The role of ‘place’ in productivity.

Contribution to Productivity Inquiry.

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About this submission

A series of short insights provided by five academics spanning three institutions are provided. Each of these submissions draws on current and past research of the contributors as well as the academic literature more generally. A key theme uniting these submissions is the importance of 'place' which it can refer to local economies, the digital economy or even workplaces.

Contents

1. Understanding the significance of 'Place'

By Ashton de Silva

Productivity can be difficult to measure. Headline measures can suffer from different forms of aggregation bias e.g., time and sector. We provide a brief conceptual insight into a third source of bias; place. The intent is to help stakeholders scope its influence.

At the Australian Conference of Economists earlier this year[1] four of this submission's authors combined to map out a conceptual overview of place in economics. Three components were articulated:

1. Resources in place
2. People in place
3. Life in Place.

We suggest that each one of these components illuminate distinct dimensions of how productivity between places can substantially differ. *Resources* and *People* in place relate to common explanations of drivers of productivity growth, this includes public/private infrastructure as well as human capital. Understanding that these are different across places is critical noting that public sector policies and private sector initiatives can ultimately impact local communities very differently. Importantly, this means that productivity gains (and losses) will inevitably be unevenly distributed which in turn can have significant consequences on productivity growth and more generally national prosperity.

Technological advancement is a critical driver of productivity gains. It also provides a useful insight into the interaction of *resources* and *people* in place. Public infrastructure (resources in place) can gift local industries with competitive advantages. These advantages can only be realised if the human capital (people in place) is available to utilise these incumbent resources. This means any productivity-stimulating initiatives must consider the 'what'[2] and 'how'[3]; not only for the nation but for local economies also. This is where housing markets are crucial - which is discussed more in section 3.

We believe an important feature of technological advancement going forward will be its impact on the knowledge sector. It may be argued that technological innovation has been thought of commonly as a labour market disrupter typically focused on manual production processes. Whilst we believe this will continue, we also believe that gains in Artificial Intelligence and/or Web3 have opened a new frontier of labour market disruption in the form of productivity gains - the knowledge "highly-skilled/educated" sector. These technologies are already demonstrating their potential to significantly redefine, amongst others, the roles of Accounts, Engineers and Lawyers. More broadly, this has significant implications for local economies, particularly CBDs, as briefly discussed in section 4. It also has significant implications for the education sector.

Our third component *Life in place* touches on an aspect of productivity (in place) that is sometimes forgotten – (individual) well-being. In this context, we define well-being to include elements such as financial stress, social connectedness as well as mental and physical health which we believe builds on the discussion in the first interim report. The OECD's How's Life measure[4] (albeit a national measure) provides a useful deconstruction of well-being. Various studies have shown that an individual's circumstances can significantly affect productivity. Consider for example Greenan *et al* (2014), who finds:

> *"The intensity of work could be connected with challenging work and productivity and thus be valued as a positive evolution. However, beyond a certain intensity threshold, the sustainability of work is at risk, and the potential benefit for the individual is diminished by negative outcomes like exhaustion, stress, or dispersion" (page 402)*

This presents an important challenge to policymakers and productivity generators. Nationally and globally, in the wake of Covid-19, significant economic challenges have emerged. This includes rapid price growth, relocation of households and changes in work practices (i.e., fewer days in the office). Each of these challenges can be viewed as presenting major obstacles (at least in the short term) to productivity growth.

[1] Angelopoulos *et al* (2022)
[2] What needs to be done?
[3] How will it be used?
[4] https://www.oecd.org/wise/how-s-life-23089679.htm Accessed October 19th

For example, the cost of credit increases will likely increase the financial stress of some businesses and households. These entities will likely naturally shift to more precautionary and preservation behaviours (having reduced risk appetite) and therefore may be less able and willing to scope and embark on initiatives that could lead to productivity advancements. With the increase in interest rates also comes a demand for increases in returns on investment crowding out the number of types of initiatives that may otherwise have been explored. Relocations and the work-from-home phenomena could also dampen productivity gains through increased congestion and reduced opportunities for knowledge transmission (this is discussed more in section 2).

Overall, if policies aimed at generating productivity are pursued then an understanding of each component of *place* is necessary for several reasons, including

1. It provides stakeholders with a means of how advances in productivity can (or cannot) change the well-being of local communities and therefore define prosperity for the nation more coherently.
2. It enables policy administrators and advocates a better understanding of how *life in place* can moderate (and perhaps even mediate) the advantages of productivity growth. This is particularly poignant for regions that have experienced (repeat) natural disasters in recent times.
3. It will provide the means to more accurately fathom the potential labour market disruptions across new frontiers.

Reflecting on this short discussion there are several action items policymakers may want to pursue, at least in the short term.

- Support and enhancement of regulatory sandboxes
- Streamlining compliance requirements for businesses
- Focus on effective communication strategies that instil confidence in the business sector
- Encouragement of R&D across both private and public sectors.

Such initiatives, I believe, are more likely to reveal latent innovations, especially in the current economic environment as they will provide businesses with more confidence in uncertain and challenging times which as we discuss in section 5 has the potential to release significant productivity gains.

2. Region inequality, agglomeration, and business diversity

By Sveta Angelopoulos

As a nation is merely the sum of its regions, the unevenness of its growth path is a natural extension of the competitiveness and prosperity of its regions (Che and Spilimbergo 2012) which themselves display significant inequality. The recognition of regional disparity – whether in terms of growth, employment, or productivity – is not new, and shows little sign of diminishing (Maude, 2004). Floerkemeier et. al., (2021) argue that since the late 1980s, the trend has been increasing regional inequality across advanced economies. Economic shocks can further exacerbate existing inequalities (Compagnucci et al. 2022) and as the pandemic has demonstrated - different regions (sometimes in close proximity) can be impacted to very different degrees (Angelopoulos et al., 2022a). The variability of resources and people in place contributes to this unevenness of growth and prosperity and will affect the recovery from economic shocks such as COVID-19 thereby affecting the national growth path. For example, the national median personal income in 2019 was $51,389 (Table 1), with most states and territories within 10 percent of the national median. Despite the relative consistencies between states and territories, there is considerable variation between regions (Figure 1). National, state and even capital city averages can mask the variability of resource availability between regions, resulting in uneven productivity and growth in regions and regions' resilience to economic shocks.

Table 1: State and territory median total personal income (2019)

	AUST	NSW	VIC	QLD	SA	WA	TAS	NT	ACT
Personal Income	51,389	51,818	51,027	50,298	49,888	54,220	47,352	61,517	66,594

Source: ABS data by region, 2015-20, https://www.abs.gov.au/methodologies/data-region-methodology/2015-20.

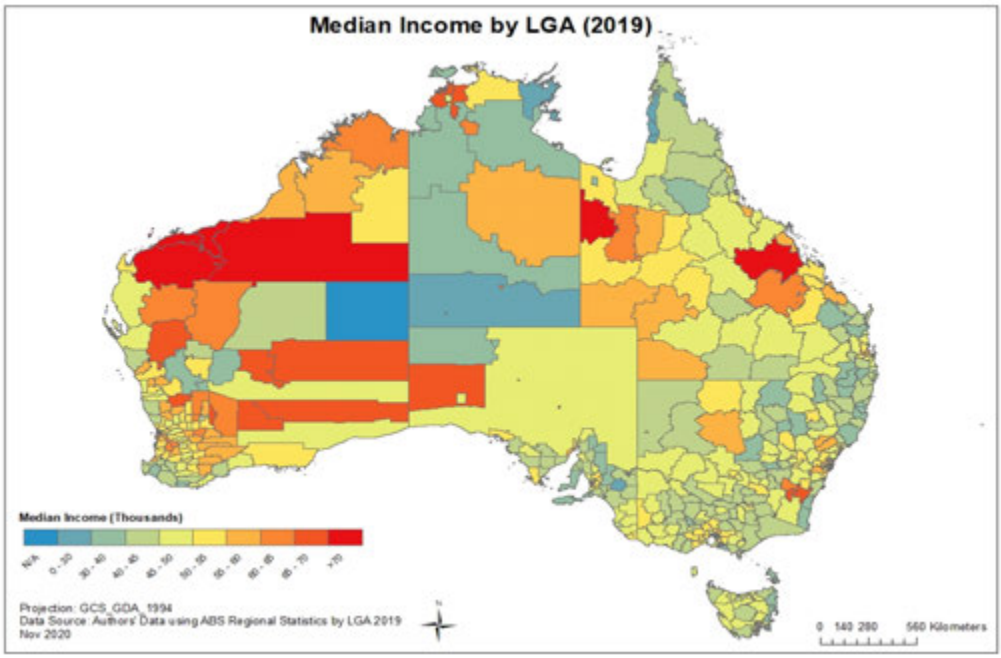


Figure 1: Heatmap of median total personal income. Source: authors' calculations using ABS data by region, 2015-20, https://www.abs.gov.au/methodologies/data-region-methodology/2015-20.

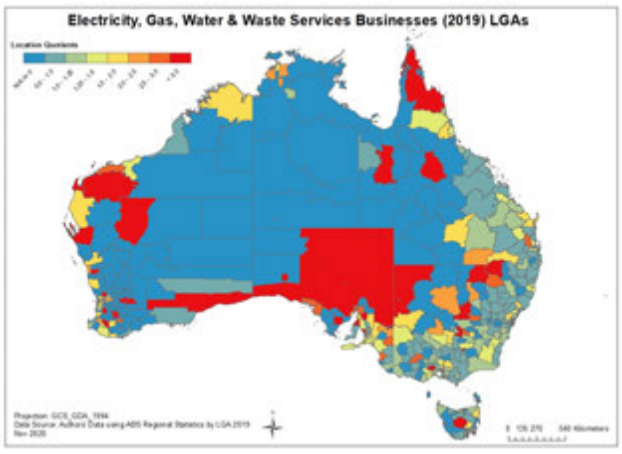
The contribution of regions to national outcomes will be affected by the resources in place – for example, the availability of suitable labour resources, the number and size of local businesses, the available infrastructure – and importantly the resilience of the area in the face of economic shocks. Whether industry agglomeration or diversity in regions is optimal for economic growth and business resilience continues to be an area of active debate (Dietz & Garcia, 2002; Feldman & Audretsch, 1999; Glaeser et al., 1992; Porter, 2000).

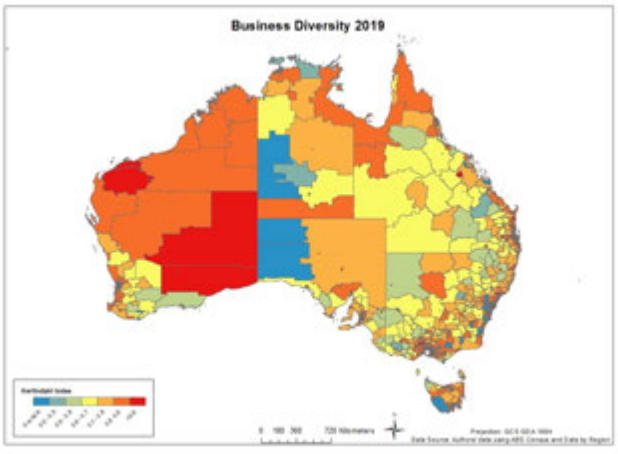
Using location quotients[5] to measure industry concentration, Table 2 illustrates the variability of industry concentrations across Australian states and territories, with the final row representing industry diversity[6]. Even though diversity across the states and territories is relatively similar and high – close to one in most instances, the composition of industries is different, with concentrations of particular industries substantially different from one state to another. These differences become even more exaggerated when we switch our analysis to Local Government Areas (LGAs). This is evident in Figure 2 where the concentration of utility businesses is relatively similar at the state/territory level but significantly different at the LGA level. Likewise, once we switch from the aggregated state/territory level, the vast differences in industry diversity are demonstrated in Figure 3.

Table 2: State and territory industry concentration (location quotients) and diversity measures

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT
Agriculture, forestry and fishing businesses	0.89	0.89	1.28	1.52	0.83	**1.73**	0.68	0.18
Mining businesses	0.55	0.43	1.71	1.12	**2.62**	1.2	1.83	0.41
Manufacturing businesses	0.93	1.04	1.07	1.09	0.95	**1.19**	0.78	0.63
Electricity, gas water and waste services businesses	0.95	0.97	1.1	**1.2**	0.97	0.91	0.95	0.86
Construction businesses	0.98	1.02	1.08	0.88	0.94	0.88	1.03	**1.22**
Wholesale Trade businesses	1.03	**1.13**	0.98	0.92	0.77	0.77	0.57	0.52
Retail trade businesses	0.99	1	1.1	0.95	0.84	**1.19**	0.98	1.01
Accommodation and food services businesses	0.97	1	1.1	0.91	0.83	**1.51**	1.16	1.44
Transport, postal and warehousing businesses	1.02	**1.1**	0.94	0.83	0.94	0.76	0.86	0.99
Information media and telecommunications businesses	1.17	0.96	1.02	0.71	0.65	0.69	0.82	**1.72**
Financial and insurance services businsses	0.98	1.01	**1.16**	0.78	0.92	0.87	0.74	1.08
Rental, hiring and real estate services businesses	0.96	0.95	1.22	0.97	0.84	0.95	**1.24**	1.09
Professional, scientific and technical services businesses	1.04	0.97	1.11	0.71	0.86	0.84	0.78	**1.81**
Administrative and support services businesses	1	0.98	1.14	0.9	0.83	0.81	1.03	**1.24**
Public administration and safety businesses	1.09	0.97	1	0.76	0.8	0.99	1.41	**1.79**
Education and training businesses	1.05	0.97	1.17	0.68	0.75	0.73	0.8	**1.7**
Health care and social assistance businesses	1.02	0.94	1.14	0.9	0.8	1.1	0.88	**1.47**
Arts and recreation services businesses	1.02	1	1.08	0.79	0.84	1.09	1.08	1.33
Other services businesses	0.95	0.95	1.2	0.95	0.94	1.01	**1.18**	1.07
Business Diversity	0.9325	0.9308	0.9136	0.941	0.9449	0.9322	0.9354	0.8922

Source: authors' calculations using ABS data by region, 2015-20, https://www.abs.gov.au/methodologies/data-region-methodology/2015-20.





Figures 2 7 3: Heatmap of industry concentration of utility businesses across and business diversity across Australia. Source: authors' calculations using ABS data by region, 2015-20, https://www.abs.gov.au/methodologies/data-region-methodology/2015-20.

[5] A location quotient is calculated as the share of businesses in a specific industry in a region relative to the national share, therefore, a location quotient of 1 indicates that the region share is equivalent with the national share. A value greater than 1 signals that the region has proportionately more businesses in the industry than nationally, and a value less than 1 signals that the region has relatively fewer businesses in the industry than nationally.

[6] Industry diversity is calculated using the Herfindahl Index (1 minus the index), using all 19 industry types in Australia. The closer the index is to 1, the greater the industry diversity in the region.

The concentration of industry activity in a confined spatial area has been found to improve productivity and growth and lead to greater rates of innovation (De Blasio & di Addrio, 2005). Benefits can accrue as a result of cost savings due to the proximity of businesses, availability of labour resources, specialisation and better diffusion of technology and knowledge (Audretsch and Feldman, 1996; Porter 1998 and 2000). These spillover effects accelerate innovation and can contribute to productivity via heightened efficiency gains as a result of knowledge accumulation and technology. Shuai's (2013) study corroborates the benefits of specialisation for small and emerging industries but found that as industries mature a region could be exposed to a 'specialisation trap' with negative outcomes for employment growth and increased exposure during economic slowdowns.

The exposure to economic shocks could be mitigated by regional industry diversity, especially in cases where particular industries are primarily impacted. Empirical studies indicate that regions abundant in business diversity are better insulated against economic shocks (Davies and Tonts, 2010; Izraeli and Murphy, 2003; Dietz and Gracia, 2002) as the impacts are diluted when many industries are present. Preliminary findings of regional resilience to COVID-19 indicate that industry diversity supported regional resilience to some extent (Angelopoulos et. al., 2022), but this finding was reversed for Victoria. The authors suggest that this may have been a result of the severity and length of restrictions imposed in Victoria, indicating that government interventions can reverse empirically accepted relationships.

Many further argue that industry diversity is beneficial to regions because knowledge spillovers across industries are more conducive to growth than spillovers within industries (Glaeser et.al., 1992), leading to improved employment outcomes and faster growth rates than areas with industry concentrations (Quigley, 1998; Dietz and Gracia, 2002). Diversity within a localised area stimulates 'dynamic knowledge externalities' (Desrochers, 2001, p. 369) through the interaction and exchange of ideas and knowledge of people from diverse firms, stimulating innovation. The 'recombination' of knowledge across diverse industries has been instrumental for innovation (Franken et. al., 2007), supporting the ideas espoused by Jacobs (1969) in what has become known as the Jacobs' externality.

Ultimately, regional inequality plays an important role in national outcomes (Furceri et al., 2022), however, there is still a lack of consensus regarding this inequality and national development. Following the neoclassical framework, many argue that growth in regions will reduce their unevenness as they converge towards their steady states (Solow, 1956; Alesina and Rodrik, 1994), however other studies dispute the feasibility of this outcome and find that economic growth leads to greater regional inequity (Myrdal 1957; Kaldor 1970).

Further research and understanding of the dynamics within our local communities will better position policy and decision-makers. Australian regions are vastly different in terms of the resources and people in place (Angelopoulos et al., 2022b), thereby affecting life in place and ultimately the productivity and resilience of the region. The diversity of our regions needs to be explored in greater depth to assess how they contribute (or limit) to productivity, growth and inequality to determine the best policy adjustment and supports to improve outcomes.

3. Productivity and Housing

By Maria Yanotti

Productivity growth has been low and diminishing in the last decade for Australia, and is a major concern for economic policy. Multifactor productivity (MFP) has increased by only 0.2% in 2020-21 relative a 0% increase in 2018-19 and 0.1% growth in 2019-20.[7] Market sector labour productivity grew 1.1% in 2020-21, relative to a previous growth of 1.8% in 2019-20; the result of a rise in gross value added (GVA) and a fall in hours worked. Overall, on a quality-adjusted labour input (QALI) basis, MFP fell 0.2% and labour productivity only rose 0.4%. The weaker growth on a QALI basis reflects a positive contribution from changes to the composition of labour due to educational attainment and work experience. In addition, the Reserve Bank of Australia (RBA) shows that current business and private dwelling investment trends are in decline for Australia during an economic expansionary and inflationary period with record low unemployment rate.[8] The annual growth of the factors of production (both net capital stock and working-age population labour) are at record low levels and declining.

The Covid-19 pandemic has brought drastic changes to the workforce and education with much of it pivoting from in-person to online operations strictly in 2020 and for some time after. Working from home (WFH) has been the 'new normal' during the period of lockdown, except for essential services that require face-to-face engagement and commuting. Brynjolfsson et. Al. (2020) found for early 2020 that of those employed pre-Covid-19 in the US, half were working from home. For Australia, the NHFIC State of the Nation's Housing 2020 report estimated that around half the working population in Australia was still working from home, likely driven by longer shutdowns taking place in Melbourne; NHFIC (2020) page 6.

In many industries across countries, the paradigm of work itself has been revolutionized with a large proportion of the workforce WFH at least part of the time. Balbontin et. al. (2021) find there is growing support from both employers and employees for more flexible working practices. They argue that the reported productivity levels by employees have either increased or remained the same, and there has been growing support from employers to allow employees to decide where to work. This hybrid work model involves WFH to some extent and fewer days commuting to a regular workplace location. Beck & Hensher (2021b) find for Australia growing evidence of a hybrid model with WFH occurring for 1 to 2 days per week for many occupations, notably professionals and managers. Brynjolfsson et. al. (2020) finds that younger people are more likely to switch to remote work, while Balbontin et. al. (2021) found that those on higher income, with more travel time to the office and no car availability, were more likely to WFH more days of the working week; and that current employer's supportive views towards WFH are an important contributor of WFH. Barrero et. al (2021) argues that the WFH effect of Covid-19 will stick around for five key reasons: (1) better-than-expected WFH experiences; (2) new investments in physical and human capital that enable WFH; (3) diminished stigma associated with WFH; (4) lingering concerns about crowds and contagion risk; and (5) pandemic-driven surge in technological innovations that support WFH.

This change in the way of working and location of work has powerful implications on economies affecting commuting activity, transport and infrastructure, housing, retailing, and demand for services and amenities amongst others. For example, changes in the commuting planning and schedules due to higher WFH and lower transport demand will also impact access to transport for non-work-related matters and potentially productivity through reduced daily available commuting options. It also reflects a greater focus on activities at the suburban and regional levels and lesser activity in metropolitan areas (Navon and de Silva, 2022).

Borsellino (2022) find that net migration to regional areas in Australia increased since the onset of the pandemic in March 2020, representing an inversion to the traditional pattern of population migration in which there is a net outflow from regional areas to metropolitan cities. This evidence is also supported by ABS migration data showing a substantial population outflow from cities and a reduced migration from regional

[7] Australian Bureau of Statistics (ABS), Estimates of Industry Multifactor Productivity, 2020-21 financial year. https://www.abs.gov.au/statistics/industry/industry-overview/estimates-industry-multifactor-productivity/latest-release

[8] Reserve Bank of Australia (RBA), Chart Pack, Graphs on the Australian Economy and Financial Markets. Released on 5 October 22. https://www.rba.gov.au/chart-pack/

areas since March 2020.[9] Australian capital cities experienced an aggregate net loss of over 11,800 residents in the March 2021 quarter to other parts of Australia. This is consistent with evidence from the US market; Haslag & Weagley (2022) document a population shift away from the largest cities and towards the smaller cities. Their examination reveals that Covid-19 households' migration is over-represented by higher-income households, supporting the argument that Covid-19 migration is motivated, in part, by the increased geographical flexibility made possible by remote work arrangements. Ramani & Bloom (2021) find for large U.S. cities that housing demand has shifted from dense CBDs towards lower-density suburban zip codes, describing a `Donut Effect' that reflects the movement of activity out of city centres into the suburban ring. Similarly, results in Liu & Su (2021) show that the pandemic has led to a shift in housing demand away from neighbourhoods with high population density, driven partially by the diminished need for living close to jobs and the declining value of access to consumption amenities. The NHFIC State of the Nation's Housing 2020 report noted that demand appeared to be shifted away from inner-city dwellings to regional centres but that it would be some time before it was apparent if WFH and people choosing to move to more regional areas would become a more permanent shift; NHFIC (2020).

This move out of the metropolitan cities and into suburban and regional cities supported by flexible and remote work arrangements implies the need for improved local transport services, and infrastructure, but also the need for housing stock and services. Lockdowns and restrictions have shifted the demand for housing, due to changes in housing preferences; Verdouw et al. (2021). Changes in housing demand reflect changing preferences in housing quality (number of bedrooms, low density, yard, nature surroundings), quality of life, and reasons to be closer to social networks and the natural environment, amongst others. This trend has encouraged some individuals to move out of the cities and has encouraged relatively fewer people to move into the cities. Smaller and further away cities also offer uncrowded safe spaces, which may have become a priority for some individuals.

Housing needs and housing outcomes have important implications on productivity; Maclennan et. al. (2019), Maclennan et. al. (2020a) and Maclennan et. al. (2020b). Maclennan et. al. (2021) highlight that the characteristics of homes impact capabilities to learn and work (as experienced through the Covid-19 lockdowns) and accumulate. They argue that

> *"…small, low amenity housing impairs child learning and development; poor quality homes are associated with poor health outcomes that impair schooling, work and income; pushing lower and middle income households further away from employment locations reduces labour productivity, not primarily by raising commuting times but by diminishing the 'thickness' and matching effectiveness of labour markets; attenuating homeownership impacts household accumulation of assets and housing price and wealth changes significantly impact investment capabilities…"* Maclennan et. al. (2021; pages 35-36).

Moreover, higher house prices and rents may induce lower house purchases or lower quality housing, or housing further away from workplaces, or they lead to households renting rather than owning their homes. All these effects can impact economic productivity.

The implications of this sudden change in internal migration trend impacted property prices, housing affordability and housing stress, particularly in regional areas where housing stock is limited and the elasticity for new housing stock is low. Yanotti et. al. (2022) find that house price growth in regional cities is leading and affecting house price changes in other submarkets, including metropolitan areas. These regional cities have traditionally provided affordable housing. However, now, residents in regions compete for a limited supply of housing stock and rising housing costs against a higher-income remote migrating workforce. The higher in-flow migration also implies higher demand for local services, amenities, infrastructure and business development.

Hsieh & Moretti (2019) show evidence of spatial labour misallocation caused by unaffordable housing costs in high-productivity cities limiting the number of workers that can access housing in those high-productivity areas and pushing away those who can't afford or access housing in less productive and more affordable regions. If remote working is long-lasting, regional housing stress has the potential to create a migration ripple in which low-income and vulnerable households are forced to migrate to less expensive and further away areas. This has social and employment consequences for regional areas.

[9] Australian Bureau of Statistics (ABS), Regional internal migration estimates, provisional March 2021. https://www.abs.gov.au/statistics/people/population/regional-internal-migration-estimates-provisional/latest-release

Growing property affordability issues and limited stock in regional areas also affect new migrants' settlement in regions. Currently, Australia is experiencing high job vacancies, and demand for workers is high,[10] particularly in the regions. However, many workers attracted to jobs in regional cities and towns are unable to access the limited housing stock even if it was more affordable than in metropolitan cities. The limited housing options then directly affect potential regional production and productivity. While more people move into regional cities, it can be expected that with the growth in housing prices in these regional cities, their residents find local housing prices less affordable, particularly relative to lower regional wages, and then find housing harder to access and unaffordable. This pattern presents challenges for regional cities and councils and puts pressure on regional communities and regional planning. There is an opportunity for government policy and public and private investment to intervene to address the housing supply imbalance in these areas.

The increased incidence of WFH can have some positive contributions. As established, the WFH flexibility learnt through the lockdowns has important spatial implications, affecting urban and rural housing markets and migration dynamics, altering the demand for housing, services, amenities and infrastructure both in rural areas and cities. These short-term shifts have particularly impacted regional cities' and towns' amenities and available housing stock altering markets considerably and pushing many regional cities and towns into housing affordability stress. However, Nguyen et. al. (2022) argue that increases in immigration do not overheat housing markets but on the contrary, would contribute towards a gradual correction of housing markets towards equilibrium. Moreover, Iacoviello and Neri (2010) and Carruth & Henley (1993) argue that the growth in (regional) housing equity through rising house prices has a positive impact on (regional) consumer spending. The longer-term effects of house price growth on productivity are however not well studied and understood.

[10] Reserve Bank of Australia (RBA), Chart Pack, Graphs on the Australian Economy and Financial Markets. Released on 5 October 22. https://www.rba.gov.au/chart-pack/

4. Web3 and Productivity

By Sarah Sinclair[11]

Blockchain technology is an institutional infrastructure specifically designed for the recording of facts in conditions where mistrust prevails. Werbach (2018) refers to the development of blockchain in 2009 as the implementation of a new trust architecture, one that at its core represents a simple idea: Blockchain enables trust in a system without necessarily trusting any or all of its parts. There are well-documented positive links between trust and productivity (Bjørnskov and Méon, P.G., 2015, Coyle and Lu 2020)) suggesting mechanisms that increase trust can impact productivity growth.

Mechanisms to increase trust include a greater level of transparency in operations and decision-making, a move to more decentralised power structures, and recent technology developments can support both. There is an increasing demand for greater citizen participation in decision-making process across a range of socio-political dimensions be they top-down or grassroots in orientation. This increased citizen participatory approach, democratisation of decision making and resulting decentralisation mean there are likely to be differences in trust structures and productivity advances across dimensions of place. In this section, we explore the links between blockchain infrastructure (web 3), trust and place and identify some of the productivity gains that could be achieved by web 3 technologies such as blockchain.

The distributed ledger architecture of blockchains and their tamper-proof qualities make them suited to activities where information needs to be shared among parties who may not trust one another particularly where credibility, provenance and authenticity need to be established.

Technically blockchains are a mixture of append-only databases, cryptographic hash functions, peer-to-peer networking and economic incentives. Blockchain can be thought of as a production technology (like a machine) or a general-purpose technology (like electricity). However, both of these don't fully capture the technology potential impact on productivity. With the prevalence of digital transformation, businesses and Governments are increasingly realising the need for the use of digital channels to conduct their business and interact with their stakeholders. While micro-level decision-making with respect to technology adoption is occurring within organisations, at a macro level a much more fundamental transformation is occurring. Technologies such as Blockchain can transform the mechanisms of economic organisation, coordination and governance itself, and in doing so impact Productivity (at a macro level).

Without delving into the pros and cons of specific technological solutions for specific industry-based problems it is interesting to apply an economic lens and consider Blockchain, not just as a new production technology but rather as a new institutional infrastructure. According to Potts (2021) Blockchain

> "*is true beginning of the digital age and that it represents the emergence of a new type of economic system that is post-industrial in a very specific sense: it is analysis of an emerging and evolving digital economy that is digital all the way down*" . (Potts 2021)

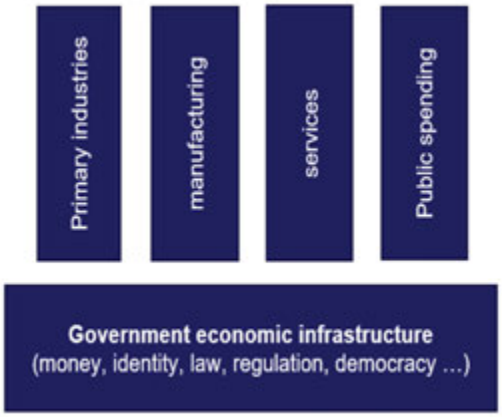
Productivity gains can be experienced through Digital platforms by driving down search costs, transaction costs, networking and verification costs, changing the economic value of data and information and disrupting industrial patterns of production.

[11] *This draws on the work of members of the RMIT Blockchain Innovation Hub – Dr Darcy Allen, Associate professor Chris Berg, Professor Jason Potts and Professor Sinclair Davidson)*

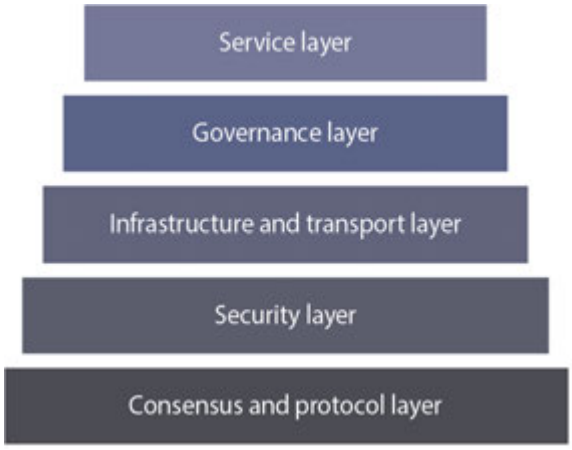
We can visualise it like this

We are somewhere between the first and second digital age, transitioning from the information age where there is a rapid shift from traditional industry to one driven by computers, cheap computation, and communication, to a world where blockchain utility in the form of a decentralised shared immutable ledgers integrates with the digital technologies of automation including artificial intelligence, the Internet of Things, and 5G. What this means is that the structure of the economy fundamentally shifts from the Industrial economy stack which has dominated since the industrial revolution to the new digital economy.

a. Industrial economy stack



b) Digital economy stack



To illustrate this new and evolving digital economy stack. Some examples of new emerging using blockchain integrating big data, IoT, 5G, and AI, include: -

- **Data markets**: *Datapace* – A decentralised marketplace for data monetization. A blockchain-powered secure transactions and automated smart contracts to sell and buy data streams. Datapace data marketplace can be used to stream any data from any source, IoT devices, physical assets, autonomous cars, and drones. It enables users to integrate 3rd party data and monetize it through the same marketplace.
- **Prediction markets:** A prediction market is a market for the buying and selling of futures contracts on binary events. One example is augur *Augur* is a decentralized oracle and peer-to-peer protocol for prediction markets. Augur is free, public, open-source software, The Augur Protocol is an attempt to try to solve the oracle problem. Augur is a trustless decentralized peer-to-peer oracle employed on a predictive market protocol. The Augur oracle allows information to be migrated from the real world to a blockchain without relying on a trusted intermediary or third party.
- **DeFi:** Decentralised finance; **system by which financial products become available on a public decentralized blockchain network.** *Defipulse* provides a good overview of the defi ecosystem (defipulse.com)
- ***DeX; Decentralised exchanges:*** A decentralised exchange is a platform where users may trade cryptocurrencies without the use of an intermediary.

- **DAOs,** Decentralised Autonomous Organisations: Member-owned communities without centralized leadership; examples include *MakerDao*

In terms of driving productivity gains:-

- Blockchains can reduce the cost of verifying, identifying, and networking without intermediaries – creating new markets and reducing costs in existing ones
- Blockchains are an institutional technology – a decentralized computation for the coordination of economic activity
- Blockchain is a new type of economic institution that competes with current known institutions such as firms, markets and governments

Blockchains aren't just simply industrial technologies that increase productivity, they are **institutional technologies**. It is the fact that their governance models are distributed that identifies blockchain as an institutional infrastructure rather than an industrial one. The decentralised nature of blockchain facilitates new models of economic governance and coordination (Davidson et al 2018). In this way, we can consider blockchain as similar to other institutional technologies (e.g. joint stock company, a nation-state) noting that this type of innovation in institutional technologies is rare. The new forms of governance driven by Blockchains could change the boundaries of organisations.

The role of trust in blockchain differs from trust in traditional centralised industrial contexts as trust is now in a decentralised network of actors rather than individual actors. Companies have traditionally employed humans to act as interfaces and intermediaries with the external world blockchain enables new means of alliance formation relating to innovation and production. If we draw on the connection of trust and productivity, as the boundaries of organisations shift, the role of **trust intermediaries shift, evolve or disappear** this will result in shifts in the potential for productivity gains.

Blockchains are a technology for the distribution, maintenance, and verification of social facts. The facts that blockchains record are **property rights** that lie at the intersection of law, economy, the state and culture. Carruthers and Ariovich (2004) define five dimensions of property: the objects of property (**what can be owned** – NFT's evolving the concept of property right), the subjects of property (who can own what), the uses of property (what can be done with it), the enforcement of rights (how property rules are maintained), and the transfer of property (how property moves between different owners). *Blockchain can be considered then as a digital property rights system.*

Blockchain ledger entries can record any data structure, including property titles, identity, and certification, and allow for their transfer digitally via smart contracts.

- Digital assets (e.g. cryptocurrencies)
- Physical property (e.g. ownership titles)
- Digital Assets with a set of unique attributes (Non-Fungible tokens)

As these decentralised systems evolve an awareness of the challenges and opportunities they present to different societal cohorts, industry sectors and regulatory bodies will need to be understood to ensure productivity gains are experienced broadly in society. Digital inclusion metrics will need to capture shortfalls in accessibility, ability and affordability of individuals to engage in the new economy and these will need to be addressed through target policy responses. Current data collection such as the Australian digital inclusion index could be extended. Data capturing skills shortfalls of relevance to the digital economy are better measured to inform education required to meet current shortfalls as the Australian higher education system evolves to meet the demand for the new skills that will be required and to keep pace with shifting global trends and ensure our international competitiveness.

5. Digital Inclusion, workplaces and productivity

By Emmanuelle Walkowiak

5.1. Innovation for Inclusion, the digital skill shortage and the labour market

The last interim report of the Productivity Commission explores the role of migration, occupational licencing, and gig economy platforms to solve skill gaps. Furthermore, the report highlights the role of technologies (RegTech) to automate industrial relations, to generate productivity gains by reforming the labour market. In this section, we demonstrate that inclusion policies offer an innovative solution to address the digital skills shortage and improve economic productivity with the example of neurodiversity initiatives (Walkowiak, 2021).

The concept of neurodiversity acknowledges the combination of strengths and difficulties associated with neurological differences between individuals, including dyslexia, dyspraxia, Attention Deficit Hyperactivity Disorder (ADHD), autistic spectrum and others. Walkowiak (2021) explores how inclusive neurodiversity initiatives combined with digital transformation drive productivity gains at the workplace. She demonstrates that the coordinated implementation of neurodiversity initiatives with the digital transformation of workplaces generates productivity gains at the individual, organisational and macro levels. Walkowiak (2021) underlines that

> *"while autistic workers offer a wide range of skills, some of them exhibit performative abilities that are in high demand in IT roles. Their cognitive differences, creativity and resilience are also in high demand in the context of the digital transformation. These set of skills generates productivity gains since they favour innovation and organisational agility. There is a strong complementarity between the cognitive skills of autistic workers, innovation and skills demanded in IT roles."*

This result is important, as it analyses innovative ways to fill digital skill shortages observed in Australia. As mentioned by Walkowiak (2021)

> *"By helping to close the digital skills shortage, a neurodiverse workforce favours the digital transformation. Tapping in the pool of autistic talents is an efficient and inclusive way to diversify the recruitment practices. By providing employment opportunities to autistic workers, the digital transformation also favours neurodiversity."*

Neurodiversity initiatives demonstrate that innovative recruitment policies that favour diversity and inclusion can drive both productivity gains and sustainable growth.

Hedley et al (2022) evaluated productivity gains associated with the DXC Dandelion programme which is a three-year supported employment program for autistic adults in the information and communication technology (ICT) sector. The study shows that economic and productivity gains for the Australian economy are substantial. Using a Cost-Benefit Analysis, they demonstrate that this targeted policy of inclusion is highly efficient (the cost representing less than 4% of the benefits) and that 75% of the net benefit of the initiatives reflects the gains in wages paid to participants, 23% of the benefit of the initiatives comes from an increase in tax revenue and 24% from welfare payment avoided when individuals are employed. Assuming that wages are a good indicator of productivity gains, these results demonstrate that these inclusive initiatives reinforce Australian productivity. Neurodiversity initiatives can thus be considered as a model of productive inclusion of workers that can be scaled in Australia (Walkowiak, 2021) due to its high economic efficiency in the short- and the long-run, with a clear positive social impact.

5.2. The transformation of workplaces: measuring productivity gains with matched employer-employee surveys

The role of technologies in productivity gains is addressed in several reports, without any mention of the role of the organisational design of workplaces to drive these productivity gains. As mentioned in other parts of this submission, there was an acceleration of the transformation of workplaces and working conditions during the Covid19 with the general implementation of remote work practices. The word "workplace" is mentioned one time in interim reports 1, 4 and 5 and three times in interim report 3 on innovation. It is not at all mentioned in report 2 on the digital dividend. While it is extensively mentioned in the interim report 6, it is mainly to focus on

problems related to industrial relations rather than to analyse how the transformation of work within workplaces generates productivity gains.

It is essential to open the black box of workplaces to understand the interaction between the workers, work organisation and the use of technologies as part of the same transformation. In this section, we argue that matched employers-employee surveys should be developed to guide evidence-based policies and to capture productivity gains associated with the transformation of work. Paradoxically, in a period of an abundance of information, the quality of the datasets to measure the impact of digital transformation on work is very limited. The organisational design of workplaces can be measured by using firm/employer datasets to inform on organisational and technological choices made by managers. Employee datasets inform about the way people work and use technologies at the workplace (or any place where they complete a task). Matched employer-employee datasets are required to provide a robust analysis of the way managerial choices in terms of technology impact productivity, through a transformation of the way tasks are completed by workers and problems are solved at the workplace (Daly et al., 2019).
For example, Behaghel et al., (2012), Walkowiak (2006) use employer datasets that they match with administrative data on the movement of the labour force within firms in France, to measure different forms of skill upgrading associated with the diffusion of technologies and technological transformation of workplaces. They identified several upskilling strategies, considering the organisational context:

1. an upward shift of their occupational structure is done via promotions of incumbent workers from lower to higher skill occupations (which is an internal labour market strategy) or by hiring highly skilled workers and/or firing them in less skilled ones (external labour market strategy).
2. External labour market adjustments may also take the form of excess turnover (or churning)—i.e. turnover over what is necessary to upgrade the occupational structure—if firms try to acquire new skills by hiring 'fresh' workers.
3. Training of workers.

All reports of the inquiry mainly rely on datasets collected at the firm level (employer level). For example, the information on the use of technologies relies on the Business Characteristics Survey data. While the view of managers on managerial and technological choices is essential, it only provides a partial picture of the impact of digital transformation on productivity.

Greenan et al., (2007) point out that workers can provide more accurate information on important questions such as: How does the introduction of digital technologies impact the way they work? Do the new technologies lead to the enrichment of jobs or on the contrary to more repetitive work? What is going on in terms of supervision and control? How do workers react individually and collectively to the introduction of new technologies? Understanding the transformation of workplaces/workstations through the lens of employees is essential to understand how productivity gains arise. Greenan & Walkowiak (2005a, 2005b) who used matched employer-employee datasets, identify four main advantages of using employee data to measure the productivity of workers when they measure the coordination of technological and organisational choices in the design of workstations. Firstly, the workstation is a homogenous unit of observation, compared to the firm that varies in size. Second, at the employee level, it is easier to obtain an objective description of the characteristics of work. At the firm level, some spurious correlation may arise from the fact that interviewed managers prefer to give a positive or innovative representation of their own technological and organisational choices. Moreover, employers do not know precisely how employees complete their tasks. Thirdly, the employee level allows controlling for potential selection biases in the access to technology or organisational practices, by introducing several control variables on the sociodemographic characteristics of workers. When reviewing the literature on the productivity impact of technologies and the use of technologies, Greenan & Walkowiak (2005a, 2005b) point out important selection biases that can only be controlled by using datasets collected on employees. The underlying ideas are that either ICTs increase employees' productivity, or they receive higher pay, because they present skills or attitudes, not statistically measurable, but known by their employer, that makes the increase in their ability in using the new technology efficiently. Last, but not least, the employee datasets allow the measurement of the quality of working life of workers, which is an essential component of productivity. Indeed, the quality of jobs and working conditions represent a key driver to attracting workers in the context of skill shortage. Greenan et al., (2014) underlines that productivity, innovative ability and competitiveness of a country lie in the quality of working life of employees. Using employee data sets from European Condition Surveys, Greenan *and al* (2014) show that the physical strain, work intensity and work complexity represent important dimensions of the quality of jobs that may impact the productivity of workers.

In conclusion, matched employer-employee surveys are required to understand how labour practices and organisational choices are translated at the workstation level, to appropriately measure productivity gains. Innovative inclusion policies, like neurodiversity initiatives that were presented in this comment, should be considered priorities by policymakers to address skill gaps, reinforce productivity and improve the economic efficiency of employment/welfare policies.

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Dr de Silva is an applied economist with a keen interest in understanding the economics of well-being at the micro, meso and macro levels. As well as publishing in leading academic journals he has a strong record of receiving grants and industry research contracts focussing on Ageing in Place, taxation, housing, property markets and welfare. In recent times this has led him to consider h the economics of 'place', both conceptually and literally as well as the potential of the web3 economy.

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Sveta is an applied economist, and lecturer at RMIT University. As a researcher, she seeks to improve the competitive advantage of regions and the well-being of residents through her research in urban and cultural economics. Her focus is on the spatial dynamics of Australian regions, their resilience, and the policy environment. As a member of the Spatial Capability Cluster at RMIT, as well as the Placemaking Economics Team, within the Societal Economics Research Group, she contributes to a field that continues to be relevant to both academics and increasingly to policymakers seeking to support the growth and resilience of regions.

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Sarah Sinclair

Sarah is a Senior Lecturer in RMIT's School of Economics Finance and Marketing and a member of RMIT's blockchain innovation Hub (BIH) the Societal Economics Group (Placemaking), and the Centre of Urban Research (CUR). Her research is integrated around people, place and technology, and the efficiencies inequities and social change arising from policy changes in an increasingly digital economy. Sarah's research has examined the decision-making of households given certain social and geographic situations and the public policy frameworks that can influence those decisions. These include where to live, family formation and expansion, divorce and the role of child support on the well-being of children in addition to retirement planning and the role of housing in facilitating positive ageing. Her current research is focused on the social, economic and equity implications of digital transformation including blockchain applications, how technology can impact on how we interact with "place" and what cohort-specific effects can we observe as the economy becomes more digitized.

Emmanuelle Walkowiak

Dr Emmanuelle Walkowiak is an economist who analyses the links between the digital transformation, new shapes of work, productivity and inequalities between workers. Her current research investigates workforce innovation in a digital economy (Web 2.0 and Web 3.0) and analyses the quality of working life for crowd workers of platforms, neurodiversity and inclusion at the workplace. Her other research interests include the impact of blockchain technologies on governance, AI/AR/VR/Metaverse and mental health support at workplace. As a labour economist, she uses advanced microeconometrics methods to evaluate the efficiency of labour market policies, such as the short-time wage subsidies (JobKeeper in Australia). Emmanuelle had academic positions in France (Dauphine, University Paris 11-Saclay, University of Orleans and University Paris 12), the UK (Westminster University), the US (Princeton University), before joining Australia.