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POLICY AND ITS TRANSMISSION MECHANISM –
EMPIRICAL EVIDENCE FROM HONG KONG**

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Effectiveness of Loan-To-Value Ratio Policy and Its Transmission Mechanism – Empirical Evidence from Hong Kong

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Abstract

This paper provides a non-technical summary of two recent empirical studies to shed light on key important issues regarding the implementation of loan-to-value (LTV) policy as a macroprudential tool, including its effectiveness, potential drawbacks and its transmission mechanism to improve financial stability. Empirical evidence suggests that LTV policy is effective in reducing systemic risk associated with boom-and-bust cycles in property markets. Although the LTV policy may be associated with higher liquidity constraints on homebuyers, we show that the mortgage insurance programme (MIP) can mitigate this drawback without undermining the effectiveness of LTV policy. Thus, MIPs play an important role in enhancing the net benefits of LTV policy. Concerning the transmission mechanism, empirical evidence suggests that the policy pass-through to property market activities may be weak. By contrast, there is clear evidence that tightening LTV cap would reduce household leverage and credit growth, and that lower leverage plays a major role in strengthening banks' resilience to property price shocks. This finding supports the view that household leverage would be an optimal target of LTV policy.

Keywords: Banking, Hong Kong, Loan-To-Value, Macroprudential Policy

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1. Introduction

Although there is a growing consensus that regulating maximum loan-to-value ratios on mortgage (henceforth referred to as LTV policy) could help contain systemic risks associated with credit-property price spirals, empirical evidence with regard to some fundamental issues of this macroprudential tool remains scant. First, how effective is LTV policy in reducing systemic risk? Second, does LTV policy create significant liquidity constraints for potential homebuyers? Third, can a mortgage insurance programme (MIP)¹ offset this drawback of LTV policy without undermining the effectiveness of LTV policy?

Drawing on the empirical findings by Wong et al. (2011), Sections 2 and 3 of this paper answer these questions based on Hong Kong's experience with both LTV policy and MIPs², and econometric analysis of panel data from 13 economies respectively. In Section 2, we present the history of LTV policy in Hong Kong, showing strong evidence that it has helped the Hong Kong banking sector weather the boom-and-bust cycles of the property market. We also present evidence that Hong Kong's MIP has helped homebuyers overcome the liquidity constraints they may experience because of LTV policy without increasing banks' credit risk. In Section 3, a summary of the panel econometric analysis is provided. The result bears out Hong Kong's experience and shows that LTV policy is effective in reducing systemic risks associated with credit-property price spirals, and that MIPs have not reduced the effectiveness of LTV policy.

While the empirical findings point to a pivotal role of LTV policy in safeguarding banking stability, there remain debates about the design of the operational framework. In particular, would LTV policy be optimal to target household leverage, credit growth or property prices in pursuit of financial stability? Theoretically, the answer crucially depends on the transmission mechanism of LTV policy, particularly (i) the extent of the policy pass-through on these three variables, and (ii) their respective contributions to financial stability.

To shed light on this issue, section 4 investigates the short-term policy impact on property market activities for three selected economies, Hong Kong, Korea and Singapore. Section 5 provides novel empirical evidence from Hong Kong based on Wong et al. (2013) on the pass-through of LTV policy to borrowers' leverage and credit growth, and their respective contributions to financial stability. Overall, the empirical results in these two sections support the view that the dampening effect of LTV policy on household leverage is more apparent than its effect on property market activities, suggesting that it would be optimal for LTV policy to target household leverage.

¹ Throughout this study, the term MIP (also known as lenders mortgage insurance) refers to insurance that aims to protect lenders against losses due to mortgage payment default by borrowers.

² Hong Kong's experience in this area – its LTV policy has been in effect for more than 20 years; property prices in Hong Kong are subject to frequent and substantial swings; and Hong Kong banks have significant exposure to property-related lending – offers an unparalleled opportunity to assess the long-run prudential effect of LTV policy on banking stability. In addition, since Hong Kong is precluded from exercising an independent monetary policy under the Linked Exchange Rate System, LTV policy plays a predominant role in safeguarding banking stability.

2. A Brief History of LTV Policy and the MIP in Hong Kong

LTV policy has long played a vital role in strengthening Hong Kong banking system's resilience to asset price volatilities and reducing the risk of cycle amplification through bank credit, rather than as a means of managing asset price cycles and market activities or targeting asset prices. Figure 1 provides a succinct visual summary of the developments in Hong Kong's LTV policy, together with changes in property prices and mortgage delinquency ratios. The development of LTV policy in Hong Kong can be broadly divided into four phases, as summarised below:

Phase 1: before 1997

Prior to the adoption of the LTV policy in 1991, Authorized Institutions (AIs)³ in Hong Kong were allowed to grant mortgage loans covering up to a LTV ratio of 90% under the Third Schedule of the Banking Ordinance, the legal framework for banking supervision in Hong Kong. In view of the systemic risk that could arise from residential mortgage lending (RML), the Commissioner of Banking⁴ had intended to amend the Third Schedule to lower the 90% LTV threshold to 70%. The Commissioner of Banking consulted the banks during 1991 on these intentions. Banks were co-operative, offering to adopt the 70% LTV policy voluntarily, removing the need to amend the Third Schedule. The 70% maximum ratio has since been fully endorsed by the Hong Kong Government as a prudential measure⁵ and has evolved into a banking industry standard intended to guard against overexposure to the property market.⁶

Phase 2: from 1997 to 1999

Against the backdrop of a sharp rise in residential property prices in 1996, signs of speculative activities and the rapid increase in RML, the HKMA issued guidelines to all AIs on 28 January 1997 recommending the adoption of a maximum LTV ratio of 60% for properties with a value of more than HK\$ 12 million – so-called luxury properties. In the wake of the Asian financial crisis, Hong Kong's property prices fell significantly – by more than 40% from September 1997 to September 1998 – yet the mortgage delinquency ratio remained below 1.43%, which is low by international standards. This fact alone suggests that LTV policy reduces the credit risk faced by banks and assures the quality of banks' mortgage loan portfolios.

³ AIs are institutions authorized under the Banking Ordinance to carry on the business of taking deposits. All AIs in Hong Kong are supervised by the HKMA.

⁴ The HKMA was established on April 1, 1993, by merging the Office of the Exchange Fund and the Office of the Commissioner of Banking. Its main functions and responsibilities are governed by the Exchange Fund Ordinance and the Banking Ordinance. Banking supervision is one of its functions.

⁵ On 2 November 1995, the Hong Kong Government confirmed at a Legislative Council meeting that the 70% LTV ratio should be adopted as a long-term regulatory policy.

⁶ For details, see HKMA (2009).

Phase 3: from 1999 to 2008

In line with measures intended to stabilise the property market implemented by the Government, the HKMA restored the maximum LTV ratio of 70% in October 2001. Meanwhile, the HKMA allowed AIs to refinance the mortgage loans of homeowners with negative equity for up to 100% of the current market value of the mortgaged property. Notwithstanding this relaxation, the HKMA emphasised that the 70% LTV policy remained as a long-term prudential measure.

Because of a significant drop in household income after the Asian financial crisis, prospective homebuyers faced significant obstacles in the property market, which led to calls for the relaxation of the 70% LTV policy. In 1999, the Hong Kong Mortgage Corporation (HKMC)⁷ launched an MIP, under which mortgage loans of up to an LTV ratio of 90% were made available to homebuyers meeting certain eligibility criteria.⁸ The MIP is designed to protect participating banks against credit losses on the portion of loans that exceeds the 70% threshold in the event of defaults. It also avoids the potential drawback of LTV policy that some homebuyers may not qualify for a mortgage because of substantial down payment requirements even if they have sound financial conditions. The increase in the number of homebuyers participating in the MIP during this period demonstrates that the MIP has helped a significant number of households overcome liquidity constraints (Figure 2) and that concerns about liquidity constraints should not be lightly dismissed.

One concern is that the MIP may reduce the effectiveness of LTV policy because it enables households to increase their leverage ratios, thereby boosting the risk of mortgage defaults, in theory, and hence of bank credit losses. In reality, however, the HKMC's MIP portfolio registers a lower delinquency ratio than Hong Kong's banking sector⁹, indicating that, thanks to prudent underwriting criteria, the MIP has not undermined the LTV policy but has actually improved the stability of Hong Kong's banking system.

Phase 4: 2009 to the present

Strong capital inflows and unusually low interest rates since early 2009 have fuelled property prices in Hong Kong sharply, particularly at the upper end of the property market. As a prudential measure, the HKMA issued guidelines in October 2009 requiring all AIs to reduce the maximum LTV ratio for properties with a value of HK\$ 20 million or more from 70% to 60%.

⁷ The HKMC, which is owned by the Hong Kong Government, was established in 1997. Its primary missions are: (1) enhancing the stability of the banking sector by serving as a reliable source of liquidity, thereby reducing the concentration and liquidity risk of mortgage lending by banks; (2) promoting wider home ownership; and (3) facilitating the growth and development of the debt securities and mortgage-backed securities markets in Hong Kong.

⁸ The criteria include maximum levels for the debt-to-income ratio, loan amounts and maturities.

⁹ The delinquency ratio of the HKMC's MIP portfolio reached a historical high of 0.39% at the end of September 2003, whereas the ratio for the Hong Kong banking sector was 1.05%.

To further safeguard banking stability and help banks manage credit risk more prudentially, the HKMA tightened LTV limits with subsequent five rounds of prudential measures between August 2010 and February 2013. As a result, the current maximum LTV ratio is set to be 50% for residential properties with a value of HK\$ 10 million or more, 60% for those with a value between HK\$ 7 and 10 million, and 70% for those with a value below HK\$7 million. The maximum LTV ratio for non-owner-occupied residential properties and properties held by a company is 50% regardless of property values. For commercial and industrial properties¹⁰, the maximum LTV ratio is 40%. For net-worth-based mortgages, the maximum LTV ratio is 40% for residential properties and 30% for commercial and industrial properties. Regardless of property types or values, the maximum LTV ratio is lowered by 10% points for mortgage applicants whose income is mainly derived from outside Hong Kong. If the mortgage loan applicants already have outstanding mortgages, a further 10-percentage-point deduction in maximum LTV ratio is applied to applicants whose income is mainly derived from outside Hong Kong and to net-worth-based mortgages. For details, see the Appendix.

3. Panel Econometric Evidence on the Effectiveness of LTV Policy and MIPs

The section provides cross-country evidence on the effectiveness of LTV policy and MIPs based on econometric analyses of panel data from 13 economies¹¹. This study aims at testing two hypotheses. First, countries with LTV policy tend to have lower sensitivity of mortgage default risk to property price shocks, and second, MIP does not reduce the effectiveness of LTV policy.

To this end, the economies are separated into three groups: (i) with both LTV policy and MIP, (ii) with LTV policy but no MIP, and (iii) no LTV policy.¹² Two fixed effects models, which postulate that the change in the mortgage delinquency ratio is negatively correlated with real property price growth and real GDP growth, are estimated.¹³ To facilitate comparisons between the three groups of economies, the estimated coefficient for property price growth and that for real GDP growth are assumed to differ across the groups.

Regarding the first hypothesis, the sensitivity of the mortgage delinquency ratio to property prices is found to be negative and lower (in absolute terms) in economies with LTV policies than in economies without LTV policies. A 1% drop in property prices would increase the delinquency ratio by 0.35 basis points in economies with LTV policies, and by 1.29 basis points in economies without LTV policies.

¹⁰ Including standalone car park space.

¹¹ The economies included in this study are Australia, Canada, Greece, Hong Kong, Korea, Malaysia, the Philippines, Portugal, Singapore, Spain, Thailand, the US and the UK. The sample covers the period 1991 Q1 – 2010 Q2.

¹² Hong Kong, Korea, Malaysia and Singapore have adopted an LTV policy according to the Bank for International Settlements (BIS (2010)) and information obtained from their respective central banks/supervisory authorities. Hong Kong, Korea and Malaysia have also implemented MIPs.

¹³ An aggregate mortgage-to-GDP ratio and the change in interest rate are included as control variables. The effect of other institutional factors such as recourse rules and personal bankruptcy regulations are assumed to be captured by country fixed effects.

The difference is found to be statistically significant, suggesting that LTV policy reduces the vulnerability of banking systems to property price shocks.

To visualise the policy effect on banking stability, a simulation exercise is conducted for Hong Kong's banking sector. The simulation counter-factually assumes that a relaxation of the maximum LTV ratio from 70% to 90% were to occur before 1997. All banks are assumed to aggressively exploit this relaxation to extend mortgage loans to an average LTV ratio of 90%. A shock of a 40% decline in real property prices is then imposed in the simulation. The simulation (Figure 3) suggests that if the maximum LTV ratio were to have been relaxed before 1997, the delinquency ratio after the property price shock would have been 1.7% (at the 95% confidence level) at the end of 1998 compared with the actual level of 0.84%.

There is supporting evidence for the second hypothesis. Specifically, empirical results find that MIPs are not a significant determinant of the sensitivity of the mortgage delinquency ratio to property prices for economies with the LTV policy, indicating that MIP should not reduce the effectiveness of LTV policy.

4. Empirical Evidence on the Policy Pass-Through to Property Market Activities

Regarding the transmission mechanism of LTV policy to improve financial stability, this section investigates whether LTV policy is an appropriate tool for stabilising property market activities. We assess this issue by studying Hong Kong, Korea and Singapore where LTV caps were tightened in the past when there was concern about the risk of overheating property markets. By quantifying the immediate effect of the tightening LTV caps on property market activities in these economies, the policy pass-through to property market activities can be evaluated.

For this purpose, a time series model is separately estimated for the three selected economies using data from 1981Q1 to 2010Q2. In the model, property market activities are explained by its lag terms, real interest rates and two dummy variables. These two dummy variables are constructed to test the change in the average value of property market activities between the six-month period right *before* the tightening LTV caps and that *after* the tightening. The model is applied for estimating the policy impact on (i) the real property price growth; (ii) the deviation of actual property prices from its trend¹⁴; and (iii) the number of property transactions (in logarithmic form).

The estimation result suggests a significant dampening effect of LTV policy on real property price growth only for the case of Hong Kong. For the other two property variables, their movements are found to be insensitive to LTV caps tightening in all the three economies. Taken together, the policy

¹⁴ The trend level is derived using the Hodrick-Prescott filter. The gap is expressed as a percentage of the actual level of property prices.

pass-through to property market activities may be weak. A similar assessment, however, finds a significant dampening impact of LTV tightening on mortgage debt leverage (measured by the ratio of mortgage loans to GDP) for all the three economies, suggesting that the effect of LTV policy on systemic risk may be primarily transmitted through effects on household leverage.

5. Empirical Evidence on the Policy Pass-Through to Leverage and Credit Growth

This section attempts to advance our understanding of the transmission mechanism of LTV policy further by quantifying the policy impact on borrowers' leverage and credit growth (i.e. henceforth referred to as the direct and indirect effects respectively¹⁵) and their respective contributions to financial stability using data from Hong Kong from 1999Q2 to 2012Q4. The empirical analysis helps assess whether household leverage or credit growth would be the optimal target of LTV policy.

5.1 The Significance of the Direct Effect

One salient feature of LTV policy is that authorities operate the tool by adjusting the maximum LTV ratio instead of the actual LTV ratio in the market (LTV_M). Theoretically, however, LTV_M is determined together with other mortgage terms both by banks and homebuyers (Zumpano et al, 1986). An important question, therefore, is to what extent the LTV cap, serving as a macroprudential instrument, would be factored in when banks and homebuyers determine LTV_M .

To answer this question, a regression model of the determinants of LTV_M is estimated. The model postulates that a higher LTV cap, a higher property price return (relative to its volatility) and rental yield, and a lower debt-servicing ratio tend to be associated with a higher LTV_M , as banks and mortgagors tend to accept a higher LTV ratio when the property market is buoyant, debt servicing burden is low, and the LTV cap is less stringent.

The empirical result is broadly in line with our expectation. In particular, the LTV cap is found to be one binding factor affecting LTV_M , with the long-run elasticity being estimated to be 0.33. To gauge the responsiveness of LTV_M to the LTV cap, Figure 4 shows the cumulative contributions of the determinants to the change of LTV_M since September 2007. The five rounds of LTV cap tightening from 2009 to 2012 are estimated to reduce LTV_M significantly. Figure 5 plots the actual LTV_M against a hypothetical series of LTV_M under a counterfactual "no policy" scenario¹⁶, suggesting that had the HKMA not tightened LTV caps, LTV_M may hover above 60% instead of 52% at the end of 2012, indicating a significant direct effect.

¹⁵ Theoretically, the direct effect improves the resilience because mortgagors would hold a larger equity buffer at origination, contributing to a lower likelihood of negative equity and thus lower default risk. The indirect effect primarily avoids banks underwriting excessively fresh mortgage loans, which are generally subject to higher default risks due to a relative low portion of equity.

¹⁶ The LTV_M under the counterfactual "no policy" scenario is estimated by removing all the policy impact of LTV cap tightening (i.e. the dark red area in Figure 4).

5.2 The Significance of the Indirect Effect

The significance of the indirect effect is studied by estimating the demand and supply equations for mortgage loans in Hong Kong with a framework that allows for, but does not impose, disequilibrium. This empirical specification reflects two considerations. First, theoretically LTV policy is likely to affect both demand for and supply of mortgage loans¹⁷. Estimating a demand-supply system could therefore facilitate a clearer identification of the policy impact. Second, loan market disequilibrium, which has been widely documented in both the theoretical and empirical literatures¹⁸, could contribute to a state-dependent effect of LTV policy on credit growth (See Figure 6 for illustration).

Table 1 presents the specification of the demand and supply equations for mortgage loans. The estimation result¹⁹ is summarised as follows:

- (a) The estimation result reveals that disequilibrium could occur in the Hong Kong mortgage market, suggesting that the demand or supply can be the sole binding factor in determining the credit volume.
- (b) LTV_M is found to be a significant determinant of both the demand for and supply of mortgage loans, with the policy impact on loan supply being estimated to be significantly larger than that on loan demand. Figures 7 and 8, which show the supply and demand estimates respectively under the actual and counterfactual “no policy” scenarios, find that the dampening effect of the five rounds of LTV cap tightening from 2009 to 2012 is much larger on the loan supply than on demand.
- (c) Estimation results (a) and (b) together suggest that the effect of LTV policy on loan growth in Hong Kong is likely to be state-dependent such that LTV policy is more effective in limiting credit growth when there is excess credit demand but less so when excess credit supply occurs. Figure 9, which presents the estimated mortgage demand and supply, reveals that since the beginning of the tightening of macroprudential policy in October 2009, the number of months with estimated excess demand is more than that with estimated excess supply, suggesting that credit supply is a major factor in determining the volume of new mortgage loans. In other words, LTV policy was effectively transmitted to the market through its dampening impact on the supply of mortgage loans.

¹⁷ LTV cap tightening may reduce demand for mortgages, as homebuyers may be forced out of the property market because of higher liquidity hurdles or lower returns on equity for property investment. LTV cap tightening may also reduce credit supply because it may lead banks to lend less than they otherwise would.

¹⁸ See Stiglitz and Weiss (1981), Jaffee (1971), Fair and Jaffee (1972), Maddala and Nelson (1974) and Laffont and Garcia (1977) for example.

¹⁹ The two-stage least square (TSLS) method is adopted to estimate the model instead of applying the method of ordinary least squares because estimators of the latter are statistically inconsistent.

5.3 The Contribution of the Direct and Indirect Effects to Financial Stability

To quantify the contribution of the direct and indirect effects to strengthening the banking sector resilience to property price shocks, we first estimate an econometric model of the determinants of the average problem loan ratio for mortgage loans²⁰ in Hong Kong. The model postulates that the average problem loan ratio is positively correlated with the proportion of mortgage loans in negative equity in banks' mortgage portfolios.²¹ Other things being equal, a mortgage loan portfolio with a *higher average LTV ratio at origination* and a *higher share of new mortgage loans to total loans* tend to have a higher proportion of mortgage loans in negative equity and thus a higher default rate should negative property price shocks occur. LTV policy could therefore reduce the mortgage default risk by dampening *the average LTV ratio at origination* (by the direct effect) and *the share of new loans to total loans* (by the indirect effect).

Based on the empirical model, we then impose a hypothetical property price shock (assuming a 60% drop in property prices²²) and the estimated impact on the problem loan ratio in the eight quarters starting from 2013Q1 under the actual and "no policy" scenarios. Figure 10 shows that the problem loan ratio would increase from 0.03% in 2012Q4 to around 0.95% in 2014Q4 in the actual scenario compared to a much higher ratio of 2.32% under the counterfactual "no policy" scenario. The result suggests that the five rounds of the LTV cap tightening from 2009 to 2012 improve the banking sector resilience to property price shocks.

Our core interest, however, is the relative contributions of the direct and indirect effects to the 1.37-percentage-point reduction of the estimated problem loan ratio from the counterfactual "no policy" scenario to the actual scenarios. A decomposition analysis using the Shapley approach²³ shows that, of the estimated 1.37-percentage-point reduction in the problem loan ratio, the direct and indirect effects account for 1.21 and 0.16 percentage points respectively. In other words, the effect of LTV policy on reducing the sensitivity of mortgage default risk to property price shocks is mainly through its impact on leverage.

6. Conclusion

This paper assesses some important issues regarding the use of LTV policy as a macroprudential tool, including its effectiveness, potential drawbacks and its transmission mechanism to improve financial

²⁰ A problem loan ratio of mortgage loans is measured by the sum of the 3-month delinquency ratio and the rescheduled loan ratio for mortgage loans in Hong Kong.

²¹ The model also includes the unemployment rate and the proportion of mortgage loans with a distressed level of DSR as explanatory variables. Similar empirical models, which hypothesise that negative equity and a high level of debt-servicing burden are two triggers for mortgage defaults, have been developed by Foote *et al.* (2008) and Elul *et al.* (2010).

²² Assuming the property price shock is associated with a 300-basis-point increase in the reference interest rate; a 20% decline in household income and the unemployment rate increasing to 8.5%.

²³ For details of the Shapley approach, see Shorrocks (1999) and Israeli (2007).

stability. Hong Kong's experience and the empirical findings of the econometric analysis of the panel data suggest that LTV policy is effective in reducing systemic risk associated with boom-and-bust cycles in property markets. Although the significant number of homebuyers participating in Hong Kong's MIP indicates that LTV policy can lead to liquidity constraints for some households, empirical evidence shows that the MIP can mitigate this drawback without undermining the effectiveness of LTV policy. Thus MIPs play an important role in enhancing the net benefits of LTV policy. More importantly, potential liquidity constraints should not be considered a compelling reason for not adopting an LTV policy to contain the systemic risk associated with property price shocks.

The empirical findings regarding the transmission mechanism of LTV policy shed light on one important policy question – Should LTV policy be assigned to target household leverage, credit growth or property market activities? There is strong evidence that tightening LTV caps would reduce household leverage, and that the effect on leverage plays the major role in reducing mortgage default risk. By contrast, there is no clear evidence that tightening LTV caps dampens property market activities. Taken together, the effect of LTV policy would be transmitted mainly through impacts on the household leverage rather than on property market activities. Regarding the policy impact on credit growth, although LTV cap tightening since 2009 is found to dampen credit growth, the state-dependent feature may suggest that calibrating this tool to curb loan growth may pose challenges for policymakers, as the calibrating needs an accurate estimate of loan demand and supply.

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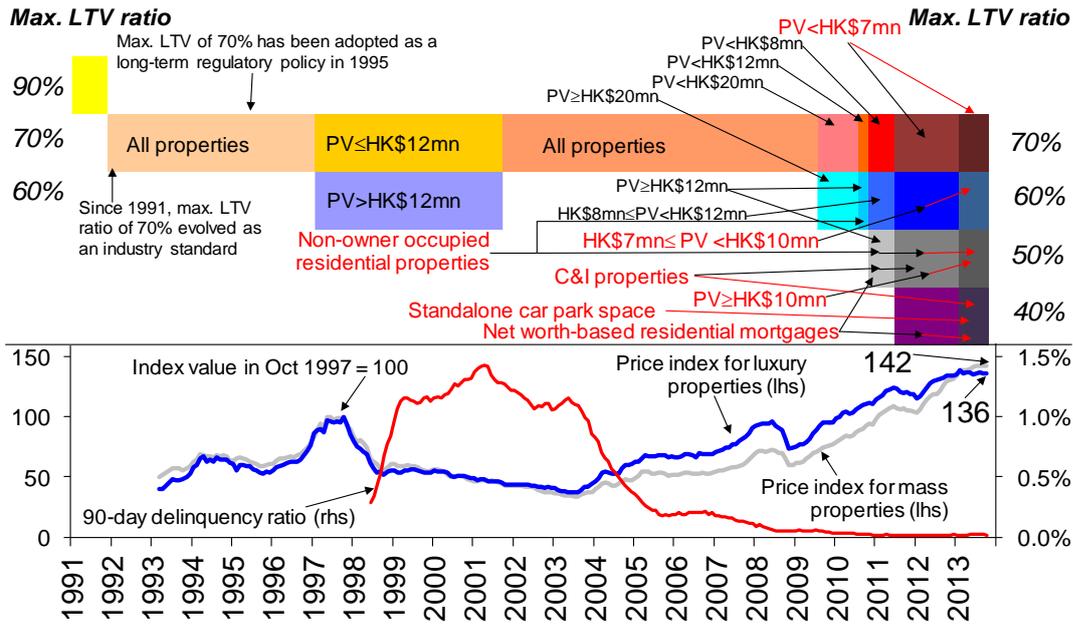
Table 1. The Specification of the Demand and Supply Regression Equations for Mortgage Loans in Hong Kong

Variable	Remark	Expected impact	Estimation result ¹
<i>Demand equation</i>			
Annual change in the market LTV ratio (LTV_M)	A lower LTV_M implies a higher down payment requirement, which could force some marginal homebuyers out of the property market (Zumpano <i>et al.</i> , 1986), implying a positive relationship between LTV_M and the demand for mortgages.	+	
Returns on equity (ROE) for property investment: $1/(1-LTV_M)^2$ times net property return ³	From a property investor's perspective, a lower LTV_M constrains investors' ability to take higher leverage to enhance their ROE, contributing to lower demand for properties. So, ROE would have a positive impact on the demand for mortgages.	+	***
An interactive term of a dummy variable for capturing the effect of the SSD and ROE		-	**
A dummy variable for stricter DSR requirements in 2010		-	
A dummy variable for DSR tightening in 2012		-	
Unemployment rate		-	***
A dummy variable for Chinese New Year		-	***
<i>Supply equation</i>			
Annual change in LTV_M	An increase in LTV_M has a positive impact on loan supply. This specification asserts that the actual price of a mortgage loan is determined not only by the mortgage rate, but also by other contractual terms, such as LTV ratio and maturity (Kent, 1980; Stiglitz and Weis, 1981). So, banks can shift their supply of mortgage loans by adjusting these non-price mortgage terms.	+	***
Risk-adjusted return of mortgage loans on capital		+	***
Annual growth rate of residential property prices		+	***
Available funds: Annual growth rate of Hong Kong dollar deposits		+	***
A dummy variable for stricter DSR requirements in 2010		-	
A dummy variable for DSR tightening in 2012		-	**

Notes:

- ***, ** indicate statistically significant at the 1% and 5% levels respectively.
- It can be shown that $1/(1-LTV_M)$ equals the ratio of the property value to equity (i.e. the amount of down payments) for property investment.
- Defined as 12-month property price return + property rental yield – effective borrowing rate for best lending rate-based mortgages times LTV_M
- Defined as (1-profit tax rate) times net mortgage return divided by an estimated amount of regulatory capital required per HKD, where net mortgage return is effective mortgage rate minus total cost of mortgages (= the sum of funding cost, administrative cost and expected credit loss).

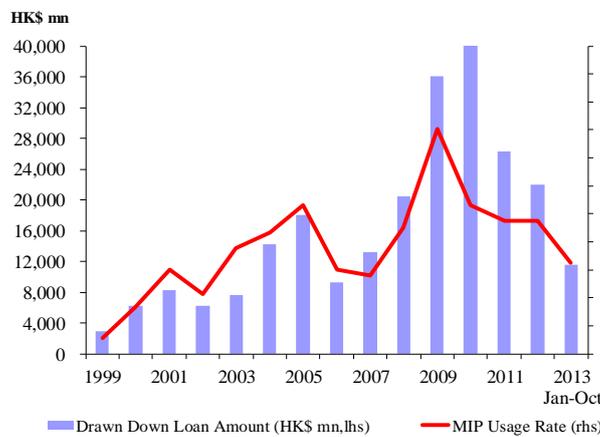
Figure 1. LTV Policy, Real Property Prices and Mortgage Delinquency Ratio in Hong Kong



Note:
LTV cap tightening for mortgage applicants whose principal income is not derived from Hong Kong and for applicants with multiple mortgages is not shown in the figure. For details, see Appendix.

Source: HKMA

Figure 2. Annual Drawn Down Loan Amount and Usage Rate of the MIP in Hong Kong



Note: The MIP usage rate is defined as the ratio of the mortgage loan amount drawn down under the MIP to the total mortgage loan amount drawn down in the Hong Kong banking sector.

Source: HKMC

Figure 3. Simulated Distribution of the Mortgage Delinquency Ratio for Hong Kong

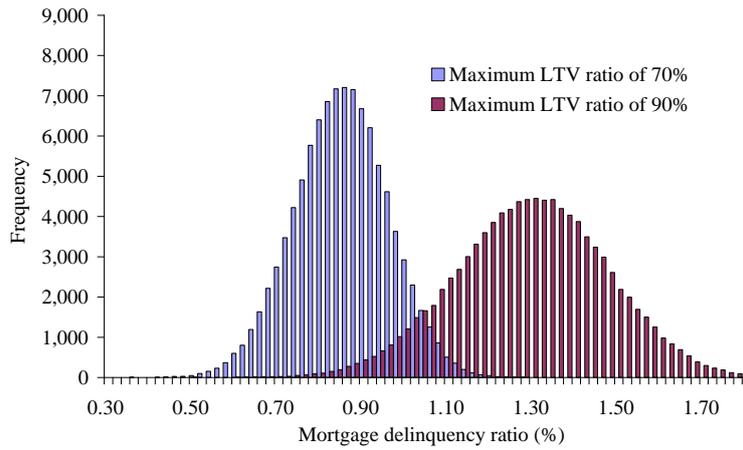


Figure 4. Contributions of Main Factors to Change in the Market LTV Ratio

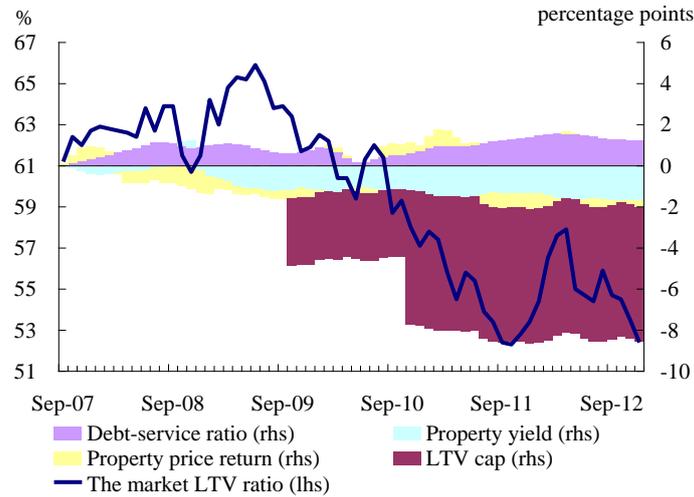


Figure 5. The Market LTV Ratio under the Actual and Counterfactual “No Policy” Scenarios

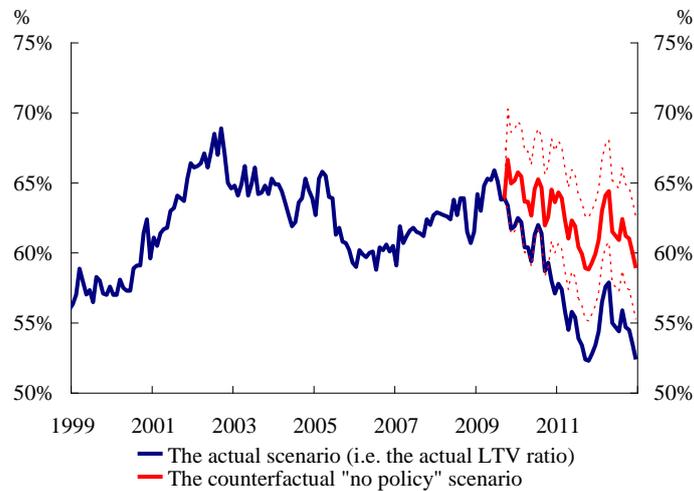
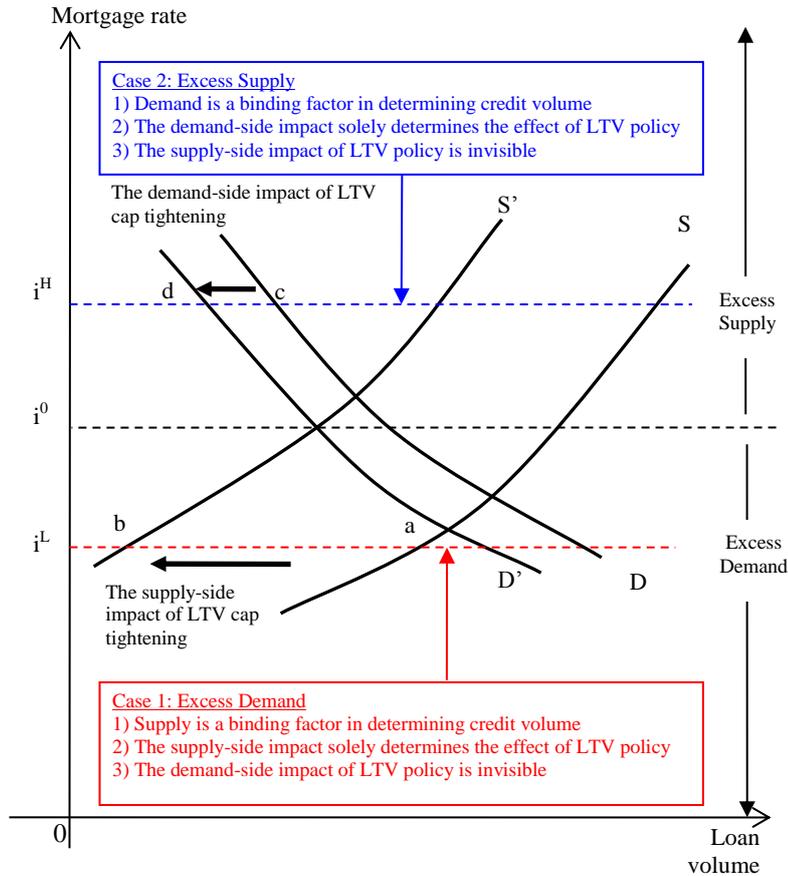


Figure 6. A Supply-and-Demand Diagram to Illustrate the Effect of LTV Policy under Scenarios of Excess Supply and Excess Demand in Loan Markets



Note: The figure illustrates the implication of loan market disequilibrium for the effect of LTV policy on credit growth. Assume that LTV cap tightening shifts the demand from D to D' moderately and supply from S to S' more significantly. In Case 1 where demand exceeds supply (implying credit supply is the binding factor) at the prevailing mortgage interest rate (i^L), the effect of the tightening solely reflects the supply-side impact, while the demand-side impact is invisible. In this case, the loan volume decreases considerably from a to b. In Case 2 where supply exceeds demand at the prevailing mortgage interest rate (i^H), the effect of the tightening solely reflects the demand-side impact, while the supply-side impact is invisible. The loan volume decreases marginally from c to d. In this hypothetical case, LTV policy is expected to be more effective when there is excess credit demand but less so when excess credit supply occurs, suggesting a state-dependent feature of the policy effect.

Figure 7. Estimated Supply of Mortgage Loans Under the Actual and Counterfactual “No Policy” Scenarios

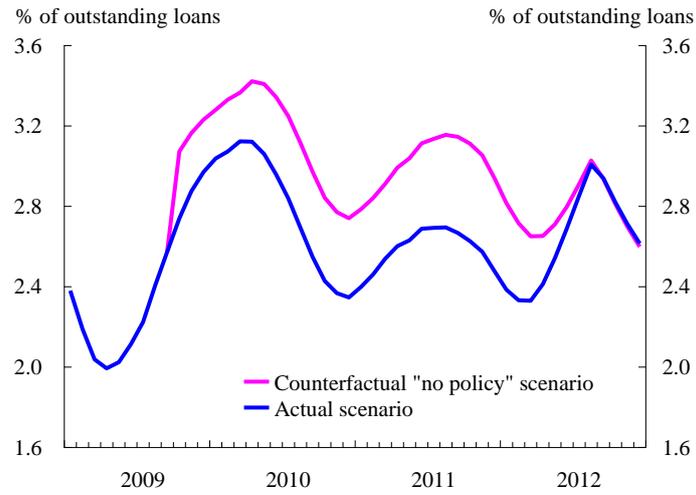


Figure 8. Estimated Demand for Mortgage Loans Under the Actual and Counterfactual “No Policy” Scenarios

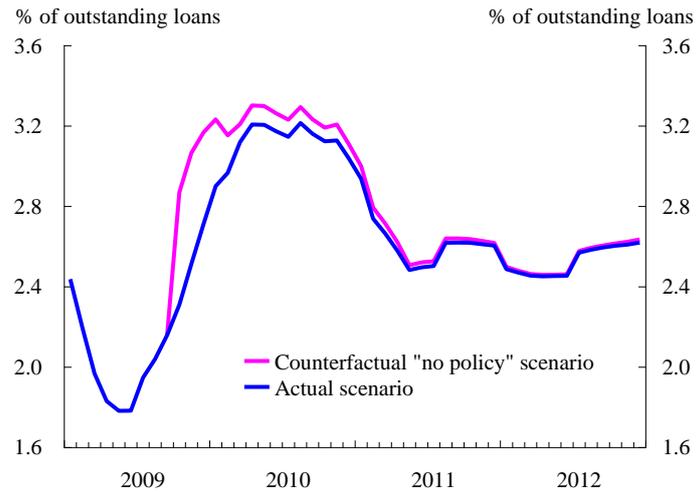


Figure 9. Estimated Demand for and Supply of Mortgage Loans

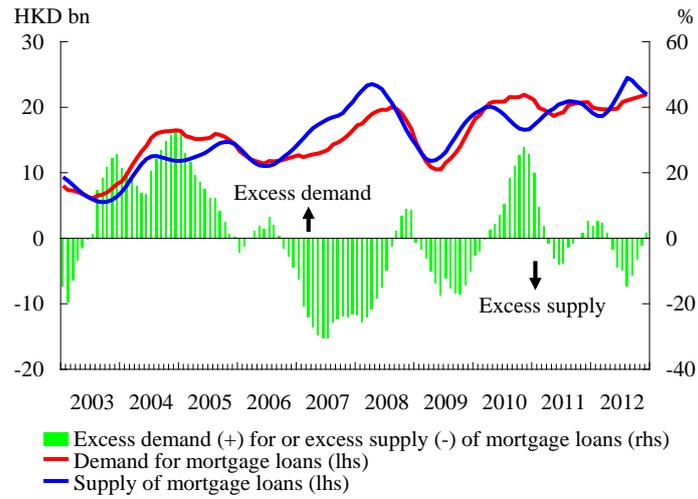
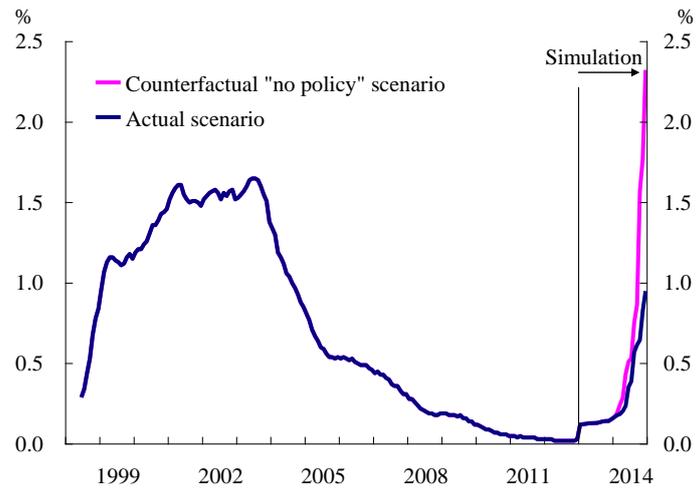


Figure 10. Estimated Problem Loan Ratio for Mortgage Loans Under the Actual and Counterfactual “No Policy” Scenarios



Appendix. Summary of the History of the LTV Policy and Other Macroprudential Measures in Hong Kong

Year	Major developments
Before 1991	<p>"Residential mortgage" was defined in the Third Schedule of the Banking Ordinance as a mortgage where, among other things, "the principal sum does not exceed 90% of the purchase price or the market value of the property, whichever amount is the lower".</p>
1991	<p>The maximum LTV ratio of 70% was adopted by the banking industry in November 1991 and has since been fully endorsed by the Commissioner of Banking as a prudent measure adopted by banks against over-exposure to the property market.</p> <p>Source: http://www.hkma.gov.hk/eng/publications-and-research/reference-materials/viewpoint/20090604.shtml</p>
1994	<p>A 40% guideline for property lending was introduced at the beginning of 1994 when property lending was rising rapidly. It advised that AIs whose property exposure as a percentage of loans for use in Hong Kong was above the average for the industry as a whole (about 40%) should seek to stabilise or reduce that percentage.</p> <p>Source: http://www.hkma.gov.hk/eng/key-information/press-releases/1998/980728-2.shtml</p>
1995	<p>The Government confirmed at a Legislative Council meeting that the 70% LTV ratio should be adopted as a long-term regulatory policy.</p> <p>Source: http://www.hkma.gov.hk/eng/publications-and-research/reference-materials/viewpoint/20090604.shtml</p>
1997	<ol style="list-style-type: none"> <li data-bbox="349 1397 1374 1608">1. The HKMA recommended that a maximum LTV of 60% should be adopted for "luxury" property with a value of more than HK\$12 million. Source: http://www.hkma.gov.hk/eng/key-information/guidelines-and-circulars/guidelines/guide_593b.shtml <li data-bbox="349 1644 1374 1901">2. All AIs were required to have a clearly defined and documented policy to assess the repayment capability of residential mortgage borrowers. This should include the use of a debt servicing ratio (DSR) test. The DSR is defined as the monthly repayment obligations of the borrower as a percentage of monthly income. The ratio should be no higher than 50-60% of income, though the upper end of this range should be confined to higher income earners. Source: http://www.hkma.gov.hk/eng/key-information/guidelines-and-circulars/guidelines/guide_594b.shtml

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- 1998 The "40% guideline" for property lending on the property exposure of authorized institutions in Hong Kong was withdrawn.
- Source:
http://www.hkma.gov.hk/eng/key-information/guidelines-and-circulars/guidelines/guide_595b.shtml
- 2001
1. While the 70% LTV guideline remained generally appropriate as a long-term prudential measure, and continued to apply to new RMLs, the HKMA did not object if AIs that judge it commercially desirable to do so choose to depart from the 70% LTV guideline in the case of refinancing RMLs in negative equity. However, such loans should not exceed 100% of the current market value of the mortgaged property.
 2. The 60% LTV guideline for the purchase of "luxury" property (with a value of more than \$12 million) had been withdrawn. The maximum LTV ratio for such loans was restored to 70%.
- Source:
<http://www.hkma.gov.hk/eng/key-information/guidelines-and-circulars/circulars/2001/20011010a.shtml>
- Oct 2009 All AIs were required to reduce the maximum LTV ratio for properties with a value of HK\$20 million or more from 70% to 60%.
- Source:
<http://www.hkma.gov.hk/eng/key-information/guidelines-and-circulars/circulars/2009/20091023-1.shtml>
- Aug 2010 The HKMA further implemented a set of prudential measures for RML:
1. Applying a maximum LTV ratio of 60% to properties with a value at or above \$12 million. For properties valued below \$12 million, the 70% LTV guideline continued to apply, but the maximum loan amount will be capped at \$7.2 million;
 2. Lowering the maximum LTV ratio for properties which are not intended to be occupied by the owners to 60%. Banks should require mortgage applicants to declare whether they intend to occupy the mortgaged property; and
 3. Standardising the limit on DSRs of mortgage applicants to 50%, instead of the current range of 50% to 60%. In addition, banks should stress-test mortgage applicants' repayment ability, assuming an increase in mortgage rates of at least two percentage points, and limit the stressed DSR to a cap of 60%.
- Source:
<http://www.hkma.gov.hk/eng/key-information/press-releases/2010/20100813-7.shtml>
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Nov 2010 To strengthen risk management in RML business of the banking sector, the HKMA implemented the following measure:

1. Lowering the maximum LTV ratio for properties with a value at HK\$12 million or above from 60% to 50%;
2. Lowering the maximum LTV ratio for residential properties with a value at or above HK\$8 million and below HK\$12 million from 70% to 60%, but the maximum loan amount is capped at HK\$6 million;
3. Maintaining the maximum LTV ratio for residential properties with a value below HK\$8 million at 70%, but the maximum loan amount is capped at HK\$4.8 million; and
4. Lowering the maximum LTV ratio for all non-owner-occupied residential properties, properties held by a company and industrial and commercial properties, and mortgage loans based on borrowers' net worth to 50%, regardless of property values.

Source:

<http://www.hkma.gov.hk/eng/key-information/press-releases/2010/20101119-5.shtml>

Jun 2011 The HKMA implemented the following measures to strengthen risk management in RML business:

1. Lowering the maximum LTV ratio for residential properties with a value of HK\$10 million or more to 50%;
2. Lowering the maximum LTV ratio for residential properties with a value between HK\$7 million and HK\$10 million to 60%, with the maximum loan amount capped at HK\$5 million;
3. Maintaining the maximum LTV ratio for residential properties with a value below HK\$7 million at 70%, with maximum loan amount capped at HK\$4.2 million.
4. Lowering the maximum LTV ratio for properties under the net-worth-based mortgage from 50% to 40%; and
5. Lowering the maximum LTV ratio by at least 10 percentage points regardless of property types or values if the principal income of the mortgage loan applicant is not derived from Hong Kong.

Source:

<http://www.hkma.gov.hk/eng/key-information/press-releases/2011/20110610-4.shtml>

Sep 2012 The HKMA tightened underwriting criteria for loans to borrowers with multiple property mortgages. The measures are as follows:

1. Lowering the maximum LTV ratio from 40% to 30% for property mortgage loans assessed based on the net worth of mortgage applicants;
2. Lowering the applicable maximum LTV ratios by another 10 percentage points for property mortgage loans to mortgage applicants whose income is derived mainly from outside Hong Kong; and
3. Lowering the limit on DSR from 50% to 40% and the maximum stressed DSR limit from 60% to 50%.

In addition, the maximum loan tenor of all new property mortgage loans is limited to 30 years regardless of whether the applicants have outstanding property mortgage loans for one or more properties at the time of loan application.

Source:

<http://www.hkma.gov.hk/eng/key-information/press-releases/2012/20120914-6.shtml>

Feb 2013 The HKMA implemented the following prudential supervisory measures on property mortgage business to strengthen banks' risk management and resilience:

1. Lowering the applicable maximum LTV ratios for all commercial and industrial property mortgage loans by 10 percentage points;
2. Limiting the maximum LTV ratio of mortgage loans for standalone car park spaces to 40%, and the maximum loan tenor to 15 years, with other requirements on maximum LTV ratio and debt-servicing ratio applicable to commercial and industrial property mortgage loans also applied to standalone car park space mortgage loans;
3. Increasing the mortgage rate upward adjustment for stress testing property mortgage loan applicants' debt servicing ability from at least 200 basis points to at least 300 basis points; and
4. Introducing a risk weight floor of 15% for all RMLs granted after 22 February 2013 by AIs using the internal ratings-based approach.

Source:

<http://www.hkma.gov.hk/eng/key-information/press-releases/2013/20130222-3.shtml>
