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Safeguarding Banks and Containing Property Booms: Cross-Country Evidence on Macroprudential Policies and Lessons from Hong Kong SAR

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Abstract

We assess the effectiveness of macroprudential policies against a number of different indicators of property sector activity and financial stability. At the cross-country level the use of LTV caps decelerates property price growth. Both LTV and DTI caps slow property lending growth. LTV caps also affect a broader range of financial stability indicators in economies with pegged exchange rates and currency boards. For Hong Kong SAR, LTV policy tends to be forward looking, with caps lowered to counter downward movements in mortgage rates, and higher growth in mortgage loan and volumes of transactions. The reduction in caps appears to respond to small and medium size flat price appreciation, and contributes to a decline in high-end volume growth after a year and total transactions volume growth after 1½–2 years. Price growth responds favorably after 2 years. The evidence suggests LTV tightening could affect property activity through the expectations channel rather than through the credit channel.

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I. INTRODUCTION

A central purpose of macroprudential tools is to contain the build-up of financial imbalances and underpricing of risk during a boom and to restrict the increase in measured risks in the subsequent bust. Another view defines the goal of macroprudential policy as limiting the risk of system-wide financial distress episodes that have significant macroeconomic costs (Borio and Drehmann, 2009).

In recent times, a number of economies have used macroprudential policies to protect their financial systems from stress induced by volatile asset prices and rapid portfolio adjustments. In Hong Kong SAR's case, faced with the onset of a credit-asset price cycle centered on the property sector, the authorities have introduced several changes since 2009 to policies concerning maximum loan-to-value (LTV) and debt service to income (DTI) ratios, as well as government-initiated land sales.

One argument made in favor of macroprudential policies is that they can be fine-tuned to address particular risk factors and vulnerabilities, as compared to the more blunt instrument of interest rate adjustments that affect economy-wide credit aggregates (IMF 2011b). But fine-tuning macroprudential policies to specific risks could also impose additional regulatory costs on the economy. Moreover, not knowing the precise side effects of the measures, for example on property market activity, could risk the credibility of the regulator in the event of a property price reversal or a collapse. Since their use is potentially costly, it is important to isolate what outcomes the specific macroprudential policies do (and do not) affect. This paper assesses the effectiveness of LTV, DTI and land sales policies against a number of different outcomes—financial stability indicators, residential property prices, and transactions.

In policy circles, the issue of how effective macroprudential tools are has received considerable attention. Until recently, however, only limited research and analytical tools were available to inform decisions on a macroprudential policy framework and strategy (see Galati and Moessner, 2011, for a review of the literature). The analysis of this paper attempts to fill this gap by complementing other recent IMF research on the topic, with an emphasis on the experience of Hong Kong SAR.[2] The analysis proceeds in two stages. First, it provides a cross-country analysis by assessing the impact of LTV and DTI instruments in a panel of economies with pegged exchange rates, currency boards, or otherwise fixed regimes and comparing the effectiveness of these policies against their impact for the full sample of economies (covering all different types of exchange rate regimes). The analysis assesses the effectiveness of these policies on a range of banking and property market outcomes. Second, it focuses on the experience of Hong Kong SAR, a currency board economy, in its attempt to cool down the property market and limit related systemic risks to the banking system through active use of LTV caps and, increasingly, government-initiated land sale policy.

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[2] Recent examples of IMF research in this area include IMF (2011a, 2011b and 2011c). This previous research has focused on whether macroprudential policies can dampen the pro-cyclicality of credit (IMF 2011b) and also on identifying, in a structural model, how these policies can reduce the systemic risk of a breakdown in financial intermediation and large output losses (IMF 2011c).

The main findings are as follows.

- Across the broader sample as well as in the subset of economies with pegged exchange rates and currency boards, the use of LTV caps tends to have a decelerating effect on property price growth. In addition, both LTV and DTI caps slow the growth of lending to the property sector for the broader sample.

- The use of the LTV instrument appears to strengthen bank capital buffers and bank performance in economies with pegged exchange rates and currency boards, while lowering NPLs in the broader sample. The instrument affects a broader range of financial stability indicators in economies with pegged exchange rates and currency boards than in the full sample.

- Comparing the subset of economies with pegged exchange rates and currency boards against the broader sample, the instruments are used more frequently in the first group. In the broader sample, interest rate tools can also be deployed to control credit aggregates which could explain why the reliance on LTV and DTI instruments appears to be smaller.

For Hong Kong SAR, impulse responses from vector autoregressive models suggest the following about LTV policy and the land sale mechanism during the past decade:

- The design of LTV policies appear to be forward looking, with ceilings tightened to counter downward movements in mortgage interest rates, and growth in mortgage lending and volumes of transactions.

- Over the short term, changes in LTV ratios do not appear to significantly affect the rate of residential property price inflation. More binding LTV limits appear to reduce transaction volume growth in both the luxury segment and mass market. Property price inflation appears to fall around 2 years after the change in the LTV ratios, affecting in a similar way both the luxury and mass market property price.

- Unlike in the broader cross-country sample, a tightening of maximum LTV limits in Hong Kong SAR appears to have little effect on total mortgage lending.

- With regard to other instruments used in Hong Kong SAR, the Land Application System and government initiated land sales strategy tend to be counter-cyclical (i.e they tend to dampen the cycle). However, the empirical evidence on the impact of government land sales on price and transaction volume growth is inconclusive.

The paper is organized as follows. Section II discusses the cross-country data and the specification used. Section III presents the results from the panel estimation and provides a comparison of policy effectiveness between the full sample and the smaller subset of fixed

exchange rate and pegged regimes. Section IV focuses specifically on Hong Kong SAR. It provides a brief background on the property market in Hong Kong SAR, outlines the recent steps taken by Hong Kong SAR to contain the credit asset cycle underway, and assesses the impact of the policies undertaken. Section V concludes.

II. Cross-Country Analysis

The first stage of the analysis studies a sample of 49 emerging and advanced economies over the time period 2000Q1 – 2010Q4. The data are drawn from a 2010 IMF Survey of the cross-country use of macroprudential policies.[3] The outcome variables are compiled from various different sources including the BIS, the IFS database, and national authorities.

A. Use of LTV and DTI Caps

As outlined in IMF 2011a and 2011b, macroprudential policies fall into four broad categories based on the risk factors they are designed to address: excessive credit growth; systemic liquidity risks; high leverage; and volatile capital flows. Under this classification system, caps on the LTV and DTI ratio are related to containing risks associated with excessive credit growth.

Conceptually, both LTV and DTI caps are intended to limit the build-up of vulnerabilities during the upswing and the extent of fallout on the financial system during the downswing of a property price cycle (Crowe et al. 2011). If the caps impose a binding constraint on lending institutions and borrowers during the upswing, they can effectively limit financial institutions' credit risk on exposures to housing, as well as household leverage. Indirectly they can also restrain property price growth by limiting the flow of credit to purchase property. However, if credit-financed purchases are only a small component of total purchases, the effect on property prices would be muted. The empirical analysis in the next section looks at multiple outcomes to assess along which particular dimensions these macroprudential instruments are likely to have the biggest impact.

When comparing the effectiveness of these instruments across exchange rate regimes, LTV and DTI caps might be expected to have a different effect on the outcomes of interest in economies such as Hong Kong SAR's that use some form of fixed exchange rates. As N'Diaye (2009) shows, in fixed exchange rate regimes macroprudential regulations can provide a mechanism for containing asset price run-ups and promoting output stability. In this subset of economies, the absence of independent interest rate tools puts more of the burden on macroprudential policies to address risks associated with credit asset cycles; by contrast, in floating rate regimes, macroprudential policies can act as complements to standard monetary policy.[4]

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[3] We thank the MCM department—particularly Francesco Columba, Alejo Costa, and Cheng Hoon Lim—for sharing the cross-country data with us.

[4] Unsal (2011) studies the complementarity between monetary policy tools and macroprudential policies in addressing the risks posed to financial stability by large inflows of capital.

As the text table shows, LTV and DTI caps tend to be used more frequently by economies that have fixed exchange rate regimes, dollarized economies, or currency board arrangements.[5] Not surprisingly, since these economies have limited tools at their disposal to combat asset price and macro fluctuations, they rely on the macroprudential toolkit more frequently than economies with relatively more flexible exchange rates and independent monetary policy settings.[6]

Fraction of quarters for which a cap is in place, 2000Q1-2010Q4		
	Full Sample	Currency Boards and Fixed Exchange Rate Regimes
LTV	0.3	0.37
DTI	0.07	0.23

B. Specification

The main specification used to assess the effectiveness of the LTV and DTI caps in the cross-country panel setting is

$$y_{j,t} = \mu_j + \beta_1 y_{j,t-1} + \beta_2 D_{j,t-i} + \beta_3 X_{j,t} + \varepsilon_{j,t} \tag{1}$$

where the outcome variable y is regressed on a dummy variable D representing (lagged) policy instruments LTV and DTI, and a vector of additional controls X. The policy instruments enter separately in the specifications presented below to link them individually with each outcome variable. The additional covariates include controls for the state of the credit cycle such as the prime lending rate and the year-on-year growth rate of credit relative to GDP.

Unlike monetary policy, which has seen a broad convergence of views on the policy objective, macroprudential policies in general can potentially focus on a mix of objectives—tempering run-ups in property prices, restraining lending to the property sector, and safeguarding banking sector financial stability. We study a range of outcomes to get a

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[5] As defined by IMF's AREAER classification. The system classifies member country exchange rate regimes into four broad categories: hard pegs (dollarized economies, currency boards); soft pegs (conventional pegged arrangements, pegged exchange rates within horizontal bands, crawling pegs and crawl-like arrangements, and stabilized arrangements); floating regimes (floating and free-floating); and a residual category (other managed arrangements). The exchange rate classification is actual and *de facto*—it may differ from members' officially announced *de jure* arrangement.

[6] This is also in line with the 2010 IMF survey on the use of macroprudential instruments, which found that economies with fixed or managed exchange rate regimes use the tools—going beyond LTV and DTI caps—more frequently.

comprehensive picture of what indicators are (and are not) influenced by these instruments.[7] The outcomes studied fall into three broad categories:

- Property Sector (Loans to Property and Property Prices)

- Capital and financial stability metrics (Capital / Assets)

- Asset quality and profitability / performance (Non-Performing Loans; Return on Assets)

The impact of the two macroprudential instruments on each outcome is studied for the full sample of economies (covering various different exchange rate regimes) and within a subset of economies that use some form of fixed exchange rates (pegged or currency board arrangements). [8] The smaller group of economies offers a closer context for the measures undertaken by Hong Kong SAR. A comparison with the full sample allows for an assessment of whether the currency board arrangement / fixed exchange rate regimes particularly enhance or limit the influence of macroprudential instruments on the four categories of outcomes listed above. The policy instruments are lagged four quarters to capture persistent effects. All panel regressions are estimated using the method of Arellano and Bond (1991), which allows for the inclusion of lagged dependent variables along with other regressors.

III. RESULTS FROM CROSS-COUNTRY PANEL

To preview the cross-country results, it appears that the LTV instrument restrains lending to the property sector and has a decelerating effect on property prices.[9] The shifts in composition of credit are in turn associated with improvements in capital buffers and banking sector performance. The effects on financial stability metrics are more lasting for the sample of fixed exchange rate and currency board regimes.

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[7] One other goal of such policies could also be to limit vulnerabilities in household balance sheets. Data limitations preclude our analysis of this policy dimension. We leave this for future research.

[8] We run separate regressions for the two samples. An alternative would be to introduce a dummy variable in the broader sample to represent the subset of economies with pegged or currency board arrangements and run one regression for the entire sample. But in that alternative set up, in order to compare the impact of the policies for the subset with the impact for the remaining economies, we would need to introduce multiple interactions that strain the degrees of freedom available in the sample. The separate regressions presented here offer a cleaner way of comparing the effectiveness of the policies. The results tables presented below also report diagnostic tests for serial correlation. The null hypothesis is of no second-order autocorrelation in the first differenced error terms. As the tables show we fail to reject the null in the specifications used, alleviating concerns about serial correlation.

A. Property Sector

Property Prices

We find a significant effect over time of LTV caps on property price growth (y/y percent change) for both the full sample and the subset of economies with fixed exchange rates and currency boards. The effect is larger in the full sample, lowering property price growth by a cumulative effect of 8.3 percent y/y, around 0.9 standard deviations. LTV caps lower property price growth by a cumulative effect of 5.56 percent y/y (around 0.4 standard deviations of the growth rate) in the sample of pegged exchange rates and currency board arrangements.

One possibility is that LTV caps restrain lending to property (the result is significant in the full sample) as the next set of results demonstrate. This would, in turn, lower demand for property and slow property price growth. Another possibility, as seen in the case of Hong Kong SAR (presented in Section IV) is that the LTV cap could help temper expectations of future price growth, which then lowers trading activity and, in a self-fulfilling way, restrains price growth.

DTI caps have a significant effect over time on property price growth in the smaller subset of economies with fixed exchange rates and currency board arrangements. The sign is positive, which is opposite to what would be expected if the instrument were working in a way that slows demand for property. However, since DTI caps are used relatively infrequently compared to LTV caps, it may be the case that they are deployed only in extreme times when a property price run-up is already underway and a sustained acceleration is expected, and this is being captured by the estimated coefficient.

Table 1: Property Price Growth

Lagged Property Price, y/y growth	0.874***	0.833***	0.874***	0.830***
	(0.0216)	(0.0288)	(0.0219)	(0.0314)
LTV Dummy	-1.046***	-0.929***		
	(0.257)	(0.176)		
DTI Dummy			0.186	1.346**
			(1.186)	(0.529)
Prime Lending Rate	-0.420***	-0.603	-0.412***	-0.592
	(0.135)	(0.387)	(0.134)	(0.387)
Credit to GDP, y/y growth	0.00904	0.102**	0.0103	0.0996**
	(0.0352)	(0.0419)	(0.0356)	(0.0452)
FULL SAMPLE	YES		YES	
PEGGED AND CURRENCY BOARDS		YES		YES
Observations	926	187	926	187
Number of countries	30	8	30	8
Arellano Bond test of no second order autocorrelation in first-differenced errors (p-value)	0.26	0.12	0.27	0.12

Notes: Dependent Variable: Property Prices, y/y growth. Panel GMM estimation.
Robust Standard Errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Loans to property

LTV and DTI have a decelerating effect on loans to property for the full sample. In the subset of economies with fixed exchange rates and currency board arrangements, the sign is negative but not significant. Taking into account cumulative effects over time, both LTV and DTI lagged four quarters have a decelerating effect on property loans. The introduction of the LTV cap has a cumulative effect of reducing loan growth by the equivalent of just over one standard deviation for the full sample; the introduction of the DTI cap lowers it by the equivalent of 0.78 standard deviations.

Table 2: Loans to Property Sector

Lagged Loans to Property, y/y growth	0.835***	0.894***	0.836***	0.894***
	(0.0216)	(0.0296)	(0.0218)	(0.0291)
LTV Dummy	-3.724***	-0.149		
	(0.845)	(0.658)		
DTI Dummy			-2.818*	0.0738
			(1.608)	(0.249)
Prime Lending Rate	-0.171**	-0.437*	-0.164**	-0.437*
	(0.0784)	(0.236)	(0.0778)	(0.236)
Credit to GDP, y/y growth	0.0518	0.207***	0.0600	0.207***
	(0.0374)	(0.0567)	(0.0394)	(0.0567)
FULL SAMPLE	YES		YES	
PEGGED AND CURRENCY BOARDS		YES		YES
Observations	1108	160	1108	160
Number of countries	39	8	39	8
Arellano Bond test of no second order autocorrelation in first-differenced errors (p-value)	0.87	0.23	0.86	0.23

Notes: Dependent Variable: Loans to property, y/y growth. Panel GMM estimation.
Robust Standard Errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

B. Capital and Financial Stability Metrics

Capital / Assets

The results indicate that the macroprudential instruments appear to have a strong impact on bank capital buffers in the sample of currency board and pegged exchange rate economies. The effect of the LTV instrument is more durable for the sample of currency board and pegged exchange rate economies. For the full sample, the effect is not significant after four periods.

With a lag of four quarters the effect is 0.18 percentage points in the sample of pegged exchange rates and currency board regimes. Taking into account that this is a partial adjustment model, the cumulative effect over time is that the LTV cap raises the capital / assets ratio by 1.41 percentage points. This is equivalent to 0.43 standard deviations of the capital asset ratio. The effect is significant at the 5 percent level.

It is difficult, however, to isolate the channel through which the LTV caps raise capital buffers. One possibility is that the LTV caps could affect both the denominator and the numerator: i.e. they may restrain bank lending to property and lower the losses related to impaired loans. The point estimates of the impact of LTV caps on lending to property and on NPLs are negative, but not significant for the sample of currency board and fixed exchange

rate economies. By including additional controls such as the prime lending rate and the growth rate of credit relative to nominal GDP, we are controlling for the state of the credit cycle and its direct impact on changes in credit quality and returns on lending (both of which will independently affect the capital / assets ratio).

The pattern is similar with regard to the impact of DTI caps. As was the case with the LTV caps, the effect over time is significant only with the subset of economies which use currency boards and fixed exchange rates. In terms of magnitudes, after four quarters, DTI caps are associated with an increase in the capital / asset ratio of 0.17 percentage points for this subset of economies. The cumulative impact, taking into account the partial adjustment nature of the model, is to raise the capital / asset ratio by 1.14 percentage points, equivalent to 0.35 standard deviations for the subset of economies which use currency boards and fixed exchange rates. However, since we do not find evidence of a decrease in lending to property associated with DTI caps in the currency board and pegged exchange rate sub-sample, it is more likely that the increase in the capital / asset ratio is being driven by other contemporaneous mechanisms (such as sales of non-property related assets or capital-raising activity). We leave this for future research.

Table 3: Capital/Assets

Lagged Capital / Assets	0.879***	0.873***	0.899***	0.852***
	(0.0171)	(0.0242)	(0.0229)	(0.0413)
LTV Dummy	0.256	0.179**		
	(0.182)	(0.0826)		
DTI Dummy			0.0113	0.168*
			(0.214)	(0.0932)
Prime Lending Rate	-0.0190**	-0.0365***	-0.0172**	-0.0388***
	(0.00790)	(0.00752)	(0.00715)	(0.00880)
Credit to GDP, y/y growth	-0.00119	-0.00418	-0.00116	-0.00639
	(0.00242)	(0.00489)	(0.00201)	(0.00396)
FULL SAMPLE	YES		YES	
PEGGED AND CURRENCY BOARDS		YES		YES
Observations	895	167	895	167
Number of countries	46	12	46	12
Arellano Bond test of no second order autocorrelation in first-differenced errors (p-value)	0.29	0.24	0.26	0.21

Notes: Dependent Variable: Capital / Assets. Panel GMM estimation.
Robust Standard Errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

C. Banking Sector Performance

Non-Performing Loans

LTV caps appear to have an impact on two aspects of banking sector performance: NPLs and Return on Assets (ROA). In the full sample, over a longer horizon (four quarter lagged effect), LTV caps lower NPLs as a fraction of total loans by 0.65 percentage points. The cumulative effect, taking into account the partial adjustment nature of the model, is equivalent to around 2.08 standard deviations.

LTV caps appear to improve credit quality over time, possibly due to restraining credit growth (as seen in the previous results). The effect is not significant for the sample of pegged exchange rate and currency board economies, but the sign is negative.

With regard to the effect of the DTI cap, we find a significant impact on the NPL ratio in the sample of economies with pegged exchange rates and currency boards, but with the unexpected sign: the introduction of the DTI cap is associated with an increase in the NPL ratio for economies with pegged exchange rates and currency boards. One possibility is that since DTI caps are used relatively infrequently compared to LTV caps (possibly because oversight and compliance is more difficult to ensure with DTI caps than with LTV caps), they may be deployed at relatively more extreme times—i.e. when a credit boom is already underway and a deterioration in credit quality is perceived to be imminent.

Table 4: NPLs as Fraction of Total Loans

Lagged NPL	0.934***	0.959***	0.940***	0.964***
	(0.0183)	(0.0192)	(0.0193)	(0.0185)
LTV Dummy	-0.647**	-0.0109		
	(0.274)	(0.113)		
DTI Dummy			-0.162	0.141***
			(0.202)	(0.0399)
Prime Lending Rate	0.000337	0.0140	0.00370	0.0124
	(0.0176)	(0.0172)	(0.0159)	(0.0180)
Credit to GDP, y/y growth	0.00476	0.00207	0.00522	0.00109
	(0.00311)	(0.00504)	(0.00337)	(0.00508)
FULL SAMPLE	YES		YES	
PEGGED AND CURRENCY BOARDS		YES		YES
Observations	814	156	814	156
Number of countries	46	12	46	12
Arellano Bond test of no second order autocorrelation in first-differenced errors (p-value)	0.79	0.41	0.99	0.41

Notes: Dependent Variable: NPL as fraction of total loans. Panel GMM estimation.
Robust Standard Errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Return on Assets

A second dimension of banking performance, return on assets, is affected positively by LTV caps for the sample of pegged exchange rates and currency boards. The LTV cap affects ROA with a lag of four quarters. The cumulative effect over time is to lift ROA by 0.65 percentage points, or around 1 standard deviation of the ROA ratio. DTI caps do not appear to have a significant effect on return on assets.

Table 5: Return on Assets

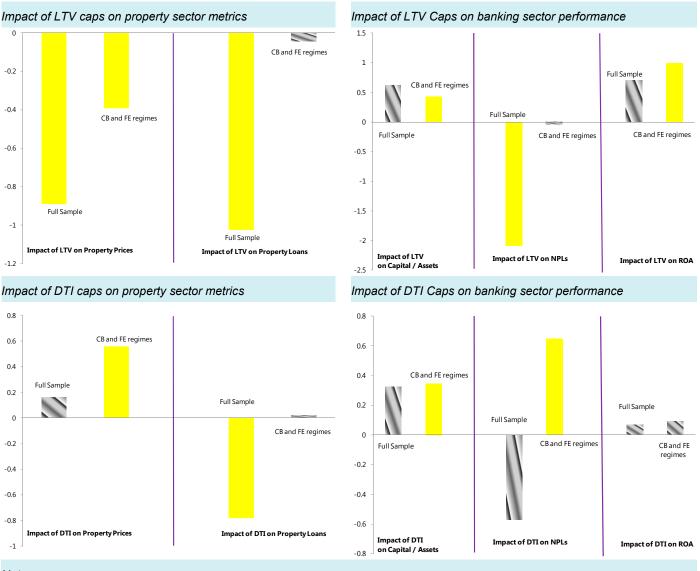|				
Lagged ROA	0.816***	0.878***	0.821***	0.883***
	(0.0447)	(0.133)	(0.0429)	(0.134)
LTV Dummy	0.123	0.0778**		
	(0.175)	(0.0345)		
DTI Dummy			0.0119	0.00697
			(0.0792)	(0.0318)
Prime Lending Rate	-0.00781	-0.0152**	-0.00845*	-0.0152**
	(0.00477)	(0.00773)	(0.00473)	(0.00755)
Credit to GDP, y/y growth	-0.00313***	-0.000344	-0.00306***	-0.000686
	(0.000974)	(0.00186)	(0.000937)	(0.00182)
FULL SAMPLE	YES		YES	
PEGGED AND CURRENCY BOARDS		YES		YES
Observations	772	127	772	127
Number of countries	46	11	46	11
Arellano Bond test of no second order autocorrelation in first-differenced errors (p-value)	0.18	0.19	0.18	0.20

Notes: Dependent Variable: ROA. Panel GMM estimation.
Robust Standard Errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Summarizing these results on banking sector performance, it appears that LTV caps have a more lasting effect on ROA in the sample of fixed exchange rate and currency board regimes. Reinforcing the results on capital buffers, these caps possibly restrain lending and shift the composition of the loan book to relatively higher quality credit, leading to lower loss impairment charges, and improvements in the return on assets. Figure 1 provides a summary of the main results.

The next section turns to assessing the effectiveness of these policies for Hong Kong SAR.

Figure 1: Cross Country Panel: Results Summary (measured in standard deviations of outcome variable)

Impact of LTV caps on property sector metrics

Impact of LTV Caps on banking sector performance

Impact of DTI caps on property sector metrics

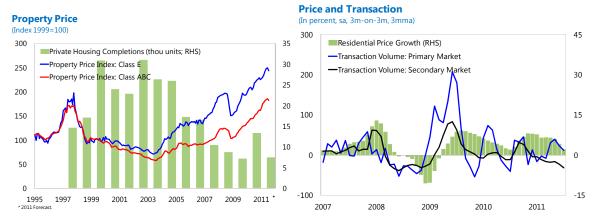**Impact of DTI Caps on banking sector performance**

Notes

- Panel estimation using a sample of 49 economies over the period 2000Q1 – 2010 Q4.

- Magnitude of impact calculated in terms of number of standard deviations of outcome variable.

- Solid bars represent statistically significant coefficients.

- Shaded bars represent statistically insignificant coefficients.

IV. CONTEXT AND BACKGROUND: HONG KONG SAR

A. Market and Policy Environment

Hong Kong SAR's residential property prices turned around and began to surge rapidly in 2009. This housing boom is broad-based and continues into 2011, driven by a buoyant economic recovery, competitive mortgage programs offered by banks at extraordinarily low interest rates, strong local and Mainland demand for housing as well as shrinking supply of new flats over the years. The price upsurge took place first at the more expensive end of the market (Classes D and E) and was followed closely by the less expensive small and medium-sized flats (Classes A, B and C). Mortgage loans have continued to increase briskly during the first half of 2011. The price trend has progressively worsened housing affordability, making it a prominent social and political issue and raised concerns about the sustainability of the property market price dynamics. Moreover, as housing prices surge, so have private housing rents, which make up around 27 percent of the consumer price basket. An increasingly large proportion of household disposable income is devoted to rental costs. As a result, cooling down the housing market has arguably been the single most prominent goal of public policy in Hong Kong SAR.

Property Price
(Index 1999=100)

Price and Transaction
(In percent, sa, 3m-on-3m, 3mma)

With the currency board ruling out an independent monetary policy option, the authorities have to rely on macroprudential measures—with emphasis on caps on loan-to-value and debt service ratios. While these measures are ostensibly designed to limit household leverage in the property sector and safeguard the financial system, they also put a lid on access to external financing and therefore in principle should help limit the degree of housing price exuberance. The aggressive tightening of loan-to-value caps, most actively applied to higher-end (classes D and E) flats, has caused average new residential mortgage loan-to-value ratio to decline steadily from around 60 percent in 2010 to just under 53 percent today. Another important component of the authorities' overarching strategy is increases in public land supply to the market. The aim of land sale policy is not only to ensure adequate supply of new flats in the pipeline (with priority given to development of smaller, mass-market units to assuage middle class concerns), but also to manage house price inflation expectation today. On this front, the government plans to boost public land sale by triggering more land auctions and tenders during fiscal year 2011-2012. In addition, the authorities have also imposed transactions taxes in the form of a Special Stamp Duty (SSD) to discourage speculative short-term trading of residential properties.

Table 6: Hong Kong SAR: Summary of Macroprudential Measures Introduced Since 2009				
Date	**Price Range**	**LTV CAP**	**Max Loan Amount**	**Other**
Oct 2009	Greater than or equal to HK$20mn	60 percent (previously 70 percent)		
Aug 2010	Greater than or equal to HK$12mn	60 percent (previously 70 percent for properties valued between HK$12mn and HK$20mn)		Debt-service-to-income ratio capped at 50% for all income groups; previously was 60% for high income groups; also must be set such that were mortgage rates to go up by 2 percentage points, the DTI would not exceed 60%
	Less than HK$12mn	Remains 70 percent	HK$ 7.2mn	
	Not owner-occupied, any price range	60 percent (previously 70 percent)		
Nov 2010	Greater than or equal to HK$12mn	50 percent (previously 60 percent)		Special Stamp Duty raised to 15% for properties resold within first 6 months of purchase
	Greater than or equal to HK$8mn and less than HK$12mn	60 percent (previously 70 percent)	HK $ 6 million	
	Less than HK$8mn	Remains at 70 percent	HK $ 4.8 million	
	Not owner-occupied, any price range	50 percent (previously 60 percent)		
June 2011	Greater than or equal to HK$10mn	50 percent		LTV cap lowered by further 10 percentage points for borrowers with main income from outside Hong Kong SAR; LTV cap for net-worth based mortgage loans lowered from 50% to 40%, irrespective of property value
	Greater than or equal to HK$7mn and less than HK$10mn	60 percent (previously 70 percent for properties valued between HK$7mn and HK$8mn)	HK $ 5 million	
	Less than HK$7mn	Remains at 70 percent	HK $ 4.2 million	

The challenge for policy makers, therefore, is to calibrate their macroprudential tools in combination with land sale policy so as to limit mortgage loan growth and temper market expectation of housing price gains.

This part of the paper aims to shed light on a few issues that are at the heart of the policy prescription in Hong Kong SAR (summarized in Table 6). Specifically, we investigate the channels through which loan-to-value caps and the land sale mechanism may influence residential mortgage loan growth as well as transaction volume and price growth.

B. Empirical Methodology

This section draws lessons from use of macroprudential as well as Special Stamp Duty (SSD) and land sale policy to address property market overheating and related risks to the banking system in Hong Kong SAR. While LTV caps are applied to all types of private housing, they have been actively used to influence activity at the larger, more expensive unit segment of the market. Our focus therefore will be on the caps' direct effect on price and trading activity for these units and on their indirect impact on smaller (mass-market) flats. In addition, we measure the effectiveness of the SSD as well as the land sale mechanism on the same variables.[10]

Methodology

Following the tradition in monetary policy analysis, we use parsimonious, reduced-form VARs to characterize the reaction of LTV policy and the land sale mechanism and we also measure the impact of policy changes on the (year-on-year) growth of house prices, transaction volumes and residential mortgage loans. SSD, which is a one-time policy measure, is an exogenous variable in every VAR. Because VARs involve current and lagged values of multiple time series, they capture co-movements that cannot be detected in uni- or bivariate time series models.

We fit a VAR for large-unit, high-end residential property segment (classes D and E) as well as the lower-end smaller flats (classes A-C). For classes D and E where the LTV caps have varied actively in boom time, the VAR consists of the policy variables, namely the stipulated LTV caps (LTV12UP) and total auctioned land area (LAND_TOT); target variables, namely year-on-year residential mortgage loan growth (LOAN_GR), year-on-year house price appreciation (PGR_D, PGR_E) and year-on-year high-end transaction volume growth (TRANS_10); as well as controls, such as mortgage interest rates (I_M) and year-on-year growth of Hang Seng Properties Index (HSI_PROPGR). For classes A-C, we use the growth rate of transactions for houses with values under 10 million HKD and the appropriate house

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[10] Related to our work, Wong et al. (2011) finds that LTV caps can help stabilize property market activity in Hong Kong SAR, but not in Singapore and Korea. They also find that LTV policy is effective in lowering the sensitivity of mortgage default risk to property price shocks.

price appreciation for each class. We keep LTV12UP as a policy variable in light of the fact that LTV policy has not been actively adjusted in the lower-end market segment.

In short, for every property class, a VAR involves 7 equations. Each equation is estimated by ordinary least squares regression. We use one lag, based on the AIC/SC criteria. This reduces the complications from having to estimate a host of extra unknown coefficients. Otherwise, without further restrictions, the macroeconomic time series data we have would not provide reliable estimates of these coefficients.

We address the well-known shortcomings of small-scale unrestricted VARs as follows. First, we include property stock prices in the VAR to mitigate the omitted variable bias typically associated with a small model of this type. Such a bias typically arises from the fact that policymakers tend to base their decisions on various other macroeconomic factors. Omitted, these considerations can end up in the error term and become part of the estimated historical shock used to estimate the impulse response. When these omitted variables suggest an increase in house price inflation or market exuberance, for example, policymakers tend to take action to calm the market. The VARs' loan-to-value shocks, in this case, predict movement in house price inflation. But because of omitted variables, the reduced-form VARs we use would mistakenly label the loan-to-value cap reduction as shocks, leading to biased impulse responses. The inclusion of the property stock price information, which could forecast housing market activity (and thus could represent other forward looking variables policy makers take into account when they set loan-to-value policy), should help lessen the omitted variable bias. The logic behind this is akin to the standard practice of including commodity prices in a typical monetary VAR—known to help mitigate the "price puzzle" where inflation tends to increase following monetary policy tightening.

Second, we refrain from making the usual assumption that target variables are sticky and do not respond within the period to policy shocks. This assumption is likely untenable when the period is as long as a quarter. In fact, the market tends to react to policy moves relatively quickly in Hong Kong SAR. In a separate paper on housing price determinants and policy effectiveness in Hong Kong SAR, Craig and Hua (2011) find that housing prices tend to revert fully to long-term trend in less than two quarters after a shock. Finally, since there is no obvious structural change over the period we study, the potential misspecification due to constant coefficients should also be mitigated.

All VARs satisfy the stability condition (i.e., no roots lie outside the unit circle), which validates the standard error bands around the generalized impulses. Moreover, these impulses do not depend on the ordering of the VAR, as an orthogonal set of innovations is constructed in the estimation process. These small-scale, stable VARs can also become a useful benchmark forecasting tool.

Data

We use quarterly data spanning the period 2003Q1-2011Q2. All data series, except the mortgage interest rates and LTV caps obtained from the HKMA, are publicly available from the Census and Statistics Department of the Government of Hong Kong SAR and CEIC. For

land supply, we use total auctioned land area since the total auctioned floor area data are not readily available.
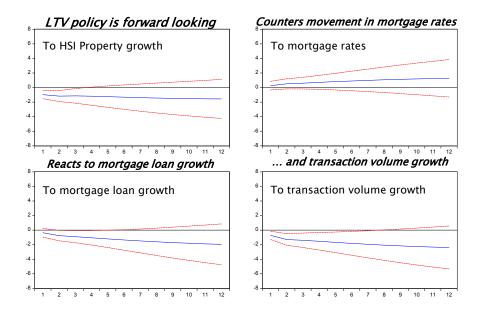
The house price and rent data refer to five property classes: Class A property are flats with saleable area less than 40 sq.m., Class B, C and D have saleable area of 40-69.9 sq.m., 70-99.9 sq.m. and 100-159.9 sq.m., respectively and Class E refers to flats that are larger than 160 sq.m.

C. Results

In general, results for high-end and low-end housing segments tend to be similar with only a few exceptions. (See figures below for highlight of the results and Figures 2-4).

LTV policy:

- LTV policy tends to be forward looking, reacting to variables with information to forecast residential market activity and price, a proxy for which in this case is the Hang Seng Properties Index.
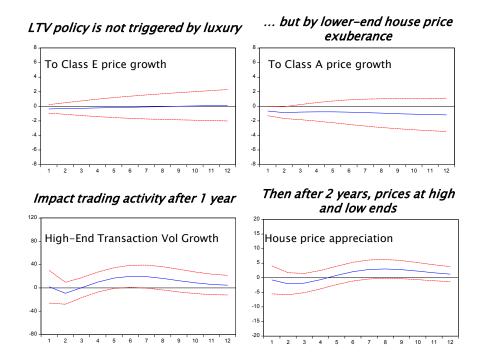

- LTV caps tend to be lowered to counter downward movements in mortgage interest rates and rising mortgage loan and transaction volume growth. A downward movement in mortgage rates, for example, would reflect looser credit conditions. The tightening of the LTV cap in response to a decline in mortgage rates suggests that the policy instrument is used as a countervailing tool against the cheaper cost of credit.

- While LTV caps are adjusted more actively at the high-end, they do not appear to react directly to price growth in that market segment. Instead, they appear to respond to the mass-market price growth. One possibility is that the measures were designed to influence mass-market prices through its expected impact on the high-end segment, which tends to lead its mass market counterpart by around 1-2 quarters. This way, the LTV measure can potentially alter market dynamics without having a direct impact on liquidity constraints (downpayment threshold) at the mass market level.

Does tighter LTV lower mortgage loan growth and temper residential market activity effectively?

- The tightening of existing LTV caps does not immediately lead to a decline in transactions volume growth, but it does contribute to a decline in high- as well as lower-end transaction volumes starting around one year after policy tightening.

- Meanwhile, price growth appears to respond favorably after around 2 years, both at the high and low ends.

- The evidence seems to suggest that tightening of LTV caps could affect property activity through the expectations channel rather than through the mortgage lending channel. Within our sample period, lowering LTV caps does not appear to help slow down loan growth during the first year and its impact beyond one year looks uncertain. We suspect that this result may have arisen from the fact that LTV caps are tightened first and mainly for higher-end properties and variation in the caps are only pronounced during the last eight quarters of the sample period. Moreover, the result

could be affected by the use of mortgage insurance, which helps ease the liquidity constraints imposed by LTV caps.

Special stamp duty:

- The use of Special Stamp Duty to reduce speculation activity has no statistical impact on both the rates of house price appreciation and transaction volume over time. [11]

Land supply policy:

- In general, the Land Application System and government-initiated land sale tend to be counter-cyclical, rising when the market is more exuberant. Auctioned land area tends to pick up about 2 quarters after the increase in total transaction volume growth.

- Responses of price and transaction volume growth to increase in government land sale are not statistically significant. [12]

V. SUMMARY

This paper assessed the effectiveness of macroprudential policies against a number of different indicators of property sector activity and financial stability. It first provided a cross-country context for the policies implemented by Hong Kong SAR by comparing the impact of LTV and DTI instruments in a panel of economies with pegged exchange rates or currency boards, against their impact for the full sample of economies (covering all different types of exchange rate regimes). Second, it focused on the experience of Hong Kong SAR specifically using vector auto-regressions to back out the impulse responses of the various outcomes of interest following the introduction of the different policy instruments.

At the cross-country level, across the broader sample as well as in the subset of economies with pegged exchange rates and currency boards, the use of LTV caps tends to have a decelerating effect on property price growth. In addition, both LTV and DTI caps slow the growth of lending to the property sector. The use of the LTV instrument also appears to strengthen bank capital buffers and bank performance. The instrument affects a broader range of financial stability indicators in economies with pegged exchange rates and currency boards.

For Hong Kong SAR, the design of LTV policies appear to be forward looking, with ceilings tightened to counter downward movements in mortgage interest rates, growth in mortgage lending, and rising volumes of transactions.
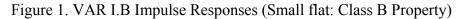
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[11] However, it is worth noting that following the announcement of the SSD in November 2010, the number of transactions dropped by around 30 percent within the first month.

[12] The result should however be interpreted with caution since the small number of sample observations may prevent us from detecting an effect of land sales policy, which tend to work with long lags.

Over the short term, changes in LTV ratios do not appear to significantly affect the rate of residential property price inflation. More binding LTV limits however appear to reduce transaction volumes in both the luxury segment and mass market after around one year. Meanwhile, property price inflation appears to fall around 2 years after the change in the LTV ratios, affecting both the luxury and mass market property price in a similar way.

Unlike in the broader cross-country sample, a tightening of maximum LTV limits in Hong Kong SAR appears to have little effect on total mortgage lending. The pattern of results—transaction volumes are affected first and property prices later—suggest that tightening of LTV caps could affect property market activity through the expectations channel.

Finally, we also find that changes in government land supply in Hong Kong SAR tend to be counter-cyclical, with more land provided at times when the market is most exuberant. However, there is little empirical evidence to suggest that changes in government land sales affect either prices or transaction volume growth.
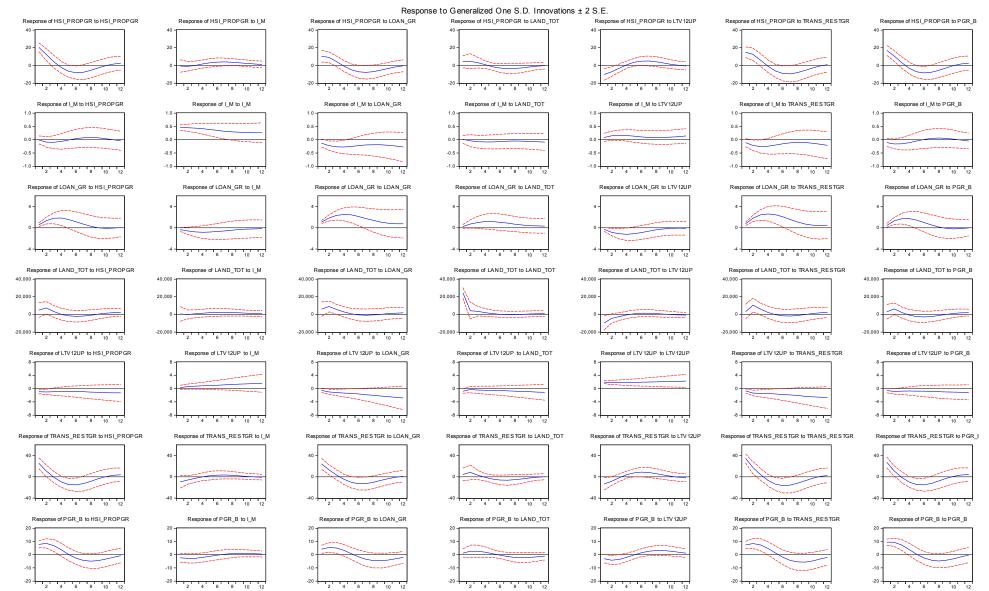
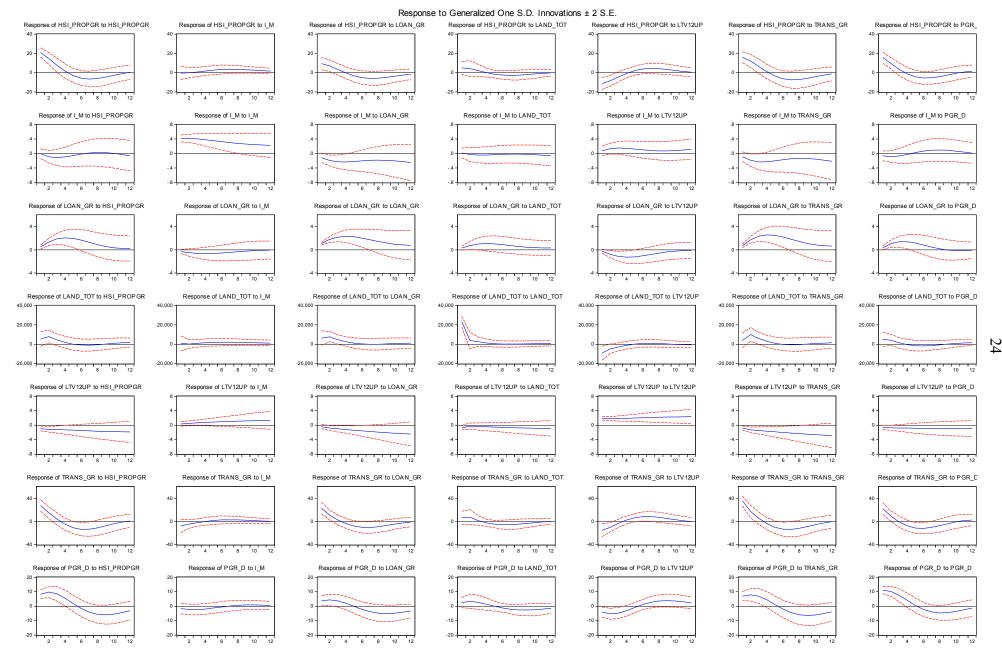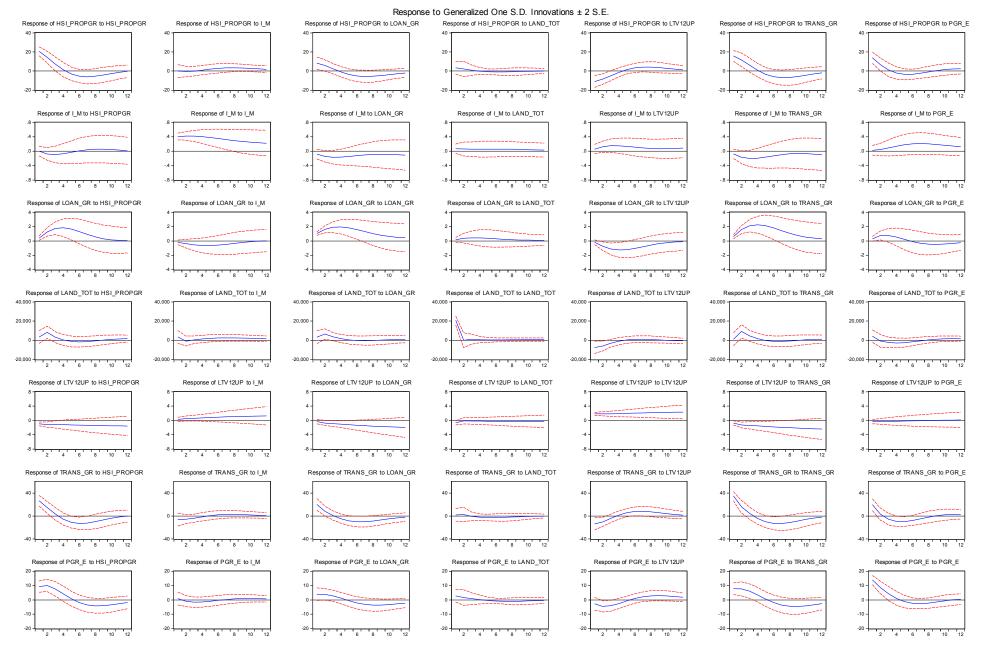Figure 1. VAR I.B Impulse Responses (Small flat: Class B Property)

Figure 2. VAR I.D Impulse Responses (Large flats: Class D property)

Response to Generalized One S.D. Innovations ± 2 S.E.

Figure 3. VAR I.E Impulse Responses (Large flats: Class E property)

Response to Generalized One S.D. Innovations ± 2 S.E.

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