Who Gains from Housing Market Stimulus?

Evidence from Housing Assistance Grants with Threshold Prices

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Abstract

This paper examines market implications of a housing assistance policy offering subsidies to buyers of new homes priced up to $600,000 in Sydney. We find this policy causes a large degree of sales bunching just below $600,000, over 8 times the counterfactual density. Policy affected homes are associated with 50% shorter time-on-market, 25% smaller area size, and especially an overpricing of $3,000, offsetting up to 56% of received benefit. Overpricing is aggravated by opportunistic developers that strategically shift their focus to policy eligible homes. This study sheds light on the effectiveness and externalities of housing subsidies to improve homeownership.

Key words: Housing assistance policy, real estate pricing, price bunching, price inflation, economic stimulus

JEL Classification Code: R20, R38

1. Introduction

Housing affordability is an acute issue for policy makers worldwide. The past decade has seen a substantial increase in housing prices and a reduction in housing affordability around Australia[1] (Hall and Thomas, 2016). To promote homeownership and new home development, the Australian government offered assistance schemes to home buyers who meet certain criteria. However, after several waves of assistance policies in recent decades, ironically the housing market has become even more unaffordable, especially for first home buyers and lower/middle income groups. In 2021, Sydney was ranked as the third most unaffordable housing market worldwide (Demographia, 2021).

Public opinion on these housing assistance schemes is mixed. Some surmise that these grants may actually contribute to rising housing prices, rather than improving affordability.[2] It is argued that although these grants do assist in getting homebuyers onto the first step in the property market, they are inflationary and actually push up property prices.[3] These concerns reverberate in recent times with various COVID-19 housing stimulus packages, offered by the Australian and other nation's governments, to alleviate the negative economic impact from COVID-19. As this program aims at reducing those housing stock under construction and stimulating the real estate industry[4], social welfare and affordable housing advocates suggest that such grants are ineffective in promoting housing affordability during a crisis.[5]

In this study, we investigate the housing market implications of government subsidies by exploiting a regulatory policy that offers stamp duty concessions for eligible new home buyers. We focus

[1] Source: Australia Bureau of Statistics in various years.
[2] Australian Bureau of Statistics data shows that since the grant was introduced in July 2000, the average house price in Western Australia increased from $125,000 to $425,000 in July 2010.
[3] Source: Calls for First Home Owner Grant to be scrapped, from The Sydney Morning Herald. Link: https://www.smh.com.au/business/companies/calls-for-first-home-owner-grant-to-be-scrapped-20110909-1k1yl.html
[4] Source: Housing plan including cash grants on the radar to kickstart construction, from The Sydney Morning Herald. Link: https://www.smh.com.au/politics/federal/housing-plan-including-cash-grants-on-the-radar-to-kickstart-construction-20200526-p54wkr.html
[5] Source: Australian Government announces Homebuilder stimulus program. Link: https://www.ahuri.edu.au/news-and-media/covid-19/australian-government-announces-homebuilder-stimulus-program

on the **Home Builders Bonus** Policy (hereafter, HBB) from 1 July 2010 to 30 June 2012 (see Appendix 1 for a detailed description of the benefit provided in the HBB policy). Buyers of new residential properties during the HBB period enjoy stamp duty exemptions for prices below $600,000; whereas for prices above $600,000, no concession is offered, and buyers are required to pay full stamp duty amounts. This creates a threshold at $600,000 whereby a $1 increase of home price could result in an extra stamp duty payment of $22,490.[6] Besides the jump in stamp duty payment at the threshold price, another noteworthy feature of the HBB is that this policy is widely available to any new home buyers, including property investors who already have a primary residence. Hence, we expect the HBB policy to have a broad and significant influence on the housing market given its availability with no limits on applicants' income or assets. As long as a new home is purchased at a price below $600,000, the HBB policy stipulates that stamp duty is completely waived for 'off-the-plan'[7] new homes, and it is reduced by 25% for completed new homes.

Using a difference-in-differences (DID) approach, we offer a clean identification of the policy impact by analyzing home sales before or after the HBB policy at above or below the policy threshold price. This DID strategy is in line with other studies exploiting exogenous policy shock or policy-induced discontinuity (DeFusco et al, 2020; Agarwal et al, 2017). We examine several aspects of the policy impacts, including housing price formation in terms of price density distribution and price level of policy affected homes, time-on-market, and supplier side analysis in terms of housing quality and opportunistic developers. Our analysis delineates the impact of housing subsidies on housing market dynamics, and also enables us to assess the extent to which the housing subsidies could address housing affordability.

[6] Based on the progressive stamp duty rates shown in Internet Appendix Table IA1, a recipient of the HBB stamp duty exemption for buying a new home priced at $600,000 could save up to $22,490. The amount of stamp duty is calculated as the transaction price times the corresponding tax rate, with different tax schedules in different price brackets. Note that as the purchase price crosses a tax bracket threshold, a higher tax rate applies to the entire amount and not just the portion that falls above the threshold as in standard graduated schedules. Hence to avoid paying higher stamp duty tax, home buyers would naturally prefer to stay at the lower level of tax schedule.

[7] Off-the-plan means when the home is sold before it has been built. It is also known as forward sales, presale, or sale at the pre-construction stage.

Employing a rich dataset of housing transaction records in the Sydney metropolitan area from June 2008 to June 2012 (i.e., [-2, +2] years window around the HBB effective date), we first show that for the market segment of new homes, the distribution of housing prices has a large and acute bunching at just below the threshold of $600,000 and a discernable hole slightly above it, while no such bunching is observed for old home sample in the same period. To further quantify the bunching effect, we compare the actual and counterfactual price distributions using the old (i.e., pre-existing, second-hand) home sales as a counterfactual. As the housing assistance is provided only for new homes, the sales of pre-existing homes serve as a natural control group. We show that for new homes during the policy period, the percentage of exact bunching at $600k is 4.67%, seven-fold of the exact-bunching density of 0.68% for old home sales . For the ±$20,000 neighborhoods, the percentage of new home sales in the price range of ($580k, $600k) is 9.61%, or over three times that of the old home sales in the same period. Our sales distribution regression analysis also offers consistent evidence that during the HBB period, policy-eligible new homes priced exactly at $600k experience 7.5% higher sales volume. Similarly, for the ±$20k neighborhoods around the threshold, we observe significantly 1.1% higher new home sales on the LHS but not on the RHS. This result implies that the HBB policy has a substantial influence on purchasing decisions, causing homebuyers to choose homes priced within the HBB-eligible range

Besides using old home sales as counterfactual, we also conduct additional bunching analysis following the method in Best and Kleven (2018). We formulate a counterfactual price distribution by estimating a frequency polynomial based on the actual price volume distribution during the policy period but with the parts around the cutoff price omitted. Our result reveals that for neighborhoods just below the threshold price, the sales volume rises by 1,039, or 8.39 times the average counterfactual sales volume. On the contrary, for neighborhoods just above the threshold, sales volume drops by 337, or 2.72 times the average counterfactual transaction volume. This lopsided bunching of -5.67 represents a significant distortion of market price distribution[8].

To offer a thorough understanding of the bunching mass, we investigate two potential sources: 1) existing buyers in the higher-end market may move down from above the threshold price to below; and 2) new buyers who did not have housing purchase plan before the policy are attracted by the subsidy to enter the market. We assess the density imbalance below and above the threshold and show that about one-third of the bunching mass just below the threshold is from homebuyers moving down from above to below the threshold. Further, using regressions comparing price density around the threshold price Pre- and Post-HBB, we obtain consistent findings that the sales volume above the price threshold drops by 0.11% while the volume below increases by 1.1% in the ±$10,000 neighborhoods. That is, the sales volume above the threshold does not drop as much as the increase in sales below, which implies that a sizable portion of sales bunching also consists of newcomers attracted by the HBB policy to enter the market, not just from buyers moving to just below the threshold from above.

Next, we examine HBB's impact on price distortions around the policy threshold. Comparing sales prices of eligible new homes with old homes not affected by the HBB, we find that policy-eligible new homes are priced $3,158 higher just below the threshold than old homes in the HBB period, using a hedonic regression approach controlling for property features, location, and time fixed effects. Relative to the amount of subsidy received, this price inflation reduces up to 56%[9] of the amount of subsidy received, depending on the amount of subsidy for which the homebuyer is eligible. We further conduct a triple-difference regression analysis by comparing the prices of homes bought before and after the HBB policy around the threshold prices for new and old homes, and find that new homes below the threshold are overpriced by about $3,889. Using subsamples comprising below or above threshold transactions

[8] The measure of bunching just below the threshold is b=8.39 and the measure of hole just above is m=2.72. The lopsided bunching is computed as -5.67, obtained from m-b. The bunching estimate b is much larger than Best and Kleven's (2018) equivalent bunching measure which ranges from 0.36 to 0.63 for UK homes eligible for a stamp duty holiday

[9] See section 4.1 for calculation details of the offset percentage.

only, we find the overpricing ranges from $1,074 to $5,832, depending on price windows. Furthermore, we use alternative specifications with price premiums derived from the residual part of a hedonic model, and find a qualitatively similar extent of housing price inflation just below the threshold price in the HBB period.

Apart from price inflation, we also examine policy impact on time-on-market and housing quality (in terms of area size) of policy-affected homes. As new homes below the threshold price face substantially higher demand, we expect these homes would sell faster with a shorter time-on-market. We find that the time-on-market of policy affected new homes decreases by over 50%. Further, these homes are smaller by about 120 square meters, or about a quarter of the average land area size during the policy period and just below the threshold, suggesting that policy-affected homes are not only more expensive but also smaller in area size.

From the supply side, we test whether the surge in demand for policy eligible homes have an unintended externality of causing certain developers to shift their sales focus substantially and concentrate their efforts on selling just homes below policy threshold price to satisfy such demand. As policy eligible off-the-plan new homes are easier to sell in terms of higher price and shorter time-on-market, unscrupulous and opportunistic developers may be attracted to enter the housing market to sell higher priced and lower-quality homes. We identify an opportunistic developer as one that has over 50% of sales concentrated in policy eligible homes between $550,000 to $600,000 in the post-HBB period, but less than 25% in the Pre-HBB period. We then analyze the sales volume in different price brackets and find that the opportunistic developers sell 1.436% more in new sales (as a percentage of total new home sales) in the price bin at the threshold price, compared with other developers. In terms of sales price, we show that opportunistic developers charge $7,000 to $9,000 more than other developers for just below threshold homes, consistent with the hypothesis that they are exploiting the increased demand for below threshold homes under the HBB policy. Note that since the savings obtained from the policy range from \$5,623 to \$22,490, this result implies that the overpricing by opportunistic developers offsets a sizable proportion of between 31% and 124% from the subsidies. Our results also imply that a large portion of the policy subsidies are actually gained by opportunistic developers at the expense of homebuyers who are the targeted beneficiary of the subsidy policy.

Lastly, we explore whether housing benefits induce a potential wealth effect; that is, whether the HBB housing subsidies lead to more conspicuous consumption of durable goods for subsidy recipients (e.g. Agarwal et al., 2007; Mian and Sufi, 2012; Parker et al., 2013; Kaplan and Violante, 2014). Specifically, we use the purchase of new cars to proxy for conspicuous consumption of durable goods. It is likely that home buyers will spend the savings from the subsidy rather than save it. For example, Parker et al. (2013) find households spent a majority of the economic stimulus payments of 2008 on durable goods, primarily new vehicles. We also find that neighborhoods that receive more housing subsidies have more new car registrations, consistent with the notion of a wealth effect brought on by the housing benefits.

Our paper makes several important contributions. First, our paper adds to the literature on bunching and policy response (Saez, 2010; Bajari et al., 2011; Kopczuk and Munroe, 2015; Slemrod et al, 2017; Agarwal et al., 2020; DeFusco et al, 2020). Bunching is a popular approach to studying distribution frequency discontinuity-related issues in microeconomics. For example, Bajari et al. (2011) study the healthcare insurance industry and find that hospitals submit significantly larger bills when the reimbursement rate is higher. Saez (2010) exploits the bunching at kink points of the tax system to estimate the elasticity of earnings with respect to taxes. Our study focuses on the policy impact on housing price distribution, documenting acute bunching at the desirable side of the policy threshold. Further, besides the volume response, we extend the bunching analysis in Best and Kleven (2018) by examining the price effect of the grant thresholds and document a strong overpricing. To our knowledge, this is the first study to provide large sample evidence on several important aspects of the housing market, including sales volume bunching, price distortion in the housing market. We further enrich the analysis further by investigating housing market liquidity and supply side effects by documenting a reduction of time-on-market, smaller home size, and strategic behaviors of opportunistic developers.

Second, existing studies on the effect of housing assistance policies mainly use aggregate statistics and lack strong inference. With our comprehensive transaction level database, we are able to identify the exact shift in price preference before and after the relevant housing assistance policy in different housing segments. The data also allow us to compare and contrast the price effect on homes that were eligible for policy aid (the treated sample) and those that were ineligible due to being just above the cut-off (the control sample), which enable to offer more clear evidence and robust identification of the policy impact.

Third, we provide welfare implications for one of the largest housing affordability initiatives by the Australian government in recent times by examining the effectiveness of housing assistance policies as a viable method for improving housing affordability and boosting homeownership. We find evidence that after the introduction of assistance policies, the homes slightly below the threshold prices are priced higher and are also smaller in area size. This implies that the benefit from the assistance policies is priced into the purchase price, and so part of the home buyer benefit is reaped by the sellers/developers. Further, we find a wealth effect from housing assistance using durable goods consumption. Households that receive this kind of housing assistance benefit spend more on new luxury car brands.

Overall, our study sheds light on the effectiveness and externalities of housing stimulus in the form of subsidies to improve housing affordability. As urban housing markets throughout the world face increasing challenges regarding housing affordability, similar to Australia, our study also offers general implications for policymakers in other markets. For example, in response to the homeownership aspirations of the community, the housing regulation authorities in countries such as Hong Kong and Canada have introduced various subsidized homeownership schemes over the past few decades, such as the Home Ownership Scheme in Hong Kong and new housing rebate scheme in Canada. Thus, the findings in this study could be used to inform relevant assistance policies for housing markets in other countries.

This paper proceeds as follows. Section 2 describes the institutional background of the housing assistance policies that we study. Section 3 reports the data and method. Section 4 reports the main analysis and empirical results, and Section 5 reports additional tests. Section 6 concludes.

2. Institutional Background on Housing Assistance Policies

Although metropolises worldwide are concerned with housing market bubbles and house affordability, there is a dearth of effective policies to address these important issues. Governments typically employ two main approaches to tackle housing affordability. The first is usually to provide public housing for lower income households at below-market price, as in Hong Kong and Singapore. The second is to offer financial assistance to certain groups of home buyers. For example, the First Home Owner Grant New Homes scheme in New South Wales (NSW), Australia provided a $15,000 rebate for home purchases below $650,000 from 2012 to 2014. There are numerous assistance schemes in various countries; however, despite the widespread introduction of such schemes, there has been a noticeable global decline in homeownership over the last several decades among the younger cohort (Battellino, 2009). It is thus important to understand why policies do not achieve the intended result, and be careful about the potential market distortion effect of any public policy.

In this study, we examine the HBB housing assistance policy in Sydney, Australia, introduced by the NSW government on 1 July 2010 and ended on 30 June 2012. This policy offered a stamp duty exemption to home buyers purchasing new homes priced up to $600,000: it represented a saving of up to $22,490. For new dwellings being built there was a 25% cut in stamp duty or up to $5,623 in savings.[10]

[10] These figures represent the actual stamp duty savings and are given in Box 4.1 in the Financial Year 2010-2011 Budget Statement Budget Paper No. 2 of the NSW Government. The maximum savings of $22,490 represents the usual amount of

Specifically, during the HBB policy period between July 2010 and June 2012, for new homes bought at \$600,000 (the policy threshold), buyers were eligible for a 25% stamp duty exemption for completed new homes or full stamp duty exemption for off-the-plan new homes. Unlike other assistance policies, there were no other eligibility requirements such as low income or existing property ownership. If the off-the-plan property was instead purchased at a price just above the threshold, say \$600,001 (i.e., \$1 above the threshold), the buyer would be subject to the full stamp duty tax of \$22,490. The stamp duty benefit in other price ranges did not experience such sudden jumps, and hence we expect the price pattern to display a much smoother variation across those ranges.

While there were other housing policies from the government throughout the past two decades in Sydney, we choose to focus on the HBB policy for the following reasons. First, there are clear price threshold in the policy, which enables us to test the policy effects on the distribution of price and volume by comparing the two sides at just above and below the threshold. The second reason is that HBB is only applicable to new homes, which enables us to compare and contrast the price distribution with old/pre-existing homes during the policy period. Third, it does not overlap with other subsidy policies, which may otherwise complicate the interpretation of each specific policy.[11] In the period prior to the HBB (the Pre-HBB policy period), first home buyers of any home (including both new and old) could receive cash grants regardless of the home price and additional stamp duty reductions for any home priced up to \$600,000.[12] These same incentives also continued into the HBB (the Post-HBB policy) period. As these policies occur Pre- and Post-HBB, we are able to isolate the sole effect of HBB using a difference-in-differences approach.

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stamp duty paid without the policy for a home priced at \$600,000. The usual stamp duty at \$600,000 is \$8,990 plus \$4.50 for every \$100 above \$300,000 or 8,990 + (600,000-300,000)/100*4.50 = \$22,490. 25% of \$22,490 is (roughly) \$5,623. The complete stamp schedule is outlined in Internet Appendix Table IA1 from the NSW Office of State Revenue website: http://www.osr.nsw.gov.au/taxes/transfer-land

[11] It is worth noting that while we have made efforts to design our study periods to isolate the effects of each assistance policy separately, to avoid potentially confounding effects from other policies, the periods we study also include other assistance policies. The complete details of these other policies are listed in Appendix 1.

[12] Below \$500,000 there is complete stamp duty waiver (saving \$17,990). For home prices between \$500,000 and \$600,000, stamp duty is \$0.2249 for every dollar above \$500,000.

There are two perspectives regarding the effectiveness of these housing schemes.[13] One stream of research shows that housing subsidies have a positive, stabilizing effect on the housing market, and that they serve as an effective means to enhance housing affordability (Besley et al, 2014; Lee and Reed, 2014). On the other hand, it is argued that government subsidies to home buyers are capitalized into the housing market, causing an overall higher level of housing prices.[14] For instance, Blight, Field and Henriquez (2012) (2012), Randolph, Pinnegar and Tice (2013), and Kupke and Rossini (2014) find that housing assistance schemes are associated with higher home prices and increased buying activity. However, all these studies do not study whether the effect was causal nor measure how much of the house price increase was due to the grant rather than other factors.

To offer external validity, we compare the HBB policy in this study with other housing policies in Australia and those in the rest of the world in Internet Appendix Table IA2. A key feature of the HBB policy is that it imposed a price cap on the eligibility of subsidies. This kind of threshold is also commonly seen in other housing policies both in Australia (for example, the Victoria Land Transfer Duty Waiver "Big Housing Build" policy) and other regions (such as Hong Kong and Canada), as shown in Table IA2.[15]

Another important attribute of the HBB policy is that it applies to all buyers of new off-the-plan homes: its primary purpose was to clear housing stock and to stimulate the real estate and construction industries, rather than making housing more affordable. This is different from the other grants in Australia and other countries that are applicable only to first-time home buyers or buyers from lower

[13] There is also a larger stream of literature on the effects of housing assistance on the well-being of recipients. See for example Jacob (2004) on Section 8 housing vouchers and their effect on student achievements, and Chetty et al. (2016) on the effect of the 'Moving to Opportunity' experiment on the long-term outcomes of children.

[14] Similar to subsidy capitalization effect, Dachis et al. (2012) find Toronto's 1.1% land transfer tax cause a declining in housing prices equal to the tax.

[15] For example, in August 2020, the Hong Kong Monetary Authority initiated a housing policy that imposes a price cap of HK$10 million if the home buyers want to borrow up to 60% loan-to-value ratio (LTV), with the maximum LTV dropping to 50% if over the cap. Similarly, in Canada, the maximum LTV drops from 95% to 80% at a threshold price of $1 million, creating an increase of $150,000 in the down payment requirement for homes at the threshold. In New York and London, so-called "mansion taxes" have been imposed on purchases of all homes valued over $1 million (USD) (since 1989) and over $1.5M (GBP) (since 2014), respectively.

income groups. As Dalton (2012) notes, Australian HBB grants were unique in that they did not target particular income or population groups. Enticed by the subsidy, financially savvy investors are likely to obtain the grant and buy eligible homes below the threshold price, thus crowding out financially constrained first home buyers.

To sum up, this study offers important implications for policymakers around the world in designing housing policies. Specifically, a policy inference we can draw from it is that effective policies to alleviate housing affordability need to specify eligibility (such as income or wealth limit) and target group (such as first-time home buyer). Policies that offer the widespread availability regardless of income may cause undesirable distortions to both price and volume. Without these, we would expect a similar crowding-out effect in housing markets elsewhere.

3. Data and Method

3.1 Sample Construction and Summary Statistics

Our empirical analysis uses a comprehensive data sample of housing transaction records for the Sydney Metropolitan Area from June 2008 to June 2012 from Australian Property Monitors. The list of variables includes transaction date and price, comprehensive property and location characteristics, and buyer and seller identities. This data is ideally suited for the analysis because the complete price pattern contains valuable information about the exact bunching location at the price threshold. We further augment this data with CoreLogic Scorecard data (provided by the Securities Industry Research Centre of Asia-Pacific (SIRCA)) and data on first home owner grants from the NSW government's Office of State Revenue. The CoreLogic Scorecard data contains monthly snapshots by suburb of property turnover and total housing stock while the First Home Owner Grant data[16] provides the monthly number of applications and dollar amounts of first homeowner cash rebates and stamp duty reductions at the

[16] Unfortunately, we do not have statistics on the HBB policy that apply to all home buyers.

suburb level. We obtain from Dungey, Wells and Thompson (2011) the detailed dates and eligibility criteria of housing assistance policies for the Pre-HBB period. We also check the Australian federal and NSW state governments' respective websites for cash grant policies for the Pre-HBB period. Additionally, we examine NSW government budget papers to obtain information on NSW assistance schemes such as the HBB.

Figure 1 illustrates the housing market trend in Sydney during this period.[17] As seen in Figure 1 Panel A, the housing price indexes for both Australia and Sydney are increasing throughout the Pre-HBB period and fall slightly in the Post-HBB period. Panel B presents the standardized monthly transaction volume, which peaks in December 2009 and is otherwise stable throughout our sample period at between 0.9 and 1.1 of transactions in June 2008.

[--- INSERT FIGURE 1 ABOUT HERE ---]

Table 1 Panel A reports summary statistics for our main data set of individual housing sales. The total number of sales is 311,220 (263,626 with full housing characteristics). The mean sales price of all homes sold is $656,240. New homes account for 7% of all homes sales. Opportunistic developers, defined as a developer with 50 percent or more of their new home sales during the Post-HBB period being just below the HBB threshold price of between $550,000 to $600,000 (inclusive) and during the Pre-HBB period sell less than 25 percent of their sales are between $550,000 to $600,000 (inclusive), make up 7% of all new home sales. We also observe 13% of homes are sold via auctions. The average home has 2.86 bedrooms, 1.59 bathrooms, 71% have parking and 51% of sales are houses.

In Table 1 Panel B we look at the mode, mean, and median sales prices for new and old (pre-existing, second-hand) homes by policy period and by whether their prices are above or below the $600,000 threshold. Note that in the Post-HBB period, the mode of sale of new homes is $600,000, consistent with the threshold for the stamp duty exemption for the HBB. For old homes, the modes are

[17] Please note that as this figure is based on monthly statistics, the gap between the pre-HBB period and post-HBB period from 9 June 2010 to 30 June 2010 does not appear.

both $500,000 for the Pre- and Post- periods. The mean price for old homes is much higher than the median due to the right-tail influence of high-priced units (e.g. over $2 million) skewing the mean. The mean price for new homes is lower than that for old ones, as there are fewer new homes in the very high price range. We further look at the subsample of homes priced up to the policy threshold, and find the mode is $600,000 for new homes Post-HBB, consistent with the large bunching induced by the HBB policy.

[--- INSERT TABLE 1 ABOUT HERE ---]

To illustrate price distribution and locations of these policy-affected homes, Figure 2 presents two heat maps of the mean sales price and the mean transaction volumes for them (i.e., new home sales less than $600,000 during the HBB period) across suburbs (neighborhoods). We can see these policy-affected homes span the entire city and their densities vary according to suburb. In Figure 2 Panel A, we see that the more expensive new homes are concentrated in Inner Sydney and particularly in the Eastern Suburbs, Mosman/Cremorne areas. Cheaper home sales occur more in the southwest and northwest from Inner Sydney. In terms of transaction volumes in Figure 2 Panel B, there is a reasonably uniform distribution across neighborhoods with notable concentrations in Canterbury Bankstown and the Lower North Shore.

[--- INSERT FIGURE 2 ABOUT HERE ---]

3.2 Bunching of Housing Prices around Threshold Price during the HBB Policy Period

In this section, we examine the effect of the HBB policy on transaction volume around the threshold price of $600,000 during the policy period. Empirically, the distribution of these variables tends to present a discontinuity or bunching effect around the threshold point. The housing subsidy policy is essentially a discontinuous function of the housing prices with certain eligibility criteria. Home buyers make their housing decision to ensure that they are on the desirable side of the policy threshold. At the threshold, individuals are subject to large changes in outcomes as a result of small changes in certain choice variables. For example, Agarwal et al. (2020) examine the bunching of the appraisal price and find that 42% of appraisals are at or near the contract value, while only 7.5% are below. It is well exploited in the literature that piecewise linear income tax schedules result in discontinuities and bunching in the density of earnings (Saez, 2010; Kleven and Waseem, 2013; Kleven et al., 2014; DeFusco et al., 2020). Imperfectly enforced price controls, such as the minimum wage, generate a similar pattern in wage distribution (Meyer and Wise, 1983; Doyle, 2007).

To exploit the policy setting, we utilize a bunching model (Best and Kleven, 2018; Han et al., 2021) to estimate the causal effect of the housing subsidy on price distribution. To gain an overview of price distribution, we plot the histograms of transaction prices for new and old home sales in our policy periods in Figure 3. We find that prices bunch at the threshold levels for policy-affected homes (new homes) rather than being smoothly distributed. Panels A and B of Figure 3 present the histograms for the Pre-HBB policy period for new and old home sales, respectively. We do not find any discernible bunching in either graph. New homes have a spike in distribution at $350,000 while for old homes it is reasonably smooth. Figure 3 Panels C and D show histograms during the HBB policy for new and old home sales, respectively. We observe clear bunching at just below $600,000, but much fewer sales just above $600,000 in the histogram for new home sales in Panel C, due to the stamp duty exemption on new home sales. In contrast, old home sales have a smooth distribution as shown in Panel D, as they are not eligible for this policy.

[--- INSERT FIGURE 3 ABOUT HERE ---]

3.3 Difference on Volume Distribution and Sale Price between New and Old Homes

As the policy targets new home sales, we could potentially use the price distribution and level of old home sales during the same period as a counterfactual distribution of new home sales without the policy, and the difference would be regarded as policy effect on volume distribution. We expect that in response to the HBB policy, sales prices and transaction volumes just below the threshold price will be higher than those just above; and we expect these effects would show up only in new homes.

For old homes to be a valid counterfactual, the parallel trend assumption must hold, where sales volume between old and new homes pre- HBB policy should display a similar pattern. In Figure 4 we plot the monthly sales volume of old and new homes across all sales prices (Panel A), below or equal $600,000 (Panel B), and above $600,000 (Panel C). We observe parallel trends across all panels in the before the HBB policy between old and new homes, hence satisfying the parallel trend assumption.

[--- INSERT FIGURE 4 ABOUT HERE ---]

Table 2 Panel A tests the mean differences in the distribution of housing sale prices, based on the sales volume in various price bins. Overall, we find that sales volume density of new homes is much higher to the left of the threshold than to the right, compared to old homes. The first row presents the proportion of sales at exactly the threshold price of $600,000 for new and old homes. We find 4.67% of new home sales sell exactly at the threshold price of $600,000, which is more than five times the exact-bunching percentage (0.68%) for old homes. The difference of 3.99% is economically and statistically significant.

[--- INSERT TABLE 2 ABOUT HERE ---]

Besides exact bunching at the policy threshold price of $600,000, we also look at bunching in a close neighborhood, using a ±$20,000 window around the threshold price. For new home sales, we find the sales density is 9.61% just below the threshold and 1.08 percent just above, indicating there is an imbalance of 8.53% (*Below* – *Above*). In contrast, the counterfactual old homes in the ±$20,000 price window have an imbalance of only 0.34% with the threshold below having slightly higher mass than the above (2.69% *Below* vs. 2.35 percent *Above*). When taking the difference of new and old home imbalances (*Below* – *Above* measure for *New* – *Old* column), the difference is 8.19%, statistically significant at the 1% level. Next, we further enlarge the price window from ±$20,000 to ±$50,000. Using a ±$50,000 price range, the new and old home imbalances between below and above $600,000 is 12.30%, statistically significant at the 1% level. This sizable imbalance shows again that the new home sales volumes are heavily skewed to below the threshold in comparison with old homes which have a density difference below and above of just 1%.

Besides sales volume analysis, we also examine sales price using a difference-in-difference approach. Turning to housing price differences results in Table 2 Panel B, we find the price differences between new and old are statistically different. For example, for the sample of new home sales, the prices of new homes sold below the threshold in the *(P-$50k, P)* window is $579.19k, compared with the average price of $632.63k in the *(P, P+50k)* window above the threshold. On the other hand, for old homes, the price imbalance (*Below – Above* around the threshold price of $600k) is -$55.44k, with the difference between new and old homes being $2.01k (the below-above imbalance of -$53.43k for new homes minus the below-above imbalance of -$55.44k for old homes), is statistically significant. This difference-in-difference test result implies that the prices of new homes are on average $2,010 more expensive due to the policy, after accounting for price imbalance in old homes. We obtain consistent results using the ±$20,000 price range, showing price inflation in new homes is $2,510 in response to the HBB policy.[18]

4. Empirical Analysis

4.1 Bunching Estimation on The Impact of the HBB Policy on Sales Volume Distribution

In this section, we estimate the excess bunching due to thresholds by creating a counterfactual distribution had there not been a threshold. We follow Best and Kleven (2018) and fit a flexible polynomial regression and excluding a region around the threshold, which is widely used in the literature (e.g. Kopczuk and Munroe, 2015; Best and Kleven, 2018; Han et al. , 2021) and also enable us to compare

[18] In Internet Appendix Table IA3, we use new home sales in the Pre-HBB period as the control group instead and find similar results. In Panel A, we find higher price distribution with similar differences in magnitudes for just below and at the threshold. For just above the threshold, we find within +/- 1% differences in price distribution. In Panel B for sales prices, we also find statistically higher prices above and below the threshold for the Post-HBB period compared with the control period. The Below – Above difference although positive is not statistically significant.

the extent of bunching in this study to other papers on bunching effects. Sales transactions are grouped into AUD$5,000 price bins with prices from $150,000 to $1,200,000. We use the following regression to estimate the counterfactual distribution around a threshold at price $\bar{v}$:

$$c_i = \sum_{j=0}^{q} \beta_j (z_i)^j + \sum_{r \in R} \eta_r I\left\{\frac{\bar{v} + z_i}{r} \epsilon \mathbb{N}\right\} + \sum_{k=\bar{h}_{v^-}}^{\bar{h}_{v^+}} \gamma_k I\{i = k\} + e_i \qquad \text{--(1)}$$

Where c_i is the number of transactions in price bin i, and z_i is the distance between price bin i and the price bin at threshold $\bar{v}$. q is the polynomial order, set at 5. The second term in equation 1 includes fixed effects for prices that are multiples of round numbers in set R, where R = {10,000; 25,000; 50,000}, ℕ is the set of natural numbers, and I{.} denotes the dummy function. The third term excludes a region (v^-, v^+) around the threshold that is being distorted by bunching responses to the threshold.

We determine the lower threshold bin $\bar{h}_{v^-}$ as when the slope between bins first changes direction when moving to below the threshold. The upper threshold bin $\bar{h}_{v^+}$ is determined when the slope between bins changes direction after the first time the slope becomes positive as we move away to above the threshold. e_i is an error term. The estimate of the counterfactual distribution is defined as $\hat{c}_i$ from the equation omitting the contribution of the dummies in the excluded range. We estimate excess bunching as the difference between the observed and counterfactual bin counts within the region (v^-, v^+) that falls below the threshold as $\hat{B} = \sum_{i=v^-}^{\bar{v}} (c_i - \widehat{c_i})$ and the missing mass above the threshold as $\widehat{M} = \sum_{i=\bar{v}}^{v^+} (\widehat{c_i} - c_i)$.

Figure 5 Panel A presents the bunching estimation result with bootstrap standard errors in parentheses, where Figure 5 Panel B reports the observed and constructed counterfactual price distributions around a threshold price of $600,000.[19] We find that during the HBB policy period,

[19] We report the coefficient estimates of the bin regressions in Internet Appendix Table IA4. We show that the first and second polynomial effects (bindist_1 and bindist_2) are negative, and the remaining polynomial effects are positive. We also observe high bin frequency for $10,000 and $50,000 bins.

bunching estimator ***b*** (unstandardized) is estimated to be 1,039.36, which implies there are about 1,039 more home sale transactions just below the threshold price, compared with the counterfactual distribution without the policy. Similarly, the missing mass estimator ***m*** (unstandardized) is estimated as 123.89, implying that there are about 124 fewer home sales at prices just above the threshold, compared with the counterfactual case. The observed bunching mass and missing mass around the policy threshold price suggest that the HBB policy has a strong distortionary effect on the sales price distribution.

Further, as the increased sales ***b*** on the lower side is much greater than the missing sales ***m*** on the upper side (i.e., b (1,039.36) >m (123.89)), this imbalance implies that the observed bunching just below the threshold comes not only from sales above the threshold moving down in price, but also from new buyers entering the housing market. Attracted by the housing assistance from the HBB policy, those who had not planned to buy a home come to the housing market to take advantage of the savings. This finding is crucial as it clearly delineates the two distinct sources from which the bunching mass is formed, including existing demand in the higher end of the housing market, as well as policy-induced demand from new entrants.

Besides looking at the raw numbers, we also analyze the standardized measures of *b* and *m*, for ease of comparison with the magnitude in other studies. The standardizing denominator is 123.89 sales, which is the average counterfactual bin size in the omitted region (denoted as dotted vertical lines in Figure 5 Panel B). We find the excess mass *b* below the threshold price is 8.39 times the size of the average counterfactual density across bins within the omitted region. The bootstrap standard error of the estimate is 0.20, making it statistically significant at the 1% level. The missing mass *m* in the region above the threshold price is estimated to be 2.72, statistically significant at the 1% level, implying that the sales volume in the price range above the threshold is 2.72 times lower than the counterfactual density without the policy.

[--- INSERT FIGURE 5 ABOUT HERE---]

Overall, the price distribution pattern shows very strong bunching around the threshold price of $600,000. The parameter estimates are also comparable with other studies that use this method. For example, Best and Kleven (2018) estimate the value of *b* to be between 1.64 and 1.85 and the value of *m* to be between 2.21 and 2.27 for stamp duty thresholds in the UK. In another related study, Leung et al. (2015) investigate stamp duty threshold changes in the Hong Kong housing market and find *b* of between 0.171 and 0.892 and *m* of between -0.273 and -0.408.

4.2 Policy Effect on Sales Distribution using Prior Periods as Counterfactual

In the previous section, we find strong distortions in sales volume and price of homes affected by the policy, using old homes as the counterfactual group. In this section, we further test the impact of the HBB policy by employing an alternative counterfactual method. Specifically, we use sales in the prior period as the counterfactual when the assistance policy was absent. We start by using the same frequency bins for new homes as we did to create our bunching estimates in Figure 5. Transactions are grouped into $5,000 price bins from $200,000 to $1,200,000[20]. We use the following regression to estimate the counterfactual distribution around a threshold price $\bar{v}$:

$$\left(\frac{c_{it}}{NewSales_t}\right) * 100 \ = b_0 + b_1 PostHBB_{it} * Threshold_{it} + b_2 PostHBB_{it} * [-X, -Y]_{it} + b_3 PostHBB_{it} * [Y, X]_{it}$$

$$+ b_4[-X, -Y]_{it} + b_5 Threshold_{it} + b_6[Y, X] + b_7 PostHBB_{it} + \sum_{j=0}^{q} \beta_j (z_i)^j + \sum_{r \in R} \eta_r I \left\{ \frac{\bar{v} + z_i}{r} \epsilon \mathbb{N} \right\} + e_{it} \quad \text{---(2)}$$

Where c_{it} is the number of new home sales in price bin *j* for period *t* (Pre- or Post-HBB), and $NewSales_t$ is the total new home sales in period *t*. $PostHBB_{it}$ is a dummy of 1 if the sale occurs in the HBB policy period from 1 July 2010 to 30 June 2012. *[-X, -Y]* is a dummy indicating whether the transaction price is greater than the policy threshold price minus *X* and lower than or equal to the

[20] We have also tried other price bin sizes including AUD$1k, AUD$2k, and AUD$10k, and obtained qualitatively similar results.

threshold price minus Y. *[Y, X]* is a dummy indicating whether the transaction price is greater than the threshold price plus Y and less than or equal to the threshold price plus X. *X* and Y take value of $10,000, 20,000 or 50,000. *Threshold* is a dummy of 1 if the bin includes the threshold price, 0 otherwise. z_i is the distance between price bin *i* and the price bin at threshold $\overline{\boldsymbol{v}}$. *q* is the polynomial order, set at 5. The last term includes fixed effects for prices that are multiples of round numbers in set R, where R={10,000; 25,000; 50,000}, ℕ is the set of natural numbers, and I{.} denotes the dummy function.

Table 3 reports our estimation results of the sales price distribution. We employ a difference-in-difference approach comparing two periods (Pre-HBB versus Post-HBB) with price ranges above and below the threshold price. Accordingly, the regression sample includes 402 observations, composed of 201 price bins with a width of $5,000 between $200,000 and $1,200,000 inclusive. Column 1 shows the estimation result on sales volume in the post period compared with pre period, for homes sold exactly at the $600,000 threshold price as well as those in price bins within ± $10k of the threshold price. Column 2 further includes the ± $20k dummies and column 3 adds the set of ± $50k dummies.

[--- INSERT TABLE 3 ABOUT HERE ---]

The regression result in Table 3 Column 1 shows that the coefficient of *PostHBB*Threshold* is positive and significant at 7.518, implying that sales volume for new homes priced at exactly $600k increase by 7.518% after the onset of the HBB policy. As the sales volume in the $600k bin in the Pre-HBB period is only 1.49%, this represents a six-fold increase in volume, consistent with the large and acute bunching at the threshold price in Table 2 Panel A. The interaction term *PostHBB*[-10k, 0]* in Column 1 is 1.10 and statistically significant, suggesting that there is 1.10% more new home sold in the ($590k, $600k] price range after the HBB policy was introduced, compared with the Pre-HBB period, again consistent with the results in Table 2 Panel A and Figure 5 Panel B. The coefficient for *PostHBB*[0,10k]* is -0.112 (statistically significant at 10% level), implying homes in the price range *[$600k, $610k]* have 0.112% fewer sales after the policy. Compared with volume increase below the threshold, this result also shows the HBB policy reduces new home sales above the threshold by a less extent than it increases sales below the threshold.

In Table 3 Column 2 we find positive and statistically significant coefficients for *PostHBB*Threshold* (7.528), *PostHBB*[-10k, 0]* (1.11), and *PostHBB*[-20k, -10k]* (0.855), again implying a bunching effect where HBB policy increases sales for homes priced below and exactly at the policy threshold price. Going from the *[-20k,-10k]* bin to the threshold, we observe the bunching effect is more pronounced when the sale price is closer to the threshold price. We also find statistically significant coefficients for *PostHBB*[0, 10k]* (-0.102), implying that the HBB policy reduces new home sales in the *[0, 10k]* range above the threshold by 0.102%. Note that the reduction in sales in *[0, 10k*] range is much smaller than the increase of 1.11% in the *[-10k, 0]* range. In the price ranges further up, we find the coefficient on *PostHBB*[10k, 20k]* (0.072) becomes positive, implying HBB's effect on reducing the volume above the threshold price only holds in the close neighborhood of *[0, 10k]* range, and does not extend beyond it.

In Column 3, we look at the ±*50k* range, and find the coefficients on *PostHBB*[-50k,-20k]* (0.698) is positive and significant, implying the sales volume increases by about 0.7% Post-HBB. The coefficients on *PostHBB*Threshold (7.557), PostHBB*[-10k, 0]* (1.139), and *PostHBB*[-20k, -10k]* (0.885) go in the same direction and are of similar magnitude to the results in prior columns. Also the result reveals that the bunching effect becomes less pronounced the further the price is away from the threshold.

Overall, these results suggest that the HBB causes a significantly higher volume of new home sales in price ranges below the threshold, and a relatively small drop in volume of homes priced just above the threshold. The results imply that the majority of the sales bunching at below the threshold price are new buyers attracted to the market by the HBB policy, in addition to those sales that were to occur above the threshold being moved down to below the threshold to receive the subsidy. This finding is consistent with the result in Table 2 and offers important implications for buyer group composition. We next look at the impact on price distortion induced by the policy given the price pressure appears to mostly come from new home sales at below the threshold, rather than only from above.

4.3 Policy Effect on Time-on-Market

As an alternative measure of sales liquidity, we use time-on-market (e.g. Cheng et al., 2008; Haurin et al., 2010) to test whether new homes just below the threshold in the Post-HBB period sell faster. We run the following triple difference-in-difference regression:

$$TOM_{ist} = b_0 + b_1 Below_{ist} * PostHBB_{ist} * New_{ist} + b_2 Below_{ist} * New_{ist} + b_3 Below_{ist} * PostHBB_{ist} + b_4 PostHBB_{ist} * New_{ist} + b_5 Below_{ist} + b_6 PostHBB_{ist} + b_7 New_{ist} + X_{ist} + \mu_{is} + m_{it} + \varepsilon_{ist} \quad \text{--(3)}$$

where TOM_{ist} is the time on market of sold home *i* in suburb *s* in date *t*, calculated as the sales date less the first advertised date of the home. For new homes, we use the first sales date in the block or estate as the first advertised date (removing the first sold home in the block/estate). To enter the sample, both the first advertised date and sales date must be in the Pre- or Post-HBB period. *PostHBB* is a dummy of 1 if the sale is in the Post-HBB period and $Below_{ist}$ is a dummy for sales price less than or equal to the threshold price.

Table 4 reports of coefficient estimate for time-on-market for different price ranges around the threshold of ± \$10k, \$20k and \$50k around the threshold in Columns 1, 2 and 3, respectively. The negative and statistically significant coefficient for *PostHBB*Below*New* in column 2 and 3 suggests a reduction of between 94 days and 125 days in sales for Post-HBB new home sales just below the threshold. Given a mean time-on-market of new homes of 213 days, this represents up to 59% reduction of sales time due to the policy. For column 1 with a price range of ± \$10k of the threshold, the coefficient represents about a halving of sales time due to the policy, although not statistically significant.

[---INSERT TABLE 4 ABOUT HERE---]

4.4 Difference-in-differences Tests using Below vs. Above and Old vs. New Homes

In this section we run the following multivariate regression to test the different between new and old homes around the threshold:

$$Pricek_{ist} = b_0 + b_1 New_{ist} + b_2 Below_{ist} + b_3 Below_{ist} * New_{ist} + X_{ist} + \mu_{is} + m_{it} + \varepsilon_{ist} \quad \text{--(4)}$$

Where New_{ist} is a dummy denoting a new home sale, and $Below_{ist}$ is a dummy for sales price less than or equal to the threshold price. The other variable definitions follow that of equation 1. Our coefficient of interest is b_3, which we expect to be positive and statistically significant if new homes just below the threshold sell for higher prices than pre-existing old homes due to the policy incentives.

Table 5 reports the results using the Post-HBB (Panel A) and Pre-HBB (Panel B) policy windows. In the Post-HBB policy window, we find a positive and statistically significant effect for *Below*New* of \$1,718, \$2,250 and \$3,158 for the ±\$10k, ±\$20k and ±\$50k window, respectively. The result suggests that the HBB policy threshold causes overpricing of homes just below the threshold. The effect is economically significant and represents a minimum 14% up to 56% of the savings in stamp duty of \$22,490 for the ±\$50k window.[21] Using the sample in the Pre-HBB window (Panel B), we find no effect around the \$600,000 threshold with *Below*New* being statistically insignificant for all price windows that we use. This suggests that controlling for housing characteristics explicitly removes any price effect from our univariate analysis.

[--- INSERT TABLE 5 ABOUT HERE ---]

[21] For off-the-plan new homes, buyers receive a stamp duty concession of \$22,490, and hence the percentage of offset is \$3,158/\$22,490=14%. For new homes under construction, they receive a concession of \$5,623 (25% of 22,490), and hence the percentage of offset is \$3158/\$5,623=56%. See Internet Appendix Table IA1's stamp duty schedule to calculate 300,000*4.5/100+8,990=22,490, assuming a house price of \$600,000.

4.5 Triple Interaction Regression including Pre-HBB and Post-HBB Policy Periods

As a more robust method of looking at price effects just below the threshold, we further compare across periods with and without the HBB policy using a triple interaction (e.g. below versus above the threshold, pre-existing old versus new, and pre versus during policy). In order to apply the difference-in-differences approach with respect to the period, we need to ensure the economic fundamentals do not have a confounding effect with the policy during the Post-HBB period. We plot and compare several key economic fundamental variables in Internet Appendix Table IA5 and show there is no sudden change in key economic indicators[22] in the Post-HBB policy period.

We use the following regression specification for the triple interaction analysis:

$$\begin{aligned} Pricek_{ist} = b_0 &+ b_1 Below_{ist} * PostHBB_{ist} * New_{ist} + b_2 Below_{ist} * New_{ist} \\ &+ b_3 Below_{ist} * PostHBB_{ist} + b_4 PostHBB_{ist} * New_{ist} + b_5 Below_{ist} \\ &+ b_6 PostHBB_{ist} + b_7 New_{ist} + X_{ist} + \mu_{is} + m_{it} + \varepsilon_{ist} \end{aligned} \qquad \text{--(5)}$$

The coefficient of interest is *Below*PostHBB*New* being positive and statistically significant. The control period is the Pre-HBB period.

Table 6 Panel A reports our results in three columns using ±$10k, ±$20k and ±$50k windows around the $600k threshold, respectively. We find *Below*PostHBB*New* is positive and statistically significant, with a value of 3.889 for the ±$50k window only. This result implies that the policy increases the sale price of new homes just below the threshold by $3,889 (or approximately 0.67% assuming an average home price of $575k) relative to new homes just above the threshold, accounting for housing market trends using old homes sales.

[---INSERT TABLE 6 ABOUT HERE---]

In Panel B we use price windows either above or below the threshold to discern whether the pricing difference is due to overpricing of sales below the threshold, underpricing above the threshold or

[22] We include four economic fundamental variables in the plots, including GDP growth rate, population of overseas migration, inflation rate, and unemployment rate. The data is from the Australian Bureau of Statistics.

a combination of both. We find statistically significant overpricing for sales below the threshold relative to the Pre-HBB period. The estimates of overpricing for the -10k (column 1), -20k (column 3) and -50k (column 5) windows are $1,074, $2,839 and $5,832, respectively. For price windows above the threshold, we do not find significant results. Overall, our findings imply strong overpricing of new home sales for prices just below the threshold due to the HBB policy.

Panel C further investigates policy effect in price windows way below the threshold. We use four windows from -400k to -300k of threshold (column 1) to -100k to -50k of threshold (column 4). We find no effect in all these price ranges further below the threshold. This implies the price pressure effect of the policy only occurs for homes just below the threshold.

4.6 Price Premium Differences between Below vs. Above and across Policy Periods

An alternative approach to estimating the under/overvaluation of sales prices surrounding the threshold is to examine price premiums (or discounts) using the residuals from a hedonic regression. We estimate the price premium of a home as the difference between the sales price and the predicted sales price (multiplied by 100 for visual purposes), using the following hedonic model across the full sample of Sydney homes from Jan. 2000 to June 2019:

$$\ln(Price_{ist}) = b_0 + b_1 New_{ist} + X_{ist} + \mu_{is} + m_{it} + e_{ist} \qquad \text{--(6)}$$

where *New* indicates whether a property is a new home, X_{ist} is a set of control variables for property characteristics (number of bedrooms, number of bathrooms, whether the home has parking, property type fixed effects, and land area size), μ_{is} are suburb fixed effects, m_{it} are year/quarter fixed effects, and e_{ist} is an error term. We apply the same policy sample periods as in previous results.

Table 7 Panel A reports the coefficient estimates of the hedonic housing price model we use to generate predicted prices, while Panel B presents average price premiums for various price range groups and sample periods. The hedonic model coefficients show transaction prices are higher for homes with more bedrooms, bathrooms, parking and for new homes. In Table 7 Panel B, for new home sales at exactly the $600,000 threshold, we find an average premium of 3.85% above the predicted price from the hedonic model in the Post-HBB period, which is statistically significant. The premium in the Post-HBB period is higher but not statistically different from the Pre-HBB period (value of 3.09 in the "Post minus Pre" column).

[--- INSERT TABLE 7 ABOUT HERE ---]

When we compare a price range of $20,000 above or below the $600,000 threshold, we find an average premium of 1.86% for $20,000 to the lower side of the Post-HBB period (statistically significant at the 1% level), suggesting homes below the threshold are inflated by 1.86%, which poses a sharp contrast to the (insignificant) -2.12% underpricing for the +$20,000 neighborhood. The *Below – Above* difference is 3.97% (statistically significant at the 10% level), implying homes just below $600,000 are overpriced by 3.97% or about $23,423 (590,000*3.97%) than those just above the threshold.

In the third set of results using a wider band of ±$50,000, we find similar results to those using the ±$20,000 band. For the Post-HBB period, homes just below the threshold price are 1.51% overpriced (1% statistically significant) and -2.71% underpriced just above the threshold (also 1% statistically significant) for a Below – Above difference of 4.22%, statistically significant at 1%. For *Post minus Pre*, the average premium is positive and statistically significant at the 10% level for *Below* and *Below – Above* of 1.50 and 2.83, respectively. This indicates the HBB largely results in overpricing new homes just below the threshold. We note that for the Pre-HBB window across all price ranges there are no statistically significant premiums or differences. Overall, the results using price premiums are consistent with the prior difference-in-differences and triple-difference results.

5. Additional Analysis

5.1 Policy Effect on Home Size

In the previous sections, we investigate the effect of housing assistance policies on transaction volume and transaction prices just below the threshold and find supportive evidence that the policies have a distortionary effect on both volume and price. In this section, we investigate whether there is an adverse effect on housing quality, specifically on the size of homes sold around the threshold price.

We employ the following regression to study the effect on home size:

$$HomeSize_{ist} = b_0 + b_1 PostHBB_{ist} * New_{ist} + b_2 PostHBB_{ist} + b_3 New_{ist} + X_{ist} + \mu_{is} + m_{it} + \varepsilon_{ist} \quad \text{--(7)}$$

Where $HomeSize_{ist}$ is the land area size in square meters of a house for sale *i* in suburb *s* at time *t*. We expect developers to build and sell smaller new homes during the HBB period with the $600k price threshold to benefit from the HBB policy.

Table 8 Panel A uses the Pre-HBB and Post-HBB period with a $600k threshold and finds new homes are between 113 to 159 square meters smaller than pre-existing old homes in the Post-HBB period than in the Pre-HBB period (statistically significant at the 10% level for ±$10k, 5% level for ±$20k and ±$50k). This reduction is both economically meaningful and statistically significant as the typical two-bedroom apartment in Sydney is about 100 square meters or smaller. Given the average area size of new homes during the Pre-HBB period is 410 square meters as shown in Table 1 Panel B, the reduction is about a quarter of the average home size.

[--- INSERT TABLE 8 ABOUT HERE ---]

In Panel B, we conduct a falsification test to examine whether parallel trends exist using a Pre-treatment sample from two years earlier. The regression result shows that *PostHBB*New* is statistically insignificant, indicating no Pre-trend in area size for new homes before the policy. Further, we plot yearly average and median land area size of new houses sold between 2006 and 2014 in Appendix Figure IA6.

We find that for new houses the median land area size is reasonably stable prior to 2010. From 2010 to 2012 (roughly during the HBB period), area size declined; and it went up after 2012. For pre-existing old house sales (Panel B), the median is also quite stable throughout the period we examine. Overall, we confirm the median land area size of new and old houses sold Pre-HBB is reasonably stable over the sample period. Our evidence therefore suggests that the HBB policy exerted a significant effect on home size, causing houses sold around the threshold to be smaller in size.

5.2 Opportunistic Developers

Thus far we have shown the price and liquidity effects of the policy largely center around homes sold just below the threshold and not above or further below it. We further investigate whether the policy causes developers to concentrate their efforts on selling homes just below the threshold. Such efforts may have consequences, in particular with unscrupulous opportunistic developers coming in to sell highly priced (quality-adjusted homes) due to the known demand.[23] To test this hypothesis, we proxy opportunistic developers with the variable *OpDev* with a value of 1 if 50 percent or more of a developer's new home sales during the Post-HBB period are just below the HBB threshold price of between $550,000 to $600,000 (inclusive) and during the Pre-HBB period less than 25 percent of their sales are between $550,000 to $600,000 (inclusive), zero otherwise. We then test for volume and price effects of such developers.

Table 9 Panel A reports summary statistics of new sales counts of *OpDev* and other developers in the Pre- and Post-HBB periods and across various price ranges around the threshold. We find that in the Pre-HBB policy period, opportunistic developers sell only 168 homes (1.86% out of the market

[23] Similar opportunistic overpricing behavior from the supply side is also documented in other contexts. For example, Ridley and Lee (2020) examine the drug price setting behavior in the medical industry and show that Medicare reimbursement based on past prices of the drug could motivate manufacturers to set higher launch prices. The rationale is that health care providers receive higher reimbursement from Medicare if past prices were higher. This evidence is also consistent with the 2018 claim from Medicare's administrator that it "creates a perverse incentive for manufacturers to set higher prices.".

volume of 9,041 units for new home sales), within which only 11 units (or 0.12% are in the [$550K, $600K] price range) just below the threshold. This result indicates these developers had a very small presence in the new home market prior to the HBB.

After the HBB policy was introduced, the sales volume of opportunistic developers increased substantially, selling a total of 1,441 homes (11.16% out of the market volume of 12,907 for new home sales), increased from 168 units in the pre-policy period. And a majority (1,219 out of 1,441) of their sales volume in the post-period comes from sales of policy affected homes with prices below the $600K threshold. This evidence suggests that in response to the policies, these profit-maximizing opportunistic developers adjust their sales strategies to focus on the market segment of the policy affected homes below the threshold price.

In particular, if we zoom in to the sales volume in the [550K, 600K] range, the sales volume of opportunistic developers increased about 86 times from 11 units in pre-HBB period to 948 units after HBB; similarly, their market share grew by about 60 times from 0.12% to 7.34%. In terms of market share of these opportunistic developers within the [550K, 600K] price range, they sell 948 units (or one third of the total sales of 2,709), comparing with only 11 units (or 1.57% of a total sales of 700) before the policy. These results further imply these opportunistic developers are incentivized to concentrate sales just below the threshold.

[--- INSERT TABLE 9 ABOUT HERE ---]

We then analyze the sales volume of *OpDev* in different price brackets for Pre- and Post-HBB. In Table 9 Panel B, we run the following sales volume regression for the Post-HBB period:

$$\left(\frac{c_{it}}{Total\_Sales_t}\right) * 100 = b_0 + b_1 Below_{it} * OpDev_{it} + b_2 Threshold_{it} * OpDev_{it} + b_3 OpDev_{it} + b_4 Below_{it} + b_5 Threshold_{it} + \sum_{j=0}^{q} \beta_j (z_i)^j + \sum_{r \in R} \eta_r I\left\{\frac{\bar{v} + z_i}{r} \epsilon \mathbb{N}\right\} + e_{it} \quad \text{--(8)}$$

Where c_{it} is the number of new home sales in price bin i for period t (Post-HBB period), and $Total\_Sales_t$ is the total new home sales in period t. This regression specification is similar to the sales volume regression in Section 4.2 except we separately apply to Pre- and Post-HBB sample periods and include the $OpDev_{it}$ interaction. We find that the *OpDev* sell less than other developers at the lower end of the housing market, as seen from the negative and statistically significant coefficients on *Below *OpDev* for both the Pre- and Post-HBB periods. *Threshold *OpDev* is negative in the Pre-HBB period but positive and statistically significant in the Post-HBB period which implies *OpDev* sell more homes just below the threshold than other developers Post-HBB only. Specifically, the coefficient for *Threshold* **OpDev* is 1.436, based on the ±$10k window, which implies that the opportunistic developers sell 1.436% more in new sales (as a percentage of total new home sales) in the price bin at the threshold price, compared with other developers. Given the average bin size is about 2.657% (from the Post-HBB intercept coefficient), this represents an over 50% increase in opportunistic developers' sales volume just below the threshold.

In order to test for a pricing effect due to opportunistic developers, we run the following regression with interactions for *OpDev*:

$$Pricek_{ist} = b_0 + b_1 Below_{ist} * OpDev_{ist} + b_2 Below_{ist} * New_{ist} + b_3 OpDev_{ist} + b_4 Below_{ist} + b_5 New_{ist} + X_{ist} + \mu_{is} + m_{it} + \varepsilon_{ist} \quad \text{--(9)}$$

Table 9 Panel C reports our results for the Post-HBB period around the $600k threshold. *Below***OpDev* is positive and statistically significant for all price ranges except for the ±$10k window. The price estimates range between $7,000 to $9,000 more than other developers, controlling for housing characteristics. Given the amount of subsidy ranges from $5,623 to $22,490, the price premium charged by opportunistic developers essentially offsets the policy subsidy by a sizable proportion of between 31% and 124%. The results imply that opportunistic developers charge more than other developers for just below threshold homes consistent with the hypothesis that they are exploiting the increased demand for below threshold homes due to the HBB policy.

5.3 Falsification Tests using Alternative Threshold Prices

To establish causality and to show the HBB policy does not result in any bunching around those non-policy threshold prices, we conduct a falsification test by replacing the $600k threshold with a randomly generated number between $200k and $1,200k (where the bulk of the new home distribution is). Specifically, we run one thousand simulations randomizing threshold prices within the price range and assign random fake 'new' home sales as if the sale would be eligible for grants below the fake policy threshold price, and not eligible if above it. To assign fake new home sales, for all sales falling within each $5,000 price bin, we randomly assign sales as new homes based on the number of actual new home sales in the bin. Thus, the distribution of fake new home sales matches that of actual new home sales. We then redo the regression in Table 5 and calculate average coefficients and t-stats from the 300 simulations.

[--- INSERT TABLE 10 ABOUT HERE ---]

Table 10 reports our results for the Post-HBB period across different price windows around the price threshold (±$10k, ±$20k, and ±$50k windows). The main coefficient of interest is Fake_Below*Fake_New (Fake new home concession/grant recipients just below the fake price threshold), which is close to zero and statistically insignificant in all windows. For example, the largest coefficient in absolute term is 0.174 for the ±$50k price range (statistically insignificant). Given the median new home sales price is $570,000 during this period (Table 1 Panel B), the price distortion of $174 in real term equates to an economically insignificant 0.03% of the median housing price. The falsification tests confirm that the results in Table 5 are not due to chance as there is no result when randomizing both the policy threshold prices and the assignment of subsidy eligible homes.

5.4 Impact of Housing Assistance Benefit on Durable Goods Consumption

In this section, we investigate whether housing grants awarded in a postcode (zip code) have a positive impact on durable goods consumption. Our hypothesis is that the housing benefits received from the government would lead to a wealth effect for the households that receive them and possibly boost consumption, particularly on durable goods. Specifically, we use the purchase of new cars as a proxy for durable goods consumption, which is commonly used in prior literature. For example, in their study of the 2008 economic stimulus package, Parker et al. (2013) find that the 2008 economic stimulus payments were largely used to purchase new vehicles. Mian and Sufi (2012) find fiscal stimulus from the "cash for clunkers" program boosts consumption on new cars. Agarwal et al. (2007) find recipients of federal income tax rebates tend to increase their spending. Note that our analysis differs from the above studies as stamp duty concessions represent a form of savings to the homebuyer and are not a direct cash handout. That is to say, although the stamp duty concession recipients have enjoyed savings from this grant, they may not have the spare liquidity to make further purchases. It is therefore unclear whether the grant would induce recipients to spend as observed in Agarwal et al. (2007), Parker et al. (2013) or Main and Sufi (2012).

5.4.1 Durable Goods Consumption using New Car Sales

To test our hypothesis empirically, we collect the data on car registration information at the postcode level each year from the Australian Bureau of Statistics Motor Vehicle Census. The Census counts the number of motor vehicle registrations in each postcode area and also provides detailed summary disclosures of the brand and year of manufacture, amongst other information. We match this data with the monthly first homeowner grant data from the NSW Office of State Revenue to form the relevant sample in this section.

Our regression specification is as follows:

$$(NewCars_{p,t}/TotalReg_{p,t})*100 = b_0 + b_k \sum_{1}^{k=3} (\widehat{subsidy}_{p,t-3} + \cdots + \widehat{subsidy}_{p,t-1}) + b_4 Avgtaxincome_{p,t-1} + b_5 Pop2011_{p,t} + \phi_{is} + FE(year) + e_{p,t} \quad \text{--(10)}$$

We define $NewCars_{p,t}$ as the total number of new passenger car registrations as of January of year *t* for postcode *p*. We use all new car registrations, new car registrations of the most popular brands (these are Ford, Holden, Honda, Hyundai, Kia, Mazda, Mitsubishi, Nissan, Subaru, Toyota, and Volkswagen), and new car registrations of luxury brands (these are Audi, Aston Martin, Bentley, BMW, Ferrari, Jaguar, Lamborghini, Lexus, Maserati, Mercedes Benz, Porsche, Range Rover, Rolls Royce, and Tesla). We flag a registration as a new car registration if the manufacture year of the car is within the two years prior to the car registration census date. For example, for cars that were registered in January 2018, we identify new cars as those that were manufactured between January 2016 and Dec 2017. $TotalReg_{p,t}$ is defined as the total number of registered passenger cars in that postcode area *p* as of January of year *t*, which is used as a scaling factor to measure the percentage of new car sales in that specific postcode. $subsidy_{p,t-k}$ is either total first home buyer cash grants or stamp duty concessions (SDC) given in the prior *k* financial year (financial years run from July one year to June the next). This is measured as the total number of applications or the dollar value (in thousands of dollars) of these two types of subsidies combined.

We use a rolling window sum of housing grants from the previous year to the third previous financial year. For example, for car registrations in 2018, we use financial years from 2015 to 2017 as the grant periods. This time lag ensures that home buyers have received the grant from the government and so are able to use it towards purchasing a new car, which would be captured in the 2018 Car Registrations Census. $AvgIncome_{p,t-1}$ is the average taxable income in the postcode in the previous financial year. $Pop2011$ is the population of the postcode area collected from the Australian Bureau of Statistics 2011 Census. $d(TopPostcode_k)$ is a dummy of 1 if the postcode is the *k*th (*k*=1,2,…, 10) largest in population based on the 2011 Census, 0 otherwise. *FE(year)* are year fixed effects.

Table 11 reports the summary statistics of key variables used in the analysis at the postcode/year level in Panel A and regression estimation results in Panels B, C and D. Panel A shows that the average number of car registrations per suburb/year is 10,127. The average new car percentage of total registrations is 14.74%, with 10.65% being new popular brand cars and 2.45% being new luxury brand cars. The average number of previous year grants awarded in each suburb/year is 143.51 and the dollar amount is $1,409.50. For previous year stamp duty concessions, the average number is 117.06 and the average dollar amount (savings) is $1,423.28. The average taxable income in our sample is $71,221.23 and the average population in a postcode based on the 2011 Census is 17,535.80.

[--- INSERT TABLE 11 ABOUT HERE ---]

5.4.2 Impact of Housing Subsidy on Car Consumptions: Instrumental Variable Approach

We then conduct regression analysis on the impact of housing subsidy on durable goods consumption as proxied by new car sales. As both a neighborhood's car consumption and housing grants received by its residents could be determined by latent factors, using OLS estimation may suffer from potential endogeneity concern. For example, developers may choose certain neighborhoods they perceive as having promising growth potential for new housing developments. And these time trends in income and the desirability of the up-and-coming neighborhood may drive the car purchase trends.

To address this potential endogeneity concern, we employ the 2SLS estimation approach, and instrument $subsidy_{p,t-k}$ with a Bartik share measure (Bartik, 1991; Goldsmith-Pinkham, 2020) calculated as below:

$$B_{p,t} = subsidy_{p,2009} / \sum_1^P \left(subsidy_{p,2009}\right) \times \left(\sum_1^P \left(subsidy_{p,t-k}\right) - subsidy_{p,t-k}\right) \quad \text{--(11)}$$

where $subsidy_{p,2009}$ is the amount of the subsidy in 2009 and p denotes the postcodes in NSW. The Bartik measure addresses endogeneity concerns by predicting grants using historical shares of grants for each zip code interacted with the statewide total number of grants. These predicted grants are correlated with the amounts awarded each year in each postcode but uncorrelated with yearly new car registrations at the postcode level.

Table 11 Panels B, C, and D report instrumental variable estimation results using all, popular brand, and luxury brand new cars, respectively. We find that coefficients on the subsidy are largely positive regardless of car type, and it is statistically significant for luxury car brands in Panel D.[24] Specifically, the coefficient on $\widehat{Number\ of\ FHB\ grants}\ ('000)$ is 0.408 in column (1) for luxury-brand new car registrations in Panel D, which implies that the proportion of new car registrations in total car registrations increases by 0.408% if the number of FHB grants increase by 1,000 in the past three years for a postcode. Based on the average number of car registrations in a year of 10,128 and the average grant value of $9,822, the increase in luxury cars bought is about a quarter of the average grant value, assuming a luxury car price of $60,000 based on the government's luxury car tax cutoff price during this period.[25]

In Panel D Column (4), the coefficient for $\widehat{SDC\ (\$'Mil)}$ is 0.039, implying that if a neighborhood receives $1 million stamp duty concession in the past three years, it will result in 0.039% more new luxury car registrations in that year, or 23.7% savings spent on luxury cars consumptions[26], consistent in magnitude with the result on grant numbers. Overall, we document evidence that housing assistance grants influence conspicuous consumption through new car purchases.

[24] We report OLS estimates in Appendix Table IA7 and find qualitatively similar results.
[25] The average amount of housing grant is $9,821.62, estimated based on the statistics from Table 11 Panel A, by dividing the mean FHB grant dollar amount in a postcode $1,409,500 by the mean number of FHB grants 143.51 ($1,409,500/143.51= $9,821.62). The luxury car cutoff price of $60,000 is obtained from the Australia Taxation Office Website https://www.ato.gov.au/rates/luxury-car-tax-rate-and-thresholds/. The average number of car registrations in a year 10,128 is from Table 11 Panel A. We can calculate that about 41.32 (=0.408%*10,128) extra new luxury brand car purchase for every 1,000 new grants in a postcode per year. The proportion of grant value spent on buying luxury cars is estimated from 41.32*60,000/(9,821.62*1,000)=25.24%.
[26] Based on the coefficient of 0.039%, and average number of car registration of 10,128, the number of new car registrations is 0.039%*10,128=3.95, or $236,995.2 assuming a luxury car price of $60,000. The proportion of stamp duty concessions spent on cars is then calculated as 236,999/1,000,000= 23.7%.

6. Conclusion

This paper examines the impact of a housing assistance policy with a threshold price on housing market outcomes, using comprehensive housing transaction data from the Australian housing market. Investigating the HBB policy in Sydney, which offered stamp duty tax savings to all new home buyers during July 2010 and June 2012, we find large and acute price bunching slightly below the threshold price, over eight times a counterfactual sales volume estimated based on the bunching estimation technique in Best and Kleven (2018). Meanwhile, we also observe missing mass on the upper side of the threshold price, although to a much lesser extent than on the lower side. The imbalance implies that about one-third of the bunching mass is from buyers moving down from above, while the rest consists of new market entrants attracted by the policy.

Besides the distortion of price density distribution, we also pin down the policy's impact on time-on-market (selling speed) and price level inflation. We show that the policy affected homes sell at a much faster speed, with over 50% reduction of selling time, consistent with the surge in demand for policy affected homes induced by the HBB policy.

More importantly, the demand surge for homes priced below the policy threshold price also drives up prices in that specific market segment and leads to an overpricing of $3,000 based on our difference-in-difference analysis, where old homes serve as the counterfactual group. This price inflation translates to up to 56% of the received benefit from the HBB grants, which offsets the benefit considerably. We further find that opportunistic developers that strategically shift their focus to sell policy-eligible new homes also contribute to a sizeable proportion of the observed overpricing.

We further analyze the policy impact on housing quality in terms of area size, and find that the area size of homes around the threshold in the HBB period is smaller than that in the prior period, suggesting that the assistance policy also distorts housing quality. Finally, we find evidence that areas with many housing assistance recipients also have higher durable good consumptions in terms of new car purchases, consistent with a wealth effect brought on by the grants.

Overall, our study document unique evidence on the effectiveness and externalities of housing subsidies with threshold price to improve housing affordability. Urban housing markets throughout the world face increasing challenges in balancing the need to stimulate housing construction post crisis and managing housing affordability for social wellbeing. Although our study is based on the Australian housing market, the findings could be generalizable to offer useful inference for the effectiveness of public policies in other housing markets.

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Appendix 1: Details of the HBB Policy and other Housing Assistance Policies around the HBB Policy Period

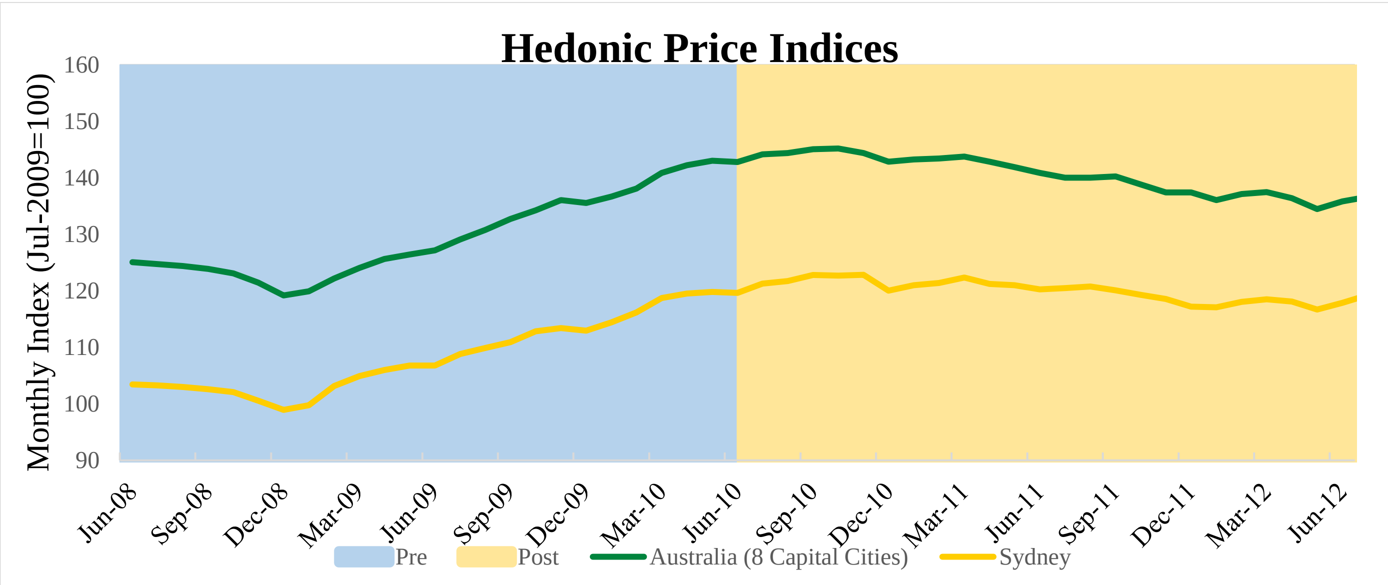
Policy	Period	Benefit	Eligible Benefit
Pre-HBB	8 June 2008 – 8 June 2010	Stamp Duty Reduction	**First Home Buyers (regardless New or Pre-existing/Old Homes)**: Stamp duty reductions are offered to eligible first home buyers if their homes are priced below $600,000. Stamp duty is completely waived if home price is below $500,000. **All Other Buyers:** None
		Cash Rebate	**First Home New Home Buyers**: Various cash bonuses[27] from both state and federal governments; amounts range from $10,000 to $35,000 depending on time period. **First Home Old Home Buyers:** Various cash bonuses from both state and federal governments; amounts range from $3,500 to $21,000 depending on time period. **All Other Buyers:** None
Post-HBB	1 July 2010 – 30 June 2012	Stamp Duty Reduction	**First Home New Home Buyers**: Same as Pre-period. **First Home Old Home Buyers:** Same as Pre-period until 31 Dec 2011. No stamp duty reduction thereafter. **All New Home Buyers (HOME BUILDERS BONUS):** Buyers of new dwellings priced up to $600,000 will receive a 25% reduction in normal duties, worth up to $5,623, if building has already started. Alternatively, buyers purchasing 'off-the-plan' – before construction is underway – will pay zero stamp duty, saving up to $22,490.
		Cash Rebate	**First Home New Home Buyers**: $3,000 from the NSW state government with no cap, and $7,000 from the federal government with a cap of $750,000 (up to 31 Dec 2010) or $835,000 (from 1 Jan 2011 to 30 June 2012). **First Home Old Home Buyers:** $7,000 from the federal government with a cap of $750,000 (up to 31 Dec 2010) or $835,000 (from 1 Jan 2011 to 30 June 2012). **All Other Buyers:** None

[27] Specifically, the amount of the cash rebate from the Federal government is: $7,000 (no price cap) from 8 June 2008 to 30 June 2008; $21,000 (no price cap) from 1 July 2008 to 30 Jul 2009; and $7,000 ($750,000 price cap) from 1 Jan. 2010 to 8 June 2010. In addition, the amount of the cash rebate from the NSW state government is: $14,000 (no price cap) from 8 June 2008 to 30 Sep. 2009; and $7,000 (no price cap) from 1 Oct. 2009 to 31 Dec. 2009. On top of the above, the amount of the cash rebate from the NSW New Home Buyers First Home Owner Supplement is $3,000 (no price cap) from 11 Nov. 2008 to 8 June 2010.

Figure 1: Housing Market Trend

Panel A shows the aggregated housing price index in Australia's eight capital cities (green line) and that of Sydney (gold line). The index starts at the nominal value of 100 in June 2008. The average price of property transactions in Sydney during the period June 2008 to June 2012 was AUD 604,200 and the average price in the eight capital cities during our data period was AUD 520,100. Panel B shows the monthly total number of property transactions relative to the number that took place in July 2009 in Sydney (gold line) and Australia's eight capital cities (green line). Price and volume data are from Corelogic. The average monthly number of property transactions in Sydney during the period June 2008 to June 2012 was 93,178 while the average monthly number of property transactions in this period in all eight capital cities was 302,510.

Panel A: Housing Price Index



Panel B: Standardized Transaction Volume

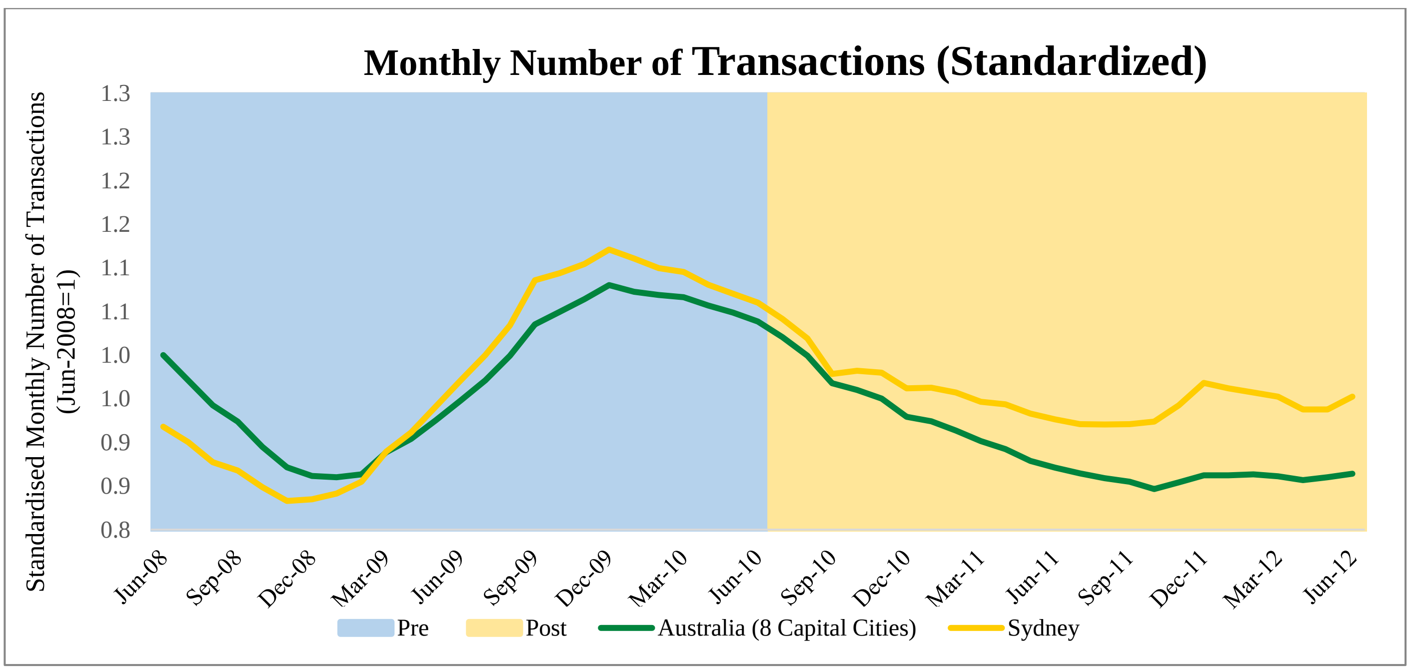
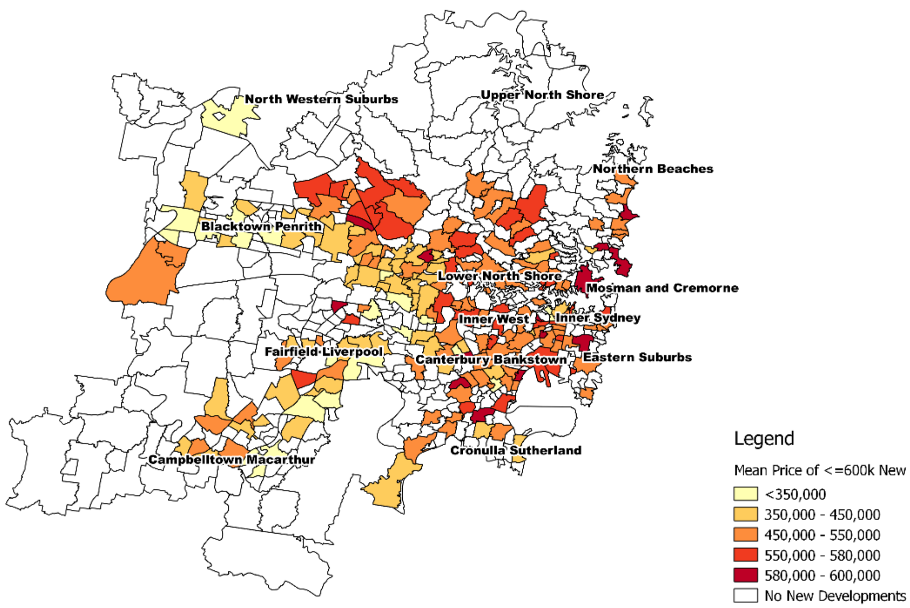


Figure 2: Heat Maps of Mean Housing Prices and Sales Frequency of New Home Sales during the HBB Policy across Sydney Suburbs

The figures report the mean property prices and sales frequency of new property sales in the Post-HBB period across Sydney suburbs. Panels A and B report mean property prices and sales frequency Post-Home Builders Bonus (HBB) policy, respectively. The HBB policy is from 1 July 2010 to 30 June 2012.

Panel A: Mean Sales Prices of New Homes less than $600,000 in the Post-HBB period



Panel B: Sales Frequency of New Homes less than $600,000 in the Post-HBB period

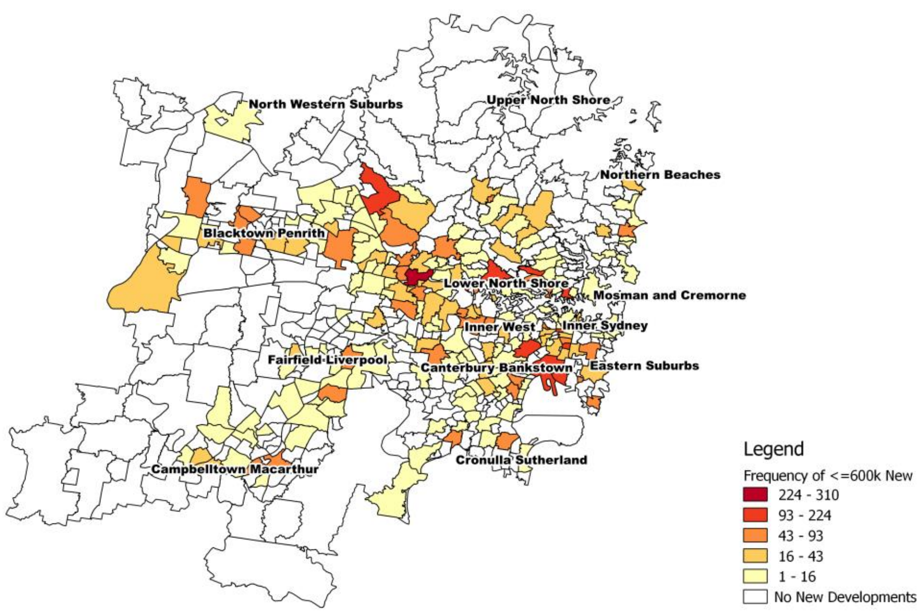
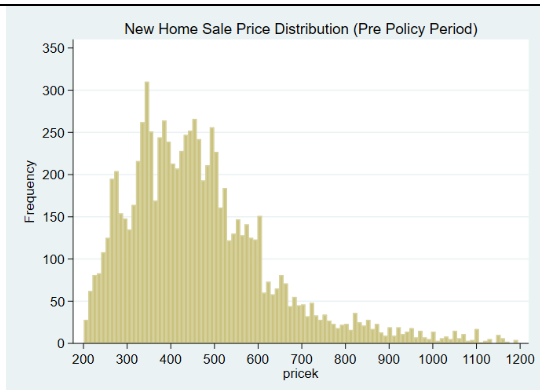
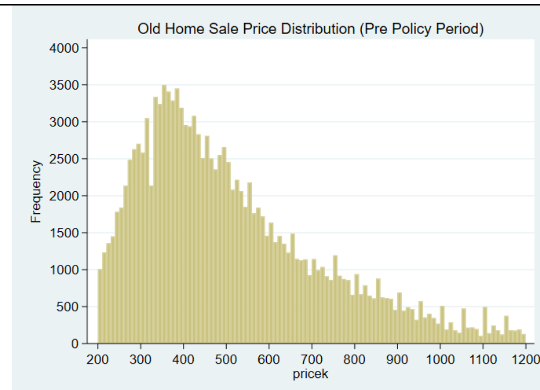


Figure 3: Histogram of New and Old Home Prices Pre- and Post-HBB

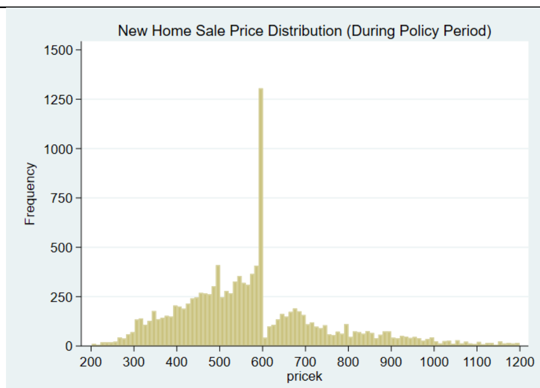
The figure shows the distribution of new and old home sales price Pre- (8 June 2008 to 8 June 2010) and Post- (1 July 2010 to 30 June 2012) the Home Builders Bonus (HBB) policy. The distributions are truncated for sales prices between $200,000 and $1,200,000. Panels A and B report for the Pre-HBB period new and old homes, respectively. Panels C and D report for the Post-HBB period new and old homes, respectively.



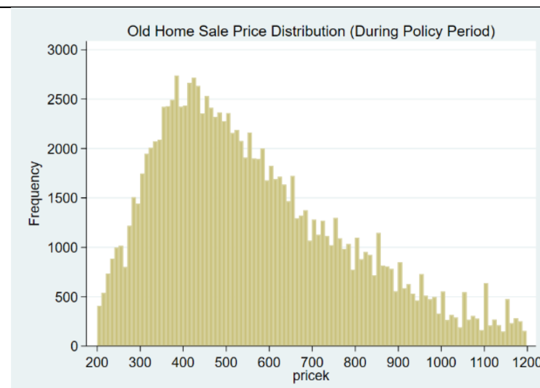
Panel A: Pre-HBB Period, New Homes



Panel B: Pre-HBB Period, Old Homes



Panel C: Post-HBB Period, New Homes

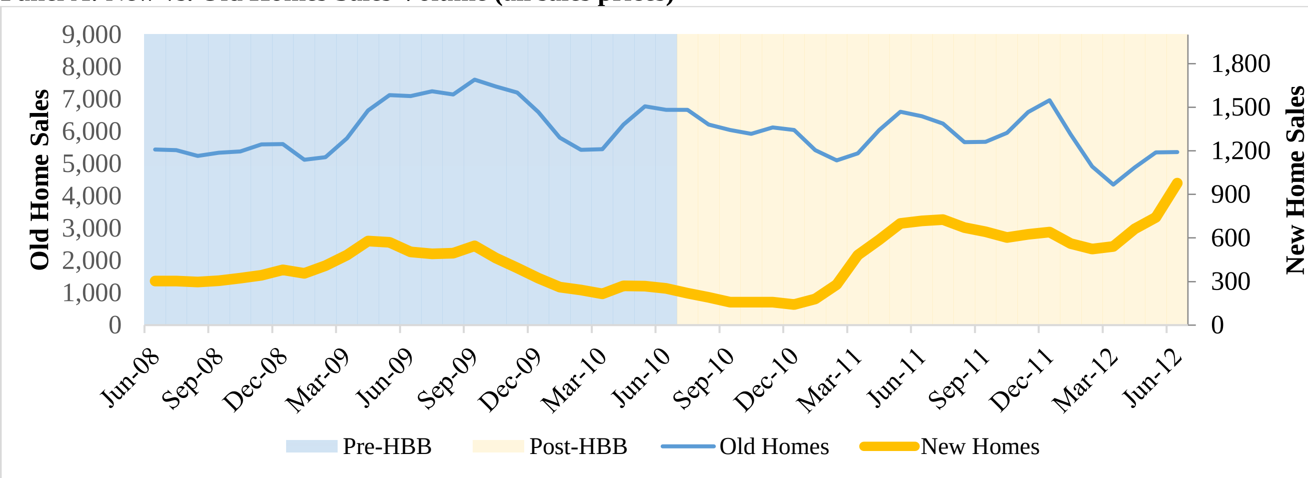


Panel D: Post-HBB Period, Old Homes

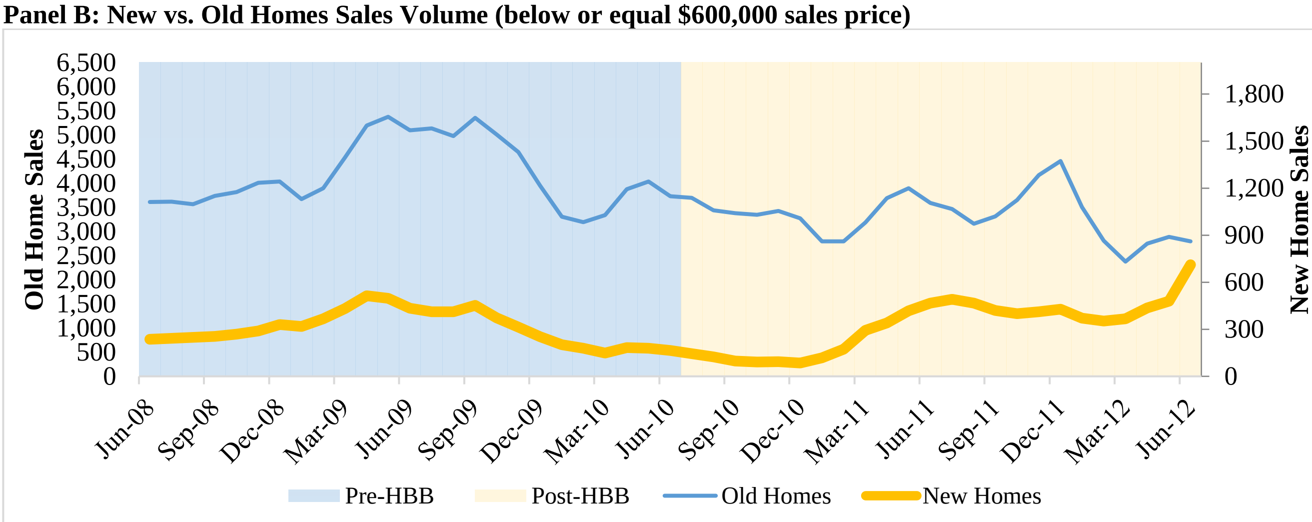
Figure 4: New vs. Old Home Sales Volumes Above and Below Threshold Price

Panel A reports new versus old home sales quarterly rolling average volume during our sample period. Panel B reports old vs. new for sales prices below or to equal $600,000. Panel C reports old vs. new for sales prices above $600,000.

Panel A: New vs. Old Homes Sales Volume (all sales prices)



Panel B: New vs. Old Homes Sales Volume (below or equal $600,000 sales price)



Panel C: New vs. Old Homes Sales Volume (above $600,000 sales price)

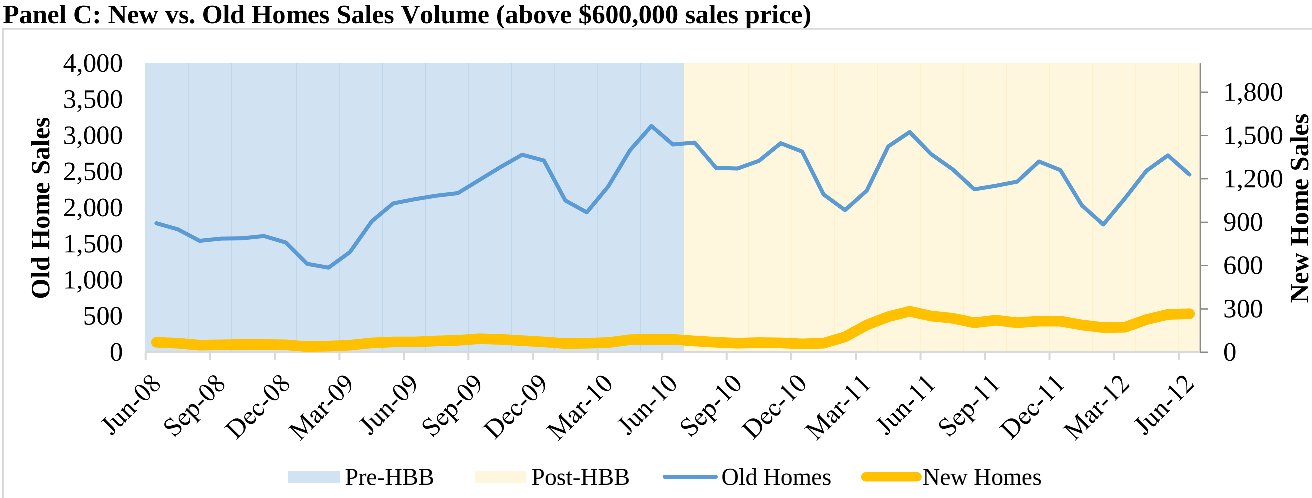


Figure 5: Counterfactual Distribution around Bunching Regions

This figure presents the bunching effect around the \$600,000 threshold, in response to the HBB policy from 1 July 2010 to 30 June 2012. We follow Best and Kleven (2018) in working out the counterfactual distribution around thresholds of interest. The data is individual new housing sales for the Sydney metropolitan area from Australian Property Monitors. Transactions are grouped into AUD\$5,000 price bins from \$150,000 to \$1,200,000. We use the following regression to estimate the counterfactual distribution around a threshold at price $\bar{v}$:

$$c_i = \sum_{j=0}^{q} \beta_j (z_i)^j + \sum_{r \in R} \eta_r I\left\{\frac{\bar{v} + z_i}{r} \epsilon \mathbb{N}\right\} + \sum_{k=\bar{h}_{v^-}}^{\bar{h}_{v^+}} \gamma_k I\{i = k\} + e_i$$

where c_i is the number of transactions in price bin i, z_i is the distance between price bin i and the price bin at threshold $\bar{v}$. q is the polynomial order, set at 5. The second term includes fixed effects for prices that are multiples of round numbers in set R, where *R={10,000; 25,000; 50,000}*, $\mathbb{N}$ is the set of natural numbers, and $I\{.\}$ denotes the dummy function. The third term excludes a region (v^-, v^+) around the threshold that is being distorted by bunching responses to the threshold. We determine the lower threshold when the slope between bins first changes direction when moving to the left of the threshold. The upper threshold is determined when the slope between bins changes direction after the first time the slope becomes positive as we move to the right of the threshold. e_i is an error term. The estimate of the counterfactual distribution is defined as $\hat{c}_i$ from the equation omitting the contribution of the dummies in the excluded range. We estimate excess bunching as the difference between the observed and counterfactual bin counts within the region (v^-, v^+) that falls below the threshold as $\hat{B} = \sum_{i=v^-}^{\bar{v}} (c_i - \hat{c}_i)$ and the missing mass above the threshold as $\hat{M} = \sum_{i=\bar{v}}^{v^+} (\hat{c}_i - c_i)$. Estimates of $\hat{B}$ and $\hat{M}$ are scaled by the average predicted counterfactual bin counts in the omitted region. Δv is the difference between v* and $\bar{v}$ where v* is found where B is equal to the cumulative counterfactual bin counts above $\bar{v}$ to v*. To calculate standard errors on all estimates we use the residual bootstrap method as in Chetty et al. (2011) with 200 replications. The vertical dashed lines represent the lower and upper boundaries of the excluded region that we do not use to estimate the counterfactual distribution. Panel A reports bunching measure components (standard errors in parentheses). Panel B plots the bin counts for between 550k to 650k housing prices.

Panel A. Summary Statistics of Components of Bunching Measures

b (unstandardized raw number)	m (unstandardized raw number)	Standardizing denominator	b	m	m-b
1039.36	336.63	123.89	8.39	2.72	-5.67
(30.26)	(46.06)		(0.20)	(0.31)	(0.39)

Panel B. Plot of Actual and Counterfactual Bins

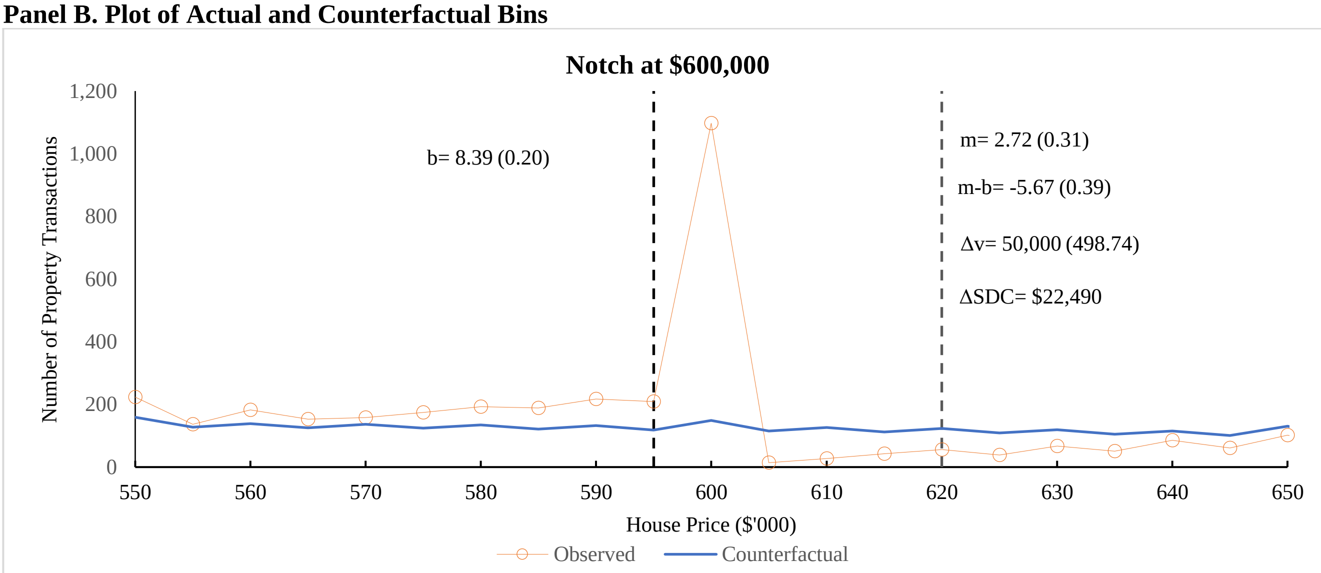


Table 1: Summary Statistics

This table reports summary statistics of individual home sale transactions in the Sydney metropolitan area during our sample period. Panel A reports the mean, median, standard deviation, first and third quartile statistics for the price (in $AUD thousands), dummy for new home, dummy for auction sales, number of bedrooms, number of bathrooms, whether the home has parking, and whether the home is a house. Panel B reports summary statistics split by new homes and old homes for the mode, mean, and median transaction price by policy sample periods. Refer to Appendix 1 for policy sample period dates. Data is obtained from Australian Property Monitors.

Panel A: Descriptive Statistics for Key Variables

Variable	Mean	Median	Std	P25	P75	N
Price (in thousands)	656.24	510	605.32	375	735	311,220
New Home Dummy	0.07	0	0.26	0	0	311,220
Opportunistic Developer Dummy (New only)	0.07	0	0.26	0	0	21,948
Auction Dummy	0.13	0	0.34	0	0	311,220
Number of Bedrooms	2.86	3	1.06	2	4	263,626
Number of Bathrooms	1.59	1	0.71	1	2	263,626
Parking	0.71	1	0.46	0	1	311,220
House	0.51	1	0.50	0	1	311,220

Panel B: Price Statistics (in thousands) for New and Old Homes by Policy Sample Period

	New Homes				*Old Homes*				*All*
Policy Period	**Mode**	**Mean**	**Median**	**N**	**Mode**	**Mean**	**Median**	**N**	**N**
Pre-HBB	500.00	505.09	442.00	9,041	500.00	627.00	478.00	150,965	160,006
Post-HBB	600.00	633.56	570.00	12,907	500.00	700.15	550.00	138,307	151,214
Overall	600.00	580.64	515.00	21,948	500.00	661.97	510.00	289,272	311,220
	New Homes ≤ $600k				*Old Homes ≤ $600k*				*All*
Policy Period	**Mode**	**Mean**	**Median**	**N**	**Mode**	**Mean**	**Median**	**N**	**N**
Pre-HBB	500.00	408.81	408.00	7,445	500.00	392.97	390.00	101,387	108,832
Post-HBB	600.00	484.58	500.00	8,609	500.00	420.54	423.00	79,160	87,769
Overall	600.00	449.44	460.00	16,054	500.00	405.06	405.00	180,547	196,601

Table 2: Price Distribution and Sales Prices around the Threshold Price

This table reports the summary statistics for the percentage frequency and sales price in the distribution for new homes and pre-existing old homes to above and below the policy price threshold of $600,000, and the statistical difference in percentage frequency of distributions between new and old homes. Panel A presents the result on sales volume, comparing new and old home sales in the Post-HBB policy period. Panel B presents the result on sales price in thousands, comparing new and old home sales in the Post-HBB policy period. Refer to Appendix 1 for the policy periods. *t*-stats in parentheses. ***, **, * signifies statistical significance at the 1, 5, and 10 percent level, respectively.

Panel A: Comparison of Sales Volume between New and Old Homes in Post-HBB Policy Period

	New Homes (Treatment Group)		Old Homes (Control Group)		New - Old	
Price Range	**Percentage**	**N**	**Percentage**	**N**	**Percentage Diff**	***t-stat***
P=600k	4.67	603	0.68	939	3.99***	(43.45)
Below:(*P*-20k, *P*)	9.61	1,241	2.69	3,714	6.92***	(42.54)
Above: (*P*, *P*+20k)	1.08	140	2.35	3,246	-1.27***	(-9.27)
Below - Above	8.53		0.34		8.19***	(38.12)
Below: (*P*-50k, *P*)	17.52	2,261	6.98	9,659	10.54***	(42.73)
Above: (*P*, *P+50k*)	4.22	545	5.99	8,280	-1.77***	(-8.18)
Below - Above	13.30		1.00		12.30***	(36.29)

Panel B: Comparison of Sales Prices ($'000) between New and Old Homes in Post-HBB Policy Period

	New Homes (Treatment Group)		Old Homes (Control Group)		New – Old	
Price Range	**Mean Price**	**N**	**Mean Price**	**N**	**Diff in Mean Price**	***t-stat***
P=600k	600.00	603	600.00	939	0.00	-
Below:(*P*-20k, *P*)	592.25	1,241	587.70	3,714	4.55***	(22.58)
Above: (*P*, *P*+20k)	614.51	140	612.47	3,246	2.04***	(4.19)
Below - Above	-22.26		-24.77		2.51***	(4.57)
Below: (*P*-50k, *P*)	579.19	2,261	572.19	9,659	7.01***	(20.02)
Above: (*P*, *P+50k*)	632.63	545	627.63	8,280	5.00***	(7.85)
Below - Above	-53.43		-55.44		2.01**	(2.72)

Table 3: Difference-in-Difference Analysis on Home Sale Volume

The table reports coefficient estimates of the following regression on home sale volume:

$$\left(\frac{c_{it}}{NewSales_t}\right) * 100 \ = b_0 + b_1 PostHBB_{it} * Threshold_{it} + b_2 PostHBB_{it} * [-X, -Y]_{it} + b_3 PostHBB_{it} * [Y, X]_{it}$$
$$+ b_4[-X, -Y]_{it} + b_5 Threshold_{it} + b_6[Y, X] + b_7 PostHBB_{it} + \sum_{j=0}^{q} \beta_j (z_i)^j + \sum_{r \in R} \eta_r I \left\{ \frac{\bar{v} + z_i}{r} \epsilon \mathbb{N} \right\} + e_{it}$$

where c_{it} is the number of new home sales in price bin *j* for period *t* (Pre- or Post-HBB), and $NewSales_t$ is the total new home sales in period *t*. $PostHBB_{it}$ is a dummy of 1 if the sale occurs in the Post-HBB policy period from 1 July 2010 to 30 June 2012. *[-X, -Y]* is a dummy indicating whether the transaction price is greater than the policy threshold price minus *X* and lower than or equal to the threshold price minus Y. *[Y, X]* is a dummy indicating whether the transaction price is greater than the threshold price plus Y and less than or equal to the threshold price plus X. *X* and Y take value of $10,000, 20,000 or 50,000. *Threshold* is a dummy of 1 if the bin includes the threshold price, 0 otherwise. z_i is the distance between price bin *i* and the price bin at threshold $\bar{v}$. q is the polynomial order, set at 5. The sixth term includes fixed effects for prices that are multiples of round numbers in set *R*, where *R={10,000; 25,000; 50,000}*, $\mathbb{N}$ is the set of natural numbers, and $I\{.\}$ denotes the dummy function. Transactions are grouped into $5,000 price bins from $200,000 to $1,200,000. The data are individual new housing sales for the Sydney metropolitan area from Australian Property Monitors. See Appendix 1 for each policy's sample period. Standard errors are in parentheses. ***, **, * signifies statistical significance at the 1, 5, and 10 percent level, respectively.

$Y=\left(\frac{c_{it}}{NewSales_t}\right)*100$	(1)	(2)	(3)
PostHBB*Threshold	7.518***	7.528***	7.557***
	(0.025)	(0.025)	(0.025)
PostHBB*[-10k, 0]	1.100***	1.11***	1.139***
	(0.106)	(0.106)	(0.106)
PostHBB*[0, 10k]	-0.112***	-0.102***	-0.073***
	(0.026)	(0.026)	(0.026)
PostHBB*[-20k, -10k]		0.855***	0.885***
		(0.102)	(0.103)
PostHBB*[10k, 20k]		0.072**	0.101***
		(0.030)	(0.03)
PostHBB*[-50k, -20k]			0.698***
			(0.08)
PostHBB*[20k, 50k]			0.233***
			(0.06)
Threshold	0.437***	0.432***	0.401***
	(0.072)	(0.073)	(0.078)
[-10k, 0]	-0.157	-0.163	-0.191*
	(0.107)	(0.107)	(0.11)
[0, 10k]	-0.469***	-0.475***	-0.504***
	(0.035)	(0.035)	(0.041)
[-20k, -10k]		-0.12	-0.148
		(0.101)	(0.103)
[10k, 20k]		-0.379***	-0.408***
		(0.038)	(0.043)
[-50k, -20k]			-0.216***
			(0.066)
[20k, 50k]			-0.361***
			(0.044)
PostHBB	-0.047*	-0.057**	-0.086***
	(0.025)	(0.025)	(0.025)
$10k Round Bin Dummy	0.103***	0.103***	0.103***
	(0.026)	(0.025)	(0.024)
$25k Round Bin Dummy	0.025	0.025	0.027
	(0.042)	(0.042)	(0.036)
$50k Round Bin Dummy	0.154**	0.154**	0.154**
	(0.074)	(0.074)	(0.069)
Intercept	0.768***	0.774***	0.803***
	(0.037)	(0.037)	(0.042)
Price Bin Polynomials	5	5	5
Number of Observations	402	402	402
Adjusted R-squared	0.8556	0.8639	0.8778

Table 4: Triple Difference-in-Difference Analysis on Time-on-Market

The table reports coefficient estimates of the following regressions on time-on-market:

$$TOM_{ist} = b_0 + b_1 Below_{ist} * PostHBB_{ist} * New_{ist} + b_2 Below_{ist} * New_{ist} + b_3 Below_{ist} * PostHBB_{ist} + b_4 PostHBB_{ist} * New_{ist} + b_5 Below_{ist} + b_6 PostHBB_{ist} + b_7 New_{ist} + X_{ist} + \mu_{is} + m_{it} + \varepsilon_{ist}$$

where TOM_{ist} is the time on market of home i in suburb s sold on date t, calculated as the sales date less the first advertised date of the home. For new homes, we use the first sales date in the block or estate as the first advertised date (removing the first sold home in the block/estate). To enter the sample, both the first advertised date and sales date must be in the Pre- or Post-HBB period. $PostHBB_{it}$ is a dummy of 1 if the sale occurs in the Post-HBB policy period from 1 July 2010 to 30 June 2012. New_{ist} is a dummy denoting if the property is a new home. X_{ist} are control variables that include the number of bedrooms, number of bathrooms, parking, and property type (e.g. house, apartment, etc.). μ_{is} are suburb fixed effects and m_{it} are year/quarter fixed effects. Standard errors are clustered by suburb. The data are individual new housing sales for the Sydney metropolitan area from Australian Property Monitors. See Appendix 1 for each policy's sample period. The sample for Column 1 includes transaction prices within ±$10,000 of the threshold, Column 2 is the ±$20,000 window, and Column 3 is the ±$50,000 window. Standard errors are in parentheses. ***, **, * signifies statistical significance at the 1, 5, and 10 percent level, respectively.

Y: time-on-market	(1) ±$10k window	(2) ±$20k window	(3) ±$50k window
PostHBB*Below*New	-133.727	-124.617**	-93.636**
	(86.618)	(54.594)	(39.111)
PostHBB*Below	1.629	-2.747	-3.232
	(5.770)	(3.505)	(2.499)
PostHBB*New	107.631	86.424	58.494
	(86.994)	(60.335)	(40.154)
Below*New	-67.507**	-10.477	9.852
	(31.129)	(22.664)	(30.831)
PostHBB	136.710***	125.882***	104.326***
	(29.484)	(23.644)	(12.340)
Below	1.291	4.154*	4.610**
	(3.882)	(2.505)	(1.795)
New	182.723***	149.649***	132.155***
	(33.032)	(24.692)	(17.749)
Constant	-86.884	-124.858***	-95.446***
	(66.071)	(41.039)	(26.693)
Housing Controls	Yes	Yes	Yes
Property Type FE	Yes	Yes	Yes
Suburb FE	Yes	Yes	Yes
Year/Quarter FE	Yes	Yes	Yes
Clustered SE by	Suburb	Suburb	Suburb
Observations	5,173	9,712	23,109
Adj. R-squared	0.196	0.197	0.192

Table 5: Effect of HBB Policy on Sales Prices around $600k During Policy Period

This table examines the effect of the HBB policy on the housing price below and above the threshold price. We estimate the following regression and nested variants:

$$Pricek_{ist} = b_0 + b_1 New_{ist} + b_2 Below_{ist} + b_3 Below_{ist} * New_{ist} + X_{ist} + \mu_{is} + m_{it} + \varepsilon_{ist}$$

$Pricek_{ist}$ is the property price in $AUD thousands. $Below_{ist}$ is a dummy if the sales price is below the threshold price. New_{ist} is a dummy for if the property is a new home and X_{ist} are control variables that include the number of bedrooms, number of bathrooms, parking, and property type (e.g. house, apartment, etc.). μ_{is} are suburb fixed effects. m_{it} are year/quarter fixed effects. Standard errors are clustered by suburb. The sample includes all individual housing sales in the Sydney metropolitan area from Australian Property Monitors during the sample periods. Panel A uses the Post-HBB policy period sample with a threshold price of $600,000 from 1 Oct 2010 to 30 June 2012. Panel B uses the Pre-HBB policy sample 8 June 2008 to 8 June 2010, when HBB policy was not in place, as a placebo test. Clustered standard errors are in parentheses. ***, **, * signifies statistical significance at the 1, 5, and 10% level, respectively.

Panel A: Post-HBB Policy $600k Threshold (1 Oct 2010 to 30 Jun 2012)

	(1)	(2)	(3)
Y: price in thousands	±$10k window	±$20k window	±$50k window
Below*New	1.718**	2.250**	3.158**
	(0.723)	(0.948)	(1.302)
New	0.143	1.726*	5.154***
	(0.650)	(0.884)	(1.110)
Below	-11.762***	-22.228***	-50.951***
	(0.125)	(0.169)	(0.301)
Constant	591.576***	472.367***	789.132***
	(119.807)	(143.115)	(181.242)
Housing Controls	Yes	Yes	Yes
Property Type FE	Yes	Yes	Yes
Suburb FE	Yes	Yes	Yes
Year/Quarter FE	Yes	Yes	Yes
Clustered SE by	Suburb	Suburb	Suburb
Observations	4,265	7,886	18,435
Adj. R-squared	0.686	0.729	0.750

Panel B: Pre-HBB Policy $600k Threshold (8 June 2008 to 8 June 2010)

	(1)	(2)	(3)
Y: price in thousands	±$10k window	±$20k window	±$50k window
Below*New	0.803	1.335	-0.347
	(0.816)	(0.845)	(1.383)
New	-0.293	0.043	3.446***
	(0.614)	(0.772)	(1.170)
Below	-11.435***	-21.956***	-51.810***
	(0.161)	(0.192)	(0.298)
Constant	589.420***	606.597***	611.764***
	(9.181)	(3.641)	(10.023)
Housing Controls	Yes	Yes	Yes
Property Type FE	Yes	Yes	Yes
Suburb FE	Yes	Yes	Yes
Year/Quarter FE	Yes	Yes	Yes
Clustered SE by	Suburb	Suburb	Suburb
Observations	3,251	6,104	14,974
Adj. R-squared	0.673	0.725	0.751

Table 6: Effect of HBB Policy on Sales Prices around $600k Compared with Pre-HBB Period

Panel A reports coefficient estimates for the following regression:

$$Pricek_{ist} = b_0 + b_1 Below_{ist} * PostHBB_{ist} * New_{ist} + b_2 Below_{ist} * New_{ist} + b_3 Below_{ist} * PostHBB_{ist} + b_4 PostHBB_{ist} * New_{ist} + b_5 Below_{ist} + b_6 PostHBB_{ist} + b_7 New_{ist} + X_{ist} + \mu_{is} + m_{it} + \varepsilon_{ist}$$

$Pricek_i$ is the property price in $AUD thousands. $Below_{ist}$ is a dummy denoting whether the property is below the price threshold. $PostHBB_{ist}$ is a dummy of 1 if the sale occurs during the HBB policy period from 1 July 2010 to 30 June 2012. New_{ist} is a dummy denoting if the property is a new home. X_{ist} are control variables that include the number of bedrooms, number of bathrooms, parking, and property type (e.g. house, apartment, etc.). μ_{is} are suburb fixed effects and m_{it} are year/quarter fixed effects. Standard errors are clustered by suburb. The data are all individual housing sales in the Sydney metropolitan area from Australian Property Monitors. See Appendix 1 for policy sample periods. Panel A reports results using the Pre- and Post-HBB policy windows. The sample for Column 1 includes transaction prices within ±$10,000 of the threshold, Column 2 is the ±$20,000 window, and Column 3 is the ±$50,000 window. Panel B reports results using one-sided price windows either only above or below the threshold. Panel C reports further tests for price ranges further below the threshold for price between -400k to -300k below the threshold in column 1, to -100k to -50k in column 4. Clustered standard errors are in parentheses. ***, **, * signifies statistical significance at the 1, 5, and 10% level, respectively.

Panel A: Triple Interaction of Post-HBB Policy with Price Windows of New Homes (with $600k as the Threshold Price)

	(1)	(2)	(3)
Y: price in thousands	±$10k window	±$20k window	±$50k window
Below*PostHBB*New	0.950	0.883	3.889**
	(1.000)	(1.187)	(1.833)
Below*New	0.940	1.405	-0.507
	(0.783)	(0.866)	(1.389)
Below*PostHBB	-0.332*	-0.269	0.694*
	(0.193)	(0.246)	(0.393)
PostHBB*New	0.248	2.011*	1.766
	(0.870)	(1.094)	(1.578)
Below	-11.434***	-21.960***	-51.835***
	(0.150)	(0.186)	(0.287)
PostHBB	0.252	1.174	4.125***
	(0.565)	(0.739)	(1.023)
New	-0.333	-0.303	3.420***
	(0.639)	(0.781)	(1.260)
Constant	607.311***	611.211***	610.900***
	(1.575)	(1.865)	(1.368)
Housing Controls	Yes	Yes	Yes
Property Type FE	Yes	Yes	Yes
Suburb FE	Yes	Yes	Yes
Year/Quarter FE	Yes	Yes	Yes
Clustered SE by	Suburb	Suburb	Suburb
Observations	7,516	13,990	33,409
Adj. R-squared	0.682	0.727	0.749

Panel B: Pre- and Post-HBB Policy Window (above or below $600k Threshold)

	(1)	(2)	(3)	(4)	(5)	(6)
Y: price in thousands	-10k window	+10k window	-20k window	+20k window	-50k window	+50k window
PostHBB*New	1.074**	-0.045	2.839***	1.655	5.832***	1.830
	(0.495)	(1.011)	(0.701)	(1.185)	(1.422)	(1.676)
PostHBB	0.067	0.244	1.420	0.385	7.137***	1.467
	(0.841)	(0.666)	(1.006)	(1.037)	(1.217)	(1.677)
New	0.705*	-0.322	0.974	-0.425	2.651**	3.201**
	(0.414)	(0.646)	(0.649)	(0.860)	(1.220)	(1.265)
Constant	594.418***	612.340***	588.542***	601.822***	560.053***	600.650***
	(2.578)	(4.860)	(2.589)	(4.042)	(1.735)	(3.933)
Housing Controls	Yes	Yes	Yes	Yes	Yes	Yes
Property Type FE	Yes	Yes	Yes	Yes	Yes	Yes
Suburb FE	Yes	Yes	Yes	Yes	Yes	Yes
Year/Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Clustered SE by	Suburb	Suburb	Suburb	Suburb	Suburb	Suburb
Observations	4,957	2,559	8,491	5,499	19,389	14,020
Adj. R-squared	0.047	0.024	0.044	0.018	0.053	0.032

Panel C: Pre- and Post-HBB Policy Window (further below $600k Threshold)

	(1)	(2)	(3)	(4)
Y: price in thousands	[-400k, -300k]	[-300k, -200k]	[-200k, -100k]	[-100k, -50k]
PostHBB*New	-6.543	1.230	-2.399	-0.220
	(5.873)	(3.274)	(2.493)	(1.176)
PostHBB	27.634***	31.361***	24.825***	5.454***
	(2.979)	(1.714)	(1.153)	(0.742)
New	13.599**	10.662***	12.126***	4.043***
	(5.275)	(2.662)	(2.044)	(0.882)
Constant	203.279***	339.323***	420.451***	509.540***
	(6.222)	(2.506)	(3.084)	(2.978)
Housing Controls	Yes	Yes	Yes	Yes
Property Type FE	Yes	Yes	Yes	Yes
Suburb FE	Yes	Yes	Yes	Yes
Year/Quarter FE	Yes	Yes	Yes	Yes
Clustered SE by	Suburb	Suburb	Suburb	Suburb
Observations	12,987	34,321	42,002	19,098
Adj. R-squared	0.320	0.307	0.202	0.055

Table 7: Price Premium Differences around Threshold Prices and Sample Periods

The table reports the average price premiums of new homes in our policy periods within respective price ranges. The price premium is the difference between the log sales price and the predicted log sales price (multiplied by 100 for visual purposes), using a hedonic model:

$$\ln(Price_{ist}) = b_0 + b_1 New_{ist} + X_{ist} + \mu_{is} + m_{it} + e_{ist}$$

Where New_{ist} is a dummy denoting whether the property is a new home, X_{ist} is a set of control variables for property characteristics (number of bedrooms, number of bathrooms, suburb, etc.), μ_{is} are suburb fixed effects, m_{it} are year/quarter fixed effects, and e_{ist} is an error term. Refer to Appendix 1 for the policy sample periods. *t*-stats in parentheses. ***, **, * signifies statistical significance at the 1, 5, and 10% level, respectively. The table reports average price premiums for new homes for various price range groups and sample periods using a hedonic model across the full sample from Jan 2000 to June 2019. Panel A reports the coefficients of the hedonic model used for predicting log prices. Panel B reports the average premiums for different price ranges and sample periods.

Panel A: Coefficients from Hedonic Model for Price Prediction

Y: ln(price)	
Beds	0.125***
	(0.004)
Baths	0.129***
	(0.004)
Has Parking	0.042***
	(0.006)
New	0.134***
	(0.007)
Constant	10.417***
	(0.151)
Property Type FE	Yes
Property Type FE*Area Size	Yes
Suburb FE	Yes
Year/Quarter FE	Yes
Clustered SE by	Suburb
Observations	1,036,485
Adj. R-squared	0.853

Panel B: Average Price Premiums

	Pre-HBB		Post-HBB		Post minus Pre
Price Range	Premium	N	Premium	N	Premium
Exact Bunching at Threshold					
P=600k	0.76	39	3.850**	162	3.09
	(0.33)		(2.36)		(0.88)
Bunching at (-20k, +20k) range					
Below: (*P*-20k, *P*)	0.69	205	1.86***	690	1.16
	(0.68)		(2.89)		(0.89)
Above: (*P*, *P*+20k)	-1.30	74	-2.12	64	-0.81
	(-0.67)		(-1.17)		(-0.3)
Below – Above	2.00	279	3.97*	754	1.98
	(0.97)		(1.82)		(0.64)
Bunching at (-50k, +50k) range					
Below: (*P*-50k, *P*)	0.00	459	1.51***	1,118	1.50*
	(0.01)		(3.03)		(1.69)
Above: (P, P+50k)	-1.38	214	-2.71***	245	-1.33
	(-1.49)		(-2.78)		(-0.98)
Below – Above	1.38	673	4.22***	1,363	2.83*
	(1.17)		(3.65)		(1.66)

Table 8: Effect of HBB Policy on Home Size

This table reports the coefficient estimates of the following regression for house sales in Sydney either the Pre-HBB and Post-HBB policy period with $600k threshold:

$$HomeSize_{ist} = b_0 + b_1 PostHBB_{ist} * New_{ist} + b_2 PostHBB_{ist} + b_3 New_{ist} + X_{ist} + \mu_{is} + m_{it} + \varepsilon_{ist}$$

Where $HomeSize_{ist}$ denotes home size in square meters of a house for sale *i* in suburb *s* at time *t*. New_{ist} is a dummy denoting if the property is a new home, and $PostHBB_{ist}$ is a dummy of 1 if the sale occurs from 1 July 2010 to 30 June 2012. The Pre-HBB policy period is from 8 June 2008 to 8 June 2010. X_{ist} are various property characteristics such as number of bedrooms, number of bathrooms, and parking; μ_s is the suburb location specific fixed effects. m_t are year/quarter fixed effects. Panel A uses the Pre- and Post-HBB sample. Panel B is a falsification test using a sample two year prior. Clustered standard errors are in parentheses. ***, **, * signifies statistical significance at the 1, 5, and 10% level, respectively.

Panel A: The Policy Effect on Home Size using Pre- and Post-HBB Sample Periods

Y: Home Size (sqm)	(1) ±$10k window	(2) ±$20k window	(3) ±$50k window
PostHBB*New	-159.130*	-147.159**	-113.154**
	(84.417)	(67.085)	(57.126)
PostHBB	-89.471	-45.669	-102.231**
	(59.978)	(48.958)	(44.231)
New	-111.568*	-115.348***	-153.560***
	(58.562)	(41.357)	(34.632)
Constant	806.180***	727.325***	808.713***
	(91.792)	(84.689)	(67.175)
Housing Controls	Yes	Yes	Yes
Suburb FE	Yes	Yes	Yes
Year/Quarter FE	Yes	Yes	Yes
Clustered SE	Suburb	Suburb	Suburb
Observations	3,966	7,480	18,266
Adj. R-squared	0.679	0.598	0.567

Panel B: The Policy Effect on Home Size using False Pre- and Post- Policy Period (Two Years Prior to the Actual Policy Period)

Y: Home Size (sqm)	(1) ±$10k window	(2) ±$20k window	(3) ±$50k window
FalsePostHBB*New	-49.810	-33.489	-5.965
	(45.168)	(36.719)	(34.683)
FalsePostHBB	-261.768***	-162.401***	-99.680**
	(64.364)	(37.330)	(44.938)
New	-86.670**	-91.370***	-146.192***
	(40.877)	(30.372)	(27.030)
Constant	897.057***	822.659***	776.128***
	(90.345)	(66.112)	(45.282)
Housing Controls	Yes	Yes	Yes
Suburb FE	Yes	Yes	Yes
Year/Quarter FE	Yes	Yes	Yes
Clustered SE	Suburb	Suburb	Suburb
Observations	3,693	7,133	17,558
Adj. R-squared	0.709	0.675	0.662

Table 9: Opportunistic Developers, Sales Volume and Home Prices

The tables report analysis on sales volume and pricing of opportunistic developers. *OpDev* is a dummy of 1 if 50 percent or more of the developer's new home sales during the Post-HBB period are just below the HBB threshold price of between $550,000 to $600,000 (inclusive) and during the Pre-HBB period less than 25 percent of their sales are between $550,000 to $600,000 (inclusive).

Panel A: Summary Statistics on Sales Volume

This table reports the number and percentage of new home sales during the Pre- and Post-HBB period in various price ranges around the price threshold by *OpDev* and other developers. For example, [-50k, 0] denotes home sales with prices in the range [550K, 600k].

Period	OpDev	[-200k,-100k]	[-100k,-50k]	[-50k,0]	All (Below 600k)	All
Pre-HBB						
Number	0	2,298	748	689	7,298	8,873
	1	63	25	11	147	168
	Total	2,361	773	700	7,445	9,041
Percentage	0	25.4%	8.3%	7.6%	80.7%	98.1%
	1	0.7%	0.3%	0.1%	1.6%	1.9%
	Total	26.1%	8.5%	7.7%	82.3%	100%
Post-HBB						
Number	0	2,476	1,342	1,761	7,390	11,466
	1	127	132	948	1,219	1,441
	Total	2,603	1,474	2,709	8,609	12,907
Percentage	0	19.2%	10.4%	13.6%	57.3%	88.8%
	1	1.0%	1.0%	7.3%	9.4%	11.2%
	Total	20.2%	11.4%	21.0%	66.7%	100%

Panel B: Opportunistic Developer Percentage Volume with Threshold Price at $600k

Panel B uses the following regression to estimate the counterfactual distribution around a threshold at price $\bar{v}$:

$$\left(\frac{c_{it}}{New\_Sales_t}\right) * 100 = b_0 + b_1 Below_{it} * OpDev_{it} + b_2 Threshold_{it} * OpDev_{it} + b_3 OpDev_{it} + b_4 Below_{it} + b_5 Threshold_{it} + \sum_{j=0}^{q} \beta_j (z_i)^j + \sum_{r \in R} \eta_r I\left\{\frac{\bar{v} + z_i}{r} \epsilon \mathbb{N}\right\} + e_i$$

Transactions are grouped into AUD$5,000 price bins from $200,000 to $1,200,000. c_{it} is the number of new housing transactions in price bin *i* for period *t* in the Post-HBB period and grouped by either *OpDev* or other developer. Below is 1 if the price bin is equal or equal $600,000, 0 otherwise. z_i is the distance between price bin *i* and the price bin at threshold price $\bar{v}$. *q* is the polynomial order, set at 5. The second last term includes fixed effects for prices that are multiples of round numbers in set *R*, where *R={10,000; 25,000; 50,000}*, $\mathbb{N}$ is the set of natural numbers, and $I\{.\}$ denotes the dummy function. η_r denotes coefficients on round number dummies. Column 1 uses new homes in the Pre-HBB period and column 2 uses new homes in the Post-HBB period. Clustered standard errors are in parentheses. ***, **, * signifies statistical significance at the 1, 5, and 10 percent level, respectively.

Y=$\left(\frac{c_{it}}{New\_Sales_t}\right) * 100$	(1)	(2)
Below*OpDev	-1.386***	-3.343***
	(0.129)	(0.305)
Threshold*OpDev	-3.267***	1.436***
	(0.000)	(0.284)
OpDev	-2.203***	-1.872***
	(0.129)	(0.111)
Threshold	2.653***	30.032***
	(0.306)	(0.603)
Below	1.134***	5.828***
	(0.153)	(0.481)
$10,000 Round Number Dummy	0.268*	0.396***
	(0.137)	(0.134)
$25,000 Round Number Dummy	0.098	0.065
	(0.191)	(0.193)
$50,000 Round Number Dummy	0.35	0.61
	(0.366)	(0.41)
Intercept	2.407***	2.657***
	(0.152)	(0.269)
Period	Pre-HBB	Post-HBB
Order of Price Bin Polynomial	5	5
Number of Observations	402	402
Adjusted R-squared	0.6206	0.8806

Panel C: Opportunistic Developers on Home Prices with Threshold Price at $600k

Panel C presents coefficient estimates for the following housing price regression using the sample of home sales Post-HBB[28]:

$$Pricek_{ist} = b_0 + b_1 Below_{ist} * OpDev_{ist} + b_2 Below_{ist} * New_{ist} + b_3 OpDev_{ist} + b_4 Below_{ist} + b_5 New_{ist} + X_{ist} + \mu_{is} + m_{it} + \varepsilon_{ist}$$

$Pricek_{ist}$ is the property price in $AUD thousands. $Below_{ist}$ is a dummy denoting if the price is below or equal to the threshold price. New_{ist} is a dummy denoting if the property is a new home. X_{ist} are control variables that include the number of bedrooms, number of bathrooms, parking, and property type (e.g. house, apartment, etc.). μ_{is} are suburb fixed effects and m_{it} are year/quarter fixed effects. Standard errors are clustered by suburb. Column 1 prices ±$10,000 around the $600,000 threshold, Column 2 at the ±$20,000 window, and Column 3 at the ±$50,000 window. Clustered standard errors are in parentheses. ***, **, * signifies statistical significance at the 1, 5, and 10% level, respectively.

Y: price in thousands	(1) ±$10k window	(2) ±$20k window	(3) ±$50k window
Below*OpDev	-0.031	7.147***	9.128**
	(1.650)	(2.282)	(4.554)
Below*New	1.666**	0.988	1.073
	(0.793)	(1.001)	(1.423)
OpDev	0.712	-4.608*	-3.436
	(1.654)	(2.471)	(3.798)
Below	-11.764***	-22.232***	-50.967***
	(0.125)	(0.169)	(0.301)
New	-0.060	2.082**	5.354***
	(0.674)	(0.908)	(1.109)
Constant	607.738***	611.301***	611.412***
	(1.583)	(2.320)	(1.210)
Housing Controls	Yes	Yes	Yes
Property Type FE	Yes	Yes	Yes
Suburb FE	Yes	Yes	Yes
Year/Quarter FE	Yes	Yes	Yes
Clustered SE by	Suburb	Suburb	Suburb
Observations	4,265	7,886	18,435
Adj. R-squared	0.686	0.730	0.750

[28] Note: Since *UnderDev* dummy captures a subset of new homes, it follows that *UnderDev*New* is the same as *UnderDev* and therefore the usual triple diff-in-diff regression:

$$Pricek_{ist} = a_0 + b_1 Below_{ist} * New_{ist} * UnderDev_{ist} + b_2 Below_{ist} * UnderDev_{ist} + b_3 Below_{ist} * New_{ist} + b_4 New_{ist} * UnderDev_{ist} + b_5 * UnderDev_{ist} + b_6 Below_{ist} + b_7 New_{ist} + X_{ist} + \mu_{is} + m_{it} + \varepsilon_{ist}$$

simplifies to:

$$Pricek_{ist} = a_0 + b_1 Below_{ist} * UnderDev_{ist} + b_2 Below_{ist} * New_{ist} + b_3 UnderDev_{ist} + b_4 Below_{ist} + b_5 New_{ist} + X_{ist} + \mu_{is} + m_{it} + \varepsilon_{ist}$$

Table 10: Falsification Test by Changing Policy Threshold Price

This table reports the falsification tests for the diff-in-diff policy threshold comparison regression in Table 5. We run 300 simulations randomizing threshold prices (between $200,000 and $1,200,000 where the bulk of the new home distribution is) and assigning Fake 'new' home sales as if the sale were eligible for grants below the (Fake) threshold and not eligible if above the threshold. To assign Fake new home sales, for each $5,000 price bin, we randomly assign sales as new homes based on the number of actual new home sales in the bin. We then estimate the below regression and calculate average coefficients and *t*-stats from the 300 simulations:

$$Pricek_{ist} = b_0 + b_1 Fake\_Below_{ist} * Fake\_New_{ist} + b_2 Fake\_Below_{ist} + b_3 Fake\_New_{ist} + b_4 New_{ist} + X_{ist} + \mu_{is} + m_{it} + \varepsilon_{ist}$$

$Pricek_{ist}$ is the property price in $AUD thousands. $Fake\_Below_{ist}$ is a dummy if the sales price is below the Fake threshold price, and $Fake\_New_{ist}$ is a dummy for the Fake assignment of the home as a new home eligible for the grant below the threshold and not eligible if above the threshold. *New* is a dummy denoting if the property is a new home. X_{ist} are control variables that include the number of bedrooms, number of bathrooms, parking, and property type (e.g. house, apartment, etc.). μ_{is} are suburb fixed effects. m_{it} are year/quarter fixed effects. Standard errors are clustered by suburb. The data used are all individual housing sales in the Sydney metropolitan area from Australian Property Monitors. Refer to Appendix 1 for policy sample periods. Newey-West corrected standard errors are in parentheses. ***, **, * signifies statistical significance at the 1, 5, and 10 percent level, respectively.

Y: price in thousands	(1) ±$10k window	(2) ±$20k window	(3) ±$50k window
Fake_Below*Fake_New	-0.019	-0.136	0.174
	(0.084)	(0.105)	(0.211)
Fake_Below	-9.994***	-19.854***	-47.932***
	(0.03)	(0.062)	(0.165)
Fake_New	-0.032	0.009	-0.255
	(0.057)	(0.067)	(0.165)
New	0.056	0.258***	1.623***
	(0.04)	(0.067)	(0.156)
Constant	716.818***	719.815***	729.994***
	(17.341)	(17.263)	(17.461)
Housing Controls	Yes	Yes	Yes
Property Type FE	Yes	Yes	Yes
Suburb FE	Yes	Yes	Yes
Year/Quarter FE	Yes	Yes	Yes
Clustered SE by	Suburb	Suburb	Suburb
Observations	300	300	300
Adj. R-squared (average)	0.781	0.761	0.757

Table 11: Subsidies and the Effect on New Car Registrations

We run the following two-stage least squares regression for the postcode-year sample from 2013 to 2018 (available car registration data) for Sydney, Australia. Data for car registrations are from the Australian Bureau of Statistics Motor Vehicle Census and data for new home buyer subsidies (grants and stamp duty concessions) are from the NSW Office of State Revenue. Note we use postcodes rather than suburbs as the first home buyer subsidy information is by postcode. The second stage regression is:

$$(NewCars_{p,t}/TotalReg_{p,t}) = b_0 + b_k \sum_{1}^{k=3}(\widehat{subsidy}_{p,t-3} + \cdots + \widehat{subsidy}_{p,t-1}) + b_4 Avgtaxincome_{p,t-1} + b_5 Pop2011_{p,t} + \phi_{is} + FE(year) + e_{p,t}$$

Where $NewCars_{p,t}$ is the number of new passenger car registrations as of January of year t for postcode p. We use all new car registrations, new car registrations of the most popular brands (Ford, Holden, Honda, Hyundai, Kia, Mazda, Mitsubishi, Nissan, Subaru, Toyota, and Volkswagen), and luxury car registrations (Audi, Aston Martin, Bentley, BMW, Ferrari, Jaguar, Lamborghini, Lexus, Maserati, Mercedes Benz, Porsche, Range Rover, Rolls Royce, and Tesla). New cars are identified if the year of manufacture is in the prior 2 years of the car registration census date. For example, for car registrations as of January 2018, new cars are those manufactured in 2016 and 2017. $TotalReg_{p,t}$ is the total number of registered passenger cars in that postcode as of January year t and we use it as a scaling factor to measure the percentage of new car sales in the postcode. $subsidy_{p,t-k}$ is either total first home buyer (FHB) grants or Stamp duty concessions (SDC) given in the prior year k . This is measured in the number of applications or the dollar value (in thousands of dollars). We instrument $subsidy_{p,t-k}$ with a bartik style measure: $subsidy_{p,2009}/\sum_{1}^{P}(subsidy_{p,2009}) \times \left(\sum_{1}^{P}(subsidy_{p,t-k}) - subsidy_{p,t-k}\right)$ where $subsidy_{p,2009}$ is the subsidy amount in 2009 and P is for all postcodes in NSW. $Avgtaxincome_{p,t-1}$ is the average taxable income of the postcode in the prior financial year. *Pop2011* is the population in the postcode from the Australian Bureau of Statistics 2011 Census ϕ_{is} are postcode fixed effects. *FE(year)* are year fixed effects. Panel A reports summary statistics. Panel B reports for all newly registered cars, Panel C reports for newly registered popular cars only, and Panel D reports for newly registered luxury cars only. Postcode clustered standard errors are in parentheses. ***, **, * signifies statistical significance at the 1, 5, and 10 percent level, respectively. We also report tests of under-identification (Kleibergen-Paap LM statistic with a critical p-value in parentheses) and weak instruments (Kleibergen-Paap Wald rank F statistic) based on Kleibergen and Paap (2006).

Panel A: Summary Statistics

Variable	N	Mean	Std. Dev.	Min	Max
$TotalReg_{p,t}$ ($NewCars_{n,t}$ + Old $Cars_{n,t}$)	1,342	10,127.73	7,677.98	15.00	56,801.00
($NewCars_{p,t}/TotalReg_{p,t}$)*100 (All)	1,342	14.74	5.22	0.00	56.54
($NewCars_{p,t}/TotalReg_{p,t}$)*100 (Popular)	1,342	10.65	4.19	0.00	52.88
($NewCars_{p,t}/TotalReg_{p,t}$)*100 (Luxury)	1,342	2.45	1.98	0.00	13.27
Number of FHB Grants (in Thousands)	1,342	0.14	0.20	0.00	1.95
Number of Stamp Duty Concessions (in Thousands)	1,342	0.12	0.18	0.00	1.56
Amount of FHB Grants ($'Million)	1,342	1.41	2.00	0.00	16.92
Stamp Duty Concessions ($'Million)	1,342	1.42	2.13	0.00	19.67
Amount of FHB + SDC ($'Million)	1,342	2.83	4.06	0.00	36.59
AvgIncome (in Thousands)	1,342	71.22	26.90	25.07	233.99
Pop2011(in Thousands)	1,342	17.54	13.28	0.00	95.04

Panel B: All New Cars

Y: $(NewCars_{p,t}/TotalReg_{p,t})*100$	(1)	(2)	(3)	(4)	(5)
$\widehat{Number\ of\ FHB\ Grants}$ ('000)	0.350				
	(0.517)				
$\widehat{Number\ of\ SDC}$ ('000)		0.599			
		(0.554)			
$\widehat{\text{FHB Grants}}$ ($'000,000)			0.045		
			(0.064)		
$\widehat{\text{SDC}}$ ($'000,000)				0.042	
				(0.049)	
$\widehat{FHB + SDC}$ ($'000,000)					0.023
					(0.029)
AvgIncome ('000)	0.008	0.008	0.008	0.008	0.008
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Pop2011 ('000)	-0.634***	-0.634***	-0.635***	-0.633***	-0.634***
	(0.006)	(0.005)	(0.007)	(0.005)	(0.006)
Postcode FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
	Postcode	Postcode	Postcode	Postcode	Postcode
	22.917	26.954	30.568	27.964	28.089
Clustered SE by	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Test of underidentification	1,013.688	319.165	257.760	233.755	232.842
	(<0.05)	(<0.05)	(<0.05)	(<0.05)	(<0.05)
Observations	1,342	1,342	1,342	1,342	1,342
Adj. R-squared	0.900	0.901	0.900	0.900	0.900

Panel C: Popular Brand-New Cars Only

Y: $(NewCars_{p,t}/TotalReg_{p,t})*100$	(1)	(2)	(3)	(4)	(5)
$\widehat{Number\ of\ FHB\ Grants}$ ('000)	-0.109				
	(0.543)				
$\widehat{Number\ of\ SDC}$ ('000)		0.024			
		(0.609)			
$\widehat{\text{FHB Grants}}$ ($'000,000)			0.019		
			(0.066)		
$\widehat{\text{SDC}}$ ($'000,000)				-0.000	
				(0.054)	
$\widehat{FHB + SDC}$ ($'000,000)					0.004
					(0.031)
AvgIncome ('000)	-0.010	-0.010	-0.011	-0.010	-0.011
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Pop2011 ('000)	-0.422***	-0.423***	-0.424***	-0.423***	-0.423***
	(0.007)	(0.006)	(0.008)	(0.006)	(0.007)
Postcode FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Clustered SE by	Postcode	Postcode	Postcode	Postcode	Postcode
Test of underidentification	22.917	26.954	30.568	27.964	28.089
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Test of weak instruments	1,013.688	319.165	257.760	233.755	232.842
	(<0.05)	(<0.05)	(<0.05)	(<0.05)	(<0.05)
Observations	1,342	1,342	1,342	1,342	1,342
Adj. R-squared	0.873	0.873	0.873	0.873	0.873

Panel D: Luxury New Car Brands Only

Y: $(NewCars_{p,t}/TotalReg_{p,t})*100$	(1)	(2)	(3)	(4)	(5)
$\widehat{Number\ of\ FHB\ Grants}$ ('000)	0.408**				
	(0.169)				
$\widehat{Number\ of\ SDC}$ ('000)		0.523**			
		(0.212)			
$\widehat{\text{FHB Grants}}$ ($'000,000)			0.028		
			(0.026)		
$\widehat{\text{SDC}}$ ($'000,000)				0.039**	
				(0.019)	
$\widehat{FHB + SDC}$ ($'000,000)					0.018
					(0.012)
AvgIncome ('000)	0.022***	0.022***	0.022***	0.022***	0.022***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Pop2011 ('000)	-0.170***	-0.169***	-0.169***	-0.168***	-0.169***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Postcode FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Clustered SE by	Postcode	Postcode	Postcode	Postcode	Postcode
Test of underidentification	22.917	26.954	30.568	27.964	28.089
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Test of weak instruments	1,013.688	319.165	257.760	233.755	232.842
	(<0.05)	(<0.05)	(<0.05)	(<0.05)	(<0.05)
Observations	1,342	1,342	1,342	1,342	1,342
Adj. R-squared	0.914	0.914	0.914	0.914	0.914

Internet Appendix Table IA1: Stamp Duty Schedule

The table below shows the stamp duty schedule that applies for homes bought during the entire sample period. The schedule is from the NSW Office of State Revenue website: http://www.osr.nsw.gov.au/taxes/transfer-land

Property Value	**Rate of duty**
$0 - $14,000	$1.25 for every $100 or part of the value
$14,001 - $30,000	$175 plus $1.50 for every $100, that the value exceeds $14,000
$30,001 - $80,000	$415 plus $1.75 for every $100, that the value exceeds $30,000
$80,001 - $300,000	$1,290 plus $3.50 for every $100, that the value exceeds $80,000
$300,001 - $1m	$8,990 plus $4.50 for every $100, that the value exceeds $300,000
$1m - $3 m	$40,490 plus $5.50 for every $100, that the value exceeds $1,000,000
Premium Property Duty: over $3m	$150,490 plus $7.00 for every $100, that the value exceeds $3,000,000.

Internet Appendix Table IA2: Comparison of the Home Builders Bonus Policy with Housing Policies in Other Regions

Policy Name	**Home Builders Bonus**	**Victoria Land Transfer Duty Waiver "Big Housing Build"**	**"Million Dollar" policy**	**Loan-to-value Ratio**
Jurisdiction	New South Wales, Australia	Victoria, Australia	Canada	Hong Kong
Period of Operation	July 2010 to June 2012	Nov 2020 to June 2021	Since July 2012 to date	Since August 20, 2020 to date
Qualification	Any buyer, off-the-plan home, housing price ≤A$600,000 (c.US$636,000)	Any buyer, newly built homes (50% stamp duty discount) and existing homes (25%), housing price ≤A$1,000,000 (c. US$776,600)	Maximum loan-to-value ratio drops from 95% to 80% at threshold price of CA$1 million (c. US$1 million)	Owner occupier, income derived mainly from Hong Kong, maximum LTV of 60% for homes priced up to HK$10 million (c. US$1.25 million); it drops to 50% for homes priced above HK$10 million;
Maximum Benefit/Cost	A$22,490 (c.US$23,839)	A$27,500 (c. US$21,400)	CA$150,000 (c. US $150,000) in additional down payment	HKD 1 million (c. US$125,000)
Reference	NSW Government Home Builders Bonus Website	Victorian Government Big Housing Build website	Canadian Mortgage and Housing Corporation website; Han et al. (2021)	Hong Kong Monetary Authority prudential measures
Website	https://www.revenue.nsw.gov.au/grants-schemes/previous-schemes/home-builders-bonus	https://www.budget.vic.gov.au/place-call-home-victorias-big-housing-build	https://www.cmhc-schl.gc.ca/en/buying/mortgage-loan-insurance-for-consumers/what-is-mortgage-loan-insurance	https://www.hkma.gov.hk/media/eng/doc/other-information/FAQ_J1_Table_Eng.pdf

Internet Appendix Table IA3: Price Distribution and Sales Prices around the Threshold Price (New Homes, Pre vs. Post Periods)

This table reports the summary statistics for the percentage frequency and sales price in the distribution for new homes Pre- vs. Post-HBB, above and below the policy price threshold of $600,000, and the statistical differences. Panel A presents the result on sales volume, comparing new home sales in Pre- vs. Post- HBB policy period. Panel B presents the result on sales price in thousands, comparing new home sales Pre- vs. Post- HBB policy period. Refer to Appendix 1 for the policy periods. *t*-stats in parentheses. ***, **, * signifies statistical significance at the 1, 5, and 10 percent level, respectively.

Panel A: Comparison of Sales Volume between New Homes Pre- vs. Post-HBB Policy Period

	Pre		Post		Post - Pre	
Price Range	**Percentage**	**N**	**Percentage**	**N**	**Percentage Diff**	***t-stat***
P=600k	0.81	73	4.67	603	3.86***	(16.41)
Below:(*P*-20k, *P*)	3.10	280	9.61	1,241	6.51***	(18.86)
Above: (*P*, *P*+20k)	1.38	125	1.08	140	-0.30**	(-1.99)
Below - Above	1.71		8.53		6.82***	(17.91)
Below: (*P*-50k, *P*)	7.69	695	17.52	2,261	9.83***	(21.21)
Above: (*P*, *P+50k*)	3.73	337	4.22	545	0.49*	(1.84)
Below - Above	3.96		13.30		9.34***	(16.82)

Panel B: Comparison of Sales Prices ($'000) between New Homes in Pre- vs. Post-HBB Policy Period

	Pre		Post		Post - Pre	
Price Range	**Mean Price**	**N**	**Mean Price**	**N**	**Diff in Mean Price**	***t-stat***
P=600k	600.00	73	600.00	603	0.00	-
Below:(*P*-20k, *P*)	589.69	280	592.25	1,241	2.56***	(5.69)
Above: (*P*, *P*+20k)	612.33	125	614.51	140	2.18***	(3.24)
Below - Above	-22.64		-22.26		0.38	(0.41)
Below: (*P*-50k, *P*)	573.88	695	579.19	2,261	5.32***	(7.57)
Above: (*P*, *P+50k*)	628.55	337	632.63	545	4.08***	(4.26)
Below - Above	-54.67		-53.43		1.24	(0.96)

Internet Appendix Table IA4: Counterfactual Bin Regression Coefficients

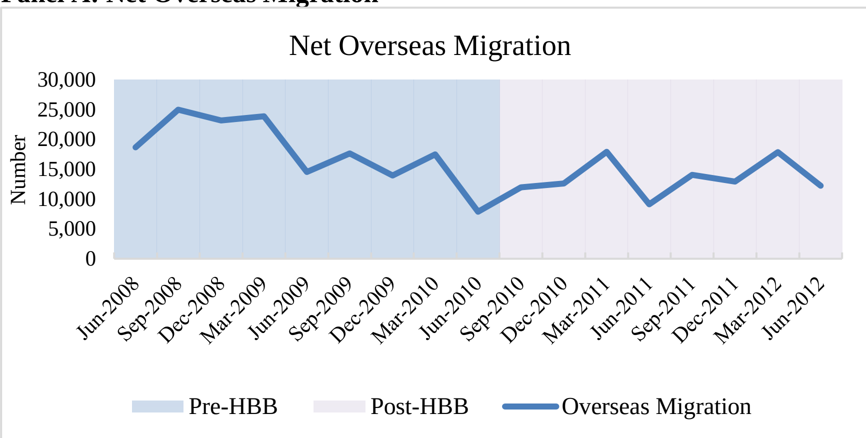
The table reports coefficient estimates for the counterfactual bin regressions used in Figure 5. *Bindist_1* to *Bindist_5* are the coefficients for the bin distance polynomials from order 1 to 5. *r10000, r25000 and r50000* are dummies for bins with price ranges ending in $10,000, $25,000 and $50,000, respectively. *Bindist_1* to *Bindist_5* coefficients are multiplied by 1,000 for visual purposes.

	(1)
Y: c_i	Post-HBB Period ($600k threshold)
Bindist_1	-1,484.37***
	(0.095)
Bindist_2	-37.175***
	(0.004)
Bindist_3	0.455***
	(0.000)
Bindist_4	0.003***
	(0.000)
Bindist_5	0.000***
	(0.000)
r10000	12.537***
	(3.252)
r25000	0.767
	(5.748)
r50000	18.157*
	(9.928)
Intercept	116.866***
	(5.541)
Number of Observations	195
Adjusted R-Square	0.8256

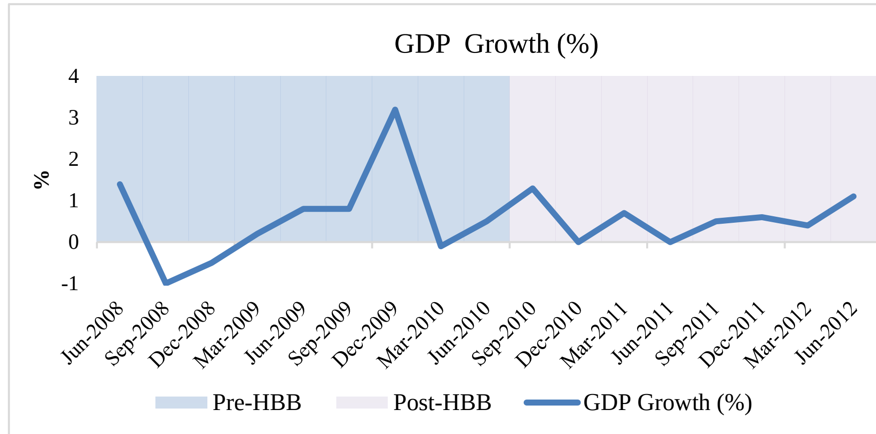
Internet Appendix Table IA5: Economic Fundamentals

The table shows net overseas migration in the state of NSW (Panel A), gross domestic product (GDP) growth (Panel B), consumer price index (CPI) growth (Panel C) and unemployment rate (Panel D) over the sample period. The data are obtained from the Australian Bureau of Statistics.

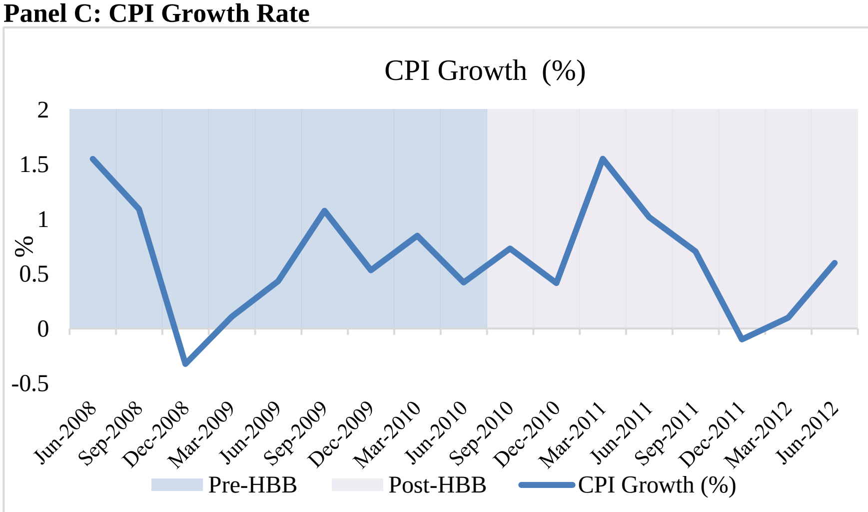
Panel A: Net Overseas Migration



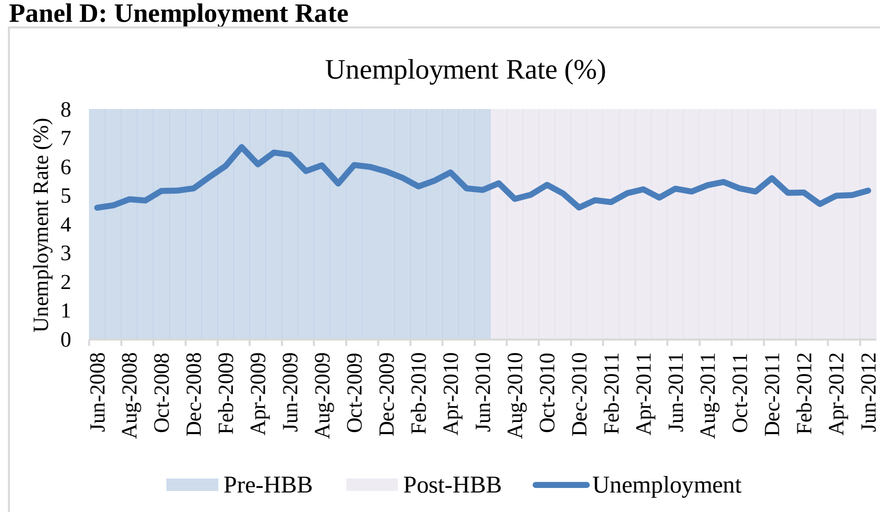
Panel B: GDP Growth Rate



Panel C: CPI Growth Rate

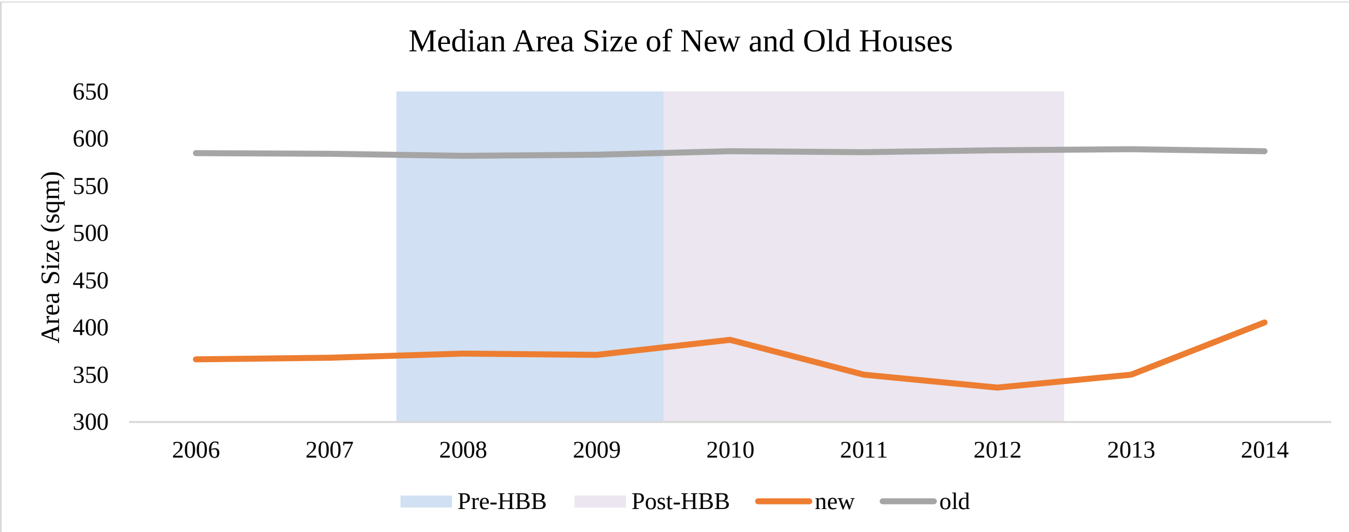


Panel D: Unemployment Rate



Internet Appendix Figure IA6: House Average Size over Time

The figure reports the median house area size (in square meters) for sales in each year for new and pre-existing old homes.



Internet Appendix Table IA7: Subsidies and the Effect on New Car Registrations (OLS)

We run the following regression for the postcode-year sample from 2013 to 2018 (available car registration data) for Sydney. Data for car registrations are from the Australian Bureau of Statistics Motor Vehicle Census and data for new home buyer subsidies (grants and stamp duty concessions) are from the NSW Office of State Revenue. Note we use postcodes rather than suburbs as the first home buyer subsidy information is by postcode. The regression is:

$$(NewCars_{p,t}/TotalReg_{p,t}) = b_0 + b_k \sum_{2}^{k=5}(subsidy_{p,t-2} + \cdots\ subsidy_{p,t-k}) + b_6 Avgtaxincome_{p,t-1} + b_7 Pop2011_{p,t} + \phi_{is} + FE(year) + e_{p,t}$$

Where $NewCars_{p,t}$ is the number of new passenger car registrations as of January of year t for postcode p. We use all new car registrations, new car registrations of the most popular brands (Ford, Holden, Honda, Hyundai, Kia, Mazda, Mitsubishi, Nissan, Subaru, Toyota, and Volkswagen), and luxury car registrations (Audi, Aston Martin, Bentley, BMW, Ferrari, Jaguar, Lamborghini, Lexus, Maserati, Mercedes Benz, Porsche, Range Rover, Rolls Royce, and Tesla). New cars are identified if the year of manufacture is in the prior 2 years of the car registration census date. For example, for car registrations as of January 2018, new cars are registered cars that are manufactured in 2016 and 2017. $TotalReg_{p,t}$ is the total number of registered passenger cars in that postcode as of January year t and we use it as a scaling factor to measure the percentage of new car sales in the postcode. $subsidy_{p,t-k}$ is either total first home buyer (FHB) grants or Stamp duty concessions (SDC) given in the prior k year. This is measured in the number of applications or the dollar value (in thousands of dollars). $Avgtaxincome_{p,t-1}$ is the average taxable income of the postcode in the prior financial year. *Pop2011* is the population in the postcode from the Australian Bureau of Statistics 2011 Census. ϕ_{is} are postcode fixed effects. *FE(year)* are year fixed effects. Panel A reports for all newly registered cars, Panel B reports for newly registered popular cars only, and Panel C reports for newly registered luxury cars only. Postcode clustered standard errors are in parentheses. ***, **, * signifies statistical significance at the 1, 5, and 10% level, respectively. Note that coefficients are multiplied by 100 for visual purposes, where indicated.

Panel A: All New Cars

Y: $(NewCars_{p,t}/TotalReg_{p,t})$*100	(1)	(2)	(3)	(4)	(5)
Number of FHB Grants	0.065				
	(0.052)				
Number of SDC		0.119**			
		(0.053)			
FHB Grants ($'000)			0.009*		
			(0.005)		
SDC ($'000)				0.008*	
				(0.005)	
FHB + SDC ($'000)					0.005*
					(0.003)
AvgIncome	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Pop2011	-0.064***	-0.064***	-0.064***	-0.063***	-0.064***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Constant	4,461.339***	4,449.705***	4,462.829***	4,447.235***	4,453.655***
	(69.314)	(68.982)	(69.792)	(67.549)	(68.878)
Postcode FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Clustered SE by	Postcode	Postcode	Postcode	Postcode	Postcode
Observations	1,342	1,342	1,342	1,342	1,342
Adj. R-squared	0.900	0.901	0.901	0.901	0.901

Panel B: Popular Brand-New Cars Only

Y: $(NewCars_{p,t}/TotalReg_{p,t})$*100	(1)	(2)	(3)	(4)	(5)
Number of FHB Grants	0.012				
	(0.052)				
Number of SDC		0.072			
		(0.058)			
FHB Grants ($'000)			0.006		
			(0.005)		
SDC ($'000)				0.005	
				(0.005)	
FHB + SDC ($'000)					0.003
					(0.003)
AvgIncome	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Pop2011	-0.042***	-0.043***	-0.043***	-0.042***	-0.043***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	3,232.635***	3,224.691***	3,232.684***	3,223.163***	3,227.091***
	(81.311)	(80.867)	(82.219)	(79.178)	(80.992)
Postcode FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Clustered SE by	Postcode	Postcode	Postcode	Postcode	Postcode
Observations	1,342	1,342	1,342	1,342	1,342
Adj. R-squared	0.873	0.873	0.873	0.873	0.873

Panel C: Luxury New Car Brands Only

Y: $(NewCars_{p,t}/TotalReg_{p,})*100$	(1)	(2)	(3)	(4)	(5)
Number of FHB Grants	0.033**				
	(0.016)				
Number of SDC		0.026			
		(0.020)			
FHB Grants ($'000)			0.001		
			(0.002)		
SDC ($'000)				0.002	
				(0.002)	
FHB + SDC ($'000)					0.001
					(0.001)
AvgIncome	0.002***	0.002***	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Pop2011	-0.017***	-0.017***	-0.017***	-0.017***	-0.017***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	882.589***	880.614***	883.552***	880.298***	882.092***
	(23.722)	(23.728)	(24.198)	(23.661)	(23.799)
Postcode FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Clustered SE by	Postcode	Postcode	Postcode	Postcode	Postcode
Observations	1,342	1,342	1,342	1,342	1,342
Adj. R-squared	0.914	0.914	0.914	0.914	0.914