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PUBLIC POLICY RESEARCH FUNDING SCHEME

Final Report

Cooling Measures in Hong Kong and its Residential Property Market (2020.A3.025.20C)

樓市降溫「辣招」與香港樓市

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B. Executive summary

B1. Abstract of the research

Since the Global Financial Crisis, Hong Kong has witnessed house prices surge from one record high to the next. In an attempt to rein in the overheated housing market, the Hong Kong government rolled out 12 rounds of interventions (cooling measures) from October 2009 to May 2017, which included tightening the mortgage supply and imposing various stamp duties (as shown in Table 1). Despite intensive debate among market observers, no consensus has been reached on whether the measures have been successful. There has also been growing concern over the unintended consequences of the measures. With the economy hit hard by the US–China trade tension, the unprecedented social unrest in 2019, and the subsequent COVID-19 outbreak, Hong Kong has inevitably slipped into economic recession. Given this, calls have been made to ease certain restrictions on the residential property market. However, without a comprehensive assessment of the overall impact, especially the unintended consequences, of each round of government interventions, it is difficult to determine when and which cooling measure(s) should be relaxed. In this regard, understanding the effectiveness of each of the past interventions is of first-order importance.

This project provides a comprehensive empirical analysis using robust transaction-level data containing over 90% of transactions of residential properties in Hong Kong from January 2008 to October 2018. The 12 rounds of cooling measures are numbered chronologically and classified into mortgage-tightening measures (Round 1, 3, 5, 6, 9, and 12) and tax-related measures (Round 2, 4, 7, 8, 10, and 11). Considering the inherent heterogeneities across submarkets, the residential housing market is further classified into two dimensions: market type and floor area. Such classification creates a total of nine submarkets: first-hand market, second-hand market, mass market, high-end market, second-hand HOS market, first-hand mass market, first-hand high-end market, second-hand mass market, and second-hand high-end market. A regression discontinuity design (RDD) is employed to explore the overall effectiveness, unintended consequences, and transmission mechanisms of each round of cooling measures on the nine submarkets.

The empirical results suggest that mortgage-tightening measures have effectively curbed the overheated property market by reducing price and trading volume in the short term. However, specific submarkets have still experienced volatilities on occasion. For example, the first-hand market, particularly the mass submarket, witnessed an increase in price and volume under the Round 3 and 6 measures. The second-hand market and its submarkets, on the other hand, have seen a decline in both price and volume.

The project also documents the distribution and pattern of price and volume responses to tax-driven measures by market. The findings suggest that while tax-driven measures, compared to mortgage-tightening measures, are more efficient in suppressing trading activities, they also trigger price volatilities across market sectors. In particular, the second-hand market was disproportionally subdued in terms of volume compared to the first-hand market. Moreover, as market observers note, stamp duties may cause a reduction in flats listed in the second-hand market, which eventually leads to a higher price.

Finally, there is suggestive evidence of the "spillover" effect on subsidized public housing (HOS) units, which experienced a price hike after the Round 2 measures and slashes in both price and volume following the Round 4 measures. In addition, the transaction volume declined further after the Round 8 measures, which introduced "Double Stamp Duty."

This project is expected to provide policy implications and recommendations that will be helpful to policymakers in reviewing the current cooling measures and for designing future housing policies.

研究摘要

香港政府於 2009 年 10 月開始先後推出了十二餘輪包括按揭貸款的宏觀審慎措施以及徵收各類印花稅在內的「樓市辣招」,意圖抑制過度熾熱的樓市。究竟每一輪降溫措施是否達到了其最初的目標?各項措施是否產生了負面影響?在這十年間,坊間對樓市措施的成效及後果一直褒貶不一。近幾年來香港更是遭受中美貿易摩擦,社會運動,以及 COVID-19 爆發的影響而步入技術性衰退,因此有提議政府是否應當放寬,甚至於取消相應的樓市辣招。現有的相關研究多數受到相關數據以及研究方法的限制,而未能提供有力的實證結果。

為了對以上的公眾疑問進行實證分析研究,本課題運用包含了 2008 年 1 月至 2018 年 10 月期間香港 90%以上的私人住宅交易資訊,採用斷點迴歸這一方法來檢驗每一輪 降溫措施對香港住宅價格,交易量的「凈效應」。十二輪降溫措施按時間順序編號, 按性質分為按揭貸款的宏觀審慎措施(第一,三,五,六,九,十二輪)以及徵收印 花稅措施(第二,四,七,八,十,十一輪)。本課題亦考慮不同子市場對樓市措施 的不同反應:譬如一手房相比于二手房市場,私人住宅市場相比於居屋市場,中小型 住宅(大眾)市場相比於大型住宅(高端)市場等。

研究結果表明,按揭貸款的宏觀審慎措施在短期內有效地降低了住宅價格價與成 交量。然而,一些子市場仍會經歷價格或交易量的波動。例如,一手住宅市場,特別 是中小型住宅子市場,在第三、六輪措施下,出現了價格和交易量齊升的局面。而二 手住宅市場及其子市場的價格和交易量都出現了下降。另一方面,雖然一系列的徵收 印花稅措施相比與抵押貸款緊縮措施更有效地抑制了住宅交易交易量,但它們也引發 了整個住宅市場的價格波動。在多重住宅交易稅的影響下,二手市場的成交量相比與 一手市場呈現不成比例地低迷。這一結果側面證實了一些市場觀察者的觀點:加重住 宅印花稅可能會導致二手住宅市場的供應量減少,最終導致價格上漲。

最後,本課題還發現表明居屋市場(HOS)亦受到多輪降溫政策的「溢出」效應 影響。例如,居屋價格在第二輪措施後經歷了短暫的上漲,而在第四輪措施後其價格 和交易數量均大幅下降。此外,在引入"雙重印花稅"的第八輪措施後,居屋交易量進

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一步下降。各項措施對一手市場的影響有限,而二手市場扭曲加劇,體現在價格和交易量的跌幅遠高於一手市場。

本課題的研究結果全面評估了十二輪住宅市場降溫政策的短期影響,為政策制定者審查當前的降溫措施和設計未來的住房政策提供了參考。

B2. Layman Summary on policy implications and recommendations

A number of implications are grounded on the research findings of this project. Specifically, the short-term effect of each round is different from each other, and the effect of each round varies significantly across submarkets. For example, the Round 1, 2, and 7 measures did not affect transaction volume, whereas the Round 8 and 9 measures were associated with a stronger response in transaction volume relative to price. Also, the first-hand mass market saw a price hike and a decrease in volume, whereas the second-hand mass market saw a price dip after Round 3 measures. While some measures, in particular, tax-related measures, curbed speculative activities, there are unintended consequences, including the depressed second-hand market and the "spillover" effect on the HOS market. Lastly, the first-hand market was more responsive to mortgage-tightening measures are relative to tax-related measures.

The research findings and policy implications lead to the following recommendations:

i. Cautiously consider the potential impact on the HOS market when designing policies that target the private residential market

The project finds suggestive evidence of the "spillover" effect of the collection of cooling measures on HOS units, including impeded residential mobility and price volatility. Some HOS homeowners are deterred from upgrading, either due to the higher liquidity hurdle or higher stamp duties. Future policies should aim to avoid such unintended consequences and ensure that liquidity in the HOS market and public renting market are not (less) affected.

ii. Fully consider the heterogeneous responses across submarkets when designing future housing policies.

The findings revealed that mixed responses were frequently observed in price and transaction volume in different submarkets. For example, the first-hand mass market saw a price hike and a decrease in volume, whereas the second-hand mass market saw a price dip after the Round 3 measures. While some measures have effectively curbed the overheated property market by reducing the price and trading volume, they arguably induced a total of 11 price hikes in specific submarkets, including the second-hand mass market. This points to the necessity to further classify the market when reviewing the current measures and, more importantly, when designing future housing policies.

iii. Consider correcting distortion between the first-hand and second-hand market.

In response to the collection of cooling measures, the second-hand market was disproportionally subdued in terms of both price and volume compared to the first-hand market. The project finds evidence that the first-hand market was more responsive to mortgage-tightening measures relative to tax-driven measures. To revive the secondary market, some tax-related measures could be relaxed on the grounds that current stamp duties, according to the findings, are more efficient in suppressing trading activities than slashing price.

iv. Consider supply-side measures as well as demand-side suppression.

Aiming to rein in speculative activities in the residential property market, the 12 rounds of cooling measures were designed to suppress speculative demand. However, genuine homebuyers, including existing homeowners seeking to upgrade and non-homeowners, are not necessarily benefiting from the demand-side interventions, which have resulted in volatile prices and the volume of transactions being slashed.

To accelerate supply in the private residential market, existing vacant housing units in both the first-hand and second-hand markets should be brought back into efficient use. The government is encouraged to review the feasibility of imposing a vacancy tax on residential properties in both the first-hand and second-hand market and, if needed, imposing higher taxes on vacant units with higher demand, such as small–medium size units.

v. Consult professional groups, market observers, and industry practitioners when designing future housing policies.

This project lends empirical support to a few pieces of anecdotal evidence and market observations. For example, some measures may act to deter existing homebuyers seeking to upgrade from listing their homes in the secondary market, making prospective homebuyers flock to the first-hand market. The findings of this project have reached some level of consensus about the unintended consequences of certain cooling measures through the insights of industry practitioners. This indicates the necessity of conducting public and professional consultation during housing policy creation.

vi. Conduct comprehensive analysis on the long-term/cumulative effectiveness of the cooling measures.

This project investigates the short-term effect of each of the 12 rounds of cooling measures enacted from October 2009 to May 2017. The cooling measures are usually "clustered" within a short space of time; for example, four rounds in 13 months. For this reason, the analysis compares the responses in price and volume in the 98 days before each round of measures with those after the effective date of a round of measures. A comprehensive analysis of the long-term/cumulative effects of the collection of (selected) cooling measures may offer insights that are complementary to the short-term effectiveness documented in this project.

政策影響概述及相關政策建議

本課題的研究結果表明:各輪降溫措施的短期效果各不相同,例如,第一、二、七 輪措施實施後大部分子市場都經歷了短期的價格上漲或下跌,然而交易量並無明顯的 影響;第八和第九輪措施則對交易量的影響大於對價格的影響。此外,同一輪措施對 不同子市場會產生不同的影響。例如,第三輪措施的實施導致中小型住宅市場整體價 格下跌,而其子市場則呈現相反的價格反應:一手中小型住宅市場價格上漲,成交量 減少,而二手中小型住宅市場價格下跌。雖然一些措施,特別是與印花稅相關的措施, 一定程度上遏制了住宅市場的投機活動,但也帶來了一些非預期的後果,包括二手市 場的低迷以及居屋市場受到的「溢出」效應影響。最後,相比於印花稅類措施,各類 按揭收緊措施對一手市場的影響較為明顯。

基於以上所述的政策影響,本課題提供以下建議以供政策制定者審視,在修訂現行 的房屋政策以及未來制定相關政策時,以作參考。

i. 在制定針對私人住宅市場的房屋政策時需謹慎考慮對居屋市場的潛在影響。

雖然各輪降溫措施皆針對私人住宅市場,然而居屋市場卻受到了多輪政策的「溢出」 效應影響:一些居屋業主因為無力承擔不斷推高的首付要求以及(或者)受限於加碼 的買賣印花稅,無法實現住宅升級(購入私人住宅)。因此,未來的房屋政策應儘量 避免此類「溢出」效應影響,確保居屋市場和公共租賃市場的流動性不會(或較少地) 受到影響。

ii. 在制定未來的房屋政策時,充分考慮各個子市場對各類措施可能呈現出的不同反應。

本課題的研究結果表明,同一輪措施對不同住宅子市場會產生不同的影響。雖然 一部分措施的確有效遏制了過熱的住宅市場,但也無可否認地在各類子市場一共引 發了 11 次價格上漲(其中包括二手中小型住宅市場),這顯然與降溫政策的初衷相 違背。因此,在將來的房屋政策時,對各類住宅市場深入進行分類討論十分必要。

iii. 平衡一手住宅市場與和二手住宅市場的穩定發展,修正現行房屋政策對二手住宅市場帶來的過度打壓。

本課題的研究結果表明,各項措施對一手住宅市場的影響有限,而二手市場的扭曲加劇,體現在價格和交易量的跌幅遠高於一手市場。究其根源,雖然按揭收緊措施一定程度上抑制了交易量,但對價格的影響更為明顯;各類印花稅措施雖能引起 價格短期內波動,但在抑制交易活動方面相比於按揭收緊措施更有,尤其對二手市 場的影響尤其顯著。一手住宅市場對印花稅類措施的反應遠不及對各類按揭收緊措 施的反應。因此,適度地放寬各類交易印花稅有助於重振二手住宅市場,滿足以自 住為目的的購房需求,提高此類需求者的房屋擁有率。

iv. 住房措施不應限制於壓制購房需求,更應側重於提升房屋供應。

十二輪降溫措施旨在擊退住宅市場的投機活動,壓制投機需求。然而,一部分真 正以自住為目的的購房者,包括尋求住宅升級的業主和租房者,卻未必從這些降溫 政策中受益。為加快私人住宅市場的供應,一手和二手市場的現有空置房屋應得到 有效利用。政府可考慮重新審視對一手和二手市場的住宅物業徵收空置稅的可行性; 如有必要,應對需求較高的空置單位(例如中小型單位)徵收更高的空置稅。

v. 在制定未來的住房政策時廣泛諮詢專業人士的建議(包括學者,市場觀察者,以 及業界人士等)。

本課題的實證分析為大量的市場觀察分析提供了有力的支援。例如,一些居屋業 主因為無力承擔不斷推高的首付要求以及(或者)受限於加碼的買賣印花稅,無法 實現住宅升級。本課題的研究結果與業界人士對樓市降溫政策的觀點達成了一定程 度的共識。因此,為了盡可能地降低措施可能帶來的負面影響,在制定房屋政策之 初進行專業諮詢,從而評估,預測相關措施可能對各類住房市場帶來的負面影響十 分必要。

vi. 對降溫措施的長期效果進行綜合分析

需要注意的是,本課題研究了 2009 年 10 月至 2017 年 5 月期間頒佈的十二輪降溫 措施中每一輪的短期效果。這些降溫措施通常在短期內「集中」實施,例如 13 個月 內推出了四輪措施。因此,本課題的研究僅限於比較每一輪措施生效日期的前後 98 天的價格和交易量的反應。針對降溫措施對各個住宅子市場長期效果的研究工作, 將與本課題的研究成果形成有效互補,為政府完善住房政策提供更多參考價值。

C. Main Body

1. Introduction

Since the Global Financial Crisis, Hong Kong has witnessed house prices surge from one record high to the next. In October 2009, the Hong Kong government rolled out more than ten rounds of interventions (cooling measures) to rein in the overheated property market, including tightening the mortgage supply and imposing various stamp duties. With the economy hit hard by the China-United States trade war, the unprecedented unrest since June 2019, and the outbreak of COVID-19, Hong Kong has inevitably slipped into an economic recession. While the economies in the region and worldwide are facing recovery, Hong Kong's economy also gradually rebounds from recession this year following social unrest and the COVID-19 outbreak over the last two years. Under the low interest-rate environment, the property market recovered, with the number of residential sales picked up from a monthly average of 4,562 in the first half of 2020 to 6689 in the first half of 2021. The Centra-City Leading Index is marginally higher than the high of 190.48 in June 2019, when the social unrest first broke out. Recently, calls have been made to ease certain restrictions on the residential property market. There have also been growing concerns over the unintended consequences of the cooling measures.

However, despite intensive debate among market observers, no consensus has been reached regarding whether the government interventions have successfully cooled down the overheated property market. It is difficult to determine when the government should consider relaxing which of the intervention measure(s). With this in mind, understanding the effectiveness of each of the past interventions is of current and imminent importance.

Academic studies on this topic are relatively sparse.¹ Existing studies on the policy passthrough in the residential housing market typically focus on selected cooling measures and suffer from critical technical issues. First, they employ aggregate-level data which mask significant heterogeneities in price variations across housing subsets (Deng, Gyourko, and Li, 2019). Second, while cooling measures are usually "clustered" within a short period, e.g., four rounds within 13 months, there could be lagged responses for homebuyers in adjusting their purchasing and funding decisions. As a result, traditional ordinary least squares (OLS) estimates are empirically challenging to disentangle the net effect of each mortgage-tightening tool, tax-driven measure, and various concurrent uncertainties from the financial market and broader economy.

Noticeably, macroeconomic uncertainties and some confounding political events, which are likely to affect the property market anyway, may coincide with certain rounds of cooling measures. Understandably, this can add to the challenges of identifying the effectiveness of specific cooling measures. For example, the sixth round of cooling measures was implemented two months after the assumption of office for the fourth term of the Chief Executive of Hong Kong, with a series of livelihood initiatives following the latter. In addition, the launching of

¹ The few exceptions include, for example, Wu, Gyourko, and Deng (2012, 2015, and 2016), Deng, Morck, Wu and Yeung (2015), Deng, Liu and Wei (2018), Deng, Girardin and Joyeux (2018), and Deng, Gyourko and Li (2019).

Shanghai-Hong Kong Stock Connect and the "occupy central protest" took place four months before introducing the ninth round of measures. Further, there was a sharp decline in tourism in 2015–2016 during the ninth and tenth rounds of measures.

Taken together, the changes in price, volume, and floor area across market sectors could be an aggregate result that is jointly contributed to rounds of restrictive mortgage measures, stamp duties, and various macroeconomic and political factors. Without consolidated empirical analysis, one cannot jump to any convincing conclusion regarding the effectiveness of the cooling measures and their mechanism to affect the property market.

This project is one of the first studies that use micro-level data to examine the effectiveness of government intervention in the property market and its implications to the general economy. Using cooling measures by the Hong Kong government as the context, the project explores the transmission mechanisms of each policy pass-through on the residential market. The use of large-scale micro-level transaction data, together with the identification strategy design, enables me to obtain credible estimations of the policy effects.

Additionally, the findings also add valuable empirical evidence to the current debate regarding calls for reforming the existing initiatives. For example, Tse (2017) recommended, while speculative investors remain subject to the restrictions, certain relaxations from the special stamp duty tax could be considered for genuine homebuyers seeking to upgrade to a bigger home. By evaluating each round of initiatives' market response and transmission mechanisms, this paper will provide new insights and valuable empirical data to policymakers for reviewing and revising the current curbs.

1.1. Hong Kong's housing market

In addition to private residential flats, there are two major forms of public housing, namely public rental housing (PRH) and subsidized-sale public housing. Under the PRH scheme, flats in designated estates are rented at discounted rates to low-income residents. As of November 2018, 243 public rental housing estates have been built and are managed under the Hong Kong Housing Authority (HKHA) and Hong Kong Housing Society (HKHS). Although they were initially designed for renting, PRH estates can be sold under the Tenants Purchase Scheme (TPS). This allows existing tenants in the rented public housing estates to purchase their flats at a concessionary price, much lower than the market prices of private flats due to subsidies and restrictions on selling.²

Among the various government subsidy programs, the Home Ownership Scheme (HOS) is the most popular, under which flats are sold to eligible public housing tenants and low-income residents at prices below market level, with discounts usually between 30% and 40%.³ As of October 2018, 218 subsidized-sale public housing estates are managed by the HKHA and local private developers (under the Private Sector Participation Scheme (PSPS)).⁴

² 1% of transactions in EPRC data set are flats in PRH estates.

³ Around 10% of transactions in the EPRC data set are flats in subsidized sale housing estates.

⁴ As an ancillary scheme, local private developers can provide property for sale in this subsidized housing sector under the Private Sector Participation Scheme.

Despite launching various public housing schemes, an acute shortage of supply remains, as only about 29% of Hong Kong's population was renting public housing, and 15.7% were residing in subsidized sale flats (mainly flats under HOS) in 2017 (Housing in Figures 2018). The waiting time for PRH reached an all-time high of 5.5 years on average in 2018. This partly stemmed from the shortage of reclaimed land in Hong Kong.

The persistent strong supply-demand imbalance, along with strong capital inflows and unusual low mortgage rates (1% in 2009), drastically pushed up property prices (He, 2014). As a result, Hong Kong witnessed unprecedented growth in the residential property market from 2009 to 2018, with house prices skyrocketing by over 300%, driven by a flood of money in the wake of the global financial crisis.⁵ Although there was a temporal deceleration from Q4 2015 to Q3 2016 amidst Hong Kong's economic slowdown and a decline in tourists, the property market rebounded quickly and subsequently kept refreshing its price record. Hong Kong has been ranked as the world's least affordable housing market since 2011. Its record-high price-to-income ratio (PIR, median home price relative to median annual income) of 20.9 in 2018 far surpassed second-placed Vancouver, whose PIR was 12.6. (Bertaud, 2019).

To the best of my knowledge, this study will be the first to assess the "pure" effect of each round of cooling measures enacted by Hong Kong authorities since October 2009. More importantly, the paper intends to explore the transmission mechanisms of each policy pass-through to the Hong Kong residential market. Last, this paper provides policy implications that will be helpful to policymakers for reviewing and revising the current curbs.

1.2. A summary of the cooling measures

Beginning on October 23, 2009, the Hong Kong government decided to cool the overheated housing market by launching more than ten rounds of interventions in the following eight years (as shown in Table 1), which mainly involved tightening the mortgage supply, and imposing various stamp duties.⁶

Specifically, the Hong Kong Monetary Authority (HKMA) rolled out mortgage-tightening measures mainly in the form of tightened LTV caps and imposing a stricter limit on debt servicing ratios (DSRs). Initially targeting luxury dwellings, the first round of measures introduced in October 2009 lowered the maximum LTV ratio for properties valued at or above \$20 million⁷ from 70% to 60%. LTV ratio caps were further reduced in the following rounds, with differentiated limits depending on the value and purpose of the pledged property. Consequently, the current LTV ratio for first-home buyers with a local income is capped at 50% for properties valued at or above \$10 million, and 60% for those valued below \$10 million (subject to a loan cap of \$5 million). The criteria for non-first-home buyers or those with income sources overseas is even stricter, with LTV ratio caps further lowered by ten percentage

⁵ The Centa-City Index soared from 56.81 in January 2009 to a record-high of 185.82 in July 2018.

⁶ The government amended its Capital Investment Entrant Scheme (CIES) in October 14, 2010 by excluding real estate investment as a class of permissible investment assets (PIA) under CIES. This means that individuals are no longer qualified to obtain Hong Kong Residency simply by purchasing real estate property. Before this suspension, only 200 of such transactions on average were recorded each year, accounting for less than 0.2% of the total annual transaction volume of resale residential properties (Property.hk, Oct.14 2010). Considering its trivial proportion, this policy is excluded from this study.

⁷ \$ denotes HK\$ in this study. Unless otherwise stated, the currency is HK\$ throughout this proposal.

points for each ladder.⁸ In addition, the maximum DSR for borrowers acquiring a first home for self-use has been slashed to 50%, while second-home borrowers and non-self-use property acquisition is subject to an even lower DSR of 40%. Taken together, by lowering the LTV ratio caps and DSR limits, the targeting scope of these mortgage-tightening measures was gradually extended from luxury homes to medium/small size flats, and later to borrowers with non-local income or who have multiple mortgages (He, 2014).

Likewise, an array of stamp duties was introduced to dampen runaway demand, particularly speculative demand. Starting from April 1, 2010, the rate of stamp duty on properties valued above \$20 million was raised from 3.75% to 4.24%. Effective as of November 20, 2010, a Special Stamp Duty (SSD) of up to 15% was imposed if a property was resold within six months of acquisition, with the minimum holding period to be exempt from paying tax being two years. This SSD was reinforced on October 26, 2012, and ranged from 10% to 20%, with the minimum holding period to be waived from paying SSD being extended to three years. A Buyer's Stamp Duty (BSD) was introduced on the same day, which required a flat rate of 15% on all transactions of residential properties, except for those acquired by Hong Kong Permanent Residents (HKPR). An Ad Valorem Stamp Duty (AVD) was first doubled on February 22, 2013, with the highest rate being 8.5%. Two years later, this was enhanced to a flat rate of 15% on all transactions for residential properties.

Noticeably, the cooling measures were typically "clustered" within a narrow time span, in the sense that the gap between two consecutive rounds of measures ranged from 1.4 to 20.6 months (as shown in Figure 1). This means that a new round of interventions was implemented every eight months on average. Due to the relatively high frequency, it is empirically difficult to capture each policy's "pure" effect since they were likely to be entangled with each other.

Figure 1 (a) depicts the Centa-City Sub-Index by unit size, with 2009 M1=100. The Center-City Index (CCI) reflects that the price growth of secondary private residential properties more than tripled in mid-2018 from early 2009, followed closely by small/medium units. On average, large units saw relatively benign growth, increasingly diverging from small/medium units from mid-2012. The widening gap in price growth suggests the necessity of accounting for the inherent heterogeneities across market sectors.

The vertical lines in light blue in Figure 1 indicate the introduction date of the respective cooling measures, most of which were "concurrent with" a robust upward trend of price appreciation. One cannot draw any convincing conclusions from such an "eyeball test." Instead, additional consolidated analyses are required to explicitly examine each policy's "pure" effect with respect to price response and housing market activities and controls for the heterogeneities across market segments, types of homebuyers, and macroeconomic factors.

⁸ Although Mortgage Insurance Program (MIP) is available, it is subject to a series of restrictions. Eligibility criteria includes, but is not limited to, all mortgagors not holding any residential property in Hong Kong at the time of application; (ii) all applicants being regular salaried persons; and (iii) maximum debt-to-income ratio of 45%. The property value is also capped at \$6 million. As such, coverage is less than 18% and therefore the effectiveness of the MIP is rather limited.

1.3. Literature review and public concerns

Since the Asian housing boom following the global financial crisis, a large amount of academic research has looked at market behavior and governments' role in the residential housing market in Asia (see, for example, Wu, Gyourko and Deng, 2012, 2015, 2016; Deng, Girardin and Joyeux, 2018; Deng, Gyourko and Li, 2019; Deng, Liu and Wei, 2018; Deng, Morck, Wu and Yeung, 2015; Deng, Qin and Wu, 2019). However, academic research on the effectiveness of cooling measures is limited. Using quarterly aggregate-level data of Hong Kong, Wong, Ho, and Tsang (2015) conclude that tightened LTV caps would lower household leverage by dampening the credit supply, which eventually reduces potential default risk.⁹ In contrast, they find no evidence that this LTV policy curbs property market activities. There are two studies on this topic using transaction-level data. Focusing only on the impact of stamp duties enacted before 2008, Leung, Leung, and Tsang (2015) find evidence that bunching in transactions (BIT) and underpricing near the cut-offs are observable in the Hong Kong secondary market. Ho, Wei, Wong, and Hu (2018) assess the effects of selected cooling measures in the secondary market of Hong Kong. They evaluate the overall impact of mortgage tightening measures and stamp duty measures using a small sample of fewer than 30,000 transactions in 1997–2016. However, their study suffers from some critical empirical issues, and the inclusive results remain unconvincing.¹⁰

Globally, Davidoff and Leigh (2013) provide evidence in the Australian housing market that stamp duties on land transfers effectively reduce house prices and turnover rates, indicating that the burden of stamp duties was born by the sellers rather than the buyers. Deng, Gyourko, and Li (2019) find evidence that the cooling measures enacted by Singapore's government from 2009 to 2013 effectively reduced house prices by 10–15%. They conclude that those policies largely achieved the initial goals without causing significant collateral damage to the broader economy. Krznar and Morsink (2014) show that selected macroprudential measures curbed mortgage credit growth and moderated the surge in house prices in Canada in 1998–2013. A panel sample across 25 countries introduced similar measures over the 2000–2012 period.

Additionally, a growing literature examines how housing transaction tax (HHT, hereafter) affects the housing market and other economic outcomes. For example, Kopczuk and Munroe (2015) use discontinuities in housing transaction taxes in New York and New Jersey and find robust price bunching. Slemrod et al. (2017) identify manipulation of the sales price to the lower-tax-rate region around the price notch. This manipulation is used to show that there was significant awareness of the tax changes and the incentives they created. Fritzsche and Vandrei (2019) find that an increase in the transfer tax produces large anticipation effects. Montalvo et

⁹ To compare with the actual policy pass-through, they calibrate the impact in the counterfactual "no policy" scenario simply by removing the policy indicators from the model estimation.

¹⁰ In Ho, Wei, Wong, and Hu's (2018) study, mortgage and stamp duty–related policies are measured by integers ranging from 0–7 and 0–3, respectively, without any alternative measures. The sample spans from 1997 to 2016, while the first round of mortgage measures started in late 2009, leaving a great number of zero values in the two policy variables. Last, some key empirical details remain unknown, since they claim that there are 479,258 transactions in their sample, but the baseline regression consists of only 25,557 observations, and the observations are even less in other subsamples. A statistics summary of all variables (not even the key variables) is missing as well, leaving the sample distribution unclear.

al. (2020) show that the ratio "appraisal over declared purchasing price" predicts tax evasion. Eerola et al. (2021) find the welfare costs of HHT are larger than previously thought because previous studies ignore spillovers between treatment and control groups. However, this strand of literature does not provide evidence on how HHT affects the general economy.

While academic research is scarce, there has been intensive debate over the effectiveness of the series of cooling measures. Generally, market observers challenge whether these "spicy measures" have effectively reined in property prices, as the LTV caps exert no impact on cashrich speculators (Tse, 2017, and Forgan, 2018). The measures have arguably caused a deterioration in home quality, since the average size of units under construction dropped 40% from 1,022 square feet in 2013 to 600 square feet in 2018. (Lam, 2018). More importantly, the tax-driven measures, in their opinion, disproportionally suppressed the secondary market, whereas they revived the primary market. They argue that existing homeowners are reluctant to sell their homes within 36 months of acquisition in order to avoid paying stamp duty. Due to a sharp fall in flats listed in the secondary market, prospective homebuyers are flocking to the primary market to jostle for new flats, with prices being driven up by elevated demand (Li and Lam, 2017, and Tse, 2017).

At the same time, the suppressed transaction volume in the secondary market could also be attributed to macroprudential tools (mainly slashed LTV ceilings). In response to such tightening measures, developers managed to attract home buyers by offering financing packages outside the HKMA's regulations. In light of this, transactions in the secondary market have seen a drastic shrink, in that such packages make new homes far more attractive than pre-owned ones (Forgan, 2018). In addition, homeowners seeking to upgrade are shying away from listing their flats due to the higher liquidity hurdle resulting from the even lower LTV caps. As a result, trades for such home upgrading purposes account for a significant portion of transactions in the secondary market. Such a deadlock in the secondary market eventually pushed up the price of both market sectors (Tse, 2017).

Nevertheless, some commenters still hold the view that the government should not lift the curbs. They argued that any move to ease restrictions would somehow encourage more people to chase high-priced properties that are beyond what they can afford. As a result, these homebuyers may end up with more debt on their shoulders (see, for example, Cheung, 2016, You, 2019, and Li and Liu, 2019). Contrarily, maintaining the current curbs does not help address the deadlock; instead, it may exacerbate market distortion. This is because the subtle signal of relaxing the restrictions may contribute to panic-buying among first-time homebuyers in the primary market and eventually spill into the secondary market, resulting in continuous record-breaking prices in both market sectors (Tse, 2017, and Li and Liu, 2019).

2. Objectives of the study

This project aims to corroborate these public concerns with consolidated empirical analysis. To the best of my knowledge, this project will be the first study to assess the "pure" effect of each round of cooling measures enacted by the Hong Kong authorities since October 2009. The project will explore the transmission mechanisms of each policy pass-through on the Hong Kong residential market: by examining the effectiveness of the two clusters of

measures across market segments, one can identify the specific market segments in which the mortgage-tightened policies and the stamp duty-related measures work most efficiently. This will provide suggestive evidence of whether each type of interventions achieved its primary goal in the target market. The project intents to provide implications to authorities in future policy formulation and revision.

- Explicitly assess the net effect of each round of cooling measures enacted by the Hong Kong authorities on the local residential market;
- Identify the specific market segments where the mortgage-tightened policies and the stamp duty-related measures work most efficiently;
- Investigate whether the two types of measures separately or jointly skew home acquisition toward the purchase of newly built homes;
- Explore how market distortion caused by the cooling measures, if any, eventually results in different price responses in the first-hand and second-hand property markets;
- Examine how the measures exert different impacts on speculative and genuine homebuyers;
- Examine whether certain measures have a "spillover" effect on the subsidized public housing market (mainly the HOS market);
- Examine whether (and which of) the interventions deteriorated home quality by steering homebuyers to acquire smaller flats or preventing people from upgrading existing homes.
- Provide implications to policymakers in reviewing and revising the current curbs on the Hong Kong residential property market.

3. Research methodology

3.1. Methodology: Regression Discontinuity Design (RDD)

As discussed, most cooling measures were implemented within a relatively narrow time span. For example, four rounds of cooling policies were introduced within 13 months from October 2009 to November 2010, and another three rounds within five months from September 2012 to February 2013. As such, there could be lagged responses for homebuyers in adjusting their purchasing and funding decisions. As a result, it is challenging to disentangle the treatment effect of each round of measures with aggregate-level data due to its lower frequency. Therefore, following Deng, Gyourko, and Li (2019), this project applies the regression discontinuity approach to explore the response dynamics to the changes.

The rich and comprehensive EPRC dataset (transaction-level data) allows me to explicitly evaluate the net impact of each round of cooling measures by conducting regression discontinuity analysis. This micro-level data with high frequency is perfect for regression discontinuity design (RDD), which requires a large number of observations around the treatment threshold. RDD is an appropriate approach for program evaluation problems, in which treatment status depends on whether an observed covariate exceeds a fixed threshold (Lee and Card, 2008). The basic idea of RDD is to compare outcomes for observations just above and just below the treatment threshold, which in this case, is the date of policy implementation (treatment date). The running variable is the number of days x that the

transaction took place before or after the treatment date x_0 .¹¹ In other words, x describes how close a transaction date is to the treatment date. The cut-off rule is straightforward: a transaction is treated if it took place after policy implementation, i.e., $x \ge x_0$, and untreated otherwise.

For most of the cooling measures, a sharp RDD setting by restricting the event window to be 98 days before and after the implementation date is employed.¹² Moreover, as a key assumption of sharp RDD, prospective homebuyers who decide to buy properties within the event window (±98 days of the treatment date) are assumed to be unable to perfectly manipulate their transaction date.¹³ Last, the outcome variables (price and transaction volume) are expected to be a smooth time series around the implementation date if there was not a policy intervention, which means the local continuity assumption is satisfied.

With the key assumptions having been satisfied, this paper nicely fits a sharp RDD analysis. Following Deng, Gyourko, and Li (2019), for each of the selected cooling measures, the transactions are sorted, falling into the 98-day event window into 20 bins. By conducting RDD analysis, estimating Equation (1) is estimated, where x is the running variable: number of days to the event date x_0 , and the outcome variables are transaction price (HK\$ per square foot) and daily transaction volume. An array of property characteristics control variables (in vector Z') are included, such as floor area, size of the estate, age of the estate, building age, number of units of the estate, and district fixed effects.

The estimation of Equation (1) is restricted to treated observations (transactions taking place after the policy implementation), while Equation (2) is estimated based on untreated observations (transactions before the policy implementation). $f(\cdot)$ and $g(\cdot)$ are any continuous functions of x_i .

$$Outcome Variable = \beta + f(x_i - x_0) + Z'y + \varepsilon_i$$
(1)

$$Outcome Variable = \gamma + g(x_i - x_0) + Z'y + \mu_i$$
(2)

The average effect of each of the cooling measures is measured as $\beta - \gamma$, which measures the difference in the conditional mean of the outcome variable before and after implementation. Alternatively speaking, with various property attributes and heterogeneities across the markets controlled for, any discontinuity in the conditional mean of the outcome variable observed around the implementation date should be attributed to the "pure" effect of the given cooling measure. This can be seen in the scatter graph, where the conditional mean of the outcome variable of each bin is plotted versus the running variable *x*, i.e., the number of days from the event date. Further details of the application of RDD can be found in Lee and Card (2008), Lee and Lemieux (2010), Grout, Jaeger, and Plantinga (2011), and Chetty, Friedman, Leth-Petersen, Nielsen, and Olsen (2014).

¹¹ The term "treatment date," "implementation date," and "event date" are interchangeable throughout this paper. ¹² For cooling measures with a gap less than 98 days from the consecutive measures, a narrower event window is adopted to ensure no overlap. Given the narrower event window, daily bins are used accordingly.

¹³ Deng, Gyourko and Li (2019) make the same assumption when conducting RDD analysis in a similar study.

3.2. Data and variables

The data for this study was sourced from the Economic Property Research Center (EPRC), which has reported almost all transactions of residential properties in Hong Kong from January 2008 to October 2018. This transaction-level dataset provides a rich set of information related to the transaction and property characteristics. For example, the dataset includes the date of transaction, (pre-tax) transaction price, market type, floor area, floor level, block number, property location, property type, size of the estate, and building age. After a preliminary data cleaning process, the dataset remains at around 665,000 transactions, of which 21% took place in the first-hand market, and 79% were from the secondary market. Public rental housing, subsidized public housing (mainly Home Ownership Scheme flats), and private residential dwellings account for 1%, 10%, and 89%, respectively.

This project focuses on transactions in both first-hand and second-hand private residential markets. This leaves a sample of 592,791 transactions across 5,151 estates, which range in size from 22 (1st percentile) to 15,924 (99th percentile) units, with an average *size* of 2,313 units in an estate. Table 2 presents the summary statistics: the average *age of the estate*¹⁴ is 16.2 years, and the negative values indicate that some *first-hand* units were traded before the occupation date. The average net price is HK\$9,781 per square foot (in real terms), and the average floor area of the traded units is 554 square feet. To address the heterogeneity between the mass market and high-end market, the sold units are further classified by floor area:¹⁵ around 34% of transactions are related to *Class A* flats, defined as units with a saleable area of less than 430.56 square feet (40 square meters); 50% of transactions are related to *Class B* flats, with a saleable area between 430.56 to 752.4 square feet (40 to 69.9 square meters); *Class C* flats, with a saleable area between 752.5 to 1075.3 square feet (70 to 99.9 square meters), account for 12.1% of transacted units, and *Class D* and *E* flats, with a saleable area between 1075.4 to 1721.1 square feet (100 to 159.9 square meters) and 1721.2 (160 m²) or above, account for 3.7% and 0.3%, respectively.

3.3. Samples

The primary (first-hand) residential market in Hong Kong is highly oligopolistic (Leung, Leung, and Tsang, 2015) and exhibits a fundamental difference from the secondary (resale) market. In response to the tightened mortgage supply, developers have attracted prospective homebuyers by offering compelling financing packages outside the HKMA's regulations.¹⁶ In light of this, one concern is that macroprudential tools and tax-driven measures jointly result in a thriving primary market at the expense of the shrinking secondary market. Moreover, speculators act differently from genuine homebuyers in terms of purpose, preference, holding period, etc. Anecdotal evidence indicates that cooling measures might have spurred demand in small-size properties relative to luxury houses. Speculators, given their elastic demand, usually are more active in the small-size property market. Meanwhile, homebuyers are "steered" to acquire smaller flats or trapped from upgrading their existing homes (Liu, 2014). Due to the

¹⁴ The age of the estate is the difference between the date of transaction and date of occupation.

¹⁵ This classification rule is laid down by the Rating and Valuation Department of Hong Kong.

¹⁶ See the interviews with some market observers documented in "Cooling measures in Hong Kong and Singapore: what works, what doesn't", Issue No. 145 of PropertyGuru Property Report Magazine.

inherent heterogeneities across market sectors, the private residential market is further classified along two dimensions:

1). Market type, i.e., the first-hand market and the second-hand market;

2). Floor area, i.e., the mass-market and the high-end market; flats with a floor area less than 70 square meters (class A and B) are grouped into the mass market, and flats with a floor area greater than 70 square meters (class C, D, and E) are grouped into the high-end sector.

Furthermore, by their very nature, cooling measures are specifically designed to cool down an overheating housing market by placing barriers in front of speculators and developers (Forgan, 2018). Consequently, if these measures are designed and applied correctly, the subsidized public housing market (HOS sector) should not be influenced. However, an "eyeball econometrics" from Figure 2 suggests that although HOS home prices fluctuated, they were largely maintaining their upward trend and kept breaking new records despite government cooling measures. Furthermore, although there is a restriction on a buyer's eligibility when purchasing an HOS flat and will assume liability to pay the premium if the flat sells on the open market in the future, a seller of an HOS flat can negotiate the price freely. Demand for HOS flats far exceeded the supply. As such, the price of a resale HOS flat could be affected by the prices of private flats, since transactions in the HOS resale market are quite similar to open market prices. For this reason, a sample of the second-hand Subsidized Public Housing Market is included to investigate whether specific cooling measures place an unintended "spillover" effect on these non-private residential sectors. Table A1 presents a list and descriptions of each of the nine sub-samples.

4. Research results/findings

The RDD analyses of the price response to each round of measures by the market sector are presented in Figures A1–A10, and the transaction volume response is shown in Figures B1-Figure B10. Notably, the lines of best fit in both pre-, and post-event windows and their respective confidence intervals are provided, which denote the 95% significance level. For example, Figure A1a illustrates a marked discontinuity around the event date. The confidence interval of the fitted line in the post-event window does not overlap with its counterpart in the pre-event window, indicating a significant price drop in the first-hand market after the implementation of Round 1. The volume responses to the same measures in the same market are shown in Figure B1a, where no significant drop in volume can be observed since the confidence interval of the fitted line in the post-event window overlaps with that of the pre-event window. Tables 3–14 summarize the sign and significance of the price and volume responses to each round of cooling measures in major markets.

4.1. Effectiveness of tax-related measures

Round 2 cooling measures (with effect from April 1, 2010):

As shown in Table 4, there are heterogeneous market responses to Round 2 interventions, mainly raising the stamp duty from 3.75% to 4.24% for properties valued above \$20 million. As the primary target sector, the high-end market witnessed a price decline in response to these

interventions. While transaction prices dropped discontinuously in the first-hand market, they slightly increased in the second-hand market. A closer look at the submarkets reveals that first-hand mass (Sample 5) and high-end subsets (Sample 6) all experienced price decline. Although this round of interventions curbed the price in the high-end market, it induced price growth in the second-hand mass market (Sample7), which is the main contributor to the rise in the second-hand market. Contrarily, no marked difference in transaction volume is observed in any of the markets. Interestingly, the price of subsidized public housing units rises sharply, suggesting the substitute effect between the public and private sectors of Hong Kong's residential property market.

Notably, while all other rounds of interventions were implemented immediately after the announcement date, the Round 2 measure was the only exception. The Round 2 measure was announced on February 24, 2010, with a 36-day gap between the announcement and effective dates.¹⁷ This may help explain why the Round 2 measure failed to have a significant effect on the property market in the sense that the market had gradually digested the shock before the actual implementation date.

Nonetheless, there was bunching in transactions around the cut-off price at HK\$ 20 million after the intervention. As shown in Figure 3 (a) and (c), transaction volume decreases with house prices as a whole, without observable discontinuity around the cut-off price before the intervention in both markets. However, after the rise in the Stamp Duty rate, transaction volume increased as house prices drew closer to the cut-off and dropped discontinuously right after prices exceeded the cut-off (Figure 3(b) and (d)).

Round 4 cooling measures (with effect from November 20, 2010):

Round 4 interventions further tightened mortgage supply and, most importantly, introduced a three-level Special Stamp Duty (SSD) for the first time. As a result, all the major markets, except the first-hand market, experienced a sharp decline in transaction volume (Table 6), accompanied by price decreases in the second-hand and mass markets. The shrink in the second-hand market was mainly sourced from its mass submarket (Sample 7).

Overall, Round 4 interventions effectively cooled down the 2nd-hand market, especially, the second-hand mass market, was largely suppressed, leaving first-hand market including the two its submarkets, unaffected. Furthermore, there was a "spillover" effect on the subsidized public housing sector, where a significant decline in price and transaction volume was observed.

Round 7 cooling measures (with effect from October 27, 2012):

Only 42 days after the Round 6 measures, the government introduced a new round of interventions, which involved imposing a flat rate of 15% for the Buyer's Stamp Duty (BSD) on residential properties acquired by non-permanent residents of Hong Kong, as well as

¹⁷ All the analyses related to Round 2 measures adopt an effective date (i.e., April 1, 2010) as the event date; however, robustness analyses with the announcement date being replaced by the event date does not make a significant difference.

reinforcing the Special Stamp Duty (SSD). While aiming to cool down the overheating market further, particularly the mass market,¹⁸ this round of measures failed to cool down the market by reducing price or volume. Instead, there were some counterintuitively higher prices in the second-hand and mass markets (Table 9). Transaction volume, on the other hand, remained unchanged overall. The price surge was sourced from the overheated second-hand mass market (Sample 7), which, arguably, remained the hotspot of both speculators and non-speculators.

Round 8 cooling measures (with effect from February 23, 2013):

Round 8 measures introduced the reinforced Ad Valorem Stamp Duty (AVD), which was raised to as high as 8.5%. However, local non-homeowner buyers remained to be exempted from the new stamp duty rates. The new enactment, also known as Doubled Ad Valorem Stamp Duty (DSD) rates, largely suppressed both price and volume in the mass market and dampened the second-hand and high-end markets' trading volume (Table 10). In particular, the decline in the mass market stems from the price decline in its first-hand submarket and the volume decline in its second-hand submarket. Moreover, although price and volume responses were absent in the first-hand market, there was a marked decrease in the high-end market. Lastly, although the prices remain unaffected, the second-hand market and its submarkets witnessed a shrink in size. Overall, Round 8 measures effectively dampened transaction volume rather than price.

Round 10 cooling measures (with effect from November 5, 2016):

The AVD was further enhanced to a flat rate of 15% for residential property transactions, unlike the previous AVD rates at Scale 1 (i.e., DSD rates introduced in Round 8 measures). However, acquisitions by local non-homeowners would continue to be exempted from this New Residential Stamp Duty (NRSD). More specifically, the purchase of residential property by a non-HKPR was subject to NRSD in addition to BSD (i.e., a total stamp duty of 30% in aggregate). As a result, within the ten months following the introduction of this NRSD, around 93% of home acquisitions by HKPRs were non-homeowners, which was significantly higher than the 75% before the introduction of the NRSD (Government Press Release, November 15, 2017).¹⁹

However, no significant short-term effect on prices or transaction volume was observed across markets. It is noteworthy that even though no eminent discontinuity was observed, the fitted line of transaction prices became much flatter after the implementation date in major markets (see, e.g., Figure A9 (a)-(e)). Meanwhile, the fitted line for volume became downward and steeper (see, e.g., Figure B9 (a)-(e)). This indicates that the drastic upward trend in price before Round 10 interventions was effectively suppressed, accompanied by an accelerated drop in volume in major markets (e.g., the first-hand and second-hand markets, the mass markets,

https://www.info.gov.hk/gia/general/201711/15/P2017111500584.htm

¹⁸ "Further measures to address overheated property market", Hong Kong SAR Government Press Release, 26 October, 2012, <u>https://www.info.gov.hk/gia/general/201210/26/P201210260697.htm</u>

¹⁹ "Imposing restrictions on the purchase of residential properties to curb speculation", Hong Kong SAR Government Press Release, November 15, 2017,

etc.).

Round 11 cooling measures (with effect from April 12, 2017):

To cater to the genuine self-use needs of HKPR-buyers, the government tightened up the exemption arrangement under the New Residential Stamp Duty (NRSD). An HKPR-buyer who acquires more than one residential property under a single instrument would be subject to the NRSD rate of 15%. As shown in Table 13, no marked price or volume responses were observed in the major market within a 30-day window, except for a shrink in the first-hand high-end market. While the initial intervention was influential, the market did not exhibit a short-term response in price or volume after ten rounds of cooling measures.

4.2. Effectiveness of mortgage-tightening measures

Round 1 cooling measures (with effect from October 24, 2009):

The Round 1 interventions decreased the LTV ratio to 60% and 70% for properties valued above and below \$20 million. Table 3 summarizes the responses of transaction prices and volume to Round 1 cooling measures. Transaction prices statistically significantly declined in first-hand, second-hand, and the mass market. Although transaction volume decreased, the effects are not statistically significant. The mass market saw a decline in both price and volume, which is in sharp contrast with the high-end and subsidized public housing markets, where no significant change was observed in price or volume.

A closer look at the submarkets reveals the first-hand mass market, the second-hand mass market, and the first-hand high-end market all experienced price decline. Moreover, volume in the second-hand high-end market fell significantly. That said, although no significant response in the high-end market was observed, its submarkets may respond differently to the same cooling measures. The first-hand high-end market saw a price decline, whereas the second-hand high-end market saw a smaller volume.

Round 3 cooling measures (with effect from August 14, 2010):

The Round 3 interventions reduced the LTV ratio to 60% and 70% for properties valued above and below \$12 million. Table 5 reports the effects of the Round 3 cooling measures on transaction prices and volume. The first-hand market exhibited positive price response and negative volume response. The second-hand market, the mass market, and the subsidized public housing market experienced a price decline. The first-hand high-end market (sample 6) has shrunk in size, leading to a decline in the overall high-end market (sample 4). Interestingly, Round 3 measures induced a price decline in the broader mass market, while its submarkets exhibited the opposite price response: the first-hand mass market saw a price hike and a decrease in volume, whereas the second-hand mass market saw a price dip.

Round 5 interventions (with effect from June 11, 2011):

The Round 5 cooling measures involved reducing the LTV ratio to 50%, 60%, and 70% for properties valued at \$10–\$12 million, \$7–\$10 million, and below \$7 million, respectively. Table 7 presents the impacts of the Round 5 cooling measures on transaction prices and volume. Transaction prices significantly increased in the first-hand market, which was caused by the positive response from its high-end submarket (sample 6). On the other hand, the decrease in volume was attributed to the shrink of its mass submarket (sample 5). By contrast, no significant changes were observed in the second-hand or subsidized public housing market. These findings point to the necessity to classify the market to further understand the heterogeneous responses across the submarkets.

Round 6 cooling measures (with effect from September 15, 2012):

The Round 6 interventions have two measures related to the LTV ratio. First, Round 6 lowered the maximum LTV ratio to 30% for a net worth-based mortgage. Second, Round 6 required that the maximum LTV ratio reaches 20 percentage points if the principal income of the loan applicant is not derived from Hong Kong. As summarized in Table 8, the first-hand market, particularly its mass submarket, saw a decline in price and an increase in trading volume. The mass market saw a mixed response in its first-hand and second-hand submarkets. The second-hand market, the high-end market, and the subsidized public housing market are not affected. This finding is in line with the market observation that developers managed to attract liquidity-constrained home buyers by offering additional financing packages in response to such tightening measures, leading to a thrive in the first-hand market.

Round 9 cooling measures (with effect from February 28, 2015):

The Round 9 interventions lowered the LTV ratio to 60% for properties valued below \$7 million. Table 11 statistically summarizes the responses of transaction prices and volume to Round 9 cooling measures. Transaction prices significantly declined in the mass markets, where the transaction volume was not affected. The second-hand market, in particular, its mass submarket, experienced a decline in both price and volume. With the absence of price response, the subsidized public housing market saw a shrink in size. Contrarily, no significant change was observed in the first-hand market or its submarkets. Overall, Round 9 measures were associated with stronger response in transaction volume relative to price.

Round 12 cooling measures (with effect from May 20, 2017):

As property prices continued to hit record highs, a new round of prudential measures for mortgage supply was introduced 38 days following the last round. Aiming to strengthen banks' risk management and resilience, this round of interventions mainly involved marginal adjustments to existing measures, including lifting the risk-weight floor and reducing the LTV ratio cap and DSR limit by ten percentage points for mortgage borrowers satisfying certain criteria. As shown in Table 14, neither submarkets exhibit responsiveness in price or volume to the introduction of Round 12 interventions. Thus, the effectiveness of this round of cooling

measures is questionable. This is partly due to the relatively short interval from the last round of measures implemented 38 days prior.

5. Policy implications and recommendations

This section reports the policy implications of the research findings (5.1) as well as a number of policy recommendations (5.2) for the government to consider.

5.1. Policy implications

i. The short-term effect of each round is different from each other.

The Round 1, 2, and 7 measures did not affect transaction volume; although, both upward and downward price movements were observed in most of the submarkets. In comparison, the Round 3 to 6 measures induced adjustment in both price and volume, and the Round 8 and 9 measures were associated with stronger response in transaction volume relative to price. Contrarily, the last three rounds of cooling measures, including the Round 10 measures which introduced a flat rate of 15% (Ad Valorem Stamp Duty) AVD, did not place significant short-term impact on the residential housing market.

ii. The effect of each round varies significantly across submarkets.

The Round 2 measures induced a price decline in first-hand market, whereas the secondhand market and HOS market witnessed a price hike. The Round 3 measures induced price growth but lower volume in the first-hand market. Contrarily, second-hand market, mass market, and the HOS market saw a price slash. The Round 4 measures effectively cooled down the second-hand market, mass market, and HOS market, all of which experienced a sharp decline in both transaction price and volume; although, the first-hand market was unaffected. Similar cases were found under the Round 9 measures.

It is also necessary to classify the market to further understand the heterogeneous responses across the submarkets. Specifically, while the first-hand market experienced a price hike and a decrease in volume after the Round 5 measures, a closer investigation shows that the price hike was attributed to first-hand high-end market, whereas the decrease in volume was mainly observed in the first-hand mass market. Similarly, the price hike in the second-hand market after the Round 2 measures came from its mass submarket. The overall transaction volume in the second-hand market remained unchanged; however, lower volume was observed in its high-end submarket. Also, although no significant response in the high-end market was observed, its submarkets may respond differently to the same cooling measures. The first-hand high-end market saw a price decline, whereas the second-hand high-end market saw a smaller volume.

Another example can be found in the Round 3 measures, which induced a price decline in the broader mass market, while its submarkets exhibited the opposite price response: the first-

hand mass market saw a price hike and a decrease in volume, whereas the second-hand mass market saw a price dip. Similar cases can be found in the mass market under the Round 8 and 9 measures.

iii. Some unintended effects are observed: the second-hand market was disproportionally subdued in terms of both price and volume compared to the first-hand market, and the "spillover" effect was observed in the HOS market.

Transaction volume in the first-hand market and its two submarkets increased after the Round 6 measures. This finding is in line with the market observation that developers managed to attract liquidity-constrained home buyers by offering additional financing packages in response to such tightening measures. Targeting speculative activities, the Round 7 measures introduced a flat rate of 15% for the Buyer's Stamp Duty (BSD) for non-local home buyers, as well as reinforced the Special Stamp Duty (SSD). However, some counterintuitively higher prices were observed in the second-hand and mass markets. Transaction volume, on the other hand, remained unchanged overall. The price surge was sourced from the overheated second-hand mass market, which, arguably, remained the hotspot for both speculators and non-speculators. Round 8 measures effectively dampened transaction volume rather than price. Lower volume was observed in both the high-end market and second-hand mass market.

Noticeably, the first-hand market was less responsive to tax-driven measures relative to mortgage-tightening measures: it experienced both upward and downward adjustments in price and volume under various mortgage-tightening measures. Contrarily, it did not respond to tax-driven measures, except when a price decline was observed under the Round 2 measures.

Moreover, there is suggestive evidence of the "spillover" effect on HOS units, which experienced a price hike after the Round 2 measures and slashes in both price and volume following the Round 4 measures. In addition, the transaction volume declined further after the Round 9 and also Round 8 measures, which introduced "Double Stamp Duty." These findings are consistent with the market observation that some HOS homeowners are deterred from upgrading, either due to the higher liquidity hurdle or, the higher stamp duty.

iv. Some measures did not have a significant short-term impact on major markets.

The Round 10 measures further enhanced the AVD to a flat rate of 15% for residential property transactions acquired by non-local homebuyers (also known as the New Residential Stamp Duty [NRSD]). This means that the purchase of residential property by a non-Hong Kong Permanent Resident (HKPR) was subject to NRSD in addition to BSD (i.e., a total stamp duty of 30% on aggregate). As a result, in the ten months following the introduction of the NRSD, around 93% of home acquisitions by HKPRs were non-homeowners, which was significantly higher than the 75% before the introduction of the NRSD (Government Press Release, November 15, 2017). However, these statistics simply show a stylized fact. The empirical evidence suggests that with various property attributes and heterogeneities across submarkets controlled for, no significant short-term effect of the Round 10, 11, or 12 measures on prices or transaction volume was observed in the Hong Kong property market.

v. In the short-term, mortgage-tightening measures worked more efficiently in cutting housing price than reducing transaction volume. Tax-driven measures are more efficient in suppressing trading activities, they also trigger price volatilities over time.

Table 15 and 16 summarize the distribution and pattern of price and volume responses to mortgage-tightening and tax-driven measures by submarkets. Mortgage-tightening measures induced five counts of significant price hikes, 14 counts of price declines in various markets, three counts of a rise in volume, and 10 counts of a decline in volume. In comparison, tax-based interventions successfully induced six counts of significant price hikes, 10 counts of price declines in various markets, and 14 counts of volume decline.

5.2. Policy recommendations

Based on the above policy implications, a few recommendations are summarized as follows:

i. Cautiously consider the potential impact on the HOS market when designing policies that target the private residential market.

The project finds suggestive evidence of the "spillover" effect of the collection of cooling measures on HOS units, including impeded residential mobility and price volatility. Some HOS homeowners are deterred from upgrading, either due to the higher liquidity hurdle or higher stamp duties. Future policies should aim to avoid such unintended consequences and ensure that liquidity in the HOS market and public renting market are not (less) affected.

ii. Fully consider the heterogeneous responses across submarkets when designing future housing policies.

The findings revealed that mixed responses were frequently observed in price and transaction volume in different submarkets. For example, the first-hand mass market saw a price hike and a decrease in volume, whereas the second-hand mass market saw a price dip after the Round 3 measures. While some measures have effectively curbed the overheated property market by reducing the price and trading volume, they arguably induced a total of 11 price hikes in specific submarkets, including the second-hand mass market. This points to the necessity to further classify the market when reviewing the current measures and, more importantly, when designing future housing policies.

iii. Consider correcting distortion between the first-hand and second-hand market.

In response to the collection of cooling measures, the second-hand market was disproportionally subdued in terms of both price and volume compared to the first-hand market. The project finds evidence that the first-hand market was more responsive to mortgage-tightening measures relative to tax-driven measures. To revive the secondary market, some tax-related measures could be relaxed on the grounds that current stamp duties, according to the findings, are more efficient in suppressing trading activities than slashing price.

iv. Consider supply-side measures as well as demand-side suppression.

Aiming to rein in speculative activities in the residential property market, the 12 rounds of cooling measures were designed to suppress speculative demand. However, genuine homebuyers, including existing homeowners seeking to upgrade and non-homeowners, are not necessarily benefiting from the demand-side interventions, which have resulted in volatile prices and the volume of transactions being slashed.

To accelerate supply in the private residential market, existing vacant housing units in both the first-hand and second-hand market should be brought back into efficient use. The government is encouraged to review the feasibility of imposing a vacancy tax on residential properties in both the first-hand and second-hand market and, if needed, imposing higher taxes on vacant units with higher demand, such as small–medium size units.

v. Consult professional groups, market observers, and industry practitioners when designing future housing policies.

This project lends empirical support to a few pieces of anecdotal evidence and market observations. For example, some measures may act to deter existing homebuyers seeking to upgrade from listing their homes in the secondary market, making prospective homebuyers flock to the first-hand market. The findings of this project have reached some level of consensus about the unintended consequences of certain cooling measures through the insights of industry practitioners. This indicates the necessity of conducting public and professional consultation during housing policy creation.

vi. Conduct comprehensive analysis on the long-term/cumulative effectiveness of the cooling measures.

This project investigates the short-term effect of each of the 12 rounds of cooling measures enacted from October 2009 to May 2017. The cooling measures are usually "clustered" within a short space of time; for example, four rounds in 13 months. For this reason, the analysis compares the responses in price and volume in the 98 days before each round of measures with those after the effective date of a round of measures. A comprehensive analysis of the long-term/cumulative effects of the collection of (selected) cooling measures may offer insights that are complementary to the short-term effectiveness documented in this project.

6. Details of the public dissemination held

The PI had originally planned to disseminate the research findings of this project in public forums and international conferences. However, the fifth wave of COVID-19 hit Hong Kong in December 2021, followed by a series of tightened social-distancing measures and work-from-home arrangements in the subsequent three months. As a result, the original dissemination plan was not achievable. In light of this, an alternative channel of public dissemination was adopted. An online workshop entitled "Cooling Measures in Hong Kong and its Residential Property Market" was held on March 22, 2022 to disseminate the findings of the project to the public. Two housing policy experts were invited to provide comments and suggestions on the research findings. Additionally, both experts delivered a talk relating to housing policies in China and the US. The audience of this workshop included staff and students from Lingnan University.

7. Conclusion

This project sheds light on the question of whether the government has reasonable grounds to intervene in the housing market. The answer is 'yes' on at least two bases. First, the sharp rise in prices across mass and high-end markets following the onset of the global financial crisis of 2007–2008 could have reasonably led regulators to believe that destabilizing speculative forces were at play. Second, on social grounds, the government was probably concerned by the deterioration of affordability conditions. Notably, Hong Kong has been ranked as the world's least affordable housing market since 2011. The record-high price-income ratio (PIR, which measures the median home price relative to the median annual income) of 20.9 in 2018, far surpassed Vancouver in second place, whose PIR was 12.6 (Bertaud, 2019).

Evaluating government intervention in a housing market is challenging because housing is a durable consumption good (a shelter for the household to stay), as well as an investable asset (the household's primary form of wealth). Moreover, the housing market is closely linked to many other economic sectors, and as such, it is virtually impossible to "hold all else constant" for empirical analysis. Nevertheless, this project provides a comprehensive valuation of the Hong Kong government's recent efforts to cool its housing market by investigating the overall effectiveness, unintended consequences, and transmission mechanisms of each round of cooling measures on Hong Kong housing market from January 2008 to October 2018. The findings suggest that mortgage-tightening measures worked more efficiently at cutting price, tax-driven measures are more efficient in slashing volumes. Also, first-hand market is less responsive to tax-driven measures. The second-hand market was disproportionally subdued in terms of both price and volume compared to the first-hand market. In conclusion, the cooling measures, especially the tax-related measures, largely deterred speculative activities. However, genuine homebuyers, including existing homeowners seeking to upgrade and non-homeowners, are not necessarily benefiting from these interventions.

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Tables

Table 1.List of 12 rounds of cooling measures:

E	Effective date	Brief highlights of the measures
1 st Round	24/10/2009	• Max. LTV ratio of 60% if property value \geq \$20 mn;
		• Max. LTV ratio of 70% if property value < \$20 mn; (loan amount
		capped at \$12 mn)
2 nd Round ¹	1/4/2010	• Stamp duty raised to 4.25% from 3.75% if property value > \$20 mn;
		No defer payment of stamp duty is allowed.
^{3rd} Round	14/8/2010	• Max. LTV ratio of 60% if property value \geq \$12 mn;
		• Max. LTV ratio of 70% if property value < \$12 mn; (loan amount
		capped at \$7.2 mn)
		• The limit of DSRs standardized at 50% (stressed DSR capped at 60%);
		Stress tests on mortgage applicants required;
4 th Round	20/11/2010	• Max. LTV ratio of 50% if property value \geq \$12 mn;
		• Max. LTV ratio of 60% if $8 \text{ mn} \leq \text{property value} < 12 \text{ mn}$; (loan
		amount capped at \$6 mn);
		• Max. LTV ratio of 70% if property value < \$8 mn; (loan amount capped
		at \$4.8 mn);
		• Max. LTV ratio of 50% for non-owner-occupied residential properties.
		• An SSD of 15% if holding period ≤ 6 months;
		• An SSD of 10% if 6 months < holding period \leq 12 months;
		• An SSD of 5% if 12 months < holding period \leq 24 months;
5 th Round	11/6/2011	• Max LTV ratio of 50% if \$10 mn < property value < \$12 mn
0 1100110	11, 0, 2011	 Max. LTV ratio of 60% if \$7 mn < property value < \$10 mn; (loan
		amount capped at \$5 mn):
		 Max. LTV ratio of 70% if property value < \$7 mn: (loan amount capped)
		at \$4.2 mn);
		• Max. LTV ratio lowered by at least 10 percentage points if the principal
		income of the loan applicant is not derived from Hong Kong;
		• Max. LTV ratio lowered to 40% for net worth-based mortgage;
6 th Round	15/9/2012	• The limit of DSRs lowered to 40% (stressed DSR capped at 50%);
		• Max. LTV ratio lowered to 30% for net worth-based mortgage.
		• Max. loan tenor of all new loans limited to 30 years;
		• Max. LTV ratio lowered by 20 percentage points if the principal income
		of the loan applicant is not derived from Hong Kong;
7 th Round	27/10/2012	• A BSD at a flat rate of 15% for all residential property acquisitions
		(HKPR exempted);
		• A higher SSD of 20% if holding period ≤ 6 months;
		• A higher SSD of 15% if 6 months < holding period \leq 12 months;
		• A higher SSD of 10% if 12 months <holding 36="" months;<="" period="" th="" ≤=""></holding>
8 th Round	23/2/2013	• Stricter stress-test: assuming a 300-basis point hike in interest rate rather
		than 200 basis points hike;
		• A risk weight floor of 15% for all residential mortgages by banks using
		the internal ratings-based approach;

¹ This round of interventions was announced on February 24, 2010, with 36-day gap between announcement date and effective date. The PI will test whether there is announcement effect by conducting an Regression Discontinuity analysis with this date being the event date.

		AVD raised to 1.5% from \$100 if property value < \$2 mn;	
		Highest AVD doubled at 8.5% (non-homeowner HKPR are exempted	d);
9 th Round	28/2/2015	Max. LTV ratio of 60% if property value \leq \$7 mn; (loan amount capped and the second	ped
		at \$6 mn.);	
		The limit of DSRs lowered to 40% for acquisitions of second propert	.y
		and non-self use properties (stressed DSR capped at 50%);	_
10 th Round	5/11/2016	AVD jumped to a flat rate of 15% for all residential property	
		acquisitions (non-homeowner HKPR are exempted);	
11 th Round	12/4/2017	No exemption of the 15% AVD for HKPRs' acquisition of more than	1
		one residential property under a single instrument;	
12 th Round	20/5/2017	• The risk-weight floor raised to 25% for new residential mortgages by	
		banks using Internal Ratings-Based Approach;	
		• The LTV cap reduced by 10 percentage points for mortgages extende	d to
		borrowers with one or more pre-existing mortgages;	
		DSR limit reduced by 10 percentage points for mortgages extended to	С
		borrowers whose income is mainly derived from outside of Hong Kon	ng.

Sources: Hong Kong Monetary Authority and Inland Revenue Department of Hong Kong SAR; Author's tabulation. Notes:

Mortgage-tightening measures;

Tax-driven measures

LTV ratio: Loan-to-value ratio; DSRs: Debt Servicing Ratios; SSD: Special Stamp Duty; BSD: Buyer's Stamp Duty; AVD: Ad valorem stamp duty; HKPR: Hong Kong Permanent Resident;

Variables	Obs.	Mean	p1	p99	Std.Dev
Age of the estate	592791	16.2	-3.2	51.2	13.8
Net floor area	592791	554	216	1459	253
Class A Units	592791	0.337	0	1	0.473
Class B Units	592791	0.5	0	1	0.5
Class C Units	592791	0.122	0	1	0.327
Class D Units	592791	0.037	0	1	0.189
Class E Units	592791	0.004	0	0	0.061
Holding years	592791	4.5	0.1	9.6	2.8
First-hand	592791	0.216	0	1	0.412
Size of the estate	592791	2313	22	15924	3172
Net price (per sqf.)	592791	9781	2452	26741	5265
Speculation	592791	0.117	0	1	0.321

Table 2Descriptive statistics.

Table 3 Responses of price and volume to Round 1 cooling measures by market.

First-hand Market (Sample 1)		Mass Market (Sample 3)		First-hand Mass Market (Sample 5)				
				Price	Volume	Subsidized Public Housing (Sample 9)		
				_*	-			
				First-hand High-end Market (Sample 6)				
Price	Volume	Price	Volume	Price	Volume	Price	Volume	
_*	-	_*	-	_*	-	-	-	
				Second-hand Mass Market (Sample 7)				
Second-h	and Market	High-end Market		Price	Volume			
(Sample 2)		(Sample 4)		_*	-	-		
				Second-hand High-end Market (Sample 8)				
Price	Volume	Price	Volume	Price	Volume			
_*	-	-	+	+	_*			

Table 3 summarizes the sign and significance of the price and volume responses to Round 1 cooling measures by market. The RDD analyses of the price response in each of the submarkets are plot in Figures A1 (a)-(e), and the transaction volume response is shown in Figures B1(a)-(e).

Table 4 Responses of price and volume to Round 2 cooling measures by market.

First-hand Market		Mass Market		First-hand Mass Market (Sample 5)				
				Price	Volume	Subsidized Public Housing (Sample 9)		
(San	(Sample 1)		(Sample 3)		-			
					First-hand High-end Market (Sample 6)			
Price	Volume	Price	Volume	Price	Volume	Price	Volume	
_*	-	+	+	-*	+	+*	-	
	Second-hand Market (Sample 2)		High-end Market (Sample 4)		Second-hand Mass Market (Sample 7)			
Second-ha					Volume			
(Sam					+			
					Second-hand High-end Market (Sample 8)			
Price	Volume	Price	Volume	Price	Volume			
+*	+	_*	+	+	+			

Table 4 summarizes the sign and significance of the price and volume responses to Round 2 cooling measures by market. The RDD analyses of the price response in each of the submarkets are plot in Figures A2 (a)-(e), and the transaction volume response is shown in Figures B2 (a)-(e).

 Table 5
 Responses of price and volume to Round 3 cooling measures by market.

First-hand Market		Mass Market		First-hand Mass Market (Sample 5)			
				Price	Volume	Subsidized Public Housing (Sample 9)	
(Sar	(Sample 1)		(Sample 3)		_*		
					First-hand High-end Market (Sample 6)		
Price	Volume	Price	Volume	Price	Volume	Price	Volume
+*	_*	_*	-	+*	_*	_*	-
	Second-hand Market (Sample 2)		High-end Market (Sample 4)		Second-hand Mass Market (Sample 7)		
Second-ha					Volume		
(Sam					-		
					Second-hand High-end Market (Sample 8)		
Price	Volume	Price	Volume	Price	Volume		
_*	-	+	-*	-	-		

Table 5 summarizes the sign and significance of the price and volume responses to Round 3 cooling measures by market. The RDD analyses of the price response in each of the submarkets are plot in Figures A3 (a)-(e), and the transaction volume response is shown in Figures B3 (a)-(e).
Table 6
 Responses of price and volume to Round 4 cooling measures by market.

	First-hand Market (Sample 1)			First-hand Mass Market (Sample 5)			
First-han			Mass Market (Sample 3)		Volume	Subsidized Public Housing (Sample 9)	
(San					-		
					First-hand High-end Market (Sample 6)		
Price	Volume	Price	Volume	Price	Volume	Price	Volume
+	+	_*	_*	+	+	_*	_*
				Second-hand Mass Market (Sample 7)			
Second-ha	nd Market	High-en	High-end Market		Volume		
(Sam	ple 2)	(Sam	ple 4)	_*	_*		
					ligh-end Market ple 8)		
Price	Volume	Price	Volume	Price	Volume		
_*	_*	+	_*	-	_*		

Table 6 summarizes the sign and significance of the price and volume responses to Round 4 cooling measures by market. The RDD analyses of the price response in each of the submarkets are plot in Figures A4 (a)-(e), and the transaction volume response is shown in Figures B4 (a)-(e).

Table 7Responses of price and volume to Round 5 cooling measures by market.

				First-hand Mass Market (Sample 5)				
First-ha	nd Market	Mass Market (Sample 3)		Price	Volume	Subsidized Public Housing (Sample 9)		
(Sai	mple 1)			-	_*			
					First-hand High-end Market (Sample 6)			
Price	Volume	Price	Volume	Price	Volume	Price	Volume	
+*	_*	+	-	+*	-	+	-	
			I	Second-hand Mass Market (Sample 7)				
Second-h	and Market	High-en	High-end Market		Volume			
(San	ple 2)	(Sam	ple 4)	+	-			
					ligh-end Market ple 8)			
Price	Volume	Price	Volume	Price	Volume			
+	-	+	-	-	-			

Table 7 summarizes the sign and significance of the price and volume responses to Round 5 cooling measures by market. The RDD analyses of the price response in each of the submarkets are plot in Figures A5 (a)-(e), and the transaction volume response is shown in Figures B5 (a)-(e).

 Table 8
 Responses of price and volume to Round 6 cooling measures by market.

	First-hand Market (Sample 1)			First-hand M (Sam	First-hand Mass Market (Sample 5)		
First-har			Mass Market (Sample 3)		Volume	Subsidized Public Housing (Sample 9)	
(Sar					+*		
					First-hand High-end Market (Sample 6)		
Price	Volume	Price	Volume	Price	Volume	Price	Volume
_*	+*	+	-	+	+*	-	-
				Second-hand Mass Market (Sample 7)			
Second-ha	and Market	High-en	d Market	Price	Volume		
(Sam	ple 2)	(Sam	ple 4)	+	-		
					ligh-end Market ple 8)		
Price	Volume	Price	Volume	Price	Volume		
+	-	+	+	+	-		

Table 8 summarizes the sign and significance of the price and volume responses to Round 6 cooling measures by market. The RDD analyses of the price response in each of the submarkets are plot in Figures A6 (a)-(e), and the transaction volume response is shown in Figures B6 (a)-(e).

 Table 9
 Responses of price and volume to Round 7 cooling measures by market.

	First-hand Market (Sample 1)		Mass Market (Sample 3)		First-hand Mass Market (Sample 5)			
First-han					Volume	Subsidized Public Housing (Sample 9)		
(San					-			
					First-hand High-end Market (Sample 6)			
Price	Volume	Price	Volume	Price	Volume	Price	Volume	
+	-	+*	-	+	+	-	-	
				Second-hand (Sam	Second-hand Mass Market (Sample 7)			
Second-ha	and Market	High-en	High-end Market		Volume			
(Sam	ple 2)	(Sam	ple 4)	+*	-			
					ligh-end Market ple 8)			
Price	Volume	Price	Volume	Price	Volume			
+*	-	-	-	-	-			

Table 9 summarizes the sign and significance of the price and volume responses to Round 7 cooling measures by market. The RDD analyses of the price response in each of the submarkets are plot in Figures A6 (a)-(e), and the transaction volume response is shown in Figures B6 (a)-(e).

 Table 10
 Responses of price and volume to Round 8 cooling measures by market.

	First-hand Market (Sample 1)			First-hand Mass Market (Sample 5)			
First-har			Mass Market (Sample 3)		Volume	Subsidized Public Housing (Sample 9)	
(San					-		
					First-hand High-end Market (Sample 6)		
Price	Volume	Price	Volume	Price	Volume	Price	Volume
-	-	_*	_*	-	_*	-	_*
	I			Second-hand Mass Market (Sample 7)			
Second-ha	and Market	High-end Market		Price	Volume		
(Sam	ple 2)	(Sam	ple 4)	-	-*		
					ligh-end Market ple 8)		
Price	Volume	Price	Volume	Price	Volume		
-	_*	-	-*	-	_*		

Table 10 summarizes the sign and significance of the price and volume responses to Round 8 cooling measures by market. The RDD analyses of the price response in each of the submarkets are plot in Figures A7 (a)-(e), and the transaction volume response is shown in Figures B7 (a)-(e).

 Table 11
 Responses of price and volume to Round 9 cooling measures by market.

	First-hand Market (Sample 1)		Mass Market (Sample 3)		First-hand Mass Market (Sample 5)			
First-han					Volume	Subsidized Public Housing (Sample 9)		
(San					+			
					First-hand High-end Market (Sample 6)			
Price	Volume	Price	Volume	Price	Volume	Price	Volume	
-	+	_*	-	-	+	-	_*	
				Second-hand Mass Market (Sample 7)				
Second-ha	and Market	High-en	High-end Market		Volume			
(Sam	ple 2)	(Sam	ple 4)	_*	-*			
					ligh-end Market ple 8)			
Price	Volume	Price	Volume	Price	Volume			
_*	_*	+	_*	+	_*			

Table 11 summarizes the sign and significance of the price and volume responses to Round 9 cooling measures by market. The RDD analyses of the price response in each of the submarkets are plot in Figures A8 (a)-(e), and the transaction volume response is shown in Figures B8 (a)-(e).

 Table 12
 Responses of price and volume to Round 10 cooling measures by market.

	First-hand Market (Sample 1)			First-hand M (Sam	First-hand Mass Market (Sample 5)		
First-har			Mass Market (Sample 3)		Volume	Subsidized Public Housing (Sample 9)	
(Sar					-		
					First-hand High-end Market (Sample 6)		
Price	Volume	Price	Volume	Price	Volume	Price	Volume
+	-	-	-	-	-	-	-
				Second-hand Mass Market (Sample 7)			
Second-ha	and Market	High-end Market		Price	Volume		
(Sam	ple 2)	(Sam	ple 4)	-	-		
					ligh-end Market ple 8)		
Price	Volume	Price	Volume	Price	Volume		
+	-	+	-	+	-		

Table 12 summarizes the sign and significance of the price and volume responses to Round 10 cooling measures by market. The RDD analyses of the price response in each of the submarkets are plot in Figures A9 (a)-(e), and the transaction volume response is shown in Figures B9 (a)-(e).

 Table 13
 Responses of price and volume to Round 11 cooling measures by market.

	First-hand Market (Sample 1)			First-hand M (Sam	First-hand Mass Market (Sample 5)			
First-har			Mass Market (Sample 3)		Volume	Subsidized Public Housing (Sample 9)		
(San					-			
					First-hand High-end Market (Sample 6)			
Price	Volume	Price	Volume	Price	Volume	Price	Volume	
+	-	+	-	-	_*	-	-	
				Second-hand Mass Marke (Sample 7)				
Second-ha	and Market	High-end Market		Price	Volume			
(Sam	ple 2)	(Sam	ple 4)	-	-			
					ligh-end Market ple 8)			
Price	Volume	Price	Volume	Price	Volume			
-	-	+	-	+	-			

Table 13 summarizes the sign and significance of the price and volume responses to Round 11 cooling measures by market. The RDD analyses of the price response in each of the submarkets are plot in Figures A10 (a)-(e), and the transaction volume response is shown in Figures B10 (a)-(e).

 Table 14
 Responses of price and volume to Round 12 cooling measures by market.

	First-hand Market (Sample 1)		Mass Market (Sample 3)		First-hand Mass Market (Sample 5)			
First-han					Volume	Subsidized Public Housing	ublic Housing	
(San					+	(Sample 9)		
					First-hand High-end Market (Sample 6)			
Price	Volume	Price	Volume	Price	Volume	Price	Volume	
-	+	+	-	-	+	-	-	
				Second-hand Mass Market (Sample 7)				
Second-ha	and Market	High-en	High-end Market		Volume			
(Sam	ple 2)	(Sam	ple 4)	-	+			
					igh-end Market ple 8)			
Price	Volume	Price	Volume	Price	Volume			
-	-	+	+	+	-			

Table 14 summarizes the sign and significance of the price and volume responses to Round 12 cooling measures by market. The RDD analyses of the price response in each of the submarkets are plot in Figures A10 (a)-(e), and the transaction volume response is shown in Figures B10 (a)-(e).

		Price decline	Price increase	Volume decline	Volume increase
Sample 1	First-hand Market	Round 1, Round 6	Round 3, Round 5	Round 5	Round 6
Sample 2	Second-hand Market	Round 1, Round 3, Round 9		Round 9	
Sample 3	Mass Market	Round 1, Round 3, Round 9			
Sample 4	High-end Market			Round 3, Round 9	
Sample 5	First-hand Mass Market	Round 1, Round 6	Round 3	Round 3, Round 5	Round 6
Sample 6	First-hand High-end Market	Round 1	Round 3, Round 5	Round 3	Round 6
Sample 7	Second-hand Mass Market	Round 1, Round 3, Round 9		Round 9	
Sample 8	Second-hand High-end Market			Round 9	
	Second-hand Subsidized Public Housing				
Sample 9	Market	Round 3		Round 9	
	Total Counts	14	5	10	3

Table 15 A summary of the responses of price and volume to mortgage-tightening measures: Round 1, 3, 5, 6, 9, and 12 measures.

		Price decline	Price increase	Volume decline	Volume increase
Sample 1	First-hand Market	Round 2			
Sample 2	Second-hand Market	Round 4	Round 2, Round 7	Round 4, Round 8	
Sample 3	Mass Market	Round 4, Round 8	Round 7	Round 4, Round 8	
Sample 4	High-end Market	Round 2		Round 4, Round 8	
Sample 5	First-hand Mass Market	Round 2, Round 8			
Sample 6	First-hand High-end Market	Round 2		Round 8, Round 11	
Sample 7	Second-hand Mass Market	Round 4	Round 2, Round 7	Round 4, Round 8	
Sample 8	Second-hand High-end Market			Round 4, Round 8	
Sample 9	Second-hand Subsidized Public Housing Market	Round 4	Round 2	Round 4, Round 8	
	Total Counts	10	6	14	0

Table 16 A summary of the responses of price and volume to tax-driven measures: Round 2, 4, 7, 8, 10, and 11 measures.

Figures



Figure 1 Centa-City Sub-Index by unit size, with 2009 M1=100.

The vertical lines in light blue color denote the dates of launching cooling measures.

Source: Centa Data, author's calculations.

Figure 2 The monthly average prices of Private residential properties and HOS flats: 2008 M1-2018 M10.



Unit: HK\$ per square feet (pre-tax transaction price of the unit divided by salable floor area) Source: EPRC dataset, author's calculation.

First-hand market Ņ 2 15 15 Density .1 Density 05 05 0 0 15 25 15 20 Transaction Price (million) 20 Transaction Price (million) 25 (a) (b) Before Round 2 cooling measures. After Round 2 cooling measures. Second-hand market





Notes: under the Round 2 measures which was enacted on April 1 2010, the rate of stamp duty on transactions of properties valued more than \$20 million was increased from 3.75 per cent to 4.25 per cent, and buyers would no longer be allowed to defer payment of stamp duty on such transactions.



Figure 4 Bunching in transactions around the cut-off price at HK\$ 7 million.

Notes: under the Round 9 measures enacted on February 28, 2015, the maximum loan-to-value (LTV) ratio for self-use residential properties with a value below HK\$7 million will be lowered by a maximum of 10 percentage points from 70% to 60%.

Appendix:

Table A1 Sample descriptions

No.	Sample	Sample size	Sample Descriptions
1	First-hand Market	128,210	This sample includes transactions in the primary private residential market.
2	Second-hand Market	464,581	This sample includes transactions in the secondary private residential market.
3	Mass Market	496,434	This sample includes transactions of Class A and B flats, i.e., flats smaller than 70 square meters in saleable area, in the private residential market.
4	High-end Market	96,357	This sample includes transactions of Class C, D, and E flats, i.e., flats equal to or larger than 70 square meters in saleable area, in the private residential market.
5	First-hand Mass Market	94,152	This is a sub-sample of First-hand Market (Sample 1), which is further restricted to those traded in the Mass market sector. It includes transactions of Class A and B flats, i.e., flats smaller than 70 square meters in saleable area, in the primary private residential market.
6	First-hand High-end Market	34,058	This is a sub-sample of the First-hand Market (Sample 1), which is further restricted to those traded in the High-end sector. It includes transactions of Class C, D, and E flats, i.e., flats equal to or larger than 70 square meters in saleable area, in the primary private residential market.
7	Second-hand Mass Market	402,282	This is a sub-sample of the Second-hand Market (Sample 2), which is further restricted to those traded in the Mass-market sector. It includes transactions of Class A and B flats, i.e., flats smaller than 70 square meters in saleable area, in the secondary private residential market.

8	Second-hand High-end Market	62,299	This is a sub-sample of the Second-hand Market (Sample 2), which is further restricted to those traded in the High-end market sector. It includes transactions of Class C, D, and E flats, i.e., flats equal to or larger than 70 square meters in saleable area, in the secondary private residential market.
9	Second-hand Subsidized Public Housing Market	63,913	This sample includes transactions of subsidized public housing flats (flats under the Home Ownership Scheme) in the secondary market.

APPENDIX

Figure A 1 Response of price to Round 1 cooling measures by sub-market.

Figure B 1 Response of volume to Round 1 cooling measures by sub-market.





Figure A1 b Second-hand Market (Sample 2)



Figure A1 c Mass Market (Sample 3)



Figure B1 b









Figure A1 d High-end Market (Sample 4)

Figure B1 d



Second-hand Subsidized Public Housing Market (Sample 9)

Figure A 2 Response of price to Round 2 cooling measures by sub-market. Figure B 2 Response of volume to Round 2 cooling measures by sub-market.



Figure A2 a First-hand Market (Sample 1)







Figure A2 b Second-hand Market (Sample 2)



Figure A2 c

Mass Market (Sample 3)



Figure B2 b



Figure B2 c



Figure A2 d High-end Market (Sample 4)



Figure B2 d



Figure A2 eFigure B2 eSecond-hand Subsidized Public Housing Market (Sample 9)

Figure A 3 Response of price to Round 3 cooling measures by sub-market. Figure B 3 Response of volume to Round 3 cooling measures by sub-market.



Figure A3 a First-hand Market (Sample 1)



Figure B3 a



Figure A3 b Second-hand Market (Sample 2)



Figure A3 c Mass Market (Sample 3)







Figure B3 c



Figure A3 d High-end Market (Sample 4)



Figure B3 d



Figure A3 eFigure B3 eSecond-hand Subsidized Public Housing Market (Sample 9)

Figure A 4 Response of price to Round 4 cooling measures by sub-market.



Figure B 4 Response of volume to Round 4 cooling measures by sub-market.

Figure A4 a First-hand Market (Sample 1)



Figure A4 b Second-hand Market (Sample 2)



Figure A4 c Mass Market (Sample 3)



Figure B4 a



Figure B4 b



Figure B4 c



Figure A4 d High-end Market (Sample 4)



Figure B4 d



Figure A4 eFigure A4 eSecond-hand Subsidized Public Housing Market (Sample 9)



Figure A 5 Response of price to Round 5 cooling measures by sub-market. Figure B 5 Response of volume to Round 5 cooling measures by sub-market.

Figure A5 a First-hand Market (Sample 1)





Figure A5 b Second-hand Market (Sample 2)



Figure A5 c Mass Market (Sample 3)







Figure B5 c





Figure A5 d High-end Market (Sample 4)

Figure B5 d



Figure A5 eFigure B5 eSecond-hand Subsidized Public Housing Market (Sample 9)





Figure A6 a First-hand Market (Sample 1)





Figure A6 b Second-hand Market (Sample 2)







Figure A6 c Mass Market (Sample 3)







Second-hand Subsidized Public Housing Market (Sample 9)

Figure A 7 Response of price to Round 8 cooling measures by sub-market. Figure B 7 Response of volume to Round 8 cooling measures by sub-market.





Figure A7 a First-hand Market (Sample 1)







Figure A7 b Second-hand Market (Sample 2)



100



Figure A7 c Mass Market (Sample 3)













Figure A7 e

Figure B7 e

Second-hand Subsidized Public Housing Market (Sample 9)



Mass Market (Sample 3)





Figure A8 d High-end Market (Sample 4)





Figure A8 eFigure B8 eSecond-hand Subsidized Public Housing Market (Sample 9)







-50

0 Transaction Date

-100

-100

-50

0 Transaction Date 50

100

100

50





Figure A9 d High-end Market (Sample 4)

Figure B9 d



Figure A9 eFigure B9 eSecond-hand Subsidized Public Housing Market (Sample 9)

Figure A 10 Response of price to Round 11 and Round 12 cooling measures by submarket.



Figure B 10 Response of volume to Round 11 and Round 12 cooling measures by submarket.

100

-20

-100

Figure A10 a First-hand Market (Sample 1)



-50



Figure A10 b Second-hand Market (Sample 2)



0 Transaction Date

50

100

Figure B10 b






100





High-end Market (Sample 4)

Figure B10 d



Figure A10 e Figure B10 e Second-hand Subsidized Public Housing Market (Sample 9)