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# Entry affordability of employment types: Evidence along the theory of full-time and part-time wage differentials

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#### ABSTRACT

With the prevailing uncertainties in the labour market, existing literature has not adequately covered the link between employment contracts of part-time and full-time employees with entry to the housing market. We examine the current entry affordability of these income earners for strata and non-strata property types using data from 2004 to 2021 and forecasted this index for the period 2022Q1 to 2031Q4 for each of the metropolis of three cities of Greater Sydney. By mirroring the theory of full-time and part-time wage differentials, we empirically found that income supplements like wealth and scaling down housing preferences play an important role in entering the housing market. The forecasted entry affordability shows there is nowhere in Greater Sydney where the mere reliance on NSW median part-time or median full-time income could make entry to the market possible. Also, entry affordability from 2004 to 2021 was extremely unaffordable for both employment contracts. These findings could help developers, homebuyers, lending institutions, and policymakers to make more informed decisions about their activities, manage risks, and plan for the market.

# 1. Introduction

Entry into the housing market has become a difficult venture for many prospective homebuyers as the rising trend of house prices over the years has shown no sign of a turnaround. Using the weighted average of the eight capital cities of Australia, for example, the Australian Bureau of Statistics [ABS] [2021a, 2021b] reported a 23.7 % increase in residential property prices between December 2020 and December 2021 alone. Apart from Darwin and Perth, the index also shows a steady increase in house prices from December 2011 to December 2021 in all the other cities. This market situation is worsened by the snail pace at which household income is growing (Bangura & Lee, 2023, 2019). Additionally, there are an increasing number of part-time employees in many advanced economies, contributing to low levels of household income. According to the International Labour Organisation [ILO] (2022), total hours worked globally in 2022 is almost 2 % lower than the prepandemic level when population growth is adjusted. Earlier, ILO (2004) noted that, in most industrialised nations, the proportion of parttime employees to total employment increased from 25 % to 50 % in the past 20 years. Moreover, part-time employment is prevalent among women and low-skilled employees and in the service sector. Statistics from Trading Economics (2022) further show a rise in part-time employment in the United States by 0.63 % between September 2022 and October of the same year. Australian Bureau of Statistics [ABS], 2022a, 2022b) publications also show that the part-time share of employment in October 2022 stood at 30.2 % and the proportion of parttime employees grew to 23.6 % in May 2021 from 20.6 % in May 2020.<sup>1</sup> Weaving together these labour market dynamics depicts fluctuations in household income which may impact their deposit savings for housing market entry and continue to exacerbate the affordability issue in the market. This is documented in OECD (2020) which highlights entry into the housing market can be particularly difficult for low- or unstableincome earners including part-time employees. It further illuminates what Adkins et al. (2021) described as the progressive divergence between property inflation and the growth of wages.

As this situation continues in the labour market, it heightens the importance of examining the link between the dominant employment schemes - part-time and full-time employment contracts - with the cost of entering the housing market. This trend is particularly astonishing in Australia, given the very high levels of insecure employment among

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<sup>&</sup>lt;sup>1</sup> According to the ABS, full-time employees refers to people who usually work 35 h or more a week (in all jobs), while part-time employees are those who work less than 35 h a week (in all jobs).

households in the country (Rafferty & Bryan, 2018). This also highlights the issue of income growth and income inequality and their impact on housing affordability (Lee et al., 2022). As Adkins et al. (2021) point out, further empirical studies are required to examine the link between the current employment-based class schemes and the dramatic increase in house prices. Therefore, our study estimated the current and projected entry affordability of part-time and full-time income earners for strata and non-strata property types to offer a better understanding of the affordability situation of these employees. By drawing from the fundamental principles of the theory of full-time and part-time wage differentials, we adopt a blend of contemporary and forward-looking approaches that could feed into broad policies and actions that seek to improve affordability, especially for low-income households with insecure employment contracts. We examine quarterly entry affordability from 2004 to 2021 and forecast this index for the period 2022Q1 to 2031Q4 for each of the metropolis of three cities of Greater Sydney. We consider both strata and non-strata dwellings, use the median weekly part-time and full-time employee earnings, and contribute to the literature in the following ways.

Firstly, despite the enormous literature on the deteriorating entry affordability, none has provided an estimate of affordability at least in the next five to ten years. Premised on the differences in the wages paid to employees, we examine the entry affordability of part-time and fulltime employees for the period 2022Q1 to 2031Q4. The deployment of this forward-looking approach to entry affordability in the context of a submarket framework defined by income-based delineation has provided significant insight into the housing market of both strata and nonstrata dwellings. Our findings show there is nowhere in Greater Sydney where the mere reliance on average part-time or full-time income could make future entry to the market possible. We have provided an enhanced understanding of the future residential property market that could help developers, homebuyers, and policymakers to make more informed decisions, manage risks, and plan their business activities. As lending institutions often consider the past, current, and projected income situation of the borrower, our findings about future affordability could also be used by these institutions to enhance their risk analysis about housing loans and help them develop mitigating measures.

Second, for prospective homebuyers with insufficient income to enter the market, we test the statistical significance of income supplements like household wealth and taste in improving their chances of purchasing a home. If the index is within the affordability threshold of 30 %, then other factors like wealth and taste will be redundant in making housing purchases and vice versa. The results of the dynamic ordinary least square (DOLS) model show the statistical significance of wealth and taste in determining entry affordability for both part-time and full-time earners in strata and non-strata markets. The findings mean if part-time and full-time employees rely only on their average income, they would not be able to enter the housing market be it strata or non-strata. The only feasible option is for prospective homebuyers to include their wealth or that of a family member or surrogate in addition to adjusting the size and type of property before they could afford a dwelling property. This is the first empirical test of the statistical significance of these factors and the results offer a new perspective in the analysis of entry affordability that could better inform policymakers who seek to ameliorate housing affordability in major cities. First homebuyers could also use the findings to plan their housing purchase.

Finally, we examine housing market entry from the perspective of labour market dynamics for both strata and non-strata dwellings. Even though our results strengthen previous studies of deteriorating housing affordability, decoupling affordability in terms of part-time and fulltime employees in both strata and non-strata housing markets is a novelty in housing studies. We found extreme unaffordability for both types of employment contracts. The worst scenario is when a part-time earner seeks to enter the market for non-strata dwellings. It is an almost impossible venture to rely on their average income alone, especially in the Eastern Harbour metropolis. These findings will aid decisions around the activities of prospective homebuyers and developers in the market.

The remainder of the paper is structured as follows. Section 2 provides a profile of Greater Sydney including the metropolis of three cities, while Section 3 reviews the relevant literature. The theoretical framework and hypothesis development are contained in Section 4, and the data and methodology in Section 5. The findings are discussed in Section 6, while Section 7 outlines the concluding statements.

#### 2. Brief profile of Greater Sydney

Greater Sydney has been the capital of the state of New South Wales since the country became Commonwealth of Australia in 1901 (Parliamentary Education Office [PEO], 2019). Geographically, Sydney is bordered by the Tasman Sea to the east, the Blue Mountains to the west, the Hawkesbury River to the north, and the Woronora Plateau to the south (City of Sydney [CoS], 2022). As shown in Fig. 1, Greater Sydney covers 12,368.2 km<sup>2</sup>, and since the proclamation of the amalgamation of some local councils in 2016, the city is now delineated by 35 local government areas with hundreds of suburbs that are connected by a complex transport network that includes public and private bus services, heavy and light rail services, ferry services, taxis, and a road and cycle network. The iconic Sydney Opera House and the Harbour Bridge are some of the biggest attractions to millions of tourists to Sydney every year (CoS, 2022).

According to the ABS 2021 census figures, Greater Sydney had a total population of 5,231,147, representing almost 65 % of the population of NSW and almost 20 % of the population of Australia, making it the most populous city in Australia (Australian Bureau of Statistics [ABS], 2022b, 2022c). Over the years, Greater Sydney has been characterised by spatial polarisation and social disadvantage. Randolph and Tice (2014), for instance, revealed remarkable differences in key socio-economic and demographic characteristics across the municipalities of Greater Sydney. More specifically, Bangura and Lee (2019, 2020) highlighted the social and economic discrepancies between residents in the north and east with those in the west of the city. These findings have significant housing implications.

As earlier noted by Forster (2006), existing strategies of metropolitan cities across Australia are at odds with the increasing geographical complexity that emerges from such spatial polarisation. The NSW Government, for example, identified that about 725,000 additional homes will be needed by 2036 to catch up with the projected housing demand. By 2056, the projections show that a significant number of housing supply will be needed to meet Greater Sydney's continued robust population growth (Greater Sydney Commission, 2018). To meet the needs of this growing and changing population, as shown in Fig. 2, the Greater Sydney Commission articulated a vision that seeks to transform Greater Sydney into a metropolis of three cities: Western Parkland City; Central River City; and Eastern Harbour City. One of the key objectives of this vision is to improve housing affordability across these sub-cities. Therefore, our study is well situated in this vision in that we offer a futuristic picture of housing affordability for both part-time and fulltime employees of the state of NSW to further inform the drafters and implementers of this vision in improving housing affordability. The findings will also aid housing policymakers across the globe to make more informed decisions around affordability.

#### 3. Literature review

#### 3.1. Housing affordability situation

Over the years, there has not been any sign of improvement in housing affordability at the level of the household in many advanced economies. More broadly, the stock of affordable housing has also declined significantly especially for low-income cohorts (Anacker, 2019; Lee et al., 2022). Pawson et al. (2020) described the rapid growth of



Fig. 1. Map of Greater Sydney. Source: Greater Sydney Commission.

house prices over income as a key global marker of declining affordability. They stated that the rule of 30 % of breadwinner income is often used to assess affordability and this index is expected to produce varying results due to household income inequality. Molloy (2020), for instance, found that the proportion of households spending more than 30 % of their income has grown to almost 25 % in 2016 from less than 20 % in 1980. Similar evidence was provided by Acolin and Green (2017) who reported a 45 % increase in the number of households spending more than 30 % of their income between 2007 and 2013. More recently, Cox (2022) argued that, since 1990, the growth of housing prices over household income has widened significantly, especially in the metropolitan cities of countries such as Canada, Australia, New Zealand, Ireland, the United Kingdom, and the United States. This marked difference in the growth levels of housing prices over income was supported by Zhang et al. (2016) and they further highlighted the role of income inequality in driving up housing prices in the market. This widening gap between household income and rising house prices is emerging as a key issue in many metropolitan cities (Stanley et al., 2017).

Several reasons have been advanced for the declining affordability. Liu and Ong (2021), for instance, identified low-income, exorbitant land and construction costs, supply-demand mismatch, and macroeconomic policies as contributing factors to the deteriorating level of affordability among low-income households. The issue of housing financialisation and increasing neoliberal housing policies were highlighted by Bangura and Lee (2023). Garde and Song (2022) argued that land use policies, especially in metropolitan cities are at odds with the improvement of housing affordability and suggested a recalibration of such policies to ameliorate the issue. These sentiments are shared by Paccoud et al. (2022). In addition, the nexus between family composition and housing choice is a contributing factor to declining affordability (Friedman, 2012). The issue of housing attributes and its impact on affordability was also pointed out by Soon and Tan (2019). Activities in the labour market also play a pivotal role in improving or exacerbating affordability among households. Employees with well-paid jobs tend to meet their affordability threshold, while their low-paid counterparts tend to struggle with housing expenses (Okkola & Brunelle, 2018). Gordon (2020) noted that the driving forces of housing affordability are not only local but are also intensified by foreign ownership, pushing housing prices beyond the income levels of local households.

The decline in housing affordability has significant socio-economic consequences which have worsened since the outbreak of COVID-19 (Galster & Lee, 2021). This has culminated in substantial and disproportionate household budgetary concerns, leaving less income for food, transport to work, health, childcare expenditure, the pursuit of higher education, and savings (Anacker, 2019). This has further widened housing inequality between low-and-high-income families (James et al., 2022), a situation that was previously highlighted by Moore and Skaburskis (2004) and Nepal et al. (2010). As such, they argued for a shift towards low to moderate-income households in evaluating affordability



**Fig. 2.** Map of the metropolis of the three cities of Greater Sydney. Source: Greater Sydney Commission.

as higher-income earners are likely to have adequate income to spend on non-housing expenses. Deidda (2015) described the affordability issues in several European cities as a 'non-negligible burden' that could result in severe economic challenges for households. This concern is also raised by Okkola and Brunelle (2018), highlighting the emerging vulnerabilities among first homebuyers especially young people, female-headed households, and low-paid employees, who are often subjected to increasing housing stress. Meen and Whitehead (2020) reiterated housing affordability will continue to worsen for the majority of younger and lower-income cohorts. These findings reflect the issue of housing poverty raised by Bangura and Lee (2019) as low-income households are spending a large proportion of their income on housing-related expenses, leaving little or no room for other family needs. This was previously discussed by Chen et al. (2010) by examining the residual income of households to determine their purchasing power for nonhousing consumption.

#### 3.2. Housing affordability policies

Pawson et al. (2020) documented the role of public policy in addressing declining affordability. Murphy (2014) stated that since the global financial crisis (GFC), more national and sub-national housing policies have been executed in several countries across the world. Randolph et al. (2013), for instance, summarised Australia's Commonwealth government policies that aimed at assisting first homebuyers from 1964 to 2013: the Home Savings Grant Scheme (HSGS) offered financial assistance to 'young married persons' buying or building their own home with a grant of A\$1 for every A\$3 of approved savings up to a limit of A\$2000 given that these savings were held for three years; the Home Deposit Assistance Act (HDAA) in 1982 which ran until 1983; the First Homeowner Scheme (FHOS), lump sum payment at the time of purchase was introduced in 1983; and the First Homeowner Boost (FHOB) which provided a lump sum of A\$21,000 for buying or building a new home during the GFC. Even though the First Homeowner Grant (FHOG) varies across states, it offers grants to eligible first-home buyers if they buy or build their first home within a certain price range (Cho et al., 2021). The Homebuilder program was initiated by the Commonwealth Government to spur economic growth and support eligible homebuyers during the COVID-19 pandemic (Bangura & Lee, 2023). The program allows households that meet certain criteria to receive a grant of \$15,000 or \$25,000 if they were to build or renovate substantially an existing home (Bangura & Lee, 2023; Cho et al., 2021).

From the supply side of the market, the planning process in Australia contributes to the rising construction cost of residential properties as development levies and other local infrastructure charges are directly impacting house prices (Healey, 2016; Ruming et al., 2011). The role of the Commonwealth Government in urban policy and planning is limited and this is impacting the delivery of affordable housing (Austin et al., 2014; Gurran & Whitehead, 2011). The public sector in Australia has maintained a siloed system of governance in the policy framework and operations of its housing system (Pawson et al., 2020). Murray and Phibbs (2023) added that the regulation of land use could put immense pressure on housing prices by restricting the supply of new houses, causing a drop in the availability of affordable housing. So, a robust government role in urban policy and land regulation is critical for successful affordable housing provision, as seen in the United Kingdom and the Netherlands (van den Nouwelant et al., 2015). More recently, there has been a new frontier of government actions. In collaboration with states, territory, and local governments, the construction sector, and institutional investors, the Australian Government agreed to a National Housing Accord to construct up to 1.2 million new well-located homes over 5 years beginning in mid-2024 (Australian Treasury Department [ATD], 2024).

International evidence is also available. In New Zealand, housing policy formation generally mirrors the global policy direction (Murphy, 2014). Matheson (2018) argued that macroprudential policies are superior to property-tax policies due to the tax volatility that characterises the latter. In the United Kingdom, notable policies that promote first homebuyers include "Lifetime ISA", "Help to Buy: ISA", and the "Help to Buy: Equity Loan". First homebuyers are assisted by boosting their savings by 25 % if they save money in the Help to Buy: ISA (OECD, 2019). From December 2015 to November 2019, the Help to Buy: ISA supported the purchasing of homes totalling GBP25.3 billion (Wilcox & Williams, 2018). The Lifetime ISA supports young people within the age bracket of 18-39 to save and receive a government bonus of 25 % on their savings of up to GBP 4000 a year. The "Right to Buy", "Buying through shared Ownership", and the "Rent to Buy" are another suite of policies that support first homebuyers to enter the market (OECD, 2019). The US expanded the 1977 Community Reinvestment Act (CRA) to support communities that are affected by the growing levels of foreclosure and develop programs that promote sustainable loan modifications (IMF, 2011). The Home Investment Partnerships is a yearly grant from the federal government to state government and local municipalities to support the execution localised housing programs to promote homeownership and affordable housing opportunities for low and very low-income households. The Community Development Block Grant Program (CDBG) is a formula-based distribution of funds to metropolitan cities, urban counties, and states by the US Department of Housing and Urban Development (HUD) to promote homeownership among lowand moderate-income households (OECD, 2019). In 2019, the Malaysian government enacted the National Affordable Housing Policy (DRMM) to improve housing affordability for low-income groups (Liu & Ong, 2021). In China, there is the Housing Provident Fund (HPF), a collective saving scheme for low-income that offers subsidies to the loan amount used to purchase a new home (Deng et al., 2021). These policies might generally not be well tailored to adequately address affordability, especially for

low-income earners (Bangura et al., 2023; Cho et al., 2021).

In summary, housing affordability continues to worsen especially for low- and moderate-income households even with the design and implementation of several policies. Moreover, the current dynamics of the labour market indicate a rise in the number of part-time employment contracts amid global economic uncertainties. Therefore, a more forward-looking approach is required to enhance our understanding of the link between employment contracts and entry affordability to aid policies that could help to address the declining affordability.

# 4. Theoretical framework and hypothesis development

We adopt the theory of full-time and part-time wage differentials to examine the link between employment contracts and housing affordability. The concept of wage differential was introduced by Adam Smith in his seminal work, "The Wealth of a Nation" in the eighteenth century (Diatkine, 2021). Wage differential fundamentally refers to the differences in the wages paid to employees due to a range of factors such as the desirability or undesirability of a job, differences in the risk of injury, skills and competency levels, the number of contract hours, the regularity in the job market, and the degree of responsibility. The core of the theory has evolved and contextualised in various studies over the years. For instance, Rodgers (2004) applied the theory of full-time and parttime wage differentials in cadres of employees including female parents with young children, students, and semi-retired using the concept of opportunity cost. At low wage rates, the opportunity cost of full-time employment is low giving rise to more part-time contracts. At about the same time, premised on the theory of full-time and part-time wage differentials, Baffoe-Bonnie (2003) raised the issue of uncertainties in the labour market as a contributing factor to low wages.

Several other factors have accounted for the existence of wage differentials in the job market. Historically, gender has been a key factor. In the 1950s, in the Netherlands, for instance, labour policies on part-time employment were foisted to promote women's participation in the labour market, increasing employment rates among this cohort by the mid-twentieth century (de Groot, 2023). Similarly, Nightingale (2021) argued that part-time work continues to be critical in shaping the persistent gender inequality in low pay for UK employees. In Switzerland, the empirical findings of Backes-Gellner et al. (2014) confirm that the part-time training disparity is largely gender-based as women working part-time rather than full-time constitutes only a minor difference in training. State policies and regulations also contribute to wage differentials. Yonezawa et al. (2022), for instance, highlighted the paradoxical effect of minimum wage hikes in the market. They found that, in the United States, minimum wage legislation aims to improve the welfare of employees by increasing their income. However, employers are likely to reduce employment offers and contract hours in response to such minimum wage hikes. Along this line, with the introduction of the Affordable Care Act in the United States, Dillender et al. (2022) reported that employers with at least 50 full-time equivalent employees working at least 30 h a week are required to offer affordable health insurance to their employees. Their study found that employers circumvent this regulation by reducing their employees' weekly hours below the threshold provided by the Act. The issues around job satisfaction and career trajectories in the labour market were also raised by Kifle et al. (2019) and Mäkinen et al. (2023).

A host of empirical studies on wage differential have shown wideranging circumstances that ensued into the discrepancies in remuneration. These findings have strong implications for household income. As income is central to housing market entry, we use the fundamental principles of the theory of full-time and part-time wage differentials to establish the housing affordability of this broad spectrum of employees in the labour market. We examine where part-time and full-time employees sit in the sliding scale of past and future housing affordability for various property types. In situations where income is insufficient to enter the housing market, we test the statistical significance of income supplements like the wealth of the prospective homebuyer or financial support from their surrogate as well as lowering their housing preferences or taste. This is supported by Bangura et al. (2023) who highlighted the role of wealth and taste in shaping the purchasing decisions of prospective homebuyers in the market. They found rising housing prices are causing increasing reliance on family support, and some prospective homebuyers may have to relocate to a less desirable area due to fear of missing out. Similarly, in the United Kingdom, Druta and Ronald (2017) found that parents are more willing to assist with entry to the housing market than for any other purpose. Another study on firsttime homebuyers by Glenworth (2021) reported that over 22 % of first-time homebuyers are asking their parents for direct financial assistance and 12 % discussing family grantees. O'Keeffe et al. (2022) also found young people may have to change their housing desires as a way to purchase their first home. Circumstances of prospective homebuyers having to relocate so they can enter the housing market are well documented in Bangura et al. (2023), National Housing Finance and Investment Corporation [NHFIC] (2021), and Bangura and Lee (2019). These findings generally show the importance of considering wealth and taste in addition to income in assessing entry affordability, especially with the growing trend of part-time employment contracts. It is in this context that we apply the theory of part-time and full-time wage differentials on housing affordability.

This theoretical framework aims to empirically examine if entry to the housing market depends on the income of the homebuyer alone, or factors like their wealth or that of a family member or surrogate, and the housing type the homebuyer wishes to purchase also plays an important role. These factors are intuitively appealing in the current housing landscape as entry has become extremely challenging, especially in the past two or more decades (Pawson et al., 2020). As such, first-home buyers are increasingly exploring other options to supplement their income to purchase their first home. Based on this framework, it is therefore reasonable to expect that buying a new house in the current market situation goes beyond one's income. This means a successful housing purchase may certainly include the wealth of the prospective homebuyer or that of a family member and downsizing the housing type. Premised on this discussion, we postulate our hypothesis as follows:

Hypothesis: Entry into the housing market will be impossible for both full-time and part-time employees if they rely solely on their median income.

This hypothesis posits homebuyers, whether full-time or part-time employees, cannot rely on their median income only to be able to enter the housing market. We test if this theory holds for both past and future entry affordability across the metropolis of three cities of Greater Sydney. If past and future affordability indices are more than 30 %, it signifies that relying on average income may be insufficient to enter the market. This will validate the use of other factors to be able to enter the market. However, if past and forecasted affordability indices are less than 30 %, then average income will be the only determinant of entry to the market, which will repudiate the relevance of wealth and taste. This is supplemented by a dynamic model to test the statistical significance of wealth and housing taste in determining the affordability of part-time and full-time employees for various housing types.

#### 5. Data and methodology

# 5.1. Data

The quarterly median house price data spanning March 2004 to December 2021 of the various local government areas (LGA) of Greater Sydney was collected from Housing NSW, while the quarterly housing lending rate was collected from Eikon. The weekly median income for full-time and part-time employees for the State of New South Wales for the period 2004–2021, the total value of dwelling stock owned by households, and the number of building approvals were obtained from the Australian Bureau of Statistics (2024, 2023).<sup>2</sup> We use the LGA time series data to derive the median house price data for each of the metropolis of three cities of Greater Sydney as defined by the Greater Sydney Commission. The cluster of LGAs of each of these sub-cities is in Appendix 1.

# 5.2. Methodology

We adopted a three-staged methodology. Stage 1 is an estimate of entry affordability for each of the metropolis of three cities of Greater Sydney using the cost-to-income index. This index is defined as the likely mortgage repayment of a prospective homebuyer if they enter the market for various periods. Previously used by Bangura and Lee (2023), the cost-to-income index integrates the market value of the property, loan-to-value, average housing lending rate, and the loan period and it is expressed as a percentage of the NSW median household income for fulltime and part-time employees as follows:

$$EAI = \frac{100}{MHI} \times \left( MV \times LTV \times \frac{\frac{i}{12}}{1 - \left(\frac{1}{\left(1 + \frac{i}{12}\right)12n}\right)} \right) \times 12$$
(1)

From (1), EAI denotes the entry affordability index, MHI denotes annual median household income, MV is the market value of the property, LTV denotes loan to value, i is the mortgage lending rate, and n is the loan period. The EAI is an annualised effective cost of mortgage repayment expressed as a standard thirty-year annuity formula (that is n = 30) with monthly compounding. The LTV is 80 %, assuming a 20 % deposit. We used a 30 % threshold to represent affordable mortgage repayment, and above 30 % to signify unaffordability. Therefore, Eq. (1) calculates the quarterly entry affordability index of strata and non-strata dwellings of the three cities of Greater Sydney for both part-time and full-time employees.

The second stage of the methodology is the application of the Box-Jenkins auto-regressive integrated moving average (ARIMA) model to forecast this index for the three cities of Greater Sydney. The model is grounded on three key components – lagged values of the main variable, entry affordability (AR component); lagged values of the error term (MA component), and the degree of integration, defined by the level of differences required to make the variable of interest stationary (Valipour, 2015). The ARIMA model in the context of our study allows the entry affordability index to be explained by its past performance and its stochastic error terms and it combines the autoregressive (AR), moving average (MA), and differencing of the variable (Lam & Oshodi, 2016). As defined in Eq. (1), our variable of interest, the entry affordability index is represented by EAI. We start with a generalised first-order autoregressive (AR) model that progresses to p number of lags as follows:

$$AR(1): EAI_t = \tau + \beta_1 EAI_{t-1} + \mu_t$$
(2)

$$AR(2): EAI_t = \tau + \beta_1 EAI_{t-1} + \beta_2 EAI_{t-1} + \mu_t$$
(3)

<sup>&</sup>lt;sup>2</sup> We use the total value of dwelling stock in NSW owned by households as a proxy variable for household wealth since more than 60 % of Australian households invest in residential property (Lee & Reed, 2014) and their equity can be used to support another housing purchase. We also use NSW residential building starts as a proxy for taste since new buildings provide more variety in housing supply and are more attractive to homebuyers than older ones.



Fig. 3. Entry affordability index (%) of strata dwellings using part-time income.

$$AR(p): EAI_t = \tau + \sum_{i=1}^{p} \beta_i EAI_{t-1} + \mu_t$$
(4)

Like our AR model, we design our first order moving average (MA) in the following form:

$$MA(1): EAI_{t} = \pi + \alpha_{0}\mu_{t} + \alpha_{1}\mu_{t-1}$$
(5)

$$MA(2): EAI_{t} = \pi + \alpha_{0}\mu_{t} + \alpha_{1}\mu_{t-1} + \alpha_{2}\mu_{t-2}$$
 (6)

$$MA(q): EAI_{t} = \pi + \alpha_{0}\mu_{t} + \sum_{j=1}^{q} \alpha_{j}\mu_{t-j}$$
(7)

From Eqs. (4) and (7), we see that EAI is explained by its own past values and the current and past values of its error term. From these two equations, we define ARMA in terms of (p, q) as follows:

$$ARMA(p,q): \tau + \sum_{t=1}^{p} \beta_{t} EAI_{t-1} + \mu_{t} + \alpha_{0}\mu_{t} + \sum_{j=1}^{q} \alpha_{j}\mu_{t-j}$$
(8)

with  $\mathbf{E}(\mathbf{\mu}_t) = \mathbf{0}; \mathbf{E}(\mathbf{\mu}_t^2) = \sigma^2; \mathbf{E}(\mathbf{\mu}_t, \mathbf{\mu}_s) = \mathbf{0}, t \neq s$ 

The ARIMA is finally derived through the integration of differenced stationarity in the ARMA and, as such, an ARIMA (p, d, q) denotes EAI has p number of lags, d is how many times EAI is differenced to become stationary, and q is the number of lags of the error term. Therefore, the



Fig. 4. Entry affordability index (%) of strata dwellings using full-time income.

ARIMA (p, d, q) can be represented as:

$$\Psi(\mathbf{B})(\mathbf{I} - \mathbf{B})^{\mathrm{d}}\mathbf{E}\mathbf{A}\mathbf{I}_{\mathrm{t}} = \Theta(\mathbf{B})\boldsymbol{\mu}_{\mathrm{t}}$$
(9)

with 
$$E(\mu_t) = 0; E(\mu_t^2) = \sigma^2; E(\mu_t, \mu_s) = 0, t \neq s$$

where B denotes the backshift operator such that  $B_{EAI} = EAI_{t-1}$ , and d denotes the order of difference. When the series are stationary, the value of d becomes zero.  $\psi(B)$  is the polynomial of the order of p in the backshift operator B defined as follows:

$$\Psi(\mathbf{B}) = 1 - \sum_{i=1}^{p} \psi_i B^i \tag{10}$$

Similarly,  $\Theta(B)$  is the polynomial of the order of q in the backshift operator B defined as follows:

$$\Theta(\mathbf{B}) = 1 - \sum_{i=1}^{q} \Theta_i B^i \tag{11}$$

For more reliable forecasting results using ARIMA, Box and Jenkins's (1976) procedure stipulated these four steps (i) identification (ii) estimation (iii) diagnostic checking, and (iv) forecasting. The identification stage tests if the ARIMA series is stationary, which means, it has a constant mean, variance, and autocorrelation over time. The second step is the estimation of the parameters in Eq. (9) to determine the coefficients that best fit the ARIMA. Step three is a diagnostic check for the adequacy of the specified model. To achieve this, Box and Jenkins (1976) suggested two approaches - (i) overfitting and (ii) residual diagnostics. The concept of overfitting involves checking if the specified model is larger than is required to avoid the addition of extra terms that would not necessarily improve the estimation. The residual diagnostics involves checking if the residuals are independent, that is, they have a constant mean, and variance, and are uncorrelated with each other. This is achieved by plotting the autocorrelation and partial autocorrelation of the residuals to help identify any misspecification of the model. If there is evidence of misspecification, the model will be corrected and respecified. Once these three steps are executed, we proceed with



Fig. 5. Entry affordability index (%) of non-strata dwellings using part-time Income

forecasting the EAI.

The third stage of the methodology is a test of the statistical significance of the other two variables, wealth and taste. We use the dynamic ordinary least square (DOLS) model to examine the long-run significance of these variables. Developed by Stock and Watson (1993), the DOLS framework addresses potential simultaneity bias and performs even in small sample sizes. The model also corrects endogeneity in the explanatory variables by including leads and lags of first differences of these regressors and fixes serially correlated errors by a GLS procedure. In the context of our study, the DOLS model becomes:

$$\begin{aligned} \text{EAI}_{\text{t}} &= \beta_0 + \beta_1 \text{HHW}_{\text{t}} + \beta_2 \text{TE} + \sum_{p=-m}^{m} \left( a_{2p} \left( \Delta HHW_{t+p} \right) \right. \\ &+ \sum_{p=-1}^{p} \left( a_{3p} \left( \Delta TE_{t+p} \right) + \varepsilon_{\text{t}} \end{aligned} \tag{12}$$

From Eq. (12), as discussed above EAI denotes the entry affordability index, HHW denotes household wealth, and TE denotes prospective homebuyer taste. We hypothesise a negative relationship between EAI and each of the explanatory variables, and the symbol  $\Delta$  in (12)

represents the lagged and lead values of differences of these explanatory variables. An improvement in a household's wealth will enhance the likelihood of financial support to prospective homebuyers, and the more residential buildings are approved, the more choices the prospective homebuyers have, and this may ease affordability.

# 6. Discussion of results

# 6.1. Entry affordability 2004-2021

For the period 2004–2021, we disaggregated the discussion of the results into four major sub-periods - the start of the study period in 2004; the Global Financial Crisis (GFC) from 2009; tightened lending conditions from 2015; and the COVID-19 pandemic period from 2020–2021. The results of entry affordability of strata dwellings using part-time and full-time incomes are reported in Figs. 3 and 4.

For strata dwellings, part-time income earners did not show any evidence of affordability throughout the study period. From 2004 to the



Fig. 6. Entry affordability index (%) of non-strata dwellings using full-time income.

period before the GFC, the index was generally more than 100 in all three metropolises of Western Parkland, Central River, and Eastern Harbour, suggesting that part-time earners were not able to buy a property even if they spent their entire salary. During the GFC, we saw a slight improvement in the index especially in Western Parkland of Greater Sydney as it ranges from 74 to 91. This can be attributed to the introduction of the First Homeowner Grant Boost which offered financial support to first homebuyers to enter the market (Randolph et al., 2013). The index worsened again during 2015–2019 due to a tightened lending landscape. Another slight improvement in the index was experienced during the COVID-19 pandemic across the three sub-cities. These results are consistent with the findings of Murray (2024) and Bangura and Lee (2023) who argued that there is a semblance of affordability during the COVID-19 pandemic which we attribute to attractive home lending rates and other government efforts to support home purchasing. The affordability of full-time earners is similar to parttime, though as expected, it is much better than the part-time income earners. Western Parkland, for example, recorded an entry affordability index in the range of 30–43 throughout the study period. As expected, the higher the salary of the prospective homebuyer the greater the chances of entering the market, holding everything else constant. For the non-strata dwellings, as shown in Figs. 5 and 6, we found a similar affordability trend for strata across the three metropolises over the four segments of the study period. However, the index for non-strata is significantly higher than for strata due to the differences in housing prices between the two dwelling types.

Generally, we found a direct relationship between affordability and proximity to the central business district (CBD) of Greater Sydney. The closer the sub-city to the CBD of Greater Sydney, the more challenging it becomes to enter the market for both strata and non-strata dwellings.

#### Table 1

Unit root results and AR(I)MA model identification.

Variable	ADF on level (p- Value)	ADF 1st difference (p-value)	Parameters (p, d, q)	Model
Strata Entry Affordability Index of Western Parkland Fulltime employee income	0.13	0.02**	(1,1,1)	ARIMA
Strata Entry Affordability Index of Central River Fulltime employee income	0.07*		(1,0,1)	ARMA
Strata Entry Affordability Index of Eastern Harbour Fulltime employee income	0.01**		(1,0,1)	ARMA
Strata Entry Affordability Index of Western Parkland Part- time employee income	0.15	0.00***	(2,1,1)	ARIMA
Strata Entry Affordability Index of Central River Part-time employee income	0.17	0.02**	(2,1,2)	ARIMA
Strata Entry Affordability Index of Eastern Harbour Part-time employee income	0.06*		(1,1,1)	ARMA
Non-Strata Entry Affordability Index of Western Parkland Fulltime employee income	0.29	0.04**	(3,1,3)	ARIMA
Non-Strata Entry Affordability Index of Central River Fulltime employee income	0.52	0.00***	(1,1,1)	ARIMA
Non-Strata Entry Affordability Index of Eastern Harbour Fulltime employee income	0.63	0.00***	(2,1,2)	ARIMA
Non-Strata Entry Affordability Index of Western Parkland Part-time employee income	0.11	0.00***	(2,1,3)	ARIMA
Non-Strata Entry Affordability Index of Central River Part- time employee income	0.18	0.00***	(2,1,2)	ARIMA
Non-Strata Entry Affordability Index of Eastern Harbour Part-time employee income	0.19	0.03**	(2,1,2)	ARIMA

The Augmented Dickey Fuller (ADF) tested the null hypothesis of unit root. \*\*\* denotes a rejection of the null hypothesis at the 1 % significance level; \*\* denotes a rejection of the null hypothesis at the 5 % significance level; \*\* denotes a rejection of the null hypothesis at the 10 % significance level. The parameters p, d, and q are non-negative integers defined as follows: p is the number of lags of the autoregressive model (AR); d is the level of difference of the variable; and q is the number of lags in the moving average model (MA). When the variable is stationary on level, the ARMA model applies, while first difference stationary of the variable requires its integration to derive the ARIMA model.

Apart from a few periods in Western Parkland, what is worth highlighting is the excess of the entry affordability index beyond the 30 threshold throughout the study period for all three disaggregated cities of Greater Sydney. Apart from the slight drop in the index during the GFC in 2008 and 2009 and the COVID-19 period in 2020 and 2021, we found no further improvement in affordability as Sydney dwellers would have to save significantly and for an extended period to keep their dream of owning a home alive. The degree of unaffordability in Eastern Harbour is the most alarming followed by Central River and then Western Parkland. Moreover, the difference in affordability between Central River and Western Parkland is less than the flagrant disparity between Eastern Harbour and these two other cities. Features like proximity to the CBD, teeming service-sector jobs, robust rail and road network, and a coastline with world-class beaches are important attractions in Eastern Harbour especially for high-income-earners, the more educated, and those who are desirous of a seaside life. These unique characteristics are contributing to the rising levels of unaffordability in this seashore sub-city over Central River and Western Parkland. Our findings are consistent with previous studies such as Yates (2008), Bangura and Lee (2019), and Pawson et al. (2020) who

# Table 2

Forecasted entry affordability index (in %) of strata dwellings.

Period	Western Parkland City		Central Ri	Central River City		Eastern Harbour City	
	Full- time income	Part- time income	Full- time income	Part- time income	Full- time income	Part- time income	
202201	58,49	88.58	65.07	105.73	69.07	174.23	
202202	58.53	88.27	65.12	105.56	69.17	174.17	
202203	58.57	87.96	65.55	105.16	69.06	174.32	
202204	58.61	87.66	65.52	104.99	69.04	174.94	
202301	58.65	87.36	65.67	104.58	70.03	174.92	
202302	58.69	87.09	65.42	104.41	70.01	176.16	
202303	58.73	86.78	65.87	104.01	71.00	175.59	
202304	58.78	86.47	65.88	103.84	71.98	175.18	
202401	58.82	86.18	65.87	103.44	71.97	175.86	
202402	58.86	85.87	65.91	103.26	70.96	175.63	
202403	58.90	85.60	65.92	102.86	71.94	174.46	
202404	58.94	85.29	65.93	102.69	71.93	175.33	
202501	58.98	84.99	64.08	102.29	71.91	175.24	
202502	59.02	84.69	64.03	102.11	71.90	175.17	
202503	59.06	84.40	64.18	101.71	72.88	175.12	
202504	59.10	84.11	63.13	101.54	72.87	176.08	
202601	59.14	83.81	63.78	101.14	72.86	176.05	
202602	59.18	83 51	63.13	100.97	72.84	176.03	
202603	59.23	83.22	63.78	100.56	72.83	176.01	
202604	59.27	82.92	63.73	100.39	72.81	177.00	
202701	59.31	82.63	64.18	100.99	72.80	176.99	
202702	59.35	82.33	64.23	100.82	72.78	176.98	
202703	59.39	82.04	64.58	101.42	72.77	176.98	
202704	59.43	81.74	64.43	101.24	72.75	176.97	
202801	59.47	81.44	63.78	101.84	72.74	176.97	
202802	59.51	81.16	62.13	102.67	73.73	176.97	
202803	59.55	80.86	62.38	102.27	73.71	176.97	
202804	59.59	80.56	62.93	102.09	73.70	177.17	
202901	59.63	80.27	62.18	102.69	73.68	177.47	
202902	59.68	81.97	62.33	102.52	73.67	177.82	
202903	59.72	81.68	62.68	103.12	73.65	177.11	
202904	59.76	81.39	63 43	103.94	74.64	177.07	
203001	59.80	81.09	63.01	103.54	74.63	177.08	
203002	59.84	81.79	63.44	103.37	74.61	177.16	
203003	59.88	82.50	63.99	104.97	74.60	178.13	
203004	59.92	82.21	63.64	104.80	74.58	178.01	
203101	59.96	82.91	64.19	104.39	75.57	178.14	
203102	60.00	82.62	63.84	104.22	75.55	178.16	
203103	60.04	82.32	63.59	104.82	74.54	178.29	
203104	60.09	82.03	63.83	104.65	75.53	178.96	

articulated the deteriorating levels of affordability across Greater Sydney. However, we depart from these studies in the definition of the submarkets using the metropolis of the three cities of Greater Sydney for strata and non-strata dwellings. As hypothesised, there is a striking difference in the level of unaffordability between strata and non-strata residential properties with the latter being extremely higher than the former throughout the study period.

From the perspective of employment status, we find clear unaffordability for both part-time and full-time income earners in all three subcities. However, the affordability index for part-time employees is exceeding the 30 threshold far more than for full-time earners. For strata dwellings in Western Parkland, the average entry affordability index for a full-time earner over the study period was 35 and 92 for a part-time worker, while it was 41 and 109 for Central River, and finally, 62 and 163 for Eastern Harbour. The indices deteriorated significantly for nonstrata dwellings with Western Parkland, recording 51 and 134 for fulltime and part-time employees respectively, Central River recording 53 and 139 for full-time and part-time employees each, and 126 and 330 were reported for full-time and part-time employees respectively in Eastern Harbour. These estimates reveal the relative affordability for Greater Sydney residents in the study period was only for strata dwellings in Western Parkland which has an index above the threshold by a margin of 5. Closer to this is strata dwelling in Central River which on average is 11 above the 30 threshold. In Eastern Harbour, affordability is

#### Table 3

Forecasted entry affordability index (in %) of non-strata dwellings.

Period	Western P City	arkland	Central River City		Eastern Harbour City		
	Full- time income	Part- time income	Full- time income	Part- time income	Full- time income	Part- time income	
2022Q1	62.67	138.65	66.40	165.28	147.84	430.80	
202202	62.62	138.50	66.47	165.51	148.51	432.37	
2022Q3	62.57	138.34	66.65	165.75	149.27	434.12	
2022Q4	62.52	138.18	66.73	165.98	150.08	435.69	
2023Q1	62.47	138.03	66.90	166.22	150.04	437.44	
2023Q2	62.42	137.87	66.98	166.45	150.70	439.01	
2023Q3	62.37	137.71	67.16	166.68	151.46	440.77	
2023Q4	62.32	137.56	67.23	166.92	152.28	442.34	
2024Q1	62.27	137.40	67.41	167.15	152.25	444.09	
2024Q2	62.22	137.24	67.48	167.39	152.92	445.66	
2024Q3	62.18	137.09	67.66	167.62	153.67	447.41	
2024Q4	62.13	136.93	67.73	167.85	154.49	448.98	
2025Q1	62.08	136.77	67.91	168.09	154.47	450.74	
2025Q2	62.03	136.62	67.98	168.32	155.14	452.31	
2025Q3	61.98	136.46	68.16	168.55	155.90	454.06	
2025Q4	61.93	136.30	68.23	168.79	156.72	455.63	
2026Q1	61.88	136.15	68.41	169.02	156.71	457.38	
2026Q2	61.83	135.99	68.48	169.26	157.38	458.95	
2026Q3	61.78	135.83	68.66	169.49	158.14	460.70	
2026Q4	61.73	135.68	68.73	169.72	158.96	462.27	
2027Q1	61.68	135.52	68.91	169.96	158.96	464.03	
2027Q2	61.63	135.37	68.99	170.19	159.64	465.60	
2027Q3	61.58	135.21	69.16	170.43	160.40	467.35	
2027Q4	61.53	135.05	69.24	170.66	161.21	468.92	
2028Q1	61.48	134.90	69.42	170.89	161.23	470.67	
202802	61.43	134.74	69.49	171.13	161.91	472.24	
2028Q3	61.38	134.58	69.67	171.36	162.67	474.00	
2028Q4	61.33	134.43	69.74	171.60	163.48	475.57	
2029Q1	61.28	134.27	69.92	171.83	163.51	477.32	
202902	61.23	134.11	69.99	172.06	164.19	478.89	
202903	61.18	133.96	70.17	172.30	164.95	480.64	
202904	61.13	133.80	70.24	172.53	165.76	482.21	
203001	61.08	133.64	70.42	172.76	165.81	483.96	
2030Q2	61.04	133.49	70.49	173.00	166.49	485.53	
2030Q3	60.99	133.33	70.67	173.23	167.25	487.29	
2030Q4	60.94	133.17	70.74	173.47	168.06	488.86	
2031Q1	60.89	133.02	70.92	173.70	168.12	490.61	
2031Q2	60.84	132.86	70.99	173.93	168.80	492.18	
2031Q3	60.79	132.70	71.17	174.17	169.56	493.93	
2031Q4	60.74	132.55	71.25	174.40	170.37	495.50	

frightening for both strata and non-strata dwellings for both part-time and full-time income earners. These results suggest that residents of Greater Sydney would not be able to buy any home in Eastern Harbour, whether strata or stand-free if they are earning the median weekly wage rate of NSW.

# 6.2. Forecasted entry affordability 2022Q1 - 2031Q4

To offer more insights into the affordability situation of prospective homebuyers of these sub-cities of Greater Sydney in the next ten years, we forecast the entry affordability of both part-time and full-time employees for strata and non-strata dwellings. Before forecasting the entry affordability index, we checked for the stationarity of the index to determine whether the model follows an ARMA process or if differencing of the index is required to justify the use of the ARIMA model. The entry affordability index for full-time employees for strata dwellings in Central River, full-time employees for strata in Eastern Harbour, and part-time employees for strata in Eastern Harbour are stationary on levels and the ARMA model was employed in forecasting. The index for all the other variables are first differenced stationary and, as such, the ARIMA model was deployed though with varying levels of AR and MA processes. We used the Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF) in the correlogram to determine the appropriate number of lags for the AR and MA models respectively. The

l'able 4			
OOLS results	on entry	affordability	index

Long run variable	Strata Part-time (EAI) Coefficient/t- value	Strata Full-time (EAI) Coefficient/t- value	Non-strata Part-time (EAI) Coefficient/t- value	Non-strata Full-time (EAI) Coefficient/t- value
Household Wealth Buyer Taste	-0.89 (2.99)** -0.42 (2.11)**	-0.62 (2.02)** -0.11 (1.99)*	-0.24 (3.23)*** -0.69 (0.10)	-0.29 (2.76)** -0.69 (1.41)
Constant	2.88 (1.15)	6.69 (1.98)	10.11 (2.23)**	9.42 (1.98)*
Log- likelihood	0.82	0.95	0.96	0.99

This is the result of the DOLS model of Eq. (12). The dependent variable is the entry affordability index of each of these four scenarios –strata part-time income, strata full-time income, non-strata part-time income, and non-strata full-time income, and the explanatory variables are household wealth and buyer taste. \*\*\* means the variable is significant at the 1 % level; \*\*\* means the variable is significant at the 1

null hypothesis of the residuals being white noise is not rejected in all the models.<sup>3</sup> The preferred models are defined in Table 1.

The results of the forecasted entry affordability index for the period 2022Q1 to 2031Q4 are reported in Tables 2 and 3. The results showed a high-growth trajectory across the three disaggregated cities of Greater Sydney, suggesting that housing market entry is expected to get worse in the next ten years for both part-time and full-time employees be it for strata or non-strata dwellings. The forecasted results in Tables 2 and 3 generally accentuated the deteriorating affordability across the property types and employment status in the three metropolises of Greater Sydney discussed earlier. These forecasted results, like the historical indices, highlighted that full-time and part-time employees will not be able to enter the housing market by relying on their average incomes alone. This means they would require wealth and, in some cases, go for a less desirable property before they will be able to purchase a property.

To sum up, the degree of unaffordability in Greater Sydney is very challenging, indicating that entering the market has generally become an extremely difficult endeavour irrespective of location, dwelling type, and employment status. With Greater Sydney moving towards a metropolis of three cities, policymakers should be aware of the magnitude of challenges that lie ahead for prospective homebuyers if they are to make a headway in improving affordability.

# 6.3. The role of household wealth and household taste

Both the past and forecasted affordability situation for both part-time and full-time employees in the strata and non-strata housing markets have shown that the mere reliance on median income is inadequate for entering the housing market. This means prospective home buyers will require support elsewhere or scale down their housing desire. This motivates the need to examine if wealth and taste also play a critical role in household consumption. As discussed in Section 4, the dramatic rise in housing prices is causing increasing reliance on family support and some prospective homebuyers may have to relocate to a less desirable housing market due to fear of missing out. This shows wealth and taste could play a vital role in housing market entry. In this section, we apply the DOLS model to test the long-run statistical significance of wealth and taste in determining entry affordability of strata and non-strata dwelling types and for both employment schemes – part-time and full-time. The

 $<sup>^3</sup>$  The results of the correlogram and the diagnostics tests are not reported for brevity, but they are available from the authors.

## results are reported in Table 4.

The results from Table 4 show the statistical significance of household wealth across the four scenarios at the relevant levels. More importantly, the negative signs of the coefficients are consistent with our hypotheses, reinforcing the sentiment that increasing household wealth would also increase the chances of prospective homebuyers entering the housing market. Similarly, as more residential properties are supplied in the market, it offers more housing variety that helps prospective home buyers adjust their purchasing desire due to affordability. The results show most prospective home buyers will have to utilise their wealth or seek financial support from family members or a surrogate and certainly scale down their housing desire before they can enter the market.

#### 7. Conclusion and implications

Employment contracts in many advanced countries are becoming fluid. More part-time employees are entering the workforce due to social factors, changes in labour and related regulations, differences in the degree of risk involved in the job, the vicissitudes of global events, varying skills and competency levels, and differences in the nature and scope of job responsibilities. These driving factors of employment contracts ultimately affect household income, making entry into the housing market extremely challenging for many prospective homebuyers. This calls for more research to explore the ramifications of various employment contracts on homeownership. From the body of the literature on housing affordability, no study has shed light on its link with employment type. More specifically, there is a gap in the literature on the past, current, and future affordability of two main employment contracts - part-time and full-time. This lacuna also extends to whether future entry into the housing market would be possible with the reliance on median part-time or full-time income alone. To answer these questions, we case-studied a metropolis of three cities of Greater Sydney in the state of NSW in Australia and developed a three-staged methodology. Stage one is the computation of entry affordability for each LGA in each of the metropolis of three cities of Greater Sydney from 2004 to 2021; stage two is the deployment of an ARIMA model to forecast entry affordability of both part-time and full-time employees for both strata and non-strata dwellings over the period 2022 to 2031; and stage 3 is a test of the statistical significance of income supplements like wealth and

taste in entering the housing market. We also applied the theoretical framework of full-time and part-time wage differentials to determine whether income alone or supplements like wealth and housing taste play an important role in the housing market and documented the following findings.

Firstly, we conducted an income-based delineation of the housing submarket and forecasted the entry affordability of part-time and fulltime employees for the period 2022-2031 for both strata and nonstrata dwellings. Secondly, we empirically tested the statistical significance of wealth and taste in determining entry affordability for both part-time and full-time earners in strata and non-strata markets. We found that both factors are applicable in the housing market as part-time and full-time employees would have to supplement their average income with their wealth and certainly demand a less desirable property before they would be able to enter the housing market. Finally, we decoupled past entry affordability into part-time and full-time employees in both strata and non-strata housing markets and found extreme unaffordability for both types of employment contracts. These historical and forecasted results have significant policy implications. These findings could help developers, homebuyers, and policymakers to make more informed decisions, manage risks, and plan the market. Lending institutions could also use this information to enhance their risk analysis about housing loans and help them develop mitigating measures.

#### CRediT authorship contribution statement

**Mustapha Bangura:** Writing – original draft, Methodology, Formal analysis, Data curation. **Chyi Lin Lee:** Visualization, Software, Conceptualization.

#### Declaration of competing interest

There is no conflict of interest in this article.

# Data availability

The authors do not have permission to share data.

Appendix 1. Clus	ster of local	government areas	into	the	three	sub-ci	ties
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Western Parkland City	Central River City	Eastern Harbour City <sup>a</sup>
Blue Mountains	Blacktown	Burwood
Camden	Cumberland	Inner-West
Hawkesbury	Parramatta	Canada Bay
Campbelltown	The Hills	Strathfield
Fairfield		Randwick
Liverpool		Waverly
Penrith		Woollahra
Wollondilly		Hornsby
		Hunters Hill
		Ku-ring-gai
		Lane Cove
		Mosman
		Northern Beaches
		North Sydney
		Ryde
		Willoughby
		Sydney
		Bayside
		Georges River
		Sutherland
		Canterbury-Bankstown

<sup>a</sup> The Eastern Harbour City clusters the eastern, north, and south districts.

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