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House price dynamics and internal migration across Australia

From the AHURI Inquiry: Inquiry into projecting Australia's urban and regional futures: population dynamics, regional mobility and planning responses

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Acronyms and abbreviations used in this report

ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
AHURI	Australian Housing and Urban Research Institute Limited
CBD	central business district
Covid-19	Coronavirus 2019
GDP	Gross Domestic Product
LGA	local government area
NSW	New South Wales
NT	Northern Territory
OLS	ordinary least squares
QLD	Queensland
SA	South Australia
SEIFA	Socio-Economic Indexes for Areas
SIH	Survey of Income and Housing
UK	United Kingdom
US	United States
VAR	vector autoregressive
WFH	work from home

Glossary

A list of definitions for terms commonly used by AHURI is available on the AHURI website ahuri.edu.au/glossary.

Executive summary

Key points

- Regional cities and suburban fringe areas play an increasingly important role in influencing national patterns in Australian housing prices.
- Internal migration determines the way in which housing price increases in one housing submarket increase housing prices in other submarkets.
- The relationship between house prices across different housing submarkets has changed considerably since 2020, reflecting differences in the impact of Covid-19 and varying responses from state and territory governments.
- The unexpected increase in migration to regional cities and fringe areas led to a housing-supply imbalance in regional and rural areas—particularly for affordable housing. This highlighted the need for government policy, and both public and private investment, to intervene through targeted strategies.
- There is a need for coordination across councils and different government levels when implementing housing policy. This coordination needs to be applied to both demand-side and supply-side policies.
- Policy makers can use housing market data as indicators of population migration to inform more timely decisions about regional investment, internal migration policy and macroeconomic setting.

Key findings

This project is part of the AHURI Inquiry on *Projecting Australia's urban and regional futures: population dynamics, regional mobility, and planning responses*. It analyses how house prices in Australian regional submarkets affect and are affected by one another, and how migration interacts with the interconnectivity across housing markets.

`Housing submarkets' is a term used to describe the limits of where people are prepared to live and move to/from, based on housing stock, location, connection to job opportunities, education, availability of amenities andtransport, amongst others. In this report, we define housing submarkets in a spatial way, following local government area (LGA) delimitations, based on land use regulations.

The overarching research question it addresses is:

- What are the housing market spillover effects of urban and regional population change in Australia?

We define house price `spillover effect' as the dynamic where housing price changes in one market spread to other housing markets, impacting community welfare. To answer this question, the project addresses four sub-questions:

1. How has connectivity between housing submarkets in Australia changed over time?
2. How did the Covid-19 pandemic affect housing connectivity in Australia, both within states and across states, and how does this compare to longer-term trends?
3. What are the main drivers of house price spillovers across regional submarkets?
4. What is the effect on regional housing market price, affordability, housing supply and population change from spillover effects over time?

With the Covid-19 pandemic, regional cities and fringe areas became important players in house price dynamics across Australian housing submarkets. This is reflected in population movements, particularly in the eastern states of New South Wales (NSW), Victoria (VIC) and Queensland (QLD), demonstrating a population trend away from the inner-metropolitan areas of state capital cities and towards suburban fringe and regional city areas.

House prices in Australia have generally increased since 2000, with particularly high price appreciation in capital cities and high-amenity coastal towns. This resulted in areas of intense housing stress. House price growth had slowed in 2018 before accelerating in late 2020 during the Covid-19 pandemic. House price movements differ widely across Australian states and territories, often driven by specific exposure to key industries. For example, resource-intensive states of QLD, Western Australia (WA) and the Northern Territory (NT) show periods of house price slowdown and negative growth related to localised, industry-related shocks. What is less well-understood is how property price movements in one housing submarket can affect property prices in another (not necessarily contiguous) submarket. We describe these relationships as the `interconnectivity' between housing submarkets.

In this report, we determine the interconnectivity between house prices across Australian submarkets at both the state level and the local government area (LGA). To do this, we measure the price `spillover effect' from one housing submarket to another.

In economics, a 'spillover' is a consequence of the functioning of a market that has an impact on the running of another market (Hu and Oxley 2018). A macroeconomic example of a spillover is a recession in one country adversely impacting the economic growth of a major trade partner:

- a spillover 'contributor' is a market that influences others;
- a spillover 'receiver' is a market that is influenced by the spillover contributors.

In our context, house price spillovers from one housing submarket to another happen when increasing house prices in one market lead to predictable increases in other markets. We estimate spillover effects using median house price growth. The spillover measure captures the source, direction and strength of interconnectivity in house price changes between each pair of submarkets.[1] The empirical definition of house price spillover is explained more completely in Section 3.2.

The results from this analysis show housing submarkets are interconnected within states and across states, and that the house price dynamics and connectivity between and across states changed considerably during the pandemic years (2020–2021) strongly reflecting the different ways Covid-19 impacted state and territories and the corresponding government responses. During the pre-pandemic years (2009-2019), we find that QLD, NSW, NT, and Tasmania (TAS) were net contributors to house price spillovers. Conversely, the Australian Capital Territory (ACT), WA, VIC, and South Australia (SA) were net receivers of house price spillovers. During the pandemic period, Victoria became the strongest contributor to house price changes in all other states and territories. This reflects Victorians' response to the state's strict lockdown measures, and highlights the interconnectedness of Australia's housing markets in response to localised shocks.

In our second empirical spillover analysis (Section 4), we classify LGAs into one of the following four submarkets:

- *Metropolitan* cities
- *Fringe* suburbs
- regional *Cities*
- *Rural* areas.

For this analysis, we focus on LGAs in NSW and VIC.

The NSW submarket analysis shows that, before the pandemic, *Metro* and (to a lesser extent) *Fringe* were net contributors of house-price spillovers over regional *Cities* and *Rural* areas. For example, 37.1 per cent of housing price increases in Fringe LGAs came from house price increases in Metro LGAs, pre-pandemic. These effects changed during the pandemic years, with house price increases in *Fringe* and regional *Cities* contributing to strong house-price spillover effects to other submarkets. For example, during the pandemic, the Metro-to-Fringe spillover effect decreased to 13.5 per cent while 46.6 per cent of the house price increases in Metro LGAs were determined by house price increases in Regional LGAs.

The change in spillover effects is particularly striking for VIC during the pandemic period. We find a strong reversal in the direction and magnitude of the interconnectivity between submarkets for Victoria during the pandemic years. Before the pandemic, VIC *Metro* was the single net contributor of house price spillovers to the other submarkets: the strength of the spillover effect from *Metro* to other submarkets outweighed the strength of the spillover effect it received from other submarkets.

By contrast, in 2020–2021, VIC *Metro* was a net receiver of house price spillovers from other submarkets in the state. Taken together, this means that before the pandemic, the house price dynamics in the metropolitan LGAs of Melbourne (the Victorian capital) were influencing price dynamics in other LGAs. But during the pandemic period, the metropolitan LGAs in Melbourne were being influenced by the house price dynamics in the housing market dynamics of the other LGAs. During the pre-pandemic period, 26.9 per cent of house price increases in the LGAs within the Metro VIC got "spilled-over" into Regional cities, while during the pandemic period 48.7 per cent of house price increases in Regional cities influenced house price increases in the Metro LGAs within VIC. Our results highlight the recent prominent role Fringe areas and regional Cities have in house price dynamics.

1 The empirical definition of house price spillover is explained more completely in Section 3.2.

In this report, we also explore the relationship between internal migration and house price interconnectivity across markets. We find that net internal arrivals increase the house price connectivity across submarkets —in other words, our findings reveal that internal arrivals into a housing submarket are likely to intensify house price increases spreading into other markets, while internal departures from a region will intensify the chances of that region receiving house price effects from other housing markets' dynamics. These results are statistically significant even after controlling for a set of variables related to housing affordability, employment and locational factors.

This confirms that internal migration is an important determinant for house price interconnectivity across submarkets. More specifically, we find that:

- a 1 per cent increase in the proportion of the population migrating into an LGA will increase the house-price net spillover index by 3.12 per cent. This increases the probability that the LGA will generate house price spillovers to other submarkets.
- a 1 per cent increase in the proportion of the population departing from an LGA will decrease the net spillover index by 3.70 per cent. This increases the probability that the LGA will be a receiver of house price spillovers from other submarkets.

Policy implications

The findings of this report have several potential implications for policy.

Overall, we show that housing submarkets are interconnected within states and across states, and that the interconnectedness across housing submarkets has changed during the recent Covid-19 pandemic. Our results highlight the recent prominent role Fringe areas and regional Cities have in house price dynamics. Moreover, internal migration increases the house price interconnectedness across housing submarkets.

That is, the findings of this study show that when people move into a particular region house prices increase not only in that region and surrounding areas, but may also extend to other, more distant locations within that region and beyond. The spatial extent of these house price movements in response to people moving into a region can extend as far as non-contiguous areas.

People moving into a region and the consequent house price impacts of that movement may also trigger successive population movements of people moving out of that region, perhaps because they were displaced by house prices and therefore moving to other parts of the state or to other states, triggering a succession of house price impacts in these other areas.

In addition, the findings of this study show that the spatial impacts of people moving into regions and out of cities have changed during the Covid-19 pandemic. Our study shows that population appeared more mobile in response to changing housing market dynamics during the Covid-19 pandemic. This likely reflects the fact that people were able to exercise the option to move from a more expensive housing market to a less expensive housing market by accessing opportunities such as flexible and remote work and lifestyle amenities.

Therefore, people were more likely to generate those impacts by moving in response to a house price trigger. The Covid-19 pandemic appeared to influence not only the likelihood that people might move to other areas in response to housing preference adjustments but also due to house price affordability, making it more likely that they would move to regional areas beyond the metropolitan area.

Summarising, we show evidence of a real response to house price dynamics, in that house prices move when people move in, and people may also move out when house prices go up. But these impacts may be spatially discontinuous: while we expect house price increases in an area to potentially have a rippling effect in neighbouring areas, we find that these ripples might be spatially discontinuous and affect further-away non-contiguous areas.

Moreover, this propensity for people to move in response to house price pressures seemed to have increased during the Covid-19 pandemic. We observed an intensity in house price interconnectedness across housing submarkets, and people appeared to have moved further away into more affordable regional areas accessing flexible and remote work arrangements and lifestyle preferences. This implies that the spatial discontinuity that we found was particularly pronounced during that Covid-19 pandemic.

Recognising the interconnectedness of housing submarkets and the fact that house price displacement can be spatially discontinuous has important implications for housing markets. Understanding intrastate and interstate housing submarket interconnectedness has important implications for forecasting urban migration and for planning metropolitan and regional policy and investment. Lower income renters in regional areas and city fringes are likely to be further displaced if these areas receive an increase in housing demand pushing housing prices in those areas.

Regional cities will need to be ready with supply responses to accommodate potential increased demand. An understanding of housing submarkets interconnectedness will enable state and local governments to predict and prepare for shifts in housing demand through land use planning and infrastructure strategies. Moreover, service providers also need to be aware of housing prices and migration dynamics, with potential gentrification effects and displacement to less resourced areas. Understanding potential spatial movements in response to changing patterns of housing dynamics will also enable service providers to prepare the necessary resources to service a larger population and provide social infrastructure such as schools, hospitals, and other social services. In addition, it may provide direction towards additional investment in social and affordable housing and emergency accommodation.

Regional cities have been suffering higher affordability pressures since the Covid-19 pandemic. The results present an opportunity for government policy, and both public and private investment, to intervene through more timely strategies that address future housing-supply imbalance. The potential benefits of this approach are greatest in regional and rural areas. This is because of the relatively slower increases in housing supply, lower average income and wealth levels of long-term residents, and greater reliance on community networks for support in these areas.

Targeted policies that provide support for households experiencing housing stress, particularly in regional areas—including financial assistance, rental relief, building development policies and housing reform—could be enacted to minimise social disruption and maintain community cohesion. Policy makers could also consider addressing factors that contribute to demand imbalances, such as the increasing presence of short-term holiday letting in regional areas.

In the longer term, increases in appropriate housing supply (including social and affordable housing) require consideration across local government policies for new housing developments. In this regard, policy should focus on the strategic growth and development of regional and rural areas, including education and employment opportunities, to support a potential trend of people moving away from capital cities and into regional areas. Regional investment policy needs to ensure that additional pull factors to regions are balanced with sufficient and appropriate housing supply and services.

Our analysis contributes to national debate on the need for coordination across different government levels when implementing housing policy. This coordination needs to be applied to both demand-side and supply-side policies. The current housing policies across the three different levels of government should be aligned with other supporting policies relating to urban infrastructure and social infrastructure. An extension of greater coordination of housing and economic policy across different jurisdictions is the potential for a planned policy to develop our next mid-sized cities. The current distribution of cities by size in Australia is imbalanced relative to other developed countries. A more balanced urban population distribution can be achieved with a planned policy response that focusses on the growth of small and mid-sized cities.

Another implication of our results is that policy makers could use housing market data relating to sales price and price changes as indicators of population migration to inform more timely decisions relating to regional investment, internal migration incentives and policy, and macroeconomic setting.

There is the potential for greater policy effectiveness if more investment were made in capturing and analysing localised data. Future policy-setting has the potential to be dynamic using real-time data and avoid contemporary issues relating to latency and lagged information.

The study

This project examined house price dynamics across Australian housing submarkets, with particular interest in understanding how price movements in one submarket may affect other submarkets.

This research comprised four main parts.

1. A background scan on internal migration in Australia, exploring migration trends as released by the Australian Bureau of Statistics (ABS) 1-year and 5-year internal migration data from the 2011, 2016 and 2021 censuses. We provide a housing market analysis, using CoreLogic RP Australian house prices for our sample period. We observe annual house price growth rates for median house prices for LGAs for all states in Australia to explore the changes between the interconnection of housing submarkets.
2. Identifying the interconnectedness of house prices across LGAs, and separately across states and territories, by calculating a spillover measure using a recently developed methodology based on a vector autoregressive (VAR) model. VAR models explain simultaneous changes in multiple variables over time, employing their present and past (lagged) values. This approach shows the source, direction, and the strength of price changes and effects (or shocks) from one submarket to another. We split our sample into two distinct periods: the pre-pandemic period from January 2009 to December 2019, and the pandemic period from March 2020 to December 2021. We repeat the exercise by further classifying NSW and Victoria LGAs into four submarkets -- *Metro, Fringe, Cities,* and *Rural* – in order to interpret results in urban and regional clusters. Section 1.3.1 describes the definition of these four submarkets in detail, Figure B1 in Appendix B shows a map with the submarket definitions for NSW and Victoria, and Tables A1 and A2 in the Appendix provide a list of all the LGAs included in each submarket category for NSW and Victoria respectively.
3. Data collection on migration, average household income, labour market indicators, and some indicators for local amenities and location with the purpose of finding suitable variables to explain the variability in the house price spillover indices. We carry out a regression analysis on the determinants of the house price spillover index.
4. Synthesis of results to discuss how ready housing markets are to receive or mitigate house-price spillover effects based on the results of our regression analysis.

1. House prices and population

- Housing markets are leading indicators of the aggregate economy, and play a significant role in shaping economies.
- House-price spillover analysis highlights the effects of price changes in one market on other markets. This sheds light on Australian migration dynamics because of the strong links between price changes and population movements.
- We find evidence of an increased relevance of regionality after the Covid-19 pandemic, prompting analysis on how regional cities adapt to changes.
- Results emphasise the interconnectedness across housing submarkets, despite their individual characteristics. This prompts the need for a national strategic framework for approaching housing policy at a place-based level.
- Understanding the relationships between Australia's urban and regional housing spillover effects and migration patterns is crucial for housing affordability.
- This report provides evidence to discuss the challenges and opportunities that arise for regions and their place-based sustainable growth paths.

1.1 Policy context

This project informs the Australian Housing and Urban Research Institute (AHURI) Inquiry into `Projecting Australia's urban and regional futures: population dynamics, regional mobility, and planning responses'. The Inquiry researches the drivers of individual migration decisions, the place-based factors influencing population growth, and the housing submarket spillovers arising from regional mobility, all of which have implications for settlement planning, and may be determined by policy responses. To contribute to this discussion this report addresses the following overarching question:

- What are the housing market spillover effects of local and regional population growth?

This research is being undertaken during a pivotal point in Australia's population policy and settlement planning. With the global Covid-19 pandemic and the extraordinary suspension of international migration to Australia in the years 2020–2021, there has been evidence of a reversal in the trend of metropolitan population growth, and we have seen a strong trend of population movements away from the major capital cities of Sydney and Melbourne and towards regional areas and other state capitals. Fewer people were moving into the densely populated cities, and fewer people were moving out of regional and rural cities. Closure of state and international borders made skill shortages evident, while working from home and remote working were embraced by a large proportion of workplaces. Regional cities are now seen as key players in policy targeting sustainable population and economic growth (Beer, Crommelin et al. 2022; Gurran, Forsyth et al. 2021).

The current social and economic environment combines international migration growth after border closures; housing affordability pressures not only in big cities but also in regional cities; skills shortages highlighted by border closures and housing affordability pressures; flexible and remote work implemented at different degrees in different industries; a change in the macroeconomic environment associated with higher inflation and higher interest rates; and the background context of an ageing population (Australian Government, 2023; RBA, 2022; RBA, 2023). In this current environment, accurate and timely data is needed to ensure infrastructure, settlement planning, and housing-supply decisions support anticipated population growth and change.

Housing markets are leading indicators of the aggregate economy, and play a significant role in shaping economies. House price movements reflect consumption and investment decisions related to residential locational preference, job and educational opportunities, and access to health and amenity services.

Housing affordability pressures have been highlighted in the recent years, but they have been a persistent concern for communities and policy makers. Most markets have experienced substantial rises in house prices since 2020, and by 2022 the shortage of affordable rental accommodation intensified accompanied by very low vacancy rates near major employment centres and in regional areas. Households are still experiencing housing stress (Anglicare, 2023; NHFIC, 2023). Governments are under mounting pressure to support growing numbers of low and moderate-income households in the private rental market. Housing affordability stress pushes populations out of high-priced markets into lower-resourced markets, many times with consequences that impact job opportunities, education, health, etc. (Maclennan, Long et al. 2021).

This project uses local government area (LGA) level house price data from CoreLogic to examine local housing market spillovers arising from population change. In other words, we are looking at how house price dynamics in one market can affect other markets, and how population mobility can affect the interconnectivity between housing markets. We discuss these effects at submarket level across Australia.

Jones (2002) argues that a local housing market area is defined by reference to criteria linked to migration self-containment, in a context of strategic planning. We have opted in this study to define 'housing submarkets' as the administrative boundaries known as local government areas (LGAs). While using LGA housing submarket delimitation is convenient in terms of accessing data, it considers the policy level application in recognising the power of local councils in residential zoning and regional planning. We also carry this analysis at a state and territory level across the nation, expanding the governance level.

House-price spillover analysis highlights the effects of price changes in one market upon other markets. This sheds light on migration dynamics in Australia because of the strong links between house price changes and population movements (Meen, 1996; Meen, 1999). The house-price spillover analysis reflects Maclennan's (1992) approach to sectoral and geographical search patterns by households indicating the perceived structure of the local housing market (which may not be limited to the LGA boundaries), and the localised nature of demand.

In other words, the spillover analysis can highlight pressure points across these artificially defined administrative boundaries by identifying the interconnectedness between their housing markets.

We use a decade-long sample for the period January 2009–December 2021 to investigate changes in the interconnectivity between housing submarkets over time, and to consider the effects of the Covid-19 pandemic on migration and housing markets. This report also provides evidence of the increased relevance of regionality post Covid-19, providing evidence to discuss how regional cities can adapt to changes.

1.2 Existing research on migration and house prices

In this report we study the interconnectivity between Australian housing submarkets, and explore how migration affects house price dynamics across Australia. House prices reveal supply and demand characteristics of housing markets. Given the heterogeneous characteristics of the housing stock and the inelastic supply of housing, house prices—especially when considered in the shorter-term—tend to reflect demand patterns, providing information on housing preferences, choices and affordability.

House prices have been used to understand the value of locational preference (Kiel and Zabel 2008), amenities (Banzhaf and Farooque 2013; Beracha, Gilbert et al. 2018; Cheung and Fernandez 2021), access to services and infrastructure (Hoogendoorn, van Gemeren et al. 2019; Lipscomb 2003), and migration (Plantinga, Detang-Dessendre et al. 2013; Potepan 1994).

It is important to understand the relationship between housing markets and migration.

In the first place, a combination of socio-economic and place-based 'push' and 'pull' factors influence regional migration decisions. These in turn result in population migration, which impacts housing market dynamics and can generate spillover effects to other markets. Howard and Liebersohn (2021) find that location demand explains the largest portion of the national increase in rents in the US. In other words, internal migration in the US produces an aggregate rent increase in all US cities.

Housing market conditions can be identified as 'push' factors and 'pull' factors. These factors influence regional mobility by 'pushing' out lower-income earners in locations impacted by rising costs or by limiting housing choices in high demand areas. House prices have long been considered a driver of migration for those seeking cheaper rental accommodation or homeownership, particularly out of higher-priced major cities (Crommelin, Denham et al. 2022; Vij, Ardeshiri et al. 2022). Potepan (1994) finds that higher net migration raises metropolitan housing prices—yet, at the same time, higher housing prices discourage further net migration.

This implies there is reverse causality between house prices and migration. As people move in or out of a place, the available stock of housing and preferences change, and therefore house prices change accordingly. But while migration occurs because of employment opportunities (and other reasons discussed in this Inquiry), relative house prices can also encourage migration. Vij, Ardeshiri et al. (2022) find that housing market factors such as lower dwelling prices or cheaper rents attract people to non-metropolitan regions—that is, regions that are relatively more affordable. This argument states that higher house prices encourage migration to regions with lower and more affordable prices, creating interconnectivity and spillovers in house prices over time. Jeanty, Patridge et al. (2010) show that neighbourhoods are likely to experience an increase in housing values if they gain population, and they are more likely to lose population if they experience an increase in housing values.

The existing Australian research on the relationship between house prices and migration supports this reverse causality. Kohler and van der Merwe (2015) find that during the 1980s and 1990s, housing prices grew broadly in line with general price inflation and the increase in the debt-to-income ratio of Australian households. However, since the mid-2000s, strong population growth has played an increasing role in explaining Australian house price growth. Moallemi and Melser (2020) find that international immigration flow to Australia of 1 per cent of a postcode's population increases house prices by around 0.9 per cent. Moallemi, Melser et al. (2021) also find that house prices and rental growth tend to rise when immigrants' motherland economies are performing poorly. Erol and Unal (2022) find that internal migration that increases the total local population by 1 per cent is associated with an increase in house prices of between 0.52 and 0.71 per cent in NSW, VIC and QLD. However, they also find for the period 2013-2019, that while the migration inflow has a significant effect on metropolitan house price changes, the effect is insignificant for non-metropolitan regions.

The role of regional cities in migration dynamics has been less explored. Migration, and particularly internal migration, has a significant impact on the local economies, including increasing the demand for housing in areas that receive migrants, which results in house price rises in those areas. Costello (2007) explores the impact of urban–rural migration on a small, semi-rural receiving area, and finds the effects include increases in house prices, decreases in affordability, declines in rental stock and a division between traditional residents and 'newcomers' over access to amenities and economic development. Looking beyond Australia, Jeanty, Partridge et al. (2010) find that high immigration in certain regions of the US led to an increase in housing prices and rents. Wang, Hiu et al. (2017) studied inter-regional migration in Chinese cities and find that a 1 per cent increase in inter-regional migrants resulted in a 0.70 per cent increase in housing prices (after controlling for other relevant factors). Stillman and Maré (2008) find that internal population change in New Zealand affected rents and sales prices of apartments and houses, with a 1 per cent increase in an area's population being associated with a 0.2–0.5 per cent increase in local housing prices.

Given the strong links between house price changes and population movements, this research provides insights into migration dynamics in Australia by studying house price dynamics across Australian housing submarkets. We apply a house-price spillover analysis at the LGA level, and then explore if migration is a determinant of these house price spillovers.

1.3 Research methods

1.3.1 Data

To study population movements via internal migration, we use the internal migration matrices for the 2016 Census and the 2021 Census. Specifically, we build 2011–2016 and 2016–2021 internal migration matrices at the LGA level (LGA of Usual Residence five years ago by LGA of Usual Residence in the census year). These LGA internal migration matrices are built within the state level, as well as at the between-states level, in order to study the movement of people:

- within the LGAs of each state
- between the LGAs of different pairs of states.

To study the housing market, we source data on monthly median house prices for Australian LGAs[2] from CoreLogic RP data.[3] Our time period covers the period January 2009–December 2021. We define the pandemic period as March 2020–December 2021.[4] For comparison to a long-term benchmark, our pre-pandemic window starts in January 2009 and includes data until December 2019.[5]

We study house prices for all LGAs, as well as at aggregate state and territory levels. This analysis is presented in Section 3. Moreover, for NSW and VIC,[6] we aggregate each LGA index into one of the following four geographical submarkets: *Metropolitan* cities, *Fringe* suburbs, regional *Cities* and *Rural* areas. These four submarkets have been grouped based on common characteristics, such as access to transport, infrastructure and amenities:

- *Metro* refers to LGAs within the main cities of Australia, representing economic, political, and cultural centres, and hubs for international connections, commerce and communications.
- *Fringe* submarkets refer to LGAs in suburbs surrounding the Metro area, reflecting urban sprawl. These areas can still be classified in the urban region and provide access to the benefits and services of a metropolis.
- Regional *City* refers to LGAs in large regional non-capital cities. Regional cities offer services and amenities, and are hubs for regional connections and commerce.
- *Rural* areas include LGAs in rural towns that typically have lower access to services and amenities and infrastructure.

This analysis is presented in Section 4. Tables A1 and A2 in Appendix A provide a list of all the LGAs included in each submarket category for NSW and VIC. Figure B1 in Appendix B shows a map with the submarket definitions for NSW and VIC.

We estimate the spillover indices using monthly median house price growth rates by LGA.

2 Some LGAs are excluded from our analysis if there is not enough data because of few property transactions.
3 SIRCA: https://www.sirca.org.au/about-sirca/. Data accessed 5 September 2022.
4 We do not extend the sample period into 2022 due to the onset of global macroeconomic events, including the war in Ukraine and tightening monetary policy, as well as the reopening of Australian international borders in February 2022.
5 For robustness, we have tested our results with other sample periods including 2019–2021 and 2000–2021. Our conclusions remain across different sample periods when comparing pandemic and pre-pandemic results.
6 We follow the subdivisions from NSW councils classification and Regional Development Victoria respectively: https://www.yourcouncil.nsw.gov.au/wp-content/uploads/2020/05/Australian-Classification-of-Local-Government-and-OLG-group-numbers.pdf and https://www.rdv.vic.gov.au/information-portal/more-information/region-descriptions-and-geography-structure. We do not provide the same subclassification for other states and territories in Australia because the delineation between urban, regional and rural is more limited. For example, TAS and the NT have only 29 and 22 LGAs respectively, and all of them would be classified as regional or rural areas according to the above classification as, by this definition, Metro submarkets have population density of over 1 million people. However, we do the analysis for all states and territories at the LGA level.

We then merge house price and spillover data for LGAs with ABS census data. We extract the following variables at the LGA level for the 2021, 2016, and 2011 censuses:[7] internal arrivals, internal departures, interstate arrivals, interstate departures, and overseas arrivals in the past five years (based on people's place of usual residence), total population, average household income, unemployment rate, number of unemployed people, number of people in the labour force, labour participation rate, and indicators for the Socio-Economic Indexes for Areas (SEIFA).[8] We have also calculated the geographical centroids of LGAs, as well as the distance from the LGA centroid to the state's capital central business district (CBD) centroid, the area of each LGA, and the parkland area in the LGA.[9]

1.3.2 Methods

Section 2 provides an analysis of the trends in population changes and house price movements for the sample period under study—which includes the last three censuses—at the LGA level within states and across states. We present an analysis of the median house price growth and internal migration to provide a context for our spillover analysis across housing submarkets.

In Section 3 we explore the interconnectivity between house price dynamics across Australia to understand how house price dynamics in one housing submarket can affect another housing submarket. We apply a spillover modelling technique to median house price growth data at the LGA level. Using a decade-long sample, we are able to study how these interconnections between submarkets have changed over time. We estimate spillover indices across all LGAs within each Australian state and territory, and then we estimate the spillover indices across states and territories. Our approach (described in Section 3.2) allows us to quantify the impact changes in housing prices in one market have on other housing markets, particularly in the context of the Covid-19 pandemic and the resulting population shifts identified earlier. We interpret the estimated results and provide policy implications.

To explore the interconnectivity between urban and regional centres more directly, in Section 4 we estimate the spillover indices across four housing submarkets for the NSW and VIC submarkets: *Metro, Fringe*, regional *Cities* and *Rural*. (See subsection 1.3.1 for submarket descriptions.)

In Section 5, we explore the main determinants of house price spillovers, applying pooled ordinary least squares (OLS) analysis. We regress the net-house-price spillover against migration and other control variables. In Section 6 we present a discussion of results and, in Section 7, a summary of results and policy implications.

7 The data for 2011 and 2016 has been converted to 2021 LGA-based data using the corresponding relationships provided by the ABS.
8 SEIFA includes the index of relative socio-economic disadvantage, index of socio-economic advantage and disadvantage, index of economic resources, and index of education and occupation.
9 These data are calculated based on the ABS digital boundary files: https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/access-and-downloads/digital-boundary-files.

2. Recent scan of movements in population and house prices

- Eastern states demonstrate a sustained population trend away from major cities and towards suburban and regional areas.
- In NSW, the highest population gains are recorded in contiguous regional areas surrounding Greater Sydney and LGAs such as Blacktown and the Hills Shire in the metropolitan area.
- The Victorian LGAs recording the largest population gains are the regional cities of Geelong, Ballarat and Bendigo, and metropolitan LGAs.
- Across state lines, NSW is experiencing net population loss, with residents migrating to Queensland and Victoria.
- House prices have been increasing since 2000. Resource-intensive states such as QLD, WA and NT show periods of slowdown and negative growth related to localised, industry-related shocks.
- Statewide house price growth generally slowed in 2018, then accelerated in late 2020 with the Covid-19 pandemic. This result is consistent across submarkets.
- In NSW and Victoria, regional and rural areas experienced sustained house price growth pre-pandemic, while metropolitan prices weakened.

2.1 Recent research on population movements

Australia's major cities have been losing population. Research based on 2021 ABS Census data shows a net decrease of 160,000 people from Australia's capital cities over five years (2016–2021). This loss is reported as 'significantly greater than the last two census periods'.[10]

However, this national statistic obscures some more nuanced dynamics. Disaggregating these results, the data shows that Sydney recorded the largest population loss of all capital cities in the period, with a net decrease of 154,800 people, representing 3 per cent of the city's overall population. On the other hand, Brisbane experienced positive net migration, with an increase in population of 54,400, representing about 2.2 per cent of the city's population.

The story for regional areas shows more gains rather than losses. In the period 2016–2021, regional Australia recorded a net gain of 184,000 people (up from 81,600 in 2016). While non-capital-city areas of QLD (+63,700), VIC (+62,900) and NSW (+59,000) showed significant net gains, the non-capital-city areas of WA (–9,000) and NT (–3,800) recorded small net losses.

Sunshine Coast (QLD), Gold Coast (QLD) and Geelong (VIC) recorded the largest positive net migration for regional areas. The ABS reports that the 'Sunshine Coast and Gold Coast have ranked in the top three ABS statistical area level 4s (SA4s) for positive net internal migration for the past three censuses (2011, 2016, 2021), while Geelong ranked in the top three for the past two censuses (2016, 2021)'.[11]

These patterns of capital city and regional area movements reflect the substantial population gains in south-east Queensland, both in the capital city and adjacent regional areas. As a result, Queensland is the state with the highest population growth from internal migration.

The other regions in the top 10 that have led in net population gains from internal migration are Moreton Bay–North (QLD), Latrobe–Gippsland (VIC), Wide Bay (QLD), Ipswich (QLD), Hunter Valley (excluding Newcastle) (NSW), Mid North Coast (NSW), and Newcastle and Lake Macquarie (NSW).

This reveals an interesting dynamic, in which net population growth is concentrated in the eastern states of QLD, NSW and VIC. To examine this in more depth, we analyse internal migration patterns within and between QLD, NSW and VIC at the LGA level in Section 2.2.

Affordability pressures in metropolitan cities are increasing. City wage premiums are generally not sufficient to afford housing costs, as wages have not kept pace with inflation and rent (RBA, 2022). In order to access more affordable housing, households may move from the cities to the suburban fringes or beyond into the regions. These moves to traditionally more affordable areas, particularly in regional and remote areas, typically involves a decrease in income and reduced access to services. A better understanding of inter-regional population migration could lead to more informed housing, infrastructure and amenity and services policy.

2.2 Data analysis on population movements

In this section we analyse population changes for areas in QLD, NSW and VIC. Using census data, our analysis considers LGA-level population changes and internal migration trends between 2011–2016 and 2016–2021. Through this analysis, a strong de-centralisation trend in population emerges. We observe a sustained pattern of net population migration away from the metropolitan cities and into fringe and regional cities across the last three ABS Census periods. This dynamic is strongest in NSW and Victoria, and to a lesser extent in QLD.

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10 ABS, *Population Movement in Australia*, https://www.abs.gov.au/articles/population-movement-australia. Accessed 26 March 2022.
11 ABS, *Population Movement in Australia*, https://www.abs.gov.au/articles/population-movement-australia, accessed 5 May 2023.

Tables 1–6 show the 10 LGAs that recorded the highest population gains, and the 10 LGAs that recorded the highest population losses for QLD, NSW and VIC. The second and third columns in each table show the total number of people incoming and outgoing from these LGAs, and the fourth column shows the difference between incoming and outgoing as net migration. The fifth column reflects the total population for the LGA in the original year. Columns six and seven show the percentage of incoming and outgoing migration as a proportion of the original population respectively, while column eight shows the percentage of net migration as a proportion of the original population.

While a high increase in migration as a proportion of the original population suggests a higher impact of incoming population into an LGA or region, the importance of this impact may be overestimated if the original population size is relatively small. Therefore, reporting total numbers as well as percentages that reflect the increase or decrease as a proportion of the original population provides a more complete overview and understanding of the migration dynamics.

2.2.1 Net internal migration for LGAs in Queensland

We start by looking at the net migration for QLD LGAs. This shows a very interesting pattern where mid-sized cities are seeing development, and the development appears to be more polycentric: while Brisbane holds its prime position, other cities have a chance to reach comparable sizes.

From 2011 to 2016, Table 1a shows the 10 LGAs that recorded the highest gains and Table 1b shows the 10 LGAs that recorded the highest losses. These numbers are based on internal state-level movements, incorporating an analysis of internal migration within QLD. The south-east QLD LGAs of Sunshine Coast, Ipswich, Moreton Bay and Scenic Rim received the largest influx of people in the period 2011–2016, while LGAs of Brisbane, Mackay, Cairns, Central Highlands and Mount Isa had the largest outflow of people.

Repeating this analysis for the 2016—2021 ABS Census period, Table 2a shows the 10 LGAs that recorded the highest gains, and Table 2b shows the 10 LGAs that recorded the highest losses. These data show that Moreton Bay, Sunshine Coast and Ipswich remain the QLD LGAs with the largest influx of people, in addition to Gympie and Livingstone. However, Isaac and Noosa are among the LGAs with the largest outflow of people in this period, alongside Brisbane, Cairns, Mount Isa and Central Highlands.

The Brisbane LGA registered losses in both five-year phases, consistent with our earlier observation of net outflows across Australia's capital cities. While the Gold Coast LGA experienced a gain in population in the period 2011–2016, it recorded a net outflow of population for the period 2016–2021. However, few LGAs in regional Queensland received a net influx of people during that period.

Table 1: LGAs with the highest (a) and lowest (b) net population changes, QLD, 2011–2016

(a)

LGA	Total incoming (as % of 2011 population)	Total outgoing (as % of 2011 population)	Net migration (as % of 2011 population)	Population (2011)	% Total incoming	% Total outgoing	% Net migration
Sunshine Coast	35,718	23,890	11,828	306,909	11.6	7.8	3.9
Moreton Bay	50,738	39,321	11,417	378,045	13.4	10.4	3
Ipswich	26,316	20,587	5,729	166,904	15.8	12.3	3.4
Gold Coast	33,575	30,202	3,373	494,501	6.8	6.1	0.7
Redland	18,534	17,127	1,407	138,666	13.4	12.4	1
Fraser Coast	12,071	10,822	1,249	95,312	12.7	11.4	1.3
Scenic Rim	7,182	5,948	1,234	36,456	19.7	16.3	3.4
Livingstone	6,201	5,092	1,109	---*	---	---	---
Gympie	7,075	6,049	1,026	45,749	15.5	13.2	2.2
Lockyer Valley	6,688	5,749	939	34,954	19.1	16.4	2.7

(b)

LGA	Total incoming	Total outgoing	Net migration	Population (2011)	% Total incoming	% Total outgoing	% Net migration
Brisbane	94,644	102,623	−7,979	1,041,839	9.1	9.9	-0.8
Mackay	9,899	14,318	−4,419	112,798	8.8	12.7	-3.9
Cairns	12,233	15,276	−3,043	156,169	7.8	9.8	−1.9
Mount Isa	2,236	4,960	−2,724	21,237	10.5	23.4	−12.8
Central Highlands	4,310	7,031	−2,721	28,715	15	24.5	−9.5
Isaac	4,522	7,058	−2,536	22,588	20	31.2	−11.2
Gladstone	7,012	9,400	−2,388	57,891	12.1	16.2	−4.1
Logan	35,379	37,291	−1,912	278,050	12.7	13.4	−0.7
Banana	1,799	2,988	−1,189	14,456	12.4	20.7	−8.2
Bundaberg	9,074	10,008	−934	89,810	10.1	11.1	−1

Source: Author

Table 2: LGAs with the highest (a) and lowest (b) net population changes, QLD, 2016–2021

(a)

LGA	Total incoming	Total outgoing	Net migration	Population (2016)	% Total incoming	% Total outgoing	% Net migration
Moreton Bay	56,682	46,138	10,544	425,302	13.3	10.8	2.5
Sunshine Coast	38,490	28,957	9,533	294,367	13.1	9.8	3.2
Ipswich	33,945	25,053	8,892	193,733	17.5	12.9	4.6
Logan	44,889	41,238	3,651	303,386	14.8	13.6	1.2
Fraser Coast	13,340	10,859	2,481	101,504	13.1	10.7	2.4
Gympie	8,450	6,693	1,757	49,559	17.1	13.5	3.5
Bundaberg	10,394	9,041	1,353	92,897	11.2	9.7	1.5
Livingstone	6,339	5,089	1,250	36,272	17.5	14	3.4
Toowoomba	18,988	17,982	1,006	160,779	11.8	11.2	0.6
Redland	20,849	20,002	847	147,010	14.2	13.6	0.6

(b)

LGA	Total incoming	Total outgoing	Net migration	Population (2016)	% Total incoming	% Total outgoing	% Net migration
Brisbane	109,360	121,648	−12,288	1,131,155	9.7	10.8	−1.1
Gold Coast	34,999	38,712	−3,713	555,721	6.3	7	−0.7
Cairns	12,213	15,437	−3,224	156,901	7.8	9.8	−2.1
Townsville	15,932	18,964	−3,032	186,757	8.5	10.2	−1.6
Noosa	6,750	8,972	−2,222	52,149	12.9	17.2	−4.3
Central Highlands	4,482	5,944	−1,462	27,999	16	21.2	−5.2
Gladstone	6,945	8,301	−1,356	61,640	11.3	13.5	−2.2
Rockhampton	8,501	9,819	−1,318	79,726	10.7	12.3	−1.7
Mount Isa	2,631	3,906	−1,275	18,671	14.1	20.9	−6.8
Isaac	4,271	5,546	−1,275	20,940	20.4	26.5	−6.1

Source: Author

2.2.2 Net internal migration for LGAs in New South Wales

Table 3a shows net migration for LGAs in NSW. Camden, Maitland, Central Coast, Port-Macquarie-Hastings and Shoalhaven received the largest net migration increase between 2011 and 2016, while, as shown in Table 3b[12], Cumberland, Canterbury-Bankstown, Fairfield and Parramatta were the LGAs with the largest net outflow of people.

The story for NSW is similar for the period 2016–2021. Table 4a shows the 10 LGAs that recorded the highest net population growth, and Table 4b shows the 10 LGAs that recorded the largest net population losses for NSW 2016–2021. Table 4a shows that Camden, Central Coast and The Hills Shire, as well as Lake Macquarie and Maitland, are the LGAs that received the largest net migration, while the LGAs with the greatest net population losses for NSW are again Cumberland, Parramatta, Fairfield, and Canterbury-Bankstown, along with Randwick and Georges River.

There is a clear geographic pattern in these movements. While the LGAs recording the highest losses are within the Greater Sydney area, many areas recording the highest gains are located in regions that surround Greater Sydney, or are located at the outer-most urban fringe, such as Blacktown and The Hills Shire. This result can be attributed to the relative affordability and urban proximity of these LGAs, as well as the North-West Priority growth area plan which is driving residential development and the creation of new suburbs in Sydney's north-west.

12 Note that total population for 2011 (column 5) is not available for some LGAs in ABS, and therefor we are unable to calculate the proportions in the last columns (6,7, and 8) of tables 3a and 3b.

Table 3: LGAs with the highest (a) and lowest (b) net population changes, NSW, 2011–2016

(a)

LGA	Total incoming	Total outgoing	Net migration	Population (2011)	% Total incoming	% Total outgoing	% Net migration
Camden	21,384	8,219	13,165	56,720	37.7	14.5	23.2
Central Coast	33,017	23,864	9,153	--	--	--	--
Port Macquarie-Hastings	10,104	5,688	4,416	72,696	13.9	7.8	6.1
Shoalhaven	12,178	7,770	4,408	92,812	13.1	8.4	4.7
Maitland	12,973	8,609	4,364	67,478	19.2	12.8	6.5
Wollongong	19,506	15,295	4,211	192,418	10.1	7.9	2.2
Mid-Coast	11,782	7,818	3,964	--	--	--	--
The Hills Shire	27,149	23,439	3,710	169,872	16	13.8	2.2
Lake Macquarie	23,919	20,528	3,391	189,006	12.7	10.9	1.8
Penrith	25,640	22,309	3,331	178,467	14.4	12.5	1.9

(b)

LGA	Total incoming	Total outgoing	Net migration	Population (2011)	% Total incoming	% Total outgoing	% Net migration
Cumberland	22,076	36,800	−14,724	--	--	--	--
Canterbury-Bankstown	33,455	45,265	−11,810	--	--	--	--
Fairfield	13,218	24,596	−11,378	187,766	7.0	13.1	−6.1
Parramatta	36,092	46,610	−10,518	166,858	21.6	27.9	−6.3
Georges River	18,757	24,432	−5,675	--	--	--	--
Sydney	34,701	40,044	−5,343	169,505	20.5	23.6	−3.2
Inner West	32,497	37,064	−4,567	--	--	--	--
Randwick	18,868	23,067	−4,199	128,989	14.6	17.9	−3.3
Waverly	10,007	13,858	−3,851	--	--	--	--
Rockdale	16,703	19,567	−2,864	97,340	17.2	20.1	−2.9

Source: Author

Table 4: LGAs with the highest (a) and lowest (b) net population changes, NSW, 2016–2021

(a)

LGA	Total incoming	Total outgoing	Net migration	Population (2016)	% Total incoming	% Total outgoing	% Net migration
Camden	35,877	12,066	23,811	78,218	45.9	15.4	30.4
The Hills Shire	40,572	27,012	13,560	157,243	25.8	17.2	8.6
Central Coast	35,825	27,657	8,168	327,736	10.9	8.4	2.5
Lake Macquarie	30,536	23,474	7,062	197,371	15.5	11.9	3.6
Maitland	17,252	10,515	6,737	77,305	22.3	13.6	8.7
Port Macquarie-Hastings	12,196	5,739	6,457	78,539	15.5	7.3	8.2
Shoalhaven	14,409	8,191	6,218	99,650	14.5	8.2	6.2
Mid-Coast	13,567	8,108	5,459	90,303	15	9	6
Blacktown	57,476	52,414	5,062	336,962	17.1	15.6	1.5
Cessnock	12,167	7,778	4,389	55,560	21.9	14	7.9

(b)

LGA	Total incoming	Total outgoing	Net migration	Population (2016)	% Total incoming	% Total outgoing	% Net migration
Cumberland	25,101	44,268	−19,167	216,079	11.6	20.5	−8.9
Canterbury-Bankstown	37,128	55,368	−18,240	346,302	10.7	16	−5.3
Fairfield	12,706	29,899	−17,193	198,817	6.4	15	−8.6
Parramatta	47,120	56,431	−9,311	226,149	20.8	25	−4.1
Randwick	19,883	29,004	−9,121	140,660	14.1	20.6	−6.5
Inner West	36,779	44,977	−8,198	182,043	20.2	24.7	−4.5
Sydney	43,822	51,962	−8,140	208,374	21	24.9	−3.9
Georges River	20,689	28,260	−7,571	146,841	14.1	19.2	−5.2
Northern Beaches	23,256	28,757	−5,501	252,878	9.2	11.4	−2.2
Waverly	11,542	16,850	−5,308	--	--	--	--

Source: Author

2.2.3 Net internal migration for LGAs in Victoria

Table 5a shows the 10 Victorian LGAs that recorded the highest population gains in the period 2011–2016, and Table 5b shows the 10 LGAs that recorded the highest population losses in the same period. These numbers are based on internal state-level movements, incorporating an analysis of internal migration within Victoria. Table 5a shows that during the period 2011–2016 the LGAs of Whittlesea, Cardinia, Wyndham, Melton, Baw Baw and Casey received the largest influx of people. Table 5b shows that Brimbank, Monash, Greater Dandenong and Whitehorse were the LGAs that experienced the largest decrease in population during that period.

These migration dynamics continue into the period 2016–2021. Table 6a shows the 10 LGAs that recorded the highest population gains 2016–2021, and Table 6b shows the 10 LGAs that recorded the highest population losses in that same period. Cardinia, Melton, Greater Geelong, Baw Baw and Casey remain the LGAs with the largest influx of people, along with Bass Coast. Similarly, Brimbank, Monash, Greater Dandenong and Boroondara are the LGAs with the greatest net population decrease in Victoria, along with Port Phillip, Yarra and Stonnington.

Overall, the biggest population losses in Victoria are recorded by LGAs within the Greater Melbourne area. The biggest population gains are recorded by fringe LGAs within the Greater Melbourne area, along with the regional cities Geelong, Bendigo and Ballarat.

Table 5: LGAs with the highest (a) and lowest (b) net population changes, VIC, 2011–2016

(a)

LGA	Total incoming	Total outgoing	Net migration	Population (2011)	% Total incoming	% Total outgoing	% Net migration
Whittlesea	28,633	16,785	11,848	154,880	18.5	10.8	7.6
Cardinia	21,179	11,355	9,824	74,176	28.6	15.3	13.2
Wyndham	28,847	19,464	9,383	161,575	17.9	12	5.8
Casey	42,080	33,749	8,331	252,382	16.7	13.4	3.3
Greater Geelong	23,145	14,937	8,208	210,875	11	7.1	3.9
Melton	21,261	13,386	7,875	109,259	19.5	12.3	7.2
Mornington Peninsula	21,106	14,217	6,889	144,608	14.6	9.8	4.8
Ballarat	12,295	8,623	3,672	93,501	13.1	9.2	3.9
Greater Bendigo	10,551	7,378	3,173	100,617	10.5	7.3	3.2
Baw Baw	7,316	4,421	2,895	42,864	17.1	10.3	6.8

(b)

LGA	Total incoming	Total outgoing	Net migration	Population (2011)	% Total incoming	% Total outgoing	% Net migration
Brimbank	16,512	28,279	−11,767	182,735	9	15.5	−6.4
Monash	23,514	34,366	−10,852	169,280	13.9	20.3	−6.4
Greater Dandenong	15,423	24,827	−9,404	135,605	11.4	18.3	−6.9
Whitehorse	23,283	29,614	−6,331	151,334	15.4	19.6	−4.2
Boroondara	26,066	30,641	−4,575	159,184	16.4	19.2	−2.9
Darebin	21,974	26,389	−4,415	136,474	16.1	19.3	−3.2
Moreland	24,415	28,777	−4,362	147,241	16.6	19.5	−3
Knox	20,695	24,809	−4,114	149,300	13.9	16.6	−2.8
Manningham	14,520	18,286	−3,766	111,300	13	16.4	−3.4
Glen Eira	20,837	24,254	−3,417	131,013	15.9	18.5	−2.6

Source: Author

Table 6: LGAs with the highest (a) and lowest (b) net population changes, VIC, 2016–2021

(a)

LGA	Total incoming	Total outgoing	Net migration	Population (2016)	% Total incoming	% Total outgoing	% Net migration
Greater Geelong	35,033	17,947	17,086	233,429	15	7.7	7.3
Melton	32,658	18,651	14,007	135,443	24.1	13.8	10.3
Casey	56,285	42,917	13,368	299,301	18.8	14.3	4.5
Cardinia	27,572	16,310	11,262	94,128	29.3	17.3	12
Wyndham	37,301	28,934	8,367	217,122	17.2	13.3	3.9
Mornington Peninsula	24,623	17,360	7,263	154,999	15.9	11.2	4.7
Hume	30,375	23,420	6,955	197,376	15.4	11.9	3.5
Bass Coast	9,479	3,631	5,848	32,804	28.9	11.1	17.8
Baw Baw	11,165	5,355	5,810	48,479	23	11	12
Ballarat	15,335	9,597	5,738	101,686	15.1	9.4	5.6

(b)

LGA	Total incoming	Total outgoing	Net migration	Population (2016)	% Total incoming	% Total outgoing	% Net migration
Brimbank	17,271	36,437	−19,166	194,319	8.9	18.8	−9.9
Greater Dandenong	16,447	32,173	−15,726	152,050	10.8	21.2	−10.3
Monash	29,086	38,874	−9,788	182,618	15.9	21.3	−5.4
Boroondara	27,436	36,477	−9,041	167,231	16.4	21.8	−5.4
Moreland	29,329	37,532	−8,203	162,558	18	23.1	−5
Whitehorse	27,046	34,163	−7,117	162,078	16.7	21.1	−4.4
Port Phillip	21,439	28,018	−6,579	100,863	21.3	27.8	−6.5
Darebin	26,053	32,397	−6,344	146,719	17.8	22.1	−4.3
Stonnington	22,329	28,370	−6,041	103,832	21.5	27.3	−5.8
Yarra	21,801	27,619	−5,818	86,657	25.2	31.9	−6.7

Source: Author

2.2.4 Population movements across eastern states

In the analysis presented in this section thus far, we have focussed on within-state migration. We next examine population movements across the eastern states. In addition to migration from NSW LGAs at state borders into neighbouring states (for example, from Tweed LGA to the Gold Coast LGA), the results reveal a large number of people migrating from Greater Sydney LGAs to Melbourne LGAs and to fast-growing regional cities in south-east QLD.

We first consider the interstate migration between NSW and QLD, and then look at interstate movements between NSW and VIC.

Interstate migration between New South Wales and Queensland

Table 7 reports the statistics for interstate population movement to QLD (destination) from NSW (origin). Table 7a shows the 10 LGAs that recorded the highest population gains in QLD, and Table 7b shows the 10 LGAs that recorded the highest population losses from NSW in the period 2011–2016.

Table 7 shows that the influx of people from NSW to QLD is concentrated in the Gold Coast and Brisbane, along with Moreton Bay and the Sunshine Coast. People migrating from NSW to QLD are mainly coming from Tweed and Central Coast, as well as several LGAs in metropolitan Sydney.

Table 8 repeats this analysis for the more recent 2021 ABS Census. The results show a consistent pattern in LGA migration in the period 2016–2021, but with increasing numbers. Table 8a shows the 10 LGAs that recorded the highest population gains in QLD, and Table 8b shows the 10 LGAs that recorded the highest population losses from NSW. Gold Coast, Brisbane, Sunshine Coast and Moreton Bay remain the LGAs with the largest influx of people from NSW to QLD. Similarly, Tweed and Central Coast, along with Northern Beaches and several Sydney metropolitan LGAs, experienced population outflow to Queensland.

While the migration from the Tweed LGA can be explained by its location next to the Gold Coast, the more surprising result is the large number of people migrating from the Central Coast and outer-Sydney LGAs to the rapidly expanding south-east Queensland LGAs.

Table 7: Migration to QLD (a) from NSW (b) LGAs, 2011–2016

(a)

LGA	Total incoming
Gold Coast	24,947
Brisbane	21,470
Moreton Bay	8,044
Sunshine Coast	7,505
Townsville	4,411
Logan	4,361
Ipswich	4,168
Cairns	3,112
Toowoomba	2,817
Redland	2,673

(b)

LGA	Total outgoing
Tweed	6,929
Central Coast	4,215
Blacktown	3,327
Northern Beaches	3,164
Sydney	2,826
Coffs Harbour	2,769
Sutherland Shire	2,716
Penrith	2,282
Lismore	2,166
Clarence Valley	2,155

Source: Author

Table 8: Migration to QLD (a) from NSW (b) LGAs, 2016–2021

(a)

LGA	Total incoming
Gold Coast	33,126
Brisbane	26,968
Sunshine Coast	12,211
Moreton Bay	11,167
Logan	6,381
Ipswich	5,905
Townsville	4,150
Fraser Coast	4,072
Redland	3,721
Cairns	3,356

(b)

LGA	Total outgoing
Tweed	8,945
Northern Beaches	5,747
Central Coast	5,383
Blacktown	4,624
Sydney	4,200
Sutherland Shire	3,749
Penrith	3,272
Coffs Harbour	2,998
Inner West	2,803
Randwick	2,717

Source: Author

Interstate migration between New South Wales and Victoria

Lastly, we look at the interstate migration between NSW and VIC. Table 9a reports the 10 NSW LGAs that recorded the highest population losses based on NSW to VIC migration data for the period 2011–2016. Table 9b shows the 10 Victorian LGAs that recorded the highest population gains in the period 2011–2016.

Table 9a shows that the NSW LGAs with the largest outward migration to Victoria were Albury (located on the Victorian border), along with LGAs in inner Sydney, including Sydney and the Inner West. Table 9b shows that Greater Melbourne LGAs such as Melbourne, Wyndham, Wodonga and Moreland were net recipients of population movements from NSW 2011–2016.

Table 10 reports the results for the 2021 Census period. Table 10a shows an accelerating trend for the period 2016–2021, with a greater number of people migrating in a consistent pattern to that observed for the period 2011–2016.

Table 9: Migration from NSW (a) to VIC (b) LGAs, 2011–2016

(a)	
LGA	Total outgoing
Albury	3,671
Sydney	3,316
Inner West	2,198
Blacktown	1,971
Canterbury-Bankstown	1,623
Parramatta	1,575
Cumberland	1,453
Murray River	1,442
Northern Beaches	1,427
Wagga Wagga	1,422

(b)	
LGA	Total incoming
Melbourne	2,980
Wyndham	2,904
Wodonga	2,581
Moreland	2,430
Port Phillip	2,268
Stonnington	2,218
Yarra	2,161
Boroondara	1,956
Darebin	1,846
Greater Geelong	1,753

Source: Author

Table 10: Migration to VIC (a) from NSW (b) LGAs, 2016–2021

(a)	
LGA	Total incoming
Wyndham	4,582
Melbourne	4,364
Wodonga	2,917
Moreland	2,799
Yarra	2,395
Casey	2,355
Greater Geelong	2,299
Port Phillip	2,164
Stonnington	2,083
Hume	2,025

(b)	
LGA	Total outgoing
Sydney	4,137
Albury	3,680
Inner West	2,803
Blacktown	2,653
Parramatta	2,423
Cumberland	2,111
Canterbury-Bankstown	1,984
Northern Beaches	1,575
Murray River	1,525
Wagga Wagga	1,663

Source: Author

2.3 House prices, migration and the Covid-19 pandemic

Australians move and relocate often. Between 2015 and 2020, 42.1 per cent of Australian households reported moving home at least once.[13] Most household relocations are intrastate but beyond the local area. Of those households that have moved within Australia:

- 7 per cent moved from a different state or territory;
- 65 per cent moved within the same state or territory, but to another suburb or locality;
- 25 per cent moved within the same suburb or locality.[14]

This within-state migration is endogenously linked to the urban development of housing submarkets (Hillier, Fisher et al. 2002).

The academic evidence indicates that house prices and affordability are both a major impetus and impediment to household mobility (Crommelin, Denham et al. 2022). Based on ABS survey data of households that moved between 2019 and 2020, two of the main reasons for relocating include a preference to purchase their own home (19.8 per cent) and access to larger or better housing (12.3 per cent).[15] Moreover, during this same period, households that wanted to move identified housing affordability (61 per cent) and costs associated with moving (25 per cent) as barriers to moving.

Our research builds on this work by providing greater insight to population migration trends through the analysis of house price growth and spillovers.

Migration away from major city centres has been broadly documented, both in Australia and other developed countries. This is attributed, at least partially, to the inadequate growth in city wage premiums relative to housing costs. In order to access more affordable housing, whether through home ownership or renting, households moved away from cities and towards either the suburban fringes or regional areas outside the city. For these households, such a move potentially involves reductions in income and access to services. The traditional urban economic model assumes low-cost migration between places (Glaeser and Gottlieb 2008). This is justified by the assumption that high wages in an area are offset by higher cost of living (including housing prices), while low real wages in other areas are offset by high amenities. Under this theoretical model, any wage increase is offset by a housing price increase. As metropolitan cities have become less affordable in recent years, a breakdown in the traditional urban economic model could explain the migration trend around the world towards outer-suburban and proximate regions from metropolitan cities.

This de-urbanisation trend accelerated with the 2020 onset of the Covid-19 pandemic, with recent research documenting a shift in housing demand away from inner-city dwellings to regional centres (Denham 2021; Hopkins and Houghton 2021; McManus 2022; RAI 2022; Verdouw, Yanotti et al. 2021). Hu, Lee et al. (2021) show that during the Covid-19 pandemic, housing demand decreased the most in dense neighbourhoods, explained by both the lower value of workplace access and access to amenities and city-specific attributes. The National Housing Finance and Investment Corporation (NHFIC) 2020 report State of the nation's housing argues that the short-term outlook for housing markets' prices and affordability is uncertain as workplaces navigate new ways of remote and hybrid working (NHFIC 2020: 6).

13 ABS, *Housing Mobility and Conditions*, based on the Survey of Income and Housing (SIH), 2019/20 financial year. https://www.abs.gov.au/statistics/people/housing/housing-mobility-and-conditions/2019-20. Accessed 26 February 2023.
14 ABS, *Housing Mobility and Conditions*, based on the Survey of Income and Housing (SIH), 2019/20 financial year. https://www.abs.gov.au/statistics/people/housing/housing-mobility-and-conditions/2019-20. Accessed 26 February 2023.
15 ABS, *Housing Mobility and Conditions*, based on the Survey of Income and Housing (SIH), 2019/20 financial year. https://www.abs.gov.au/statistics/people/housing/housing-mobility-and-conditions/2019-20. Accessed 26 February 2023.

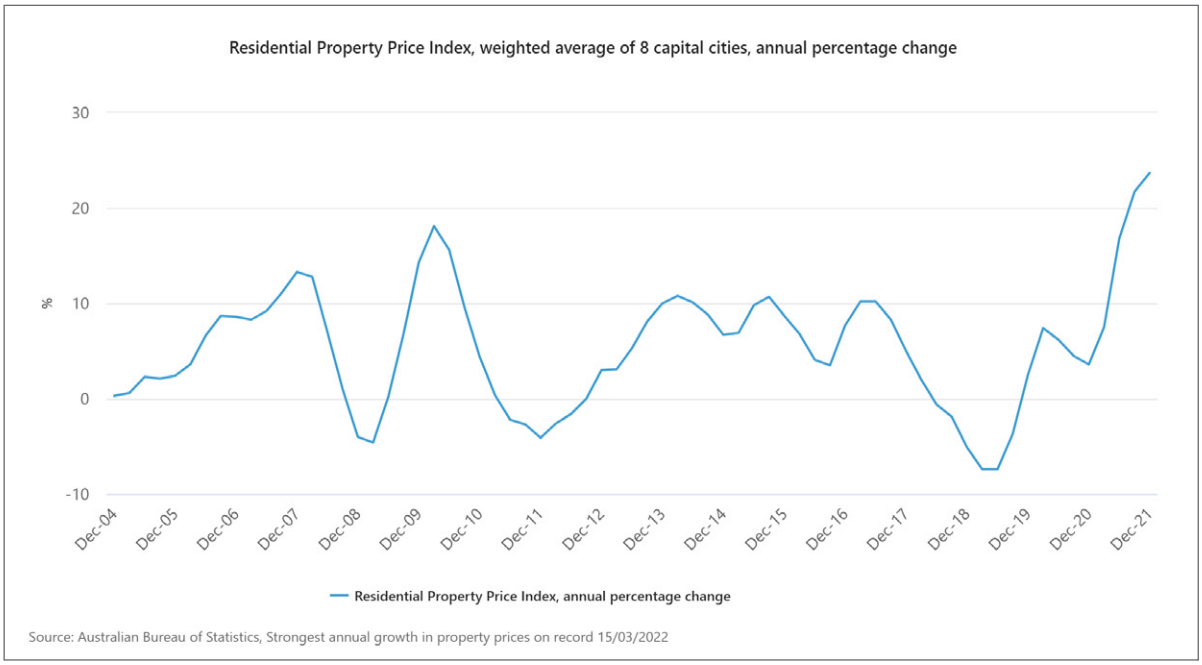
The effect of the Covid-19 pandemic on housing markets and internal migration has also been studied internationally. In the US, Gupta, Mittal et al. (2021) show that the pandemic caused house price and rent declines in city centres, while increasing house prices and rents in areas away from the centre. This resulted in a 'flattening' of the bid-rent curve in most metropolitan areas. Ramani and Bloom (2021) and Liu and Su (2021) find that housing demand for large US cities had shifted from dense central CBDs towards lower-density suburban zip codes (US postcodes). This 'donut effect' reflects the movement of activity out of city centres and into the suburban ring. However, Ramani and Bloom (2021) do not find evidence for major reallocation across cities, from large US cities to smaller regional cities or towns. Cheung, Yiu et al. (2021) also find evidence of flattened house price growth from the epicentre to the urban peripherals of Wuhan city, China, between 2019 and 2020, with price premiums in high-density areas also substantially discounted after the city's lockdown.

2.4 House price trends in Australia, 2000–2021

We study annual growth rates for monthly median house prices across Australian states and territories, capital cities and LGA submarkets for the period January 2000–December 2021. To study the housing market in Australia, the dataset used is CoreLogic RP Australian house prices, provided by SIRCA. We also rely on the commonly used ABS residential property price index, which is the weighted average of residential property prices in the eight Australian capital cities. In Figures 1–5 and Table 11, we document and discuss housing prices in Australia.

The ABS residential property price index shows that Australian housing prices have sustained positive growth for most of the period 2004–2022. The only periods of national house price decline were in late 2008, as a result of the Global Financial Crisis, and again in 2011 and 2018 when the market eased slightly after record growth. These periods are shown in Figure 1 with price declines observed when the growth rate goes below zero. National housing prices have rapidly increased since March 2019. Despite a slight easing in the growth rate between March and June 2020 during the early months of the Covid-19 pandemic, housing prices have grown at an accelerated pace since early 2021.[16] The strongest recorded house price growth Australia-wide was in March 2022.

Figure 1: ABS residential property price index, annual percentage change, 2004–2022



Source: Australian Bureau of Statistics, Strongest annual growth in property prices on record 15/03/2022

16 ABS, *Total Value of Dwellings*, March quarter 2022. https://www.abs.gov.au/statistics/economy/price-indexes-and-inflation/total-value-dwellings/latest-release

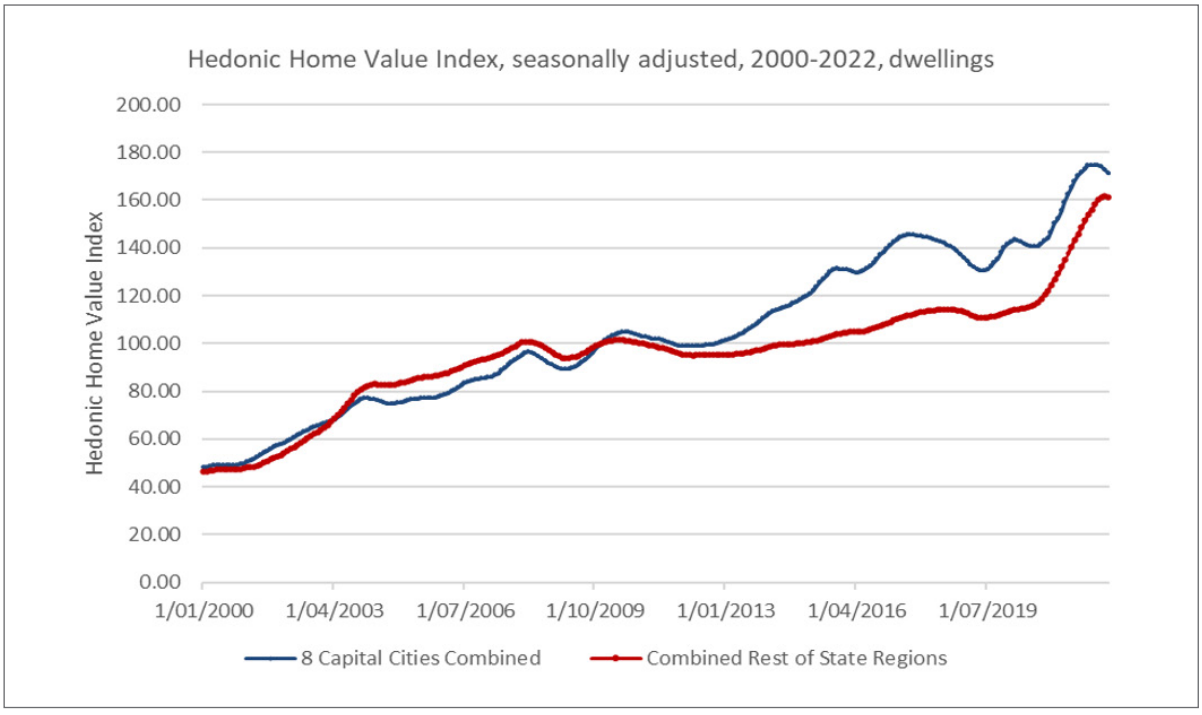
House price growth outside of capital cities presents a mixed picture. Figure 2 shows the average home value index for dwellings for the combined eight capital cities, and for the combined rest of state regions (provided by CoreLogic). Figure 2 shows that since 2010, on average, dwelling values have been greater for cities relative to regions. It also shows that the value of dwellings in the rest of the regions grew faster than those of the capital cities from November 2020 (the slope of the red line is steeper than the slope of the blue line after 2019), peaking later than for capital cities. In June 2021, the annual house-price growth rate for combined regions was 17.7 per cent, while that of combined capitals was 12.4 per cent.

The average house price for the eight capital cities in Australia increased by 23.7 per cent over 2021—the largest annual rise since September 2003. This strong growth in house prices across Australian capital cities has consequences for housing decisions, affordability pressures and relocation incentives.

Figure 3 shows the average median house price growth across Australian states and territories 2000–2021. House price growth is evident from 2000 onwards, particularly for NSW, VIC, TAS, SA and the ACT. QLD, WA and the NT show some periods of slowdown and negative growth related to localised, industry-related shocks. Most states and territories experienced a brief slowdown in house price appreciation in 2018, which then reverted and accelerated in the second half of 2020, during the Covid-19 pandemic.

House prices increased nationally from mid-2020, particularly for regional Australia. The combined capital cities in Australia saw a 25.5 per cent growth from the Covid-19 trough to their growth peak in April 2022, while the combined regional index saw growth of 41.6 per cent from the Covid-19 trough to their growth peak in June 2022.

Figure 2: Home value index for dwellings, 2000–2022



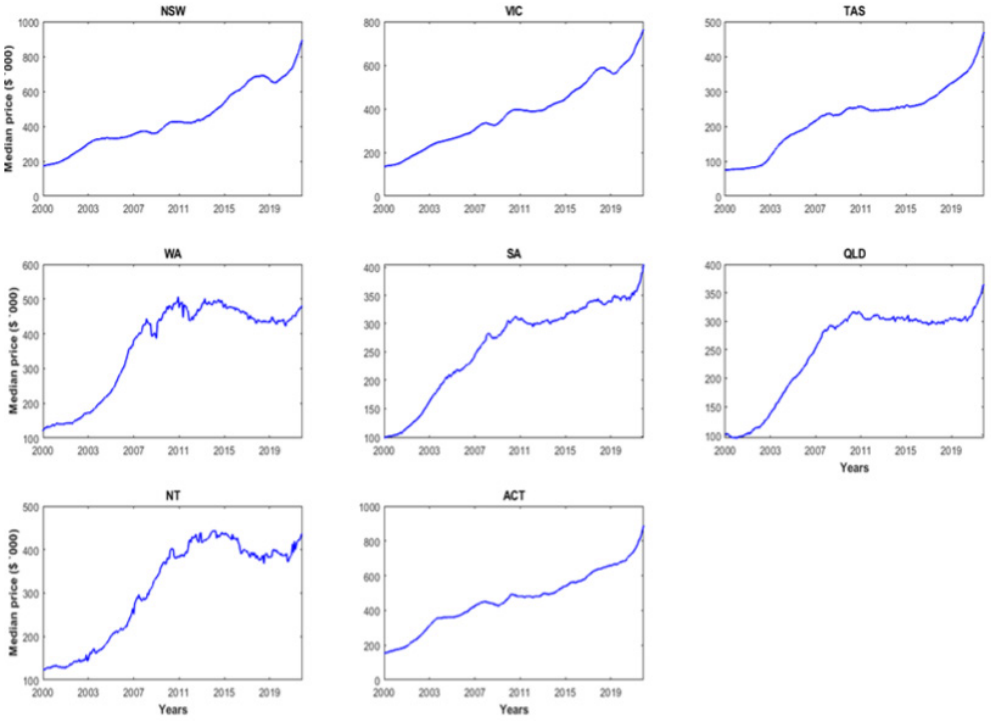
Source: Author

Table 11: Descriptive statistics for median house price growth (%)

		Mean	Min	Max	Mean	Min	Max
		Pre-pandemic period (2009–2019)			Pandemic period (2020-2021)		
NSW	Metro	6.83	−9.81	20.31	11.90	−2.65	24.96
	Fringe	6.71	−7.89	20.22	8.49	−4.11	24.22
	City	4.47	−1.76	14.84	9.85	0.62	24.30
	Rural	4.76	−0.09	18.28	7.59	0.73	20.82
VIC	Metro	6.12	−9.68	20.84	9.95	0.88	17.08
	Fringe	6.03	−1.17	16.50	9.48	1.33	16.00
	City	3.56	−0.70	9.90	11.93	5.50	21.20
	Rural	4.00	−2.28	9.25	15.49	5.16	24.81
TAS	All	3.53	−3.97	10.14	14.06	7.48	25.14
QLD	All	0.64	−5.27	8.18	9.20	−1.43	16.14
SA	All	2.01	−1.95	8.10	5.97	−0.08	14.15
WA	All	−0.19	−6.56	9.76	8.82	−0.26	17.51
NT	All	2.81	−8.83	15.83	3.41	−3.17	14.33

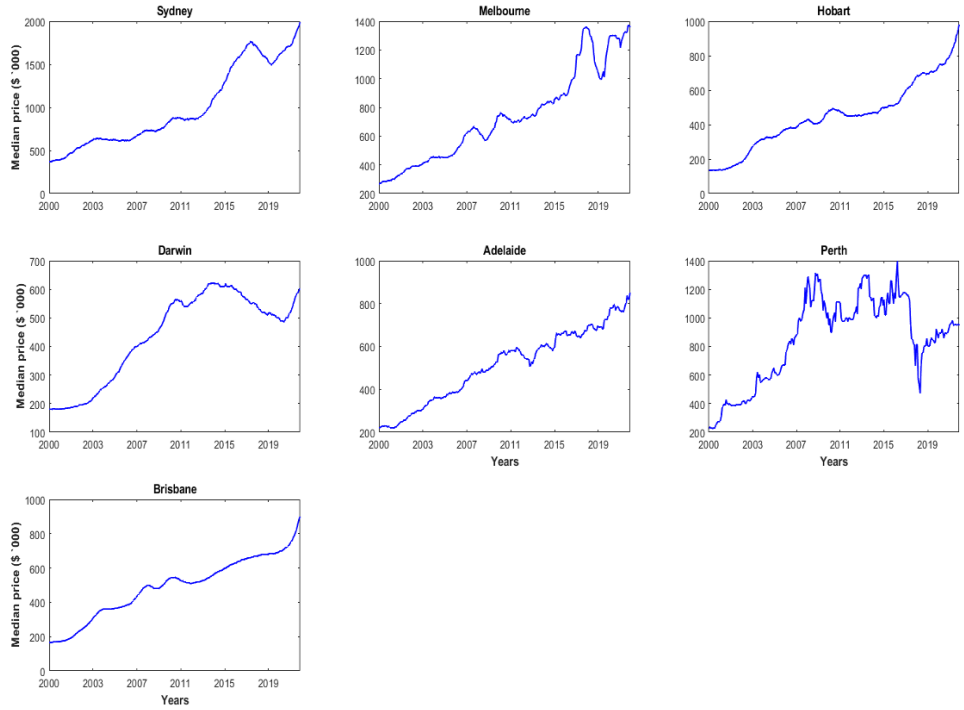
Source: Author

Figure 3: Average median house prices, Australian states and territories, 2000–2021



Source: Author

Figure 4: Median house prices across Australian capital cities, 2000–2021



Source: Author

Next, we explore house price dynamics for Australian capital cities, and across submarkets. Figure 4 shows the average median house price growth for all Australian capital cities 2000–2021. Sydney and Melbourne experienced strong house price appreciation after 2015. The market cycle reverted in 2018, but was interrupted by the Covid-19 pandemic in 2020. Rather than a continued period of price easing, house prices increased from the second half of 2020 for Sydney, followed shortly after by Melbourne. Hobart and Brisbane experiencing sustained price growth since 2020, accelerating in late 2020. Perth, Darwin, and to a lesser extent Adelaide, had more volatile markets.

Focussing on Australia's two largest states, and based on subgroupings of LGAs, we present our subsequent results for four different housing submarkets for NSW and VIC: Metro, Fringe, regional City and Rural. These groupings are determined by common characteristics, as explained in subsection 1.3.1:

- *Metro* refers to LGAs within the main cities and metropolis;
- *Fringe* markets refer to LGAs in suburbs that surround the Metro area and form the outer border of the capital city areas;
- regional *City* refers to LGAs in regional large cities;
- *Rural* areas combine LGAs in rural and remote towns.

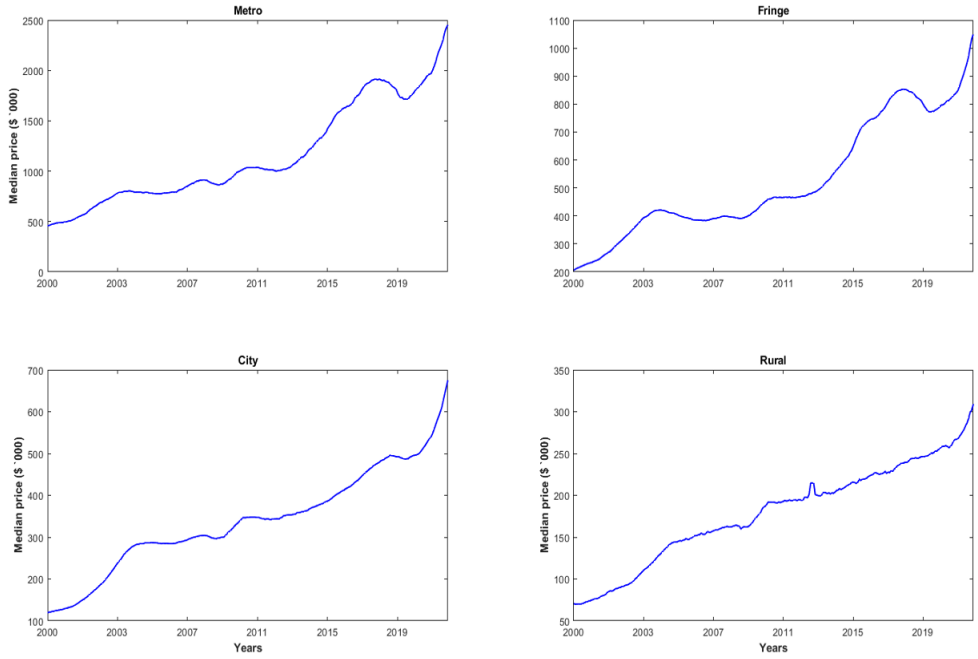
Tables A1 and A2 in Appendix A provide a complete list of the LGAs included in each submarket for NSW and VIC. Figure B1 in Appendix B shows a map of the submarkets for NSW and VIC.

Figure 5 shows the trend for the average median house prices for the four housing submarket categories for NSW and VIC respectively. As shown by Figure 5a, the City and Rural submarkets of NSW experienced sustained price growth, while the 2018 price easing, discussed earlier, was concentrated in the Metro and Fringe submarkets. From mid-2020, we observe a consistent growth in house prices for all NSW submarkets. Figure 5b shows that while Victoria's Fringe, City and Rural submarkets experienced sustained growth in house prices before the pandemic, Metro experienced some house price slowdown around 2018. With the pandemic, all Victorian submarkets saw a strong rise in house price.

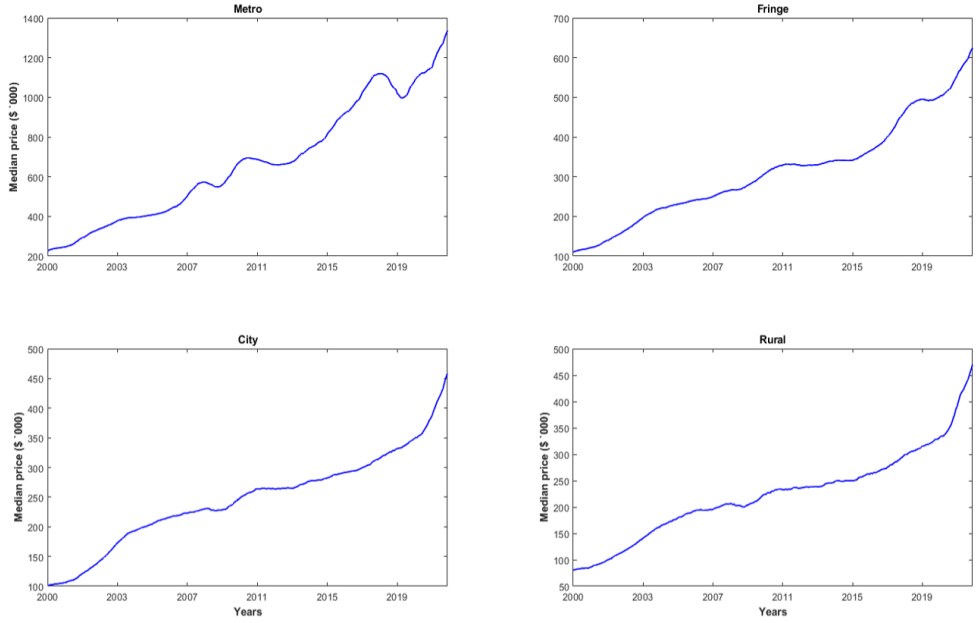
Table 11 presents descriptive statistics for the median house price growth for each state and territory, and for the submarkets in NSW and VIC, for the decade 2009–2019, and for the pandemic period 2020–2021. Median house price growth became stronger during the pandemic years across states and territories and across submarkets. Interestingly, regional cities and rural areas have only experienced house price appreciation during the pandemic years.

Figure 5: Average median house prices across submarkets, 2000–2021

a. NSW submarkets



b. Victorian submarkets



Source: Author

2.5 Policy implications

- Changes in population growth in housing submarkets through migration impact local residents and have significant social, economic and policy implications.
- Australia's regional areas have traditionally played an important role in the provision of larger and less-expensive housing services, contributing to higher quality of life for households that are more geographically mobile in their employment opportunities and lifestyle preferences.
- However, affordability in regional and rural areas is currently being tested following strong house price appreciation during the Covid-19 pandemic—which highlights an urgent need for a considered policy response across different levels of government.
    - Flexible and remote work, along with changing locational preferences in the post-pandemic environment, have increased households' access to more affordable further-away housing options through lower reliance on capital city and employment-centric housing.
    - The influx of people into regional cities has led to an intensification of housing affordability issues in many regional cities, with limited stock and very low vacancy rates, in part due to the lack of social and affordable housing options in regional areas.
    - If flexible and remote working is to be a more permanent feature of employment markets, housing stress in regional areas has the potential to create a migration ripple effect, where low-income and vulnerable households are forced to relocate to less-expensive areas.
    - There is an opportunity for government policy and both public and private investment to intervene through targeted strategies that address the housing-supply imbalance in these areas—particularly for affordable housing.
- In the short-term, our analysis has implications for demand-side policies that target home purchases in regional areas that can contribute to population migration by putting additional strain on property prices. The Regional First Home Buyer Guarantee is one current policy that may have adverse consequences in a post-pandemic context.
- Regional house price growth also has an asymmetric effect on households with fewer resources and lower tenancy status. While owner-occupiers and investors benefit from price appreciation, a substantial negative effect is disproportionately experienced by low-income households and renters in regional areas. Given the traditional attraction of regional areas as relatively affordable locations, these areas also have a high proportion of low-income and rental households.
- Targeted policies that provide financial support for households experiencing housing stress in regional areas could be considered to minimise social disruption and maintain community cohesion, along with other supports such as rental assistance and rental reform.
- Policy considerations should include other factors that contribute to demand imbalances and erode community cohesion, such as the role of short-term holiday letting in regional areas—for example, Airbnb.
- In the longer term, increases in appropriate and diversified housing supply are necessary. Such policy should focus on the strategic growth and development of regional and rural areas, to support the trend of moving away from capital cities into regional areas. Regional investment policy needs to ensure that additional pull factors to regions are balanced with sufficient and appropriate housing supply.

3. Housing spillovers within and across states

- Housing spillovers refer to the impact that house price movement in one submarket has on house prices in other submarkets. We measure house price spillovers in national submarkets to determine the direction and degree of interconnectivity in house price changes between geographical areas.
- The interconnectivity of house prices across states and territories changed considerably during the pandemic, strongly reflecting the different experiences of Covid-19 and state government responses to it.
- Pre-pandemic, QLD, NSW, Tasmania and the NT were net contributors of house price spillovers to other states and territories. House price changes in these states and the NT influenced house prices in the net receiver states—ACT, WA, VIC and SA—to varying degrees.
- The spillover analysis reveals geographical patterns and industry-related patterns. Geographically, house price movements in NSW strongly contributed to house price dynamics in VIC and the ACT. In industry-related patterns, house price dynamics in QLD strongly contributed to house price movements in WA.
- During the 2020–2021 pandemic, VIC became the strongest contributor to house price changes in other states and territories, highlighting the interconnectedness of Australia's housing markets in response to localised pandemic shocks.
- In 2020–2021, VIC and NSW were net contributors of house price spillovers, while states with fewer Covid-19 outbreaks and fewer restrictions were net receivers of house price spillovers.

3.1 House price spillovers across states

Housing markets are leading indicators of the aggregate economy, playing a significant role in shaping economies (Quigley 2001). House price dynamics reflect consumption and investment decisions of a society, revealing locational preferences, job and educational opportunities, access to services and amenities, as well as connection to infrastructure and transport. Housing markets are seen by investors as reliable risk-diversifying markets with expected capital gains for relatively unsophisticated assets (Conover, Friday et al. 2002; Fugazza, Guidolin et al. 2009).

A rich body of literature shows that housing markets are interconnected (Agyemang, Chowdhury et al. 2021; Cesa-Bianchi 2013; de Bandt, Barhoumi et al. 2010; Gomez-Gonzalez, Gamboa-Arbelaez et al. 2018). The general expectation is that shocks in one region's housing market would directly spillover to other housing markets through established channels—including migration and capital movement.

Most of the literature explores the interconnectivity of housing markets across countries (Kim and Park 2016; Vansteenkiste and Hiebert 2011), and some across regions (Alexander and Barrow 1994; Ashworth and Parker 1997; C. Hudson, J. Hudson et al. 2018). For example, Shih, Li et al. (2014) studied house-price spillover effects for provinces in China, and Vansteenkiste (2007) studied state-level housing price spillovers and interest rate shocks in the USA.

There is limited prior research on the interconnectedness between housing markets in different Australian cities and regions and across Australian states. Costello, Fraser et al. (2011) find that NSW appeared to be relatively more susceptible to house price spillovers transmitted from other states, while the ACT and WA were the least affected, perhaps reflecting their economic and geographical isolation from the rest of the country. No Australian study explores the connectivity between housing markets across states at a more disaggregated level than the capital housing submarket geographical delimitation.

The presence of interconnectivity and spillovers in housing markets has critical implications for investors in real estate markets (Wright and Yanotti 2019; Yanotti and Wright 2021)—but more importantly for housing market residents, in terms of housing accessibility and affordability pressures. There are also important implications for policy and government intervention, particularly if existing policies are set on an assumed pattern of interconnectedness between regional housing markets and there is a subsequent deviation that is inconsistent with the policy modelling. (We expand on this in Section 6 and Section 7.)

3.2 Methodology

We use a framework proposed by Diebold and Yilmaz (2012) to measure spillover effects in the housing markets. This approach is widely used in finance, and provides an intuitive way to quantify spillovers across different assets (Diebold and Yilmaz 2012; Wang, Xie et al. 2016). The spillover measure follows directly from the variance decomposition in a generalised VAR model. It is constructed as follows. (A more technical explanation of the methodology is provided in Appendix C.)

Consider a VAR(p) with *n* variables for a covariance stationary process, as in Eq(1).

$$y_t = \sum_{i=1}^{p} \Phi_i \, y_{t-i} + \varepsilon_t \qquad \text{Eq(1)}$$

In this case y_t represents house price growth, explained by house price growth in previous months, y_{t-1}, and an error term.

We then calculate the contribution of shocks to variable *j* to the H-step-ahead generalised forecast error variance of entity *I* (as explained in Appendix C), and normalise the generalised variance decomposition for comparison purposes.

Then we define the spillover index, a measure of the contribution of spillovers from house price volatility shocks across the variables in the system to the total forecast error variance.

The house price spillover index has two indicators: 'contribution to others' $(S_{i\rightarrow others}(H))$ and 'contribution from others' $(S_{i\leftarrow others}(H))$.

The spillover is derived using the variance decomposition of the house price growth. The magnitude of the static spillover, which can be between zero and one, reflects 'the overall strength' of spillovers over different regions and submarkets. A higher value for the spillover index points to more active spillovers among regions. Diebold and Yilmaz (2012) further highlight that spillovers can be used to estimate the level of systemic risk, on the basis that the magnitude of spillovers can detect the extent of the correlation among regions.

Net total spillovers are obtained by taking the difference between 'contribution to others' and 'contribution from others':

$$S_i(H) = S_{i\rightarrow others}(H) - S_{i\leftarrow others}(H) \qquad \text{Eq(2)}$$

This net spillover index tells us how much each submarket contributes to the dynamics in other submarkets. The positive (or negative) net spillover indices indicate that a given submarket *i* has a net contribution of price changes to (or from) other submarkets. In other words, a positive spillover index indicates that house price changes in one market generate spillover effects in other housing submarkets, and influence house prices in that other submarket. A negative spillover index indicates that a housing submarket is a recipient of house price spillovers from other housing submarkets. In other words, their house prices are influenced by house price movements in other submarkets.

The advantage of using this methodological approach to measure the influence between housing submarkets is that it shows the source, direction and strength of the house price effect from one LGA to another. This methodology provides a comprehensive view of the relationships and interactions between regional and urban housing markets.

Following the methodological approach described in this subsection, we estimated the spillover index for all states and territories, and all LGAs within states and territories, across Australia for the period 2009–2019 as the pre-pandemic period, and for the period 2020–2021 as the pandemic period for comparison purposes.

3.3 Spillovers within states

The tables in this subsection show the spillover indices for all LGAs for each state and territory. They are extensive, as the analysis considers all pair-wise combinations of LGAs within a state. (Because of space considerations, the complete intrastate LGA spillover results are untabulated in this report, but can be provided by the authors upon request.) To demonstrate the output:

- Table 12 shows the spillover results for the NT—the territory with the fewest LGAs[17]
- Figure 6 provides the spillover network results for Tasmania—the state with the fewest LGAs.

Table 12 shows the spillover effects between NT LGAs for both the pre-pandemic and pandemic periods. The results have been highlighted in a 'traffic-light' analysis for easier comprehension, where green shows lower magnitudes and red shows higher magnitudes. The tables show the spillover directions 'from' by reading down the columns and 'to' by reading across the rows. In other words, if the table is interpreted as a matrix, a row provides effect 'to', while a column provides effects 'from'. Table 12 shows the static spillover index in the inner cells of the matrix and net spillover indices in the last row of the table. A positive net spillover value indicates a net contribution to other LGAs, while a negative net spillover value indicates a net contribution from other LGAs.

To aid in reading these tables, we will explain the interpretation of the results in Table 12. For the pre-pandemic period in the NT, the top panel shows in the first row that Coomalie (0.04), Katherine (0.06), Litchfield (0.24) and Palmerston (0.20) received a house-price spillover effect from Alice Springs. The spillover effect value indicates the strength and direction of the relationship between house prices in the two markets. The reported results are interpreted as 24 per cent—which means that 24 per cent of the variability in house prices in Litchfield was determined by house price movements in Alice Springs, while 20 per cent of the variability in house prices in Palmerston was determined by house price movements in Alice Springs.

Following the red and orange colours, the pre-pandemic panel in Table 12 shows that Palmerston was a contributor of house price dynamics to Darwin (0.46) and Alice Springs (0.20), and Litchfield was a contributor of house price dynamics to Alice Springs (0.24). Overall, looking at the last row of the top panel, the net spillover values indicate that Palmerston (0.71) and Litchfield (0.25) were net contributors of house price spillovers, while Darwin (−0.48), Alice Springs (−0.41), and Katherine (−0.08) were net recipients. It is worth noting that the strongest net contributor LGA, Palmerston, also recorded the fastest increase in population for the NT during this period.

This pattern changes during the pandemic years, as reflected in the second panel of Table 12. During the period 2020–2021, again following the red and orange colours, Litchfield was a contributor of house price spillovers to Alice Springs (0.51), Darwin (0.38), Palmerston (0.36) and Coomalie (0.20). Darwin and Coomalie also became contributors of house price spillovers. That is, 51 per cent of house price variability in Alice Springs was determined by the variability in Litchfield's house prices, and 38 per cent of Darwin's house price variability was determined by the variability in Litchfield's house prices.

Overall, the net effects reported in the last row indicate that Litchfield (1.05) and Coomalie (0.19) and, to a lesser extent Darwin (0.06), were net contributors of house price spillovers, while Alice Springs (−0.75), Palmerston (−0.44), and Katherine (−0.11) were net recipients of house price spillovers during the pandemic period.

17 Note that the house price dataset may not provide data for all LGAs in a state or territory if the number of property transactions in that LGA is too small because of concerns about identification and anonymisation of data. For this reason, in particular, we have few LGAs with observations for the Northern Territory, shown in Table 13.

Table 12: Static spillover effects for NT LGAs

Pre-pandemic

	Alice Springs	Coomalie	Darwin	Katherine	Litchfield	Palmerston	FROM others
Alice Springs	0.00	0.04	0.00	0.06	0.24	0.20	0.54
Coomalie	0.02	0.00	0.01	0.02	0.01	0.00	0.06
Darwin	0.05	0.01	0.00	0.00	0.02	0.46	0.54
Katherine	0.01	0.01	0.00	0.00	0.04	0.11	0.17
Litchfield	0.02	0.00	0.04	0.00	0.00	0.01	0.08
Palmerston	0.03	0.01	0.01	0.01	0.02	0.00	0.08
TO others	0.13	0.07	0.06	0.10	0.33	0.78	**1.47**
NET	−0.41	0.01	−0.48	−0.08	0.25	0.71	

Pandemic era

	Alice Springs	Coomalie	Darwin	Katherine	Litchfield	Palmerston	FROM others
Alice Springs	0.00	0.14	0.16	0.04	0.51	0.09	0.94
Coomalie	0.10	0.00	0.12	0.05	0.21	0.03	0.52
Darwin	0.00	0.17	0.00	0.01	0.38	0.14	0.70
Katherine	0.07	0.07	0.08	0.00	0.05	0.02	0.29
Litchfield	0.01	0.17	0.14	0.07	0.00	0.08	0.47
Palmerston	0.00	0.16	0.26	0.01	0.36	0.00	0.80
TO others	0.19	0.71	0.76	0.18	1.52	0.36	**3.72**
NET	−0.75	0.19	0.06	−0.11	1.05	−0.44	

Source: Author

Untabulated results for intrastate LGAs spillovers in other states and territories reveal the following patterns for QLD, WA and SA.

Spillovers in Queensland LGAs

During the pre-pandemic period, Burdekin, Toowoomba, Townsville, Gladstone, Cassowary Coast, Gympie, Redland, Logan and Goondiwindi were the main house price spillover contributors across other LGAs in Queensland. During the pandemic period, Moreton Bay, Sunshine Coast, Redland, Brisbane, Logan, Cairns, Noosa, Mount Isa, Douglas and Gold Coast became the main contributors of house price spillovers to other LGAs in Queensland.

Spillovers in West Australian LGAs

During the pre-pandemic period, Mundaring, Augusta, South Perth, Claremont, Harvey, Bunbury and Denmark were the main house price spillover contributors to other LGAs. During the pandemic years, Wagin, Melville, Vincent, Karratha, Port Hedland, Augusta, Esperance, Bridgetown, Carnarvon, Broome, Subiaco, Gosnells and Mandurah were the main contributors of house price spillovers across Western Australian LGAs.

Spillovers in South Australian LGAs

For SA, the main contributors of house price spillovers during pre-pandemic years were West Torrens, Roxby Downs, Unley, Flinders Ranges, Alexandrina, Murray Bridge, Marion, Mount Gambier, Ceduna, and Mallala. During the pandemic years, the main contributors of house price spillovers were Playford, Roxby Downs, Peterborough, Norwood, Charles Sturt, Tatiara, Burnside, and Southern Mallee.

Network dynamics for house price spillover indices for Tasmanian LGAs

Figure 6 presents the network dynamics for the house price spillover indices for LGAs across Tasmania for pre-pandemic years (panel a) and pandemic years (panel b). In this figure, we present the same results of house price spillover indices (as for example those shown for the NT in Table 12), but in a different format, using network analysis to highlight the direction and strength of the house-price spillover effects in Tasmania.

All Tasmanian LGAs are represented in Figure 6 by vertices. Arrows depart from some LGAs with their direction to other LGAs indicated by the arrow's point. The strength of the spillover effect is highlighted with wider arrows:

- magenta arrows indicate stronger spillover effects;
- green arrows indicate a relatively weaker house-price spillover effect from one LGA to another.

Due to the large number of connections in this figure, we have removed those indices with the weakest spillover effects (<15 per cent).[18]

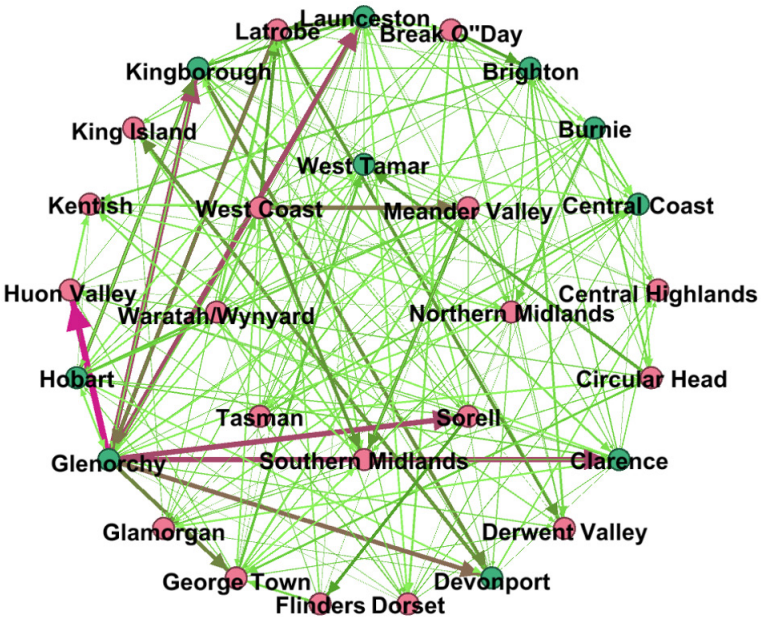
As shown in Figure 6 panel a, before the pandemic Glenorchy was a strong contributor of house price spillovers to geographically close LGAs such as Clarence, Kingborough, Huon Valley and Sorell, as well as LGAs located in the north of Tasmania, such as Launceston and Devonport. Overall, the main contributors to house price spillovers during the pre-pandemic period were Glenorchy, the West Coast, Hobart, Brighton and Break ODay.

Panel *b* in Figure 6 shows that during the pandemic years, the house price interconnectivity dramatically increased across LGAs. Effectively, all submarkets became more closely integrated, as demonstrated by the more intense interconnecting lines. In particular Launceston, Devonport, Tasman, Hobart and Meander Valley become strong contributors to house price spillovers to the rest of the LGAs in Tasmania.

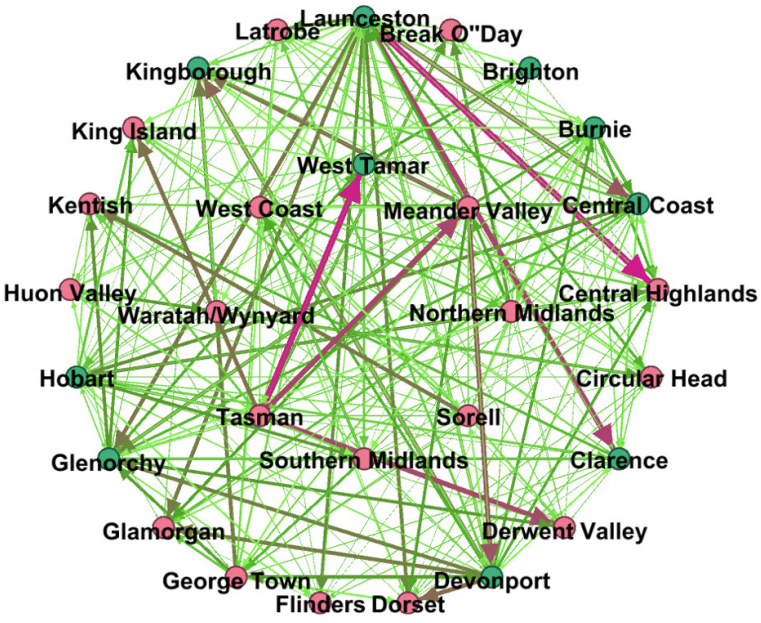
18 Note: We have tested different threshold percentages in order to make the figure more informative and readable. However, there is no commonly agreed threshold level in the literature.

Figure 6: Networks for house price spillovers for TAS LGAs

a. Tasmania, pre-pandemic period



b. Tasmania, pandemic period



Source: Author

House price spillover results for LGAs in NSW and VIC are interpreted in Section 4.

While house price dynamics across LGAs within states reflect specific migration and market dynamics, it is evident that the Covid-19 pandemic and associated restrictions impacted the direction and magnitude of house price spillovers across all LGAs within states and territories. House price spillovers became stronger during the pandemic.

3.4 Spillover results across states

We also estimated spillover indices across states and territories to understand the interconnections, which potentially reflect migration dynamics.

Table 13 shows the spillover index estimates across Australian states and territories. The top panel shows pre-pandemic results, and the bottom panel shows results for the pandemic period. We again follow the red and orange cells indicated in the traffic-light matrix.

In the decade 2009–2019, NSW was a contributor of house price spillovers, mainly towards the ACT (0.354), VIC (0.303) and SA (0.113). In other words, 35.4 per cent of the house price variability in the ACT was determined by the variability in NSW house prices, and 30 per cent of Victoria's house price variability was determined by the variability in NSW house prices. QLD was a contributor to house price spillovers to WA (0.262). Victoria was a contributor to house price spillovers to TAS (0.140), while TAS was a contributor to house price spillovers to SA (0.176) and the ACT (0.181). Finally, the NT was a contributor to house price spillovers in the ACT (0.140).

These dynamics are also depicted visually in Figure 7, panel a, where bolder magenta arrows indicate larger magnitudes for the spillover indices, and thinner green arrows indicate lower magnitudes for the spillover indices. The direction of the spillover index is indicated by the direction of the arrowhead.

Overall, QLD (0.496), NSW (0.446), NT (0.212) and TAS (0.206) were net contributors of house price spillovers during the pre-pandemic years, while the ACT (−0.679), WA (−0.331), VIC (−0.203) and SA (−0.147) were net recipients of house price spillovers.

Table 13: Static spillover effects across Australian states and territories

Pre-pandemic

	NSW	VIC	WA	QLD	SA	TAS	NT	ACT	FROM
NSW	0.000	0.105	0.008	0.131	0.021	0.058	0.070	0.024	0.418
VIC	0.303	0.000	0.029	0.123	0.026	0.075	0.096	0.028	0.680
WA	0.038	0.011	0.000	0.262	0.077	0.057	0.017	0.009	0.472
QLD	0.017	0.032	0.018	0.000	0.019	0.043	0.140	0.003	0.272
SA	0.113	0.081	0.031	0.048	0.000	0.176	0.053	0.016	0.518
TAS	0.026	0.140	0.011	0.069	0.087	0.000	0.076	0.002	0.411
NT	0.012	0.015	0.029	0.039	0.109	0.026	0.000	0.029	0.260
ACT	0.354	0.093	0.013	0.095	0.033	0.181	0.020	0.000	0.790
TO	0.864	0.477	0.141	0.768	0.371	0.617	0.472	0.111	**3.821**
NET	0.446	−0.203	−0.331	0.496	−0.147	0.206	0.212	−0.679	

Pandemic era

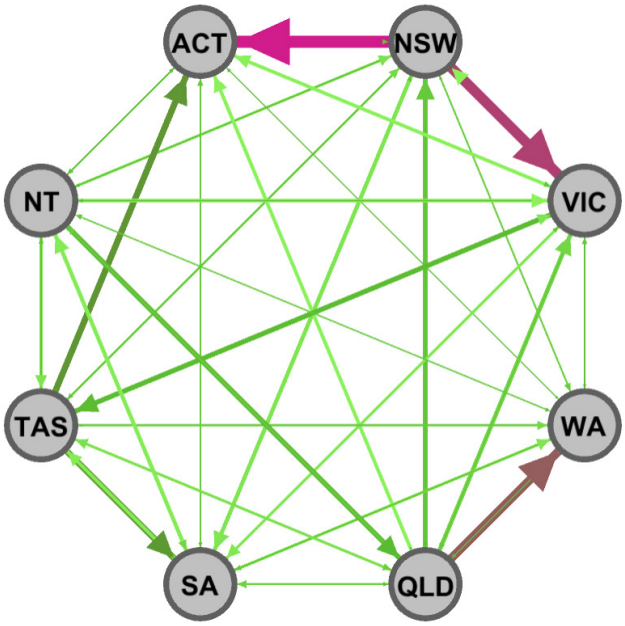
	NSW	VIC	WA	QLD	SA	TAS	NT	ACT	FROM
NSW	0.000	0.471	0.051	0.025	0.060	0.145	0.027	0.028	0.807
VIC	0.136	0.000	0.056	0.017	0.108	0.102	0.016	0.020	0.456
WA	0.089	0.498	0.000	0.025	0.088	0.106	0.028	0.067	0.902
QLD	0.194	0.519	0.032	0.000	0.073	0.053	0.015	0.046	0.931
SA	0.139	0.487	0.069	0.007	0.000	0.123	0.027	0.017	0.870
TAS	0.134	0.480	0.070	0.017	0.080	0.000	0.035	0.032	0.848
NT	0.054	0.463	0.117	0.019	0.107	0.132	0.000	0.050	0.942
ACT	0.185	0.460	0.049	0.037	0.048	0.133	0.026	0.000	0.938
TO	0.931	3.379	0.444	0.147	0.565	0.794	0.174	0.261	**6.695**
NET	0.124	2.923	−0.458	−0.784	−0.305	−0.055	−0.769	−0.678	

Source: Author

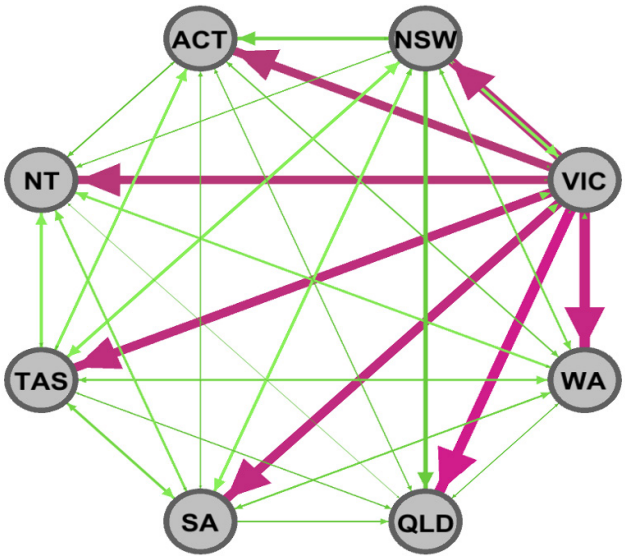
Notes: Spillovers across the states for the pre-pandemic (1 January 2009—31 December 2019) and during the pandemic (1 January 2020—31 December 2021). Variance decompositions are based on 10-months-ahead forecasts and a VAR lag length of order 1 was selected by the Schwarz Bayesian information criterion and Akaike information criterion. 'FROM others' shows the total spillovers received by a submarket i from all other submarkets. 'TO others' shows the total spillovers transmitted by a submarket i to all others. 'NET' shows the net spillovers from submarket i to all other submarkets. The bold value is the total spillover index.

Figure 7: Networks for spillovers across Australian states and territories

a. Pre-pandemic period



b. Pandemic period



Source: Author

The interconnectivity of house price dynamics across states and territories changed considerably during the pandemic years, and strongly reflects the different ways Covid-19 impacted states, largely through different government responses. The bottom panel in Table 13 shows that Victoria became a strong contributor of house price changes in other states and territories. NSW and TAS were also influencers of house price movements in other states, but to a lesser degree than VIC. These changes are visually striking in panel *b* of Figure 7.

Considering the results in the last row of Table 13 we observe that VIC (2.923) and NSW (0.124) were net contributors of house prices spillovers during the pandemic years, while QLD (−0.784), NT (−0.769), the ACT (−0.678), WA (−0.458), SA (−0.305), and TAS (−0.055) to a lower extent, were net receivers of house price spillovers. A possible explanation for these results is the starkly different experience of the pandemic depending on the policy responses of individual states. Victorian residents experienced the strictest lockdowns in Australia, and limits on population mobility because of the high Covid-19 infection rate in the state changed the way people worked—and, consequently, where they chose to live. This had direct effects on the local housing market, but the volatility and uncertainty generated in VIC appears to have spilled over to all other states and territories. The possible channels for this spillover include migration and consumer sentiment, which is usually biased towards negative signals, as in Abosedra, Laopodis et al. (2021) and Nguyen and Claus (2013).

3.5 Policy development implications

- Understanding the interconnectivity between different housing markets across Australia is very important to effectively regulate housing markets. This includes protecting lower-income and tenant households from affordability pressures, supporting sustainable housing and regional investment and development across submarkets, and managing financial stability in instances of extreme house price movement, uncertainty and 'bubbles'.
- Our results demonstrate that house prices are interconnected within and across states and territories. This means that localised housing market issues have the potential to impact the national housing market. Consequently, a key implication of our analysis is the need for policy coordination across regions and levels of government.
- This coordination needs to be applied to both demand-side (social infrastructure) and supply-side (urban infrastructure) policies.
- Australia currently has a range of policies that promote home ownership, particularly for first home buyers, but these vary by jurisdiction and can focus demand towards specific regions.
- Policy to address home ownership should also align with other supporting policies relating to urban investment, gentrification, education and employment initiatives, infrastructure, and amenities.
- An implication of our research is the need for a review of current policy and practice that crosses state and area borders and moves beyond housing-specific policy.
- Future policy development should implement and regulate in ways that address the nuances of different but interconnected housing submarkets to minimise adverse spillover transmission throughout the national housing market.

4. Housing spillovers: NSW and Victorian submarkets

- We classify LGAs in NSW and Victoria into four housing submarkets: *Metro*, *Fringe*, regional *City* and *Rural* area. We study the interconnectivity between house price changes across these submarkets.
- In NSW, *Metro* and *Fringe* areas were net contributors of house price spillovers, while regional *City* and *Rural* areas were net receivers of house-price spillover effects in the pre-pandemic period (2009–2019).
- During the pandemic period (2020–2021), the direction of spillover influence changed, with *Fringe* and regional *City* areas becoming the net-house-price contributors to other NSW submarkets.
- Victoria's shift in spillover patterns during the pandemic is striking. Pre-pandemic, *Metro* was the only net contributor of house price spillovers in VIC, while *Fringe*, regional *City*, and *Rural* were net receivers.
- During the pandemic, the direction of influence of Victoria's submarkets flips. *Metro* becomes a strong net receiver of house price spillovers, while *Fringe*, regional *City* and *Rural* become net contributors.
- This pattern in house price dynamics across submarkets in NSW and VIC clearly changes during the pandemic years relative to the pre-pandemic period.
- Overall, our results highlight the recent prominent role of *Fringe* areas and regional *Cities* in house price dynamics.

4.1 House price spillovers across regional submarkets

While most of the literature studies spillovers across countries, some studies focus on exploring house price spillover across regions. Alexander and Barrow (1994) show evidence of housing market spillovers transmitted from greater London to other regions of the UK, and Ashworth and Parker (1997) study interconnectivity between house prices for 11 UK regions. Montagnoli and Nagayasu (2015) explore house price spillovers across regions in the UK, while Stevenson (2004) examines house price diffusion for regions across the Republic of Ireland and between Ireland and Northern Ireland. Yang, Yu et al. (2018) study housing price spillovers for cities in China, and Lu, Li et al. (2021) explore time-varying inter-urban housing price spillovers for regions in China.

The prior literature that examined housing spillovers in Australia focuses on the main capital cities. Akimov, Stevenson et al. (2015) find evidence of cyclical behaviour among the eight largest metropolitan housing markets in Australia, and specifically found a high level of house price interaction between Sydney and Melbourne compared with the rest of the metropolitan cities. Luo, Liu et al. (2007) find Sydney has the most house price spillover patterns with other cities, followed by Melbourne. However, Tu (2000) finds that Sydney's real housing prices influenced Melbourne housing prices in the short run, but did not have any effect on any other cities nor did they dominate national housing price dynamics in the long run.

While Beer, Crommelin et al. (2022) highlight the relevance of the regions in the Australian context, and discuss their role in managing population growth, and Gurran, Forsyth et al. (2021) discuss the potential for Australia's regional areas to attract and sustain population and economic growth, there is no current study exploring the house price interactions among Australian regional housing markets and capital cities, or across regional housing markets.

The Covid-19 pandemic had a strong impact on housing markets and population movements, as outlined in Section 2 and Section 3. Housing preferences have changed in the midst of a global pandemic, reflecting changes in quality of life, along with changes in preferences to be closer to social networks and to the natural environment (Verdouw, Yanotti et al. 2021). Crommelin, Denham et al. (2022) find that the key benefits of regional city living were housing types and affordability, community connections, access to nature, and the ease of travel within the city—particularly work commutes.

Liu and Su (2021) find 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. Vij, Ardeshiri et al. (2022) argue that it is possible that Covid-19 could fundamentally alter settlement preferences, but it is too soon to tell how large these shifts are likely to be, and how long they will persist. Barrero, Bloom et al. (2021) argue that the work-from-home (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 risk of contagion;
5. Pandemic-driven surge in technological innovations that support WFH—for example, evidence from patents (Bloom, Davis et al. 2021).

This trend has encouraged some individuals to move out of the cities, and has encouraged relatively fewer people to move into the cities. Gupta, Mittal et al. (2021) find that the flattening of the bid-rent curve is larger when WFH is more prevalent, housing markets are more regulated, and supply is less elastic.

Understanding housing submarket connectivity has important implications for forecasting urban migration, planning regional investment, and managing macroeconomic risks.

4.2 Spillover results across submarkets

In this section, we follow the framework described in Section 3.2 and estimate house price spillover indices for the four submarkets identified for NSW and VIC: *Metro*, *Fringe*, regional *City* and *Rural*. Section 1.3.1 describes the definition of these four submarkets in detail. Figure B1 in Appendix B is a map with the submarket definitions for NSW and VIC. Tables A1 and A2 in Appendix A list all the LGAs included in each submarket category for both NSW and VIC.

Tables 14 and 15 show the spillover effects between submarkets for the pre-pandemic and the pandemic periods for NSW and Victoria respectively. As in previous spillover results, the 'traffic-light' analysis is used for easier comprehension, where green reflects lower magnitudes and red shows higher magnitudes. The tables show the spillover directions 'from' by reading down the columns and 'to' by reading across the rows; in other words, if the table is interpreted as a matrix, row provides effect 'to' while the column provides effects 'from'. The tables show the static spillover index in the inner cells of the matrix and net spillover effects in the last row of the table. A positive net spillover value indicates a net contribution to other markets, while a negative net spillover value indicates a net contribution from other markets.

Spillovers for NSW submarkets

Table 14: Static spillover effects for NSW submarkets

Pre-pandemic

	Metro	Fringe	City	Rural	From others
Metro	0.000	0.292	0.077	0.184	0.554
Fringe	0.371	0.000	0.091	0.182	0.643
City	0.088	0.308	0.000	0.124	0.520
Rural	0.037	0.114	0.174	0.000	0.325
To others	0.495	0.715	0.342	0.491	**2.042**
NET	−0.059	0.072	−0.178	0.166	

Pandemic era

	Metro	Fringe	City	Rural	From others
Metro	0.000	0.366	0.409	0.032	0.807
Fringe	0.170	0.000	0.423	0.029	0.623
City	0.160	0.383	0.000	0.023	0.566
Rural	0.154	0.377	0.438	0.000	0.969
To others	0.484	1.126	1.270	0.085	**2.965**
NET	−0.323	0.503	0.704	−0.884	

Source: Author

Notes: Spillovers for NSW submarkets for the pre-pandemic (1 January 2009–31 December 2019) and during pandemic outbreak (1 January 2020–31 December 2021). Variance decompositions are based on 10-months-ahead forecasts and a VAR lag length of order 1 was selected by the Schwarz Bayesian information criterion and Akaike information criterion. 'From others' shows the total spillovers received by a submarket from all other submarkets. 'To others' shows the total spillovers transmitted by a submarket i *to all others. 'NET' shows the net spillovers from submarket* i *to all other submarkets. The bold value is the total spillover index.*

To aid in reading Table 14, a detailed explanation of one set of results follows. The top panel of Table 14 shows the NSW pre-pandemic period. It shows that *Fringe* (0.371), *City* (0.088) and *Rural* (0.037) have received a house-price spillover effect from Metro. The effect from *Metro* to *Fringe* (0.371) was quite high pre-pandemic. However, *Fringe* generated a housing spillover effect in return to *Metro* (0.292), reflecting the relationship and interaction between the two housing submarkets. This suggests that 37 per cent of the variability in house prices in *Fringe* was determined by house price movements in *Metro*, while 29 per cent of the variability in house prices in *Metro* was determined by house price movements in *Fringe*. If we consider the net effect (0.371 – 0.292 = 0.079), it suggests that house price movements in *Metro* had a stronger influence on house price movements in *Fringe*. This effect may reflect the house price affordability pressures in *Metro* NSW, which push population out from the metropolitan city into the fringe suburbs, a trend documented in Bourne, Houghton et al. (2020) before the pandemic.

Table 14 also shows that house price movements in *Fringe* affected house price changes in regional *City* (0.308), while *Metro* (0.184) and *Fringe* (0.182) received house price spillovers from Rural.

Overall, for the pre-pandemic years, we see stronger spillover effects from *Metro* to *Fringe*, from *Fringe* to *City* and from *Fringe* back to *Metro*. These are presented by the cells highlighted red and orange in the top panel of Table 14.

The NET row at the bottom of the top panel shows the net spillover effects from the submarkets indicated in each column. For Table 14, that means that for pre-pandemic NSW, *Rural* (0.166) and *Fringe* (0.072) were net contributors of positive spillover effects, while *Metro* (–0.059) and City (–0.178) were net receivers (negative spillovers) of house-price spillover effects.

The second panel in Table 14 shows our results for NSW in the pandemic years 2020–2021. It is clear to see by inspecting the traffic-light colouring in the two panels in Table 14 that the spillover effects have changed considerably with the Covid-19 pandemic.

The second panel shows that house price changes in *Fringe* and regional *City* NSW generated strong spillover effects to the rest of the submarkets during the pandemic. *Fringe* influenced *Metro* (0.366), *City* (0.383) and *Rural* (0.377) house prices during the pandemic, and *City* also influenced *Metro* (0.409), *Fringe* (0.423) and *Rural* (0.438). The spillover effects from *City* were stronger than those from *Fringe*. This emphasises the important role regional cities played in house price dynamics during the pandemic.

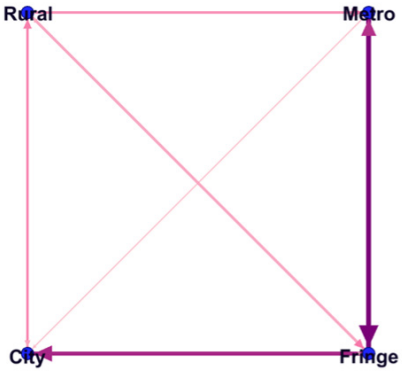
The last row in Table 14 shows the net spillover effects for the pandemic years 2020–2021. They indicate that *City* (0.704) and *Fringe* (0.503) were net contributors of house-price spillover effects in NSW submarkets, while *Metro* (–0.323) and *Rural* (–0.884) were net receivers of house price spillovers. This pattern has clearly changed for the pandemic years relative to the earlier period, and highlights the prominent role of fringe suburbs and regional cities in house price dynamics.

Another way to observe these changes in house price connectivity is with network analysis. Figure 8 shows the spillover networks between the four submarkets: *Metro, Fringe, City* and *Rural*. Again, the arrows show the spillover from one market to another, with the direction indicated by the arrowhead, and the strength of the spillover effect highlighted by the width of the arrow width and the intensity of its colour.

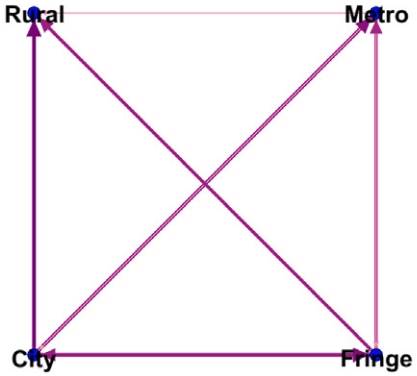
While Figure 8 panel a shows larger spillover effects from *Metro* to *Fringe,* from *Fringe* to *City* and from *Fringe* back to *Metro* for the pre-pandemic years (darker magenta arrows), panel *b* shows a more dynamic and stronger connectivity between submarkets for the pandemic period. This is consistent with the evidence showing that in 2020–2021, during the pandemic, people changed their housing preferences, and many moved away from the metropolitan centres towards regional cities and urban centres with smaller populations. Relocating to these areas offered individuals the opportunity to maintain existing metro-based employment under more flexible work arrangements, access more affordable and larger housing, and have better access to community, the natural environment, and other amenities.

Figure 8: Networks between submarkets for NSW and VIC for pre-pandemic and pandemic periods

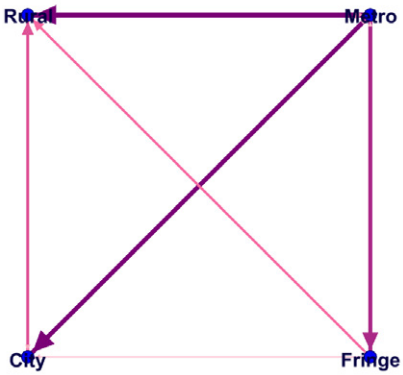
a. NSW pre-pandemic period



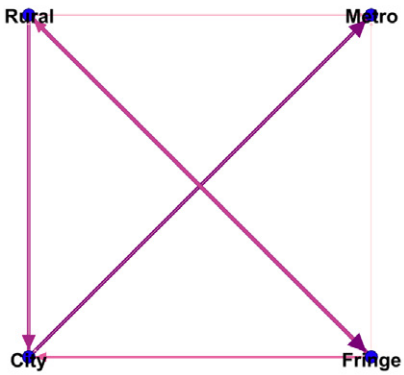
b. NSW pandemic period



c. Victoria pre-pandemic period



d. Victoria pandemic period



Source: Author

Spillovers for Victorian submarkets

The results for VIC are quite different to those for NSW. Table 15 shows the spillover effects for the four Victorian submarkets—*Metro, Fringe, City* and *Rural*—and Figure 8 shows the networks between submarkets in panels *c* and *d*.

While NSW and VIC share similar characteristics—such as population size, work opportunities, services and amenities—particularly around the two main capital cities of Sydney and Melbourne, their experience through the Covid-19 crisis has been quite different. NSW and VIC implemented different policy responses to the Covid-19 pandemic, and Sydney and Melbourne were impacted by these regulations and requirements in divergent ways (Horne, Willand et al. 2020; Leishman, Aminpour et al. 2022; Verdouw, Yanotti et al. 2021).

The top panel in Table 15 shows that during the pre-pandemic years *Metro* was a contributor of house price spillovers to *Rural* (0.270), City (0.269) and *Fringe* (0.222), and that *Rural* was a receiver of house price spillovers from *Metro* (0.270), *City* (0.170) and *Fringe* (0.146). This can also be seen in panel *c* of Figure 8.

Table 15: Static spillover effects for VIC submarkets

Pre-pandemic

	Metro	Fringe	City	Rural	FROM others
Metro	0.000	0.068	0.068	0.111	0.248
Fringe	0.222	0.000	0.055	0.024	0.300
City	0.269	0.076	0.000	0.080	0.425
Rural	0.270	0.146	0.170	0.000	0.586
TO	0.760	0.290	0.293	0.215	**1.559**
NET	0.512	−0.009	−0.131	−0.371	

Pandemic era

	Metro	Fringe	City	Rural	FROM
Metro	0.223	0.749	0.666	1.048	2.686
Fringe	0.068	0.000	0.099	0.478	0.645
City	0.107	0.291	0.000	0.399	0.797
Rural	0.047	0.340	0.108	0.000	0.495
TO others	0.446	1.380	0.873	1.926	**4.624**
NET	−2.241	0.735	0.076	1.431	

Source: Author

Notes: Spillovers for Victoria submarkets for the pre-pandemic (1 January 2009–31 December 2019) and during pandemic outbreak (1 January 2020–31 December 2021). Variance decompositions are based on 10-months-ahead forecasts and a VAR lag length of order 1 was selected by the Schwarz Bayesian information criterion and Akaike information criterion. 'FROM others' shows the total spillovers received by a submarket i from all other submarkets. 'TO others' shows the total spillovers transmitted by a submarket i to all others. 'NET' shows the net spillovers from submarket i to all other submarkets. The bold value is the total spillover index.

Overall, in the pre-pandemic years, as indicated in the last row of the first panel in Table 15, Victoria's *Metro* area (0.512) was a net contributor of house price spillovers, while *Fringe* (−0.009), *City* (−0.131), and *Rural* (−0.371) were net receivers of house price spillovers in Victoria.

By comparing static spillover effects for the two panels in Table 15, our results show there was a notable change in the direction of house-price spillover effects in Victoria during the pandemic. Over 2020–2021, *Metro* became a receiver of house price spillovers from *Rural* (1.048), *Fringe* (0.749) and *City* (0.666). *Fringe* was also a transmitter of house price changes to *Rural* (0.340) and *City* (0.291), and *Rural* was a transmitter of house price changes to *Fringe* (0.478) and *City* (0.399). These patterns are also displayed in panel d of Figure 8.

Examining the net effects for the pandemic in the last row of Table 15, *Metro* (−2.241) became a net strong receiver of house price spillovers, while *Fringe* (0.735), *City* (0.076) and *Rural* (1.431) became net contributors of house price spillovers. These dynamics have completely changed from the pre-pandemic period, which can be seen by comparing the last rows in the top and bottom panels of Table 15 labelled 'NET'. The interconnectivity between submarkets completely changes and reverses during the pandemic years for Victoria. This pattern can also be seen in panels c) and d) in Figure 8, and reflects the migration out of metropolitan cities and into outer areas seen during the pandemic.

4.3 Findings and policy development implications

- Understanding intrastate housing submarket connectivity has important implications for forecasting urban migration and planning metropolitan and regional investment. These research findings should be disseminated across policy and practice communities.
- Our results in this section highlight the prominent role that regional and rural areas play in supporting population growth—particularly in the largest states of NSW and VIC—providing a balance of accessibility to major metropolitan centres, reasonable lifestyle amenity, and more affordable housing options.
- The change in the direction of housing submarket influence from metropolitan cities to regional cities and fringe suburbs during the Covid-19 pandemic has implications for state-based policy regarding investment in growth and development in regional areas.
- These dynamics across housing submarkets impact labour markets and educational opportunities, along with demand for social services (including health and education), amenities, urban infrastructure (including affordable housingand transport), and culture and community engagement.
- If regional cities are attracting high-skill, high-income workers who can work flexibly and remotely, there are potential benefits of agglomeration, gentrification and knowledge and human capital externalities—as well as new investment and entrepreneurial opportunities for regions. However, there are also challenges in terms of availability of housing stock, access to services and infrastructure, and displacement of groups of residents—particularly those that are most vulnerable.
- Local and state governments need to understand and support the growth in regional cities, acting proactively rather than reactively.
- Our findings suggest that the varied effects of Covid-19 and the government responses to it across submarkets has impacted house-price spillover effects. The dynamics across VIC evolved differently to those of NSW. This provides an opportunity for governments to consider the impact of their policies and restrictions on regional house price dynamics and affordability.
- The findings in this section highlight the resurgence of regional cities in the pandemic period as desirable destinations for household relocation. We document the increased relevance of regionality as a result of the Covid-19 pandemic. This provides the context to extend discussions exploring how regional cities adapt to changes, and how their labour markets evolve, considering the dynamics across areas and submarkets.
- Our results provide evidence for the important role that regional cities play as satellite cities to the metropolitan cities and fringe suburbs. Investment in these cities has the potential to alleviate the negative externalities generated by high-density city living—including congestion, unaffordable housing, infectious diseases, and pollution—in a flexible working environment.
- An extension of greater coordination of housing and economic policy across different Australian jurisdictions is the potential for a more effective planned policy aimed at developing our next mid-sized cities. The current distribution of cities by size is imbalanced in Australia relative to other developed countries. There are five capital cities with populations over 1 million each, only two mid-sized cities within the population range of 500,000 to 1 million, and a long tail of many small cities. With a planned policy response focussed on the growth of small and mid-sized cities, a more balanced urban population distribution can be achieved.
- Lastly, recognising the interconnectedness of housing submarkets—and the change in direction and degree of this relationship post-pandemic—in developing policy is important for maintaining macroeconomic and financial stability.

5. Main drivers of housing spillovers

- Internal arrivals within the last five years increase the house price spillover index even after controlling for affordability, employment, and locational factors.
- A 1 per cent increase in the proportion of the population through migrant arrivals into an LGA will increase the house price spillover index by 3.12 per cent. This increases the probability that the LGA will generate house price spillovers to other housing markets.
- Internal departures within the last five years decrease the house price spillover index even after controlling for affordability, employment and locational factors.
- A 1 per cent increase in the proportion of the population departing from an LGA will decrease the house price spillover index by 3.70 per cent. This increases the probability that the LGA will be a receiver of house price spillovers from other markets.
- In other words, while internal arrivals are likely to contribute to house price spillover to other markets, internal departures will contribute to receiving house price spillovers from other markets.

5.1 Existing research on spillover determinants

After identifying the direction and magnitude of housing market spillovers in Section 4, we now explain the main determinants for house price spillovers across LGAs. The general expectation is that changes in one housing market would directly spillover to other housing markets through established direct channels, such as migration and capital movement.

However, housing market dynamics and cross-regional house price spillovers may have indirect channels. Local characteristics between regions and their distinctive housing market connectivity can explain changes that are not explained by fundamental factors such as migration and capital movement.

Some studies that measure housing market spillovers also try to explain their determinants. Various explanations for housing market interconnectivity and spillovers include factors such as:

- economic resemblance across regions (Case, Goetzmann et al. 2000);
- variability in global real interest rates when comparing across countries (Ahearne, Ammer et al. 2005; Otrok and Terrones 2005);
- extravagant price increase expectations (Shiller 2007);
- housing supply and household income (Jacobsen and Naug 2005);
- monetary policy (Pomogajko and Voigtlander 2012).

In their study of housing market spillovers across countries, Agyemang, Chowdhury et al. (2021), find trade, common language, and colonial history to be the main factors explaining cross-country housing spillovers, while migration didn't seem to play a significant role. Yang, Yu et al. (2018) explain the variability in house price spillover indices among Chinese regions by considering these factors: education, health amenities, community facilities, weather. Yang, Yu et al. also include environmental, demographic and economic factors. They find the significant factors determining house price spillovers are higher administrative status, population, GDP size and secondary education. Meen (1999) finds equity transfer, arbitrage and migration to be the main factors explaining regional housing market spillovers in the UK. In addition, Ling, Naranjo et al. (2014) show that sentiments[19] contribute to house price movements across regions.

In this section, we explore the main factors explaining house price spillovers across Australian LGAs and housing submarkets. Macroeconomic variables such as interest rates and monetary policy, which are expected to affect all markets in the same way, may not be relevant. We predict migration to be an important determinant of house price spillovers across Australian regions. Theoretically, dynamics in migration and population might influence the magnitude and direction of house price spillovers.

There is an argument around the relationship and direction of the causality between house prices and migration. On the one hand, as people move in or out, the available stock of housing and the housing preferences change, and house prices change accordingly. Migration, particularly internal migration, has an impact on local economies in Australian cities and regions; this impact includes increasing demand for housing in migration-receiving areas, which results in house price rises in those areas. Erol and Unal (2022) find that for every 1 per cent increase in new internal migrants to the population of an area, there is an associated increase of 0.52–0.71 per cent in house prices—particularly for the metropolitan cities of Sydney and Melbourne.

19 In finance, the term sentiment refers to the attitudes or mood of investors regarding financial markets.

On the other hand, while migration occurs because of employment opportunities and other reasons, it can be argued that relative house prices also encourage migration. This argument states that higher house prices in cities encourage migration to regions with lower and more affordable house prices, creating interconnectivity and house price spillovers over time. Jeanty, Patridge et al. (2010) show that neighbourhoods are likely to experience an increase in housing values if they gain population, and they are more likely to lose population if they experience an increase in housing values. The implication of the market equilibrium showed in Glaeser and Gottlieb (2008) suggests that assuming that individuals are indifferent to where they are located, residents of low-resource places receive low incomes but have low housing prices and other costs of living, so the lower housing costs should compensate for the lower salaries (holding human capital constant). The implication behind this logic is that there should not be a need for redistributing government support to places with lower resources as the cost of living in real terms should be equivalent. In this sense, government policy targeted at improving incomes in poorer or lower-resourced places will generate an equal and offsetting impact on housing prices, as found in Jeanty, Patridge et al. (2010). Under a spatial equilibrium, property owners will be the main beneficiaries of development policies aiding lower-resourced places. To some extent, this is what we observe in some regional markets, with regional cities experiencing high increases in house prices and rents, and low vacancy rates for the limited housing supply due to an unexpected migration influx.

We concentrate on the main established channel of people movement (migration) determining spillover effects, and don't consider capital movement. While the role of capital flows would be interesting to explore, it is much harder to measure and harder to access the data. For example, over the Covid-19 period, perhaps people moved but rented first before purchasing an asset. This would suggest the people-movement effect was relevant, but the capital movement effect wasn't yet playing a role. The opposite could also be the case: people purchasing (investment) property in other states, but not yet moving into those states. We are not able to disentangle these people and capital movement effects within our dataset and analysis.

Our approach in addressing the third research question suggests that migration patterns determine the house price interconnectivity across housing markets; we test this by regressing current house price spillovers against internal migrations in the past five years. In Section 6 we explore the potential reverse causality, and how the connectivity between house prices across housing markets can contribute to internal migration.

5.2 Method and findings: determining drivers of house price spillovers

We consider the existing evidence in the literature (Crommelin, Denham et al. 2022; Meen 1999) and propose a relationship between housing demand and population growth, as housing supply tends to be inelastic and sluggish. To address the third research question, *What are the main drivers of house price spillovers across regional submarkets?* we build the following empirical model to explain the house price spillover index:

$$Spillover\ index_{it} = \beta_0 + \beta_1 x_{it} + \beta_2 y_{it} + \beta_3 z_{it} + \varepsilon_{it} \quad \text{Eq(3)}$$

Where $Spillover\ index$ is the estimated net-house-price spillover index at a given period t and for a given LGA i (as per Section 3.2), x_{it}, y_{it}, z_{it} are explanatory variables respectively associated with:

- demographic factors—internal, interstate and international migration;
- housing-related factors—location and housing affordability;
- macroeconomic factors—average household income and unemployment rate.

$\beta_0,\ldots,\beta_3$ represent the intercepts and the regression coefficients associated with the respective explanatory variables and ε_{it} is a disturbance term.

We regress the logarithm of the house price spillover index[20] against a set of variables. Our main variables of interest are migration variables. We use the ABS Census internal arrivals, internal departures, interstate arrivals, interstate departures, and overseas arrivals in the past five years by LGAs, based on people's place of usual residence.[21] Our results appear to be stronger when considering internal migration, rather than interstate or international migration. This is supported by Erol and Unal (2022), who argue that as immigrants rarely buy a property right away and most of them first rent for several years, overseas migration might not be a significant driver for housing price growth in Australia. And as births and deaths may only add marginal housing supply to the market, they conclude that residents' relocation through internal migration would be a better indicator of where housing price growth is to be expected. Therefore, we have included the number of internal arrivals as a proportion of the total population for every LGA and internal departures as a proportion of the total population for every LGA as our main explanatory variables.[22] We also control for the total population in each LGA.

While migration flows and resettlement affect local house prices in the receiving areas and left-behind areas, house price movements can affect migration due to affordability constraints. This two-way causality generates endogeneity and simultaneity in an econometric specification. Regressing the net-house-price spillover (rather than house prices) against migration in the past five years (and other control variables) allows us to minimise the simultaneity problem that arises between migration and house prices.

Yang, Yu et al. (2018) argue that interconnectivity in housing markets can arise through different channels, including migration or relocation due to spatial housing price redistribution (Jones and Leishman 2006) and the interconnectivity of local factors that drive the local housing price (Miao, Ramchander et al. 2011), as well as macroeconomic factors such as employment and income fundamentals (Cotter, Gabriel et al. 2015).

Local economic factors such as employment and educational opportunities, industry development and concentration, and access to infrastructure and services play an important role in migration decisions (Sarkar, Moylan et al. 2021). Vij, Ardeshiri et al. (2022) find that mid-sized urban areas with high average incomes, low unemployment rates, and easy access to education, arts and recreation services, are more likely to attract and retain migrants, especially those that are young, university educated or international migrants. In general, they find that average incomes have a positive impact on a city's attractiveness to potential migrants, while unemployment rates, housing costs and other living costs have a negative impact.

We propose a set of additional control variables that may be relevant at the regional level, which could also be correlated with migration patterns. We control for housing affordability at the LGA level by including:

- the house price-to-income ratio—calculated by dividing the median house price by LGA into the average household income by LGA;
- the rent-to-income ratio—calculated as the median rent price by LGA over the average household income by LGA.

20 We apply the logarithm of the net-house-price spillover index plus one. As the net spillover index can be a positive or a negative value, when applying the logarithm to the variable, we would lose all of the negative values. As almost all negative values for the net spillover index are between −1 and 0, we added 1 to the series to obtain only positive values. We then apply the logarithm to the new series without losing important observations.

21 We have also tested in other versions of our model the ABS Census LGA internal arrivals, internal departures, interstate arrivals, interstate departures, and overseas arrivals in the last year, based on people's place of usual residence. Overseas departures are not captured in the census data.

22 We also tested our results with the number of interstate arrivals as a proportion of the total population and interstate departures as a proportion of the total population in every LGA, as well as the proportion of overseas arrivals in the LGA population, but the results were weaker for these variables.

We also control for the unemployment rate of the LGA,[23] as well as whether the LGA is part of the capital city or not.[24] This last 'capital' dummy allows us to segregate regional cities from metropolitan cities. We have tried some other control variables in our models,[25] but they appeared not to have a strong effect on our results.

One of the empirical issues we face is that most of the data for Australia at the LGA level is provided in the census data, which is only collected every five years, while our house price spillover index is calculated on a monthly basis based on advertised house price movements in the private market. To address this, we matched the data for each LGA collected on census days with the average yearly net-house-price spillover index for that month and year by LGA. We perform a basic pooled ordinary least squares (OLS) regression. We have 435 LGAs across Australia, and three points in time that are the census dates for data collection: 9 August 2011, 9 August 2016 and 10 August 2021. Overall, we have 1,305 observations. We could argue that the 2011 and 2016 Census data reflects the pre-pandemic period, while the 2021 Census data (collected in August 2021) reflects the pandemic period. We have run regressions for the whole dataset (including 2011, 2016 and 2021), and then separately for each year.

Figure B2 in Appendix B shows a summary of the distribution of the net-house-price spillover index by state for the three census periods. The figure suggests that the house price spillover index has been increasing for LGAs in most states over the three censuses considered (2011, 2016 and 2021), along with the house price appreciation reported in Section 2. The exceptions appear to be WA and VIC, where the house price spillovers have been decreasing. Figure B2 also highlights that the house price spillover index can be a positive (net contributor) or a negative value (net receiver), as discussed in Section 3 and Section 4.

Figures B3 and B4 provide, through visual inspection, a preliminary relationship between the house price spillover indices and net intrastate and interstate migration respectively. Figure B3 shows a potential positive relationship between the net spillover index and the net internal migration, particularly for 2016 and 2021. This suggests that higher net migration between LGAs increases house price spillovers across those LGAs. We explore this relationship more formally through the regression in Eq(3). Our first findings are presented in Table 16.

23 In other versions of our model, at the LGA level we considered the number of unemployed people, the number of people in the labour force, the five-year change in the unemployment rate, the average household income, the five-year change in average household income, the labour participation rate, and the five-year change in the labour participation rate.

24 In other versions of our estimated model, we considered the distance from the LGA centroid to the state's capital CBD centroid, the LGA area, the parkland area in the LGA, and the LGA parkland ratio. Locational factors, such as access to coastline or natural environments and resources, and distance to nearest metropolitan centres, also have an important impact. Cheung and Fernandez (2021) find households were willing to pay a premium for dwellings located adjacent to open spaces and beaches.

25 We also included in versions of our models the different indicators for the SEIFA scores, which include the index of relative socio-economic disadvantage, the index of socio-economic advantage and disadvantage, the index of economic resources, and the index of education and occupation.

Table 16: OLS results for net spillover index

	Dependent Variable: Log(Net Spillover Index +1)			
	All	**2011**	**2016**	**2021**
InternalArr(%)	0.988	0.008	0.272	3.120**
InternalDep(%)	−1.117*	1.308	−1.184	−3.702**
Population	0.005*	0.007	0.000	0.006
House price/income	0.004	0.013	0.020	0.002
Rent/income	0.002	0.002	0.000	−0.007
Unemployment rate	−0.756	−3.859	1.615	0.848
Capital city	−0.074	−0.149	−0.193*	0.093
State controls	Yes	Yes	Yes	Yes
Year controls	Yes	No	No	No
Adj R2	0.0211	0.0356	0.0478	0.1173
Observations	1,176	378	403	395

*Note: This table shows the pooled OLS regression results for the full sample, and for the subsamples for 2011, 2016 and 2021. *, **, *** denote significance at 10%, 5%, and 1%, respectively. Robust standard errors.*

Table 16 shows the results for the pooled OLS regression. The second column shows the estimated coefficients for the whole data sample (including 2011, 2016 and 2021 Census data), while columns 3, 4 and 5 show the estimated coefficients for the subsamples for the years 2011, 2016 and 2021 respectively. We clearly see in Table 16 (and later in Table 17) that house price spillovers are more strongly determined by internal migration for the 2021 data (pandemic period) relative to the previous census years.

Table 16 shows that while there is a positive (negative) relationship between the house price spillovers and the proportion of internal arrivals into (departures out of) an LGA in the last five years, the relationship shows little statistical significance when considering the whole sample period (in the second column), or the census years of 2011 (third column) and 2016 (fourth column). However, these relationships turn significant in the last column of Table 16 when considering the 2021 Census within the context of the Covid-19 pandemic. Results show that internal arrivals (departures) increase (decrease) the house price spillover index even after controlling for affordability, employment and locational factors. A 1 per cent increase in the proportion of the population through internal migration into an LGA will increase the house price spillover index by 3.12 per cent, increasing the probability that the LGA will generate house price spillovers to other markets. On the other hand, a 1 per cent increase in the proportion of departing population away from an LGA will decrease the net spillover index by 3.70 per cent, decreasing the connectivity across LGAs. The net internal migration (arrivals less departures) can potentially offset the effect on the house price spillover index. Therefore, while internal arrivals are likely to generate house price spillover to other markets, internal departures will decrease the interconnectivity across markets.

Table 16 also shows that LGAs within the capital cities had lower house price spillovers in 2016 at a statistically significant level. While not shown in Table 16, the estimates for spillover determinants appear to be statistically significantly different for VIC and WA (relative to NSW) in 2021, for TAS, SA and VIC in 2016, and for TAS in 2011.

We extend our specification a bit further by considering the geographical distance between LGAs, as places that are closer to each other are more likely to have higher interconnectivity across them and receive spillovers from each other. To more effectively model the interactions among LGAs, we extend the previous model in Eq(3) by including a geographical contiguity effect as follows:

$$Spillover\ index_{it} = \beta_0 + \beta_1 x_{it} + \alpha W y_1 + \beta_2 y_{it} + \beta_3 z_{it} + \varepsilon_{it} \quad \text{Eq(4)}$$

Where *W* is the contiguity matrix formed by *1*s when LGAs share a border and *0*s otherwise, acting basically as a geographical contiguity weight; y_1 is median house price at the LGA level; and α of the coefficient for the contiguity weighted relative median house price.

Table 17 shows the results for the net spillover regression when we control also for the average median house prices across all neighbouring/contiguous LGAs following Eq(4). Results are still consistent with those obtained in Table 16. While internal arrivals as a proportion of the population have a positive effect on net-house-price spillovers, these effects are only significant for 2021. Internal departures usually have a negative effect on house price spillovers, but now these effects are not only significant for 2021, but also for the whole sample. Affordability seems to explain some of the net-house-price spillovers in 2016, where higher house price-to-income ratios significantly increase the house price spillover index. Moreover, the average relative median house price across contiguous/neighbouring LGAs appears statistically significant in 2011—however, it doesn't seem economically significant. As above, the second set of results are statistically significantly different for VIC and WA (relative to NSW) in 2021, for TAS and VIC in 2016, and for TAS and the NT in 2011.

Table 17: OLS results for net spillover index with contiguity matrix

	Dependent Variable: Log(Net Spillover Index +1)			
	All	**2011**	**2016**	**2021**
InternalArr(%)	0.875	0.027	0.005	3.011**
InternalDep(%)	−1.270*	0.926	−1.067	−3.709**
Population	0.004	0.000	0.001	0.006
House price/income	0.004	0.003	0.041*	0.015
Rent/income	0.003	−0.001	0.001	−0.006
Contiguity av. house price	0.001	0.020**	−0.019	−0.010
Unemployment rate	−0.602	−3.538	1.758	1.003
Capital city	−0.069	−0.177	−0.159	0.114
State controls	Yes	Yes	Yes	Yes
Year controls	Yes	No	No	No
Adj R^2	0.0229	0.0412	0.0554	0.1196
Observations	1,160	373	397	390

*Note: This table shows the pooled OLS regression results for the full sample, and for the subsamples for 2011, 2016 and 2021. *, **, *** denote significance at 10%, 5%, and 1%, respectively. Robust standard errors.*

As anticipated, our results imply that house price spillovers across LGAs are mainly determined by internal migration dynamics within the last five years.

5.3 Policy implications

- The results presented in this section indicate that house price spillovers across LGAs are determined by internal migration dynamics within the last five years, especially for the pandemic period. In other words, internal migration dynamics across LGAs impact how much house price growth in a market can influence or be influenced by house price growth in other markets.
- This suggests that migration policy, as well as planning and regional development that affects migration, can affect house prices not only in the local area but also in other areas through house price spillover effects.
- The major implication of this result is that policy makers could use housing market data relating to sales price and price changes as indicators of population migration to inform more timely decisions relating to regional investment, internal migration incentives and policy.
- Census data and population data tend to be low frequency and slow release, limiting the scope for agile policy that can respond to increasingly fast-changing economic conditions. However, housing market data can be sourced in near real-time, improving the ability to respond to—and even predict—population movements.
- A related implication is the potential for greater policy effectiveness if more investment were made in capturing and analysing localised and frequent data. Future policy-setting has the potential to be dynamic and avoid contemporary issues relating to latency and lagged impact if it can be increasingly data-driven using real-time data.[26]

26 For example, opportunities may arise for exploring nowcasting techniques using house prices as a factor for modelling population movements and the impacts of other policy suggestions that this report points to, including monetary policy, urban investment and macroprudential regulation.

6. Housing spillover effects on regional markets

- Internal migration can explain house-price spillover effects.
- Our findings highlight the resurgence of regional cities in the past years and their current position of pressure and opportunity.
- The influx of people into regional cities has led to an intensification of housing affordability issues, with limited stock and very low vacancy rates in regional areas.
- Regional house price growth has an asymmetric effect on households with lower resources and tenancy status.
- Regional housing stress has the potential to create a migration ripple effect, where low-income and vulnerable households are forced to move out to less-expensive and lower-resourced areas.
- Migration influx can bring associated benefits of agglomeration, gentrification and knowledge and human capital externalities, as well as new investment and entrepreneurial opportunities to regions.
- We provide evidence to support policy exploring how regional cities adapt to changes in sustainable development paths.

6.1 Discussion

In this section, we discuss the potential house-price spillover effects on housing markets in regional areas, addressing research question 4:

- What is the effect on regional housing market price, affordability, housing supply, and population change from spillover effects over time?

We structure this discussion around our main findings:

- Regional cities and fringe suburbs have become more important players in house price dynamics across housing submarkets around Australia since the Covid-19 pandemic.
- The varied effects of Covid-19, and government responses to it in different states and territories, has impacted house price interconnectivity between housing markets.
- Internal migration is the main explanatory factor for the house-price spillover effects.

6.1.1 Regional cities and suburbs as main contributors of house price spillovers

We show that within each state and territory, the trend is a population movement from inner-city suburbs towards outer city areas and regional areas. Our results also highlight the prominent role that regional cities have played in population growth and house price dynamics, particularly during the pandemic years 2020–2021.

Traditionally, regional areas have played an important role in the provision of larger and less expensive housing. Regional cities and rural areas experienced strong house price appreciation during the pandemic years. Flexible and remote work, along with changing locational preferences, increased the feasibility of access to more affordable, further-away housing options. The influx of people into regional cities has led to an intensification of housing affordability issues, with limited stock and very low vacancy rates, in part due to the lack of social and affordable housing options in regional areas.

Regional house price growth has an asymmetric effect on households with fewer resources and lower tenancy status. Given the traditional attraction of regional areas as relatively affordable locations, these areas are also home to a high proportion of low-income and tenant households. While owner-occupiers and investors benefit from price appreciation, a substantial negative effect is disproportionately experienced by low-income households and renters in regional areas.

Migration influx can bring associated benefits of agglomeration, gentrification and knowledge and human capital externalities to regions, as well as new investment and entrepreneurial opportunities. However, there are also challenges in terms of housing stock availability, access to services and infrastructure, and displacement of groups of residents.

If the move to flexible and remote working is long-lasting, regional housing stress has the potential to create a migration ripple effect, where low-income and vulnerable households are forced to move out to less-expensive and lower-resourced/serviced areas. In addition, incoming populations may find it difficult to secure housing. This has social and employment consequences for regional areas. Costello (2007) argues that the potential effects of migration into regional cities include:

- increases in house prices;
- housing polarisation pushing low-income earners out of the housing market;
- suburbanisation of housing on the periphery of the town borders;
- changes in the local economy and streetscapes with the perception of a new rural class.

Costello (2007) argues that state and local governments need to attend to issues of housing polarisation on the local economy and infrastructure—particularly in the context of an ageing population.

There is an opportunity for government policy and both public and private investment to intervene through targeted strategies to address the housing-supply imbalance in these areas—particularly for affordable housing.

For example, NSW, especially Greater Sydney LGAs, are losing population to regional city LGAs in QLD and VIC. Moreover, NSW shows a general movement away from Greater Sydney into fringe suburbs and outer cities. NSW should consider taking steps towards investing in the growth of medium-sized and small-sized cities that provide the same opportunities and amenities as the growing regions in QLD and VIC, since it is likely that affordability pressures are driving people out of Greater Sydney into these regions.

Targeted policies that provide financial support for households experiencing housing stress in regional areas should be considered to minimise social disruption and maintain community cohesion, along with supports such as rental assistance and reform. Policy can also consider other factors that contribute to demand imbalances and erode community cohesion, such as the role of short-term holiday letting in regional areas—for example, Airbnb.

In addition, the state capitals of Brisbane and Melbourne are among the top population-gaining LGAs when receiving migrant populations from NSW. QLD has been the best performer in terms of the growth of medium-sized and small-sized cities.

Following our house-price spillover analysis, and after reviewing the existing literature on the relationship between house prices and migration, these areas are expected to experience house price growth as well as an increasing demand for services and residential amenities. Erol and Unal (2022) show that the internal mobility of the Australian population has local economic impact by pushing up the demand for housing in destination areas, which leads to an increase in house prices. Governments need to be ready to respond by supporting these increasing demands.

In particular, place-based approaches may need to account for potential spillover effects into other regions, and be based on an understanding of the interconnectivity between places.

Understanding the interaction between different housing submarkets across LGAs within states and territories is very important for effective policy implementation at state and local government levels—particularly around housing, infrastructure and zoning portfolios and social services—and for achieving coordination and avoiding unintended outcomes across towns and cities.

Our analysis has implications for demand-side policies that target home purchases in regional areas that can contribute to population migration, putting additional strain on property prices. For example, the Regional Home Buyer Guarantee is one current policy that could have adverse consequences in the post-pandemic context. The different state schemes for the first homeowner grant (FHOG) may also provide incentives for relocation, particularly for residents living near state borders (Brackertz, de Silva et al. 2015).

In the longer term, increases in appropriate and diversified housing supply is required across local government policies for new housing developments. Regional investment policy needs to ensure that additional pull factors to regions are balanced with sufficient and appropriate housing supply and services. At the moment, affordability pressures in the major cities are acting as push factors, pushing people into regional areas. If the planned policy response focusses on the development of small- and medium-sized cities, this would act as a pull factor, attracting people into regional areas, increasing their locational choices, and acting as economic triggers of growth overall. Thus, policy should focus on the strategic growth and development of regional and rural areas to support the trend of moving away from capital cities into the regional areas.

Population relocation decisions within and across states and territories contribute to the broader migration patterns that will shape regions, cities, states and territories in the future. Population growth and decline through migration impacts local residents and has significant social, economic and policy implications.

Our findings highlight the resurgence of regional cities in the past years (2020-2021) and their current position of pressure and opportunity. We document the increased relevance of regionality as a result of the Covid-19 crisis. This provides the context to further conversations about how regional cities adapt to changes and how their labour markets evolve, supporting existing research in Beer, Crommelin et al. (2022), Gurran, Forsyth et al. (2021) and Pill, Gurran et al. (2020).

Australia has a peculiar city-size distribution, with five capital cities beyond a population size of 1 million each, only one or two mid-sized cities within the population range of 500,000 to 1 million, and many small cities. With a planned policy response focussed on the growth of small and mid-sized cities, a more balanced urban population distribution can be achieved.

6.1.2 Government responses and house price spillovers

We find that the varied effects of Covid-19, and responses to it from different state and territory governments, impacted house-price spillover effects. As discussed earlier, the—for the moment, short-term—effects of the Covid-19 pandemic have particularly impacted on the labour markets and available housing stock of regional cities and towns, altering markets considerably and pushing some regional cities and towns into housing affordability stress.

Our results demonstrate that house prices are interconnected within and across states and territories. This means that localised housing market issues have the potential to impact the national housing market.

In particular, the house price variability in Victoria's housing markets during the pandemic had strong spillover effects over the housing markets of other states and territories. House price variability in Victoria during the pandemic resulted from the high infection rate, as well as from public and private developments and restrictions on movement to manage the pandemic. It is evident that these developments not only had an impact on the Victorian housing market, but also generated a house-price spillover effect on housing markets in all Australian states and territories, regardless of their experience during the pandemic.

Australia currently has a range of policies that promote home ownership, particularly for first home buyers, but these vary by jurisdiction and sometimes target demand towards specific regions. Current housing policies are complex and distort underlying house prices (Mason, Moran et al. 2020). They also should be aligned with other supporting policies relating to urban investment, gentrification, education and employment initiatives, infrastructure and amenities.

Government policies include protecting lower-income and rental households from affordability crises, supporting sustainable investment and development across submarkets, and managing financial stability in instances of extreme house price movements and 'bubbles' (Mason, Moran et al. 2020). These policies will have repercussions on communities, regional development, and people's everyday lives in cities and regions.

One implication of our research is the need for a review of current policy and practice that crosses state and territory borders and moves beyond housing-specific policy, and relates to the implementation of national economic policy (Gurran, Rowley et al. 2018; Maclennan, Long et al. 2021). While there is heterogeneity in house price growth across regions and states, our spillover analysis demonstrates the interconnectedness of housing markets.

If house prices in regions deviate from region-specific policies and government interventions due to spillovers, this needs to be considered in policy decisions. Localised approaches need to account for potential spillover effects into other states and regions and account for the interconnectivity between places. Future policy development could consider how to implement and regulate in ways that incorporate the nuances of different housing submarkets in order to minimise adverse spillover transmission throughout the national housing market.

Consequently, a key implication of our analysis is the need for policy coordination across regions and levels of government. This coordination needs to be applied to both demand-side and supply-side policies. An extension of greater coordination of housing and economic policy across different Australian jurisdictions is the potential for a planned policy for developing our next mid-sized cities. The current Australian distribution of cities by size is imbalanced relative to other developed countries. With a planned policy response focussed on the growth of small and mid-sized cities, a more balanced urban population distribution can be achieved.

6.1.3 Internal migration explains house price spillovers

House price movements reflect factors such as:

- housing supply;
- locational preferences based on requirements for education, labour or leisure;
- preferences for a certain climate and other amenities;
- commuting patterns—for example, distance between fringe towns to metropolitan areas.

Housing affordability in major Australia cities is an ongoing concern for the community and policy makers—and affordability is a problem in regional and rural cities since the pandemic.

The results presented in Section 5 indicate that net-house-price spillovers across LGAs are mainly determined by internal migration dynamics within the last five years. In other words, internal migration dynamics across LGAs impact how much house price changes in a market influence (or are influenced by) house price changes in other markets. This suggests that migration policy, as well as planning and regional development, can affect house prices not only in the local area but also in other areas through spillover effects. Policy makers need to understand that housing submarket connectivity has important implications for forecasting urban migration and planning regional investment.

We here test the reverse causality—whether net internal migration can be determined by house price spillovers. We regress the following empirical model to explain the internal migration:

$$Internal\ migration_{it} = \alpha_0 + \alpha_1 Spillover_{it} + \alpha_2 v_{it} + \varepsilon_{it} \qquad \text{Eq(5)}$$

Where $Internal\ migration$ is the ABS Census net internal arrivals (arrivals minus departures) in each LGA within the past year, based on people's place of usual residence.[27] $Spillover\ index$ is the average yearly net-house-price spillover index for the census month and year (as per Section 5.2), while $\mathbf{v}_{it}$ are other explanatory variables, in this case reflecting locational factors such as state dummy controls, a capital city dummy when the LGA belongs to the capital city. α_0,..., α_2 represent the intercepts and the regression coefficients associated with the respective explanatory variables and ε_{it} is disturbance term.

27 In other versions of our model we also tested the ABS Census LGA internal arrivals, internal departures, interstate arrivals, interstate departures, and overseas arrivals in the last year, based on people's place of usual residence. Overseas departures are not captured in the census data.

Table 18: OLS results for net spillover index as explanatory variable

	Dependent variable: net internal migration: 1Yr (%)			
	All	**2011**	**2016**	**2021**
Net-house-price spillover	0.00071	−0.00065	0.00100	0.00276**
Capital	0.00010	−0.00063	0.0041*	−0.0033
State controls	yes	yes	yes	yes
Year controls	yes	no	no	No
Adj R^2	0.0137	0.0116	0.0427	0.0361
Observations	1,305	435	435	435

Source: Author

*Note: This table shows the pooled OLS regression results for the full sample, and for the subsamples for 2011, 2016 and 2021. *, **, *** denote significance at 10%, 5%, and 1%, respectively. Robust standard errors.*

Table 18 shows that, while not a major explanator, average yearly net-house-price spillovers contributed to internal migration (measured as a proportion of the population in the past year) during 2021. The last column in Table 18 shows that higher house price spillovers can explain an increase (0.00276**) in net internal migration for the 2021 Census data.

A major implication is that policy makers can use housing market data relating to sales price (as well as number of sales, rent prices, vacancy rates, etc.) and changes in house prices as indicators of population migration. These indicators can be used to inform more timely decisions relating to regional investment, internal migration incentives and policy, and macroeconomic setting. Census data and population data tend to be low frequency and slow release, limiting the scope for agile policy that can respond to increasingly fast-changing economic conditions. However, housing market data can be sourced in near real-time, improving the ability to respond to and even predict population movements.

There is potential for greater policy effectiveness if more investments were made in capturing and analysing data. Future policy-setting has the potential to be dynamic and avoid latency and lagged impact if it can be increasingly data-driven using real-time data. For example, opportunities may arise to explore nowcasting techniques using house prices as a factor for modelling population movements and the impacts of other policy suggestions, such as monetary policy, urban investment and macroprudential regulation.

Moreover, the dissemination of these research findings across policy and practice communities can support evidenced-based decision-making.

7. Summary and policy suggestions

7.1 Key questions and answers

In the context of the AHURI Inquiry on 'Projecting Australia's urban and regional futures: population dynamics, regional mobility, and planning responses', this project analysed how housing prices in Australian submarkets affect and are affected by one another, and how migration interacts with these housing dynamics. We define house price `spillover effect' as the dynamic where changes in housing prices in one market spread to other housing markets. This housing spillover could be a result of migration patterns. While housing affordability issues in some cities may push households out towards more affordable regions, the resulting population inflows to regional areas can increase house prices, leading to housing stress.

Our overarching research question asks: What are the housing market spillover effects of urban and regional population change in Australia? To answer this, our project addresses these research questions:

1. How has connectivity between housing submarkets in Australia changed over time?
2. How did the Covid-19 pandemic affect housing connectivity in Australia, both within states and across states, and how does this compare to longer-term trends?
3. What are the main drivers of house price spillovers across regional submarkets?
4. What is the effect on regional housing market price, affordability, housing supply, and population change from spillover effects over time?

7.1.1 Housing submarket interconnectivity in Australia and its changes over time

We first examined the population movement dynamics for Australia. We found that the trend away from the metropolitan cities into fringe areas and regional cities is evident in a comparison of the past three censuses. This particularly applies to NSW and VIC and, to a lesser extent, QLD.

In NSW there is a clear geographic pattern in population movements. The LGAs recording the highest population losses are mainly in Greater Sydney, and those recording the highest population gains are regional areas to the north, west and south of Sydney. However, some LGAs within Greater Sydney, such as Blacktown and The Hills Shire, continue to show population gains.

In Victoria, the biggest population losses were recorded by LGAs within the Greater Melbourne area. The biggest population gains were recorded by fringe LGAs within the Greater Melbourne area, as well as regional cities Geelong, Ballarat and Bendigo. Across the states, NSW is losing population to QLD and VIC.

This population movement trend has paralleled a cycle of house price rises. Across Australian states and territories, house prices have been growing since the 2000s—particularly for NSW, VIC, TAS, SA and the ACT. Queensland, WA and the NT showed some periods of slowdown and negative growth related to localised, industry-related shocks. Most states and territories experienced a slowdown in house price appreciation in 2018, which then reverted and accelerated in the second half of 2020 during the Covid-19 pandemic.

Following our submarket definition for NSW, regional *City* and *Rural* had experienced sustained growth before the pandemic, while *Metro* and *Fringe* saw house price drops from 2018. We then saw consistent growth in house prices in late 2020 during the pandemic for all NSW submarkets. For Victoria, *Fringe*, regional *City* and *Rural* housing markets experienced sustained growth in house prices before the pandemic, and *Metro* experienced some house price drops from late 2018. With the Covid-19 pandemic, all submarkets in Victoria saw strong house price growth from late 2020.

With these developments in house prices and population movements in the background, we explored the interconnection between housing submarkets, making a clear-cut distinction between a pre-pandemic period and a pandemic period.

Interconnection and comparison: Sydney

In the pre-pandemic period (2009–2019) NSW *Metro* and *Fringe* were net contributors of house-price spillover effects, while regional *City* and *Rural* were net receivers of house-price spillover effects. During the pandemic (2020–2021), house price changes in NSW *Fringe* and regional *City* generated strong spillover effects to the other NSW submarkets. The net spillover effects for the pandemic years indicated that regional *City* and *Fringe* were net contributors of house-price spillover effects in NSW submarkets, while *Metro* and *Rural* are net receivers of house price spillovers.

Interconnection and comparison: Melbourne

The results for Victoria are remarkable. In the pre-pandemic years 2009–2019, *Metro* was a net contributor of house price spillovers, while *Fringe*, regional *City*, and *Rural* were net receivers of house price spillovers from *Metro*. But there was a notable change in the direction of house-price spillover effects in VIC during the pandemic. For 2020–2021, *Metro* became a net strong receiver of house price spillovers, while *Fringe, City* and *Rural* became net contributors of house price spillovers. This suggests that the direction of the interconnectivity between submarkets completely reversed during the pandemic years.

This pattern in house price dynamics across submarkets in NSW and VIC clearly changed during the pandemic years relative to the pre-pandemic period. Results highlight the recent prominent role of Fringe areas and regional Cities in house price dynamics across housing submarkets, which is reflected in house price movements and population movements.

7.1.2 The effect of Covid-19 on housing submarket connectivity

The Covid-19 pandemic and associated restrictions impacted on the direction and magnitude of house price spillovers across all Australian LGAs. Overall, house price spillovers became stronger during the pandemic.

Across submarkets within states, we found that *Fringe* areas and regional *Cities* contributed to around 50 to 70 per cent of house price dynamics in other submarkets during the pandemic. This compares with *Metro* and *Fringe* being the main contributors to house price dynamics to other markets before the pandemic. The direction of the interconnectivity between submarkets completely reversed during the pandemic years 2020–2021 for VIC. Victoria was the most affected Australian state during the pandemic. In the decade before the pandemic, *Metro* contributed to 51 per cent of house price variability to other submarkets in the state; *Fringe* contributed to 74 per cent of the variability in the other submarkets, along regional *City* and *Rural*. For 2020–2021, Metro became a receiver of house price spillovers, while *Fringe, City* and *Rural* become net contributors of house price spillovers.

The dynamics across states changed considerably during the pandemic years, strongly reflecting the different ways Covid-19 impacted state and territories and the resulting government responses. QLD, NSW, TAS and the NT were net contributors of house price spillovers during the pre-pandemic years, while the ACT, WA, VIC, and SA were net receivers of house price spillovers.

During the pandemic period, VIC became a strong contributor of house price changes in all other states and territories. NSW and Tasmania were also influencers of house price movements in other states, but to a lesser degree than Victoria. While VIC was a contributor to house price spillovers, QLD, the NT, the ACT, WA and SA received house price spillovers despite their different individual state or territory experiences during the pandemic.

7.1.3 Exploring the main drivers of house price spillovers across regional submarkets

We find that net internal arrivals within the last five years increased the net spillover index. In other words:

- internal arrivals increase house price spillovers across submarkets;
- internal departures decrease house price spillovers.

These results are statistically significant even after controlling for a set of variables related to housing affordability, employment and locational factors.

More specifically, we find that a 1 per cent increase in the proportion of the population through internal migration into an LGA will increase the net spillover index by 3.12 per cent—which increases the probability that the LGA will generate house price spillovers to other markets. Conversely, a 1 per cent increase in the proportion of the population departing from an LGA will decrease the net spillover index by 3.70 per cent, decreasing the strength of interconnectivity across housing markets.

Our findings suggest that while internal arrivals are likely to contribute to house price spillovers to other markets, internal departures will become receivers of other markets' house price spillovers.

Thus, we confirm the effect internal migration has on house price dynamics, as evidenced in Kohler and van der Merwe (2015). Kohler and van der Merwe found that, during the 1980s and 1990s, housing prices grew broadly in line with general price inflation and the increase in the debt-to-income ratio of Australian households; but since the mid-2000s, strong population growth played an increasing role in explaining Australian housing price growth. Our results show that migration has a strong effect in explaining house price interconnectivity across housing markets.

At the LGA level, our results do not appear strong for interstate arrivals or departures, or for overseas arrivals. But as regards intrastate arrivals, our findings are in line with Jeanty, Patridge et al. (2010), and Erol and Unal (2022). Jeanty, Patridge et al. find that gains in neighbourhood population are likely to increase housing costs. Erol and Unal (2022) find that for every 1 per cent increase in new internal migrants to the population of an area, there is an increase in house prices of between 0.52 and 0.71 per cent.

However, we go beyond these findings to say that internal arrivals increase the house-price spillover effect to other housing submarkets. This has important implications for coordination across councils and different government levels when implementing planning, infrastructure, housing, or other regional development projects.

7.1.4 Spillover effect on regional housing market price, affordability, housing supply and population change

Regional areas have traditionally played an important role in the provision of larger and less expensive housing. Regional cities and rural areas experienced strong house price rises during the pandemic. Flexible and remote work, along with changing locational preferences, made access to more affordable further-away housing options more feasible. The influx of people into regional cities led to an intensification of housing affordability issues in many regional cities, with limited stock and very low vacancy rates, in part due to the lack of social and affordable housing options in regional areas.

Our spillover analysis suggests that areas receiving internal migration can expect to experience house price growth, as well as increased demand for services and residential amenities. These dynamics across housing submarkets impact labour markets and educational opportunities, and demand for services (including health), amenities, infrastructure and transport, and culture and community engagement. Migration influx can bring associated benefits of agglomeration, gentrification and knowledge and human capital externalities, as well as new investment and entrepreneurial opportunities to regions. However, there are also challenges in terms of housing stock availability, access to services and infrastructure, and displacing groups of residents.

If the shift to flexible and remote working continues, regional housing stress has the potential to create a migration ripple effect, where low-income and vulnerable households are forced to move out to less-expensive, lesser-resourced/serviced areas. In addition, incoming populations may find it difficult to secure housing. This has social and employment consequences for regional areas.

Regional house price growth has an asymmetric effect on households with fewer resources and tenancy status. Regional areas traditionally attract population because of the relatively affordable cost of living (including housing); these areas are also home to a high proportion of low-income and tenant households. While owner-occupiers and investors benefit from price appreciation, a substantial negative effect is disproportionately experienced by low-income households and renters in regional areas.

Population relocation decisions within states and across states contribute to the broader migration patterns that will shape regions, cities, states and territories in the future. Population growth and decline through internal migration impacts local residents, and has significant social, economic and policy implications.

7.2 Policy suggestions

Our findings highlight the resurgence of regional cities in the past years (2020 onwards) and their current pressures and opportunities. We documented the increased relevance of regionality as a result of the Covid-19 crisis. This provides the context to further conversations exploring how regional cities adapt sustainably to changes, and how their labour markets evolve.

Understanding intrastate and interstate housing submarket interconnectedness has important implications for forecasting urban migration and for planning metropolitan and regional policy and investment.

Regional cities and fringe areas have been receiving internal migration. Regional cities need to be ready with supply responses to accommodate potential increased demand. An understanding of housing submarkets interconnectedness will enable state and local governments to predict and prepare for shifts in housing demand through land use planning and infrastructure strategies. Service providers also need to be aware of housing prices and migration dynamics, with potential gentrification effects and displacement to less resourced areas. Understanding potential spatial movements in response to changing patterns of housing dynamics will also enable service providers to prepare the necessary resources to service a larger population and provide social infrastructure such as schools, hospitals, and other social services.

In addition, it may provide direction towards additional investment in social and affordable housing and emergency accommodation. House prices in these places have been growing very fast and they are leading house price movements and generating house price spillovers. Lower income renters in regional areas and city fringes are likely to be displaced if these areas receive an increase in housing demand pushing housing prices further in those areas.

There is an opportunity for government policy, and both public and private investment, to intervene through targeted strategies to address the housing supply imbalance in regional and rural areas—particularly for affordable housing.

Targeted policies that provide financial support for households experiencing housing stress in regional areas and other supports, including rental assistance and reform, could be considered to minimise social disruption and maintain community cohesion in regions with population influx and rapid house price appreciation. These are especially relevant in the context of unusually high movements of people to regions, as experienced throughout the pandemic, and may be relevant to other situations—for example, mining booms. Policy considerations can also examine other factors that contribute to demand imbalances, such as the rising presence of short-term holiday letting in regional areas.

Understanding the interaction among different housing submarkets across LGAs within states and territories is crucial for effective policy implementation. This is especially true for coordinating policies at state and council levels and avoiding unintended outcomes related to housing, infrastructure and zoning portfolios. Place-based approaches should consider potential spillover effects into other (potentially neighbouring) regions, and recognise the interconnectivity between places.

There is a need for coordination across councils and different government levels when implementing housing policy. This coordination needs to be applied to both demand-side and supply-side policies. Current housing policies across the three levels of government should be aligned with other supporting policies relating to urban investment, gentrification, education and employment initiatives, infrastructure, and amenity. An implication of our research is the need for a review of current policy and practice that crosses state borders and moves beyond housing-specific policy.

In the longer term, local governments need to consider the effects that policies for new housing developments can have across submarkets before they increase housing supply. This is relevant where there has been a shift in the pattern of regional migration, with regional areas keeping their residents and becoming desirable places to live now that they are facilitated by the rise of remote/flexible working and lifestyle amenities. Policy should focus on the strategic growth and development of regional and rural areas—including the education and employment opportunities across a range of economic sectors—to support the trend of moving away from capital cities into the regional areas. Regional investment policy needs to ensure that additional pull factors to regions are balanced with sufficient and appropriate housing supply and services. At the moment, affordability pressures in the major cities are acting as push factors, pushing people into regional areas. If the planned policy response focusses on the development of small and medium-sized cities, this would act as an additional pull factor, attracting people into the regional areas, increasing their locational choices, and trigger economic growth.

The current distribution of cities by size is imbalanced in Australia relative to other developed countries. Greater coordination of housing and economic policy across different jurisdictions in Australia would enable a planned policy to develop our next mid-sized cities. This would lead to a more balanced urban population distribution.

Another implication of our results is that policy makers use housing market data relating to sales price and price changes as indicators of population migration. This would inform more timely decisions relating to regional investment, internal migration incentives and policy, and macroeconomic setting.

If more investment were made in capturing and analysing localised data, future policies could become more effective. If future policy-setting becomes increasingly data-driven using real-time data, it has the potential to be dynamic and avoid contemporary issues relating to latency and lagged impact.

7.3 Limitations

Data access at the regional level is an important limitation for regional research and regional policy-making. One issue we faced in this research was a lack of regularly published high-frequency data at the LGA level. Most high quality data at the LGA level (or other geographically disaggregated level) for Australia is provided in the census data, which is collected every five years, at one point in time.

The spillover index that we apply in this research is based on house price data that is available on a monthly basis based on advertised house price movements in the private market with a three- to four-month lag in the release. Ideally, to study the main determinants of the monthly house price spillover indices, we would need:

- monthly data on migration—internal arrivals and departures, interstate arrivals and departures, overseas arrivals and departures;
- monthly data on population count;
- monthly data on local economic factors—unemployment rate, participation rate, level of employment, average household income;
- monthly indicators for socio-economic disadvantage (such as SEIFA), government expenditure on education, government expenditure on health, etc.

It is hard to obtain this monthly data at the LGA level, as it would require engaging individually with the local governments and checking the frequency with which the data is provided.

We had to compromise our analysis and match the data for each LGA collected on the three past census dates, with the average yearly net spillover index for the month and year of the census and the respective LGA. We believe our regression analysis results would have been stronger, and some other effects could be observed, if we had higher frequency data at a geographical disaggregated level.

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Appendix A: Tables

Table A1: LGAs by submarket categories for NSW

Metro

Blacktown
Botany Bay
Burwood
Canada Bay
Canterbury-Bankstown
Cumberland
Fairfield
Georges River
Hunters Hill
Inner West
Ku-ring-gai
Lane Cove
Liverpool
Mosman
North Sydney
Northern Beaches
Parramatta
Randwick
Rockdale
Ryde
Strathfield
Sutherland Shire
Sydney
Waverley
Willoughby
Woollahra

Fringe

Blue Mountains
Camden
Campbelltown
Central Coast
Hawkesbury
Hornsby
Penrith
The Hills Shire
Wollondilly

City

Albury
Armidale Regional
Ballina
Bathurst Regional
Bega Valley
Broken Hill
Byron
Cessnock
Clarence Valley
Coffs Harbour
Eurobodalla
Goulburn Mulwaree
Griffith
Kempsey
Kiama
Lake Macquarie
Lismore
Lithgow
Maitland
Mid-Coast
Mid-Western Regional
Newcastle
Orange
Port Macquarie-Hastings
Port Stephens
Queanbeyan-Palerang Regional
Richmond Valley
Shellharbour
Shoalhaven
Singleton
Snowy Monaro Regional
Tamworth Regional
Tweed
Wagga Wagga
Western Plains Regional
Wingecarribee
Wollongong

Rural

Balranald
Bellingen
Berrigan
Bland
Blayney
Bogan
Bourke
Brewarrina
Cabonne
Carrathool
Central Darling
Cobar
Coolamon
Coonamble
Cowra
Dungog
Edward River
Federation
Forbes
Gilgandra
Glen Innes Severn
Greater Hume Shire
Gundagai
Gunnedah
Gwydir
Hay
Hilltops
Inverell
Junee
Kyogle
Lachlan
Leeton
Liverpool Plains
Lockhart
Moree Plains
Murray River
Murrumbidgee
Muswellbrook
Nambucca
Narrabri
Narrandera
Narromine
Oberon
Parkes
Snowy Valleys
Temora
Tenterfield
Upper Hunter Shire
Upper Lachlan Shire
Uralla
Walcha
Walgett
Warren
Warrumbungle Shire
Weddin
Wentworth
Yass Valley

Source: Author

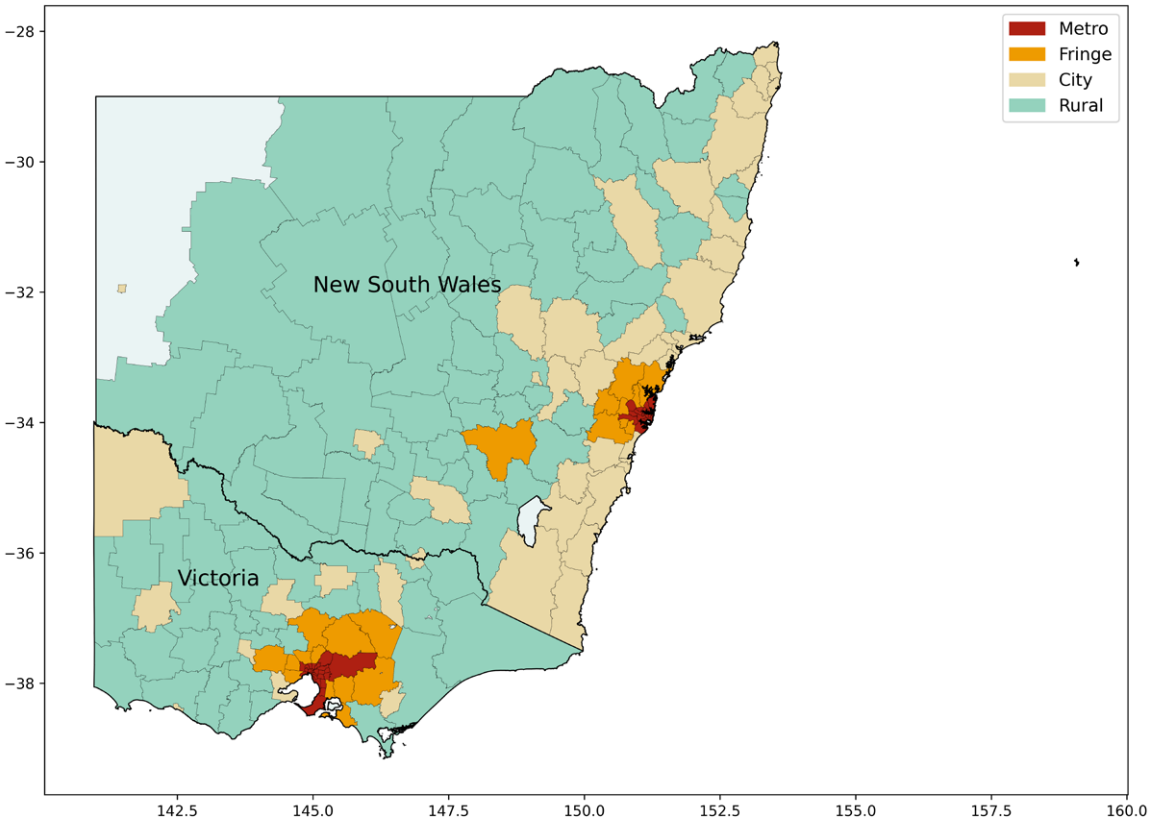
Table A2: LGAs by submarket categories for VIC

Metro	Fringe	City	Rural	
Banyule	Bass Coast	Ballarat	Alpine	Surf Coast
Bayside	Baw Baw	Greater Bendigo	Ararat	Swan Hill
Boroondara	Cardinia	Greater Geelong	Benalla	Towong
Brimbank	Casey	Greater Shepparton	Buloke	Wellington
Darebin	Hume	Horsham	Campaspe	West Wimmera
Frankston	Mansfield	Latrobe	Central Goldfields	Yarriambiack
Glen Eira	Melton	Mildura	Colac-Otway	
Greater Dandenong	Mitchell	Wangaratta	Corangamite	
Hobsons Bay	Moorabool	Warrnambool	East Gippsland	
Kingston	Murrindindi	Wodonga	Gannawarra	
Knox	Whittlesea		Glenelg	
Manningham	Wyndham		Golden Plains	
Maribyrnong			Hepburn	
Maroondah			Hindmarsh	
Melbourne			Indigo	
Monash			Loddon	
Moonee Valley			Macedon Ranges	
Moreland			Moira	
Mornington Peninsula			Mount Alexander	
Nillumbik			Moyne	
Port Phillip			Northern Grampians	
Stonnington			Pyrenees	
Whitehorse			Queenscliffe	
Yarra			South Gippsland	
Yarra Ranges			Southern Grampians	
			Strathbogie	

Source: Author

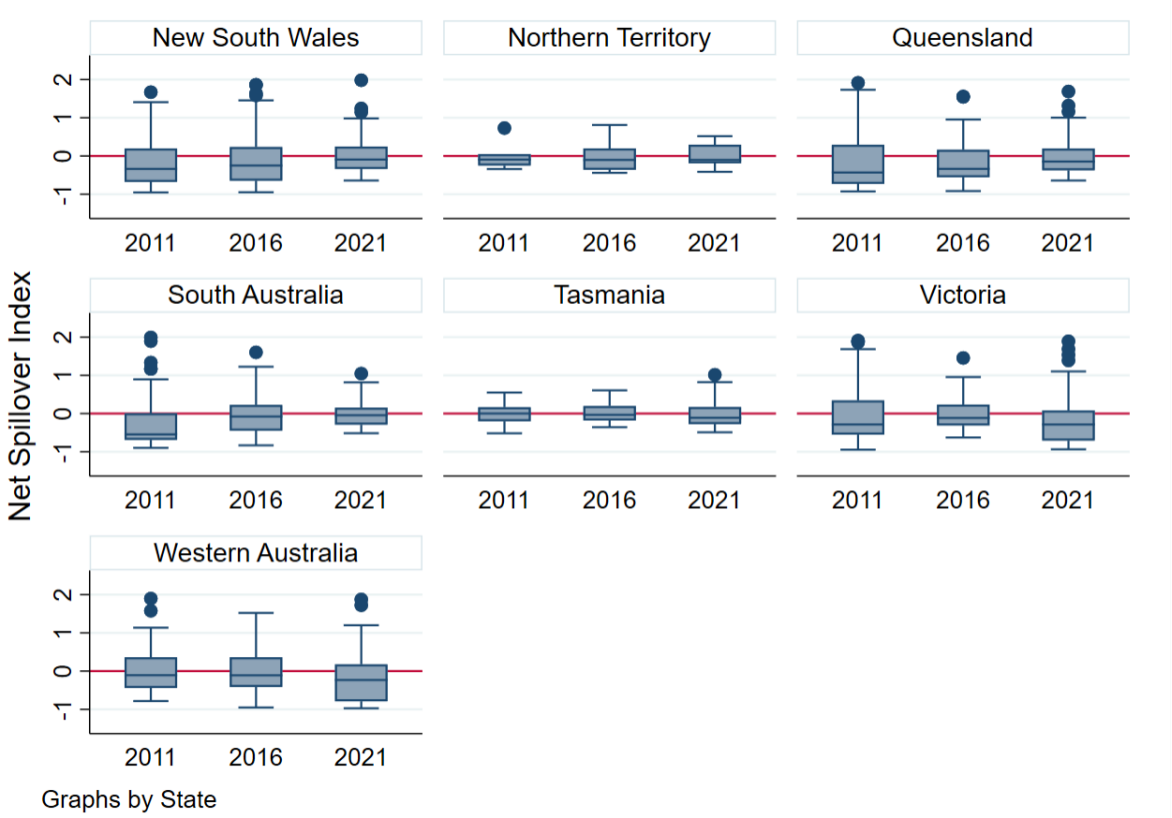
Appendix B: Figures

Figure B1: Map for submarket delineations for New South Wales and Victoria



Source: Author

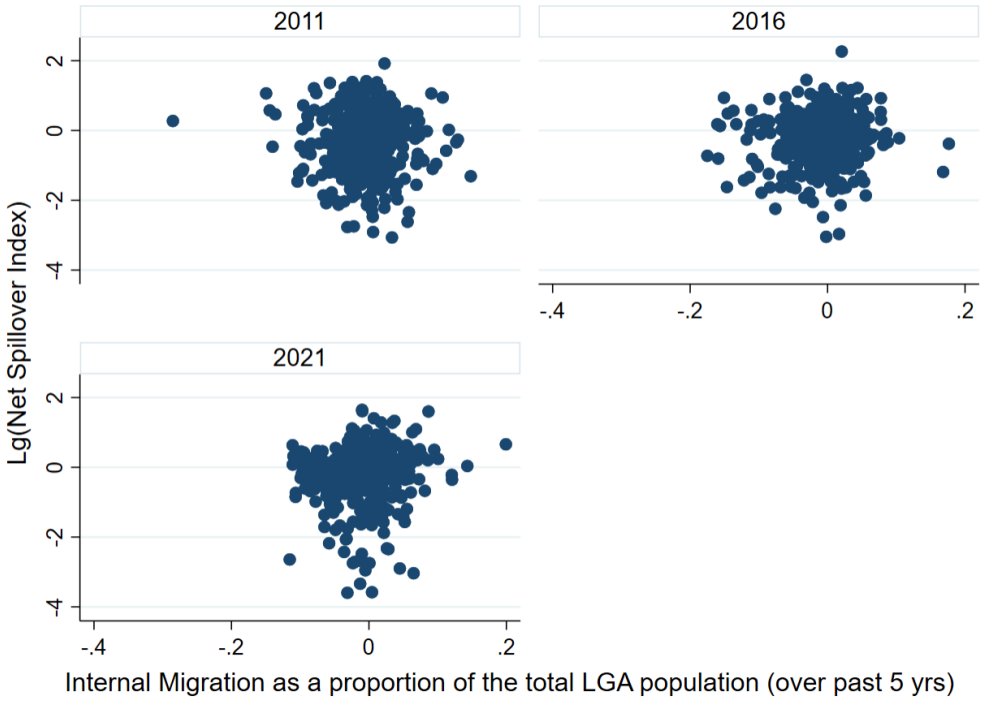
Figure B2: Box and whisker plots for net-house-price spillover index across Australian states and territories



Source: Author

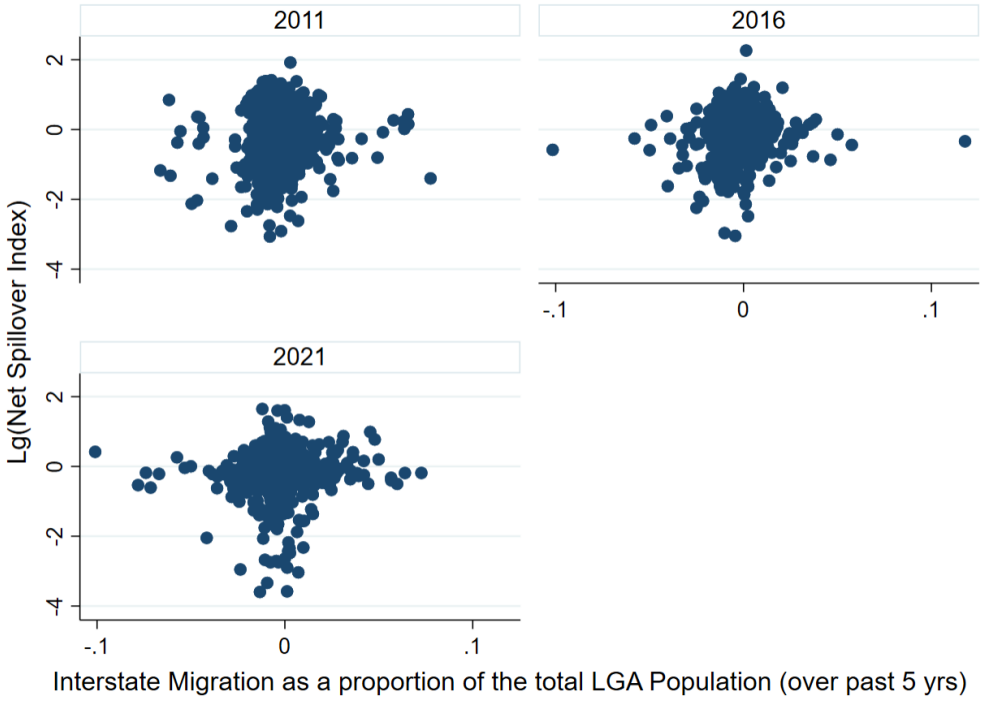
Notes: Figure B2 shows box and whisker plots for the annual average house price spillover indices for each of the census dates for Australian states and territories. The box and whisker plots show the distribution of the house price spillover indices for 2011, 2016 and 2021. Each plot depicts the first quartile (25th percentile), the median (50th percentile) and the third quartile (75th percentile) for the distribution of house price spillovers for the years 2011, 2016 and 2021. These summary statistics are represented by the boxes (with the bottom of the box representing the first quartile and the top of the box representing the third quartile) and the line inside the box representing the median. Each plot also shows minimum and maximum values of the spillover indices (the lines extending from the box, known as `whiskers'). The red horizontal line indicates the zero value, to differentiate positive spillover effects (contributors of house price spillovers) from negative spillover effects (receivers of house prices spillovers).

Figure B3: Scattergram for net-house-price spillover index and intrastate migration



Source: Author

Figure B4: Scattergram for net-house-price spillover index and interstate migration



Source: Author

Appendix C: Methodology

We used a framework proposed by Diebold and Yilmaz (2012) to measure spillover effects in the housing markets. This approach is widely used in finance and provides an intuitive way to quantify spillovers across different assets (Diebold and Yilmaz 2012; Wang, Xieet al. 2016). The spillover measure follows directly from the variance decomposition in a generalised vector autoregressive (VAR) model. It is constructed as follows. Consider a VAR(p) with *n* variables for a covariance stationary process, as in Eq(1)

$$y_t = \sum_{i=1}^{p} \Phi_i \, y_{t-i} + \varepsilon_t \qquad \text{Eq(1)}$$

where $y_t = (y_{1,t}, y_{2,t}, ..., y_{n,t})$ is a *n*-dimensional random vector of observation, ε_t is a vector of residuals, Φ_i ($i = 1, 2, ..., p$) is a parameter matrix, and *p* is the lag order of VAR. In this case, y_t represents house price growth, explained by house price growth in previous years, y_{t-1}, and an error term.

We denote $\theta_{ij}^{g}(H)$ as the H-step-ahead generalised variance decomposition matrix from the VAR in Eq(1). This helps us identify the contribution of shocks to variable *j* to the H-step-ahead generalised forecast error variance of entity *i*, $\theta_{ij}^{g}(H)$, which are derived as follows:

$$\theta_{ij}^{g}(H) = \frac{\sigma_{jj}^{-1} \sum_{h=0}^{H-1} \left(e'_i \Psi_h \sum_{\varepsilon} e_j\right)^2}{\sum_{h=0}^{H-1} \left(e'_i \Psi_h \sum_{\varepsilon} \Psi'_h e_j\right)} \quad H = 1, 2, \ldots \qquad \text{Eq(a)}$$

where σ_{jj} is the standard deviation of the error term for the j^{th} equation and e_j is the selection vector, with 1 as the i^{th} element and 0 otherwise, Σ_{ε} is the variance covariance matrix for the shock vector ε_t. The coefficient matrices Ψ_i are the moving average from the forecast at time *t* and they obey the recursion $\Psi_i = \phi_1 \Psi_{(i-1)} + \phi_2 \Psi_{(i-2)} + \ldots + \phi_L \Psi_{(i-L)}$ with Ψ_0 an $n \times n$ identity matrix and $\Psi_i = 0$ for $i<0$.

Each entry of the generalised variance decomposition is normalised for comparison purposes by the row sum as:

$$w_{ij} = \frac{\theta_{ij}^{g}(H)}{\sum_{j=1}^{n} \theta_{ij}^{g}(H)} \qquad \text{Eq(b)}$$

Where, by construction, $\sum_{j=1}^{n} \omega_{ij} = 1$ and $\sum_{j,j=1}^{n} \omega_{ij} = n$. ω_{ij}. ω_{ij} represents the contributions of spillovers from volatility shocks, which are normalised by the total forecast error variance.

We can define the spillover index, a measure of the contribution of spillovers from house price volatility shocks across the variables in the system to the total forecast error variance as:

$$S(H) = \frac{\sum_{i,j=1,i\neq j}^{n} w_{ij}(H)}{n} \times 100 \qquad \text{Eq(c)}$$

The house price spillover index has two indicators: 'contribution to others' $(S_{i\rightarrow others}(H))$ and 'contribution from others' $(S_{i\leftarrow others}(H))$. The spillover is derived using the variance decomposition of the house price growth. The magnitude of the static spillover, which can be between zero and one, reflects 'the overall strength' of spillovers over different regions and submarkets. A higher value for the spillover index points to more active spillovers among regions. Diebold and Yilmaz (2012) highlight that spillovers can be used to estimate the level of systemic risk on the basis that the magnitude of spillovers can detect the extent of the correlation among regions.

Net total spillovers are obtained by taking the difference between 'contribution to others' and 'contribution from others':

$$S_i(H) = S_{i\rightarrow others}(H) - S_{i\leftarrow others}(H) \qquad \text{Eq(2)}$$

This net spillover index tells us how much each submarket contributes to the dynamics in other submarkets. The positive (negative) net spillover indices indicate that a given submarket *i* has a net contribution of price changes to (from) other submarkets.

In other words, a positive spillover index indicates that house price changes in one market generate spillover effects on other housing submarkets and influence the house prices in that other submarket. A negative spillover index indicates that a housing submarket is a recipient of house price spillovers from other housing submarkets. That is, house prices in that submarket are influenced by house price movements in other submarkets.

The advantage of using this methodological approach to measure the influence between housing submarkets is that it shows the source, direction and strength of the house price effect from one LGA to another. This methodology provides a comprehensive view of the relationships and interactions between regional and urban housing markets.

Following the methodological approach described above, we estimated the spillover index for all states and territories and LGAs within states and territories across Australia for the period 2009–2019 as the pre-pandemic period, and for the period 2020–2021 as the pandemic period for comparison purposes.

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