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Unpacking Singapore's Leasehold Relativity Table – An Empirical and Legal Analysis

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In Singapore, most land is state-owned, with the state generally issuing leasehold estates via state leases of not more than 99 years[1], depending on the intended land use. Naturally, the value of a leasehold estate, which erodes over time as the lease approaches the end of its term, is a key component of the premium charged for lease renewals, or the tax imposed for permission given in relation to a development that would increase the value of the land. By law, the state valuation of leasehold land is prescribed by a leasehold relativity table colloquially known as 'Bala's Curve' or 'Bala's Table'. Since its adoption in 1948, however, the underlying assumptions and discount rate inherent to the curve have not been disclosed. This paper aims to deconstruct or reverse engineer Bala's Table to derive the best fit model of the curve. Doing so allows policymakers to evaluate whether the model parameters align with prevailing economic realities, and if not, modify them to reflect the market and more accurately value leasehold estates for calculating taxes and premiums.

Keywords

Leasehold land valuation, Law and economics, Land policy, Planning law

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[1] Under the State Lands Rules r 10, 'the title ordinarily to be issued shall be a lease for a term not less than 10 years and not exceeding 99 years…'.

1. Introduction

With a total land area of approximately 730 square kilometres, Singapore is a small country with limited land resources. Somewhat unsurprisingly, the proportion of land held in 'fee simple', a form of freehold estate[2] by non-state owners, has been estimated to be as low as 10% (Purves, 2023), and in any case, certainly not more than 20% of all land in Singapore (Sing and Sia, 2021). The state is thus the freeholder of most land in Singapore, and issues leasehold estates via state leases of varying lengths of tenure for sale, depending on the intended land use. Under long leases, an upfront payment or premium (i.e., the price) is paid, rather than periodic payments of rent, which are more common for short leases. For residential properties, the 99-year leasehold tenure is the most common estate. In carving out a leasehold from a freehold estate, the land law describes the freeholder as owning the reversion, with the current owner of the leasehold estate owning the term. The term and reversion thus collectively form the entirety of the estate.

In Singapore, Phang (2001) observes that 'the boundaries within which the market is allowed to operate in the various housing sub-sectors are almost completely defined by planning and public policy'. According to the Singapore Land Authority (2025), the general government policy is to allow leasehold estates to expire without renewal so as to respond to 'fast changing socio-economic needs'. As a result, the residual value of the leasehold estate at the end of the lease is arithmetically zero when the leasehold reverts to the state. Given that most landowners in Singapore are in fact long lessees, it is essential to understand how property values change as the 99-years elapse, albeit that no private residential leasehold property has yet come to the end of its tenure (Sing and Sia, 2021). During the lifetime of a leasehold tenure, owners of leasehold property derive value by selling the remaining lease of the property. This may occur either via a sale in the secondary market, or when owners of strata-title property (typically an apartment or condominium unit) collectively sell all the units and common property to a developer, known as an 'en bloc' sale (Ti, 2020; 2023a). In such cases, where planning permission is given to demolish the old building and build a new development in its stead, the state typically permits the developer to 'top-up' the leasehold site, which is seen as a de facto renewal of the 99-year lease tenure. As property valuation may be seen as a function of law and policy (Ti, 2023b), the purpose of this paper is to analyse the framework which governs how the state values leasehold property to take into consideration lease decay and relatedly, how the state prices renewals of leasehold land. Section 2 offers an overview of the rationale behind leasehold land in Singapore and includes a legal analysis of the relativity curve utilised in Singapore, commonly referred to as 'Bala's Table' or 'Bala's Curve', as

[2] Singapore recognises two forms of freehold estates – the fee simple and the life estate. However, as the term 'freehold' is commercially synonymous with the fee simple (i.e., the right to own a plot of land forever), this paper adopts the term of freehold estates.

presented in Table 1. Section 3 examines the empirical study related to Bala's Table in both private and public properties. Section 4 emphasises the mathematical justification of Bala's Table by using various mathematical models. Section 5 focuses on the applications of the proposed model, while Section 6 presents the conclusions. The research findings of this paper are significant as there is very limited literature on this topic, and by establishing a mathematical model of Bala's Table, this paper makes patent some of the underlying assumptions and rationale that support the curve. While a long-standing policy of the state for lease renewal of residential land is site intensification, a recent policy change to increase the housing stock suggests that even in the absence of site intensification, the state may allow leasehold estates to be refreshed to mitigate property decay and foster the preservation of communities. This makes understanding the rationale behind lease renewals even more significant.

2. Legal Analysis of Bala's Table

2.1 Rationale of Leasehold Land

The practice of issuing 99-year leases instead of freehold estates dates back to colonial Singapore, pursuant to the Crown Land Rules 1947. Land reforms were driven by land revenue considerations (See, 2022) and pragmatism meant that this practice continued post-independence. Ninety-nine-year leases are now granted pursuant to the State Land Rules.

In explaining the apparent paradox between ownership of public flats on a leasehold basis for instance, the previous Minister for National Development of Singapore, Desmond Lee, explains why a 99-year lease strikes an appropriate balance between meeting the current needs of ownership with future national needs of urban renewal (Parliament of Singapore, 2023):

'We firmly believe in home ownership, as it provides us the stability to build our families and raise our children, gives us a sense of rootedness in Singapore and allows us to have a stake in our country's progress. Home ownership has worked for us, and we need to continue with the good work to make it work for the next generation. That is why we sell HDB flats on 99-year leasehold, which strikes a balance between providing a home-for-life, asset appreciation and enabling us to rejuvenate our city and build new homes for the next generation too.'

Understandably, the national ethos sees the scarce land resources of Singapore as an asset that has to be subject to careful stewardship. As the Minister of State for National Development, Tan Kiat How, explains (Parliament of Singapore, 2021c):

Table 1 Leasehold Values as a Percentage of Freehold Value

Term of Years	Percentage (%) of Freehold Value	Term of Years	Percentage (%) of Freehold Value	Term of Years	Percentage (%) of Freehold Value
1	3.8	34	63.7	67	84.2
2	7.5	35	64.6	68	84.5
3	10.9	36	65.4	69	85.4
4	14.1	37	66.2	70	86.0
5	17.1	38	67.0	71	86.5
6	19.9	39	67.7	72	87.0
7	22.7	40	68.5	73	87.5
8	25.2	41	69.2	74	88.0
9	27.7	42	69.8	75	88.5
10	30.0	43	70.5	76	89.0
11	32.2	44	71.2	77	89.5
12	34.3	45	71.8	78	90.0
13	36.3	46	72.4	79	90.5
14	38.2	47	73.0	80	91.0
15	40.0	48	73.6	81	91.4
16	41.8	49	74.1	82	91.8
17	43.4	50	74.7	83	92.2
18	45.0	51	75.2	84	92.6
19	46.6	52	75.7	85	92.9
20	48.0	53	76.2	86	93.3
21	49.5	54	76.7	87	93.6
22	50.8	55	77.3	88	94.0
23	52.1	56	77.9	89	94.3
24	53.4	57	78.5	90	94.6
25	54.6	58	79.0	91	94.8
26	55.8	59	79.5	92	95.0
27	56.9	60	80.0	93	95.2
28	58.0	61	80.6	94	95.4
29	59.0	62	81.2	95	95.6
30	60.0	63	81.8	96	95.7
31	61.0	64	82.4	97	95.8
32	61.9	65	83.0	98	95.9
33	62.8	66	83.6	99	96.0

Source: Singapore Land Authority.

'We recycle our limited land, for instance, through selling it on a leasehold basis, allowing us to refresh our land use and renew our cityscape and neighbourhoods…At the heart of these decisions, it is not just about balancing the various needs of Singaporeans today, but, importantly, it is also about balancing the needs of today's generation with those that come after us.'

Given the large proportion of leasehold property in Singapore, determining the correct valuation of leasehold assets at various stages of the lease is critical. The proper execution of compulsory acquisitions, collective sales, lease renewals, the facilitation of the sales and purchase of existing leasehold properties, mortgage lending, and the securitisation of leasehold real estate assets on the stock market all require a systematic and consistent method to value leasehold property relative to a freehold site with otherwise identical attributes. Determining this relativity is often done by using a leasehold relativity table.

2.2 Bala's Table

The leasehold relativity table of Singapore - Bala's Table or Bala's Curve - is named after a local land office employee who first drew up this assumed relationship between freehold properties and 99-year leasehold properties (Parliament of Singapore, 2023). Bala's Table was originally an internal document of the colonial Land Office used for the alienation of state land after approximately 1948; it was only in July 2000 that the table became statutorily enshrined (Kwek and Hoh, 2017). Leasehold relativity tables are necessary because the market value of a leasehold property does not follow straight line depreciation, as the value of the land does not fall at a constant annual rate as its lease period falls. This is based on the time value of money, or the concept that a dollar today (or present use and ownership of land today) is worth more than that in the future. Elsewhere, leasehold relativity tables are typically used by real estate appraisers as valuation benchmarks. In valuing the relative value of leasehold flats in London for instance, the 'Gerald Eve'[3] graph of relativities was held by an Upper Tribunal Lands Chamber (Trustees of the Sloane Stanley Estate v Adrian Howard Mundy, 2016) as an 'industry standard'. Upon appeal in the same case, the English Court of Appeal (Adrian Howard Mundy v Trustees of the Sloane Stanley Estate, 2018) describes the Gerald Eve graph as 'the most influential' among the leasehold relativity graphs used in London. Since they are industry led, these graphs essentially use past market transactions that compare properties with similar characteristics except for tenure to estimate the relative value of a leasehold property compared to a freehold one, based on the number of years left on the lease.

While the Bala's Table for Singapore also seeks to provide a value of leasehold land relative to freehold, it differs from industry-led relativity graphs in two

[3] Founded in 1930, Gerald Eve LLP is a real estate advisory business headquartered in London.

ways. First, Bala's Table has the force of law and is not merely influential, as it is provided for in the seventh schedule for the *Land Betterment Charge (Table of Rates and Valuation Method) Regulations 2022* (Singapore Statues Online, 2025). Second, unlike relativity tables that seek to use past transactions to predict future values, Bala's Table is static and does not respond to market transactions – conversely, the table would certainly have an effect on market prices. While the fixed nature of Bala's Table may be seen as double-edged sword, it is noteworthy that the English Court of Appeal laments the fact that they have no standardised graph to determine relativity, which they can adopt and is both reliable and simple to apply (Adrian Howard Mundy v Trustees of the Sloane Stanley Estate, 2018). That Singapore enjoys the certainty of Bala's Table is thus laudable. While Bala's Table statutorily provides the relative value of leasehold to freehold land, the application of the table is more nuanced, and unpacking this requires distinguishing between betterment levies and lease renewal premiums.

2.2.1 Betterment Levies

In Singapore, the land betterment charge (LBC) is a tax levied when planning permission is granted to carry out development that increases the value of the land, for instance, where the site is re-zoned to a higher value use, or the permissible plot ratio is increased, thus resulting in a larger gross floor area.[4] While the Explanatory Statement for the *Land Betterment Charge Bill* (the Bill; Parliament of Singapore, 2021a) states that the purpose of the Bill is to provide a 'transparent and certain process…by making the amounts payable where consent is given for development…by reference to a straightforward, simple (no valuations required) table of rates', the Bill permits the LBC to be calculated by using either the valuation method or the table of rates method. However, Section 9(5) of the *Land Betterment Charge Act* states that the election to adopt the valuation method instead of the table of rates method is irrevocable. Regardless which method is adopted, the LBC is meant to capture 70% of the increase in land value that arises from the grant of consent for proposals that involve the development of land (Singapore Statutes Online, 2025; Parliament of Singapore, 2021b).

It should be emphasised that the table of rates method is *not* Bala's Table. Singapore comprises 118 geographical sectors for any given type of land use (i.e., single-dwelling residential, high-rise residential, commercial, etc.), with transactions in every sector for each given land use type used by the Chief Valuer updated in the table twice a year – 1 March and 1 September.[5] Table 2 shows the rates of the first 7 (of 118) geographical sectors, as well as the use

[4] URA, 'Development Charge' (19 June 2024) https://www.ura.gov.sg/Corporate/Guidelines/Development-Control/Planning-Permission/Folder/DC-Charge-Rates.

[5] For the most recent revision, see https://www.sla.gov.sg/articles/press-releases/2024/revision-of-land-betterment-charge-rates-from-1-march-2024.

groups, as of March 2024. While the land value rates in the table of rates are adjusted twice a year, the deemed rate of lease decay found in Bala's Table remains constant.

Bala's Table is primarily used to provide a standardised basis for the downward adjustment of the LBC payable for properties with a residual tenure of 99 years or less (Tay et al., 2022). This means the LBC payable for all state leases with a residual tenure of 99 years or less is adjusted downwards by the leasehold factor found in Bala's Table to account for the remaining tenure of leasehold land. For instance, if a 1,000 square-metre industrial site (Use Group D) is allowed a change of use to a non-landed residential use (Use Group B2) in Geographical Sector 4 with a remaining lease of 65 years, then the LBC payable for the permitted change of the use without any corresponding lease renewal is adjusted downwards by a factor of 83%, according to Bala's Table. Therefore, with an increase in site value of 11,375,000 SGD[6] due to the change of use in this case where the pre-chargeable value is 875,000 SGD and post-chargeable value is $12,250,000, the LBC payable is 9,441,250 SGD according to Table 2.[7]

2.2.2 Lease Renewal Premiums

When the estate of a leaseholder has run down, the term 'topping up' the lease is often used, which gives the erroneous impression that the state extends the current lease. In actuality, what happens is that the leaseholder – typically a developer who has collectively purchased a strata development and wants to redevelop the site on a renewed lease – surrenders its existing leasehold interest and pays a lease renewal premium for the issue of a new 99-year lease. Unlike the LBC, the fee imposed in this scenario is not a tax, but akin to purchasing the tail-end of the lease for the number of years that separate the old lease surrendered and that of a fresh 99-year lease. Thus, a developer who surrenders a 60-year lease and is issued a 99-year lease gains the benefit of adding a tail lease of 39-years and charged the present value. A related difference is that while stamp duty is payable on lease renewal premiums (i.e., Article 8 in First Schedule of Stamp Duties Act 1929 (Attorney-General's Chambers of Singapore, 2025)), stamp duty is not levied on the LBC as the LBC is a tax – the principle being that a tax may not be levied on a tax (Parliament of Singapore, 2021b).

Unlike the calculation of LBC for leasehold sites, which provides for the use of the table of rates and Bala's Table, there is no statutory provision that requires the Chief Valuer to use a particular method to determine the lease renewal premium for any given site. Rather, the assessment is made based on the 'prevailing market value at the point of renewal' (Parliament of Singapore,

[6] 1.28 SGD = 1 USD

[7] Referencing Table 2, this amount is based on the calculation of $(12,250 x 1000 x 0.83 – 875 x 1000 x 0.83).

2017). The remaining lease tenure of the site is, however, a factor taken into consideration by the Chief Valuer in determining how much lease renewal premium is payable (Parliament of Singapore, 2023).[8] It has been observed that the valuation of the lease renewal premium may be contentious as, in contrast to the extremely transparent calculation of the LBC, the valuation of lease renewals is comparatively opaque, and there is no independent tribunal for a land owner to make an appeal against the amount of lease renewal premium imposed (Tay et al., 2022). It has thus been suggested that like the LBC, the lease renewal premium should be calculated by using the table of rates and Bala's Table, with the difference between the two leasehold values for any given land use and geographical sector providing the amount of the premium (Tay et al., 2022).

While there is no statutory provision that mandates the use of Bala's Table for lease renewal premiums, a paper issued by the Centre for Liveable Cities (CLC), a division of the Ministry of National Development, states that Bala's Table *is* used to calculate lease renewal premiums, with the table providing a transparent, easy to use comparison of land values across different lease periods (Kwek and Hoh, 2017). This suggests that the Chief Valuer, while adopting a more precise land rate for each site compared to the table of rates in any given geographical sector, uses Bala's Table to determine the rate of discount of the adopted land price. The CLC paper gives an example of a government land sale of an urban entertainment centre site at Victoria Street in 2005, where developers could choose to tender for either a 30 or 60-year lease. Under the conditions of tender of the site, tenders for 60-year leases (worth 80% of a freehold site) were adjusted by a factor of ¾ to be comparable with tenders for 30 years (worth 60% of a freehold site): this corresponds exactly to the relative values of leasehold land under Bala's Table (Kwek and Hoh, 2017). There is thus compelling evidence that Bala's Table has significant real-world implications not just in calculating the LBC but also providing the basis to calculate how much lease renewal premium a landowner would need to pay when s/he surrenders her/his old lease and obtains a fresh 99-year state lease. Bala's Table thus has two roles – adjusting how much an LBC is payable from a change of use or intensification, as well as determining the applicable lease renewal premium payable should the state permit an existing leaseholder the right to have a fresh 99-year-lease.

[8] Desmond Lee, Singapore Parliamentary Debates (22 November 2023) vol. 95 https://sprs.parl.gov.sg/search/#/sprs3topic?reportid=written-answer-15152

Table 2 Rates (Per Square Metre) of the First Seven Geographical Sectors (out of 118)

Geographical Sectors	Use Groups								
	A	B1	B2	C	D	E	F	G	H
1	$15,400	$5,040	$12,250	$13,720	$875	$910	$10	-	$1
2	$15,400	$5,040	$12,250	$13,720	$875	$910	$10	-	$1
3	$15,400	$5,040	$12,250	$18,270	$875	$910	$10	-	$1
4	$15,400	$5,040	$12,250	$16,240	$875	$910	$10	-	$1
5	$15,400	$5,040	$12,250	$18,270	$875	$910	$10	-	$1
6	$15,400	$5,040	$12,250	$18,270	$875	$910	$10	-	$1
7	$13,650	$5,040	$12,250	$14,420	$875	$910	$10	-	$1

First column		*Second column*
Use Group		*Description of purposes*
1.	A	Shop, office, association office, cinema, place of entertainment, clinic, medical suite, restaurant, petrol station, auto-service centre, commercial garage, market, sports and recreation building
2.	B1	Residential (landed dwelling-house)
3.	B2	Residential (non-landed residential building)
4.	C	Hospital, hotel room and hotel-related use
5.	D	Industrial, warehousing, science park, business park, transport depot, airport, dock, port uses, utility installation, telecommunication infrastructure, Mass Rapid Transit Station, Light Rail Transit Station
6.	E	Place of worship, community building, community sports and fitness building, educational and institutional uses, government building
7.	F	Open space, nature reserve
8.	G	Agriculture
9.	H	Drain, road, railway, cemetery, Mass Rapid Transit Route, Light Rail Transit Route

Credit: Land Betterment Charge (Table of Rates and Valuation Method) Regulations 2022

2.2.3 Public Housing Pricing Adjustments

The Housing & Development Board (HDB), which was established in 1960, is the public housing authority in Singapore tasked with providing more than 1.1 million affordable flats that house over 80% of the population as of 2024. Approximately 90% of these residents own their home, which is typically sold pursuant to 99-year leasehold agreements.

Introduced in 2009, the Lease Buyback Scheme (LBS) is the only equity release option in Singapore designed to help HDB flat owners aged 65 and above access retirement funds without outright selling their flat. The scheme allows owners to monetise their property by retaining the front-end of the remaining lease and selling the tail-end lease back to the HDB. Owners therefore retain the right to live in their flat for the duration of the front-end lease. Proceeds from the sale, calculated based on the present value of the tail-end lease, are allocated to supplement retirement income (Kwong et al., 2021). An HDB document issued to a flat owner that outlines the estimated market values for various retained front-end lease periods suggests that the HDB likely employs Bala's Table to adjust lease values based on the retained lease period. For instance, the market values for front-end leases of 25, 30, and 35 years are given as $240,200 SGD, 264,000 SGD, and 284,200 SGD, respectively, in the document. This results in lease value ratios of 0.9198 (25 to 30 years), 0.8452 (25 to 35 years), and 0.9289 (30 to 35 years). These ratios closely align with those derived from Bala's Table, which are 0.9100, 0.8452, and 0.9288, respectively.

Another example of the HDB use of Bala's Table for pricing public flats is the scheme for short-lease 2-room Flexi flats. This housing option is designed to meet the diverse needs of elderly residents with an affordable price. By combining affordability with flexible lease durations, 2-room Flexi flats provide a practical age-in-place solution for citizens or permanent residents aged 55 and above who meet the income ceiling requirements. Eligible elderly buyers can choose lease durations in 5-year increments that range from 15 to 45 years, as long as the lease lasts until they reach at least 95 years old. For short-lease 2-room Flexi flats, the prices are highly subsidised, with costs influenced by location, demand, and the chosen lease duration. Based on indicative price ranges from various projects over the years, there are compelling indications that the HDB uses Bala's Table to adjust its pricing model according to the lease duration. This conjecture can be illustrated by using examples from two projects launched in 2019 and 2024, respectively.

The first project, Green Spring, located in the Tampines estate, consists of six residential blocks with a total of 657 units, including 2-room Flexi, 3-room, 4-room, and 5-room flats, launched in November 2019. The second project launched in October 2024, Towner Breeze, is situated in the Kallang estate, and comprises a single residential block that offers 355 flats, with a mix of 2-room Flexi and 4-room units. Table 3 provides the indicative price range for 2-room

Flexi (Type 1[9]) flats across different lease durations, while Table 4 outlines all potential lease ratios derived from the minimum price range of both projects in comparison to the lease ratios from Bala's Table. Remarkably, the ratios from both projects closely align with the corresponding figures from Bala's Table, with the maximum absolute difference not exceeding 0.011. This provides compelling evidence that the HDB uses Bala's Table to adjust the selling prices of 2-room Flexi flats based on varying lease durations.[10]

3. Empirical Study of Bala's Table

Bala's Table provides a practical framework for valuing Singapore public flats with varying lease durations, thus offering the HDB a straightforward and transparent method for determining pricing strategies. Bala's Table also appears to be adopted when existing leaseholders of private property are granted a fresh 99-year-lease. However, Bala's Table may not always accurately reflect the pricing dynamics of the market, as leasehold properties may experience lease decay differently from the assumptions that underlie Bala's Table. A parliamentarian has noted that Bala's Table does not accurately represent how flat prices 'actually behave in the secondary market' (Parliament of Singapore, 2023). Despite this, Bala's Table carries the force of law, thus suggesting that the market may be over-discounting leasehold properties, as the lease decay curve derived from actual data is steeper than that assumed by Bala's Table. To illustrate these discrepancies, we will analyse empirical data from both private and public properties.

Table 3 Indicative Price Range for 2-Room Flexi Flats (Type 1) with Different Lease Tenures

Lease Tenure	Green Spring	Towner Breeze
15	$49,000 - $57,000	$72,000 - $94,000
20	$58,000 - $69,000	$87,000 - $112,000
25	$66,000 - $78,000	$99,000 - $128,000
30	$73,000 - $86,000	$108,000 - $140,000
35	$78,000 - $92,000	$116,000 - 151,000
40	$83,000 - $98,000	$123,000 - 160,000
45	$87,000 - $103,000	$129,000 - 168,000

Note: 1.28 SGD = 1 USD.

[9] The main difference between Types 1 and 2 lies in the size and layout, with Type 1 (36-38 sqm) being more compact and Type 2 (45 sqm) providing extra space with two bedrooms.

[10] Similar results are also observed if the maximum of the price range is used.

3.1 Private Property Evidence

Giglio et al. (2014) investigate how households weigh immediate costs against uncertain benefits over very long horizons, which exceed 100 years. Focusing on the housing market in Singapore, where property ownership is either leasehold or freehold, the researchers analyse price differences between these forms. They find that 71-to-85-year leaseholds are valued by the market at 25% less than comparable freeholds—a significantly greater discount than the 7% to 14% range suggested by Bala's Table.

Table 4 Comparisons of Lease Ratios Based on Minimum of Indicative Price Range in Green Spring and Towner Breeze with Bala's Ratio

Bala's Table

Lease Tenure	Base Lease					
	45	40	35	30	25	20
15	0.557	0.584	0.619	0.667	0.733	0.833
20	0.669	0.701	0.743	0.800	0.879	
25	0.760	0.797	0.845	0.910		
30	0.836	0.876	0.929			
35	0.900	0.943				
40	0.954					

Green Spring

Lease Tenure	Base Lease					
	45	40	35	30	25	20
15	0.563	0.590	0.628	0.671	0.742	0.845
20	0.667	0.699	0.744	0.795	0.879	
25	0.759	0.795	0.846	0.904		
30	0.839	0.880	0.936			
35	0.897	0.940				
40	0.954					

Towner Breeze

Lease Tenure	Base Lease					
	45	40	35	30	25	20
15	0.558	0.585	0.621	0.667	0.727	0.828
20	0.674	0.707	0.750	0.806	0.879	
25	0.767	0.805	0.853	0.917		
30	0.837	0.878	0.931			
35	0.899	0.943				
40	0.953					

Additionally, our analysis of Orchard Court, a residential development in Singapore, provides anecdotal evidence that supports the findings. Orchard Court is a unique mixed-tenure development that was launched in 1973. It comprises 96 similar-sized units, with leases of either 99 years (leasehold) or 993 years (considered effectively freehold due to the long duration). From 1995 to 2024, we documented 52 leasehold transactions and 21 freehold transactions at Orchard Court. We plotted the price per square foot (PSF) against the property age (in years) in Figure 1, which show non-linear fitted curves with the use of a local regression method[11].

Figure 1 illustrates that freehold properties are generally valued higher than leasehold properties, thus indicating that a discount is indeed applied to leasehold properties. Using the fitted local regression models, we estimate the ratio of PSF for leasehold to freehold and plot the results against Bala's Table in Figure 2. As the remaining lease term decreases, the empirical PSF ratios for leasehold properties fluctuate between 70% and 80%, while the Bala values consistently decline from 91% to 74%. Figure 2 offers compelling evidence that the property market applies a consistent discount on leasehold properties compared to freehold properties, as transaction prices suggest a more significant discount than indicated by the statutory table when the remaining lease ranges from 60 to 80 years.

3.2 Public Property Evidence

While Bala's Table offers a straightforward pricing framework for the HDB to determine flat values based on lease durations, the open HDB resale market incorporates additional economic factors and flat attributes when valuing public flats with varying lease durations, thus leading to inconsistencies with Bala's Table. For illustrative purposes, monthly HDB resale transactions from January 1999 to June 2024 in two mature estates, Clementi and Kallang, are analysed to examine how variations in the remaining lease durations of flats influence resale prices[12].

The HDB resale price (psqm) is initially adjusted for different transaction dates by using the HDB Resale Price Index as the response variable Y_i for the regression analysis. The dataset is then categorised by type of flat—3-room, 4-room, and 5-room flats—within each considered estate. For each category, we construct 3 different regression models with the independent variable either remaining lease X_1, or Bala's Table value X_2, where the 3 models are:

$$M1: Y = \beta_0 + \beta_1 X_1 + \varepsilon \quad (1)$$

[11] Both curves are fitted by using local regression with a tuning parameter of 60% of local points.

[12] All datasets are obtained from a government open-source database https://data.gov.sg/

$$M2: Y = \beta_0 + \beta_1 X_1 + \beta_2 X_1^2 \varepsilon \quad (2)$$

$$M3: Y = \beta_0 + \beta_1 X_2 + \varepsilon \quad (3)$$

M1 and M2 examine the linear and quadratic relationships of X_1 with Y, respectively while M3 investigates the linear relationship of X_2 with Y. The result is plotted in Figure 3. All 3 models are statistically significant across all cases studied, thus illustrating the expected upward trend in flat prices as the remaining lease increases, except for the 5-room Kallang, which initially shows a downward trend before rising. Nonetheless, M1 and M2 consistently outperform M3 in terms of the adjusted R-squared measure, thus suggesting that Bala's Table does not explain the resale price better than the remaining lease variable. Interestingly, M3 always projects a higher resale price for leases that range from 60 to 90 years compared to M1 and M2. This empirical analysis strongly indicates that the open HDB resale market does not always align with Bala's Table when it comes to price adjustments for varying remaining lease durations.

Figure 1 **Non-linear Relationship Between Age and Price for Freehold and Leasehold in Orchard Court Transactions**

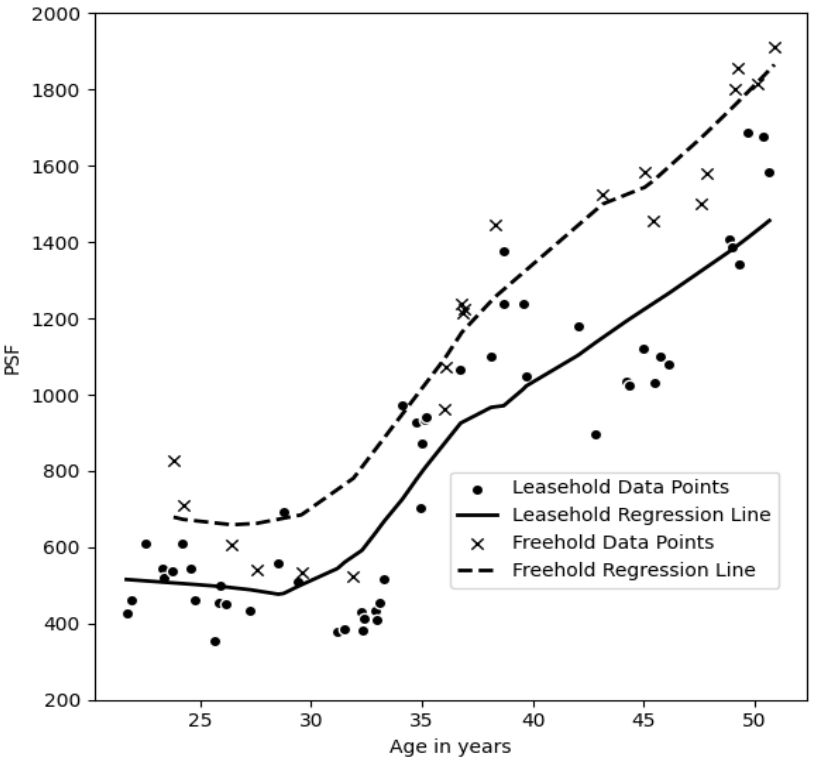
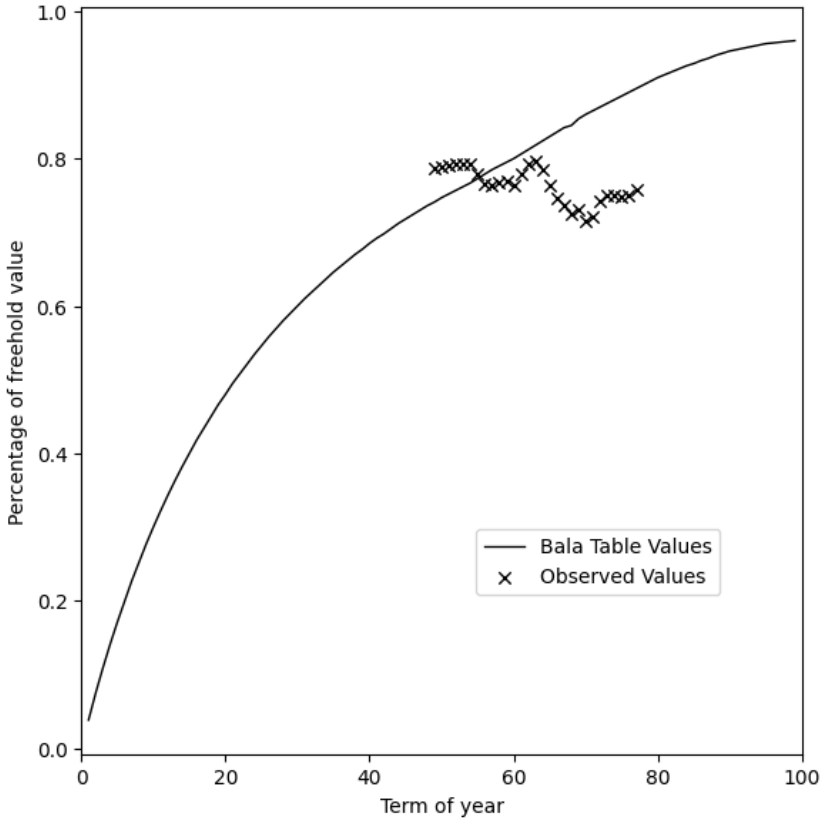


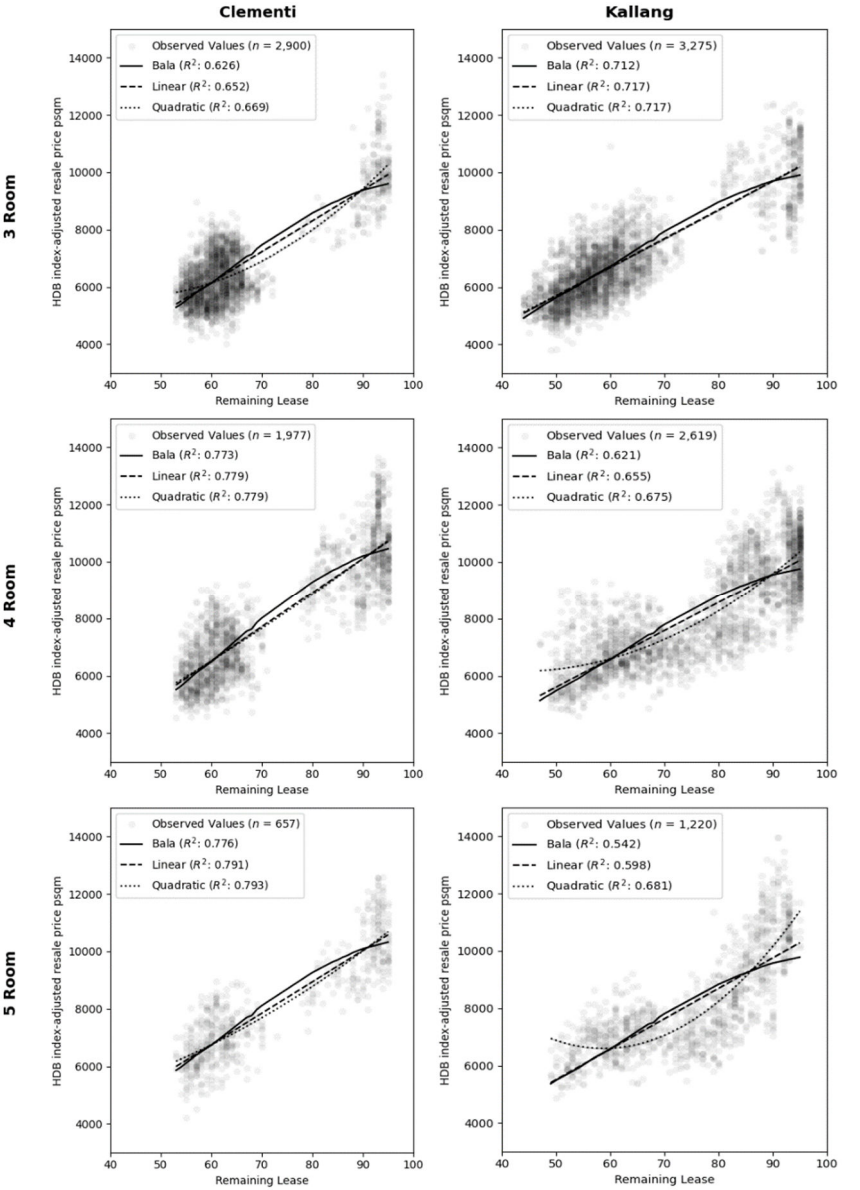
Figure 2 Comparison of Bala's Curve with the Observed Percentages from Orchard Court Transactions



4. Modelling Bala's Table

While a CLC paper by Kwek and Hoh (2017) suggests that Bala's Table is based on a discount rate of approximately 3.5%, it does not provide a detailed breakdown of the assumptions that underlie this rate. This paper employs internal rate of return (IRR) models to analyse how the remaining lease tenure influences the values in Bala's Table. These models provide insights for policymakers by elucidating the empirical and economic assumptions that underpin the table. By examining whether these assumptions align with current economic conditions, the state can adjust the parameters of the model to modify the gradient of the statutory leasehold decay table if necessary. This research is innovative in its approach.

Figure 3 **Fitted HDB Index-adjusted Resale Price against Remaining Lease for Different Estates and Flat Types under 3 Different Models**



When analysing the potential costs and benefits of an investment over its lifetime, the net present value (NPV) is commonly used to find the difference between the present value of its benefits and that of its costs. At a specified discount rate that depends on the current cost of capital, if the calculated NPV is positive, i.e., the present value of its benefits outweighs that of its costs, the investment opportunity should be undertaken. Otherwise, the investment opportunity should not be pursued. However, the IRR approach does not depend on any pre-specified discount rate like the NPV. For a given cash flow stream associated with an investment, the IRR identifies a discount rate such that the present value of both the benefits and costs is equal. In other words, the specified rate in the IRR is defined as the discount rate in the NPV where NPV=0. Unlike the NPV, the IRR is entirely determined by the stream of cash flow without any reference to the external financial world such as a pre-specified discount rate. Therefore, the IRR is the best approach to explain the Bala values without considering current financial factors or investment environments.

We examine three IRR models to clarify Bala's values. The first model, referred to as IRR Model 1, is based on the assumptions of uniform benefit cash flows and a fixed return rate. While the discrepancies between the calculated Bala's values under IRR Model 1 and the actual Bala's values are substantial, this initial straightforward model offers valuable insights on how to adjust either benefit cash flows or return rates for the subsequent models, known as IRR Models 2 and 3. The calculated Bala's values in these two models will closely align with the statutory Bala's values.

4.1 IRR Model 1

Let $(x_0, x_1, x_2, \ldots, x_n)$ be a stream of cash flows for a given investment opportunity in each of n years. Then the IRR of this investment is a number r that satisfies the following:

$$0 = x_0 + \frac{x_1}{1+r} + \frac{x_2}{(1+r)^2} + \cdots + \frac{x_n}{(1+r)^n}$$

In the proposed IRR Model 1 for explaining Bala's values, we make the following assumptions:

1. The model determines a unique r for the freehold or leasehold properties, regardless of the tenure of the lease.
2. The initial cash flow x_0 is the cost of the property and the remaining cash flows are the benefits generated from the investment.
3. The benefit cash flows which have a constant amount $x_i = C$ for $i = 1,2, \ldots,$ are applied to all the freehold and leasehold properties in future years.

The first assumption ensures that all the properties under the model will be evaluated under the same IRR or have the same quality of investment opportunity regardless of the lease duration. As Bala's Table is applied to all the property valuations, it is reasonable to assume that each property investment has the same internal rate of return or no investment is preferable to others. The second assumption provides the theoretical justification that the calculated r is a unique rate and always exists. At the beginning of the property transaction, the developer pays, as part of the price of the property, the right to use the property within the lease period as the initial cash flow, and expects to generate a stream of income benefits, e.g., rental incomes, until the expiry of the lease period. The second assumption which is consistent with general business practices ensures that there is only one unique r that satisfies the IRR equation according to the algebraic theory.

Without considering the impacts of tax, depreciation, inflation, etc., the third assumption is relatively simplistic by assuming a constant cash flow of the benefits. However, the outcomes of this model will suggest a better way to derive a more realistic model later. Under IRR Model 1, the value of a property with a lease tenure of i years, V_i, can be easily derived as follows:

$$V_i = \frac{C[1-(1+r)^{-i}]}{r} \tag{4}$$

and the value of freehold property is:

$$V_\infty = \frac{C}{r} \tag{5}$$

As a result, the calculated Bala's values B_i^* under IRR Model 1 is equal to

$$B_i^* = \frac{V_i}{V_\infty} = 1-(1+r)^{-i} \tag{6}$$

Following which, IRR Model 1 determines the value r by minimising the mean squared error (MSE) between the Bala's values B_i and calculated B_i^* for $i = 1, 2, \ldots, 99$. Figure 4 shows the curves for the Bala's values and calculated Bala's values under IRR Model 1 with $r = 3.0229\%$ and the minimum MSE $= 5.535 \times 10^{-4}$.

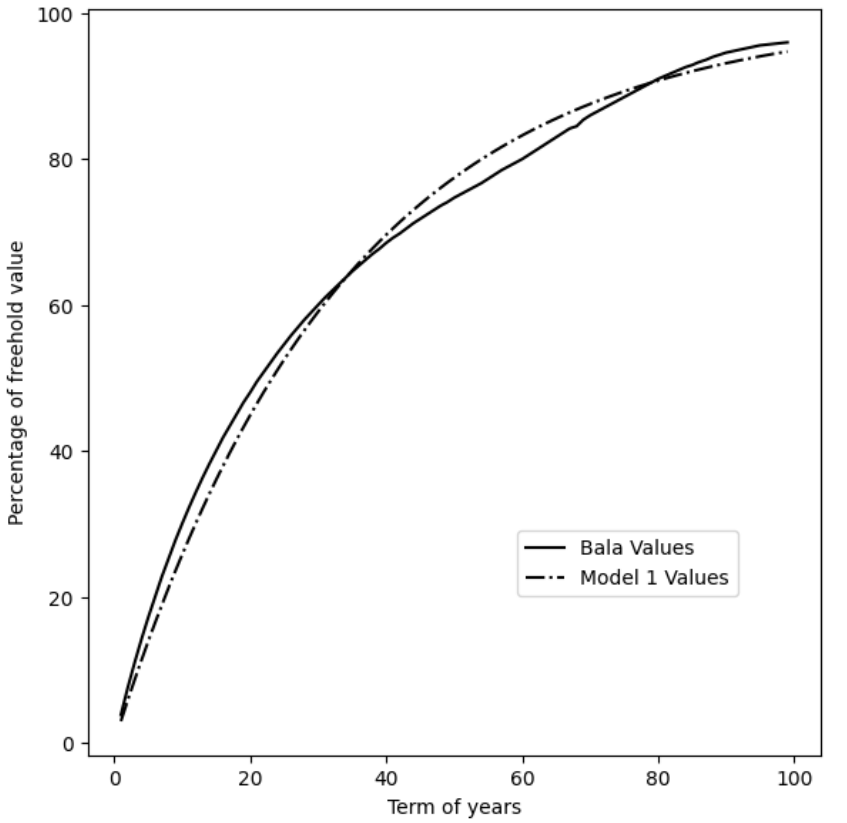
As seen in Figure 4, IRR Model 1 with $r = 3.0229\%$ underestimates the Bala's values when the lease tenure is either less than 35 years or more than 78 years, but overestimates when the lease tenure is between 35 to 78 years (inclusive). To refine IRR Model 1 so that the differences are minimised, we modify the cash flow amounts by introducing a new assumption of benefit cash flows when constructing IRR Model 2.

4.2 IRR Model 2

The first two assumptions of IRR Model 2 are the same as that of IRR Model 1. However, the benefit cash flow amounts under IRR Model 2 are allowed to change with the annual incremental rates during various periods and these changes are applied to all the freehold or leasehold property investments. The third assumption of IRR Model 2 is as follows:

The benefits of all the investments have annual incremental rates (g_1, g_2, g_1) due to the combined factors of inflation, tax, and depreciation during the first n_1 remaining years, next $n_2 - n_1$ remaining years, and thereafter, respectively. The incremental rates of the first n_1 remaining years and the years after n_2 remaining years are the same and equal to g_1.

Figure 4 Comparison between Bala Values and Calculated Bala Values under IRR Model 1



Note that IRR Model 1 is a special case of IRR Model 2 with parameters $g_1 = g_2 = 0$. Based on the under- and over-estimation results of IRR Model 1, we expect that the annual increment rate $g_1$should be lower than g_2 for $n_1 = 35$ and $n_2 = 78$ so that the estimated Bala's values under IRR Model 2 will be closer to the statutorily provided Bala's values.

Under Assumption 3 of IRR Model 2, the amounts of the benefit cash flows are:

$$x_i = \begin{cases} C(1+g_1)^i & i = 1, 2, \dots, n_1 \\ C(1+g_1)^{n_1}(1+g_2)^{i-n_1} & i = n_1+1, \dots, n_2 \\ C(1+g_1)^{i-(n_2-n_1)}(1+g_2)^{n_2-n_1} & i = n_2+1, \dots \end{cases} \quad (7)$$

With the stream of benefit cash flows x_i, the property value with a remaining lease tenure of i years, V_i, can be derived as:

$$V_i = \frac{C[1-(1+\alpha_1)^{-i}]}{\alpha_1} \quad (8)$$

for $i = 1, 2, \dots, n_1$,

$$V_i = V_{n_1} + \frac{C(1+\alpha_1)^{-n_1}[1-(1+\alpha_2)^{-i+n_1}]}{\alpha_2} \quad (9)$$

for $i = n_1+1, \dots, n_2$,

$$V_i = V_{n_2} + \frac{C(1+\alpha_1)^{-n_1}(1+\alpha_2)^{-(n_2-n_1)}[1-(1+\alpha_1)^{-i+n_2}]}{\alpha_1} \quad (10)$$

for $i = n_2+1, \dots, 99$, where:

$$\alpha_j = \frac{r-g_j}{1+g_j} \quad (11)$$

for $j = 1, 2$. The value of freehold property is

$$V_\infty = V_{n_2} + \frac{C(1+\alpha_1)^{-n_1}(1+\alpha_2)^{-(n_2-n_1)}}{\alpha_1} \quad (12)$$

Based on the above equations to evaluate the values V_i and V_∞, we can estimate Bala's values, denoted as $B_i^{**} = V_i/V_\infty$, under IRR Model 2 by searching within the domains of five parameters (g_1, g_2, r, n_1, n_2) to minimise the MSE between values B_i and B_i^{**} for $i = 1, 2, \dots, 99$. The R optimisation programme determines $(g_1 = 0.0020, g_2 = 0.0408, r = 0.0490, n_1 = 37, n_2 = 76)$ under the criterion of a minimum MSE. The calculated Bala values are highly comparable to the actual Bala's value, with a maximum absolute difference of 0.0060 and MSE $= 9.910 \times 10^{-6}$.

4.3 IRR Model 3

IRR Model 2 adjusts the benefit cash flows by incorporating annual incremental rates alongside a fixed discount rate to align with Bala's values, whereas IRR Model 3 changes the discount rates while maintaining a fixed benefit cash flow. As a result, the last two assumptions of IRR Model 3 are the same as those of IRR Model 1, with the primary assumption for IRR Model 3 being that the discount rates fluctuate over different time periods. The present value of cash flows under IRR Model 3 with a remaining lease t satisfies the following equation:

$$0 = x_0 + \frac{C}{1+s_1} + \frac{C}{(1+s_2)^2} + \cdots + \frac{C}{(1+s_t)^t} \tag{13}$$

where discount rates $s_i = r_1$ for $i = 1, 2, \ldots, n_1$, $s_i = r_2$ for $i = n_1 + 1, \ldots, n_2$, and $s_i = r_1$ for $i = n_2 + 1, \ldots, t$. Similar to IRR Model 2, the property value with a remaining lease tenure of i years, V_i, can be derived as:

$$V_i = \frac{C[1-(1+r_1)^{-i}]}{r_1} \tag{14}$$

for $i = 1, 2, \ldots, n_1$,

$$V_i = V_{n_1} + \frac{C(1+r_1)^{-n_1}[1-(1+r_2)^{-i+n_1}]}{r_2} \tag{15}$$

for $i = n_1 + 1, \ldots, n_2$

$$V_i = V_{n_2} + \frac{C(1+r_1)^{-n_1}(1+r_2)^{-(n_2-n_1)}[1-(1+r_1)^{-i+n_2}]}{r_1} \tag{16}$$

for $i = n_2 + 1, \ldots, 99$. The value of freehold property is

$$V_\infty = V_{n_2} + \frac{C(1+r_1)^{-n_1}(1+r_2)^{-(n_2-n_1)}}{r_1} \tag{17}$$

Based on the above equations to evaluate the values V_i and V_∞, we can estimate Bala's values, denoted as $B_i^{***} = V_i/V_\infty$, under IRR Model 3 by searching within the domains of four parameters (r_1, r_2, n_1, n_2) to minimise the MSE between values B_i and B_i^{***} for $i = 1, 2, \ldots, 99$. The other R optimisation programme calculates $(r_1 = 0.0462, r_2 = 0.0078,\ n_1 = 38, n_2 = 83)$ under the criterion of a minimum MSE. The calculated Bala's values closely align with the actual Bala's value, which is shown with a maximum absolute difference of 0.0060 and MSE $= 8.924 \times 10^{-6}$.

Figure 5 compares the curves for the Bala's values and calculated Bala's values under IRR Models 2 and 3 with their calculated set of parameters. Figure 6 presents the differences between the actual and calculated Bala's values under IRR Models 2 and 3 for various terms of remaining leases. Both models with

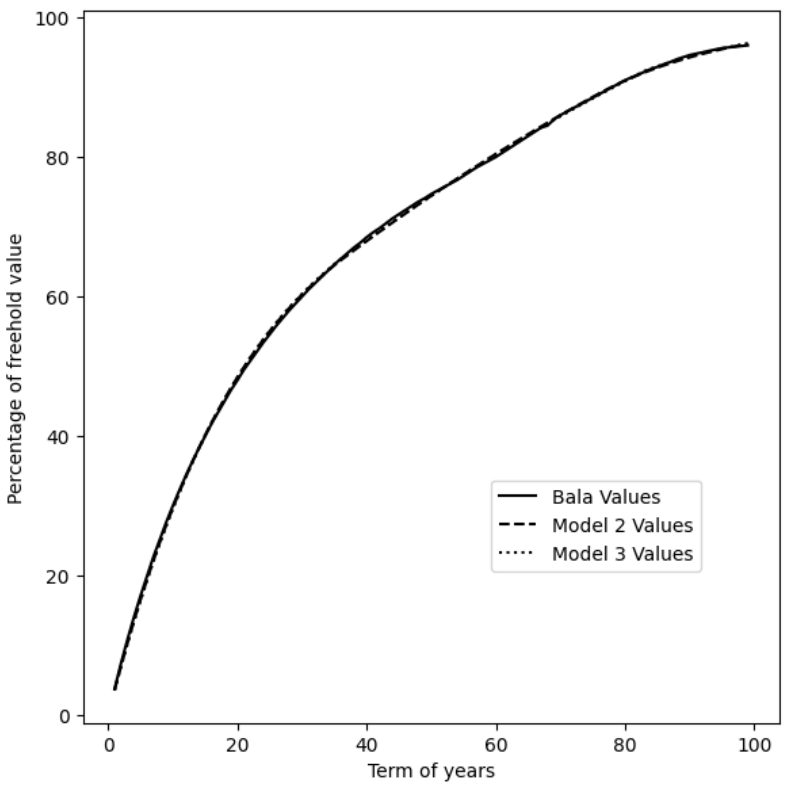
their corresponding estimated parameters thus provide a very good explanation of the actual Bala's values.

In fact, IRR Model 3 with the calculated parameters can be transformed and interpreted as a framework of generating different yield rates y_i for different remaining lease periods by solving:

$$V_i = \frac{C[1-(1+y_i)^{-i}]}{y_i} \tag{18}$$

for any i. The results are shown in Figure 7, which indicates that the yield curve remains flat at 0.0462 from Years 1 to 38. Subsequently, the curve declines somewhat linearly until reaching 0.039 at Year 83, after which, the decline continues at a slightly reduced rate to 0.0381 at Year 99. It is important to note that the implied yield rate for freehold properties is 0.0376. IRR Model 3 offers a simple and clear method for interpreting the Bala's Table in relation to the term structure of yield rates.

Figure 5 Comparison between Bala Values and Calculated Bala Values under IRR Model 2 and IRR Model 3

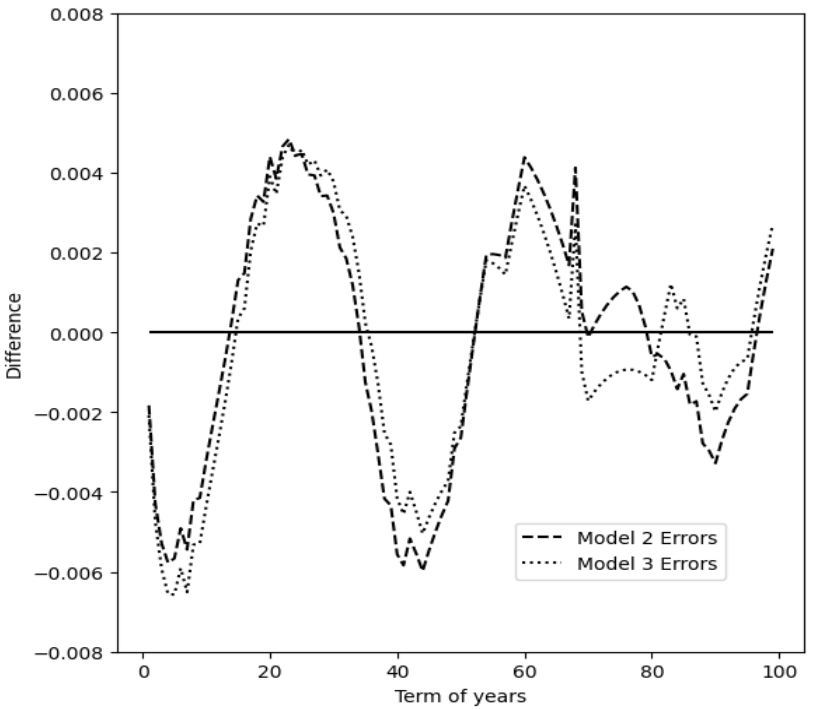


5. Applications of IRR Model 3

In contrast to IRR Model 2, IRR Model 3 offers several advantages, such as dependence on fewer parameters, a marginally lower MSE when aligning with Bala's Table, and a more straightforward interpretation of the model outcomes. Therefore, we now examine the possible practical applications of IRR Model 3 for regulators or re-developers to modify the Bala's values in response to intricate economic and financial situations.

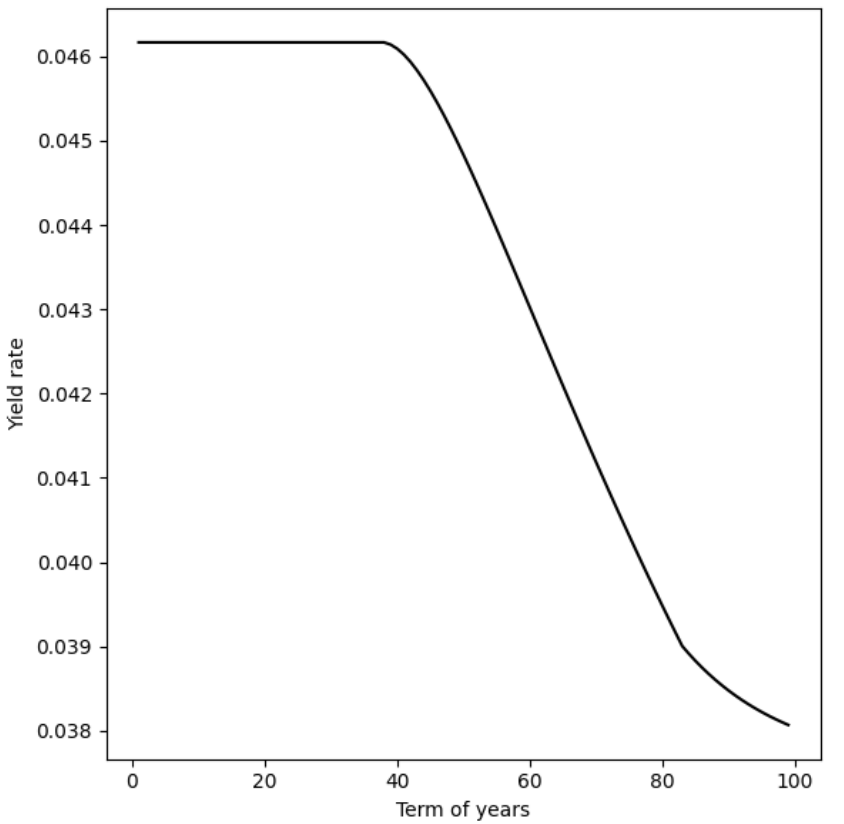
The rates presented in the Bala's Table may have influenced the trend of en bloc sales for relatively new properties, thus resulting in various forms of waste—physical, environmental, and economic. According to Chia and Sing (2023), most en bloc sales in Singapore involve properties that are 29 years old or newer, with nearly half of these sales attributed to properties aged between 20 and 29 years old. Specifically, they report that only 0.37% of en bloc properties are less than 10 years old, 21.58% are between 10 and 19 years old, 47.28% fall within the 20 to 29-year range, and 30.77% are 30 years old or older.

Figure 6 Differences between Bala Values and Calculated Bala Values under IRR Model 2 and IRR Model 3



The presence of relatively newer properties (i.e., 29 years and newer) which comprise a significant share of en bloc transactions may be an unintended effect of the current rates in the Bala's Table. If regulators decide to adjust the existing Bala's Table values to align with current economic expectations or regulate a surge in en bloc sales transactions, IRR Model 3 can be readily identified with more appropriate parameter values. This enables the calculation of a new set of Bala's values that reflect higher lease renewal premiums. For instance, if a developer wishes to surrender a private condominium project with a 70-year remaining lease to obtain a fresh 99-year state lease for redevelopment, the difference in the Bala's values between the 70-year and 99-year leases would be 10% (96% for the 99-year lease versus 86% for the 70-year lease). This difference serves as the basis for calculating the lease renewal premium.

Figure 7 The Calculated Yield Rates for Different Term of Lease under IRR Model 3



If regulators aim to temper an overheated redevelopment market by increasing development costs, they can apply a new set of parameter values under IRR Model 3, say $(r_1 = 0.04, r_2 = 0.002,\ n_1 = 38, n_2 = 83)$. With these adjustments, the calculated leasehold to freehold ratios would be 80.9% for the 70-year lease and 94.6% for the 99-year lease, thus the base changes to 13.7%, which is equivalent to a 37% increase over the original cost.

On the other hand, the other possible practical application of the model is for landowners to validate the leasehold value of their property, rather than solely relying on Bala's Table, in order to reduce the lease renewal premium owed. For example, for a property with 50 years remaining on the lease, Bala's Table indicates that a leasehold value is 74.7% of the freehold value of the site, with a top-up rate based on 21.3%.

If the prevailing economic and financial conditions support the notion that the market yield rate for investing in such a property should be guided by IRR Model 3 with parameters, say $(r_1 = 0.04, r_2 = 0.02,\ n_1 = 38, n_2 = 83)$, which corresponds to leasehold to freehold ratios of 80.3% for a 50-year lease and 97.9% for a 99-year lease, the model suggests that the lease renewal premium should be based on 17.6% instead of 21.3%. This represents a reduction of 17.4% in the lease renewal premium for landowners to top-up the existing lease to 99-years.

6. Conclusion

Accurately valuing leasehold estates is crucial for various stakeholders including the state as holder of the fee simple and landowner leaseholders. While Bala's Table is transparent, straightforward, a one-size-fits-all model, simple and easy to understand, it may not always account for the unique characteristics of different properties and economic conditions. For developers, the value of a leasehold estate greatly affects the LBC imposed for the granting of favourable planning permission, and lease renewal premiums owed for the 'topping up' of existing leases. While developers may benefit from the certainty and transparency of Bala's Table, the fixed and inflexible nature of the table may not fully capture market realities, where leasehold estates are priced at a greater discount relative to comparable freehold estates.

This paper has provided regulators and developers with a justifiable model by which to understand the existing Bala's Table. Regulators may alter the model parameters to calculate discount values which more accurately reflect the value of leasehold land after considering economic changes and different property characteristics. Through this process, the value of leasehold interest may be more accurately determined at various stages of its tenure.

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