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Urban Housing Affordability: Assessing the Effectiveness of Policy Interventions in the Singapore Public Housing Sector

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Housing affordability for many Singaporean households has been declining since 2006. While eligible households are directly allocated new-built public housing at subsidized rates, these rates reflect price behavior in the laissez faire resale market and would be higher during periods of excess demand. We examine two policy initiatives since 2011 to improve housing affordability for targeted population segments. First, the government has stabilized the prices at which it sells new-built units by increasing supply-side producer discounts to moderate the extent to which new unit prices track the resale market. Second, demand subsidies are provided to low- and middle-income households to buy new subsidized housing.

Price stabilization has prevented the transmission of demand shocks from the resale market to the new-built public housing sector but not improved affordability. However, successive calibrations of capital grants boosted the price to income ratio and debt servicing ratio indicators for households with incomes below the national median. These improvements are progressive, with the less well-off benefitting the most. Furthermore, the grants do not appear to induce housing overconsumption the way that demand subsidies are prone to do so and provide some assurance that the policies adopted in Singapore have not generated allocative inefficiencies.

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Keywords

Housing Affordability, Singapore Public Housing, Pricing Strategy, Demand Subsidies

1. Introduction

In many cities around the world, affordable access to decent housing has become problematic for low- and middle-income households. While agglomeration drives productivity growth in urban areas, the benefits of better jobs and higher wages are not evenly distributed. At the same time, growing employment and population as well as inelastic supply raise local housing costs for all. As a result, housing price inflation has outpaced income growth for many households with important welfare and political economy implications for policy makers. For example, recent research in the European Union shows that across many metropolitan regions, land and housing assets have increasingly contributed to wealth and spatial inequalities (Inchauste Comboni *et al.*, 2018). Similarly, nearly a third of all households in the United States paid more than 30 percent of their income on housing, a widely accepted metric for affordability, in 2016 (Joint Center for Housing Studies, 2019).

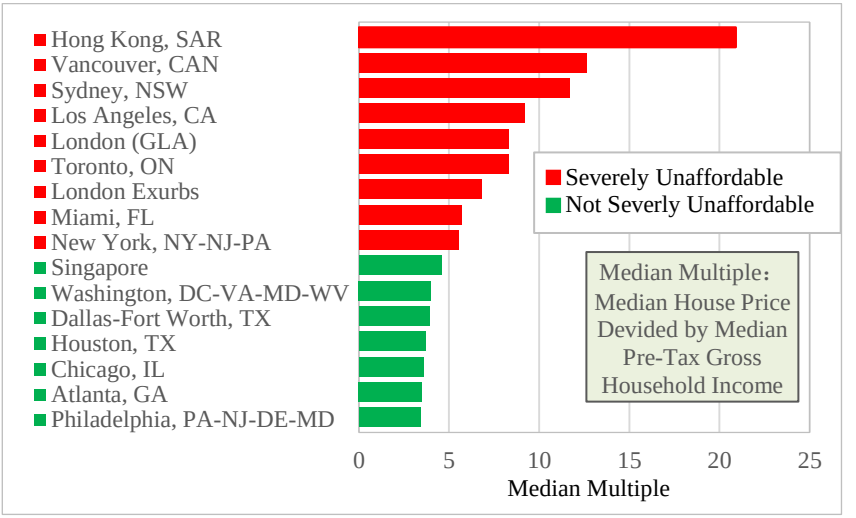
The affordability problem is even more severe in economically powerful cities where housing prices have escalated due to the tremendous local and foreign demand for their land and the "financialization" of their housing as investment vehicles (Gyourko *et al.*, 2013). Figure 1 shows a ranking from the 15th Annual *Demographia* International Housing Affordability Survey that uses Q3:2018 data of 91 major metropolitan housing markets. Based on a "median multiple" or price to income ratio (PIR) of median housing price to median household income, the most unaffordable housing is found in international gateway cities.

Our paper looks at Singapore, a city-state with a gross domestic product of S$491 billion (US$361 billion) in 2018[1]. It is densely populated: 5.6 million people who comprise 4.0 million residents (3.5 million citizens and 0.5 million permanent residents) and 1.6 million foreigners[2] live on a land mass of only 724 square kilometers. While *Demographia* had earlier estimated a median multiple of 5.9 for Singapore by using Q3:2012 data, which is in the "Severely Unaffordable" range, the median multiple was a "Not Severely Unaffordable" 4.6 last year. As we show below with disaggregated indicators that go beyond the median multiple, this improvement in housing affordability has in fact benefitted the least advantaged households in Singapore even more.

[1] Department of Statistics (DOS), *Singapore in Figures 2018*. The GDP figure is annual and in current nominal dollars with an exchange rate in December 2018 of approximately S$1.36 to US$1.

[2] DOS, *Statistics Singapore - Population Trends 2018*.

Figure 1 Housing Affordability in Markets with Population over 5,000,000 in 2018



Source: 15th Annual *Demographia* International Housing Affordability Survey

It is instructive to understand how Singapore, a land-constrained but economically successful global city, has managed to arrest and gradually reverse her housing affordability problem. In this paper, we find that this is the result of intensive government attention to managing public housing provision and outcomes. We begin in Section 2 with a description of the structure and policy context of the housing sector in Singapore. In Section 3, we explain the proximate causes of price inflation in the subsidized national public housing program. As with other metropolitan regions, house price appreciation has outstripped income growth for the lower income segments of the Singapore population. This has resulted in a deterioration in affordability based on our disaggregated analyses of housing prices and household incomes that use a sorting model. Section 4 describes the policy measures undertaken by the state since mid-2011 to address the problem and uses micro-data on public housing transactions to evaluate the effectiveness of the interventions. Section 5 concludes.

2. The Singapore Housing Sector and Policy Context

Since attaining self-governance in 1959, housing for the masses has been an important engine of social development and economic growth for Singapore. Faced with a chronic shortage of decent and affordable housing then, the ruling government established the Housing and Development Board (HDB) in 1960 as the national public housing authority to plan, develop and allocate multi-

family high-rise public housing units called HDB flats. While its original mandate was to provide social housing, i.e. basic rental accommodations for the poor, the HDB quickly introduced a Home Ownership Scheme (HOS) in 1964 through which eligible households could purchase a 99-year leasehold interest in their flat, but not in the land or common areas, at a subsidized price.

The HOS received a boost in 1968 when the government allowed citizens to withdraw the savings in their Central Provident Fund (CPF) accounts to pay the downpayment, stamp duties and monthly debt service of the flats bought from the HDB instead of relying solely on their take-home pay. The CPF is essentially a national state-managed social security savings scheme that was set up in 1955 to ensure the financial security of all workers. The scheme requires mandatory contributions of a defined percentage of the monthly contractual salary[3] of the employee into his/her personal account with the CPF from both the employer and employee. As the economy prospered and wages rose, these forced tax-exempt savings accumulated rapidly but could not be withdrawn until retirement. Between 1968 and 1981, the purchase of public housing was the only avenue by which a substantial portion of CPF savings could be used. Only Singapore citizen households were eligible to buy subsidized HDB flats. Permanent residents could purchase them in the resale market at competitive prices while foreigners were barred from owning an HDB flat. The use of CPF savings steadily increased the home ownership rate of HDB dwellers from 14% in 1964 to 92.2% in 2018[4].

The demand for subsidized public housing is typically measured by the number of households who have applied to buy a new flat. It is regulated through various eligibility rules such as citizenship status, non-ownership of private properties, household composition and household income (see Table A.1 in Appendix 1 for the household income ceiling). Below-market pricing has generally resulted in excess demand for new HOS flats. Hence, non-price rationing mechanisms such as waiting lists, balloting and queues are used to allocate the flats.

There has been a secondary market for HDB flats since 1971 in which owners who have fulfilled a stipulated minimum occupation period could sell the remaining leasehold interest in their unit at market-determined prices to anyone

[3] Contribution rates for the employer and the employee can differ and vary with economic and labor market conditions. They gradually rose from 5% in 1955 to peak at 25% of the monthly gross wages for both employers and employees from 1984 to 1986. Since then, the rates, contribution limits and exemptions based on salary floors have been adjusted according to the age and other characteristics of the employee. Since 1986, Central Provident Fund savings have been paid a market-based interest rate. For details, see http://www.cpf.gov.sg.

[4] HDB households are all headed by residents who are either Singapore citizens or permanent residents. See DOS, https://www.singstat.gov.sg/find-data/search-by-theme/households/ households/latest-data

eligible for public housing[5]. Initially when the housing stock was low, the regulations that governed resale buyer eligibility were onerous to prevent profiteering from the capitalization of state producer subsidies. As the number of HDB flats increased and the housing market became more mature, these regulations were relaxed to facilitate residential mobility[6]. Due to this institutional set-up, public housing in Singapore has come to mean state-subsidized flats, constructed by the HDB and sold for private ownership, which can subsequently be transacted at competitive prices in the secondary HDB *resale* market.

The initial focus of the HDB was on the large-scale production of affordable, standardized high-rise housing for the lower income groups. During its first decade of operation, the HDB built only one- to four-room flats[7]. Over time, it catered to middle-income and upper middle-income households as well. In response to the demand for larger units, five-room flats were introduced in the 1970s and executive apartments[8] in the 1980s while the production of smaller flats was halted. Not only was there greater emphasis on providing higher quality and a wider selection of designs, but beyond the flat itself, the HDB paid increasing attention to enhance the overall quality of the housing estate in terms of the amenities provided, aesthetic appeal and visual identity.

Since a significant proportion of the resident population are housed in HDB flats, private residential developers play a limited role of supplying expensive dwellings to the higher income groups and foreign investors. From the mid-1960s to the early 1980s, the government embarked on a massive exercise of land reclamation and compulsory acquisition for public housing and other national development projects. This raised state ownership of the total land mass in Singapore from around 40% in 1960 to more than 90% at present. Since the limited amount of privately-held land was insufficient to accommodate the demand for private housing from an increasingly affluent population, the government began to auction state-owned land for these developments. The sale of such land is an important policy lever for managing the housing market. Unlike HDB flat owners however, buyers of private units built on these state-owned land parcels own an undivided share of the rights in the land as well.

[5] Prior to this, owners who wanted to sell their flat had to return them to the HDB at the original purchase price plus the depreciated cost of improvements (Phang, 2005).

[6] In 1989, the HDB began easing its ownership eligibility criteria for resale flats: the income ceiling was lifted and Singapore permanent residents as well as private housing owners could buy resale HDB flats for owner-occupancy.

[7] A flat is named according to its number of rooms. The living-dining room and bedrooms are individually counted but not the kitchen and bathrooms. For example, a four room flat has 3 bedrooms and one living-dining room.

[8] The executive apartment has 5 rooms but is larger than the 5-room flat.

Table 1 Stock of Residential Units in Singapore

	As of end of 1997		As of end of 2009		As of end of 2011		As of end of 2013		As of end of 2015		As of end of 2017	
	Number of Units	% of Total	Number of Units	% of Total	Number of Units	% of Total	Number of Units	% of Total	Number of Units	% of Total	Number of Units	% of Total
Public Sector Housing												
1-room flat	25,182	2.7%	21,217	1.8%	24,559	2.1%	25,564	2.1%	26,840	2.0%	30,442	2.1%
2-room flat	34,610	3.8%	30,210	2.6%	32,917	2.8%	36,131	2.9%	39,894	3.0%	49,082	3.4%
3-room flat	239,562	26.1%	220,770	19.2%	222,242	18.6%	224,272	18.1%	232,144	17.3%	240,372	16.7%
4-room flat	267,517	29.2%	340,069	29.6%	354,942	29.7%	366,511	29.5%	390,901	29.2%	413,752	28.7%
5-room flat	134,051	14.6%	209,765	18.2%	213,321	17.8%	217,553	17.5%	229,829	17.2%	239,976	16.7%
Executive flat	50,320	5.5%	65,077	5.7%	65,076	5.4%	65,075	5.2%	65,082	4.9%	65,091	4.5%
HUDC Apartments	4,071	0.4%	1,865	0.2%	1,535	0.1%	1,177	0.1%	-	-	-	-
Studio Apartments	-	-	1,239	0.1%	2,250	0.2%	4,588	0.4%	7,782	0.6%	8,980	0.6%
Sub-total	755,313	82.4%	890,212	77.4%	916,842	76.7%	940,871	75.8%	992,472	74.2%	1,047,695	72.8%
Executive Condominiums	-	-	10,430	0.9%	10,430	0.9%	11,683	0.9%	18,336	1.4%	27,940	1.9%
Private Housing												
Non-Landed properties	98,042	10.7%	179,991	15.6%	198,623	16.6%	218,321	17.6%	255,456	19.1%	291,534	20.2%
Landed properties	63,231	6.9%	69,498	6.0%	70,145	5.9%	71,049	5.7%	71,992	5.4%	72,761	5.1%
Sub-total	161,273	17.6%	249,489	21.7%	268,768	22.5%	289,370	23.3%	327,448	24.5%	364,295	25.3%
Total Stock	916,586	100%	1,150,131	100%	1,196,040	100%	1,241,924	100%	1,338,256	100%	1,439,930	100%

Note: The public housing stock refers to units under HDB management, including apartments built by the Housing and Urban Development Company (HUDC) that were transferred to the HDB for management in 1982. The public housing stock data refers to the financial year end (e.g. data captioned as of the end of 2009 in Table 1 are actually as of 31 March 2010.) Hence, the period basis is slightly inconsistent with the private housing stock data that is of the calendar year end.

Sources: Government of Singapore. Department of Statistics, Singapore, various years; Government of Singapore. Housing and Development Board, various years; and Government of Singapore. Urban Redevelopment Authority, Real Estate Information System.

Table 1 shows the structure of the Singapore housing sector as a multi-tiered ladder[9]. In general, the prices in each residential stratum are supported by the prices of properties in the stratum immediately below it. The bottom floor represents the social housing sector and comprises the smallest HDB flats that are rented to disadvantaged households. Above that in ascending order are the smaller owner-occupied flats, larger and newer public housing units, Executive Condominiums[10] (ECs) and private residential properties. Private dwellings can be divided into non-landed properties, which comprise apartments and condominiums, and landed properties which are low-rise, low-density dwellings. Over time, the proportion of the total stock in private housing has been edging up and by the end of 2017, reached the long term planning intent of 25%.

3. Deteriorating Affordability

Singapore has been experiencing deteriorating affordability in her new-built public housing segment from the commencement of the global financial crisis. We posit that this is caused by an inadequate supply response and a market based pricing policy. In the late 1990s, Singapore embarked on various financial liberalization and talent recruitment policies that increased her attractiveness to capital and immigrant inflows. Particularly after 2005, the influx of hot money and skilled workers boosted housing demand at the upper tiers of the housing ladder. However, a shortage of private dwellings following a protracted reduction in the sales of state-owned land resulted in excess demand for private housing, which spilled over into the public housing resale market.

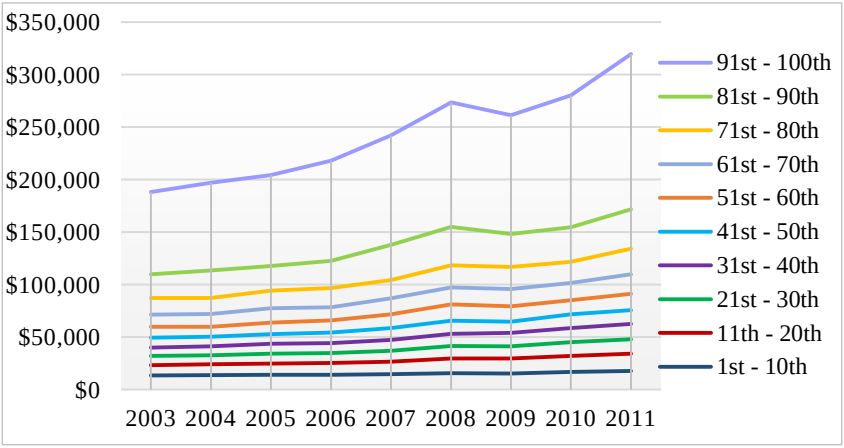
This may not have been as problematic for housing affordability had the benefits of globalization been distributed more evenly among local resident households. Figure 2 shows that this was not the case. The nominal income of the top decile group rose markedly while that of the bottom three deciles stagnated. For the latter, there is the problem of accessing affordable housing as the HDB has been releasing mainly large flats for sale since the 1990s. Furthermore, the HDB is pricing these new flats by using a market-based approach. More specifically, new flats are priced at a pre-determined discount to their potential transaction price in the competitive resale market. Any excess demand for resale flats would then raise the price levels of subsidized public housing. As we discuss below, this excess demand could arise as a result of unfulfilled spillover demand for private dwellings due to supply shortages or

[9] Studio apartments do not fall neatly into the hierarchy but have been included for comprehensiveness.

[10] ECs were introduced in 1995 to fulfill the housing aspirations of "sandwich" households whose income exceeded the HDB income ceiling but was insufficient for private housing. To be built and sold by private developers, ECs would bridge the gap between HDB flats and private condominiums by offering living standards comparable to those of the latter but at lower prices due to a land cost subsidy.

increased asset demand for private housing. Hence, a market-based approach to pricing new subsidized public housing provided a channel through which increases in resale flat prices, which could originate from pressure in the private housing market, translate into higher new flat prices.

Figure 2 Average Annual Household Income in S$ by Percentile, 2003-2011



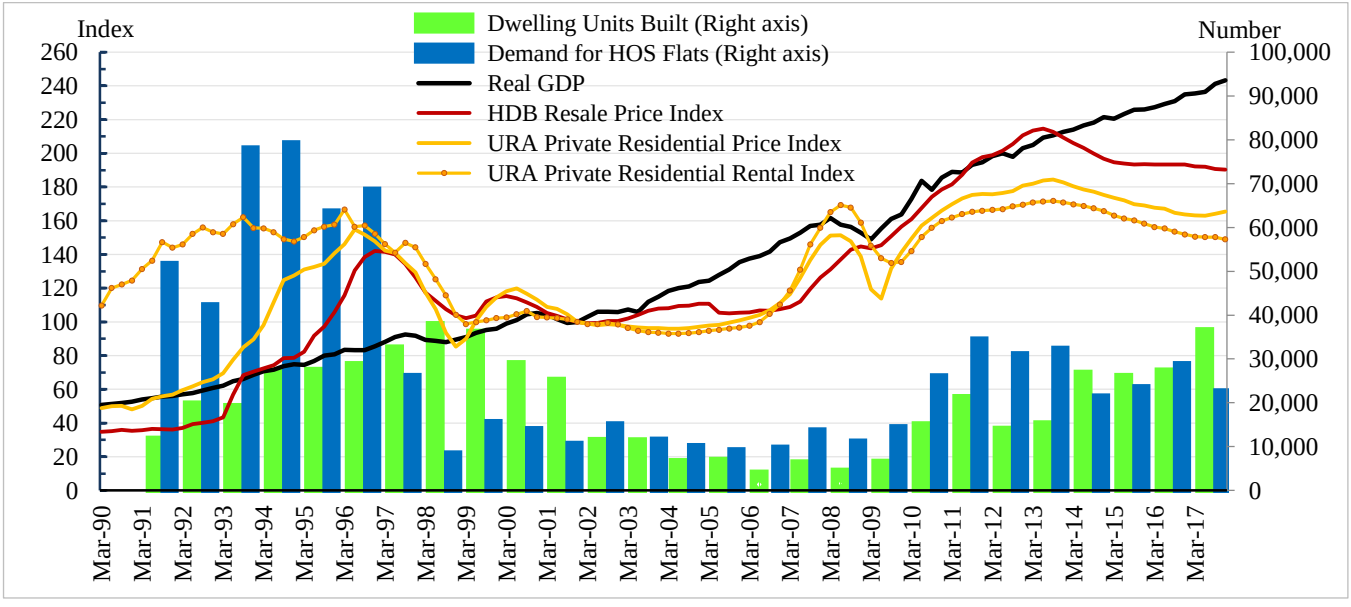
Source: Government of Singapore. Department of Statistics

3.1 The HDB Supply Program

Prior to 2002, the HDB supply program was based on demand as measured by the number of public housing applicants queueing for new HOS flats. Figure 3a shows this demand and the number of HDB flat completions, together with the HDB Resale Price Index, the Urban Redevelopment Authority (URA) private residential price index (PRPI), the URA Private Residential Rental Index (PRRI) and an index of seasonally adjusted real GDP. Furthermore, the annual percentage price changes in the HDB resale market and private housing markets over the sample period are shown in Figure 3b.

In the mid-1990s, strong demand underpinned by rising household incomes led the HDB to ramp up its flat supply. However, demand fell sharply following the Asian financial crisis (AFC) with many applicants who left the waiting list. Opting out was a relatively costless option then since the HDB was charging applicants a nominal fee to join the new flat queue. With demand destruction, the HDB was saddled with a large overhang of about 31,000 unsold flats that not only curtailed new construction, but would also take several years to clear.

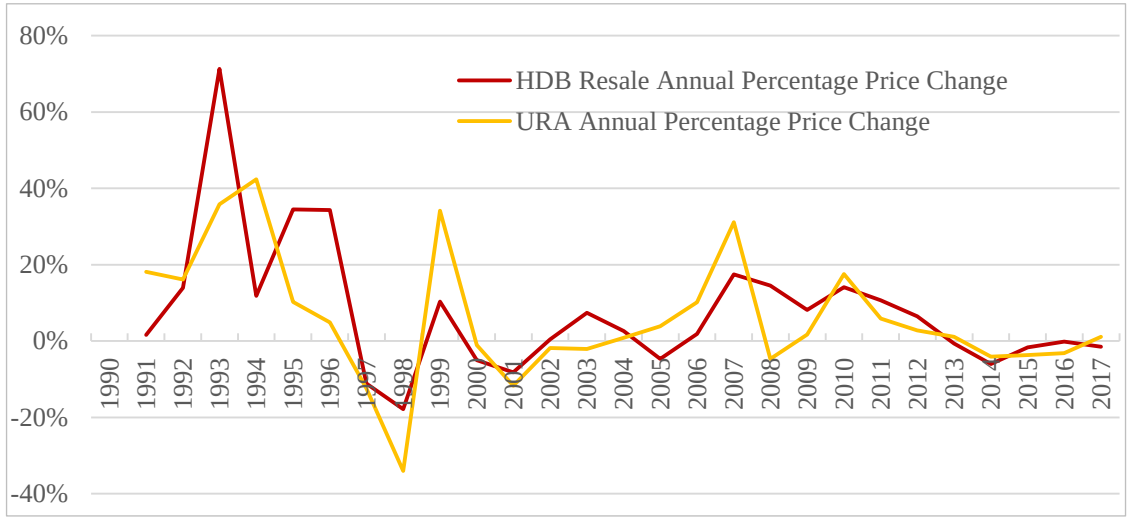
Figure 3a **Demand for New HDB flats and HDB Flat Completions, HDB Resale Price Index, URA PRPI, URA PRRI and Real GDP (Q4:2001=100 for all indices), 1991-2017**



Note: Demand for HOS flats refers to new demand in a fiscal year while flat completions are for the calendar year. Data in 1990 omitted as they are calculated on a different basis.

Sources: Government of Singapore. Department of Statistics; Government of Singapore. Housing and Development Board, various years; and Government of Singapore. Urban Redevelopment Authority, Real Estate Information System.

Figure 3b **Annual Percentage Price Change as Measured by HDB Resale Price Index and URA PRPI, 1991-2017**



Sources: Government of Singapore. Housing and Development Board website: https://www.hdb.gov.sg/cs/infoweb/residential/buying-a-flat/resale/resale-statistics; and Government of Singapore. Urban Redevelopment Authority, Real Estate Information System

To avoid a recurrence of large inventory build-ups, the HDB changed its supply program in 2002 to a Built–To–Order (BTO) system. Under this scheme, BTO flats are offered for sale on a project basis. Potential buyers ballot for the chance to select a flat[11] and successful households have to pay a downpayment to secure their flat booking. Each booking would then represent a committed buyer, who is less likely to drop off the waiting list. Construction work would only commence if at least 70% of the offered flats have been booked. These features would allow the HDB to build according to real demand.

Although its design ostensibly improved the calibration of new flat supply to the number of buyers, the BTO system initially failed to produce a sufficient quantity of new flats due to a mismatch between the types of units that the HDB launched and those that the less advantaged households could afford. Specifically, much of the housing demand was for small units while the HDB was offering 4-room or larger flats for sale at the time. As small flats were only available in the resale market, the demand for them contributed to an eventual appreciation of the HDB Resale Price Index. Two years after the implementation of the BTO system, the HDB resumed the building of 3-room flats.

Before 2006, the state already had subsidies in place for resale flat purchases. In 2006, the HDB began to offer 2-room flats again and announced first demand subsidies for *new* flat buyers. By then, economic fundamentals in Singapore had improved amid ample liquidity in her financial system. Pro-immigration policies also boosted both the consumption and asset demand for private housing as shown by the steep growth of the URA PRRI and URA PRPI respectively. Without a commensurate supply-side response in the private housing market, the excess demand from expatriates and middle-income families who had been priced out of the private market filtered down to the HDB sector in the second half of 2007. Given the tight housing market conditions then, rentals of HDB flats rose. Since HDB flats were cheaper than private residential properties, their higher rental yields and expected capital gains made public housing an attractive investment play. As a result, the HDB cleared much of its remaining unsold stock in 2007 with close to ten applicants vying for each available unit. Throughout the global financial crisis (GFC) and up to 2013, the demand for new-built units continued to overwhelm the limited supply. Since the BTO system allocated flats by ballot, many first-time applicants repeatedly failed to secure a flat.

[11] Certain groups, such as first-timers and those who are applying to live near their parents, are given extra ballot chances. A larger proportion of the flat supply is set aside for first timer families in view of their more urgent need to set up a family.

3.2 The Pricing of New HDB Flats

The pricing of new-built HDB flats for sale broadly takes into consideration the general state of the economy and the affordability level of the target groups for the different types of flats. In the past, the government has relied more on the debt service ratio (DSR) rather than the price income ratio (PIR) as a measure of affordability due to the widespread use of the CPF to finance housing purchases. Specifically, the government looked at the proportion of the gross household income that a household would use to pay debt installments and the extent to which the monthly payments could be serviced entirely by using CPF contributions without a cash top-up. Although private loans are available for financing new flats, the DSR calculations assumes that a household will take a concessionary mortgage from the HDB where the contract rate is 10 basis points above the prevailing CPF Ordinary Account savings rate. In the past, this "concessionary" rate was often below the housing loan rates charged by commercial banks but ample liquidity in the financial system and the use of upfront teaser rates by private lenders may have flipped this relationship in recent years[12]. As a rule of thumb, a flat is considered affordable if its pricing resulted in a DSR that is under 30%. Even at a constant flat price, the DSR could still vary with changes in loan tenure or other parameters.

At the start of the HOS program, the HDB referenced new flat prices to its development costs but as the secondary market became more developed in the 1990s, the HDB moved to referencing resale prices, factoring in flat attributes, location premiums and amenities such as car parks and infrastructure provision. The HDB priced new flats with reference to the competitively determined prices of comparable resale flats in the vicinity and priced them for sale below their appraised market value[13].

A market-based pricing approach has the merit of instilling discipline into the public housing calculus by explicitly accounting for the opportunity cost of scarce land and other resources. However, pricing new-built subsidized flats in tandem with the resale market for such dwellings allowed demand shocks from the resale market to be easily transmitted to the primary new flat sector. We illustrate how this impacted affordability by using two episodes in the Singapore housing narrative.

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[12] Depending on the economic conditions, the loan-to-value (LTV) ratio could reach 90% while the maximum loan repayment period was 30 years or when the borrower reached 65 years of age, whichever was earlier. The current maximum loan repayment period is 25 years while the DSR limit is 30%.

[13] The then National Development Minister S. Dhanabalan told Parliament in 1988: "We must safeguard land for our children. The only way we can be fair to all in our present and future generations is to value HDB land at market value….As long as HDB sells its flats at a price below what they can fetch in the market, the purchasers enjoy a subsidy".

The 1990s Housing Boom

Prior to the AFC, rapid household formation and a conducive housing finance environment underpinned the strong demand for both public and private housing in Singapore. In line with robust economic growth, the HDB raised the income ceiling for new flats four times[14]. The rise in the demand for new flats stretched the waiting time for obtaining one from two to seven years[15]. The HDB also relaxed many home ownership restrictions in the public resale market in 1989 and 1991 which boosted resale prices. By then, a market-based pricing regime was already in place. The prices of new four-room flats rose by an average of 12% per annum in the 1988 to 1992 period compared to only 2.5% per year between 1981 and 1988[16]. Further liberalization of the resale market in March 1993 that allowed resale flat buyers to obtain larger loans resulted in a 62% jump of the HDB resale price index by the end of the year.

To cater to the lower-income households who could not afford a four-room flat, which was the smallest flat that the HDB was building in the 1990s, the government began to repurchase three-room flats from the open market in 1994 for allocation at subsidized prices to first-timer households with a monthly household income that did not exceed SG$1000 per month. To shorten the queues, the HDB also transferred some of the demand for new HDB flats to the secondary market by offering eligible homebuyers demand-side subsidies. These were in the form of CPF housing grants[17] and partially defrayed the cost of buying HDB resale flats. Unfortunately, the housing grants alongside the strong economic fundamentals exacerbated the demand for resale flats with prices far outpacing fundamental economic growth. It was only after the AFC that the resale market softened and the quantum of CPF housing grants was eventually reduced[18].

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[14] See Table A.1 in Appendix 1.

[15] During the 1993/1994 fiscal year, for example, 76,759 households applied for the 20,925 flats available - almost four applicants for every new flat on sale. In 1995 and 1996, the HDB received about 60,000 new applications each year. The waiting list for new flats under the Registration for Flats System (RFS) grew from about 80,000 in October 1994 to 146,000 in April 1997. When the RFS was suspended on 18 May 2002, there were still about 8800 applicants left in the queue (Source: HDB Annual Report 2002/2003).

[16] In part, the higher prices also reflected increased construction and land costs and the fact that new flats were costlier than older flats as they were better appointed. See Report of the Cost Review Committee (1993).

[17] Under the CPF Housing Grant Scheme introduced in August 1994, eligible households would receive a S$30,000 grant that would be deposited into their CPF accounts when they applied to buy a resale flat. The resale flat had to be within the same town/estate or 2 km of the home of their parents or married children, and the buyer must not have purchased an HDB flat before. In August 1995, this was increased to S$50,000 while those whose resale flats are outside the proximity condition were eligible for a S$40,000 grant.

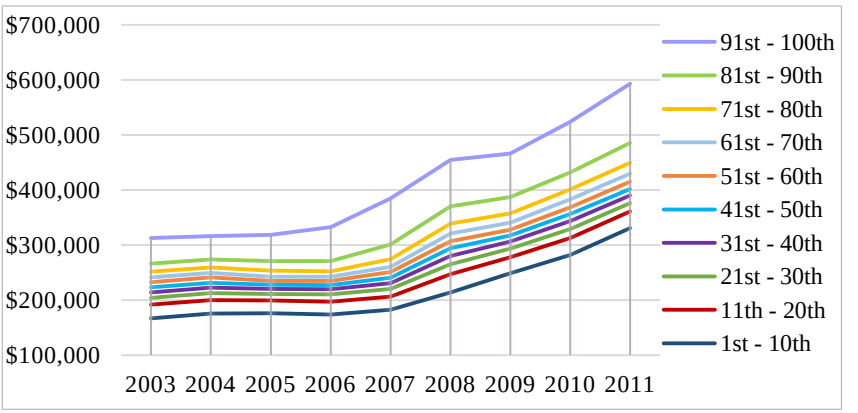
[18] With falling resale prices, the number of applications for CPF housing grants to buy resale HDB flats increased. The grants were gradually reduced over five months in two rounds beginning in January and June 1999 to S$40 000 (near parents/married

The Pre-Global Financial Crisis Boom

In the late 2000s, record job creation and the rapid influx of foreigners resulted in excess demand for housing prior to the GFC. However, the main policy levers for controlling housing supply − public housing construction and government land sales, had been substantially scaled down since the AFC. To assist low- and middle-income households, the government enhanced the housing grants for the purchase of new and *resale* flats in 2007. This contributed to a persistent increase in the transacted prices of 4-room resale flats as shown in Figure 4, which is also reflected in the HDB Resale Price Index. Through the market-based pricing channel, the increases were transmitted to new flat prices. Figure 5 shows how the prices of new 4-room flats increased from 2003 to 2011.

Note that our calculations are for the 4-room flat because it is the dominant type of flat and the only type that has been in continuous supply over our sample period. New flat prices vary from year to year depending on their attributes and locations. The prices used below are not quality-adjusted.

Figure 4 Prices of Resale HDB 4-Room Flats (in S$) by Percentile, 2003-2011



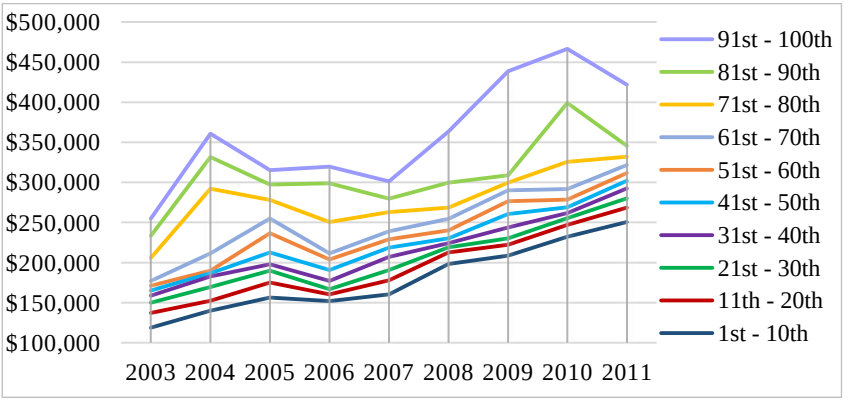
Sources: Government of Singapore. Housing and Development Board; data.gov.sg

Using a sorting approach, we construct decile-by-decile PIRs to track the affordability of 4-room subsidized new flats from 2003 to 2011. The PIR is a more suitable measure than the DSR for this period due to the large variation in lending parameters before and after the GFC. Our results are presented in Figure 6. We find a regressive pattern in the PIRs, especially from 2007, with the lowest income households facing the greatest degree of erosion in

children scheme) and S$30 000 for other resale flat and EC buyers. The grant for Joint Singles was reduced from S$25,000 to S$22,000. Singles were first awarded a S$15,000 grant in June 1998 which was reduced to S$11,000 in 1999.

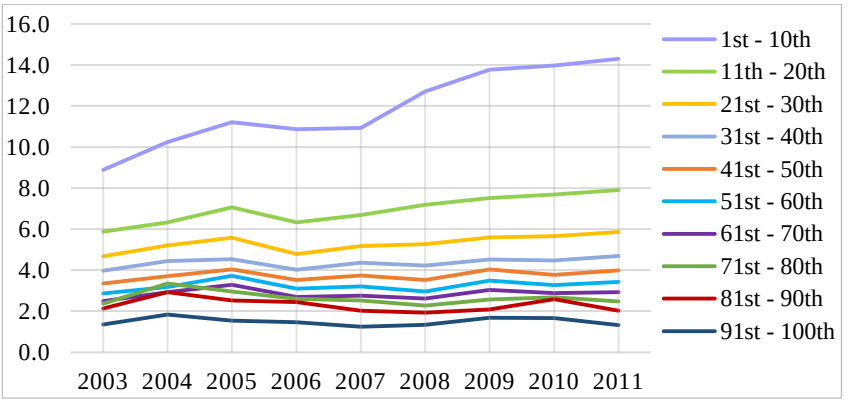
affordability. The housing needs of these households would probably be met with smaller HOS flats and rental housing rather than 4-room flats.

Figure 5 Prices of New HDB 4-Room Flats (in S$) by Percentile, 2003-2011



Source: Government of Singapore. Housing and Development Board

Figure 6 PIRs of New HDB 4-Room Flats by Percentile, 2003-2011



Sources: Government of Singapore. Department of Statistics (2019) and Government of Singapore. Housing and Development Board.

4. Policy Interventions and Their Impact on Affordability

4.1 Policy Interventions

In late 2007, increasing concerns about access to housing led the government to announce that 7000 new HDB flats would be offered for sale in 2008 with a larger proportion of smaller units. To help the most disadvantaged groups, the

HDB would also expand the social housing segment by converting existing flats into rental flats and resuming the building of new rental flats. Although about 9000 BTO flats were released in 2009, escalating resale flat prices had narrowed the price gap between the largest HDB units and entry-level private dwellings. Indeed, record private housing and resale flat prices obliged the state to continue affordable housing provision and even expand housing concessions. A slew of new policies to dampen speculative and investment demand for housing were implemented while more new flats would be allocated to first-time home buyers[19] amid significant increases to future supply[20].

Although the HDB had offered more flats for sale, construction would take another three years. This lag in delivery meant that the increased supply could not bring quick relief to the price pressures on the housing sector. After the General Election in mid-2011, several measures were implemented to mitigate new public housing price volatility and improve the affordability of new flats in non-mature estates (NMEs)[21] to targeted groups.

Stabilization of New Flat Prices

The government stabilized new flat prices by raising the supply subsidies provided[22]. If anything, the pre-crisis boom episodes in Singapore have shown that eligibility restrictions on foreign ownership of new flats could not shield public housing applicants from offshore and domestic demand shocks due to the market-based nexus. Stabilising new flat prices was all the more important to prevent the discounts and resale flat subsidies that were originally intended to benefit select groups from being capitalized and transferred (eventually) to private housing and other assets. This change in policy was also prudent since there is a practical limit to how much the state could afford to subsidize new flats if it continually took the cue from the privatized market segment to price new flats.

Modifying and Expanding the HDB Supply Program

Instead of waiting for a 70% take-up rate before construction can commence, the HDB also proceeded to build BTO flats upon offer. It would resume the normal BTO system of requiring a majority of the flats to be pre-committed, after public housing demand has stabilized. Furthermore, the HDB significantly

[19] Since November 2009, 95% of the public flat supply (up from 90%) would be allotted to first-timer applicants.

[20] About 16,000 new BTO flats and land for building 4000 Design, Build and Sell Scheme (DBSS) flats and 4,000 Executive Condominiums were made available in 2010. To help the sandwiched class, those who earn between S$8,000 and S$10,000 would be eligible for DBSS flats effective 30 August 2010.

[21] Public housing estates are categorized as mature or non-mature. Non-mature towns/estates refer to those where there is more land available for public housing development, whereas mature towns/estates are usually those with limited land for public housing development.

[22] See paragraph 13 of the Parliamentary speech by the then Minister of National Development on 6 February 2013.

"upsized" the number of flats launched for sale. More than 25,000 flats across 39 projects were offered in 2011 compared to 16,089 units in 22 projects in 2010. Since balloting would still be used to ration the excess demand, the increased volume would improve the chances that first-timer applicants secure a unit. When the HDB raised the income ceiling for new flat eligibility in late 2011 (see Table A.1 in Appendix 1), a larger number of flats would also be needed to meet the projected rise in demand.

Enhancing Demand-Side Subsidies for New HDB Flats to Targeted Buyers
Up-front demand subsidies have been provided since 1994 for the purchase of *resale* flats, but it was only in March 2006 that they were offered to eligible buyers of *new-built* BTO flats. The first scheme was the Additional Housing Grant (AHG)[23]. Lower-income citizen families applying for their first HDB flat could qualify for a grant of up to S$20,000[24] if they were in continuous employment over the preceding two years and their average gross monthly household income over that period did not exceed S$3,000. Due to the tight housing market conditions pre-GFC, the income ceiling was raised to S$4,000 and the maximum housing grant to S$30,000 in August 2007. Following the GFC, the main concern of policy-makers was to provide assistance to targeted groups affected by the recession. In February 2009, the state offered rental rebates to households in social housing and extended the AHG to middle income households by raising the income ceiling to S$5,000. The continuous employment period was reduced to one year while the maximum housing grant was increased to S$40,000.

Ahead of the 2011 General Election, a second demand subsidy scheme called the Special Housing Grant (SHG) was introduced for buying small new flats in NMEs[25]. It supplemented the AHG by providing a grant of S$20,000 to first-timer low-income families who earned up to S$2250 a month. To encourage financial prudence, households with a monthly income up to S$1500 could only buy a 2-room standard flat[26]. Those earning more than S$1,500 a month and up to S$2000 a month could choose to buy a 2-room or 3-room standard flat while those earning between S$2001 and S$2250 a month could choose to buy a 3-room standard flat. In 2013, the SHG was further extended to middle-income households who earned up to S$6500 per month and buying a 4-room or smaller flat. In August 2015, the maximum SHG amount was doubled from S$20,000 to S$40,000 and the income ceiling raised from S$6500 to S$8500. Table 2 summarizes the AHG and SHG capital subsidies schemes.

[23] The term "additional' was used because the grant was given on top of the discounted selling price.
[24] The grant amounts are for households with two citizens. The grant amounts for singles are lower.
[25] Non-mature estates.
[26] In July 2012, this was extended to 3-room standard flats in NMEs.

Table 2 Additional CPF Housing Grant and Special CPF Housing Grant Schemes (All amounts in S$)

Average Gross Monthly Household Income	Additional CPF Housing Grant			Special CPF Housing Grant			Total (AHG + SHG)
	Mar 2006	Aug 2007	Feb 2009	Mar 2011	Mar 2013	Aug 2015	
Up to $1500	$20,000	$30,000	$40,000	$20,000	$20,000	$40,000	$80,000
$1501 - $2000	$15,000	$25,000	$35,000	$20,000	$20,000	$40,000	$75,000
$2001 - $2250	$10,000	$20,000	$30,000	$20,000	$20,000	$40,000	$70,000
$2251 - $2500	$10,000	$20,000	$30,000		$20,000	$40,000	$70,000
$2501 - $3000	$5000	$15,000	$25,000		$20,000	$40,000	$65,000
$3001 - $3500		$10,000	$20,000		$20,000	$40,000	$60,000
$3501 - $4000		$5,000	$15,000		$20,000	$40,000	$55,000
$4001 - $4500			$10,000		$20,000	$40,000	$50,000
$4501 - $5000			$5,000		$20,000	$40,000	$45,000
$5001 - $5500					$15,000	$35,000	$35,000
$5501 - $6000					$10,000	$30,000	$30,000
$6001 - $6500					$5000	$25,000	$25,000
$6501 - $7000						$20,000	$20,000
$7001 - $7500						$15,000	$15,000
$7501 - $8000						$10,000	$10,000
$8001 - $8500						$5000	$5000
More than $8500							

Source: Government of Singapore. Housing and Development Board

4.2 Assessing the Effectiveness of the Measures

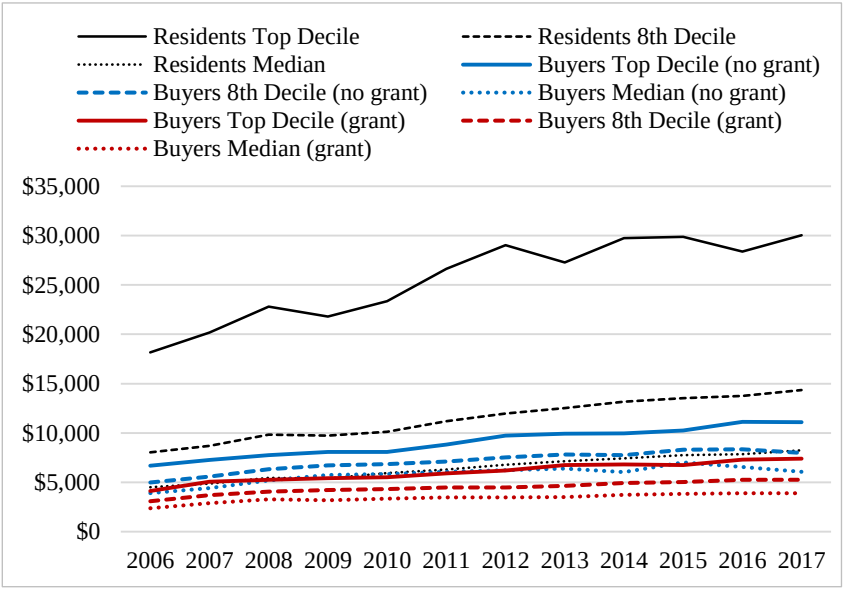
Our data sample comprises 77,253 transactions of new BTO flats in NMEs from 2006 to 2017. Of these, 25,101 were sales to households who were ineligible for capital housing grants while the remaining 52,152 transactions received AHG and/or SHG assistance of varying amounts. We observe the flat type, offer price at which the HDB launched the unit for sale, monthly household income of the buyer, and grant(s) given where applicable.

Appropriateness of Targeted Households

Figure 7 compares the average monthly household income of three selected decile cohorts, i.e. the median, 8th decile and 10th decile, for three different populations: all resident households in Singapore, new flat buyers without grants, and new flat buyers who received grants. The average household income of the top decile of new flat buyers who were also grant recipients lies below the average household income of the median decile of all residents. Furthermore, the average income profiles of new flat buyers who were ineligible for grants lie between those of the entire resident population and the grant-assisted flat buyers for the same decile. Using household income as a gauge, both the provision of subsidized public housing and housing grants appears to have been directed at the correct recipients. However, there has been some deterioration

in the average household income of the median buyers who were ineligible for grants in 2016 and 2017.

Figure 7 **Average Household Income (in S$) of the 5th, 8th and Top Deciles for All Resident Households, New Flat Buyers Ineligible for Grants and New Flat Buyers Eligible for Grants, 2006-2017**



Sources: Government of Singapore. Department of Statistics, and Government of Singapore. Housing and Development Board

The Impact of Price Stabilization

Next, we examine the impact of the stabilization of new HDB flat prices only by calculating the PIR and DSR of every new flat buyer in our sample. The DSR calculation assumes that all new flat buyers took a HDB concessionary housing loan with standard terms regarding the loan contract rate and the maximum permissible tenure that are applicable at the time of flat purchase. All the loans have a 90% LTV ratio and are also assumed to have passed their credit assessments, and that they have funds of their own for the 10% down payment. Our sample is partitioned into two groups, buyers who were ineligible and those who were eligible for grants. For the latter group of grant-assisted new flat buyers, the PIR and DSR were simulated by setting the grant amount that they received to zero. We calculate the median affordability indicators by type of flat since the rules regarding grant eligibility and grant amount were tied to the type (and design) of the flat. The rules also varied over the sample period. Table 3 and Figure 8 present the median PIR results while Table 4 and Figure 9 show the calculated median DSRs for the two groups.

Table 3 **Median PIR by Flat Type for Buyers Ineligible for Grants and Buyers Eligible for Grants where Grant Was Set to Zero, 2006-2017**

	Buyers Ineligible for Grants				Buyers Eligible for Grants, Grant=Zero			
	2R	3R	4R	5R	2R	3R	4R	5R
2006	6.2	5.7	3.6		3.8	5.5	5.4	
2007	5.9	4.5	3.8		3.8	5.8	5.3	
2008	8.5	5.6	3.7	4.9	8.0	5.2	5.6	7.5
2009	9.3	6.3	3.9	4.9	6.0	6.3	6.0	7.0
2010	6.5	6.8	3.9	4.6	6.4	6.2	6.1	6.8
2011	7.0	6.4	4.3	4.9	7.2	6.6	6.5	7.3
2012	6.5	6.8	4.3	4.8	7.2	6.4	6.8	7.5
2013	5.3	6.1	4.3	4.8	6.1	6.6	6.7	7.4
2014	5.2	6.2	4.7	4.9	5.5	6.2	6.1	7.4
2015	4.2	5.4	3.4	4.8	6.1	5.9	5.8	7.2
2016	7.0	5.2	4.6	4.7	6.3	6.2	5.8	7.5
2017	4.8	7.6	5.0	4.6	5.5	6.2	5.5	7.1

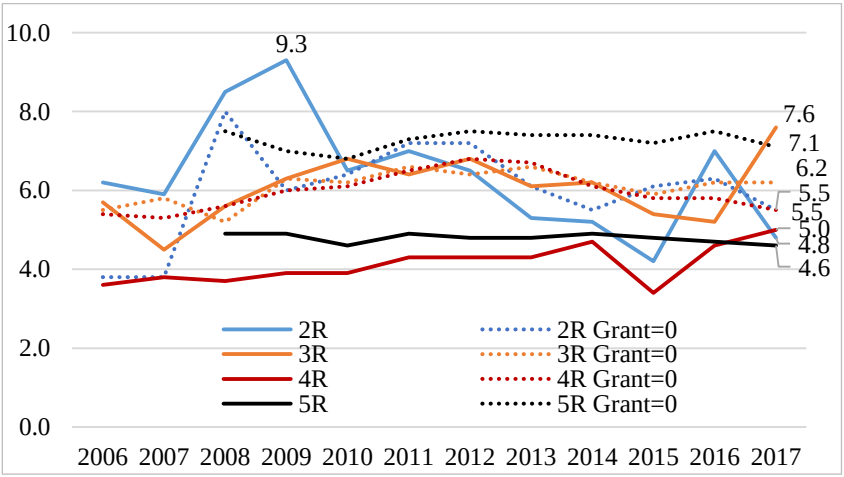
Source: Government of Singapore. Housing and Development Board

Table 4 **Median DSR by Flat Type for Buyers Ineligible for Grants and Buyers Eligible for Grants where Grant Was Set to Zero, 2006-2017**

	Buyers Ineligible for Grants				Buyers Eligible for Grants, Grant=Zero			
	2R	3R	4R	5R	2R	3R	4R	5R
2006	27%	25%	16%		16%	24%	23%	
2007	26%	20%	16%		16%	25%	23%	
2008	37%	24%	16%	21%	35%	23%	24%	32%
2009	40%	27%	17%	21%	26%	27%	26%	30%
2010	28%	29%	17%	20%	28%	27%	26%	29%
2011	30%	28%	19%	21%	31%	28%	28%	31%
2012	28%	29%	19%	21%	31%	28%	29%	33%
2013	26%	27%	19%	21%	30%	29%	30%	32%
2014	26%	30%	23%	24%	27%	31%	30%	36%
2015	21%	27%	17%	23%	30%	29%	28%	35%
2016	34%	25%	22%	23%	31%	31%	28%	37%
2017	24%	37%	25%	22%	27%	30%	27%	35%

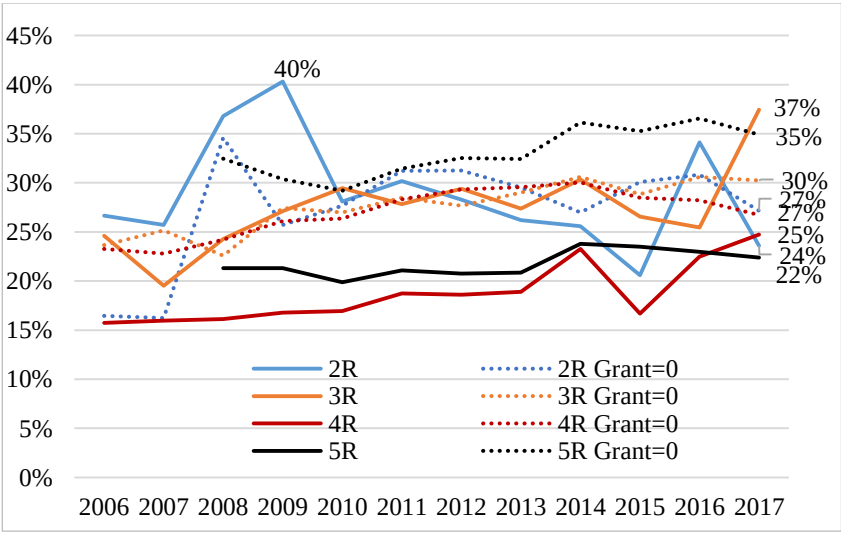
Source: Government of Singapore. Housing and Development Board

Figure 8 **Median PIR by Type of Flat for Buyers Ineligible and Eligible for Grants with Grant set to Zero, 2006-2017**



Source: Government of Singapore. Housing and Development Board

Figure 9 **Median DSR by Type of Flat for Buyers Ineligible and Eligible for Grants with Grant set to Zero, 2006-2017**



Source: Government of Singapore. Housing and Development Board

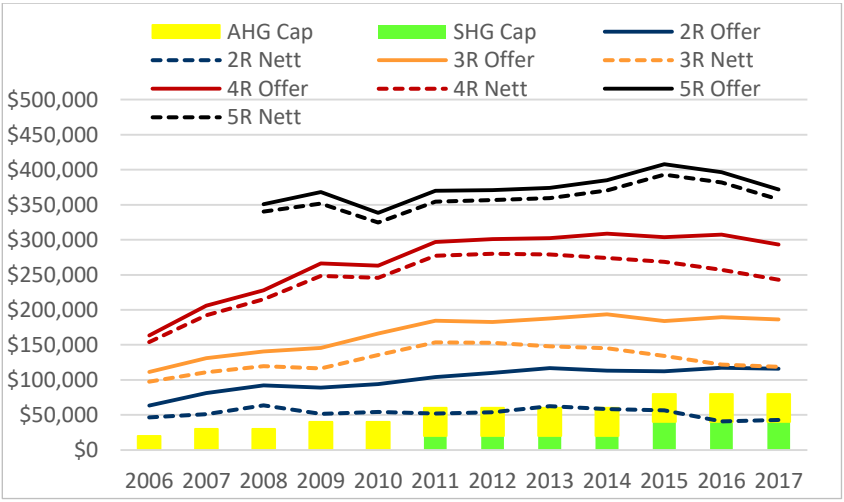
Broadly speaking, the change in the pricing policy may have moderated new flat prices but due to variations in household income, the simulated affordability

indicators that we obtained are still volatile. Buyers who are eligible for grants generally have lower affordability thresholds than those who are ineligible. The latter have an income that exceeds the grant ceilings and also typically buy the larger flats. However, it is unclear why buyers of 3-room flats who were ineligible for grants seem to have experienced some deterioration in their PIRs and DSRs in 2017. This result could be due to the small sample size. Indeed, this could be causing the higher volatility for the overall 2-room flats and for 3-room flats ineligible for grants.

The Effect of Enhanced Demand-Side Subsidies

The stabilization of new flat prices was implemented together with grant enhancements and most first-timer buyers received grants. Figure 10 compares the median offer price of new flats at launch against the median nett price-after-grant paid by households who were eligible for demand subsidies for each flat type. The enhancements in the AHG and SHG resulted in a widening gap between the amount that grant recipients would have paid if they did not receive any housing subsidies and the discounted price that they actually paid over time. Since the grant schemes are graduated according to income such that lower-income earners obtain subsidies in larger quantums than buyers who earned relatively more, the grants are generally progressive. The grants are not tiered by type of flat in that households who buy up to a 4-room flat are eligible for the same grant amount. However, lower-income earners probably buy smaller flats. As a result, a smaller flat means increased welfare of the buyers in terms of the absolute dollar amount saved. Furthermore, the proportional improvement is also larger because of the lower price points of the smaller flats.

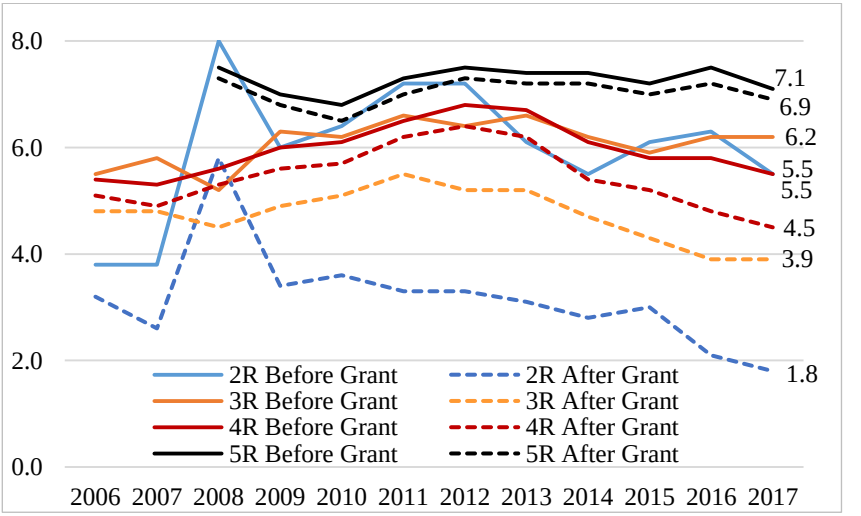
Figure 10 Median Offer Price and Median Nett Price by Type of Flat for Buyers Eligible for Grants, 2006-2017



Source: Government of Singapore. Housing and Development Board

Figures 11 and 12 present the before grant and after grant analyses of the PIR and DSR respectively for new flat buyers who were eligible to receive demand subsidies by the type of flat purchased. Note that the after-grant PIR and DSR were calculated for each buyer using the nett price paid. Buyers still pay a 10% down payment but this is based on the nett price. There is a clear improvement in affordability once the grants are factored in, and the improvement is progressive. The PIR and DSR for the larger flats are still high, probably because current income is used instead of permanent income, and buyers who obtain grants must satisfy an income ceiling restriction.

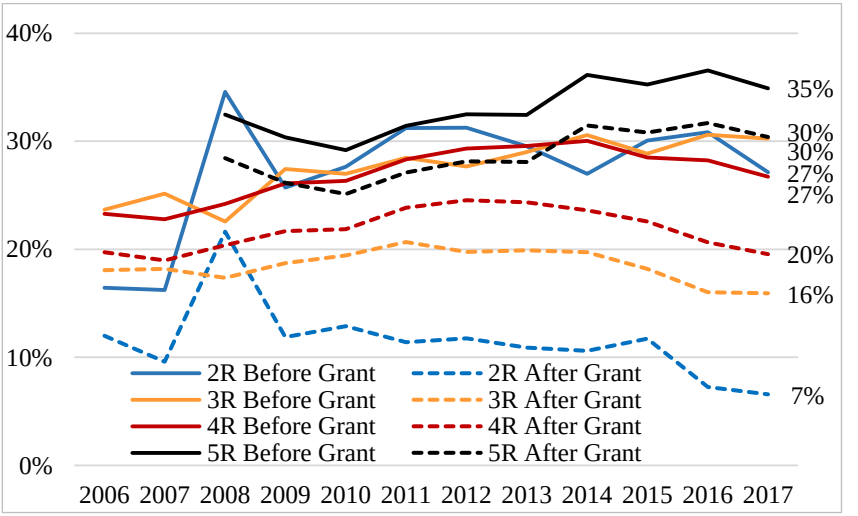
Figure 11 Median PIR by Type of Flat Before and After Receipt of Grant for Buyers Eligible for Grants, 2006-2017



Source: Government of Singapore. Housing and Development Board

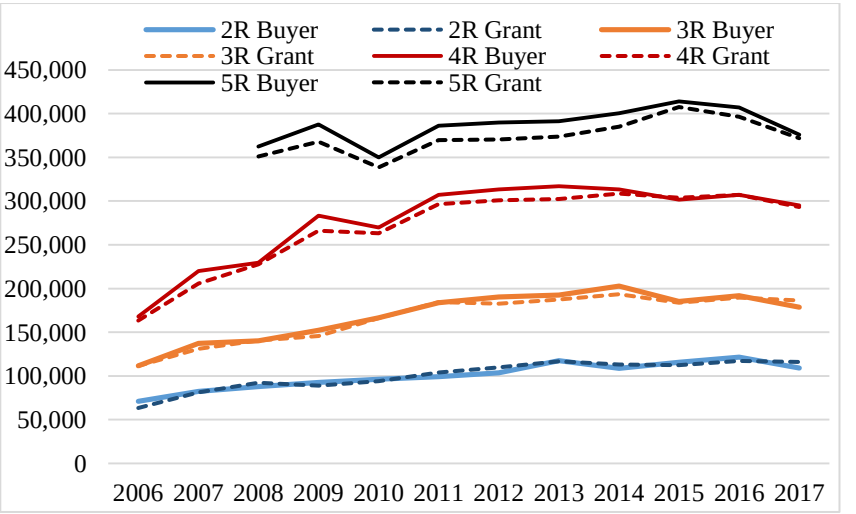
Finally, Figure 13 compares the median expenditure on housing of the grant recipients (indicated by "Grant") against non-grant recipient buyers by type of flat. At the mid-point, there are no noticeable distortions in housing expenditure although non-grant assisted buyers of larger flats appear to have spent more on housing earlier in the sample period. Demand subsidies tend to induce housing overconsumption, which puts pressure on house prices. In the case of new public flats where the prices are controlled by the HDB, housing grants may motivate buyers to buy more "house". Our preliminary finding suggests that the calibration of grant amounts has not given rise to significant allocative inefficiencies thus far.

Figure 12 Median DSR by Type of Flat Before and After Receipt of Grant for Buyers Eligible for Grants, 2006-2017



Source: Government of Singapore. Housing and Development Board

Figure 13 Median Expenditure by Type of Flat for Buyers Ineligible vs. Eligible for Grants, 2006-2017



Source: Government of Singapore. Housing and Development Board

5. Conclusion

This paper examines housing affordability challenges in the Singapore public housing sector by analyzing two proximate causes of house price appreciation in the assisted public residential market. First, we argue that an inadequate supply response in terms of state-owned land for private residential property development increases the demand tension for public resale flats. This is transmitted directly to the "subsidized" public housing sector through a pricing approach in which new HDB flats prices take reference from the resale market. We show that this market-based policy in a period of excess demand and ample credit leads to the price inflation of low-cost housing. Policy makers responded by stabilizing new flat prices by increasing the subsidies provided. The state also enhanced its housing grant assistance schemes to targeted groups to mitigate the policy-outcome gap. We provide an assessment of how well these measures have worked to improve housing affordability. Our data comprises the universe of public housing sales by the HDB of BTO flats in NMEs between 2006 and 2017. Our preliminary results show that by explicitly breaking the pricing feedback loop between the primary public housing sector and a market-driven segment, and carefully targeting underserved groups with calibrated housing transfers, the state has largely managed to reverse the housing affordability issues of low to mid income households in Singapore. The improved affordability indicators have reaffirmed that the housing grants (i.e. the Additional CPF Housing Grant and the Special CPF Housing Grant) have achieved their intended objectives in providing more financial assistance to the lower-income citizen households to own an HDB flat and set up their home. The outcomes are progressive by being more favorable for the least well-off households who buy the smallest housing units and have not been distortionary. With continued price stabilization, the resale of public housing can continue to serve as a launching pad for upward social mobility by helping flat owners build equity.

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Appendix

Table A.1 Monthly Household Income Ceiling (in S$) for Buyers of New HDB Flats by Type of Flat

Year	2-room flat	3-room flat	4-room flat	5-room flat	Executive flat[a]
1964	$800[b]				
1970	$1200				
1971	$1200			$1201−$1500[c]	
1979		$1500		$1501−$2000	$2001−$2500
1981		$1500		$1501−$3500	
1985			$4000[d]		
1989			$5000		
1991			$6000		
1992			$7000		
1994		$1000[e]	$8000		
1997		$3000	$8000	$10,000	
2006	$2000	$3000	$8000	$10,000	
2011	$2000	$5000/ $10,000[f]	$10,000	$12000	
2012	$2000/ $5000[f]		$10,000	$12,000	
2013	$5000		$10,000	$12,000	
2015	$6000	$6000/ $12,000[f]	$12,000	$14,000	

Notes:

a. The HDB stopped accepting applications for executive flats in 1995. The Executive Condominium (EC) replaced executive flats and the income ceiling from 1997 is for the EC.

b. The monthly income of any individual in a household should not exceed S$500.

c. Households with a monthly income below S$1200 were not eligible to buy 5-room flats.

d. In 1985, a single income ceiling was applied for all types of flats.

e. The HDB put the construction of 2-room and 3-room flats on hold from 1975 to 1993. It resumed the sales of 3-room flats that it purchased from the open market in 1994.

f. The lower income ceiling generally applies to non-mature estates whereas the higher figure applies to mature estates.

Sources: Compiled from Government of Singapore. Housing and Development Board, and press releases of the HDB, and various news archives

Table A.2 Exchange Rate: SGD to USD

Year	USD per SGD	Year	USD per SGD
1964	0.3267	2002	0.5714
1970	0.3267	2003	0.5845
1971	0.3278	2004	0.6064
1979	0.467	2005	0.5959
1981	0.4869	2006	0.6485
1985	0.4773	2007	0.6878
1989	0.5128	2008	0.6812
1991	0.5978	2009	0.7174
1992	0.6057	2010	0.7639
1993	0.6252	2011	0.7675
1994	0.6793	2012	0.8195
1995	0.7047	2013	0.7966
1996	0.7117	2014	0.7633
1997	0.5977	2015	0.7104
1998	0.605	2016	0.7021
1999	0.5956	2017	0.7404
2000	0.5764	2018	0.729
2001	0.545	2019	0.7378

***Source*:**

1) Since 1994: Government of Singapore. Singapore Customs. Data retrieved at https://www.customs.gov.sg/eservices/exchange-rates-and-currency-converter/currency-conversion-two

2) Others: Retrieved at https://fxtop.com/en/historical-currency-converter.php