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TECHNICAL NOTE—MACROPRUDENTIAL POLICY

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MACROPRUDENTIAL POLICY

Prepared By
Monetary and Capital Markets Department

This Technical Note was prepared in the context of an IMF Financial Sector Assessment Program (FSAP) mission held in Singapore during November 2018. It was led by Mr. Ulric Eriksson von Allmen. This note contains the technical analysis and detailed information underpinning the FSAP assessment's findings and recommendations. Further information on the FSAP program can be found at http://www.imf.org/external/np/fsap/fssa.aspx.

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Glossary

ABSD	Additional Buyer's Stamp Duty
BCBS	Basel Committee on Banking Supervision
BIS	Bank for International Settlements
CCyB	Countercyclical Capital Buffer
CET1	Core Equity Tier 1
CFM	Capital Flow Management Measure
DOS	Department of Statistics
D-SIB	Domestic Systemically Important Bank
ECs	Executive Condominiums
FSAP	Financial Sector Assessment Program
FSB	Financial Stability Board
FSR	Financial Stability Review
GLS	Government Land Sales
HDB	Housing and Development Board
LCR	Liquidity Coverage Ratio
LTV	Loan-to-value
MAS	Monetary Authority of Singapore
MPM	Macroprudential Measure
MSR	Mortgage Servicing Ratio
NSFR	Net Stable Funding Ratio
REALIS	Real Estate Information System
SGD	Singapore dollar
SSD	Seller's Stamp Duty
TDSR	Total Debt Servicing Ratio
URA	Urban Redevelopment Authority

EXECUTIVE SUMMARY[1]

Macroprudential policy in Singapore has centered on the property market, given the importance of this market for households' balance sheets, banks' loan portfolios, and the potential systemic risks. In the last decade, the authorities have been proactive in using property-related macroprudential tools to promote a stable and sustainable property market and to encourage financial prudence among borrowers. The Monetary Authority of Singapore (MAS) is the authority with a macroprudential policy mandate.

MAS has a strong institutional framework for macroprudential policy assuring the willingness to act. The framework contains a clear mandate and well-defined objectives, and has been revised in recent years, in particular to prioritize MAS' supervision and financial stability objectives vis-à-vis its developmental objective. The macroprudential mandate is assigned to dedicated committees within MAS, the Management Financial Stability Committee and the Management Financial Supervision Committee, limiting risk of dual mandates of monetary and macroprudential policies for the central bank. MAS uses a range of communication tools that supports accountability. Finally, MAS has a dedicated financial stability unit, the Macroprudential Surveillance Department, with strong analytical capacity.

The macroprudential framework also promotes the ability to act promptly. Being the financial supervisor gives MAS control and power over prudential tools which it may deploy as necessary in the pursuit of financial stability. MAS oversees all financial institutions in Singapore and has the mandate to promote financial stability which forms the basis of its macroprudential policy framework. It has (hard) powers under various legislations to apply its policy tools for macroprudential purposes.

The institutional arrangement is conducive to effective cooperation and coordination with other institutions. Coordination at the domestic level is facilitated by the concentration of responsibilities in MAS. However, given the multidimensional nature of risks arising from the property market, macroprudential policy relies on a range of policy instruments, some of which are not at the disposal of MAS, but controlled by other government agencies. An interagency taskforce on the property market serves as a platform for regular sharing of data and surveillance insights across member agencies. Internationally, MAS has signed several memoranda of understanding with foreign supervisory authorities for information sharing and cooperation and has reciprocity arrangements with other countries to ensure effective implementation of macroprudential policies, especially for countercyclical capital buffer measures.

MAS surveillance and systemic risk assessment relies on comprehensive quantitative information and constructive dialogue with industry as well as on various property market models and stress tests. The identification of systemic vulnerabilities is based on the analysis of a

[1] This Technical Note has been prepared by Romain Bouis with statistical support from Stephanie Ng (both MCM) as part of the 2019 FSAP for Singapore. The author would like to thank the Singaporean authorities for their excellent engagement and open dialogue.

variety of indicators across sectors in addition to discussion with the industry and dialogue in international fora. MAS also uses various property market models and performs stress tests of banks and other financial institutions integrating top-down and bottom-up approaches for both micro-prudential and macroprudential surveillance, as well as top-down solvency stress tests for the household sector based on granular mortgage debt information.

MAS has put efforts into filling data gaps, especially those related to household sector vulnerabilities, but systemic risk surveillance would benefit from developing flow of funds accounts and collecting information on stocks of loans by borrower in the private non-financial sector. MAS has broad powers to collect data under various legislation to fulfil its mandates and in practice, data are collected through supervisory returns, from commercial sources, and regular/ad hoc surveys. MAS is currently enhancing banking regulatory returns to improve the granularity of data and made progress to collect more granular information on household balance sheets. Singapore however does not have sectoral flow of funds accounts and is therefore encouraged to develop such accounts in the medium term to improve systemic risk monitoring. Likewise, collecting borrower-level information on the stocks of property-related loans for households (mortgages in the medium term and other types of loans in the longer term) and non-financial companies, would improve systemic risk monitoring.

Being a small attractive market, the Singaporean residential property market is exposed to pressures from global and regional demand. Empirical analysis indicates that residential property prices are significantly impacted by speculative activity and by foreigners' and corporate purchases, with purchases by foreigners having a significant effect on prices, explaining historically more than one-fourth of the changes in the quarterly growth rate of residential prices.

The authorities have adopted a multipronged approach to mitigate systemic risk via both demand- and supply-side measures. On the demand side, the authorities have actively used credit-based and fiscal-based macroprudential tools to promote financial prudence and housing market stability. Limits on LTV ratios and on Total Debt Servicing Ratio have helped contain debt developments and improve the quality of loans while the implementation of the Seller's Stamp Duty and the Additional Buyer's Stamp Duty have been followed by a significant reduction of the demand from speculators and foreigners. On the supply side, the construction program for public housing is reviewed and calibrated yearly while the government administers the sale of land for the development of private residential units through the Government Land Sales program which is reviewed every six months. These plans are revised to ensure adequate housing supply to meet medium-term demand for the population's housing needs.

Empirical analysis suggests that the effects of macroprudential measures on residential prices take time to materialize but become sizeable after one year following implementation. The estimation of the dynamic effects of macroprudential measures on residential prices using a three-dimensional panel (property type, region, time) indicates that macroprudential measures start reducing property prices from the second quarter following implementation, with a peak effect of 5 percent for each measure, reached six quarters after implementation.

Table 1. Singapore: Key Recommendations on Macroprudential Policy		
Recommendations	**Responsible Authority**	**Timeframe[1]**
Systemic Risk Monitoring		
1. Develop sectoral financial accounts (flow of funds).	MAS/DOS	MT
2. Collect detailed information on the stock of property-related loans to the non-financial private sector (mortgage loans for households and property-related loans for non-financial companies).	MAS	MT

[1] "MT–medium-term" is three to five years.

INTRODUCTION

1. Macroprudential policy in Singapore has centered on the property market, as the stability of the latter is closely linked to that of the macroeconomy and the financial sector. Residential property is the largest component in household balance sheets, representing nearly half of total household assets, and housing loans account for about three quarters of total household liabilities. Property-related loans also account for a considerable share of bank lending to non-banks (about 30 percent). Adverse developments in the residential property markets could consequently have serious implications for the soundness of household finances, the banking system, and the broader economy. Property-related macroprudential measures have therefore been implemented in Singapore, together with other measures, to safeguard financial stability and encourage financial prudence.

2. This Technical Note evaluates the macroprudential policy framework in Singapore with a focus on the price effect of macroprudential instruments. It assesses the domestic institutional arrangement, systemic risk monitoring framework, and macroprudential policy toolkit (including an assessment of the effects of macroprudential instruments on residential prices). It is built on the IMF (2013a) background paper on "Key Aspects of Macroprudential Policies," on the "Staff Guidance Note on Macroprudential Policy" (IMF 2014a), its background note ("Detailed Guidance on Instrument," IMF 2014b), and numerous publications by the Monetary Authority of Singapore (MAS) and the Financial Stability Board (FSB).

3. This note is structured as follows: Section II assesses the strengths and weaknesses of the institutional arrangements for macroprudential policymaking and provides recommendations on how to enhance them further. Section III discusses the existing systemic risk monitoring framework and provides options to strengthen it. Section IV discusses the use of macroprudential instruments in recent years and their effects on residential prices.

INSTITUTIONAL FRAMEWORK

4. International experience suggests that strong institutional arrangements for macroprudential policymaking are essential to ensure that macroprudential policy can work effectively. A strong institutional framework should assure the willingness to act and counter the underlying policy inaction bias resulting from difficulties in quantifying the benefits of macroprudential action. The institutional arrangement also needs to foster the ability to act when surveillance points to a build-up of systemic risks. Finally, the framework needs to promote effective cooperation and coordination between institutions with a financial stability mandate. This section evaluates the current institutional arrangement against these three key principles, which are set out in the Staff Guidance Note on Macroprudential Policy.

A. Willingness to Act

5. The institutional framework for macroprudential policymaking has been revised and contains a clear mandate and well-defined objectives. The authorities have taken important steps in recent years to develop the macroprudential policy framework and address relevant FSAP recommendations. Legislative amendments to the MAS Act in July 2017 prioritize MAS' supervision and financial stability objectives vis-à-vis its developmental objective. The MAS Act states that one of the principal objects of the Authority is to foster a sound and reputable financial center and to promote financial stability. The financial stability objective is set out in section 4(1)(b) of the MAS Act. This mandate forms the basis of MAS' macroprudential policy framework.

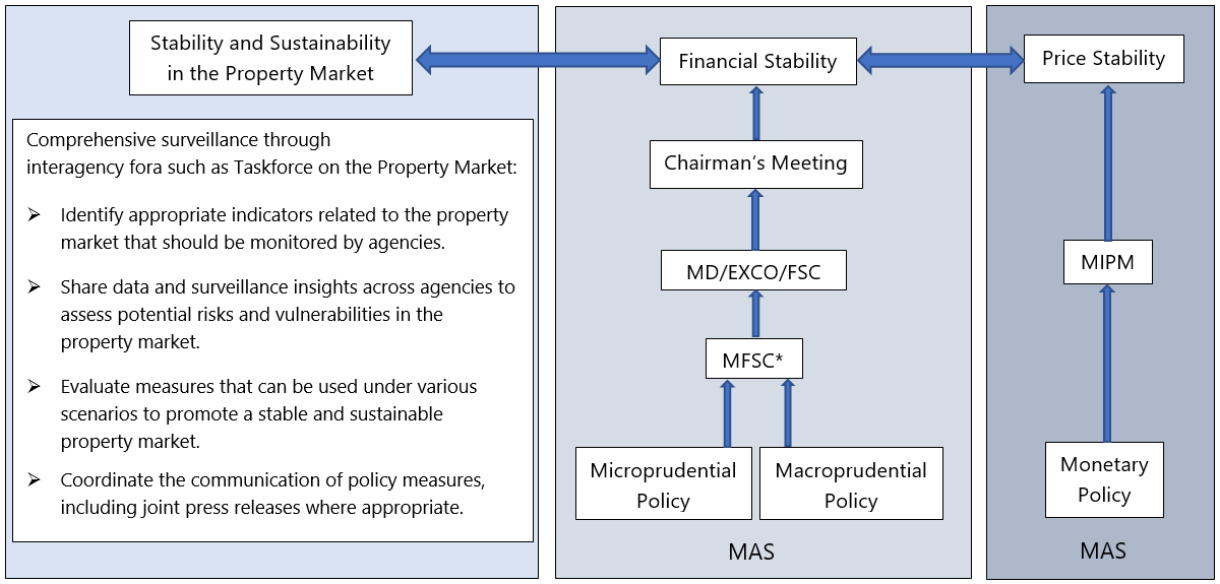
6. The macroprudential mandate is assigned to dedicated committees within MAS, limiting risk of dual mandates for the central bank. Two management-level committees are involved in macroprudential policy – the Management Financial Stability Committee and the Management Financial Supervision Committee. The Management Financial Stability Committee, chaired by the MAS Managing Director, carries out the assessment of systemic risks, formulation of macroprudential policies, and facilitates interaction with other government authorities. The Management Financial Supervision Committee, chaired by the Deputy Managing Director in charge of financial supervision, serves as a forum to discuss, on a weekly basis, regulatory and supervisory matters relating to regulated entities and may refer financial stability-related matters to the Management Financial Stability Committee for further deliberation or approval. At the same time, the Chairman's Meeting, a board-level committee chaired by the MAS Chairman and comprising the MAS Deputy Chairman, the Managing Director, and two other board members who are currently government ministers, approves major policy decisions relating to financial stability and the regulatory and supervisory framework. Finally, MAS management is responsible for the day-to-day implementation of macroprudential policies (e.g., the calibration of specific policy measures) approved by the Chairman's Meeting (see MAS 2019 for details). This organization reduces the risks related to dual mandates for MAS, by creating dedicated objectives and decision-making structures for monetary and macroprudential policies (Figure 1).

7. MAS uses a range of communication tools that help establish its commitment and public accountability, thereby fostering the effective pursuit of its objectives. Communication

tools include: (i) the annual publication of the Financial Stability Review that reviews potential risks and vulnerabilities as well as the resilience of the financial system to these risks; (ii) the publication of the Annual Report accompanied by a press conference in which the MAS Managing Director presents an overview of global and domestic economic and financial system developments, including the macroprudential policy stance; (iii) the announcement of macroprudential policy measures via press releases, with explanations of the rationale and authorities' considerations in adopting these measures (with a joint press release between authorities in case multiple authorities are involved). Such tools can help the public establish whether the authority is taking appropriate action to achieve its objectives.

8. The willingness to act is further supported by the presence of a dedicated financial stability unit. MAS' Macroprudential Surveillance Department assesses systemic risks and vulnerabilities in the financial system and conducts analysis on macroprudential policy and financial stability issues to support the internal Management Financial Supervision Committee and the Management Financial Stability Committee. The department, which comprises around 20 staff, forms part of the wider Financial Supervision Group and reports to the Assistant Managing Director responsible for Policy, Risk, and Surveillance.

Figure 1. Singapore: MAS Decision-Making Fora



Source: MAS.
Note: *Matters with implications for financial stability will be appropriately referred up to Chairman's Meeting. MD stands for Managing Director, EXCO for Executive Committee, FSC for Management Financial Stability Committee, MFSC for Management Financial Supervision Committee, MIPM for Monetary and Investment Policy Meeting.

B. Ability to Act

9. The institutional arrangements provide adequate powers to ensure MAS' ability to act. Being both the central bank and an integrated financial supervisor, MAS oversees all financial institutions in Singapore and has the mandate to promote financial stability which forms the basis of its macroprudential policy framework. Being the financial supervisor gives MAS control and power over prudential tools which it may deploy as necessary in the pursuit of financial stability. MAS has (hard) powers under various legislations (e.g., the Banking Act and the Financial Companies Act) to apply its policy tools for macroprudential purposes, a number of them being currently used, in conjunction with policy measures by other authorities, to address imbalances in the housing market in Singapore (Table 2).

C. Effective Coordination and Cooperation

10. Coordination at the domestic level is facilitated by the concentration of responsibilities in MAS. The concentration of responsibilities of macroprudential policy and of financial supervision in MAS ensures that it has access to all relevant information. Policy coordination in crisis times is furthermore facilitated insofar as the management of financial crises may require policy action far beyond the relaxation of macroprudential tools, including monetary easing and emergency liquidity assistance by the central bank.

11. An interagency taskforce on the property market serves as a platform for regular sharing of data and surveillance insights across domestic agencies. Given the multidimensional nature of risks arising from the property market, macroprudential policy relies on a range of policy instruments, some of which are not at the disposal of MAS but controlled by other government agencies. To promote information sharing and coordination across the relevant agencies, there is an interagency taskforce on the property market that comprises representatives from MAS, the Ministry of Finance, and the Ministry of National Development.

12. Internationally, MAS has signed several memoranda of understanding with foreign supervisory authorities for information sharing and mutual cooperation. MAS holds regular bilateral meetings with regional central bank counterparts to exchange views on macroprudential issues and participates in several international and regional fora with a focus on financial stability issues. Also, some macroprudential risks are more cross-border in nature and some policy tools require cooperation to be effective. For this reason, MAS has reciprocity arrangements with other countries, like Basel Committee on Banking Supervision members in the case of the countercyclical capital buffer, to ensure effective implementation and reduce spillover effects due to regulatory arbitrage.[2] For sector-specific measures where macroprudential risks may be of a local nature, spillover effects are more contained and there is less need for coordination.

[2] Risks related to the activity of bank branches and cross-border lending can be building up in the host market while capital requirements are set by the home supervisor. The countercyclical capital buffer therefore requires reciprocity arrangements between the home and host supervisors (MAS 2017).

Table 2. Singapore: List of Macroprudential Measures in Use		
Measures	**Current Calibration**	**Last Change**
Broad-Based Tools Applied to the Banking Sector		
Countercyclical capital buffer (CCyB)	MAS implements, since January 1st, 2016, a CCyB framework (including reciprocity requirements) consistent with the BCBS framework. CCyB decisions are pre-announced by up to 12 months and at least annually in MAS Financial Stability Review (FSR). As communicated in November 2018 FSR, the CCyB is currently set at zero percent.	January 2016
Capital conservation buffer	In line with the requirements and phase-in arrangements set out under the Basel III framework, MAS has implemented the requirement for a capital conservation buffer (CCB) for Singapore-incorporated banks. From January 1st, 2019, Singapore-incorporated banks need to meet a CCB of 2.5 percent (increased from 1.875 percent) of CET1.	
Liquidity Tools Applied to the Banking Sector		
Liquidity Coverage Ratio/Minimum Liquid Asset Requirement	All D-SIBs are required to comply with the Liquidity Coverage Ratio (LCR) requirement, both on an all-currency level and a Singapore Dollar (SGD) level. All other banks in Singapore may elect to comply with the LCR requirement or the Minimum Liquid Assets (MLA) framework, similarly both on an all-currency level and an SGD level. For the three local banking groups which cover all internationally active banks in Singapore, the all-currency LCR requirement started at 60 percent on January 1st, 2015 and increased 10 percent annually to reach 100 percent on January 1st, 2019. These banks are also subject to an SGD LCR requirement of 100 percent from January 1st, 2015. For other D-SIBs as well as non-D-SIBs that elect to comply with the LCR framework, they are subject to an all-currency LCR requirement of 50 percent and an SGD LCR requirement of 100 percent from January 1st, 2016. For banks complying with the MLA requirement, they are required to hold liquid assets denominated in any currency of at least 16 percent of its qualifying liabilities (a subset of the banks' liabilities) in all currencies from January 1st, 2016. They are also required to hold liquid assets denominated in SGD of at least 16 percent of its SGD qualifying liabilities.	January 2015
Net Stable Funding Ratio	All D-SIBs are required to meet the Net Stable Funding Ratio (NSFR) requirement on an all-currency level from January 1st, 2018. For the three local banking groups which cover all internationally active banks in Singapore, the all-currency NSFR requirement is 100 percent. For other D-SIBs, the all-currency NSFR requirement is 50 percent.	January 2018
Household Sector Tools		
Maximum LTV on loans granted by financial institutions	Individual borrowers: 1st Housing Loan: 75 percent; or 55 percent if the loan tenure is more than 30 years (25 years where the property purchased is an HDB flat) or extends past age 65. 2nd Housing Loan: 45 percent; or 25 percent if the loan tenure is more than 30 years (25 years where the property purchased is an HDB flat) or extends past age 65. From 3rd Housing Loan: 35 percent; or 15 percent if the loan tenure is more than 30 years (25 years where the property purchased is an HDB flat) or extends past age 65. Non-individual borrowers: 15 percent.	July 2018
Total Debt Servicing Ratio (TDSR)	60-percent maximum ratio applicable to all loans, except to mortgage equity withdrawal loans with LTV ratios of 50 percent and below.	March 2017
Mortgage Servicing Ratio (MSR) for HDB flats and Executive Condominiums (ECs)	MSR limit for housing loans granted by financial institutions for all HDB flats as well as EC units where the minimum occupation period has not expired, is capped at 30 percent of a borrower's gross monthly income. MSR limit for housing loans granted by HDB for all HDB flats is capped at 30 percent of a borrower's gross monthly income.	December 2013

Table 2. Singapore: List of Macroprudential Measures in Use (Concluded)		
Elimination of interest-only mortgages	Interest-only housing loans and loans in which the developer absorbs interest payments on behalf of the borrower for a period of time are disallowed.	September 2009
Maximum tenure for private properties and ECs	Absolute limit of 35 years on the tenure of housing loans granted by financial institutions.	October 2012
Maximum tenure for HDB properties	Maximum tenure for housing loans granted by HDB at 25 years and for loans granted by financial institutions for the purchase of an HDB flat at 30 years.	August 2013
Minimum Cash Down Payment	1st Housing Loan: 5 percent; or 10 percent if the loan tenure is more than 30 years or extends past age 65. From 2nd Housing Loan: 25 percent.	January 2013
Seller's Stamp Duty (SSD)	SSD on holding periods of up to three years with rates ranging from 4 percent (for properties sold in the third year) to 12 percent (for those sold within the first year).	March 2017
Additional Buyer's Stamp Duty (ABSD)[1]	12 percent for Singapore Citizens (SCs) buying their 2nd residential property; 15 percent for SCs buying their 3rd and subsequent residential property; 5 percent for Singapore Permanent Residents (SPRs) buying their 1st residential property; 15 percent for SPRs buying their 2nd and subsequent residential property; 20 percent for foreigners; 25 percent for entities; 30 percent for housing developers (with 25 percent remittable, subject to conditions).	July 2018
Corporate Sector Tools		
Lending to particular industries or sectors	Total property-related exposure of a bank is capped at 35 percent of total eligible assets.	
Sources: MAS and IMF Macroprudential Policy Survey database. [1]The Additional Buyer's Stamp Duty (ABSD) is a residency-based capital flow management (CFM)/macro-prudential measure (MPM) based on the Fund's Institutional View on capital flows.		

SYSTEMIC RISK MONITORING

A. Assessment

13. While the Singaporean financial system is generally healthy, some pockets of vulnerabilities deserve close monitoring.[3] These include:

- **Banks.** Locally incorporated Domestic Systemically Important Banks maintain risk-based capital ratios above the regulatory minima in adverse scenarios, although banks remain exposed to risks arising from the property market, legacy loans to transportation sector, and name concentration risk suggest some caution. Domestic Systemically Important Banks' liquidity coverage ratios reveal shortfalls of liquid U.S. dollar assets of up to 20 percent of GDP, and many banks fail the liquidity stress tests in U.S. dollars, suggesting that overall liquidity is reliant on a stable value of the domestic currency.

- **Insurers.** Insurer stress test shows the vulnerability of solvency positions, but it would not lead to systemic risk because the capital shortfalls are very small.

- **Interconnectedness.** Despite its size and level of development and complexity, domestic contagion through direct financial interlinkages between banks and non-bank financial institutions, within the interbank market, and common exposures to large borrowers, is limited. Contagion, however, could occur through cross-border interbank exposures and financial market volatility. Spillovers to and from Singapore largely mirrors a strong foreign bank

[3] See Singapore Technical Note on Financial Stability Analysis and Stress Testing for details.

presence headquartered in advanced economies (e.g., Japan, the U.K., and the U.S.). Singapore banks have more outward than inward spillover effects for its Asian neighbors.

- **Households.** Under a severe stress test scenario, the mortgage servicing burden for households purchasing private housing would in general remain below 60 percent. However, a relatively small segment of lower-income households (with monthly income under S$7,500) and younger borrowers (under 30) would see their mortgage service-to-income ratio increasing above 60 percent and face repayment difficulties.

- **Corporate.** Nonfinancial corporates have a healthy debt servicing capacity and significant cash buffers. Corporate debt-at-risk rises significantly under stress, but cash and foreign currency revenues provide a buffer.

14. MAS surveillance and systemic risk assessment relies on comprehensive quantitative information and constructive dialogue with industry. The identification of systemic vulnerabilities is based on the analysis of a variety of indicators across four sectors: banks, corporates and households, non-bank financial institutions, and the external sector, with linkages between these sectors being identified through network analysis of balance sheet variables. In addition to quantitative information, discussion on market developments and stress test scenarios with the industry, as well as dialogue in international fora help inform MAS' surveillance and risk assessments. In line with Financial Stability Board's (2018) recommendation, MAS now regularly surfaces to senior management a surveillance chart pack of indicators with extensive coverage across sectors, countries, and risk themes, aggregated across a range of sources such as BIS data, Bloomberg, and Haver, to ensure a more systematic and in-depth scan of all themes being monitored.[4]

15. MAS also uses various property market models and stress tests for surveillance and risk assessment. In the case of banks and other financial institutions, MAS performs stress tests integrating top-down and bottom-up approaches for both micro-prudential and macroprudential surveillance. For the household sector, MAS uses top-down solvency stress tests based on granular mortgage debt information assessing the debt servicing implications of shocks on interest rate and income.

16. MAS has put efforts into filling data gaps, especially those related to household sector vulnerabilities. MAS has broad powers to collect data under various legislation to fulfil its mandates, including with respect to financial stability. In practice, data is collected through supervisory returns, from commercial sources, and regular/ad hoc surveys. MAS is currently in the midst of enhancing banking regulatory returns (MAS Notice 610), with a full implementation of the revised notice planned for October 2020, to improve the granularity of data including with information on assets and liabilities by currency, country, and counterparty type. The revised returns will help in addressing data gaps for systemic risk analysis related to interbank and bank-to-non-

[4] The FSB (2018) noted that information reported to senior management (through annual discussions of the Financial Stability Review and updates through other management fora) was usually focusing on specific themes and known risks identified at the departmental/group level, potentially missing emerging risks.

banking financial institutions linkages and help enhance risk monitoring of banks' currency, interest rate, and credit exposures. MAS also made progress to collect more granular data on household balance sheets, drawing on surveys and strengthened credit bureau practices, as recommended by the 2013 Financial Sector Assessment Program (IMF, 2013b). It has collected through a monthly Housing Loan Profile Survey, account-level information on borrowers' profile and loan characteristics (including debt servicing) for new housing loans and is looking to broaden collection of account-level information for outstanding housing loans.

B. Recommendations

17. MAS together with other relevant government agencies, including the Department of Statistics, are encouraged to develop sectoral flow of funds accounts to improve the analysis of macrofinancial linkages and the monitoring of systemic risk developments. Currently, MAS uses quarterly data on assets and liabilities of the household sector from the Department of Statistics and parses partial information on the relevant economic sectors from multiple sources. However, having this information organized in the context of flow of funds accounts could improve the assessment of the cyclical behavior of financial flows across sectors.

18. MAS' monitoring of systemic risk developments would benefit from collecting information on the stock of bank loans at the account-level to the non-financial private sector. In the case of household sector stress testing, the current approach used by MAS considers the sensitivity of the debt service burden of new loans only, given that the only information available at account-level is on new loans while information on the entire stock of debt is on an aggregate level. This approach may underestimate the effect of the shocks as it excludes potentially riskier loans from the simulation sample since the risk profile of borrowers improved over time with the implementation of credit-based macroprudential measures.[5] Collecting information on the stock of debt and repayments for each borrower over time would also allow MAS to refine its analysis of household sector vulnerability by modelling probabilities of default. Given the time needed to collect information on all types of loans, MAS may in priority focus on collecting data on the stock of mortgage loans in the medium term, and in the longer term, collect information on the stock of major components of other non-mortgage loans. Likewise, for private non-financial corporates, MAS may systematically collect information on the stocks of loans by borrower to improve systemic risk monitoring, especially when these loans are related to the property market, as for real estate developers.

[5] This concern is somewhat attenuated by refinancing practices that progressively eliminate older loans of the current stock of household debt. Besides, some of the legacy loans might have higher financial buffers if the buyer has transacted in a period of lower property prices, relative to the amount of loan taken up.

PROPERTY-RELATED MACROPRUDENTIAL INSTRUMENTS

19. The use of macroprudential instruments in Singapore has largely focused on the property market to date, given the systemic linkages between this market, the financial system, and the real economy. A number of instruments are available to MAS and the government for macroprudential purposes, including the countercyclical capital buffer and property market-related tools, which include credit-based measures like the Total Debt Servicing Ratio framework, loan-to-value ratios, and loan tenure limits; and fiscal-based measures like the Additional Buyer's Stamp Duty and Seller's Stamp Duty. Since 2009, there has been active use of these property market-related measures that were further refined in successive rounds of implementation in order to promote a stable and sustainable property market, encourage greater financial prudence among households, and ensure sound lending standards (Appendix Table III.1).

20. The authorities have also implemented a macroprudential measure applying to the corporate sector, but this measure is exclusively related to the property market. The property sector exposure of a bank shall not exceed 35 percent of the total eligible assets of that bank (Table 2). The measure concerns both corporates and individuals (e.g., investment property loans). The authorities have however not yet considered applying caps on banks' exposure to other sectors, despite possible systemic risks posed by some sectors of the economy.

21. Singapore adopts a multipronged approach to mitigate systemic risk via both demand- and supply-side measures. On the demand side, the authorities have used macroprudential policies to promote housing market stability—especially after the global financial crisis. On the supply side, the government administers the development of private residential units through the sale of state-owned land—more than three-quarter of total land in Singapore. The government also provides public housing to residents at subsidized prices.

22. Singapore takes a "whole-of-government" approach in employing a set of policy tools including credit-based, fiscal-based, and administrative measures. The conduct of macroprudential policy requires coordination not only within MAS but also with other government agencies. As a result, MAS and relevant government authorities have formed an inter-agency taskforce on the property market comprising representatives from MAS, the Ministry of Finance, the Ministry of National Development, and statutory boards under these ministries. MAS administers credit-based macroprudential tools such as the Total Debt Servicing Ratio framework, loan-to-value ratios, and loan tenure limits; Ministry of Finance is responsible for fiscal measures comprising the Additional Buyer's Stamp Duty and Seller's Stamp Duty; Ministry of National Development/Urban Redevelopment Authority ensures that sufficient land is reserved (e.g., through the Concept Plan and Master Plan processes) and subsequently released in a timely manner (through the bi-annual Government Land Sales program and the public housing building program) to meet the population's housing needs.

23. This section is organized as follows. It first discusses recent developments in property markets, household debt, and in the use of macroprudential instruments. It then offers an assessment of the housing price effects of macroprudential measures.

A. Developments in Property Market, Household Debt, and Macroprudential Policy

24. Public housing represents the bulk of the residential property market in Singapore, but the private housing market is systemically important as it plays an important role in the financial system and the property market, driving prices. About 80 percent of Singapore residents live in public housing provided by the government agency Housing and Development Board. The remaining population lives in private housing, whose prices are significantly higher and are subject to more volatility as part of it constitutes purchases by wealthy Singaporeans and foreigners. Price developments of public and private residences are closely related, reflecting spillovers between the two markets (Box 1) and common driving factors while the majority of macroprudential policy interventions of the past decade have targeted private housing market transactions.

Box 1. Institutional Features of the Residential Property Market and Interactions Between Public and Private Residential Markets

The public market represents the bulk of the residential property market in Singapore but the private market, which is not subject to ownership conditions, is more reactive to pressures from fundamental and speculative factors as compared to the public housing market.

Public residences dominate the market…

Singapore has a two-tier housing market composed of a public market, regulated by the government through the Housing and Development Board, and a private market. The public market is dominant as the majority of Singapore residents (80 percent) live in public housing and Housing and Development Board flats represent 72.6 percent of residential dwelling units as of end-June 2017 (Yearbook of Statistics Singapore, 2018), versus 21.3 percent for private apartments and condominiums, 5.2 percent for landed homes, and less than 1 percent for other housing units including mixed residential/commercial units (e.g., shop houses). The vast majority of units are being owned, with Singapore's homeownership rate being over 90 percent.

Public housing is heavily subsidized when purchased directly from the Housing and Development Board but only Singaporean households with a monthly income of S$12,000 and below are eligible to purchase new Housing and Development Board flats. It is only after fulfilling a 5-year minimum occupation period requirement, that buyers can sell their flats in a secondary market to eligible Singaporeans and permanent residents, while non-resident foreigners can only rent but not purchase public housing from the secondary market.

In contrast to the public housing market, the private market is entirely driven by market forces and subject to little restrictions. Units on this market are also more heterogeneous (starting from apartments, condominiums, terraces, semi-detached houses, and detached houses, in an ascending order of average

Box 1. Institutional Features of the Residential Property Market and Interactions Between Public and Private Residential Markets (Concluded)

prices), with more premium design features, and being more expensive on a dollar per square foot basis compared to Housing and Development Board units. Although Housing and Development Board flats are typically sold on a 99-year lease agreement, private properties can also be freehold or on a 999-year leasehold.[1]

…but more than half of banks' mortgage portfolios are loans for the purchase of private units…

Although representing almost three quarters of residences, public housing contributes only half of the total value of mortgages to households (about 52 percent as of 2018Q2); of which less than one-third (16 percent of total mortgages) is extended by the Housing and Development Board and the rest by commercial banks (about 35 percent of total mortgages). Loans for the purchase of private properties (48 percent of total mortgages) are exclusively granted by commercial banks and represent almost 60 percent of banks' mortgages to households. Housing loans granted by the Housing and Development Board have more stable monthly mortgage payments compared to loans granted by commercial banks as their mortgage rates are pegged to the Central Provident Fund interest rate, unchanged for the past 20 years. However, in recent years, more borrowers from commercial banks have opted for fixed-rate loan packages and loans linked to fixed-deposit rates which provide more predictable monthly mortgage payments, with the share of outstanding housing loans on these fixed-rate and deposit rate-linked packages having tripled since end-2015 (54 percent as of 2018Q2).

…while the private market can transmit pressures from speculators, non-resident foreigners, and corporates to public housing prices

Valuations of public and private housing markets, although being directly affected by distinct types of purchasers, can be interrelated via indirect effects (Chia Li and Tang 2017). First, as public housing prices increase, for example, due to an increase in the population of residents, the affordability of Housing and Development Board flat-owners to upgrade to private properties improves and demand for private residences increases. Many Singaporeans living in Housing and Development Board flats aspire moving to a private property and upgraders are estimated to constitute about 60 per cent of annual demand for private housing. According to this "upgrading" hypothesis, price changes on the Housing and Development Board market should lead price changes of private properties. However, because the Housing and Development Board market is subject to many stringent rules and regulations, prices in this market are less sensitive to changes in fundamental and speculative factors than prices in the private market, and the effect from the "upgrading" hypothesis may be limited. Second, higher prices on the private market may translate into larger prices on the public market by crowding out some Housing and Development Board residents from the private market. This "crowding-out" hypothesis could explain how the demand from speculators, non-resident foreigners, and corporates can affect public housing prices even though these buyers do not directly participate in the public housing market.

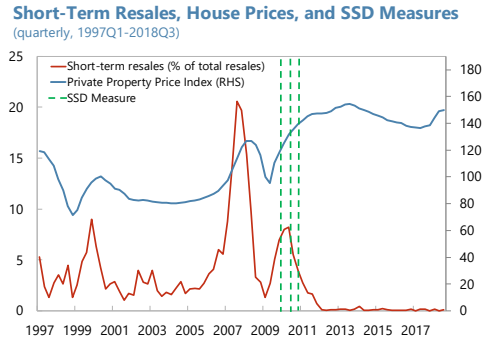
Finally, the demand-side factor from population growth is one of the key drivers of price trends in both the public and private housing market, contributing to the co-movements of these two markets.

[1] The government also introduced the Executive Condominium Housing Scheme (ECHSs) in 1995 as an affordable option for Singaporeans who wish to own a private housing. Executive Condominium (EC) units are built and sold by private developers. Like Housing and Development Board flats, ECs are subject to several restrictions: only Singaporean households with a monthly income of S$14,000 and below can directly purchase an EC from a developer, with a minimum occupation period of five years, after which the unit can only be sold to Singaporeans or Singaporean Permanent Residents, while foreigners can purchase an EC only after 10 years from development completion. Arising from these restrictions, EC developers are able to secure the land cheaper.

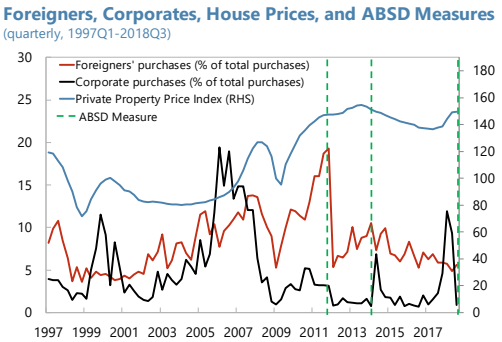
25. Property prices surged after the global financial crisis, despite the tightening of several macroprudential instruments and subdued economic growth. Prices in the private residential market increased by almost 16 percent between 2010 and 2013. Speculative activity, as well as interest from foreign investors, were high during this period, as indicated by the large shares of short-term resales (resales of properties within one year of purchase, including sub-sales[6]) and purchases by foreigners, the latter of which having peaked at about 20 percent of all transactions in 2011 (Figure 2). Prices of industrial properties also experienced a boom, doubling in the three years before 2013 until the authorities implemented for the first time in January 2013 a Seller's Stamp Duty on industrial property to discourage short-term speculative activity in this segment of the market (Figure 3).[7]

Figure 2. Singapore: Speculative Activity, Foreigners' and Corporate Purchases, and Residential Prices

Short-term resales have been correlated with the growth of residential prices before vanishing with the implementation of Seller's Stamp Duty measures



Foreigners' purchases dropped sharply following the first Additional Buyer's Stamp Duty measure whereas rising corporate purchases (including en-bloc transactions) have recently been associated with a rebound of residential prices



Sources: MAS, Urban Redevelopment Authority, and IMF staff calculations.

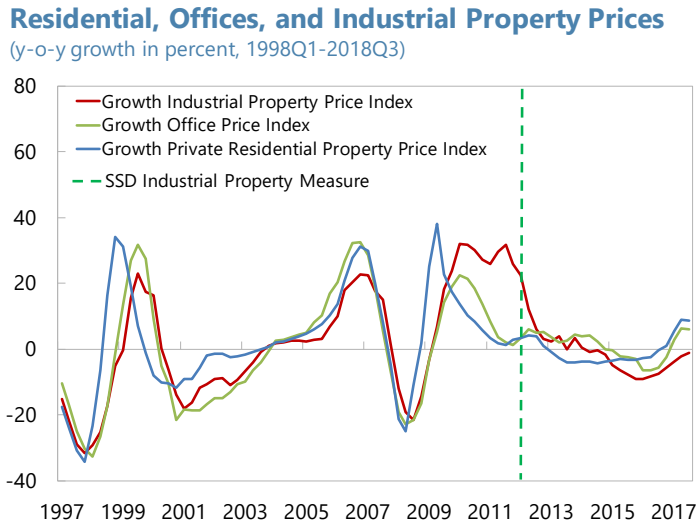
Note: This figure shows the evolutions of the Private Property Price Index, of the share of short-term resales in total resales (a proxy for speculative activity), and of foreigners' purchases and corporate purchases in total purchases. Short-term resales are defined as resales (including sub-sales) completed within one year following the original purchase date of a property. Corporate purchases shown in the chart include en-bloc transactions, that is, collective sales of housing developments to a common buyer(s) when there is majority consensus among the unit owners to sell. However, the computation of the Private Property Price Index excludes these transactions as they are considered transactions in the land sales market rather than direct sales of units. En-bloc transactions are nevertheless expected to indirectly increase property prices as sellers in these transactions receive a premium and can thereby pay a higher price for the purchase of other units. SSD stands for Seller's Stamp Duty, ABSD for Additional Buyer's Stamp Duty.

[6] A sub-sale is sale of a unit on the secondary market before the unit is completed.

[7] See http://www.mas.gov.sg/news-and-publications/media-releases/2013/additional-measures-to-ensure-a-stable-and-sustainable-property-market.aspx.

Figure 3. Singapore: Price Growth Across Property Markets

Prices of different segments of the property market have moved in tandem but industrial properties recorded a sharp increase before the implementation of a Seller's Stamp Duty on industrial properties early-2013.



Source: Urban Redevelopment Authority.

Note: SSD stands for Seller's Stamp Duty.

26. Global factors seem to have partly driven residential prices, as suggested by the high interconnectedness of cross-country house prices of the region, which significantly dropped after 2013. The presence of a high correlation in cross-country house prices, particularly before 2013, suggests that house prices are not only driven by domestic factors (Figure 4). In particular, demand for safe assets or global investors' search for yield may have contributed to house price interconnectedness in the region (see IMF 2018). However, since 2013, Singapore's house prices appear to have decoupled, following the implementation of a series of important macroprudential measures, and possible dampening effects from fundamental factors, as prices gradually fell over time in contrast to a continued rise in house prices in other cities.

27. Regression analysis indicates that residential prices have been significantly impacted by speculative activity and by foreigners' and corporate purchases. Economic effects are non-negligible. A one-standard deviation increase in speculative transactions, foreigners', or corporate purchases leads to an increase in the quarterly growth rate of property prices between 0.4 and 1.2 percentage points, with the largest effect coming from foreigners' purchases (Appendix I).

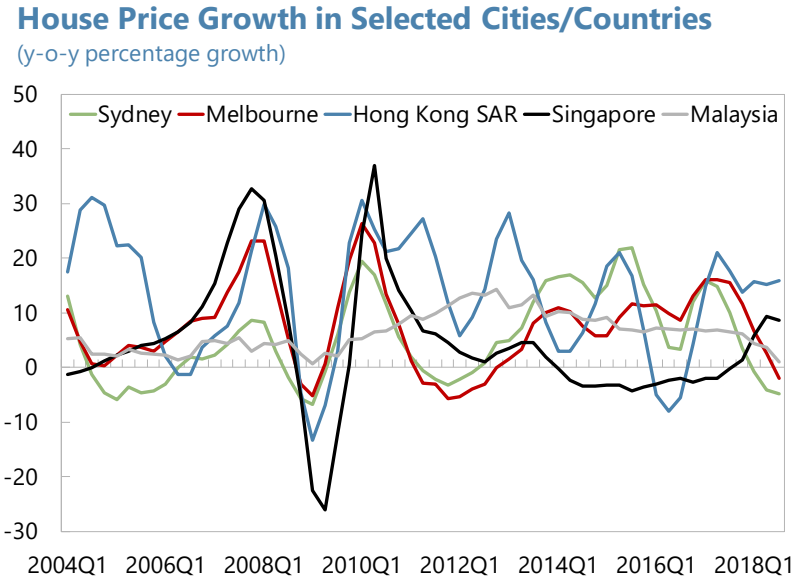
28. While earlier measures have contributed to the cooling of the property market, property prices started to decline gradually only after the implementation of a comprehensive set of cooling measures including the Additional Buyer's Stamp Duty and limits on Total Debt Servicing Ratio in 2013. In 2013, the Additional Buyer's Stamp Duty rates (first introduced at end-2011) were raised by 5 to 7 percentage points for all buyers except Singapore Citizens purchasing their first residential property, the limit on LTV ratio was lowered, and the Total Debt Servicing Ratio

framework was introduced. These measures altogether seem to have been effective in containing the rise in house prices. Seller's Stamp Duty measures, which had been implemented earlier, could also have contributed to the cooling of the market as their effects may have materialized with delay. Prices started to stabilize, and by 2017Q3 were about 12 percent below the previous peak of 2013 (Figure 5).

29. To moderate excessive speculation in 2010-2013, the government also ensured that land supply was adequate under the Government Land Sales Program and the building program for public housing to meet medium-term housing demand. Potential supply under the Government Land Sales gradually rose from 2010 until end-2013, while potential supply from private developers dwindled. Maintaining adequate land supply was important, with supply-side tools complementing the demand-side macroprudential policies, even though it is geared toward addressing medium-term demand.

30. The private property market began to recover in the second half of 2017 after four years of falling prices. Private residential property prices started to pick up in the second half of 2017 and recorded an increase of 9.1 percent, y-o-y in 2018Q2—the highest since 2011. The turnaround of the market came in the context of strong economic performance and improved market sentiment, as well as the boom in collective sales for redevelopments. Corporate purchases (including en-bloc transactions, i.e., collective sales of housing developments to a common buyer(s) when there is majority consensus among the unit owners to sell) increased during that period while purchases by non-resident foreigners remained low (Figure 2).

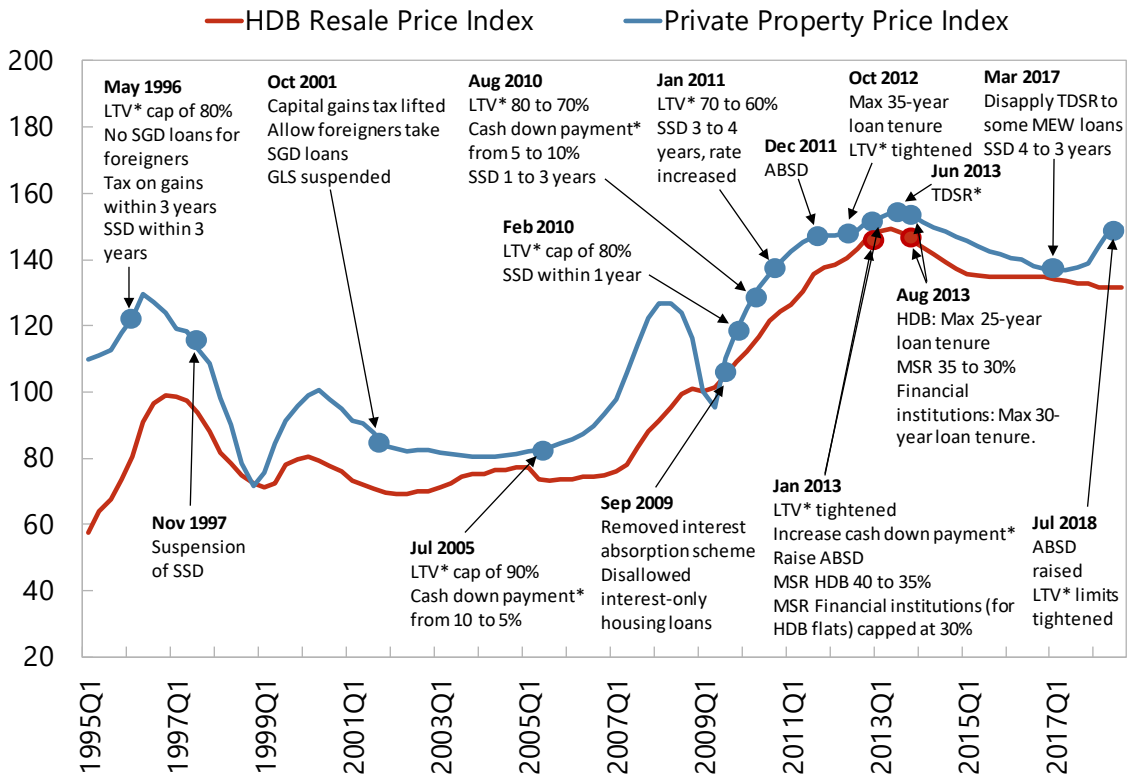
Figure 4. Singapore: International Synchronization of House Price Growth



House price growth in Singapore had been synchronized with those of other cities and countries of the region until end-2013

Source: Haver Analytics.

Figure 5. Singapore: Residential Prices and Macroprudential Property Market-Related Measures



Sources: MAS; Urban Redevelopment Authority; and IMF staff.

Notes: *Applies to loans granted by financial institutions for the purchase of both private and Housing Development Board properties. The August 2010 and January 2011 LTV restrictions are for those with one or more outstanding housing loan(s) at the time of housing purchase. ABSD stands for Additional Buyer's Stamp Duty, GLS for Government Land Sales, HDB for Housing and Development Board, MEW for Mortgage Equity Withdrawal, MSR for Mortgage Servicing Ratio, SSD for Seller's Stamp Duty, TDSR for Total Debt Servicing Ratio.

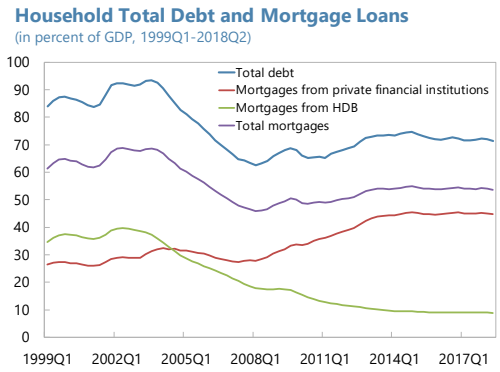
31. Following the implementation of the cooling measures in July 2018, price growth started to decelerate. In response to the residential price rebound, authorities raised the Additional Buyer's Stamp Duty rates applied to purchases by corporates, non-resident foreigners, and individual buyers (excluding Singapore citizens buying their first residential property), and tightened the LTV ratio limit for all loans granted by financial institutions in early July 2018. Following these measures, total transaction volumes dropped by more than 25 percent in 2018Q3 compared to the previous quarter (mainly reflecting lower resale transaction volumes while en-bloc activity also slowed down) and the growth of private residential prices decreased (MAS 2018).

32. Mirroring house price developments, household indebtedness surged after the global financial crisis and started to stabilize from end-2013 while the quality of new loans improved. Household debt stabilization reflects lower housing prices but also the implementation of macroprudential measures including the Total Debt Servicing Ratio. Household debt increased by

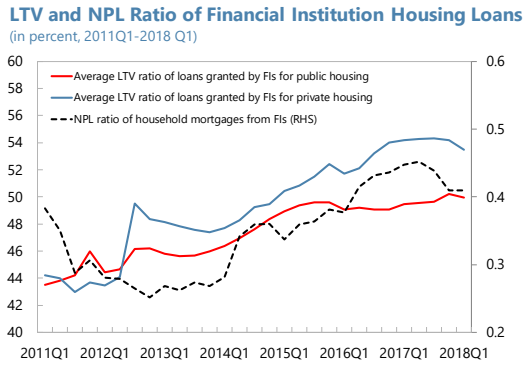
3.0 percent y-o-y in 2018Q3, reflecting mainly the growth of outstanding housing loans from financial institutions, although new housing loans have moderated in recent months. Further, the asset quality of housing loans remains strong and even improved since the implementation of the July 2018 cooling measures. The share of loans that are more than 30 days in arrears was about 1 percent and the NPL ratio was less than 0.5 percent in 2018Q4, unchanged from a year ago (Figure 6) while the share of new housing loans with LTV ratios under 70 percent rose from 37 to 45 percent from 2018Q2 to 2018Q4. Finally, the bulk of outstanding housing loans from financial institutions (53 percent) had a Total Debt Servicing Ratio under 40 percent as of 2018Q4, while 43 percent had a Total Debt Servicing Ratio between 40 and 60 percent, and only 5 percent had a Total Debt Servicing Ratio larger than 60 percent.

Figure 6. Singapore: Household Debt, LTV Ratios, and NPLs

As house prices declined, household debt stabilized…



… and LTV ratios increased, but the quality of loans remains strong



Sources: MAS and IMF staff calculations.

33. While the implementation of macroprudential measures was followed by a decline in house prices since end-2013, the contribution of these measures to the cooling of the market remains uncertain. Fundamental factors, rather than macroprudential policies, could also have contributed to lower house prices.[8] In particular, population growth has been half as much during 2013-18 as over 2007-12, while the supply of private properties in the pipeline increased, and rents declined (Figure 7).[9] The next section investigates in details the effects of macroprudential measures on house price developments.

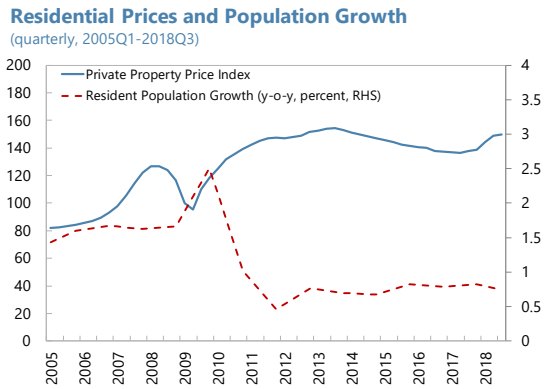
[8] Chia Li and Tang (2017) for example find that economic fundamentals (especially demographics) have accounted historically for almost 50 percent and for more than 80 percent of housing price growth of public and private markets, respectively.

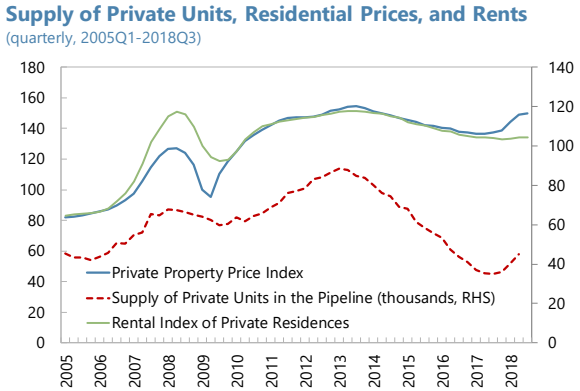
[9] The growth of the foreign workforce also recorded a significant drop, from 9.4 percent y-o-y in 2011 to 2.2 percent on average in 2013-15 and 0.6 percent in 2016-18.

Figure 7. Singapore: Resident Population Growth, Supply in the Pipeline, Residential Prices, and Rents

Resident population growth fell sharply from 2010…

…while the supply in the pipeline of private residences kept increasing, possibly weighing on residential prices and rents





Sources: Urban Redevelopment Authority and Department of Statistics Singapore.

Note: The supply of private units in the pipeline is the sum of the supply of private residential units under construction and of the planned private residential units for sale, not yet launched and sold.

B. Effects of Macroprudential Instruments

34. The objectives of macroprudential policy in Singapore are to safeguard financial stability and to encourage financial prudence among borrowers.[10] The authorities monitor speculative activities, excessive investment demand, and risky borrowing "to promote a stable and sustainable property market." Fiscal-based measures have been introduced to curb speculative investments in real estate (Seller's Stamp Duty) and limit excessive property investment demand (Additional Buyer's Stamp Duty) while credit-based measures (LTV limits, minimum cash down payment, loan tenure limits, Total Debt Servicing Ratio framework) aim in general at promoting financial prudence.

35. MAS analysis indicates that fiscal-based measures mainly impact property transactions and prices while credit-based measures affect lending. MAS developed a model of Singapore's property market (see Wong Lim and Wong 2015) to assess the effects of its macroprudential measures, by estimating a system of equations using macro-economic data for the period 2002Q3-2014Q2 and linking three key variables: property transactions (explained by property prices, mortgage loans, foreign property prices, fiscal-based macroprudential measures, GDP per capita), property prices (explained by mortgage loans, property transactions, equity prices, land supply), and mortgage loans (explained by property transactions, property prices, interest rate, credit-based

[10] According to MAS (2017), "unsustainably high and rising property prices can create financial stability risks, given both households' and the banking system's exposure to property" while "the combination of low global interest rates and elevated house prices have led to some households overextending themselves financially when purchasing property without sufficient regard to their longer-term debt-servicing ability."

macroprudential measures). Credit-based measures are found to directly constrain mortgage lending and to slightly impact property transactions and property prices through the credit channel. Fiscal-based measures directly constrain property transactions, with attendant effects on property prices and mortgage loans. Finally, land supply is found to impact property prices, with slight spillover effects on property transactions and mortgage loans. Over the sample period, property prices would have been 17 percent higher in the absence of macroprudential measures (10 percent higher without fiscal-based measures) and more than 6 percent higher without the supply measures, while mortgage loans would have been almost 35 percent larger without macroprudential measures (27 percent higher without credit-based measures).

36. On top of containing the volume of mortgages and house price developments, macroprudential credit-based measures also improved the risk profile of borrowers.[11] The number of borrowers with multiple housing loans has been declining as the LTV limit for such borrowers was progressively tightened. Since July 2018, the LTV cap for borrowers taking on a second housing loan had been reduced to 45 percent, compared to 80 percent before August 2010. Meanwhile, the share of new loans granted to borrowers with multiple housing loans halved from 30 percent in 2011 to 15 percent in 2018. The property market measures have also contributed to lower LTVs for new mortgage loans. The share of new mortgage loans with LTVs above 70 percent has fallen from a peak of 73 percent in 2010Q3 to around 60 percent from 2014Q3 onwards (around 55 percent in 2018Q4). Finally, the measure on the Total Debt Servicing Ratio (introduced against a backdrop of rising average loan maturities for housing loans, and uneven policies among banks when computing and evaluating debt service-to-income ratios of mortgage loan applicants) translated into less risky loans at origination.

37. This section focuses on the residential price effects of macroprudential measures by using micro- and region-level data. It adopts a more granular approach than MAS private property market model (Wong Lim and Wong 2015) by analyzing price effects of macroprudential measure around their date of implementation, based on micro-data from REALIS database and regression discontinuity analysis, and by estimating the dynamic price impact of the macroprudential measures using a regional panel dataset.

38. The implementation of stamp duties has been followed by a sharp reduction of speculative activity and of foreigners' purchases. Seller's Stamp Duty measures seem to have successfully reduced speculative activity (as proxied by short-term resale transactions, including sub-sales), especially after the rates were raised in the last round of tightening measures of January 2011. Likewise, the implementation of the Additional Buyer's Stamp Duty has been followed by a significant drop in the share of private residential purchases by foreigners from early 2012 (Figure 2). Although prices are positively explained by these two types of transactions (Appendix I), it is not clear if the drop-in speculators' and foreigners' transactions was sufficient to stabilize the market

[11] In line with the resilience channel through which macroprudential policy measures help contain systemic risk, as described in the Staff Guidance Note on Macroprudential Policy — Detailed Guidance on Instruments (see pages 32-33 of IMF 2014b).

since price levels kept increasing (although the pace of increase slowed) well after short-term resales vanished and foreigners' purchases dropped.

39. Other studies analyzed the effects of macroprudential measures around their implementation date, but these studies produced mixed results. Regression discontinuity analysis applied to macroprudential measures implemented between 2009 and 2017 indicates that most measures had no significant impact on transaction prices or a counter-intuitive positive effect, with only one set of cooling measures having translated into a significant drop of transaction prices (see Denga Gyourkob and Li 2019). For example, Additional Buyer's Stamp Duty announcements in December 2011 and January 2013 have been followed by a statistically significant 4-percent discrete jump, not a fall, in prices. Likewise, applying this approach to the measures implemented by authorities in early July 2018 (an increase in Additional Buyer's Stamp Duty rates and a tightening of LTV limit) indicates a statistically significant jump of transaction prices following the announcement.[12]

40. A proper approach to assess the effects of macroprudential instruments on prices is to consider longer horizons by looking at the dynamic effects of the measures. Regression discontinuity is a local approach focusing on the effect of measures a few weeks around the event date (the event window can be increased but at the cost of lowering the precision of estimates), whereas the effect of macroprudential measures on residential prices may take several months to materialize. The effects of macroprudential policy are then estimated in a dynamic approach by considering different time horizons (Appendix II).

41. It takes several quarters for macroprudential measures to produce negative effects on housing prices, with a peak effect reached 18 months after implementation. Estimates of the dynamic effects of the macroprudential measures on prices using the local projection method (Jordà 2005) and a three-dimensional panel dataset indicate that negative effects on residential prices start to materialize about three quarters after implementation of the measures and peak at six quarters. The effects remain significant when excluding the post-2013 period which saw a steady decline in prices, as well as when controlling for fundamental factors through rents. On average, each measure is found to translate into a decrease in the level of prices of 5 percent at the peak, when controlling for fundamental factors through rent indices (Appendix II).[13]

42. Stamp duties have had a larger and more persistent impact on residential prices of the Core Central Region. The Core Central Region is the area showing the largest proportions of

[12] The authors of the study (Denga Gyourkob and Li 2019) kindly provided the Stata codes to apply their approach to the macroprudential measures implemented in July 2018.

[13] This estimated effect is larger than the one obtained by MAS (Wong Lim and Wong 2015) based on a different approach and sample period. Although this is not possible to use exactly the same period of estimation due to data constrains, estimations over 2004Q1-2014Q2 controlling for rents gives a smaller effect (a 2.5-percent decrease for each measure after one year of implementation), closer to MAS estimate of a 10-percent decrease of housing prices for 5 tightening episodes of stamp duties. More generally, the magnitude of these effects should be interpreted with caution as it may not be possible to fully control for the effects from other macroprudential measures, like the LTV limits and the Total Debt Servicing Ratio, despite the inclusion of a set of fixed effects in the regressions.

speculative activity (proxied by short-term resales) and of foreigners' and corporate purchases before the implementation of the stamp duties. Regression analysis indicates that Seller's Stamp Duty and Additional Buyer's Stamp Duty measures, which are targeting short-term transactions, and foreigners' and corporate purchases, respectively, had a significantly larger and more persistent impact on private residential prices of the Core Central Region, in comparison to other regions (Appendix Table II.1, Panel D).[14]

43. Overall, property market-related measures increase the resilience of households and financial institutions against shocks by moderating the pro-cyclicality of credit and residential price developments. Stamp duties help to limit excessive property price increases by curbing speculators' and foreigners' demands, which are found to be significant drivers of residential prices. Credit-related measures, such as limits on Total Debt Servicing Ratio and LTV ratios, improve the debt service capacity of borrowers by containing an excessive growth in household debt but also reduce speculative housing demand and house price growth. Property market-related measures can thereby reduce the probability of default and the loss given default faced by lenders in the event of a negative shock. For example, for a given probability of default, the losses incurred by banks would be smaller if property price developments are well contained ex ante and the size of a price correction is smaller ex post (see Technical Note on Financial Stability Analysis and Stress Testing). Furthermore, the use of stamp duties is justified as they directly target the sources of residential price pressures—that is, the demand by speculators and foreigners—and are therefore less distortive than a tightening of macroprudential credit-based measures, whose effects are more broad-based, and stances are already tight.

[14] This result does not imply that stamp duties should only be applied to transactions in the Core Central Region – as these measures also have significant effects on prices of other regions – but should be interpreted as further evidence that macroprudential policies implemented by authorities do affect residential prices.

Appendix I. Speculative Transactions, Foreigners' and Corporate Purchases, and Residential Prices

This Appendix investigates the effect of speculative transactions and foreigners' and corporate purchases on house prices using a regional panel dataset.

1. Macroprudential policy has actively targeted transactions by speculators, foreign buyers, corporates, and property investors through stamp duties, as these transactions are claimed to distort underlying prices.[1] The effect of speculators' transactions and foreigners' and corporate purchases on prices has however not been analyzed empirically.

2. The impact on residential prices of speculative transactions and foreigners' and corporate purchases is estimated by exploiting information at the regional level. The quarterly growth rate of residential prices in each region is regressed on proxies for speculative activity (the short-term resales) and on foreigners' and corporate purchases, controlling for the growth rate of rents and the change of total transactions, using the following panel-data equation:

$$Growth\ Prices_{r,t} = \alpha_1 \times STResales_{r,t} + \alpha_2 \times Foreigners_{r,t} + \alpha_3 \times Corporate_{r,t} + \alpha_4 \times Growth\ Rents_{r,t} + \alpha_5 \times \Delta Transactions_{r,t} + \lambda_t + \lambda_r + \varepsilon_{r,t},$$

where, for each region *r* (Core Central Region, Rest of Central Region, Outside Central Region) and quarter *t*, *Growth Prices* is the growth rate of the property price index of non-landed residential properties, *STResales* is the share of short-term resales (resales, including sub-sales, completed within one year following the purchase of a property) in total resales, *Foreigners* is the share of foreigners' purchases in total purchases, *Corporate* is the share of corporate purchases in total purchases, *Growth Rents* is the growth rate of rents, Δ*Transactions* is the change of total transactions, λ_t are time fixed effects to account for time-varying macro-economic factors (e.g., credit conditions, GDP growth, population growth,…), and λ_r are region fixed effects controlling for region-specific factors of the growth rates of residential prices. Robust standard errors are clustered by region applying the correction for the small number of clusters of Cameron Gelbach and Miller (2008) wild cluster bootstrap-*t* procedure.

3. Property prices increase faster when speculative activity and foreigners' and corporate purchases are larger. Results of the regressions (Appendix Table I.1) indicate that the growth rate of private residential prices is significantly related to short-term resales. These results are in line with recent research finding that flippers (i.e., investors buying an asset to make a profit by reselling the asset in the short term) can influence residential prices in Singapore (despite representing a small

[1] The implementation of the Seller's Stamp Duty measure has been motivated by "a risk that the market could overheat in the next few months, fueled by low global interest rates and positive sentiments associated with the economic recovery" while Additional Buyer's Stamp Duty has been introduced with the objective "to promote a sustainable residential property market where prices move in line with economic fundamentals", with higher rates for foreigners "in view of the large pool of external liquidity and strong buying interest from abroad, and the relatively small size of the Singapore market." See http://www.mas.gov.sg/News-and-Publications/Media-Releases/2011/ABSD-for-a-Stable-and-Sustainable-Property-Market.aspx and http://www.mas.gov.sg/News-and-Publications/Media-Releases/2011/ABSD-for-a-Stable-and-Sustainable-Property-Market.aspx

fraction of the market – on average about 5 percent of total resale transactions over 2004-2012), by inducing a positive feedback to non-flippers, that is, rental investors and owner occupiers (Tu Zhang and Deng 2016). Estimates also indicate that corporate and foreigners' purchases explain positively the growth of residential prices. Results are qualitatively similar when focusing on the 2004-2013 period (Appendix Table I.1, regressions (5) to (8)), before residential prices declined, and speculative activity and foreigners' purchases dropped with the implementation of Seller's Stamp Duty and Additional Buyer's Stamp Duty measures.

4. Additional regressions suggest that the causality is running from transactions to prices, not the other way around. Short-term resales could be positively related to residential prices insofar as flippers are timing the market, that is, are selling their properties when prices are rising fast. Likewise, a boom in residential prices could increase appetite of foreigners and corporate investors for the domestic property market. In these cases, the growth of residential prices would explain positively transactions. Individual regressions of short-term resales, purchases of foreigners and of corporates, however indicate that none of these variables is explained by the growth of residential prices, including when different lags of the growth of prices are considered (Appendix Table I.2).

5. The effects are economically significant, with foreigners' purchases having the largest impact on the growth of residential prices. A one-standard deviation increase in the share of short-term resales (+5.3 p.p.), foreigners' purchases (+5.9 p.p.), and corporate purchases (+8.5 p.p.) is associated with an increase in the quarterly growth rate of private residential prices of 0.4, 1.2, and 0.5 percentage points, respectively (based on estimates of regression (4) of Appendix Table I.1). In comparison, the standard deviation of the quarterly growth rate of private residential prices is 4 percentage points over the sample period.

Appendix Table I.1. Singapore: Effect on Residential Prices of Speculative Transactions and Foreigners' and Corporate Purchases

	Dependent variable: Quarterly growth rate of regional price index of private non-landed residential properties							
	2004Q1-2018Q3				2004Q1-2013Q4			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Short-term resales in percent of total resales	0.17***			0.08***	0.21***			0.06***
	(0.00)			(0.00)	(0.00)			(0.00)
Non-resident foreigners' purchases in percent of total transactions		0.17		0.20***		0.23		0.28***
		(0.22)		(0.00)		(0.49)		(0.00)
Corporate purchases in percent of total transactions			0.06***	0.06***			0.13***	0.12***
			(0.00)	(0.00)			(0.00)	(0.00)
Change in quarterly volume of transactions, in thousands	0.57	0.61***	0.50***	0.71***	0.82***	0.86***	0.66***	0.97***
	(0.25)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Growth rent index, one-quarter lagged	0.15	0.22	0.21	0.16	0.23	0.28	0.28***	0.17
	(0.73)	(0.46)	(0.54)	(0.51)	(0.25)	(0.52)	(0.00)	(0.48)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	171	171	171	171	114	114	114	114
Adjusted R-squared	0.90	0.90	0.90	0.91	0.92	0.92	0.93	0.95

Note: Short-term resales are defined as resales (including sub-sales) completed within one year following the original purchase date of a property. *P* -values in parentheses based on robust standard errors clustered by region, corrected for small number of clusters using Cameron Gelbach and Miller (2008) wild cluster bootstrap-*t* procedure. ***,**,* denote statistical significance at the 1, 5, and 10 percent level, respectively.

Appendix Table I.2. Singapore: Effect of Residential Prices on Speculative Transactions and Foreigners' and Corporate Purchases

	Dependent variable: (in percent of total transactions, except otherwise indicated)					
	Short-term resales	Non-resident foreigners' purchases	Corporate purchases	Short-term resales	Non-resident foreigners' purchases	Corporate purchases
	2004Q1-2018Q3			2004Q1-2013Q4		
	(1)	(2)	(3)	(4)	(5)	(6)
Growth of price index of private non-landed residential properties, lagged	0.09	-0.13	1.30	0.10	-0.05	1.07
	(0.41)	(0.57)	(0.50)	(0.25)	(0.74)	(0.47)
Short-term resales in percent of total resales, lagged	0.80***			0.76***		
	(0.00)			(0.00)		
Non-resident foreigners' purchases in percent of total transactions, lagged		0.52			0.62***	
		(0.24)			(0.00)	
Corporate purchases in percent of total transactions, lagged			0.30***			0.40***
			(0.00)			(0.00)
Short-term resales in percent of total resales		0.17***	0.62		0.09	0.45***
		(0.00)	(0.25)		(0.70)	(0.00)
Non-resident foreigners' purchases in percent of total transactions	0.09		-0.81***	0.04		-0.23***
	(0.54)		(0.00)	(0.78)		(0.00)
Corporate purchases in percent of total transactions	0.03***	-0.08***		0.06***	-0.06***	
	(0.00)	(0.00)		(0.00)	(0.00)	
Change in quarterly volume of transactions, in thousands	-0.12	-0.89***	-0.45***	-0.27***	-0.91***	0.56***
	(0.50)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Growth rent index, lagged	0.37***	-0.02	-0.37***	0.44***	0.00	-0.13
	(0.00)	(0.49)	(0.00)	(0.00)	(0.80)	(0.51)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	171	171	171	117	117	117
Adjusted R-squared	0.95	0.94	0.75	0.96	0.92	0.63

Note: Short-term resales are defined as resales (including sub-sales) completed within one year following the original purchase date of a property and are expressed in percent of total resales. *P* -values in parentheses based on robust standard errors clustered by region, corrected for small number of clusters using Cameron Gelbach and Miller (2008) wild cluster bootstrap-*t* procedure. ***,**,* denote statistical significance at the 1, 5, and 10 percent level, respectively.

Appendix II. The Dynamic Effects of Macroprudential Measures

This Appendix provides an analysis of the dynamic effects of macroprudential measures on residential prices by applying the local projection method to a three-dimensional panel dataset of quarterly residential price indices by type of property and by region.

1. The analysis exploits information of a three-dimensional panel (property type, region, quarter). For each region (Core Central Region, Rest of Central Region, Outside Central Region) and type of property (private or Housing and Development Board flat), we collect information on residential price and rents. Housing price and rent indices are available at the regional level for the private non-landed residential market from 2004 while median Housing and Development Board prices and rents by township are available from 2007Q2.[1] Additional details on the definition and sources of the variables are available in Appendix IV.

2. The econometric approach assesses the dynamic effects of the macroprudential measures by employing the local projection method (Jordà 2005). The approach involves running a series of regressions of the log-difference of a given property-level price index between $t+j$ and t-1 on the measure event variable at time t, a set of fixed effects, and additional controls. Specifically, for j = 0, 1, …, 9, we estimate:

$$\ln(Y_{p,r,t+j}) - \ln(Y_{p,r,t-1}) = \alpha_j \times MacroPruMeasure_{p,r,t} + \sum_{l=1}^{m} \gamma_l \times \Delta y_{p,r,t-l}$$
$$+ \sum_{k=-8}^{j} \delta_k \times Controls_{p,r,t+k} + \ln(R_{p,r,t+j}) - \ln(R_{p,r,t-1}) + \lambda_p + \lambda_r + \lambda_t + \lambda_{rt} + \lambda_{pr} + \varepsilon_{p,r,t},$$

where Y is the transaction price index of the property type p (Housing and Development Board flat, private residence) in region r (CCR, RCR, OCR), *MacroPruMeasure* is the policy measure event variable,[2,3] and *Controls* include all past (in the eight quarters before the measure of interest) and future (up to quarter j) policy measure events (in order to address any omitted variable bias arising from any auto-correlation of measure events), R is the rent index by property type (Housing and Development Board, private) and region. This three-dimensional panel enables full control for macroeconomic factors—which may correlate with the measure events, for seasonal effect, through time fixed effects λ_t, for region-specific factors through region fixed effects λ_r, for property type-specific factors through property-type fixed effects λ_p, for seasonal effects specific to each region through the region-time fixed effects λ_{rt}, as well as for specific growth rates of each property type in

[1] Regional indices for the Housing and Development Board market are built by averaging median price/rent indices across 2-, 3-, and 4-bedroom apartments, for each region, and using a mapping between townships and the three-region breakdown.

[2] Credit measures applying to all types of properties and lenders (financial institutions or Housing and Development Board) are not considered as their effect is absorbed by time fixed effects. This is the case for Total Debt Servicing Ratio and LTV/minimum cash down payment measures applying to loans extended by financial institutions for the purchase of private units or Housing and Development Board resale flats. Measures affecting small segments of the market (e.g., measures on Executive Condominiums) are also disregarded. Overall, only fiscal-based measures (Seller's Stamp Duty and Additional Buyer's Stamp Duty) for the private market and MSR, loan tenure, and LTV measures for the Housing and Development Board resale market are retained.

[3] The variable *MacroPruMeasure* is taking the value 1 in case of a tightening of the macroprudential measure, the value -1 in case of relaxation, and 0 otherwise.

each region, through property type-region fixed effects, λ_{pr}.[4] Controlling for fundamental factors via rent indices is critical to check the robustness of the results as economic fundamentals (especially demographics) have been found to explain the bulk of housing price growth in Singapore (Chia Li and Tang 2017). The decline in residential prices following the implementation of macroprudential measures after the Great Financial Crisis occurred in a context of lower population growth and a larger supply of residences in the pipeline, that could have translated into lower rents.[5]

3. Baseline results suggest that the effects of macroprudential measures on prices take time to materialize and reach a peak about six quarters after implementation. Measures are initially associated with an increase in residential prices (up to two quarters following their introduction), possibly reflecting endogeneity issues, as authorities are more likely to implement macroprudential measures when residential prices are growing faster (the coefficients are however no more significantly positive when controlling for the growth of rents).[6] The effect of the measures then turns negative from the third quarter following implementation, gradually decreasing. At the peak, macroprudential measures are associated on average with a decrease in prices of almost 7 percent (Appendix Table II.1, Panel A).

4. Results are robust to excluding the post-2013 period and to controlling for fundamental factors through rents. Estimates may be driven by the price decline observed since end-2013, possibly reflecting fundamental factors rather than effects of macroprudential policies. Results are however qualitatively similar when excluding the post-2013 period (Appendix Table II.1, Panel B). Although slightly weaker, the impact of the measures also remains statistically significant when controlling for fundamental factors through rents (Appendix Table II.1, Panel C). On average, each measure is found to translate into a decrease in the level of prices of almost 5 percent at the peak. These effects can be considered as lower-bound estimates as Housing and Development Board and private residence prices are cointegrated (with a lag of about one year in the long-run relationship), possibly implying an underestimation of the impact of the measures in absolute terms.[7]

5. Private residential prices of the Core Central Region have been relatively more impacted by stamp duties given higher concentrations of speculative activity and of foreigners' and corporate purchases in the area. The Seller's Stamp Duty aims to deter short-term resales of residential properties and is expected to have a larger impact on prices of private units of

[4] λ_{pt}, the property type-time fixed effects would control for any effect of property p in quarter t but would be colinear with measures of a given quarter applying to a specific type of property across all regions (for example, the Additional Buyer's Stamp Duty and Seller's Stamp Duty measures) and are therefore not included.

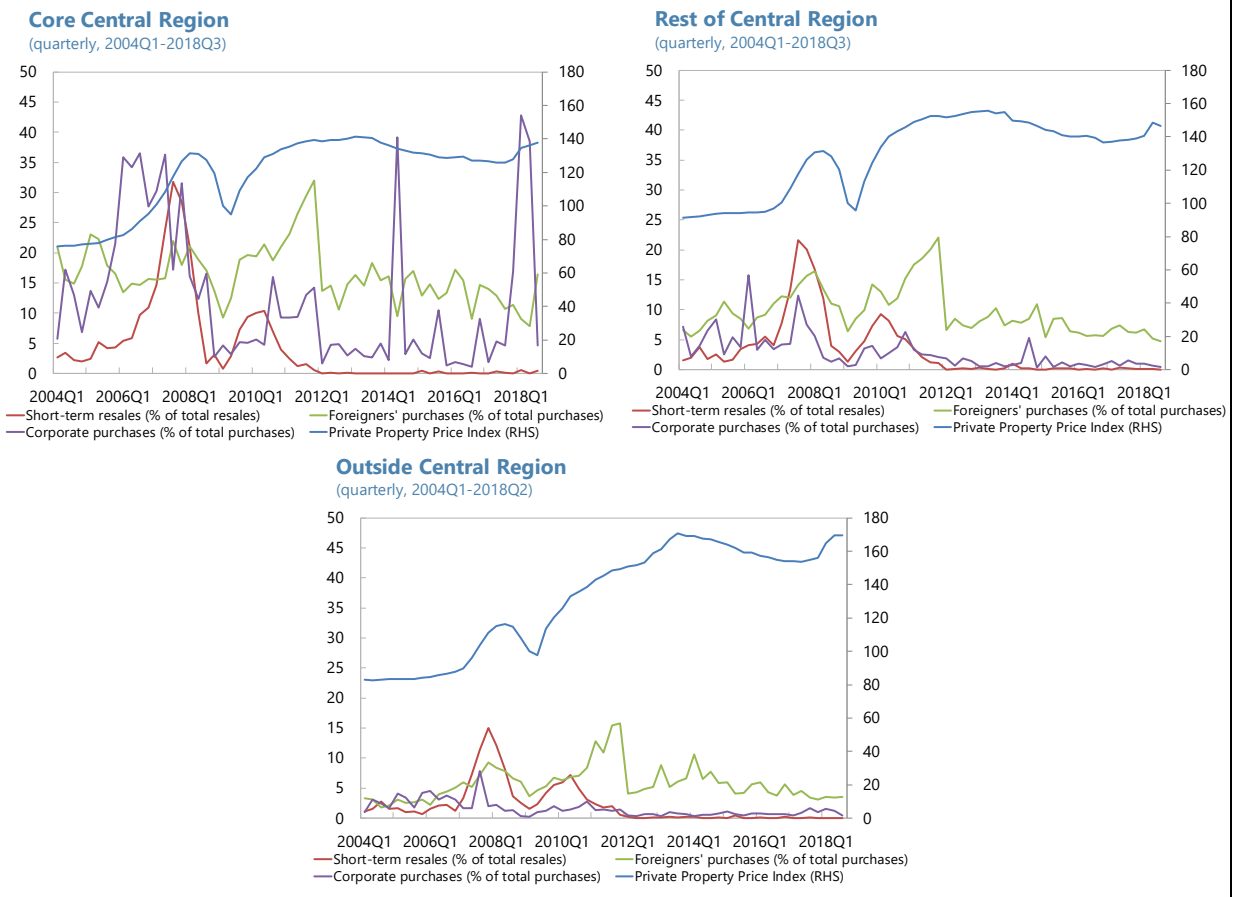
[5] Ideally, one should control for the evolution of the stock of available residences and/or supply in the pipeline at the regional level. These variables are not available at the three-region level and rent indices are used instead, with the advantage of reflecting the influence on prices of other fundamental factors, including population growth.

[6] The result of positive estimated coefficients in the first quarter following the implementation of measures is in line with findings obtained with the regression discontinuity analysis in the six months surrounding the measures.

[7] In contrast, any upward bias in the estimated effect of the measures due to an endogeneity issue of measure implementation to house prices is ruled out as the positive coefficients estimated at short-term horizons are no more significant once controlling for the growth of rents (Panels C and D).

the core central region which showed the largest presence of flippers' transactions (as a share of total resales) before the implementation of the Seller's Stamp Duty measures. Likewise, the Additional Buyer's Stamp Duty measures target foreigners and corporates and should affect relatively more private residential prices of the core central region, as this region showed the largest shares of purchases by foreigners and corporates (Appendix Figure II.1). Results of regressions (Appendix Table II.1, Panel D) confirm that stamp duties had a significantly larger impact on prices of the Core Central Region.[8] At the peak, the effect on residential prices is on average more than 6 percentage points larger in the Core Central Region than in the other regions. The impact is also more persistent as it remains statistically significant beyond two years following the implementation of the measures.

Appendix Figure II.1. Singapore: Private Residential Prices, Speculative Transactions, and Foreigners' and Corporate Purchases by Region



Sources: Urban Redevelopment Authority, MAS, and IMF staff calculations.
Note: This figure shows the evolutions of the property price index of non-landed residential properties, of the share of short-term resales in total resales (a proxy for speculative activity), and of foreigners' purchases and corporate purchases (including en-bloc transactions) in total purchases, for each of the three regions of Singapore.

[8] The variable of interest is the variable "Exposed region-property type" taking the value 1 for private property observations of the Core Central Region in quarters when the Additional Buyer's Stamp Duty and Seller's Stamp Duty measures were implemented, 0 otherwise.

Appendix Table II.1. Singapore: Dynamic Effects of Macroprudential Measures on Residential Prices

Panel A. 2004-2018

	Dependent variable: Ln(Residential Price Index)p,r,t+j - Ln(Residential Price Index)p,r,t-1									
	t	***t+1***	***t+2***	***t+3***	***t+4***	***t+5***	***t+6***	***t+7***	***t+8***	***t+9***
Macroprudential measure in quarter *t*	1.34	0.90***	-0.74***	-2.07***	-4.40***	-6.29***	-6.75***	-1.94	-1.17	-1.69
	(0.11)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.15)	(0.14)	(0.11)
Property-type, Region, and Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Property type-Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region-Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control for past and future reforms	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	285	279	273	267	261	255	249	243	237	231

Panel B. 2004-2013

	Dependent variable: Ln(Residential Price Index)p,r,t+j - Ln(Residential Price Index)p,r,t-1									
	t	***t+1***	***t+2***	***t+3***	***t+4***	***t+5***	***t+6***	***t+7***	***t+8***	***t+9***
Macroprudential measure in quarter *t*	0.93***	2.25***	2.00	0.52	-2.43	-5.50**	-6.15**	-5.21***	-5.21***	-5.26***
	(0.00)	(0.00)	(0.14)	(0.63)	(0.15)	(0.03)	(0.04)	(0.00)	(0.00)	(0.00)
Property-type, Region, and Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Property type-Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region-Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control for past and future reforms	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	171	171	171	171	171	171	171	171	171	171

Panel C. 2004-2018, controlling for rents

	Dependent variable: Ln(Residential Price Index)p,r,t+j - Ln(Residential Price Index)p,r,t-1									
	t	***t+1***	***t+2***	***t+3***	***t+4***	***t+5***	***t+6***	***t+7***	***t+8***	***t+9***
Macroprudential measure in quarter *t*	1.04	0.18	-1.19**	-1.69***	-3.57***	-4.87***	-4.95***	-2.24*	-2.38**	-2.41**
	(0.14)	(0.64)	(0.04)	(0.00)	(0.00)	(0.00)	(0.00)	(0.10)	(0.04)	(0.03)
Ln(Rent Index)p,r,t+j - Ln(Rent Index)p,r,t-1	0.30***	0.34***	0.63**	0.79**	0.83**	0.85***	0.78***	0.61***	0.54***	0.57***
	(0.00)	(0.00)	(0.03)	(0.03)	(0.04)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Property-type, Region, and Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Property type-Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region-Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control for past and future reforms	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	285	279	273	267	261	255	249	243	237	231

Panel D. 2004-2018, controlling for rents with interaction

	Dependent variable: Ln(Residential Price Index)p,r,t+j - Ln(Residential Price Index)p,r,t-1									
	t	***t+1***	***t+2***	***t+3***	***t+4***	***t+5***	***t+6***	***t+7***	***t+8***	***t+9***
Macroprudential measure in quarter *t*	1.11	0.30	-0.85*	-1.06	-2.34**	-3.72**	-3.83***	-0.53	-0.39	-0.56
	(0.15)	(0.13)	(0.09)	(0.11)	(0.03)	(0.05)	(0.00)	(0.71)	(0.83)	(0.64)
Exposed region-property type	-0.45	-0.60	-1.78	-3.24***	-6.49***	-6.14***	-5.93	-7.37***	-8.55***	-7.95***
	(0.61)	(0.35)	(0.13)	(0.00)	(0.00)	(0.00)	(0.12)	(0.00)	(0.00)	(0.00)
Ln(Rent Index)p,r,t+j - Ln(Rent Index)p,r,t-1	0.30***	0.35***	0.63**	0.79**	0.84**	0.87***	0.79***	0.62***	0.55***	0.58***
	(0.00)	(0.00)	(0.03)	(0.04)	(0.04)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Property-type, Region, and Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Property type-Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region-Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control for past and future reforms	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	285	279	273	267	261	255	249	243	237	231

Note: Regressions include past (up to 8 quarters before) and future measure events (*j* =1,..,9). *P* -values in parentheses based on robust standard errors clustered by property type-region, corrected for small number of clusters using Cameron Gelbach and Miller (2008) wild cluster bootstrap-*t* procedure. ***,**,* denote statistical significance at the 1, 5, and 10 percent level, respectively.

Appendix III. Property Market-Related Macroprudential Measures

Appendix Table III.1. Singapore: Property Market-Related Macroprudential Measures

Date	Measures	Details
July 2018	Increased Additional Buyer's Stamp Duty (ABSD) Rates Tightened LTV limits	**Increased Additional Buyer's Stamp Duty (ABSD) Rates** Increased ABSD by 5 percentage points for individuals (excluding Singapore Citizens (SCs) and Singapore Permanent Residents (SPRs) purchasing their first residential property), and by 10 percentage points for entities. Introduced an additional ABSD of 5 percentage points that is non-remittable under the Remission Rules (payable on the purchase price or market value, as applicable) for developers purchasing residential properties for housing development. The ABSD rates for SCs and SPRs purchasing their first residential property is retained at 0 percent and 5 percent respectively. **Tightened LTV Limits** Tightened LTV limits by 5 percentage points for all housing loans granted by financial institutions (does not apply to loans granted by HDB). http://www.mas.gov.sg/News-and-Publications/Media-Releases/2018/Raising-Additional-Buyers-Stamp-Duty-Rates-and-Tightening-Loan-to-Value-Limits.aspx
March 2017	Reduced Seller's Stamp Duty (SSD) holding period and rates Disapplied TDSR for specific loans	**Revisions to Seller's Stamp Duty (SSD)** • Impose SSD on holding periods of up to three years, down from four years previously; and • Lower the SSD rate by four percentage points for each tier. The new SSD rates range from 4 percent (for properties sold in the third year) to 12 percent (for those sold within the first year). **Disapply Total Debt Servicing Ratio (TDSR) framework to mortgage equity withdrawal loans with LTV ratios of 50 percent and below** To give borrowers greater flexibility to monetize their properties in their retirement years. http://www.mas.gov.sg/News-and-Publications/Media-Releases/2017/Joint-Press-Release-on-Measures-Relating-to-Residential-Property.aspx
December 2013	Introduced Mortgage Servicing Ratio (MSR) for Executive Condominiums (ECs)	**Introduction of MSR for ECs** The Mortgage Servicing Ratio (MSR) for housing loans granted by financial institutions for EC units bought directly from property developers is capped at 30 percent of a borrower's gross monthly income. It discourages EC buyers from over-stretching their finances and supports an affordable and sustainable EC market.
August 2013	Revised Mortgage Loan Terms for public housing	**Revision of Mortgage Loan Terms** • To ensure financial prudence in purchase of public housing and further stabilize the HDB resale market, the maximum tenure for housing loans granted by HDB reduced from 30 years to 25 years and MSR limit reduced from 35 to 30 percent. • In tandem, MAS reduced the maximum tenure of new housing loans and re-financing facilities granted by financial institutions for the purchase of HDB flats from 35 to 30 years. New loans with tenures exceeding 25 years and up to 30 years will be subject to tighter LTV limits.

Appendix Table III.1. Singapore: Property Market-Related Macroprudential Measures (Cont.)		
June 2013	Introduction of total debt servicing ratio (TDSR) framework	**Introduction of TDSR framework** comprising the standardization of the methodology for computing TDSR and the headline threshold of 60 percent. http://www.mas.gov.sg/News-and-Publications/Media-Releases/2013/MAS-Introduces-Debt-Servicing-Framework-for-Property-Loans.aspx http://www.mas.gov.sg/~/media/resource/news_room/press_releases/2013/FAQS_on_MAS_Total_Debt_Servicing_Framework_for_Property_Loans_and_Refinements_to_Housing_Loan_Rules.pdf
January 2013	Increased ABSD rates Expanded profile of buyers subject to ABSD LTV limits lowered MSR cap introduced for public housing loans from financial institutions, lowered for loans from HDB	**Private Housing** • Additional Buyer's Stamp Duty (ABSD) rates were: i. Raised between five and seven percentage points across the board. ii. Imposed on SPRs purchasing their first residential property and on Singapore citizens purchasing their second residential property. • LTV limits on housing loans were tightened for individuals who already have at least one outstanding housing loan, as well as for non-individuals such as companies. • Besides tighter LTV limits, the minimum cash down payment for individuals applying for a second or subsequent housing loan was raised from 10 to 25 percent. **Public Housing** • MSR for public housing loans granted by financial institutions was capped at 30 percent of a borrower's gross monthly income. • For loans granted by HDB, the cap on the MSR was lowered from 40 to 35 percent. http://www.mas.gov.sg/news-and-publications/media-releases/2013/additional-measures-to-ensure-a-stable-and-sustainable-property-market.aspx
October 2012	Introduced Maximum Loan Tenure for loans from financial institutions Lowered LTV limits	• The new loan tenure rules imposed a limit of 35 years on the tenure of housing loans granted by FIs for the purchase of any residential property. • LTV limits for new housing loans to borrowers who are individuals, if (i) the tenure exceeds 30 years or (ii) the loan period extends beyond the retirement age of 65 years, were lowered to (i) 40 percent for a borrower with one or more outstanding residential property loans and (ii) 60 percent for a borrower with no outstanding residential property loan. • The LTV limit for housing loans to non-individuals was lowered from 50 to 40 percent. http://www.mas.gov.sg/News-and-Publications/Media-Releases/2012/MAS-Restricts-Loan-Tenure-for-Residential-Properties.aspx

Appendix Table III.1. Singapore: Property Market-Related Macroprudential Measures (Cont.)		
December 2011	Imposed ABSD on selected groups of buyers	**Imposition of ABSD on the following categories of residential property purchases:** i. 10 percent for foreigners and non-individuals (corporate entities) buying any residential property; ii. 3 percent for SPRs owning one and buying a second and subsequent residential property; and iii. 3 percent for Singapore citizens owning two and buying a third and subsequent residential property. http://www.mas.gov.sg/News-and-Publications/Media-Releases/2011/ABSD-for-a-Stable-and-Sustainable-Property-Market.aspx
January 2011	Increased holding period for imposition of SSD Increased SSD rate Lowered LTV limit	• Holding period for imposition of SSD was increased from three to four years. • SSD rates were raised to 16, 12, 8, and 4 percent for residential properties bought on or after January 14. 2011, and are sold in the 1st, 2nd, 3rd, and 4th year of purchase respectively. • For property buyers who are individuals with one or more outstanding housing loans: LTV limit for housing loans granted by financial institutions was lowered from 70 to 60 percent. • For property buyers who are not individuals: LTV limit was lowered from 70 to 50 percent for housing loans granted by financial institutions. http://www.mas.gov.sg/News-and-Publications/Media-Releases/2011/Measures-To-Maintain-A-Stable-And-Sustainable-Property-Market.aspx
August 2010	Increased holding period for imposition of SSD Lowered LTV limit and raised minimum cash down payment	For residential properties bought on or after August 30, 2010, the holding period for the imposition of SSD on residential properties sold was increased from one to three years. The SSD levied on residential properties is revised as follows: • Sold within the first year of purchase, that is, the property is held for 1 year or less from its purchase date – the full SSD rate (1 percent for the first S$180,000 of the consideration, 2 percent for the next S$180,000, and 3 percent for the balance) is imposed. • Sold within the second year of purchase, that is, the property is held for more than 1 year and up to 2 years – 2/3 of the full SSD rate. • Sold within the third year of purchase, that is, the property is held for more than 2 years and up to 3 years – 1/3 of the full SSD rate. For property buyers with one or more outstanding housing loans, the LTV limit was lowered from 80 to 70 percent for housing loans granted by financial institutions and the minimum cash down payment for housing was raised from 5 to 10 percent. http://www.mas.gov.sg/News-and-Publications/Media-Releases/2010/Measures-to-Maintain-a-Stable-and-Sustainable-Property-Market.aspx

Appendix Table III.1. Singapore: Property Market-Related Macroprudential Measures (Cont.)		
February 2010	Introduced Seller's Stamp Duty (SSD) on selected residential properties and residential lands Lowered LTV limit	**Introduction of SSD on residential properties sold within one year** • Introduction of SSD on all residential properties and residential lands that were bought on or after February 20, 2010 and sold within one year from the date of purchase. • The SSD would be levied at 1 percent for the first S$180,000 of the consideration, 2 percent for the next S$180,000, and 3 percent for the balance. LTV limit for housing loans was lowered from 90 to 80 percent for housing loans granted by financial institutions. http://www.mas.gov.sg/News-and-Publications/Media-Releases/2010/Measures-To-Ensure-a-Stable-and-Sustainable-Property-Market.aspx
September 2009	Disallowed interest-only housing loans and interest-absorbing loans	Interest-only housing loans (IOL) and Interest Absorption Scheme (IAS) loans in which the developer absorbed interest payments on behalf of the borrower for a period of time were disallowed. The Monetary Authority of Singapore disallowed the IAS and IOL with immediate effect from September 14, 2009. This measure applied to all private residential projects. The only exception was uncompleted private residential projects where the units had already been offered for sale under the IAS before September 14, 2009. The IOL was disallowed with immediate effect. The IAS and IOL were offered to buyers of uncompleted private residential properties. These schemes could have encouraged property speculation in a buoyant market where prices were rising rapidly, as they were forms of housing loans that entirely eliminated or substantially lowered regular installment payments for property purchasers in the first few years before the properties were completed, that is, issued Temporary Occupation Permit. Under the schemes, a property purchaser did not have to make any significant payment, apart from the upfront 10-20 percent down-payment, until the housing project was completed. http://www.mas.gov.sg/News-and-Publications/Media-Releases/2009/Measures-to-Ensure-a-Stable-and-Sustainable-Property-Market.aspx
July 2005	Increased LTV limit Decreased minimum cash down payment	The LTV limit applicable to loans granted by FIs was raised from 80 to 90 percent, and the minimum cash down payment was decreased from 10 to 5 percent. These measures applied to loans for both private and public housing. http://www.mas.gov.sg/news-and-publications/media-releases/2005/mas-issues-revised-housing-loan-rules.aspx
October 2001	Removed deemed income tax on gains from sale of property within 3 years of purchase Allowed foreigners to take SGD housing loans Government Land Sales (GLS) review	**Removal of deemed income tax on gains from sale of property within 3 years of purchase** The Government removed deemed income tax on gains from the sale of property within 3 years on and after October 13, 2001. This was part of a review of a package of anti-speculation measures that the government introduced in 1996 to cool down the property market. **Foreigners allowed to have SGP dollar loans** The restrictions that foreigners who were not PRs and non-Singapore companies were not allowed to obtain housing loans in Singapore dollars were lifted.

Appendix Table III.1. Singapore: Property Market-Related Macroprudential Measures (Conc.)		
		GLS review The Government withheld the launch of the last 4 sites in the Confirmed List of the 2001H2 Government Land Sales Program, originally planned for release later in 2001. The sites were transferred to reserve list. The Government announced for 2002, it would suspend the sale of residential and commercial sites from the Confirmed List. However, the sites would still be made available on the reserve list.
November 1997	Suspended SSD	The Government suspended SSD for the sale of properties within 3 years of purchase made on or after November 19, 1997 to improve the liquidity of transactions in the market. SSD was no longer necessary since speculative activity in the property market had been quenched. http://www.nas.gov.sg/archivesonline/speeches/view-html?filename=1997111804.htm
May 1996	Introduced LTV cap of 80 percent Disallowed foreigners from taking SGD housing loans Introduced deemed income tax on gains from sale of property within 3 years of purchase Introduced Seller's Stamp Duty (SSD) on properties sold within 3 years Brought forward stamp duty payment date	**LTV cap of 80 percent** Housing loan quantum was to not exceed 80 percent of purchase price or valuation, whichever is lower. **Foreigners disallowed to have SGD loans** Disallowed the granting of Singapore dollar loans to non-permanent resident foreigners and non-Singapore companies for the purchase of residential properties. **Introduction of deemed income tax on gains from sale of property** Deemed income tax on gains from the sale of property within 3 years of purchase was introduced on May 14, 1996 to discourage speculation in the residential property market. **Introduction of SSD** The SSD was introduced on May 14, 1996 to discourage speculation in the residential property market. The aim is to stabilize the market and prevent prices from overshooting. The SSD was imposed on residential properties sold within three years of purchase as follows: • Sold within the first year of purchase, that is, the property is held for 1 year or less from its purchase date – the full SSD rate (1 percent for the first S$180,000 of the consideration, 2 percent for the next S$180,000, and 3 percent for the balance) is imposed. • Sold within the second year of purchase, that is, the property is held for more than 1 year and up to 2 years – 2/3 of the full SSD rate. • Sold within the third year of purchase, that is, the property is held for more than 2 years and up to 3 years – 1/3 of the full SSD rate. **Bring forward stamp duty payment date** • Previously, a buyer who purchased an uncompleted property did not need to pay stamp duty until the title was transferred to him. This allowed property speculators who bought and sold properties quickly to pay no stamp duty. • The Stamp Duties Act was amended to bring forward the stamp duty payment date to the time of agreement to purchase a property. This made property speculation costlier.

Appendix IV. Variable Description and Sources

Appendix Table IV.1. Singapore: Variable Description and Sources

Variable	Description	Sources
Private Residential Property Price Index	Index are computed using stratified hedonic regression method. The sum of values of transactions from 2014Q1 to 2015Q1 is used as weights to compute the index. It is indexed at 100 in 2009Q1.	URA
Rental Index of Private Sector Residential Properties	Index based on the ratio of the current rental per square meter per month compared with that in 4th quarter of 1998.	URA
Supply of Private Residential Units in the Pipeline	Calculated by summing up "Supply of Private Residential Units in the Pipeline under Construction," "Planned Private Residential Units with Pre-requisites for Sale," "Planned Private Residential Units without Pre-requisites for Sale with Written Permission," and "Planned Private Residential Units without Pre-requisites for Sale with Provisional Permission."	URA
Property Price Index of Non-Landed Residential Properties by region	Price index of private residential properties in Core Central Region (CCR), Rest of Central Region (RCR), or Outside Central Region (OCR).	URA
HDB Resale Price Index	Tracks the overall price movement of the public residential market. The index is based on quarterly resale price by date of registration.	HDB
HDB price index by region	HDB price index at the regional level (CCR, RCR, OCR) built by averaging price indices built from median prices by township of 3-, 4-, and 5-room flats.	HDB[1] and IMF staff calculations
HDB rent index by region	HDB rent index at the regional level (CCR, RCR, OCR) built by averaging rent indices built from median rents by township of 3-, 4-, and 5-room flats.	HDB[2] and IMF staff calculations
Transactions by Singaporeans, Permanents Residents, Foreigners, and Corporates	Quarterly volume of property purchases by Singaporeans, Permanents Residents, Foreigners, and Corporates, by region (CCR, RCR, OCR).	MAS
Population	Total and resident population	Department of Statistics Singapore[3]
Transactions	Total non-landed transactions including new sales and excluding ECs	REALIS and IMF staff calculations
Resales	Total non-landed resale transactions (including sub-sales), excluding new sales and ECs	REALIS and IMF staff calculations
Short-term resales	Non-landed resales (including sub-sales) completed within the year following the purchase date, excluding ECs.	REALIS and IMF staff calculations

[1] https://www.hdb.gov.sg/cs/infoweb/residential/buying-a-flat/resale/resale-statistics
[2] https://www.hdb.gov.sg/cs/infoweb/residential/renting-a-flat/renting-from-the-open-market/rental-statistics
[3] https://www.singstat.gov.sg/find-data/search-by-theme/population/population-and-population-structure/latest-data

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