*, 15(5), 331-342.

Hensher, D.A., Balbontin, C., Beck, M.J. and Wei, E. (2021a) The impact of working from home on model commuting choice response during COVID-19: Implications for two metropolitan areas in Australia, submitted to a Special Issue on COVID-19 (edited by Hani Mahmassani and Patricia Mokhtarian), *Transportation Research Part A: Policy and Practice*.

Hensher, D.A., Balbontin, C., Beck, M.J. (2021b) The impact of COVID-19 on the time and monetary cost outlays for commuting - the case of the Greater Sydney Metropolitan Area after three months of restrictions, *Transport Policy*, 101, 71-80

Hill, E. J., Erickson, J. J., Holmes, E. K., & Ferris, M. (2010) Workplace flexibility, work hours, and work-life conflict: Finding an extra day or two, *Journal of Family Psychology*, 24(3), 349-358.

Hopkins, J.L. and McKay, J. (2019) Investigating 'anywhere working' as a mechanism for alleviating traffic congestion in smart cities, *Technological Forecasting and Social Change*, 142, 258-272.

IA (2019) *Urban Transport Crowding and Congestion: The Australian Infrastructure Audit 2019*, Infrastructure Australia, https://www.infrastructureaustralia.gov.au/sites/default/files/2019-08/Urban%20Transport%20Crowding%20and%20Congestion.pdf, accessed 06/01/20.

IA (2020) *Infrastructure beyond COVID-19: A national study on the impacts of the pandemic on Australia*, Infrastructure Australia, Interim Report for the 2021 Australian Infrastructure Plan December 2020, https://www.infrastructureaustralia.gov.au/sites/default/files/2020-12/Final_COVID%20Impacts%20on%20Infrastructure%20Sectors%20Report_14%20Dec%202020.pdf , accessed 06/01/21.

IATA (2020) *Recovery Delayed as International Travel Remains Locked Down*, International Air Transport Association, Press Release No: 63 28/07/20, https://www.iata.org/en/pressroom/pr/2020-07-28-02/, accessed 06/01/20.

Infrastructure Victoria (2016) *The Road Ahead: How an efficient, fair, and sustainable pricing regime can help tackle congestion*, Infrastructure Victoria, Policy Papers 201603.

Kim, S.N., Choo S., and Mokhtarian P.L. (2015) Home-based telecommuting and intra-household interactions in work and non-work travel: A seemingly unrelated censored regression approach. *Transportation Research Part A: Policy and Practice*, 80, 197-214.

Kitamura, R., Nilles, R., Fleming, D. and Conroy, P. (1990) Telecommuting as a transportation planning measure: Initial results of state of California pilot project, *Transportation Research Record*, 1285 (1990), 98-104.

Lari, A (2012) Telework/workforce flexibility to reduce congestion and environmental degradation? *Procedia - Social and Behavioral Sciences* 48: 712–721.

Lenaghan, N. (2020) CBD office rents slump as workers stay home, *Financial Review* 30/06/20, https://www.afr.com/property/commercial/cbd-office-rents-slump-as-workers-stay-home-20200630-p557lj, accessed 06/01/21.

Maynard, R. (1994) The growing appeal of telecommuting, *Nation's Business*, August (1994), p. 61.

McNall, L.A., Masuda, A.D. and Nicklin, J.M. (2009) Flexible Work Arrangements, Job Satisfaction, and Turnover Intentions: The Mediating Role of Work-to-Family Enrichment, *The Journal of Psychology - Interdisciplinary and Applied*, 144 (1).

Mitomo H. and Jitsuzumi, T. (1999) Impact of telecommuting on mass transit congestion: the Tokyo case, *Telecommunications Policy*, 23(10-11), 741-751.

Mokhtarian P.L. (1991) Telecommuting and travel: state of the practice, state of the art, *Transportation*, 18, 319-342.

Mokhtarian, P.L. (2009) If telecommunication is such a good substitute for travel, why does congestion continue to get worse? *Transportation Letters*, 1(1), 1-17

Mokhtarian P.L., Collantes, G.O., and Gertz, C. (2004) Telecommuting, residential location, and commute-distance traveled: evidence from State of California employees, *Environment and Planning A*, 36(10), 1877-1897.

Mokhtarian, P.L., Handy, S.L., and Salomon, I. (1995) Methodological issues in the estimation of the travel, energy, and air quality impacts of telecommuting, *Transportation Research Part A: Policy and Practice*, 29(4), 283-302.

Mokhtarian, P.L. and Salomon, I. (2005) Measuring the measurable: Why can't we agree on the number of telecommuters in the U.S.? *Quality & Quantity*, 39: 423-452.

MySydney (2020) *COVIDSafe Travel Choices – Summer Edition 2020/2021*, https://www.mysydney.nsw.gov.au/sites/default/files/2020-12/Summer%20Edition%20eBook_0.pdf, accessed 06/01/21.

Nilles, J.M. (1988) Traffic reduction by telecommuting: A status review and selected bibliography, *Transportation Research Part A: Policy and Practice*, 22(4), 301-317.

Nilles, J.M., Carlson, F.J., Gray, P. and Hanneman, G.J. (1977*) The Telecommunications-Transportation Tradeoff, Options for Tomorrow*, John Wiley and Sons, New York.

Olszewski, P. and Mokhtarian, P.L. (1994) Telecommuting frequency and impacts for state of California employees, *Technological Forecasting and Social Change*, 45(3), 275-286.

OWD (2021) *Total confirmed COVID-19 deaths and cases per million people*, Our World in Data, University of Oxford, https://ourworldindata.org/grapher/total-covid-cases-deaths-per-million?country=~OWID_WRL, accessed 14/10/21.

Parker, S.K., Knight, C. and Keller, A. (2020) Remote Managers Are Having Trust Issues, *Harvard Business Review* 30/06/20, https://hbr.org/2020/07/remote-managers-are-having-trust-issues%20-%20should%20break%20down, accessed 06/01/21.

PC (2014) *Geographic Labour Mobility: Research Report*, Productivity Commission, http://www.pc.gov.au/inquiries/completed/labour-mobility/report/labour-mobility-overview.pdf, accessed 06/01/21.

Pratt, J.H. (2000) Asking the right questions about telecommuting: Avoiding pitfalls in surveying homebased work, *Transportation*, 27(1), 99-116.

Saleh, W., and Farrell, S. (2005) Implications of congestion charging for departure time choice: Work and non-work schedule flexibility, *Transportation Research Part A: Policy and Practice*, 39 (7–9), 773-791.

Salomon, I. (1986) Telecommunications and travel relationships: a review, *Transportation Research*, 20A, 223-238.

Salomon, I. and Salomon, M. (1984) Telecommuting: The employee's perspective, Technological Forecasting and Social Change, 25(1), 15-28.

Smith, P. (2020) *Almost half of Aussie workers will be at home post-COVID-19,* Financial Review 21/09/20, https://www.afr.com/technology/almost-half-aussie-workers-will-be-at-home-post-covid-19-study-finds-20200918-p55x58, accessed 06/01/21.

Terzon, E. (2020) *House prices rise with regional market outperforming capital cities, CoreLogic data shows*, ABC News 04/01/21, https://www.abc.net.au/news/2021-01-04/house-prices-rise-1pc-regional-beats-capital-cities/13029268, accessed 06/01/21.

TfNSW (2020), *Public Transport Patronage - Monthly Comparison*, Transport for New South Wales, https://www.transport.nsw.gov.au/data-and-research/passenger-travel/public-transport-patronage/public-transport-patronage-monthly, accessed 06/01/21.

TomTom (2020) *Traffic Index Ranking*, https://www.tomtom.com/en_gb/traffic-index/ranking/, accessed 06/01/21.

WSP (2020) *Office vs Home Working: How we can save our carbon footprint* 20/02/20, https://www.wsp.com/en-GB/insights/office-vs-home-working-how-we-can-save-our-carbon-footprint, accessed 06/01/21.

Zhang, S., Moeckel, R., Moreno, A.T., Shuai, B., and Gao, J. (2020) A work-life conflict perspective on telework, *Transportation Research Part A: Policy and Practice*, 141, 51-68.

Zhu, P. (2012) Are telecommuting and personal travel complements or substitutes? *The Annals of Regional Science*, 48, 619-639.