Loan-to-value ratio as a macroprudential tool –
Hong Kong SAR's experience and cross-country evidence

Hong Kong Monetary Authority

I.   Introduction

The 2008–09 global financial crisis has demonstrated that monetary policy and microprudential banking regulations by themselves are not sufficient to prevent the build-up of systemic risk.[1] There is a growing consensus that macroprudential policy should complement the existing policy frameworks of central banks and supervisory authorities designed to address systemic risk (Bank of England (2009), Caruana (2010b), Jordan (2010), Papademos (2010) and Strauss-Kahn (2010)). Some countries – for example, Hungary, Norway, Sweden and the United Kingdom – are considering adopting, or have recently adopted, maximum loan-to-value (LTV) ratios on mortgages (henceforth referred to as LTV policy) as a macroprudential instrument to fill the policy gap.[2]

Despite wider recognition in the policy community of the effectiveness of LTV policy, empirical evidence with regard to the following key issues remains scant.[3] First, how effective is LTV policy in reducing systemic risk generated by boom-and-bust cycles in property markets? Second, does LTV policy create significant liquidity constraints for potential homebuyers, some of whom might not qualify for a mortgage after making the sizeable down payment required under LTV policy despite their ability to repay the loan itself (see Financial Services Authority (2009))? Third, can a mortgage insurance programme (MIP)[4] offset this drawback of LTV policy, allowing banks to offer mortgage loans with LTV ratios higher than the maximum threshold without incurring additional credit risk? Or do MIPs reduce the effectiveness of LTV policy?

The objective of this note is to provide empirical evidence based, in part, on Hong Kong SAR's experience with both LTV policy and MIPs[5] and, in part, on econometric analysis of panel data from 13 economies. In Section II, we discuss the history of LTV policy in Hong Kong, presenting strong evidence that it has helped the Hong Kong banking sector weather the boom-and-bust cycles of the property market during the past two decades. We also present evidence that Hong Kong's MIP has helped homebuyers overcome the liquidity

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[1]   According to Caruana (2010a), systemic risk is the risk of disruption to financial services that occurs because of the impairment of all or part of the financial system and which can have serious negative consequences for the real economy.

[2]   Hungary, Norway and Sweden have recently adopted LTV policies (see Magyar Nemzeti Bank (2010), Norges Bank (2010), and Swedish Financial Supervisory Authority (2010)). The UK Financial Services Authority (2009) has not ruled out the possibility to employ such a policy in the future.

[3]   The practice of LTV policy across countries, and the role of LTV policy in mitigating the amplification of credit-asset price cycles and in protecting banks from the disruptive effects of the cycles, are discussed in Borio et al (2001).

[4]   Throughout this study, the term MIP refers to insurance that aims to protect lenders against losses due to mortgage payment default by borrowers. In some jurisdictions, it is known as lenders mortgage insurance.

[5]   Hong Kong's experience in this area – its LTV policy has been in effect for nearly 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.

constraints they may experience because of LTV policy without increasing the banking system's exposure to credit risk. The policy implications are discussed in the conclusion.

As shown in Annex A, econometric analysis of panel data from 13 economies bears out Hong Kong's experience with LTV policy and MIPs. It shows that LTV policy enhances banking stability, mainly by reducing the responsiveness of mortgage default risk to property price shocks, and that MIPs have not reduced the effectiveness of LTV policy.

II.   A brief history of LTV policy and the MIP in Hong Kong

LTV policy has long played a vital role in safeguarding banking stability in Hong Kong. It was developed because of the special characteristics of Hong Kong's financial system. First, residential mortgage lending (RML) has always been one of the largest areas of risk exposure for Hong Kong banks. Since 1991, RML has accounted for at least 20% of the banking sector's lending to local borrowers, reaching a peak of 37% in September 2002. Second, property prices have historically exhibited strong cyclical patterns that could seriously threaten banking stability if bank exposure to the property market were not properly managed. In fact, Gerlach and Peng (2005) find that bank lending in Hong Kong is driven largely by property price movements,[6] suggesting that systemic risk is, to a great extent, associated with developments in the property market. Third, since the Hong Kong Monetary Authority (HKMA) is precluded from conducting an independent monetary policy under the Linked Exchange Rate System, it must devise alternative policies for managing the systemic risk stemming from banks' exposures to property markets. LTV policy was introduced as an instrument for strengthening the 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.

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[6]   Gerlach and Peng (2005) conduct Granger causality tests for property prices and bank lending in Hong Kong. They find that property prices Granger-cause bank lending but not the other way around.

Graph 1

**LTV policy, property prices and mortgage delinquency ratio
in Hong Kong SAR**
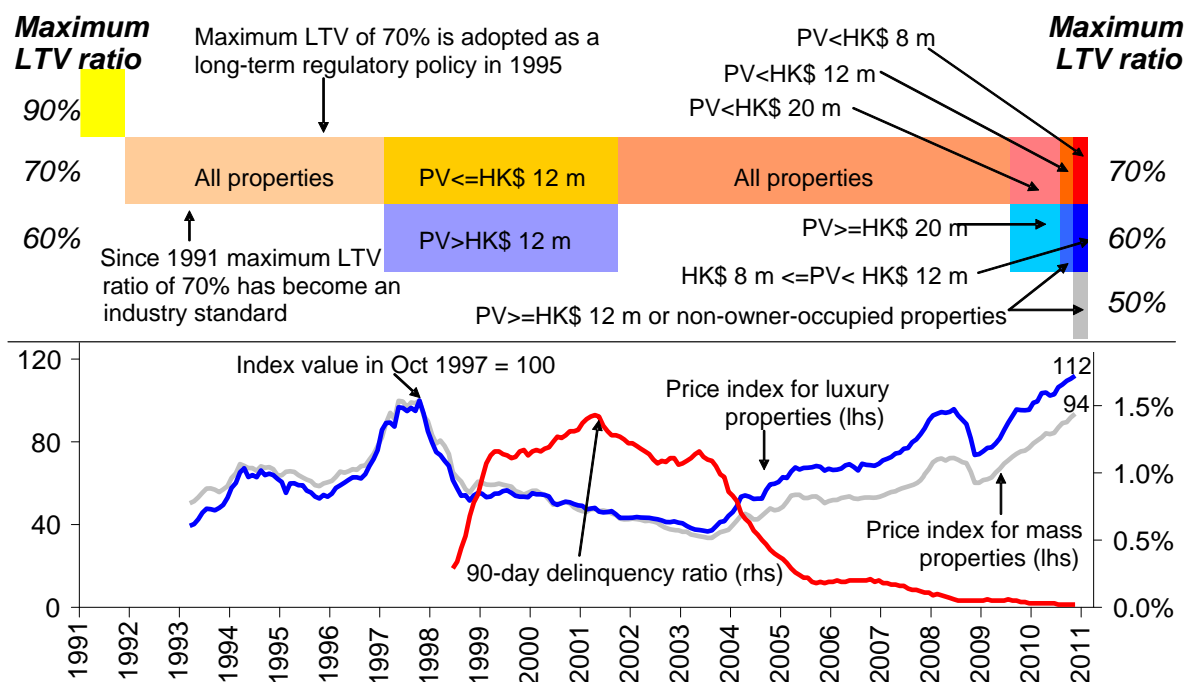
PV = property value

Source: HKMA.

Graph 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)[7] in Hong Kong were allowed to grant mortgage loans covering up to 90% of the purchase price or the market value of a property (whichever was lower) 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 RML, the Commissioner of Banking had intended to amend the Third Schedule to lower the 90% LTV threshold to 70% and issued a guideline advising banks to adopt a 70% LTV ratio for RML. The Commissioner of Banking consulted the banks during 1991 on these intentions. Banks were very co-operative, offering to adopt the 70% LTV policy voluntarily, removing the need to amend the Third Schedule.[8] The 70% maximum ratio has since been fully endorsed by the Hong Kong Government as a prudential measure and has evolved into a banking industry standard intended to guard against overexposure to the property market. On 2 November 1995, the Hong Kong Government

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[7]   AIs are institutions authorised under the Banking Ordinance to carry on the business of taking deposits. All AIs in Hong Kong are supervised by the HKMA.

[8]   See Commissioner of Banking (1991, 1992).

confirmed at a Legislative Council meeting that the 70% LTV ratio should be adopted as a long-term regulatory policy.

Phase 2: from 1997 to 1999

Against the backdrop of a sharp rise in residential property prices in 1996, signs of speculative activities (particularly at the upper end of the property market) and the rapid increase in RML,[9] 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.

Phase 3: from 1999 to 2008

After the Hong Kong Government implemented measures intended to stabilise the property market, the HKMA abandoned the 60% LTV ratio for luxury properties in October 2001 and restored the maximum LTV ratio of 70%. At the same time, 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 of the rules, the HKMA emphasised that the 70% LTV policy remained generally appropriate as a long-term prudential measure.

Because household income also declined significantly after the Asian financial crisis, prospective homebuyers faced significant obstacles in the housing market, which led to calls for the relaxation of the 70% LTV policy. In 1999, the Hong Kong Mortgage Corporation (HKMC)[10] launched an MIP aimed at promoting wider home ownership. Under the MIP, mortgage loans of up to an LTV ratio of 90% were made available to homebuyers meeting certain eligibility criteria.[11] 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 default by mortgagors. At the same time, it 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 are able to make their mortgage payments. 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 (Graph 2) and that concerns about liquidity constraints should not be lightly dismissed. And, just as important, in assisting homebuyers the MIP has helped the banking sector avoid incurring additional credit risk.

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[9] Property prices in Hong Kong increased by 30%, RML by 21%, between December 1995 and December 1996.

[10] 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.

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

Graph 2

Total annual new mortgage lending by Hong Kong SAR's banking sector and percentage of total covered by the MIP
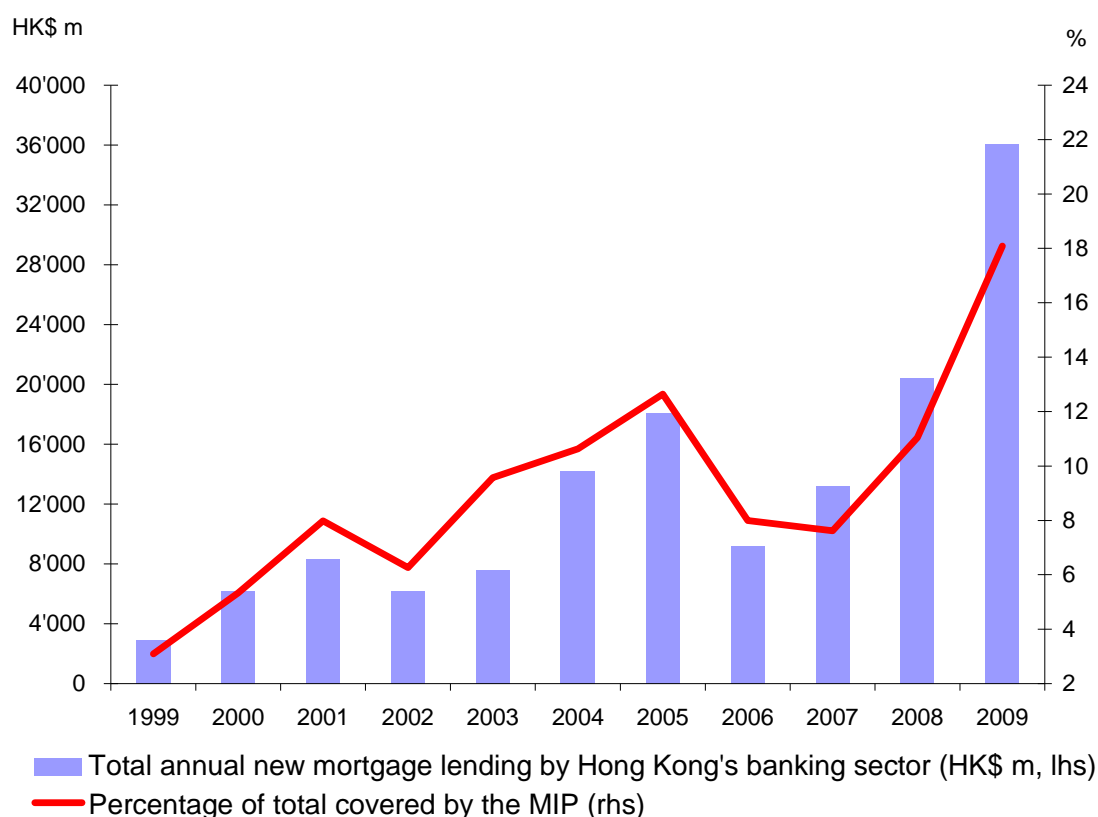
Source: HKMC.

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 enjoys a lower delinquency ratio than Hong Kong's banking sector,[12] 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

As a result of strong capital inflows and unusually low interest rates amid unprecedented quantitative easing by major central banks since early 2009, property prices in Hong Kong have increased 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%. In August 2010, to further safeguard banking stability and help banks manage credit risk

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[12] 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%.

more prudentially, the HKMA applied the maximum LTV ratio of 60% to properties with a value of at least HK$ 12 million as well as to properties that are not owner-occupied.

To strengthen risk management in the banking sector's RML business, the HKMA implemented the following measures on 19 November 2010: (1) it lowered the maximum LTV ratio for properties with a value of at least HK$ 12 million from 60% to 50%; (2) it lowered the maximum LTV ratio for residential properties with a value between HK$ 8 million and HK$ 12 million from 70% to 60%, while capping the maximum loan amount at HK$ 6 million; (3) it kept the maximum LTV ratio at 70% for residential properties valued at less than HK$ 8 million but capped the maximum loan amount at HK$ 4.8 million; and (4) it lowered the maximum LTV ratio for all non-owner-occupied residential properties, company-owned properties, and industrial and commercial properties to 50%, regardless of their market value.

Since 1994, Hong Kong has also implemented other policies with macroprudential elements, for example limiting the AIs' exposure to property markets and setting maximum debt servicing ratios[13] for mortgage applicants. Details can be found in Annex B.

III. Conclusion

This note assesses some of the most important issues surrounding the use of LTV policy as a macroprudential tool, including its effectiveness and potential drawbacks. Hong Kong's experience in this area, 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 ratios as a policy tool. 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.

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[13] The debt servicing ratio is defined as monthly repayment obligations as a percentage of monthly income.

Annex A:
An econometric analysis of the effect of
LTV policy on banking stability

Empirical specifications

In this annex, we analyse panel data from 13 economies – Australia, Canada, Greece, Hong Kong SAR, Korea, Malaysia, the Philippines, Portugal, Singapore, Spain, Thailand, the United Kingdom and the United States – using two econometric models. Model A is specified to examine the effectiveness of LTV policy by estimating the responsiveness of mortgage delinquency ratios to changes in property prices and to macroeconomic fluctuations in two groups of economies – one with, and the other without, LTV policies. Model B examines whether MIPs have reduced the effectiveness of LTV policy.

Model A:

The following fixed-effects model is used to examine the effectiveness of LTV policy:

$$\Delta MD_{i,t} = \alpha_0 + \alpha_1 \Delta P_{i,t} \times I_{LTV_i} + \alpha_2 \Delta P_{i,t} \times I_{NLTV_i} +$$
$$\alpha_3 \Delta GDP_{i,t} \times I_{LTV_i} + \alpha_4 \Delta GDP_{i,t} \times I_{NLTV_i} + \tag{1}$$
$$\alpha_5 DTGDP_{i,t} + \alpha_6 \Delta Int_{i,t} + \mu_i + \varepsilon_{i,t}$$

where i and t index the economy and time, respectively. $I_{LTV}(I_{NLTV})$ is a dummy variable for economies with (without) LTV policies. The specification assumes that changes in the mortgage delinquency ratio (ΔMD)[14] for economy i at time t are correlated with percentage changes in real property prices (ΔP) and real GDP growth (ΔGDP). The ratio of aggregate mortgage debt to GDP (*DTGDP*) and the change in the interest rate (ΔInt) are included to control for cross-country differences in the aggregate level of household leverage and monetary conditions, respectively.[15] Unobservable economy-specific effects and the remainder disturbance are captured by μ_i and ε_{it} (with zero mean and constant variance σ_ε^2), respectively.

We hypothesise that LTV policy reduces the responsiveness of mortgage default risk to changes in property prices. This implies that the estimated coefficients of $\Delta P \times I_{LTV}$ and $\Delta P \times I_{NLTV}$ (α_1 and α_2, respectively) should be negative, with the absolute value of α_1 lower than that of α_2. Similarly, we hypothesise that mortgage default risk is less responsive to macroeconomic fluctuations in economies with LTV policies than in those without them. Therefore, we expect estimates for α_3 and α_4 to be negative, and the absolute value of the former to be smaller than that of the latter. The sign of the estimated coefficient of *DTGDP* (α_5) is expected to be positive; greater aggregate household leverage generally indicates higher default risk when other factors are kept constant. A positive estimate of α_6 is expected because a higher interest rate implies a higher debt servicing burden for mortgagors.

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[14] Throughout this study, changes are measured from quarter to quarter.

[15] Other institutional factors such as recourse rules and personal bankruptcy regulations are likely to affect mortgage defaults. The effect of such factors on the mortgage delinquency ratio is assumed to be captured by the fixed-effect coefficients of the countries.

Model B:

Model B, a modification of Model A with an additional dummy variable J_i included, examines whether MIPs reduce the effectiveness of LTV policy. J_i is defined as 1 if an MIP is in place and zero otherwise. The inclusion of the additional dummy variable allows us to examine whether the coefficient estimates of the economies with both an LTV policy and an MIP are statistically different from those for economies with only an LTV policy. The model is specified as follows:

$$\Delta MD_{i,t} = \alpha_0 + (\alpha_1 + \gamma_1 J_i) \times \Delta P_{i,t} \times I_{LTV_i} + \alpha_2 \Delta P_{i,t} \times I_{NLTV_i} +$$
$$(\alpha_3 + \gamma_3 J_i) \times \Delta GDP_{i,t} \times I_{LTV_i} + \alpha_4 \Delta GDP_{i,t} \times I_{NLTV_i} + \quad\quad\quad (2)$$
$$\alpha_5 DTGDP_{i,t} + \alpha_6 \Delta Int_{i,t} + \pi_i + \delta_{i,t}$$

where π_i and δ_{it} (with zero mean and constant variance σ_ε^2) capture economy-specific effects and remainder disturbance, respectively. Note that there are two new coefficients, γ_1 and γ_3, in Model B as compared to Model A. γ_1 is the incremental sensitivity of the mortgage delinquency ratio to property prices in the economies with both LTV policy and an MIP relative to the economies with only LTV policy. Similarly, γ_3 measures the corresponding incremental sensitivity to macroeconomic fluctuations. The other estimated coefficients can be interpreted in exactly the same way as those in Model A.

Our core interest is in the estimated value and statistical significance of γ_1 and γ_3. A positive and significant estimate of $\gamma_1 (\gamma_3)$ would indicate that MIPs increase the sensitivity of the mortgage delinquency ratio to property prices (macroeconomic fluctuations), suggesting that MIPs reduce the effectiveness of LTV policy.

Data for estimations and the estimation method

The estimation sample consists of unbalanced quarterly panel data for the 13 economies from Q1 1991 to Q2 2010. The main descriptive statistics for the data are shown in Table 1. Data on the mortgage delinquency ratio are collected from the respective central banks,[16,17] whereas data on property prices, GDP, government bond yields (which are used to proxy for interest rates) and the GDP deflator are taken from various databases, including the BIS, CEIC and IMF (ie International Financial Statistics) databases. Real property prices and real interest rates are derived from the respective nominal variables and the GDP deflator.

Of the 13 economies, four – 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.[18]

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[16] The UK data, which are obtained from the Council of Mortgage Lenders, the trade association of the United Kingdom's mortgage industry, are the only exception.

[17] Mortgage delinquency data for Greece and the United Kingdom are available annually and biannually, respectively. Quarterly data for these two countries are derived by interpolating the annual/biannual series. We verified that the empirical results are not sensitive to the interpolation method used.

[18] The corresponding institutions are the HKMC, the Korea Housing Finance Corporation and Cagamas Berhad, respectively. Cagamas Berhad launched Malaysia's MIP in 2008.

Models A and B are estimated using the generalised least squares (GLS) method instead of the ordinary least squares (OLS) method because, in theory, GLS estimates are more efficient than OLS estimates given the panel structure of the dataset.[19]

Estimation results

We first discuss the estimation results for Model A, which are summarised in Table 2. The estimated sensitivity of the mortgage delinquency ratio to property prices is negative and lower (in absolute terms) in economies with LTV policies (α_1) than in economies without LTV policies (α_2). 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. The statistical results of the Wald test indicate that the null hypothesis of $\alpha_1 = \alpha_2$ can be rejected at the 10% significance level for Model A, suggesting that LTV policy reduces the vulnerability of banking systems to property price shocks.

Moreover, mortgage default risk is estimated to be less responsive to macroeconomic fluctuations (α_3) in economies with LTV policies than in those without LTV policies (α_4). All things being equal, a 1 percentage point decrease in GDP growth should raise the delinquency ratio by 3 basis points in economies with LTV policies compared with 5.1 basis points in those without LTV policies. The statistical results for the Wald test, however, suggest that the difference is not significant statistically.

The estimation results for Model B are similar to those for Model A. In addition, the estimated coefficients γ_1 and γ_3 are found to be statistically insignificant, suggesting that MIPs have not reduced the effectiveness of LTV policy.

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[19] In panel datasets, variance in cross-sectional units may be significantly different. The OLS estimation is statistically inefficient and can give misleading inference when variances in the data are unequal.

Table 1

Descriptive statistics for unbalanced panel data for 13 economies

Economies	Change in mortgage delinquency ratio In per cent Mean	Std dev	Real property price growth In per cent Mean	Std dev	Debt-to-GDP ratio In per cent Mean	Std dev	Real GDP growth In per cent Mean	Std dev	Change in real interest rates In per cent Mean	Std dev	Period
Australia	0.011	0.037	1.239	2.68	37.703	6.16	1.239	2.68	–0.075	0.930	2002–10
Canada	0.009	0.02	1.061	2.068	51.479	5.69	1.061	2.068	–0.087	1.530	2004–09
Greece	0.018	0.352	0.343	1.604	23.918	7.299	0.343	1.604	0.018	0.922	2003–09
Hong Kong SAR	–0.006	0.093	0.315	6.126	47.29	6.597	0.315	6.126	0.002	1.847	1998–10
Korea	–0.067	0.114	0.638	3.034	22.43	1.568	0.638	3.034	–0.014	3.152	2005–09
Malaysia	–0.198	0.478	–0.122	2.372	17.401	5.011	‒0.122	2.372	0.047	3.089	1999–09
Philippines	–0.113	0.495	1.848	3.397	2.069	0.127	1.848	3.397	1.497	4.318	2008–10
Portugal	0.007	0.072	–0.106	0.658	55.525	6.324	‒0.106	0.658	0.061	0.756	2003–10
Singapore	–0.061	0.141	1.007	5.361	31.373	1.983	1.007	5.361	–0.030	4.742	2004–09
Spain	–0.012	0.179	0.89	2.508	38.23	16.623	0.89	2.508	–0.107	1.223	1995–09
Thailand	–0.435	2.382	–0.108	2.834	16.329	1.849	‒0.108	2.834	–0.254	3.498	2001–10
United Kingdom	–0.025	0.129	1.375	2.606	67.756	10.176	1.375	2.606	–0.079	0.925	1995–09
United States	0.106	0.381	0.346	1.096	54.258	11.898	0.346	1.096	–0.052	0.435	1991–2010
All economies	–0.043	0.697	0.596	3.12	40.197	19.522	0.596	3.12	–0.027	2.126	1991–2010

Note: Std dev denotes standard deviation.

Table 2

Estimation results for Model A (equation 1) and Model B (equation 2)

Dependent variable:	Change in mortgage delinquency ratio (ΔMD)	
	Model A	**Model B**
Constant (α_0)	−0.2013**	−0.2003**
ΔP		
with LTV policy (α_1)	−0.0035*	−0.0021**
without LTV policy (α_2)	−0.0129**	−0.0129**
Incremental effect of MIP (γ_1)	.	−0.0016
ΔGDP		
with LTV policy (α_3)	−0.0303**	−0.0487*
without LTV policy (α_4)	−0.0508**	−0.0506**
Incremental effect of MIP (γ_3)	.	0.0228
DTGDP (α_5)	0.0051**	0.0051**
ΔInt (α_6)	0.0022	0.0024
Adjusted R-squared	0.2460	0.2435
Null hypothesis for the Wald test	**Chi-square statistics (P-value)**	**Chi-square statistics (P-value)**
$\alpha_1 = \alpha_2$	3.420* (0.065)	4.971** (0.026)
$\alpha_3 = \alpha_4$	0.589 (0.443)	0.002 (0.960)

Note: ** and * denote the 5% and 10% levels of significance, respectively.

A simulation exercise

To further visualise the effect of LTV policy on banking stability, we conduct a simulation exercise for Hong Kong's banking sector in which we estimate the degree to which relaxing the maximum 70% LTV ratio for property lending might generate losses in the banking sector in the wake of a severe property price shock. To this end, we consider a hypothetical scenario in which the 70% LTV policy was abandoned some time before 1997. We also assume that all banks aggressively exploited this policy change, expanding their business by extending mortgage loans that covered 90% of the value of a property (ie with an average LTV ratio of 90%). We then assume a 40% drop in real property prices.[20] With the assumed

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[20]   The shock is comparable to one that occurred in Hong Kong between Q4 1997 and Q3 1998.

shock, we simulate the movement of other variables (ie *GDP*, ΔInt and *DTGDP*) based on their historical relationships.[21] Together with the estimated coefficients α_2, α_4, α_5 and α_6 in Model A, we compute the overall impact of the shock on the delinquency ratio. We repeat the process 100,000 times to generate a distribution of the delinquency ratio. For comparison, another distribution that assumes an initial LTV ratio of 70% is also simulated. The distribution is simulated based on the estimated coefficients α_1, α_3, α_5 and α_6 in Model A. These two simulated distributions are shown in Graph 3. We find that if the 70% guideline had been relaxed before 1997, the delinquency ratio would have increased from 0.6% to 1.71% (at the 95% confidence level) after the 40% decline in property prices. In contrast, with the 70% LTV policy in place, the delinquency ratio would have increased only moderately, to 1.11%. This result is largely consistent with the empirical findings of Wong et al (2004).

Based on the volume of RML and total capital in Hong Kong's banking sector in 1997, we compute the credit losses based on the simulation results (Table 3). The calculation of credit losses takes into account the effect of the drop in property prices on the loss given default. Based on the tail risk, we find that, if the maximum LTV ratio is increased to 90%, the credit loss would come to about 1.87% of total capital (at the 95% confidence level), compared with 0.46% for the actual maximum LTV ratio of 70%.

Graph 3

Simulated distribution of the mortgage delinquency ratio for Hong Kong
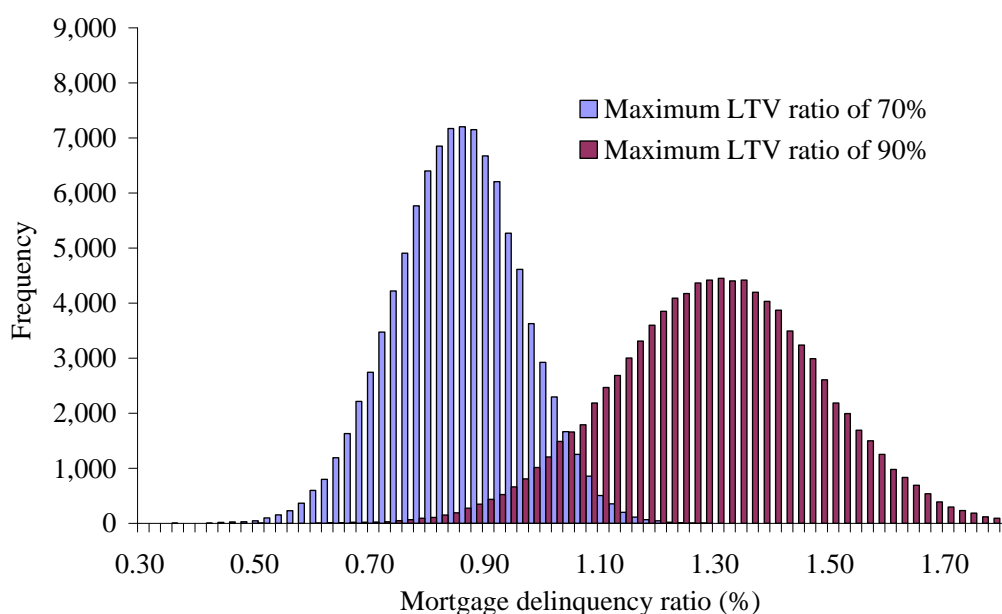
Source: Authors' estimates.

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[21]   We follow the simulation method adopted by Wong et al (2008). The model consists of a seemingly unrelated regression for the GDP growth rate, interest rates and real property prices. For the variable *DTGDP*, the value is simulated based on the simulated GDP growth rate and an initial value of 50% of *DTGDP*.

Table 3

Simulated credit losses with maximum LTV ratios of 70% and 90%

Statistics	In millions of Hong Kong dollars		As a percentage of total capital		As a percentage of Tier 1 capital	
	LTV 70%	LTV 90%	LTV 70%	LTV 90%	LTV 70%	LTV 90%
Mean	998.79	3991.05	0.3579	1.4300	0.4550	1.8183
50th percentile	1159.45	4681.32	0.4154	1.6774	0.5282	2.1327
90th percentile	1204.70	4876.01	0.4317	1.7471	0.5488	2.2214
95th percentile	1286.65	5226.50	0.4610	1.8727	0.5862	2.3811
99th percentile	1382.15	5631.18	0.4952	2.0177	0.6297	2.5655

Note: LTV 70% refers to the actual policy capping the maximum ratio at 70%, whereas LTV 90% refers to the hypothetical maximum ratio of 90%.

Annex B:
History of Hong Kong's LTV policy

Year	Major developments
Before 1991	"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".
1991	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 prudential measure against overexposure to the property market. See www.info.gov.hk/hkma/eng/viewpt/20090604e.htm.
1994	A guideline was introduced at the beginning of 1994 when property lending was rising rapidly. It advised AIs whose exposure to property markets exceeded 40% of their loans to local borrowers (the average for the industry as a whole) that they should seek to stabilise or reduce that percentage. See www.info.gov.hk/hkma/eng/press/1998/980728e2.htm.
1995	The Hong Kong Government confirmed at a Legislative Council meeting that the maximum 70% LTV ratio should be adopted as a long-term regulatory policy. See www.info.gov.hk/hkma/eng/viewpt/20090604e.htm.
1997	The HKMA recommended that a maximum LTV of 60% should be adopted for luxury properties with a value of more than HK$ 12 million. See www.info.gov.hk/hkma/eng/guide/guide_no/guide_593b.htm.
	AIs were required to have a clearly defined and documented policy with respect to assessing the ability of residential mortgage borrowers to repay their loans, including a debt servicing ratio test. The debt servicing ratio, defined as the monthly repayment obligations of the borrower as a percentage of monthly income, was set at 50–60% (the upper end of the range was confined to high-income households). See www.info.gov.hk/hkma/eng/guide/guide_no/guide_594b.htm.
1998	The 40% guideline for AIs was abandoned. See www.info.gov.hk/hkma/eng/guide/guide_no/guide_595b.htm.
2001	While the HKMA believed that the 70% LTV guideline remained generally appropriate as a long-term prudential measure, and the guideline continued to be applied to new RML, the HKMA did not object if AIs chose to depart from the 70% LTV guideline when refinancing the mortgage loans of borrowers with negative equity, so long as such loans did not exceed 100% of the current market value of the mortgaged property.
	The 60% LTV guideline for the purchase of luxury properties with a value of more than HK$ 12 million was abandoned and the maximum LTV ratio for such loans was restored to 70%. See www.info.gov.hk/hkma/eng/guide/circu_date/20011010a.htm.
Oct 2009	AIs were required to reduce the maximum LTV ratio for properties with a value of HK$ 20 million or more from 70% to 60%. See www.info.gov.hk/hkma/eng/guide/circu_date/20091023e1.htm.

Year	Major developments (cont)
Aug 2010	The HKMA implemented additional prudential measures for RML, as follows:
	Applying a maximum LTV ratio of 60% to properties with a value of at least HK$ 12 million. For properties valued below $12 million, the 70% LTV guideline continued to apply, but the maximum loan amount was capped at HK$ 7.2 million;
	Requiring banks to ask mortgage applicants whether they intended to occupy the mortgage property and lowering the maximum LTV ratio to 60% for non-owner-occupied properties; and
	Reducing the 50–60% range for the debt servicing ratio of mortgage applicants to 50%. Requiring banks to stress-test mortgage applicants' repayment ability assuming an increase in interest rates of at least two percentage points, and capping stressed debt servicing ratios at 60%.
	See www.info.gov.hk/hkma/eng/press/2010/20100813e7.htm.
Nov 2010	To strengthen risk management in RML, the HKMA implemented the following measures:
	Lowering the maximum LTV ratio for properties with a value of at least HK$ 12 million from 60% to 50%;
	Lowering the maximum LTV ratio for residential properties with a value between HK$ 8 million and HK$ 12 million from 70% to 60%, and capping the maximum loan amount at HK$ 6 million;
	Maintaining the 70% maximum LTV ratio for residential properties with a value below HK$ 8 million, but capping the maximum loan amount at HK$ 4.8 million; and
	Lowering the maximum LTV ratio for all non-owner-occupied residential properties, properties held by a company, and industrial and commercial properties to 50%, regardless of the value of said properties.
	See www.info.gov.hk/hkma/eng/press/2010/20101119e5.htm.

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