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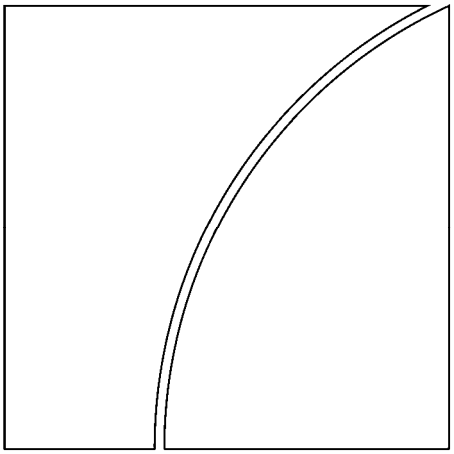

BIS Papers

No 64

Property markets and financial stability

Proceedings of a joint workshop organised by the BIS and the Monetary Authority of Singapore in Singapore on 5 September 2011

Monetary and Economic Department

March 2012

Monetary Authority of Singapore

JEL classification: E30, E44, E58, R21, R31.
Keywords: house prices, housing credit, credit conditions, monetary policy, macroprudential regulation

Papers and discussant remarks in this volume were prepared for a workshop organised by the BIS and the Monetary Authority of Singapore (MAS) in Singapore on 5 September 2011. The views expressed are those of the authors and do not necessarily reflect the views of the BIS or the institutions/central banks represented at the meeting. Individual papers (or excerpts thereof) may be reproduced or translated with the authorisation of the authors concerned.

This publication is available on the BIS website (www.bis.org).

ISSN 1609-0381 (print)
ISBN 92-9131-107-3 (print)

ISSN 1682 7651 (online)
ISBN 92-9197-107-3 (online)

Foreword

The Bank for International Settlements (BIS) and the Monetary Authority of Singapore (MAS) jointly organised a workshop on property markets and financial stability in Singapore on 5 September 2011. The workshop aimed to bring together academics and researchers at central banks, regulatory agencies and international organisations to present and discuss ongoing theoretical and empirical work in the field. In response to their call for papers, the organisers received 67 submissions from central banks, public agencies, international organisations and academic institutions. From these, a paper selection committee comprising staff of the BIS, the MAS and academia chose seven papers organised around the following four themes: (1) lessons from the crisis; (2) house price assessment; (3) housing booms and busts; and (4) property, credit and markets.

All in all, 39 participants took part, including central bank economists as well as academics from Asia and the Pacific, Europe and the United States. Assistant Managing Director Andrew Khoo of the MAS and Frank Packer, Head of Financial Stability and Markets for Asia and the Pacific of the BIS, delivered the opening remarks. Professor Timothy Riddiough at the University of Wisconsin gave a keynote speech. This volume is a collection of the opening remarks, the keynote speech, revised versions of all the papers presented during the workshop, as well as discussant remarks on these papers.

Programme

08:45–09:00	Welcome remarks
	Andrew Khoo, Assistant Managing Director, Monetary Authority of Singapore
	Frank Packer, Head of Financial Stability and Markets for Asia and the Pacific, BIS
Chair:	Wong Nai Seng (MAS)
09:00–09:45	Keynote speech by Timothy Riddiough (University of Wisconsin)
	"The first subprime mortgage crisis and its aftermath"
Session 1	**Lessons from the crisis**
09:45–10:30	"Commercial real estate loan performance at failed US banks"
	Andrew Felton (FDIC) and ***Joseph B Nichols*** (Federal Reserve Board)
	Discussant: Ilhyock Shim (BIS)
10:30–11:00	Group photo and coffee break
Session 2	**House price assessment**
Chair:	Kenneth Kuttner (Williams College)
11:00–11:45	"House prices at different stages of the buying/selling process"
	Chihiro Shimizu (Reitaku University), Kiyohiko Nishimura (Bank of Japan) and ***Tsutomu Watanabe*** (Hitotsubashi University and University of Tokyo)
	Discussant: Deng Yongheng (National University of Singapore)
11:45–12:30	"A cluster analysis approach to examining Singapore's property market"
	Lily Chan, Ng Heng Tiong and ***Rishi Ramchand*** (MAS)
	Discussant: Phang Sock Yong (Singapore Management University)
12:30–14:00	Lunch
Session 3	**Housing booms and busts**
Chair:	Deng Yongheng (National University of Singapore)
14:00–14:45	"Dealing with real estate booms and busts"
	Christopher Crowe, Giovanni Dell'Ariccia, ***Deniz Igan*** and Pau Rabanal (IMF)
	Discussant: Veronica Warnock (University of Virginia)

Session 3 (cont)	**Housing booms and busts**
14:45–15:30	"Capital inflows, financial innovation and housing booms"
	Filipa Sá (University of Cambridge), ***Pascal Towbin*** (Bank of France) and Tomasz Wieladek (Bank of England)
	Discussant: Kenneth Kuttner (Williams College)
15:30–16:00	Coffee break
Session 4	**Property, credit and markets**
Chair:	Eli Remolona (BIS)
16:00–16:45	"Credit standards and the bubble in US house prices: new econometric evidence"
	John V Duca (Federal Reserve Bank of Dallas), John Muellbauer (University of Oxford) and Anthony Murphy (Federal Reserve Bank of Dallas)
	Discussant: Frank Warnock (University of Virginia)
16:45–17:30	"Credit conditions and the real economy: the elephant in the room"
	John Muellbauer and ***David M Williams*** (University of Oxford)
	Discussant: Chris Thompson (Reserve Bank of Australia)
17:30–18:15	**Panel discussion**
Moderator:	Timothy Riddiough (University of Wisconsin)
Panellists:	Wong Nai Seng (MAS)
	Frank Packer (BIS)
	Frank Warnock (University of Virginia)

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	Frank Packer Head of Financial Markets and Stability for Asia and the Pacific
	Ilhyock Shim Senior Economist

Contents

Welcome remarks

Andrew Khoo[1]

Overview and background

Professor Timothy Riddiough, colleagues from the BIS, IMF, central banks, regulatory agencies and academia, ladies and gentlemen. Good morning.

Welcome to this workshop. We received more than 60 papers from many countries, with submissions from central banks, public agencies, supranational organisations, and academic institutions. I would like to thank everyone for their support. The very good response reflects the strong interest in this growing and important area of research.

Property market volatility poses financial stability challenges

The theme of this workshop is property markets and financial stability. Maintaining stability in property markets has been challenging for authorities across Asia in the last few years. Between 2005 and 2008, property prices in Asian economies rose rapidly. This reversed during the Global Financial Crisis, as the downturn affected incomes, confidence and the availability of financing. However, as the Asian economies rebounded, so did property prices, reaching record levels in a number of countries.

Property markets are prone to cycles, in part because supply is inelastic in the short term. This cyclical behaviour is exacerbated by several factors.

First, property is both a consumption good and an investment good. While rising prices would normally mean lower consumption, expectations of further price increases could induce more investment demand. Price momentum may escalate as valuations are usually set with reference to the latest transacted prices.

Second, housing markets tend to be highly leveraged. Most homebuyers borrow to finance their purchases, sometimes up to 80% or 90% of the value of the property. And because mortgage loans are collateralised and have historically low default rates, banks are prepared to lend at high loan-to-value ratios. In a rising market, banks are willing to lend more as the value of the collateral increases. Easier credit may contribute to further increases in house prices. But this feedback loop quickly reverses when prices are falling. Lenders tighten underwriting standards. Existing housing loans with small equity buffers may slip into negative equity and some borrowers may be forced to sell. This puts further downward pressure on prices.

Third, housing generally accounts for a significant proportion of households' balance sheets and banks' loan portfolios. In Singapore, property forms almost 50% of household assets while housing loans account for three quarters of total household debt. They also make up about 17% of bank lending to non-bank borrowers. As a result, adverse developments in housing markets can have a material impact on household wealth and the health of the banking system. This could then dampen household demand and banks' ability to supply credit, and in turn economic growth. Further, construction accounts for as much as 10% of

[1] Assistant Managing Director, Monetary Authority of Singapore.

output in some Asian economies and could pose a significant drag on growth should activity in the sector falter. Indeed, the United States, Ireland and Spain are recent examples of how property sector imbalances could cause issues as households and banks delever.

The challenge of maintaining stability

Therefore, stable property markets matter to households, to the financial system and to the economy. Asia's policy responses to property market developments over the last few years reflect this awareness. Besides encouraging individuals to borrow and banks to lend prudently, policy measures sought to mitigate the build-up of system-wide leverage. These so-called macroprudential tools are not new, as some Asian authorities have been using them since the 1990s. But there has been greater interest in such measures following the crisis.

In Singapore, the government disallowed certain loan schemes that may have encouraged property speculation, introduced a seller stamp duty, lowered LTV ratios and raised the minimum cash payment required for property purchases. Public housing construction has gathered pace and more land has been made available for private housing development. The measures have to some extent moderated the market, with the rate of increase in private property prices slowing in each of the last seven quarters. Transaction activity has fallen as well.

Our approach has been, from a whole-of-government perspective, targeted and incremental. Measures were focused on discouraging short-term speculative activity that could distort underlying prices, whilst encouraging greater financial prudence among property purchasers. Policies were fine-tuned over time to take into account implementation experience and market impact.

Research agenda

Policymakers need to deepen their understanding of the range of macroprudential tools and their efficacy. Unlike in monetary policy, where there are more established models of policy targets, transmission mechanisms and policy reaction functions, research on macroprudential tools is still at an early stage.

More research needs to be done on property markets and their interactions with the financial system and the real economy. The use of macroprudential tools in Asia and elsewhere to deal with property market pressures offers an opportunity to evaluate the effectiveness of these tools and consider how they can be refined. Policy design and implementation will benefit from a better understanding of market behaviour and interlinkages. Research findings can also feed into ongoing efforts by the IMF, the BIS and the FSB to develop guidance on issues such as the institutional set-up for macroprudential policy, tools for risk monitoring and assessment, and the design, timing and communication of policy measures. Workshops like this provide a useful forum in which to make progress on establishing a robust framework for macroprudential policies.

Conclusion

Before I end, I would like to thank the BIS for its partnership in organising this conference. On behalf of the organisers, I would like to express our appreciation to Professor Timothy Riddiough, our keynote speaker, and to Kenneth Kuttner, Frank and Veronica Warnock,

Deng Yongheng, Phang Sock Yong and Chris Thompson for kindly agreeing to be chairpersons, discussants and members of the scientific panel.

I wish you all an engaging and fruitful conference.

Welcome remarks

Frank Packer[1]

Allow me on behalf of the Asian Representative Office of the BIS also to welcome you all here. I also want to thank the Monetary Authority of Singapore (MAS) for being so receptive to our proposal nearly one year ago that we co-host this workshop on property markets and financial stability.

The BIS Asian Office was asked in 2010 by its Consultative Council of Asian central bank Governors (ACC) to focus a significant portion of its research work and the support it gives central banks over the next few years on the theme of property markets and financial stability in the region. We were asked to collaborate with ACC member central banks to design and implement research work.

There are four broad general areas that the Governors asked us to look at. First of all, how should authorities best monitor and assess valuations in housing markets? Important methodological issues include how to check the representativeness and completeness of sample transactions that underlie housing price indices, as well as how to account for the heterogeneity of the housing market.

The second topic covers housing finance arrangements and their market impact. In particular, we are interested in what institutional variables might contribute to unsustainable growth in mortgage markets. Might some types of housing finance systems be less prone to crisis?

A third category on our research agenda is the relationship between property markets and the health of the banking sector. Here we are particularly interested in the tendency of bank lending in the real estate sector to be procyclical.

Finally, the Governors have asked for work on the impact of various policy instruments on property prices and related transactions. This is a topic very close to the hearts of policymakers in Asia, where there is a very rich record of macroprudential policies.

This research workshop, which brings academic scholars together with central bank and financial supervisory experts, covers all of these topics and more.

A paper selection committee consisting of John Sequeira and Wong Nai Seng from the MAS, myself and Haibin Zhu of the BIS and scholars Frank Warnock and Yongheng Deng chose what we thought were the seven best papers from around 70 submissions. We were looking for papers that not only showed rigour and care in research, but were also relevant to policymakers and might provoke an active discussion. I think we've got an excellent line-up of papers and speakers, the fruits of which we will be enjoying over the next few days.

I'd like to brief you all here a bit on the format of the workshop. The first day's proceedings will consist of the presentation of a keynote address by Tim Riddiough, Professor at the University of Wisconsin-Madison and incoming President of the American Real Estate and Urban Economics Association, as well as the presentation and discussion of the selected research papers.

Tomorrow, there will be presentations by central banks and supervisors about current conjunctural developments in property markets as well as policy responses. The second

[1] Head of Financial Stability and Markets for Asia and the Pacific, Bank for International Settlements.

day's sessions will be in front of a somewhat smaller audience in the interest of confidentiality.

So without further ado, allow me to introduce the chair of Session 1 on the lessons of the financial crisis, Wong Nai Seng of the MAS. Nai Seng heads the Macroeconomic Surveillance Department of the MAS which is responsible for conducting research and surveillance and providing policy advice on financial stability issues. We are very lucky to have him here chairing the next session, and the floor is now his.

The first sub-prime mortgage crisis and its aftermath

Timothy J Riddiough[1]

Introduction

Financial markets in the years and months leading up to the financial crisis of 2007–08 were characterised by growth in the shadow banking sector, pyramiding and hidden leverage in the consumer and financial sectors, off-balance sheet financing by systemically important firms, and mortgage securitisation and other "creative" financing schemes that some say resembled games of "hot potato" and "hide the sausage". The failure of a prominent financial institution triggered an eventual full collapse in stock prices, resulting in, among other things, a foreclosure crisis with long-lasting negative spillovers into the real economy.

Many believe the recent crisis to be unprecedented, where, for example, Hyun Song Shin (2010) wrote: "The global financial crisis that erupted in the summer of 2007 has the distinction of being the first post-securitisation crisis in which banking and capital market developments have been clearly intertwined." In this speech I will present research I am conducting on the US panic of 1857 that contradicts Professor Shin's observation, where the 1857 panic bore eerie similarities to the more recent panic.[2]

The older panic, which occurred almost exactly 150 years prior to the more recent panic, had, in addition to the factors noted above, global capital flows emanating primarily from England and the Continent with clearly intertwined banking and capital markets. And, although sub-prime mortgage lending and securitisation were perhaps not as widespread as they were in the current crisis, they played a very central role in propagating the panic from a few strategically placed firms located near the frontier of the Old Northwest back east to New York City and Europe.[3]

It is said that every crisis is similar and that every crisis is different. Identification of the relevant similarities and differences requires memory and retained knowledge, where this knowledge can be gained and retained in different guises. The broader objective of this speech is to argue that historical perspective, and more generally inductive methods to research, provides a strong complement to more traditional deductive research methods such as large-sample econometric analysis.

This speech is organised in three acts. The first act sketches the background of the US economy in the years and months leading up to the crisis of 1857 (which occurred in late August and lasted through October of that year). The second act analyses the sub-prime mortgages and their securities that existed at the time, which were known as the railroad farm mortgage (RRFM) and the RRFM-backed security. The third and final act considers the failure of the prominent financial institution that triggered the panic, and the panic's aftermath as it specifically related to the RRFMs and their securities.

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[1] University of Wisconsin – Madison.

[2] This speech is derived directly from ongoing research I am jointly conducting with Howard Thompson on the panic of 1857 and its aftermath. See specifically Riddiough and Thompson (2011).

[3] Much of the modern treatment of the panic of 1857 is from a macro-banking perspective. See, for example, Calomiris and Schweikart (1991). Older and more historically focused treatments of the crisis include Van Vleck (1943), Fishlow (1965), Huston (1987) and Stampp (1990). One of the most interesting and informative treatments of the crisis comes shortly after the crisis occurred, from Gibbons (1859).

Act I: The years and months leading up to the panic of (late August through October) 1857

Some historical background on the 20 years leading up to the panic of 1857 is necessary to appreciate the panic's many contributing factors. At a very basic and very real level, the panic of 1857 was the natural culmination of events that started with the even more severe panic of 1837.

For my story, there are two essential direct consequences of the earlier panic that are relevant. First, as a result of state-level funding of transportation infrastructure development (canals and the relatively new invention of the railroad), a number of states defaulted on their bonds after the panic of 1837. This experience caused many states to restrict any public funding of transportation projects. These restrictions shifted the burden of financing public goods to cities and more often individuals, resulting in a number of distorting effects. Second, bank failures in the 1837 panic were related to "money-run" as opposed to "deposit-run" problems, as deposit-based banking was in its infancy in the United States. Thus, the free banking era was born after 1837, with most of the regulatory focus on the quality of money printed by individual banks. Deposit-based banks consequently operated at the fringes of banking and bank regulation at the time, and were in effect shadow banks. By the time of the 1857 panic, other non-money issuing firms such as railroads also operated as shadow banks by intermediating between direct capital suppliers and indirect investors.

In addition to state-level funding of infrastructure projects, significant amounts of the capital channelled into investment prior to the 1837 panic came from England and the Continent. After that crash, foreign investors said, "Never again!" Time and a yearning for easy riches erode many things, however. One key event that prompted a change in attitude among foreign investors was the California gold strike and gold rush of 1848 and 1849. That event significantly added to the gold stock of the United States and the world, resulting in, among other things, increased credit availability, growth in world trade, industrial construction and railroad building (Van Vleck (1943, pp. 38–39)).

Shortly after the gold rush, a railroad boom indeed began in earnest, as newfound wealth and an influx of foreign capital made its way into the hands of railroads and their promoters. Figure 1 shows the extent of the boom, with the amount of investment and added railways from 1850 to 1856. It is estimated that in excess of 25 per cent of the US GDP derived from the railroads during the mid-1850s. As noted in Panel B of the figure, Ohio, Indiana, Illinois, Michigan, Wisconsin and Iowa were considered western states at the time, at or near the frontier of the country and of railroad development. Figure 2 provides a visual depiction of railroad investment/construction activity during the 1850s.

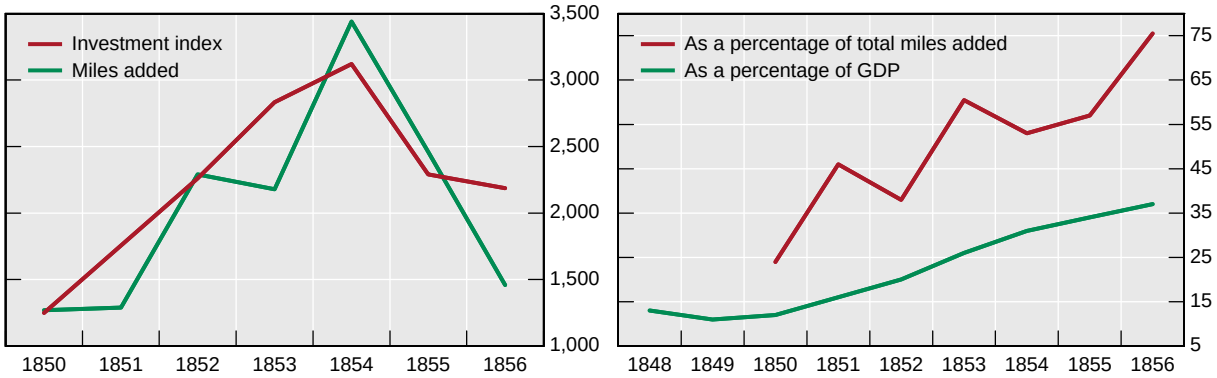
Largely because of the huge capital appetite of the railroads as a result of their stupendous growth during the 1850s, Wall Street began taking on its more modern character as an investment banker in addition to providing stock brokerage services and other methods of sourcing capital and making markets for securities. These developments helped lay the foundation for new creative ways to package securities for sale to investors.

The Crimean War raged in central Europe, lasting from late 1853 to early 1856. This war increased the demand for agricultural products grown and processed in the United States, where an increasing proportion of farming activity was migrating to the western states noted in Panel B of Figure 1. Huston (1983) and others have argued persuasively that the agricultural demand boom due to the Crimean War, followed by a decline in demand as the war approached its end, contributed to falling food commodity prices starting in 1855 and continuing through to the 1857 panic. Declining demand was coupled with a softening macroeconomy, particularly in the North, as well as ruthless and predatory competition among railroads in that most networked of industries. The result of this dynamic was railroad track being laid well ahead of demand, particularly in the frontier states of Illinois and Wisconsin.

Figure 1

Panel A: miles added and investment index, 1850–1856

Panel B: railroad investment as percentage of GDP, and miles added in Ohio, Indiana, Illinois, Michigan, Wisconsin and Iowa as percentage of total miles added, 1848–1856

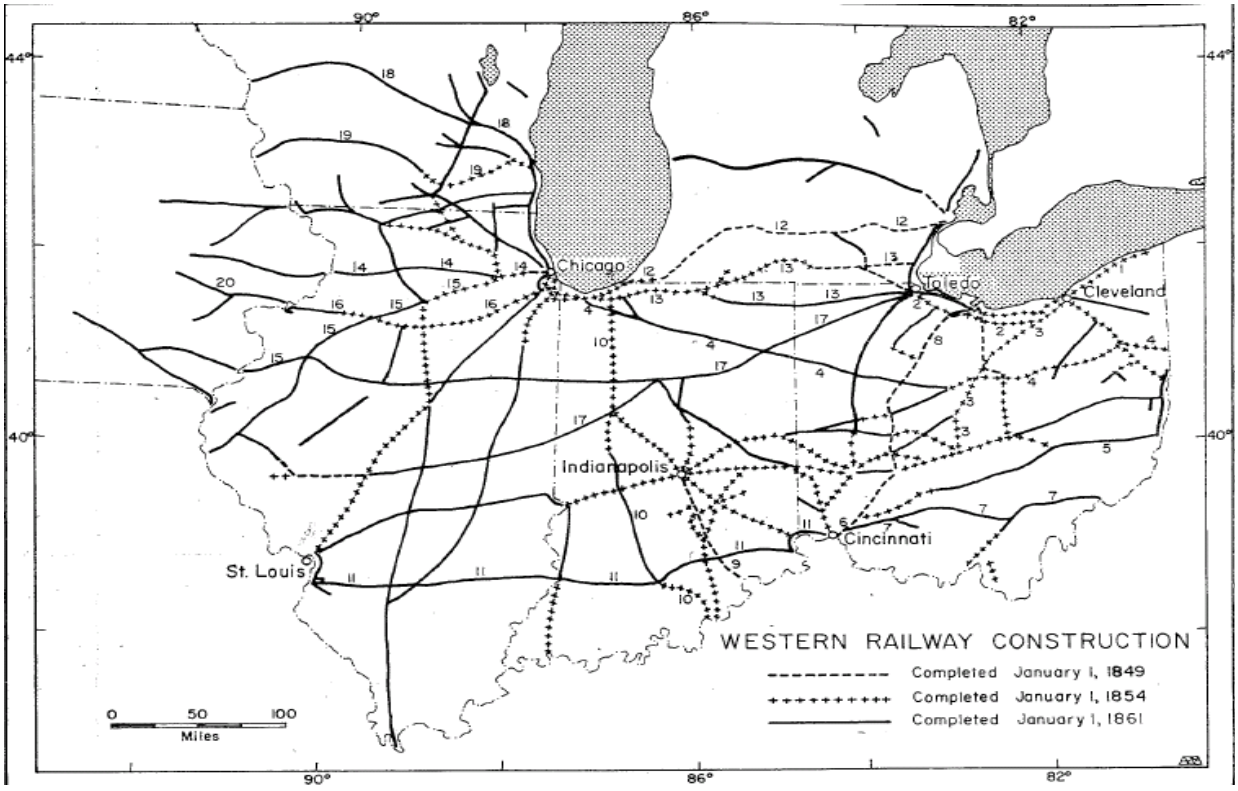


Note: In Panel A, investment equals gross investment times 30, in 1860 dollars.

Sources: Figure from Wahl (2009, Figures 5 and 6). His sources are Wilson and Spencer (1950, p.339), Stover (1987, p.317), Fishlow (1965, Table 16), and Historical Statistics of the United States, Millennial Edition (www.hsus.cambridge.org).

Figure 2

Western railway construction



Source: Fishlow (1965, Map 2).

Softening demand for long-haul transport of foodstuffs and other products produced at or near the frontier, along with overcapacity due to railroad construction occurring ahead of demand, caused a sharp decline in railroad share prices during the mid-1850s. These declines, implying increases in the cost of equity capital for the railroads, could not have come at a worse time as the railroad investment boom was moving ahead at full steam (pun intended).

A reduction in the supply of equity capital and increases in its cost had three implications for the railroads. First, it caused them to use more debt relative to equity to finance themselves, resulting in higher-leveraged firms. Second, it had the effect of increasing the opacity of the railroads, making it harder for outsiders to ascertain their true financial condition.[4] Third, it caused the railroads to become increasingly creative in the ways they sourced and packaged finance, with many railroads engaging in stock-watering schemes, off-balance sheet financings, and generally doing anything they could to raise capital but not disclose its true cost or its leveraging effects.

It was against this backdrop that the panic of 1857 occurred. Importantly, not unlike the more recent panic, there were a number of "mini-events" in the months leading up to the big event that shook the confidence of investors. Calomiris and Schweikart (1991) and Wahl (2009) stress the importance of the Dred Scott decision, which in early 1857 opened the far western American frontier to slavery. Its effects were to chill westward migration, land-value increases and railroad expansion. In early August, two prominent New England mills closed their doors due to declining demand, and at about the same time it was revealed that the Michigan Southern railroad had engaged in a Ponzi-like stock-watering scheme.

Finally, on 24 August 1857, the Ohio Life Insurance & Trust Company (OLITC) failed, triggering a full-scale meltdown in the markets. Railroad share prices plunged in the week following the failure, where, as shown in Table 1 and Figure 3, western railroads took a disproportionate share of the punishment. The four railroads singled out as "Other Western Railroads" in Table 1 experienced precipitous declines in share prices. The first two firms received most of the recent financing from the OLITC, as OLITC gambled on resurrection by doubling down its bets on the struggling railroads. The other two firms were laying track right at the north-western frontier of the country, in Wisconsin. These firms figure prominently in the next act of this speech as two of the biggest sub-prime mortgage lenders in the country.

[4] George Hudson, the king of British railroads in the 1840s, famously said, "I will have no statistics on my railroads". His counterparts a decade later in the United States had similar sentiments. Chancellor (1990), in his entertaining book on the history of financial speculation, notes of Hudson: "His false accounting and generous dividends had misled speculators into believing the railroads were more profitable than they actually were."

Table 1

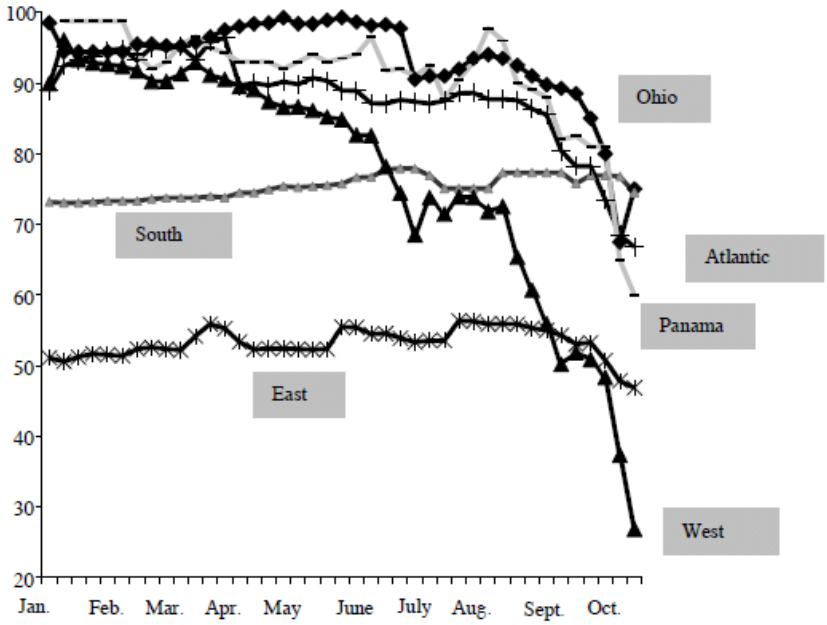
Stock price changes of railroads, grouped by region, immediately prior to and immediately after the date OLITC announced failure

Railroad	%Δ stock price ART data week prior	%Δ stock price ART data week of	%Δ stock price NYT-BA data week prior	%Δ stock price NYT-BA data day after	%Δ stock price NYT-BA data week of
New England RRs					
Boston & Lowell	0.00	0.00	N/A	N/A	N/A
Boston & Prov	2.70	-1.32	N/A	N/A	N/A
Boston & Worcester	0.00	0.00	N/A	N/A	N/A
Eastern of Mass.	0.00	0.00	N/A	N/A	N/A
Western of Mass.	0.00	0.00	N/A	N/A	N/A
Regional average	*0.56*	*-0.28*	*N/A*	*N/A*	*N/A*
Middle States RRs					
Baltimore & Ohio	0.00	5.26	N/A	N/A	N/A
New York Central	-2.50	2.56	-2.54	-3.58	-3.58
New York & Erie	-9.68	-28.57	-8.80	-17.25	-21.05
Penn Central	0.00	-8.60	N/A	N/A	N/A
Regional average	*-1.92*	*-4.30*	*N/A*	*N/A*	*N/A*
Western RRs					
Chicago Burl. & Quincy	0.00	-33.33	N/A	N/A	N/A
Cleveland & Toledo	-2.13	-13.04	-10.57	-7.78	-8.36
Illinois Central	-6.67	-28.57	-2.82	-7.14	-20.54
Michigan Central	-7.23	-22.08	-6.97	-2.28	-12.38
Regional average	*-4.41*	*-26.15*	*N/A*	*N/A*	*N/A*
Other Western RRs					
Cleveland & Pittsburgh	-16.67	-60.00	N/A	N/A	N/A
Marietta & Cincinnati	0.00	-60.00	N/A	N/A	N/A
La Crosse & Milwaukee	-21.21	-80.77	-31.20	-6.98	-51.16
Milwaukee & Mississippi	-11.11	-58.33	-2.04	-12.50	-25.00
Regional average	*-13.29*	*-63.71*	*N/A*	*N/A*	*N/A*

Source: "United States railway share and bond list," *American Railway Times*, *New York Times,* and *Boston Advertizer.*

Figure 3

Railroad stock indices, 1 March 1857–10 October 1857



Source: From Wahl (2009, Figure 14). His source is Sylla et al (2002).

Act II: Necessity as the mother of invention

As mentioned earlier, railroads at the north-western frontier were laying track ahead of demand. This was particularly true in Wisconsin, which was recognised as being endowed with extremely fertile land but having little in the way of financial capital or infrastructure outside the city of Milwaukee.

Given the speculative nature of railroad investment at the frontier, coupled with the huge capital demands of the railroad business, it is no surprise that funding such ventures proved daunting along several dimensions. First, the conventional wisdom at the time was that anything in excess of a 50 per cent leverage ratio for a railroad was imprudent.[5] This forced railroads to source significant amounts of equity capital to finance investment. Most of the available equity capital resided on the north-eastern seaboard of the United States and in Europe. This capital, in turn, wanted to see a slug of local equity capital invested as a signal of the quality of the railroad. With no local equity capital, there was therefore no arm's-length equity and hence there were strict limits on the ability to debt-finance, all of which implied no new investment. Second, as also noted earlier, many north-western states, Wisconsin included, had amended their constitutions to restrict the public financing of transportation infrastructure projects. This consequently excluded a very important potential source of local finance, forcing the railroads to become even more promotional and creative than they already were.

[5] Henry Varnum Poor was the most ardent and articulate spokesperson in this regard. See Chandler (1956) for a warm and well-executed biography of Poor and his times.

Wisconsin outside of Milwaukee was land rich but “as poor as poverty’s grandmother”. The question then was how to source the necessary local equity capital that would open the floodgates for even more debt and equity capital flowing from the east. In the early 1850s the owners of the La Crosse & Milwaukee railroad hit on an idea. Why not approach local farmers, particularly those farmers whose property lay near the path of the railroad line and its depots, and ask them to mortgage their farm to the railroad in return for shares of stock in the railroad? The dividends from the stock would be at least equal to the interest required on the mortgage, where the dividend-interest swap negated any need for the farmer to come out of pocket for interest payments on the debt. In fact, no cash changed hands at all between the farmer and the railroad in this debt-for-equity swap.

From the farmer’s perspective, it was a beautiful transaction. At no apparent cost, the farmer increased the value of his land by aiding in the laying of track near his property. He also got to share in the success of the railroad through appreciation in the stock price. There was no down payment required on the mortgage. There was also no loan documentation required – only an appraisal done by an agent of the railroad. The allowable loan-to-value ratio on the mortgage was 67 per cent – significantly higher than the prudent accepted maximum loan-to-value ratio at the time of 50 per cent. These mortgages were in essence sub-prime loans. They were even better than the sub-prime loans offered during the recent crisis, in that the railroad farm mortgages were high-leverage, no-documentation, no-down-payment loans that in fact required no mortgage payment whatsoever.

This brilliant conception accomplished several objectives at the same time for the railroad. By issuing shares to acquire an asset – the railroad farm mortgage – the railroad could claim that it successfully sourced local equity capital. The thorny issue of consideration – ie taking a mortgage in lieu of cash to fund the purchase price of the stock – could be addressed in a second step. The transaction also reduced the reported leverage of the railroad, since 100 per cent equity had been issued to finance ownership of the RRFMs. Figure 4 displays a stylised balance sheet of a railroad that starts with assets of 100 and a 50 per cent leverage ratio. The all-equity-financed purchase of 100 of the RRFMs is seen to double the size of the company and reduce the leverage ratio by half.

Figure 4

Stylised balance sheet statements of railroad with railroad farm mortgage purchases

Panel A: Prior to RRFM financing

Assets		Liabilities	
RR Assets	100	Debt	50
		Equity	50

Reported leverage ratio: 50 per cent.

Panel B: After RRFM financing

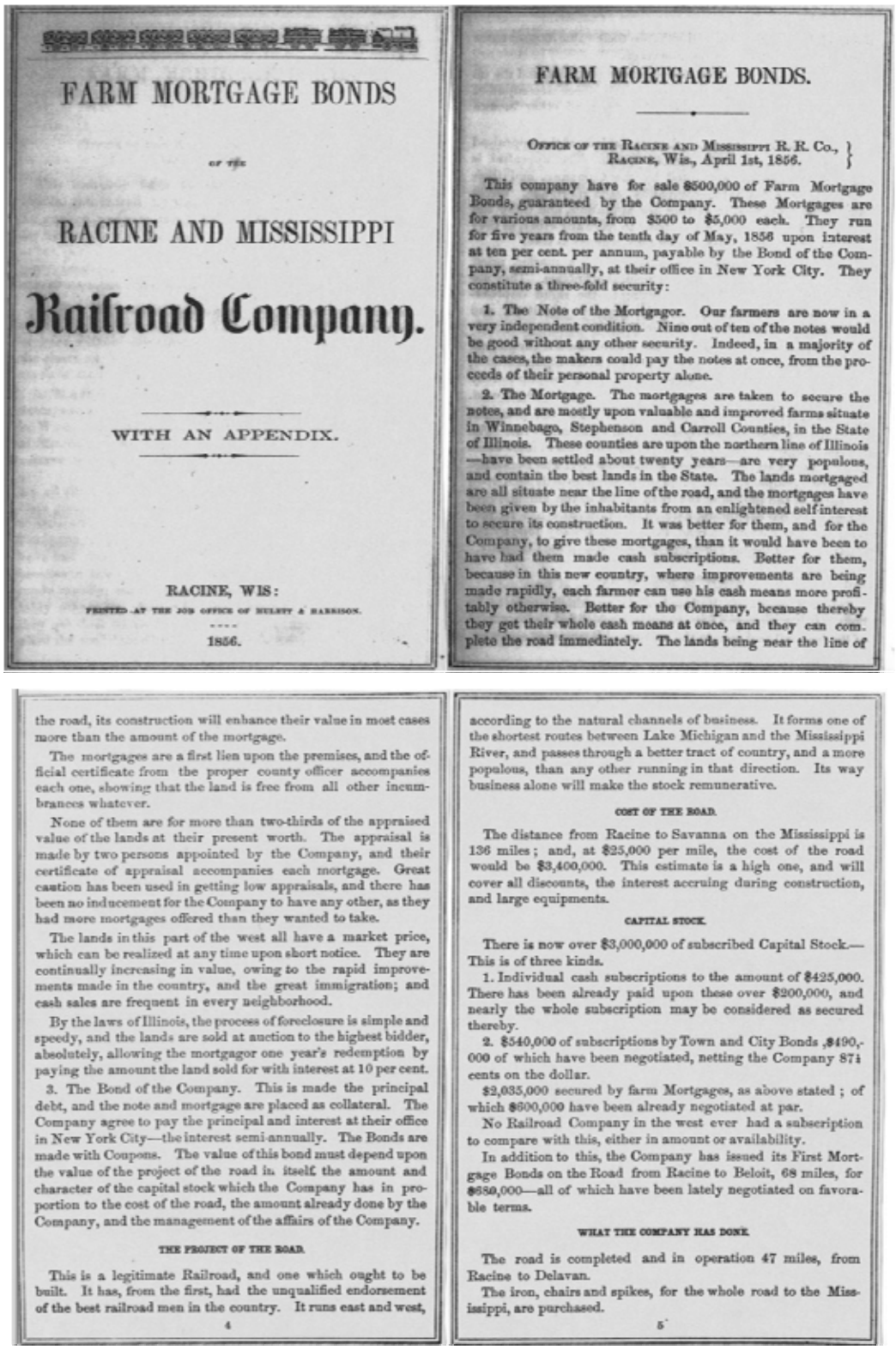
Assets		Liabilities	
RR Assets	100	Debt	50
RRFM	100	Equity	150

Reported leverage ratio: 25 per cent.

Source: Riddiough and Thompson (2011).

Figure 5

Partial prospectus of a farm mortgage bond financing from 1856



FARM MORTGAGE BONDS

OF THE

RACINE AND MISSISSIPPI

Railroad Company.

WITH AN APPENDIX.

RACINE, WIS:

PRINTED AT THE JOB OFFICE OF HULETT & HARRISON.

1856.

FARM MORTGAGE BONDS.

OFFICE OF THE RACINE AND MISSISSIPPI R. R. Co.,
RACINE, Wis., April 1st, 1856.

This company have for sale $500,000 of Farm Mortgage Bonds, guaranteed by the Company. These Mortgages are for various amounts, from $500 to $5,000 each. They run for five years from the tenth day of May, 1856 upon interest at ten per cent. per annum, payable by the Bond of the Company, semi-annually, at their office in New York City. They constitute a three-fold security:

1. The Note of the Mortgagor. Our farmers are now in a very independent condition. Nine out of ten of the notes would be good without any other security. Indeed, in a majority of the cases, the makers could pay the notes at once, from the proceeds of their personal property alone.

2. The Mortgage. The mortgages are taken to secure the notes, and are mostly upon valuable and improved farms situate in Winnebago, Stephenson and Carroll Counties, in the State of Illinois. These counties are upon the northern line of Illinois —have been settled about twenty years—are very populous, and contain the best lands in the State. The lands mortgaged are all situate near the line of the road, and the mortgages have been given by the inhabitants from an enlightened self interest to secure its construction. It was better for them, and for the Company, to give these mortgages, than it would have been to have had them made cash subscriptions. Better for them, because in this new country, where improvements are being made rapidly, each farmer can use his cash means more profitably otherwise. Better for the Company, because thereby they get their whole cash means at once, and they can complete the road immediately. The lands being near the line of

the road, its construction will enhance their value in most cases more than the amount of the mortgage.

The mortgages are a first lien upon the premises, and the official certificate from the proper county officer accompanies each one, showing that the land is free from all other incumbrances whatever.

None of them are for more than two-thirds of the appraised value of the lands at their present worth. The appraisal is made by two persons appointed by the Company, and their certificate of appraisal accompanies each mortgage. Great caution has been used in getting low appraisals, and there has been no inducement for the Company to have any other, as they had more mortgages offered than they wanted to take.

The lands in this part of the west all have a market price, which can be realized at any time upon short notice. They are continually increasing in value, owing to the rapid improvements made in the country, and the great immigration; and cash sales are frequent in every neighborhood.

By the laws of Illinois, the process of foreclosure is simple and speedy, and the lands are sold at auction to the highest bidder, absolutely, allowing the mortgagor one year's redemption by paying the amount the land sold for with interest at 10 per cent.

3. The Bond of the Company. This is made the principal debt, and the note and mortgage are placed as collateral. The Company agree to pay the principal and interest at their office in New York City—the interest semi-annually. The Bonds are made with Coupons. The value of this bond must depend upon the value of the project of the road in itself the amount and character of the capital stock which the Company has in proportion to the cost of the road, the amount already done by the Company, and the management of the affairs of the Company.

THE PROJECT OF THE ROAD.

This is a legitimate Railroad, and one which ought to be built. It has, from the first, had the unqualified endorsement of the best railroad men in the country. It runs east and west,

4

according to the natural channels of business. It forms one of the shortest routes between Lake Michigan and the Mississippi River, and passes through a better tract of country, and a more populous, than any other running in that direction. Its way business alone will make the stock remunerative.

COST OF THE ROAD.

The distance from Racine to Savanna on the Mississippi is 136 miles; and, at $25,000 per mile, the cost of the road would be $3,400,000. This estimate is a high one, and will cover all discounts, the interest accruing during construction, and large equipments.

CAPITAL STOCK.

There is now over $3,000,000 of subscribed Capital Stock.—This is of three kinds.

1. Individual cash subscriptions to the amount of $425,000. There has been already paid upon these over $200,000, and nearly the whole subscription may be considered as secured thereby.

2. $540,000 of subscriptions by Town and City Bonds ,$490,000 of which have been negotiated, netting the Company 87½ cents on the dollar.

$2,035,000 secured by farm Mortgages, as above stated; of which $800,000 have been already negotiated at par.

No Railroad Company in the west ever had a subscription to compare with this, either in amount or availability.

In addition to this, the Company has issued its First Mortgage Bonds on the Road from Racine to Beloit, 68 miles, for $680,000—all of which have been lately negotiated on favorable terms.

WHAT THE COMPANY HAS DONE.

The road is completed and in operation 47 miles, from Racine to Delavan.

The iron, chairs and spikes, for the whole road to the Mississippi, are purchased.

5

Now, the second step of the transaction was for the railroad to monetise the RRFMs so that it could purchase the track and equipment necessary to expand the line. The solution to this problem resulted in what we believe to be the first case of mortgage securitisation executed in the United States. It was a railroad farm mortgage-backed security – effectively a covered

bond offered by the railroad to potential investors located on the east coast and in Europe. Figure 5 displays the first four pages of an 1856 offering of farm mortgage bonds by the Racine & Mississippi railroad, which we believe is representative of other offerings that occurred at the time.[6] As seen in the offering, three sources of security are offered to the investor: i) the note, which states the financial obligation of the farmer to repay the stated mortgage amount; ii) the mortgage, which offers the farm as collateral; and iii) the bond of the railroad, which offers its reputation for repayment and its other assets on an unsecured basis.

Notice, however, that there is no mention of the fact that the farmer pays no interest on the underlying mortgage collateral. Also notice that no other documentation is offered on the mortgage loans, other than assurances that a loan-to-value ratio of 67 per cent is not exceeded based on an appraisal done by an agent of the railroad.

These frontier railroads were successful in their RRFM-backed securities offerings, generally raising 80 cents on the face value dollar with a coupon interest rate of 10 per cent. Figure 6 references and extends the stylised balance sheet seen in Figure 4 by showing what happens when RRFMs are securitised and sold to investors, with proceeds used to invest in railroad track and equipment. Issuance proceeds of 80 are recorded as railroad assets, while the discount of 20 on the securities (following the practice of the day) was capitalised and carried as an asset by the railroad. The contingent covered bond liability is "off-balance sheet" and hence ignored, with the leverage ratio remaining at 25 per cent. What a beautiful transaction, not only for the farmer, but also for the railroad!

Figure 6

Stylised balance sheet statements of railroad with railroad farm mortgage purchase and subsequent bond issuance

Assets		Liabilities	
RR Assets	180	Debt	50
Unam Disc	20	Equity	150

Reported leverage ratio: 25 per cent.

Source: Riddiough and Thompson (2011).

Act III: The meltdown and the aftermath

On 24 August 1857, OLITC shut its doors and was never to reopen. The closing of this historically important and highly respected bank was like "a clap of thunder in a clear blue sky" and "struck on the public like a cannon shot". It caused members of the public to look suspiciously at each other, asking, "Do you go next?"[7] The closing triggered a financial panic and a sharp downturn in the economy that was to last in the northern frontier states until the start of the Civil War. Some argue that the adverse effects of the panic, which centred on the northern states, emboldened the South to secede from the Union (see, eg Huston (1987)). In any event, OLITC's failure created a realisation in the investment community and general

[6] The full prospectus can be found in Riddiough and Thompson (2011).

[7] See Riddiough and Thompson (2011) for references and further background and context.

populace that they had neglected many significant risks – asking, what is it that we do not know that we do not know?

OLITC was, as mentioned earlier, in fact a shadow bank that financed itself with deposits largely originating from the east coast. It also operated as a regional "money centre" bank that kept excess local bank funds on deposit. It reputedly offered very attractive rates on interest on its deposits. In the years and months leading up to its closure, OLITC took this money and lent it out almost exclusively to north-western railroads. The investments were primarily in high-risk, low-priority bonds, as OLITC gambled on the resurrection of increasingly distressed firms. Its two biggest customers, the Cleveland & Pittsburgh and Marietta & Cincinnati railroads, ultimately went into receivership, as did the two Wisconsin railroads cited and discussed previously.

The failure of the Wisconsin railroads triggered a farm mortgage foreclosure crisis. As a result of the railroad bankruptcies, which revealed much greater leverage and much lesser-quality collateral than advertised, RRFM-backed securities investors nonetheless assumed they were in a relatively secure position due to the "cover" of mortgages as additional collateral backing the securities issuance. But they were soon to learn, to their surprise, that the RRFMs did not pay any interest, thus robbing them of interim cash flow and resulting in ballooning loan balances. Further, contrary to statements made in the securities prospectus, investors learned that the equity cushion on the loans, stated to be at least 33 per cent of property value, was illusory as many of the appraisals on the farm properties were in fact inflated. This problem was compounded by post-panic property value declines of 50 per cent or more. And finally, investors found out the hard way that the foreclosure process was not nearly as simple and speedy as advertised in the offering prospectus.

Railroad bankruptcy and subsequent default on the covered bonds made it necessary for security holders to travel nearly 1000 miles to pursue foreclosure in a rugged frontier state that was full of hostile farm mortgagors that had themselves misunderstood the bargain offered to them by the railroads. It was bad enough that the farm mortgagors had seen their hopes of personal riches and local prosperity dashed by the crash, but most had failed to contemplate that their farms would be taken away from them – particularly given the fact that the railroad stock that had been conveyed in return for the mortgage was now worthless. Thus, in a bargain brokered by local railroads, now gone from the scene, both sides of the RRFM transaction felt betrayed and confused, scrambling for safety as quickly as possible, with retribution at the forefront of their minds.

To get a sense of the tension that existed at the time, there are several stories of eastern security holders showing up to claim their collateral, only to find themselves surrounded by a group of hostile western farmers, temporarily imprisoned, and forcefully put on a train headed east. Indeed, the failure of these railroads created a permanent animosity between the eastern establishment and the western farmer. For example, numerous Wisconsin historians have noted lasting sentiments along the following lines: "To the end of their lives the distressed farmers and their sympathisers were never to forgive the agonies of uncertainty, of monetary sacrifice, of complete impoverishment. With these feelings went an underlying hatred of 'Wall Street' and the 'railroads.'"

Not surprisingly, circuit courts in Wisconsin, which were naturally sympathetic to the plight of the local farmer, responded to the chaos by placing stays of foreclosures on affected properties. This enraged easterners, who had found out that the bond of the railroad meant almost nothing and had been deceived into thinking that some cash flow and collateral would at least be forthcoming to cover their initial investment. As one New York Times letter writer observed: "Payment of interest has stopped, the farmers have banded together in leagues, and threaten to kill, burn and destroy … we have come to the conclusion that Wisconsin is a community lost to honour, the abode of corrupt politicians and the home of degraded people."

Many of the poorer farmer mortgagors ended up losing everything, moving out of state to avoid deficiency judgments that would otherwise haunt them for years to come. Other mortgages were purchased at steep discounts by deeper-pocketed neighbours or speculators, who then negotiated with security holders for reduced payoffs. Similarly, the original security holders often sold their positions at steep discounts to speculators and vulture investors that were often located within the borders of the state. Russell Sage was one such investor.

Finally, in 1860, the Wisconsin Supreme Court ruled in favour of the security holders, allowing them to proceed with their foreclosures. The decision turned on whether the initial debt-for-equity swap between the farmer and the railroad was a legal conveyance – the court ruled that it was. Many felt the decision was politically motivated, as the coming Civil War was already casting a long shadow, with states knowing that they would be required to borrow money in eastern capital markets to help finance the cause. Debt repudiation was not quite as attractive in 1860 as it had been in 1857.

In any case, for most involved, the decision was too little, too late, as most claims had been settled under a cloud of uncertainty, the cost of which was largely borne by the original farm mortgagors and the original security investors. The whole of the experience in what is now the upper Midwest of the United States laid the foundation for a particular brand of populism that expressed itself in the Grainger railroad regulation laws of the early 1870s, followed by the emergence of progressivism in the early 20th century.

Concluding comments

Although the crises of 1857 and 2007–08 differ in their details, the broad economic contours are remarkably similar. Agency, uncertainty, leverage, neglected risks, shadow banking and hidden systemic risks, and financial innovation in response to economic and regulatory circumstance are front and centre as first-order contributing causes to both episodes. The lessons of this earlier crisis seem to have gotten lost, however, as there has been little in the way of discussion of the 1857 panic either before or after the more recent panic. Why? I can offer two reasons. First, the panic of 1857 happened just prior to the introduction of the greenback as the national currency in the United States, which accompanied much improved archival bank data. The improved data has thus caused many researchers to ignore the antebellum years of the US banking system. Second, the panic happened just prior to the Civil War, and although the economic downturn that followed the panic may have played a key role in helping to cause the Civil War, the 1857 panic has gotten lost in the tidal wave of events surrounding the war.[8]

Looking forward from early September 2011, I am not optimistic that the financial system we are endowed with today is easily managed – at least in the West. I believe that we are in fact in the early innings of a nine-inning game with respect to figuring out how to efficiently regulate this vast interconnected financial system. Unfortunately, and contrary to what some might wish to be true, complexity in the financial system is largely irreversible and is even necessary to support complex economies.

It took the United States approximately 100 years to figure out how to regulate version 1.0 of its decentralised and fragile financial system (from the 1830s to the 1930s), and it is going to take a while for developed economies to figure out how to regulate version 2.0. Coordination amongst sovereign countries is a difficult task, as evidenced by the current problems in the

[8] See Stampp (1990) and Huston (1987) for excellent treatments of the events of 1857 and the coming of the Civil War.

eurozone. And political and economic pressures associated with entitlements, medical care, education, and voting demographics suggest the existence of many distractions over the coming years – and searches for easy financial fixes.

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Commercial real estate loan performance at failed US banks

Andrew Felton and Joseph B Nichols[1]

Introduction

Exposure to commercial real estate (CRE) loans at regional and small banks and thrifts has soared over the last two decades.[2] As banks' balance sheets become more concentrated in these types of loans, banks have become more sensitive to swings in CRE fundamentals. The concentration in CRE loans peaked in 2007, just as commercial real estate prices started a historic free fall, declining more than 30 per cent in just two years.[3] Over this same time CRE concentration has been a significant factor in recent bank failures.

Default and loss models of CRE mortgages have previously been estimated using loan data from large, income-generating properties financed by insurance companies and the commercial real estate mortgage (CMBS) market. Early research used data from insurance companies (Synderman (1991), Esaki et al (1999), Vandell et al (1993), Ciochetti et al (2003)), while more recently researchers have used data from the CMBS market (Ambrose and Sanders (2003), Archer et al (2002), Deng et al (2004), Seslen and Wheaton (2010), An et al (2009)). Black et al (2010) found that loans in CMBS pools that had been originated by portfolio lenders, such as insurance companies or commercial banks, were of a higher quality and outperformed loans originated by conduit lenders or investment banks.

The CMBS and insurance company loans used in these studies differ in structure and underlying collateral from the loans backed by bank CRE loans. Roughly a third of bank CRE loans are backed by owner-occupied CRE and another 20 to 30 per cent by land and construction loans.[4] The owner-occupied properties, which lack an external and explicit rental stream, are usually not candidates for securitisation. The loans in bank portfolios backed by land acquisition, development, and construction (ADC) projects are even less similar to those in CMBS and in insurance company portfolios. Land and construction loans are short term and the collateral is the raw land or the partially completed construction project. Finally, the loans on banks' books backed by existing income-generating commercial properties are likely to be different from those found in CMBS pools or in insurance company portfolios. Regional and small banks also make much smaller loans than those usually seen in CMBS pools or in insurance company portfolios. Clearly, each of these types of loans has performed differently during this recent financial crisis, yet we are still dependent on default and loss models estimated using data from only one type of loan.

Ours is the first paper to estimate CRE default and loss models using a loan-level dataset drawn from bank portfolios. We develop a unique dataset consisting of loan-level information on CRE portfolios for a sample of banks entering FDIC receivership over the past several years. We use this dataset to estimate a series of default and loss models. We estimate

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[1] Federal Reserve Board.

[2] Throughout the paper we mean for the term "bank" to include both commercial banks and savings institutions ("thrifts").

[3] Call Report data.

[4] Call Report data.

these models on the loans backed by existing CRE properties and compare the results with those from other papers that estimate CRE default using data from the CMBS and insurance companies. We then extend our analysis to the performance of land and construction loans, providing the first loan-level analysis of the performance of such loans.

Data

Our data are collected from a sample of banks that have failed and entered FDIC receivership over the past several years. The FDIC starts collecting data from a bank that is expected to fail several weeks before its failure date. These data are used by the FDIC to estimate the value of the bank's portfolio as it starts to market the bank to potential acquirers. The data are an output from the Automated Loan Examination Review Tool (ALERT), which every bank is required to carry out as part of the examination process.

Because the ALERT file system is used for all loan categories, it only includes variables that are populated for every loan, such as origination date, outstanding balance, maturity and interest rate. It does not include variables specific to commercial real estate, such as loan-to-value or debt service coverage ratios. It also does not include the location of the collateral. But it does include the address of the borrower, which we use as a proxy for the approximate location of the collateral. This allows us to identify "out-of-footprint" loans to borrowers outside the state the bank is headquartered in.

The dataset also does not have a consistently defined field for the type of collateral. But it does include information about how the loan is categorised in the bank's own accounting systems (the "G/L code"). These tend to be fairly descriptive (for example "vacant land", "office building", "warehouse", "convenience store"). We created a set of standard definitions of collateral type using the bank-specific data.

After a bank fails, the FDIC often engages in a "loss-sharing" transaction with the acquiring bank.[5] This is a type of guarantee in which the FDIC will reimburse the acquirer for a percentage of losses on the portfolio, usually after losses exceed a certain threshold based on the estimated losses on the portfolio. Because the FDIC has continuing exposure to these assets, it requires the banks to quarterly submit the status (paying as agreed, delinquent, charged off, or in the "other real estate owned" portfolio) of every loan to the agency. This provides us with information on the resolution of a sample of failed CRE loans that we use to estimate our loss models.

Our sample has 84,839 observations from 196 banks. There are significant differences in data quality in and between different banks. We apply a series of filters, excluding loans with missing data (interest rate, origination date, term, balance, original loan amount, state, collateral type). Data quality varies significantly across the banks. For a quarter of our banks, we have the interest rate for less than 8 per cent of their loans, while for another quarter of our banks, all the loans have an interest rate. This raises some significant doubt about the data that were recorded at some of the banks with exceptionally sparse data. We apply a final filter that exclude the data from all banks where less than 50 per cent of that bank's loans can pass our other filters. This leaves us with a final sample of 20,827 observations from 61 different banks. Of these observations, 11,890 are loans on existing CRE properties, with the remainder are land and construction loans.

[5] See, eg, http://www.fdic.gov/bank/individual/failed/lossshare for more information about loss-share agreements.

We compare the loan characteristics in our sample with loan-level data from an independent sample of large healthy banks and a sample drawn from CMBS pools. We use a new internal database produced jointly by the Federal Reserve System (FRS), the Office of the Comptroller of the Currency (OCC), and the Federal Deposit Insurance Corporation (FDIC). These data consist of an ongoing quarterly survey of the CRE portfolios at 15 banks. The database contained just over 35,000 loans in 2010 Q4 release. Although the database contains much information not available in our database of loans from failed banks, it also lacks some data that are present in our failed bank database, namely the ability to differentiate between land and construction loans. The CMBS data are drawn from a database provided by Realpoint and are based on a sample of loans that were current in December 2009. Table 1 reports the differences across these three datasets.

Table 1

Differences in CRE loans at large healthy banks, small failed banks and in CMBS pools

	Small failed Banks		**Large healthy Banks**		**CMBS**
	Existing CRE	Construction and land	Existing CRE	Construction and land	
Original loan amount	$888,886	$1,450,099	$10,623,051	$12,863,457	$11,398,795
	(1,646,691)	(3,467,959)	(28,196,742)	(26,159,376)	(46,463,5766)
Interest rate	6.4%	6.6%	6.2%	3.9%	6.5%
	(1.9)	(2.2)	(1.7)	(1.5)	(1.3)
Original term (in years)	16.4	5.0	5.8	3.4	5.2
	(10.7)	(5.5)	(4.0)	(3.5)	(4.7)

Note: Standard deviations shown in parentheses. Data on small failed banks from FDIC. Data on large healthy banks from FRS/OCC/FDIC survey. Data on CMBS from Realpoint.

The most obvious, and entirely expected, difference is that loans at large healthy banks and in CMBS are much larger than those at smaller banks. Interest rates on loans on existing properties are similar between the large healthy and the small failed banks, while interest rates on construction and land loans are significantly higher at the small failed banks than at the larger healthy banks. The most significant difference between the large and the small banks is the difference in the terms of the loans. At the small failed banks, the average term on existing property loans is 16 years, while it is 6 years at the large banks and 5 years in CMBS. Construction and land loans also have longer terms at the small failed banks.

Model

We estimate the probability that a loan was in our "default" status at the time of the bank's failure. We include all loans that are 30+ days delinquent, on nonaccrual status, or in foreclosure as "defaulted" in our model. Besides the probability of default (PD) model results, we also estimate a loss given default (LGD) model. The terms of the loss-share agreements stipulate that the bank must submit a list of loans and the associated loss on each to be reimbursed for covered losses. The ability to track the individual loans through the loss-share process enables us to see when a loss occurs and for how much. We are consequently able to calculate the LGD for the loans in our sample.

We have a subsample of 91 loans backed by existing CRE properties. The average LGD in our sample is 19.1 per cent. To gauge the impact of not having the balance at time of default, we also calculated LGD as a percentage of the originally observed balance and any undrawn lines. This version of LGD is also 19.1 per cent. As they are very similar, we consider this a good sign that our version of LGD is a good proxy for the more accurate number that we would have computed had we known the remainder at the time of the loan's default. We also have a subsample of 412 land and construction loans where we observe losses. The average LGD in our sample is 24.9 per cent and the version of LGD, calculated as a percentage of the maximum possible balance, is 22.2 per cent.

Column (1) of Table 2 reports the results of the PD model for loans on existing CRE properties. The results are largely consistent with our priors and the related literature. We expect lenders to charge riskier borrowers higher interest rates. Consistent with Black et al (2010) and Vandell et al (1993), we indeed see a significant and positive coefficient on the interest rate. We also expect that larger loans are significantly more likely to default, as Black et al (2010) found. We do find that out-of-footprint loans were more likely to default. The signs on the original term are as expected, suggesting that loans with longer terms are less likely to default. Loans within six months of their maturity date were significantly more likely to be in default at the time of bank failure. This finding is consistent with the significant impact of term defaults. If borrowers have little chance to get financing at maturity, to either refinance their balloon payment or to obtain takeout financing for their construction loan, they are less likely to keep up with the payments on their current loan. We find, similar to Vandell et al (1993), that hotels have a higher propensity to default. We also find that multi-family properties also have a higher propensity to default. The estimated probability of bank failure, based on a logistic bank failure model estimated with bank-level regulatory data as of 2007, was insignificant.

The results of the LGD model for loans on existing CRE properties, shown in the second column of Table 2, do not show as many statistically significant variables as in the PD model. The most statistically and economically significant variable, after the intercept term, is the size of the loan – larger loans have lower LGDs. This is in contrast to our PD results. While larger loans are more likely to default, their losses are smaller. The term of the mortgage is also negatively correlated with loss, as loans with shorter terms had higher loss rates. The out-of-footprint variable is insignificant.

Column (3) of Table 2 reports the results of our default model for the land and construction loans and Column (4) the LGD model. Rather than the property-type controls we used for the models for CRE loans on existing properties, we used dummies for land and single-family construction loans, holding multi-family construction as the reference case. The results are largely consistent with those in the models for CRE loans on existing properties, with the interest rate, loan size, proximity to maturity, and being out of footprint all positively correlated with default, while the original term is negatively correlated with default. Single-family loans are significant and positively correlated with default. Unlike in the existing land model, the bank quality variable is negative and significant, ie, the banks with a higher probability of failure tend to have lower default rates on their ADC loans. Unlike the loss models for CRE loans on existing properties, neither the interest rate nor the original term is significant. The original loan size, however, is significant. Land loans also had significantly higher loss rates.

This impact of the bank quality proxy is surprising and worth some added discussion. Our prior was that bad banks, ie, banks that had higher probabilities of failure, made worse loans. Our finding seems to show the opposite. Because the concentration in land and construction loans is a significant driver in the bank failure model; this proxy variable may be instead picking up the impact of bank specialisation. A bank specialising in land and construction lending may, on a loan-by-loan basis, underwrite better loans than a bank with a more diversified loan portfolio. But the concentration in land and construction loans leaves them

more exposed to systemic shocks, such as a sudden drop in demand for residential construction. We intend to explore this avenue more fully in a subsequent draft of the paper.

Table 2

PD and LGD model results

	Existing CRE		**Land and construction loans**	
	PD model	**LGD model**	**PD model**	**LGD model**
Intercept	–5.706***	1.779***	–2.648***	0.674***
	(0.408)	(0.476)	(0.327)	(0.143)
Interest rate	0.309***	–0.0215	0.126***	0.00427
	(0.017)	(0.0177)	(0.016)	(0.00689)
Original term	–0.046***	–0.0167***	–0.199***	0.00180
	(0.005)	(0.00625)	(0.011)	(0.00304)
Within 6 months of maturity date	2.170***	–0.00189	0.418***	0.00228
	(0.136)	(0.100)	(0.070)	(0.0322)
Log (original loan amount)	0.217***	–0.104***	0.187***	–0.0325***
	(0.025)	(0.0213)	(0.017)	(0.00876)
Out of footprint	–0.347***	0.152	0.434***	0.00757
	(0.113)	(0.285)	(0.091)	(0.05411)
Retail	0.105	0.125		
	(0.124)	(0.172)		
Industrial	0.200			
	(0.147)			
Multi-family	0.705***	0.0571		
	(0.120)	(0.157)		
Hotel	0.620***			
	(0.202)			
Land			–0.113	0.477*
			(0.086)	(0.245)
Single-family			0.178**	–0.0365
			(0.070)	(0.0300)
Probability of bank failure	0.1150		–1.693***	
	(0.555)		(0.615)	

Note: Standard deviations shown in parentheses. State fixed effects are limited to states and banks with large numbers of loans. The omitted property type variable for the existing CRE loan models is "office", and for the land and construction loan models, it is "multi-family". *** indicates significant at 1% level. ** indicates significant at 5% level. * indicates significant at 10% level.

Conclusion

This is one of the first papers to analyse loan-level commercial real estate data from a variety of banks. The study of land, construction, and development loans is challenging, since these loans rarely exist outside bank portfolios and little academic research exists on their performance characteristics. Previous research has depended on loans in CMBS pools and in insurance company portfolios.

The results of our analysis of the performance of CRE loans backed by existing properties are largely consistent with those in the existing research. We also find that loans approaching the scheduled maturity date are much more likely to default. Our proxy for bank quality is not significant in our default model of CRE loans on existing properties.

Land and construction loans present an entirely different risk profile, with significantly higher default and loss rates. Among land and construction loans, single-family construction loans had a higher default risk, but land loans had a higher loss rate. The risks associated with out-of-footprint lending were also higher for land and construction loans than for loans backed by existing CRE properties. Interestingly, our proxy for bank quality is significant and negative in our land and construction loan model.

The significance of loan characteristics, collateral and property type, and location in the default and loss models all show the need for more granularity in supervisory data. Recent identification of single-family construction loans in the Call Report was a step in the right direction, but the inability to identify land loans, geographical concentrations, or other loan characteristics can hinder the regulators' ability to correctly identify potential risk to institutions and the banking industry as a whole.

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Discussant remarks on Andrew Felton and Joseph B Nichols' paper "Commercial real estate loan performance at failed US banks"

Ilhyock Shim[1]

1. Overview and background

This is a very nice paper, well motivated and based on a unique dataset. Using loan-level data from community banks entering Federal Deposit Insurance Corporation (FDIC) receivership, the paper estimates the probability of default (PD) and loss-given default (LGD) of two distinct types of commercial real estate (CRE) loans. The authors also compare commercial real estate loans in community banks to those in commercial mortgage-backed security (CMBS) pools and those in large banks.

One of the main contributions of this paper is that it provides strong implications for supervisory policy. In particular, the paper stresses the need for more granularity in supervisory data, so that we can better understand what drives loan losses of community banks. This paper finds that land and construction loans have higher default and loss rates than loans backed by existing CRE properties. It also shows that more attention is warranted for single-family construction loans, land loans and out-of-footprint loans, which will be defined later.

The BIS has closely monitored developments in the commercial real estate sector since the beginning of the recent international financial crisis. The BIS Annual Reports published in 2008, 2009 and 2010 analysed potential risks stemming from the commercial real estate sector in advanced economies in depth.

In addition to the United States, commercial property prices had accelerated in a number of countries in the years up to 2007. As of early 2010, commercial property values in the United States were down by more than one third from their peak, and the delinquency rate on commercial real estate loans rose to more than 8%, which is greater than four times the rate at the end of 2006. Commercial property markets in many European countries have not fared much better, either. For example, in Ireland and the United Kingdom, commercial property prices have fallen by 40% to 50% from their peaks.

The US banks' exposure to the CRE sector also increased up to 2007. Direct exposures to commercial real estate account for almost 14% of the assets held by US banks, with the share having jumped from 19% to 33% in the case of medium-sized banks over the six years up to 2007. There were also accumulating signs of investors' heightened sensitivity to commercial property risk by 2007. In line with these developments, the issuance volume of CMBSs started to decrease in 2007 and the spreads on CMBSs widened substantially in 2007 and 2008. In response, US banks tightened their lending standards from 2006 across all types of loans.

[1] Senior Economist, Bank for International Settlements.

2. Summary of the paper

This paper is motivated by the observation that there are three types of CRE loans: loans on existing CRE properties; land and construction loans (also called land acquisition, development and construction loans (ADC loans)); and CRE loans in CMBS pools and insurance company portfolios. This paper especially focuses on changes in the business environment of community banks in the United States. In particular, the authors observe that securitisation has contributed to moving community banks out of residential mortgages, consumer credit and highest-quality commercial property loans, and into not-easily-securitised CRE loans. Finally, in terms of policy environment, the FDIC, the Office of the Comptroller of the Currency and the Federal Reserve jointly issued a guidance in December 2006, warning banks to expect increased scrutiny if the ratio of construction and development loans to equity capital is greater than one, or if the ratio of CRE loans to equity capital is greater than three.

Before I summarise the main results of the paper, it is important to know the exact definition of the following key terms:

- Loan default: loans that are delinquent for 30 days or more, on non-accrual status or in foreclosure;
- Probability of loan default: the probability that a loan was in default when the bank entered FDIC receivership (that is, when the bank failed);
- Probability of bank failure: the probability estimated by a Logit model using bank capital levels, loan quality, profitability, liquidity and CRE concentration;
- Loss-given-default: loss on the loan in default as a percentage of the loan balance outstanding when the bank failed;
  - Here, loss is measured as “covered loss”, including the charge-off amount, loss on sale of foreclosed property, accrued interest, recoveries, legal fees, etc.;
- Out-of-footprint loans: loans with the address of the borrower in a different state than the one where the bank is headquartered.

The main results of the paper can be summarised as follows:

For 11,910 loans backed by existing CRE properties, the average delinquency rate ranges from 12% to 15%. Loans with larger size, higher interest rates and shorter terms are more likely to default. Loans close to maturity are also more likely to default. For a subsample of 91 such loans with consistent LGD data, the average LGD is 19.1%. For this subsample of loans, loans with smaller size and shorter terms have higher LGD.

For 8,917 ADC loans, the average delinquency rate ranges from 43% to 50%. Loans with larger size, higher interest rates and shorter terms, and out-of-footprint loans are more likely to default. For a subsample of 412 such loans with consistent LGD data, the average LGD is 24.9%. For these loans, smaller loans have higher LGD.

The paper also provides an interesting observation that there was actually a strong provision of construction loans in 2008 and 2009. The authors find that these are mostly due to renewals and extensions of existing loans. This is an example of evergreening, which is widely discussed in the banking literature.

3. Comments

My first comment is on the risk profiles of three types of loans: (1) loans on existing CRE properties, (2) land and construction loans, and (3) CRE loans in CMBS pools and insurance company portfolios. The authors emphasise that these loans are different in terms of cash flow characteristics, uncertainty and monitoring burdens, and ease of securitisation. I would like to add one more important aspect: the correlation between the collateral value and income flows.

Loans backed by existing CRE properties tend to exhibit a low correlation between collateral value and income flows, which are potentially generated by business projects funded by the loan. By contrast, land and construction loans have a very high correlation between collateral value and repayment since the payment of loans depends on the completion of the project and the sale of the property. Loans in CMBS pools are also characterised by a high correlation between collateral value and rental income flow, since the property value and rental income from the property tend to be cointegrated in the long run. Table 1 summarises the differences in the three types of loans along the three dimensions.

Table 1

Classification of commercial real estate loans

Loan type	Cash flow characteristics	Correlation between value and cash flow	Monitoring and securitisation
Loans backed by existing CRE properties	Income potentially not from rentals but from business projects	Potentially low	Not popular for securitisation
Land and construction loans	Loan balance increases over time and cash flow is negative until the project is completed, the property is sold and the bank is repaid Very sensitive to business cycle and more uncertain	Very high	Require strong monitoring, so not for securitisation
Loans in CMBS pools and insurance company portfolios	Positive and predictable rental streams	High correlation between collateral value and rental income	Monitoring burden not so strong, thus popular for securitisation

My second comment relates to empirical approaches taken in the paper. The authors chose to use a cross-sectional concept of PD and a loan-by-loan time series concept of LGD at the same time. Even though the availability of only cross-sectional data makes it difficult to use a typical VaR-type concept of PD, I suggest that the authors might want to think about how to introduce a model with assumptions to calculate the probability that a loan will default within a given amount of time in the future. Also, given that the sample is intrinsically unbalanced and not random, the authors might want to control for the bank-specific effect, for example, by introducing a dummy variable for the largest bank, which takes up 31% of the total assets in the sample of banks, or for the top ten banks, which take up 66% of the total assets in the sample.

Finally, the paper stresses the importance of the predicted probability of bank failure. This probability is estimated by bank capital levels, loan quality, profitability, liquidity and CRE concentration. This variable is viewed as a measure of the quality of the bank's business

model, and is introduced to control for unobservable bank characteristics. We can expect that loans at banks with a higher probability of failure are less likely to be well underwritten than loans at banks with a lower probability of failure. However, the regression results do not seems to support this prediction. One possible reason for this puzzle might be that for some banks, their CRE portfolio could have played a significant role in their failure, while other banks may have failed for reasons completely unrelated to their CRE portfolio, such as subprime or other residential mortgages.

Overall, I enjoyed reading the paper, and hope the authors continue to produce interesting papers in this line of research using the interesting dataset.

House prices from magazines, realtors, and the Land Registry

Chihiro Shimizu, Kiyohiko G Nishimura and Tsutomu Watanabe[1]

I. Introduction

In constructing a housing price index, one has to make several non-trivial choices. One of them is the choice among alternative estimation methods, such as repeat-sales regression, hedonic regression, etc. There are numerous papers on this issue, both theoretical and empirical. Shimizu et al. (2010), for example, conduct a statistical comparison of several alternative estimation methods using Japanese data. However, there is another important issue which has not been discussed much in the literature, but which has been regarded as critically important from a practical viewpoint: the choice among different data sources for housing prices. There are several types of datasets for housing prices: datasets collected by real estate agencies and associations; datasets provided by mortgage lenders; datasets provided by government departments or institutions; and datasets gathered and provided by newspapers, magazines, and websites.[2] Needless to say, different datasets contain different types of prices, including sellers' asking prices, transaction prices, valuation prices, etc.

With multiple datasets available, one may ask several questions. Are these prices different? If so, how do they differ from one another? Given the specific purpose of the housing price index one seeks to construct, which dataset is the most suitable? Alternatively, with only one dataset available in a particular country, one may ask whether this is suitable for the purpose of the index one seeks to construct. This paper is a first attempt to address some of these questions.

Specifically, in order to do so, we will conduct a statistical comparison of different house prices collected at different stages of the house buying/selling process. To conduct this exercise, we focus on four different types of prices: (1) asking prices at which properties are initially listed in a magazine, (2) asking prices when an offer for a property is eventually made and the listing is removed from the magazine, (3) contract prices reported by realtors after mortgage approval, and (4) registry prices. We prepare datasets of these four prices for condominiums traded in the Greater Tokyo Area from September 2005 to December 2009. The four prices are collected by different institutions and therefore recorded in different datasets: (1) and (2) are collected by a real estate advertisement magazine; (3) is collected by an association of real estate agents; and (4) is collected jointly by the Land Registry and the Ministry of Land, Infrastructure, Transport and Tourism.

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[1] Chihiro Shimizu is at Reitaku University. Kiyohiko G Nishimura is at the Bank of Japan. Tsutomu Watanabe is at the University of Tokyo. This is a shortened version of "House prices at different stages of the buying/ selling process". We would like to thank Yongheng Deng, Erwin Diewert, David Fenwick, Sadao Sakamoto, and Hiwon Yoon for helpful discussions and comments. Nishimura's contribution was made mostly before he joined the Policy Board of the Bank of Japan.

[2] Eurostat (2011) provides a summary of the sources of price information in various countries. For example, in Bulgaria, Canada, the Czech Republic, Estonia, France, Ireland, Latvia, Luxembourg, Poland, Spain and the United States, price data collected by statistical institutes or ministries is used. In Denmark, Finland, Hong Kong SAR, Lithuania, the Netherlands, Norway, Slovenia, Sweden and the United Kingdom, information gathered for registration or taxation purposes is used. In Belgium, France, Germany, Greece, Italy, Portugal and Slovakia, data from real estate agents and associations, research institutes or property consultancies is used. Finally, in Austria, Hungary, Malta and Romania, data from newspapers or websites are used.

An important advantage of prices at earlier stages of the house buying/selling process, such as initial asking prices in a magazine, is that they are likely to be available earlier, so that house price indices based on these prices become available in a timely manner. The issue of timeliness is important given that it takes more than 30 weeks before registry prices become available. On the other hand, it is often said that prices at different stages of the buying/selling process behave quite differently. For example, it is said that when the housing market is, say, in a downturn, prices at earlier stages of the buying/selling process, such as initial asking prices, will tend to be higher than prices at later stages. Also, it is said that, for various reasons, prices at earlier stages contain non-negligible amounts of "noise." For instance, prices can be renegotiated extensively before a deal is finalised, and not all of the prices appearing at earlier stages end in transactions, for example, because a potential buyer's mortgage application is not approved.

The main question of this paper is whether the four prices differ from each other and, if so, by how much. We will focus on the entire cross-sectional distribution for each of the four prices to make a judgment on whether the four prices are different or not. The cross-sectional distributions for the four prices may differ from each other simply because the datasets in which they are recorded contain houses with different characteristics. For example, the dataset from the magazine may contain more houses with a small floor space than the registry dataset, which may give rise to different price distributions. Therefore, the key to our exercise is how to eliminate quality differences before comparing price distributions. We will conduct quality adjustments in two different ways. The first is to use only the intersection of two different datasets, that is, observations that appear in two datasets. For example, when testing whether initial asking prices in the magazine have a distribution similar to that of registry prices, we first identify houses that appear in both the magazine dataset and the registry dataset and then compare the price distributions for those houses in both datasets. The second method is based on hedonic regressions.

II. Data

We focus on the prices of condominiums traded in the Greater Tokyo Area from September 2005 to December 2009. According to the register information published by the Legal Affairs Bureau, the total number of transactions for condominiums carried out in the Greater Tokyo Area during this period was 360,243. Ideally, we would like to have price information for this entire "universe," but all we can observe is part of this universe. Specifically, we have three different datasets, each of which is sampled from this universe.

The first is the dataset collected by a weekly magazine, *Shukan Jutaku Joho* (Residential Information Weekly) published by Recruit Co., Ltd., one of the largest vendors of residential lettings information in Japan. This dataset contains initial asking prices (i.e., the asking prices initially set by sellers), denoted by P_1, and final asking prices (i.e., asking prices immediately before they were removed from the magazine because potential buyers had made an offer), denoted by P_2. The number of observations for P_1 and P_2 is 155,347, meaning that this dataset covers 43 per cent of the universe. There may exist differences between P_1 and P_2 for various reasons. For example, if the housing market is in a downturn, a seller may have to lower the price to attract buyers. Then P_2 will be lower than P_1. If the market is very weak, it is even possible that a seller may give up trying to sell the house and thus withdraw it from the market. If this is the case, P_1 is recorded but P_2 is not.

The second dataset is a dataset collected by an association of real estate agents. This dataset is compiled and updated through the Real Estate Information Network System, or REINS, a data network that was developed using multiple listing services in the United States and Canada as a model. This dataset contains transaction prices at the time when the actual sales contracts are made, after the approval of any mortgages. They are denoted by

P_3. Each price in the dataset is reported by the real estate agent who is involved in the transaction as a broker. The number of observations is 122,547, for a coverage of 34 per cent. Note that P_3 may be different from P_2 because a seller and a buyer may renegotiate the price even after the listing is removed from the magazine. It is possible that P_3 for a particular house may not be recorded in the realtor dataset although P_2 for that house is recorded in the magazine dataset. Specifically, there are more than a few cases where the sale was not successfully concluded because a mortgage application was turned down after the listing had been removed from the magazine.

The third dataset is compiled by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). We refer to this price as P_4. In Japan, each transaction must be registered with the Legal Affairs Bureau, but the registered information does not contain transaction prices. To find out transaction prices, the MLIT sends a questionnaire to buyers to collect price information. The number of observations contained in this registry dataset is 58,949, for a coverage of 16 per cent. Since P_3 and P_4 are both transaction prices, there is no clear institutional reason for any discrepancy between the two prices; however, it is still possible for these two prices to differ, partly because they are reported by different parties: a real estate agent for P_3 and the buyer for P_4. There may be reporting mistakes, intentional and unintentional, on the side of real estate agents, or on the side of buyers, or on both sides.

Some housing units appear in only one of the three datasets, but others appear in two or three datasets. Using address information, we identify those housing units which appear in two or all three of the datasets. For example, the number of housing units that appear both in the magazine dataset and in the registry dataset is 15,015; the number of housing units that are in the magazine dataset but not in the registry dataset is 140,332; and the number of housing units that are in the registry dataset but not in the magazine dataset is 43,934. This clearly indicates that these two datasets contain a large number of different housing units, implying that the statistical properties of the two datasets may be substantially different. This suggests that it may be possible for the three datasets to produce three different house price indices, which behave quite differently, even if the identical estimation method is applied to each of the three datasets.

III. Four prices at different stages of the house buying/selling process

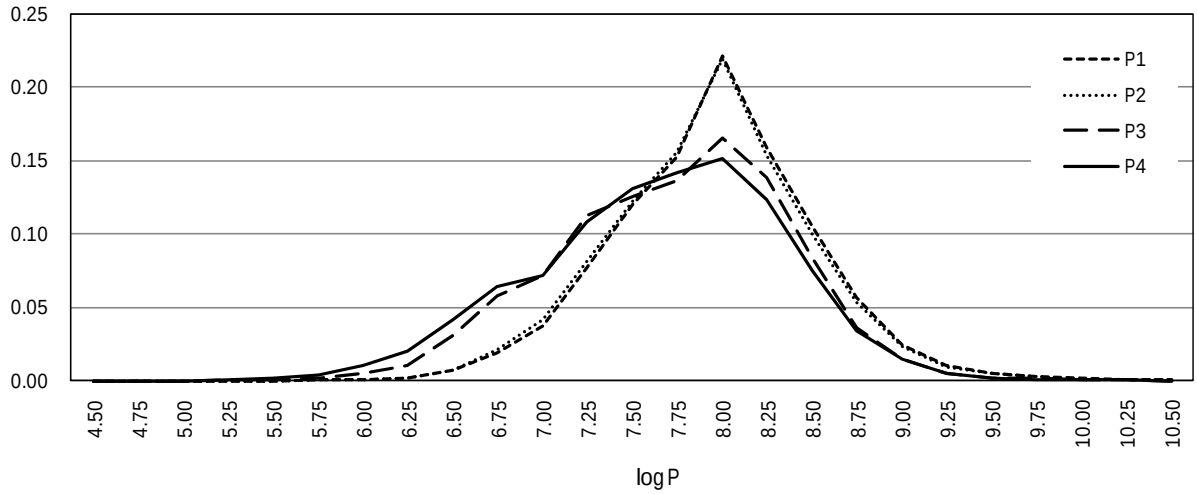
Figure 1 shows the cross-sectional distributions for the log of the four prices. The horizontal axis represents the log price while the vertical axis represents the corresponding density. We see that the distributions of P_1 and P_2 are quite similar to each other. On the other hand, the distribution of P_3 differs substantially from the distribution of P_2; namely, the distribution of P_2 is almost symmetric, while the distribution of P_3 has a thicker lower tail, implying that the sample of P_3 contains more low-priced houses than the sample of P_2. This difference in the two distributions may be a reflection of differences in prices at different stages of the house buying/selling process, but it is also possible that the difference in the price distributions may come from differences in the characteristics of the houses in the two datasets.

To investigate this in more detail, we compare the distributions of house attributes for each of the three datasets. The top panel of Figure 2 shows the distributions of floor space, measured in square metres, for the three datasets. The distribution labelled "P_1 and P_2," which is from the magazine dataset, is almost symmetric, while the distribution labelled "P_3," which is from the realtor dataset, has a thicker lower tail, indicating that the realtor dataset contains more small-sized houses whose floor space is 30 square metres or less. This pattern is even more pronounced in the registry dataset, i.e., the distribution labelled "P_4". Turning to the middle and bottom panels of Figure 2, we see that there are substantial

differences between the three datasets in terms of the age of buildings and the distance to the nearest station.

Figure 1

Price densities for P_1, P_2, P_3 and P_4



These differences in the distributions of house attributes may be related to the differences in the distributions of house prices. More specifically, the different price distributions we saw in Figure 1 may be mainly due to differences in the composition of houses in terms of their size, age, location, etc. Put differently, it could be that the price distributions are identical once quality differences are controlled for in an appropriate manner.

We will conduct quality adjustments by using only the intersection of two different datasets, that is, observations that appear in two datasets. For example, when testing whether initial asking prices in the magazine have a distribution similar to that of registry prices, we first identify houses that appear in both the magazine dataset and the registry dataset and then compare the price distributions for those houses in both datasets. In this way, we ensure that the two price distributions are not affected by differences in house attributes between the two datasets. This idea is quite similar to the one adopted in the repeat sales method, which is extensively used in constructing quality-adjusted house price indices. As is often pointed out, however, repeat sales samples may not necessarily be representative because houses that are traded multiple times may have certain characteristics that make them different from other houses. A similar type of sample selection bias may arise even in our intersection approach. Houses in the intersection of the magazine dataset and the registry dataset are cases which successfully ended in a transaction. Put differently, houses whose initial asking prices were listed in the magazine but which failed to get an offer from buyers, or where potential buyers failed to get approval for a mortgage, are not included in the intersection.[3]

IV. Results

The magazine dataset, which contains P_1 and P_2, and the registry dataset, which contains P_4, have 15,015 observations in common. On the other hand, there are 22,613 observations

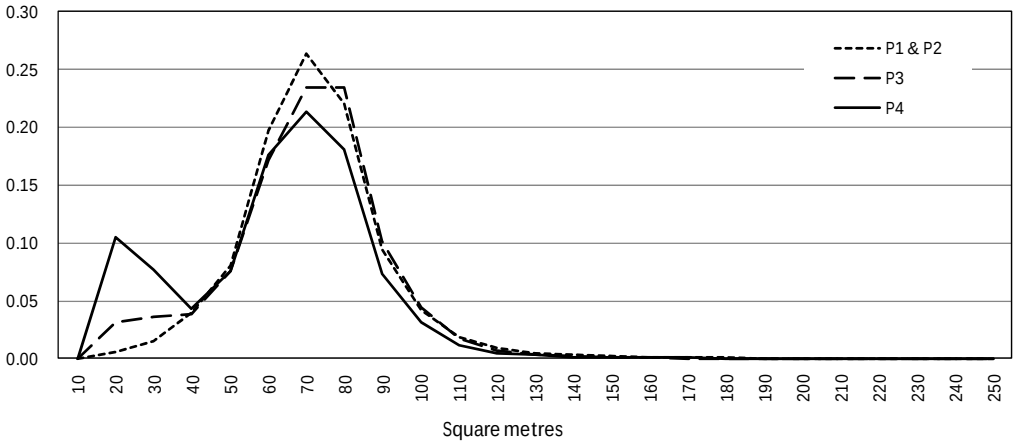
[3] See Shimizu et al. (2011) for an alternative way to conduct quality adjustment.

in the intersection of the realtor dataset, which contains P_3, and the registry dataset, which contains P_4. We will use these two intersection samples to estimate the distance between the distributions of prices at different stages of the house buying/selling process.

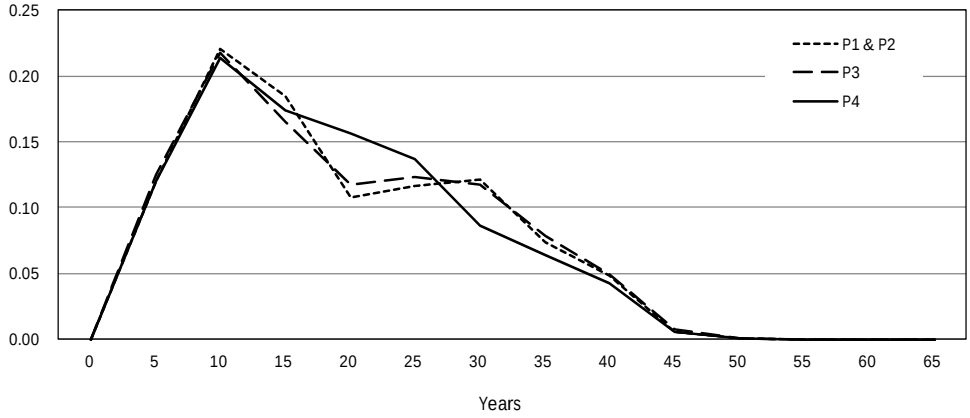
Figure 2

Density functions for house attributes

Floor space



Age of building



Distance to the nearest station

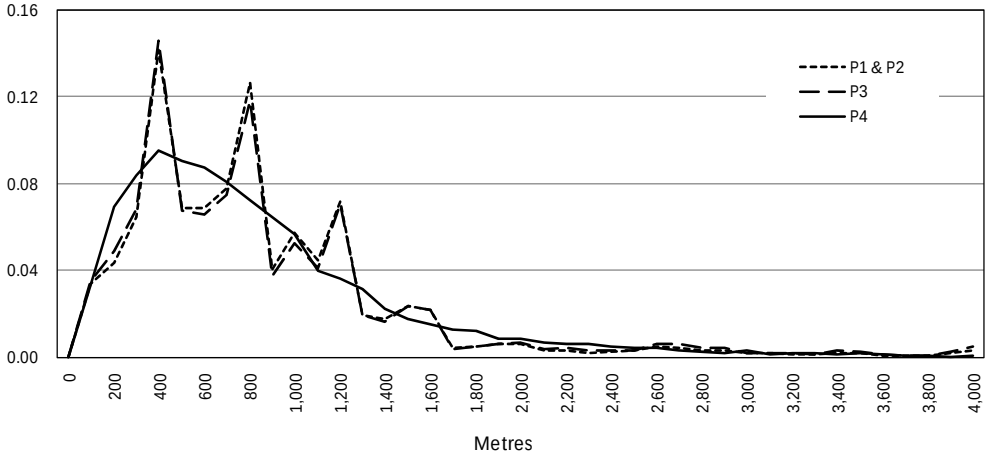


Figure 3 shows the distribution of prices using the intersection samples. The top panel compares the distributions of P_1 and P_4 using the intersection sample of the magazine and registry datasets. In Figure 1, we saw that the distributions of P_1 and P_4 are quite different. However, we now find that the difference between the two distributions is much smaller than before, clearly showing the importance of adjusting for quality. However, the two distributions are not exactly identical even after the quality adjustment. Specifically, the distribution of P_4 has a thicker lower tail than the distribution of P_1. This may be interpreted as reflecting the fact that asking prices initially listed in the magazine were revised downward during the house selling/purchase process.

The middle panel in Figure 3 compares the distributions of P_2 and P_4 using the intersection sample of the magazine and registry datasets, while the bottom panel compares the distributions of P_3 and P_4 using the intersection sample of the realtor and registry datasets. Both panels show that the differences between the distributions are much smaller than we saw in Figure 1, but there still remain some differences.

In order to see how close the distributions of the four prices are, we draw quantile-quantile (q-q) plots, which provide a graphical technique for determining if two datasets come from populations with a common distribution. The q-q plots are shown in Figure 4, where the quantiles of the first set of prices are plotted against the quantiles of the second set of prices. If the two sets of prices come from populations with the same distribution, the dots should fall along the 45-degree reference line. The greater the departure from this reference line is, the more this suggests that the two sets of prices come from populations with different distributions.

The panels in Figure 4(a) show the q-q plots for raw prices, the distributions of which were shown in Figure 1. The top panel shows the result for P_1 and P_4, with the log of P_4 on the horizontal axis and the log of P_1 on the vertical axis. Similarly, the middle and bottom panels show the results for P_2 and P_4 and for P_3 and P_4. The three panels all show that the dots are not exactly on the 45-degree line. For example, in the top panel, the dots are above the 45-degree line; moreover, they deviate more from the 45-degree line for low price ranges, indicating that the distribution of P_4 has a thicker lower tail than that of P_1. A similar deviation from the 45-degree line can be seen in the q-q plot for P_2 vs. P_4 and the q-q plot for P_3 vs. P_4, although the deviation is smaller in the case of P_3 vs. P_4 than in the other two cases.

Turning to the q-q plots for quality-adjusted prices by the intersection approach, which are presented in Figure 4(b), we see that the dots are much closer to the 45-degree line than before, although there still remains some deviation from the 45-degree line.

V. Conclusion

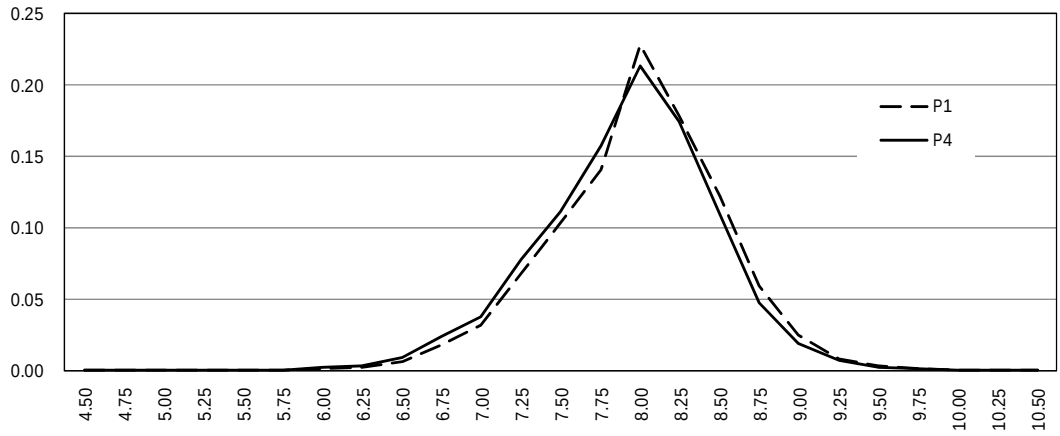
In constructing a housing price index, one has to make at least two important choices. The first is the choice among alternative estimation methods. The second is the choice among different data sources for house prices. The choice of the dataset has been regarded as critically important from the practical viewpoint, but has not been discussed much in the literature. This study sought to fill this gap by comparing the distribution of prices collected at different stages of the house buying/selling process, including (1) asking prices at which properties are initially listed in a magazine, (2) asking prices when an offer is eventually made, (3) contract prices reported by realtors, and (4) registry prices. These four prices are collected by different parties and recorded in different datasets. We found that there exist substantial differences between the distributions of the four prices, as well as between the distributions of house attributes. However, once quality differences are controlled for, there remain only small differences between the price distributions. This suggests that prices collected at different stages of the house buying/selling process are still comparable, and

therefore useful in constructing a house price index, as long as they are quality-adjusted in an appropriate manner.

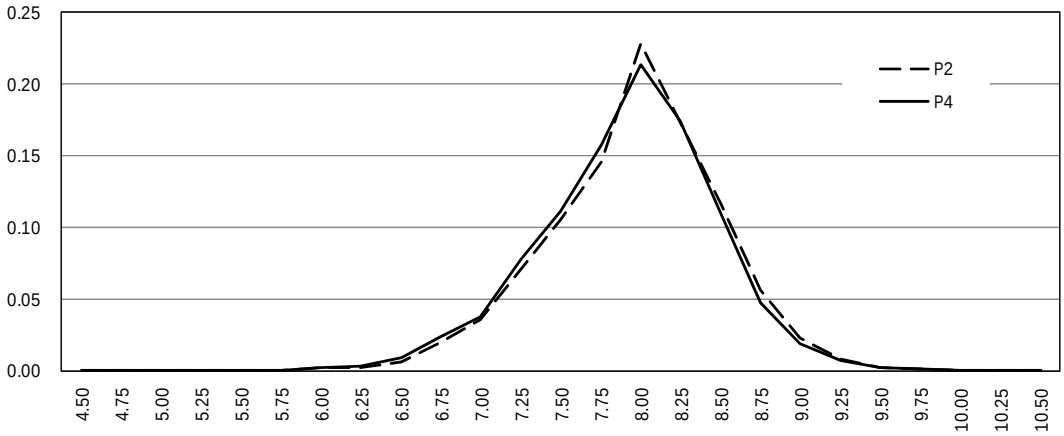
Figure 3

Price densities for housing units observed in two datasets

Densities for P_1 and P_4



Densities for P_2 and P_4



Densities for P_3 and P_4

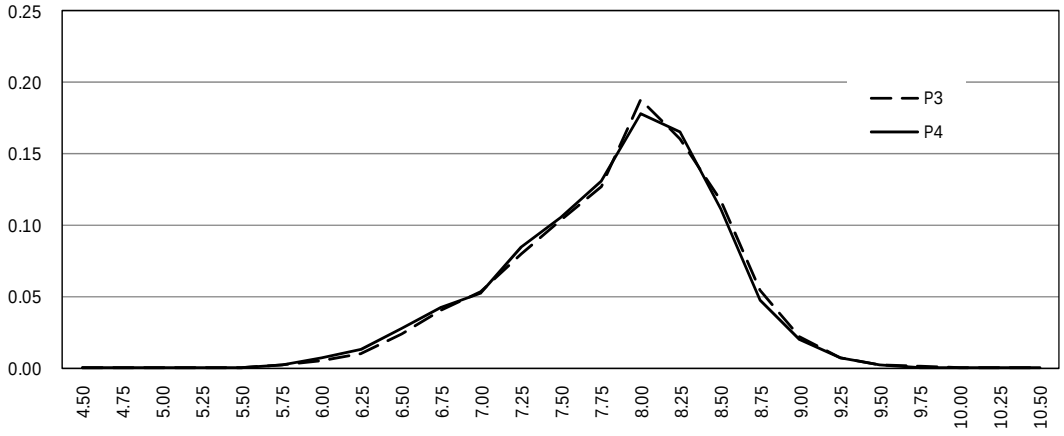
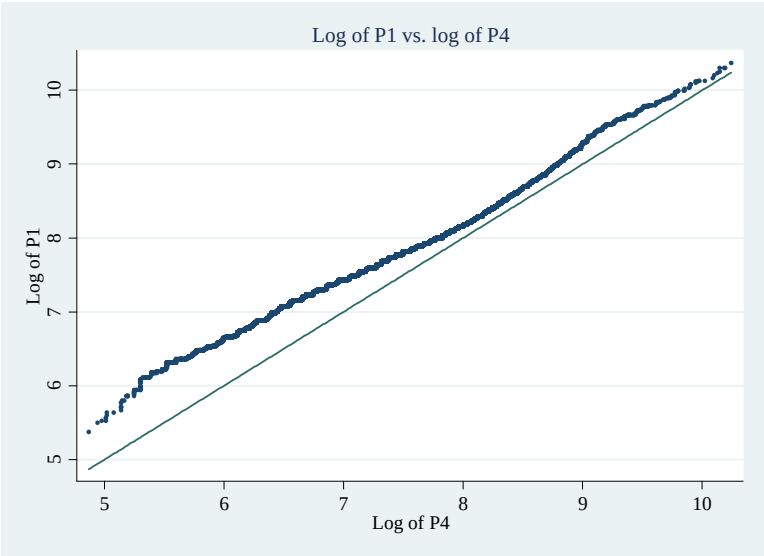
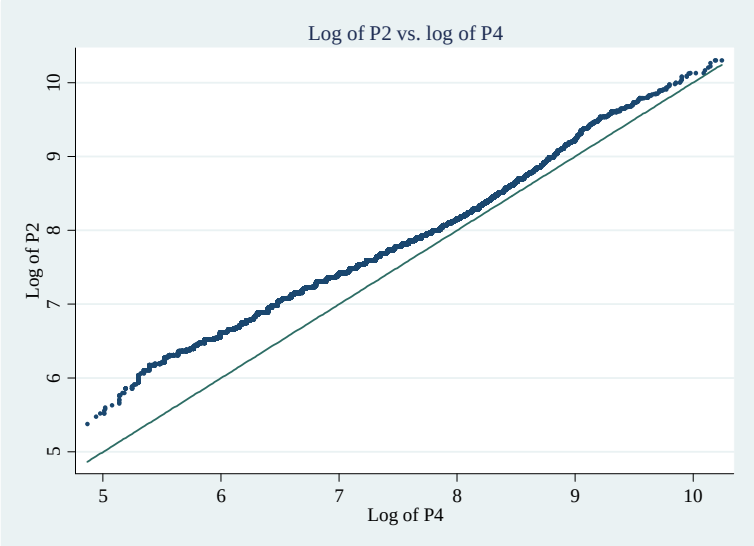


Figure 4(a)

Quantile-quantile plots for raw prices





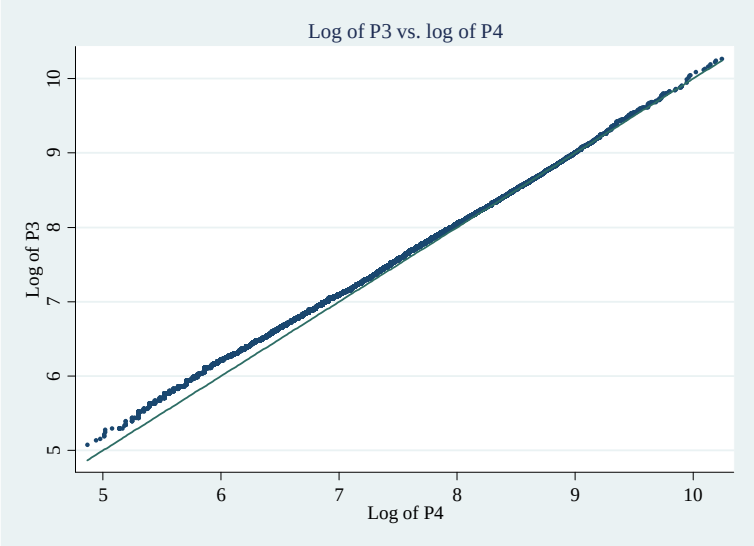
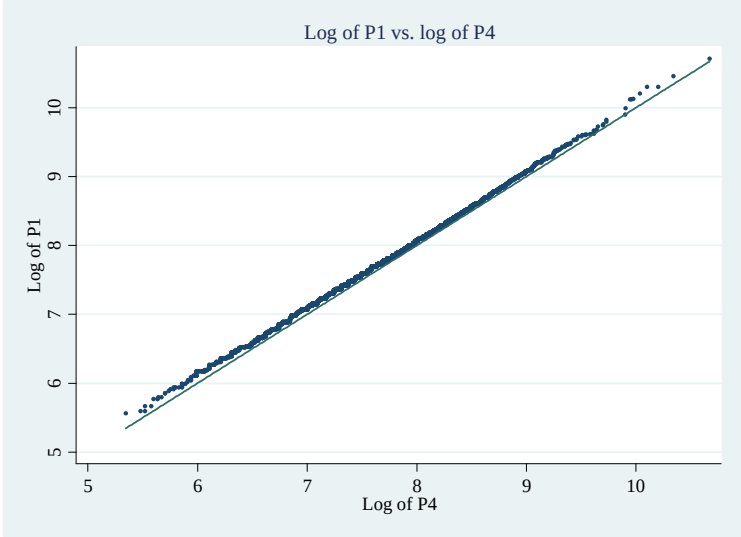
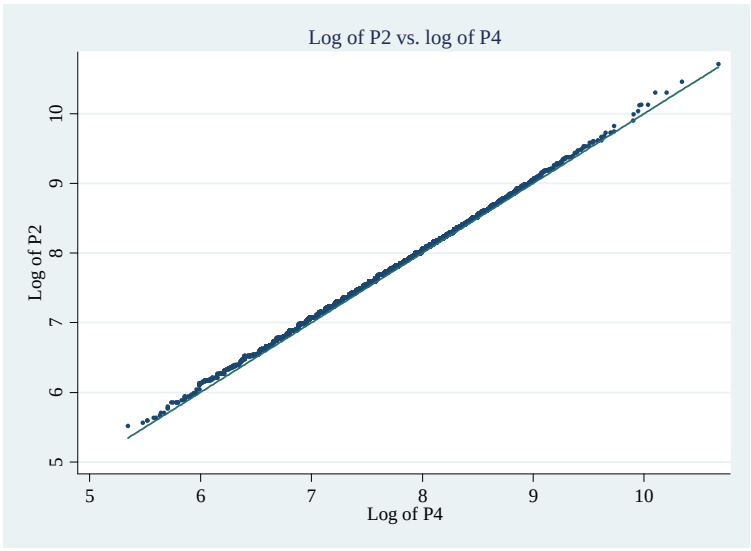
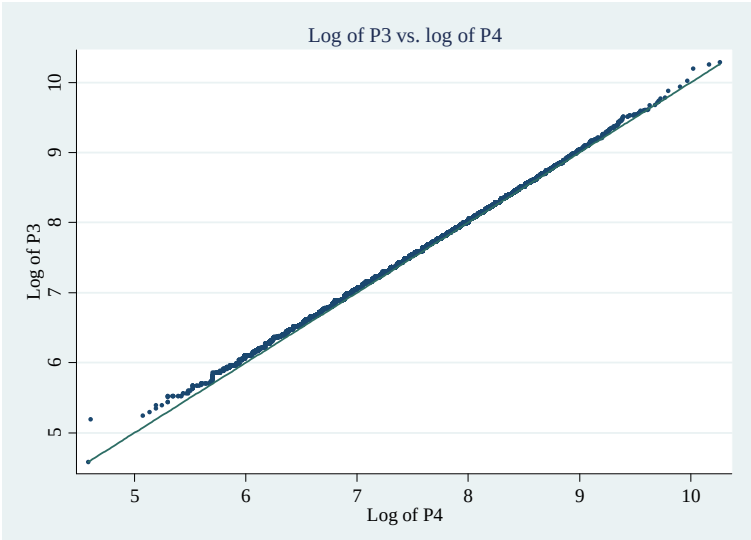


Figure 4(b)

Quantile-quantile plots for quality-adjusted prices by intersection approach







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Shimizu, C., K.G. Nishimura, and T. Watanabe (2010), "Housing prices in Tokyo: A comparison of hedonic and repeat-sales measures," *Journal of Economics and Statistics*, Volume 230, Issue 6, Special issue on "Index Theory and Price Statistics" edited by Erwin Diewert and Peter von der Lippe, December 2010, 792–813.

Discussant remarks on Chihiro Shimizu, Kiyohiko G Nishimura and Tsutomu Watanabe's paper "House prices from magazines, realtors, and the Land Registry"

Yongheng Deng[1]

Introduction

This is a very important and timely paper addressing issues regarding appropriateness in measuring property asset prices in the housing market. In doing empirical research in the field of finance and economics, including the housing financial market, the researcher has to tackle the problem of model as well as the problem of data. For example, current US Federal Reserve Chairman Ben Bernanke commented that "… this originate-to-distribute model appears to have contributed to the breakdown in underwriting standards, as lenders often found themselves able to pass on the credit risk without much resistance from the ultimate investors" (Ben Bernanke, 14 March 2008 remarks on the mortgage crisis). Others believe that the models are fine, but that they have an input problem. It becomes a number that the researcher plucks out of the air (a comment made by a former Citigroup banker, Satyajit Das). Former Fed Chairman Alan Greenspan remarked on 23 October 2008 that "the whole intellectual edifice, however, collapsed in the summer of last year because the data inputted into the risk management models generally covered only the past two decades – a period of euphoria". An et al (2011) examine the model stability and data input issues using the subprime mortgage crisis as a natural experiment.

In this paper, Shimizu, Nishimura and Watanabe carefully address both modelling issues and data challenges in constructing the housing price index that can appropriately measure the dynamics of asset prices at various stages of the housing market. The research is carefully designed and the paper is well written and easy to read. The study contributes to the existing housing price literature through carefully examining the distribution of the empirical data from different timing of the price formation and marketing periods, as well as from various data sources. The study provides valuable insight into how to tackle challenges due to the data limitations, a challenge faced not only by housing economists, but also by many others who want to conduct rigorous empirical research in broadly defined finance and economics fields.

The challenges of housing price index modelling

The literature on housing price research can be traced back to almost half a century ago, when Bailey et al (1963) proposed a weighted repeat sales house price index model that is estimated on the basis of paired sales of properties which have been sold more than once, so that the characteristics of the properties are standardised with reference only to themselves. Kain and Quigley (1970) propose a hedonic technique to account for the important non-temporal determinants of price variation. They illustrate the complexity of the

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bundle of residential services and the importance of residential quality as well as neighbourhood effects that affect housing price. Case and Shiller (1989) apply the repeat sales model to study the efficiency of the market for single-family homes. Englund et al (1999) and Shimizu et al (2010) compare various methodologies of computing housing price indexes with respect to temporal aggregation and sample definition. However, it has been well documented that existing housing price modelling approaches suffer from various limitations, for example, the strict assumption with regard to the constant quality sampling pair applied in the repeat sales approach, etc. Deng and Quigley (2008) document the magnitude and bias of the historical house price index due to the underlying data revisions, and analyse their systematic effects on the settlement prices in housing options markets.

On the data side, Deng et al (2011) report that the distribution of sale prices shifted much farther to the right at high prices than at lower prices for 1995–2010, and this pattern is particularly evident in the boom periods of 1996 and 2005–2007. The variance of the sale price distribution increased significantly during boom periods. These results imply that the variance of sale prices increased markedly during times of rapidly appreciating sale prices. More recently, China's statistics agency stopped publishing the country's much-watched official index of national property prices, owing to the underlying data accuracy being questioned (The Wall Street Journal Asia, 17 February 2011).

To handle the limited availability of housing price data, Shimizu, Nishimura and Watanabe in this paper cleverly compile a unique sample by merging four different data sets for house prices collected from different timing of the price formation and marketing periods and from various resources:

1. Initial asking price (listed in a residential information weekly magazine);
2. Final asking price (listed in a residential information weekly magazine);
3. Contract price (collected by realtors); and
4. Registry price (from the Land Registry and the Ministry of Land, Infrastructure, Transport and Tourism).

Shimizu, Nishimura and Watanabe carefully test the distributions of four different data sets, which are collected from different timing of the marketing periods. Given the timing gap between these marketing periods can be different by as much as 30 weeks in between, relying upon any single one of them (as most existing empirical research works would have done due to data unavailability) may lead to potential distributional truncation bias.

To address the modelling limitation discussed above, Shimizu, Nishimura and Watanabe adopt a quantile hedonic approach following McMillen (2008) to conduct the data quality adjustment. They find that after quality adjustment, the difference among distributions becomes smaller when two sets of prices come from closer stages. However, the p-values associated with the three tests suggest rejecting the null hypothesis that these prices are from a common distribution.

The findings reported above, however, seemingly contradict the statement in the abstract of the paper, where the authors state that "once quality differences are controlled for, there remain only small differences between the price distributions".

Final comments

The above conflict may be attributed to the fact that the quality controls used in the current study are limited to the spatial and hedonic characteristics of the building, i.e., floor space, age of building, distance to the nearest station, and travel time to the terminal station. There are other, potentially omitted quality variations missing in the current model. For example, there may have been some market variations during the 10–31 weeks' lag between the data

points from different pricing data sets; the heterogeneity in the seller's listing strategy may also lead to price distribution vitiation; furthermore, heterogeneity in negotiation between buyers and sellers in different market situations can also lead to distributional differential. A more careful specification with regard to quality adjustment, such as controlling for market characteristics and buyer and seller strategy/behaviour, is warranted here; at minimum, these can serve as robustness tests.

In addition, Shimizu, Nishimura and Watanabe can consider a revised model that follows Heckman's approach to developing a strategy to handle potential bias due to truncating distribution arising from market characteristics, the buyer and seller's heterogeneous behaviour, etc. They may also consider adopting a propensity score approach to controlling quality adjustment, and testing which quality adjustment tools/variables explain the price distributional variation.

To conclude: Shimizu, Nishimura and Watanabe have written a careful paper that improves our understanding of the housing price dynamics. I am certain this paper will play an important role in the housing price literature.

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A cluster analysis approach to examining Singapore's property market

Chan Lily, Ng Heng Tiong and Rishi Ramchand[1]

Introduction

The rapid rise of property prices following the Global Financial Crisis has featured prominently on authorities' radar screens across Asia. Price indices reached new nominal highs in several countries, while emerging signs of speculative behaviour led authorities in some countries to intervene to temper exuberance and promote more stable dynamics.

Property is an important sector in Singapore. It is the largest component of household wealth. Mortgage loans form a substantial portion of the banking systems' loan books, while the construction sector is a material contributor to economic growth. Property market stability is therefore closely linked with macroeconomic and financial stability.

Crises in property markets have sown the seeds of steep recessions and financial crises in the past (Reinhart and Rogoff, 2009). The identification of booms and busts in the property market is therefore a strand of research of perennial importance. This paper presents a data-driven approach called clustering analysis to identify different states of the property market.

Literature review

The literature that analyses the determinants of housing prices and identifies booms and busts in real estate prices can be divided into three broad categories. The first category models the probability of boom and bust episodes occurring. The second category seeks to explain deviations of market prices from model-implied prices. Studies in both these categories begin by identifying thresholds against which housing can be deemed over- or undervalued, often (but not always) using macroeconomic fundamentals. The third category adopts numerical or data-driven techniques to detect booms and busts using a dataset of fundamental indicators.

Within the first category of studies, Agnello and Schuknecht (2009) used a random effects panel probit model to model the probabilities of booms and busts. Following Harding and Pagan (2002) and Jaeger and Schuknecht (2007), they focused on persistent deviations, which were more likely to have distortionary effects on the economy. Bunda and Ca' Zorzi (2009) extended Agnello and Schuknecht (2009) by linking the probability that a peak in house prices triggered a crisis to fundamentals. More recently, Phillips and Yu (2011) concluded that there was residential real estate exuberance in Singapore in 2007 and 2008, as well as from late 2009 to January 2011. They computed a test statistic for explosive behaviour in time series, and compared it against an asymptotic distribution.

In the second category, the IMF (2011) used cross-country regressions to identify global factors that contributed to the near decade-long global housing price boom in the run-up to

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[1] Monetary Authority of Singapore. The views in this paper are solely those of the authors and should not be attributed to the Monetary Authority of Singapore. The authors are grateful to Aloysius Lim for his valuable input and comments.

the 2007 financial crisis. More recently, Tsounta (2009) and Gattini and Hiebert (2010) used error-correction models to estimate equilibrium prices in Canada and the euro area respectively, and to explain deviations of actual prices from equilibrium. Both studies used a combination of income, financing and demographic explanatory variables. Klyuev (2008) and Ahuja et al (2010) each used two methods – a panel regression approach and an asset-pricing approach – to assess overvaluation in the United States and in China, respectively. The first approach explained deviations from equilibrium using economic fundamentals, while the second explained them by deriving a relationship between prices and rents.

In the third category, Leung et al (2008) applied a clustering analysis approach to formulate a simple characterisation of the Hong Kong property market from 1996 to 2008 using a variety of demand-side variables. Periods of over- or undervaluation were grouped together based on their similarity.

Historical evolution of Singapore's property market

Between 1990 and 1996, the Urban Redevelopment Authority (URA)'s[2] Private Residential Property Price Index (PPI) more than doubled. Figure 1 shows price and transaction trends as well as key policy measures introduced since 1990. The upswing reflected long-term fundamental factors, such as high income and savings growth and rapid household formation, as well as short-term catalytic factors, such as low interest rates and foreign buying interest. In addition, rule changes in 1993 to facilitate home ownership allowed Central Provident Fund (CPF)[3] funds to be used to cover mortgage interest payments, and allowed Housing Development Board (HDB)[4] resale flat buyers to take on larger loans.

On 14 May 1996, the government announced a package of prudential and administrative measures aimed at stabilising the market. It restricted property purchases by non-Singaporeans and companies, and released more state land for development. To discourage speculative activity, a stamp duty and a capital gains tax were applied to sales of property within three years of purchase. These measures proved effective: the private property price index eased by about 16% from its peak in Q2 1996.

The onset of the Asian Financial Crisis (AFC) in mid-1997, however, led to much larger declines in both prices and transactions. The PPI reached its trough in Q4 1998, 45% below its 1996 peak. To support the market, the government relaxed stamp duties for both sellers and buyers, while developers were allowed to offer a Deferred Payment Scheme (DPS) under which purchasers could defer payments until the completion of the property.

As Singapore recovered from the AFC, private residential property prices rose 40% between end-1998 and 2000, but declined again after the collapse of the dot-com bubble in 2001, the September 2001 terrorist attack and the 2003 SARS crisis. These events prompted the government to lift the capital gains tax and to allow foreigners access to Singapore dollar property loans. Between 2003 and mid-2005, stamp duties were reduced by 30%.

The loan-to-value (LTV) limit of 80% introduced in 1996 was raised to 90% in July 2005.[5] Of the minimum 10% down payment, the cash component was reduced to 5%. Developers were

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[2] The URA is Singapore's national land-use planning and conservation authority.

[3] The CPF is a statutory board that administers Singapore's national social security savings plan.

[4] The HDB is Singapore's public housing authority.

[5] The LTV limits were raised to give banks more room to manage their risk after the government decided that financial institutions would hold first charge on home loans instead of the CPF, as was the case before.

also given more time to complete projects. These measures aided the recovery in the property market between 2005 and 2006, backed by robust global growth, improved medium-term growth prospects for Singapore and an accompanying rise in capital inflows.

Between end-2006 and their peak in Q2 2008, property prices rose about 36%, led by the high-end segment of the property market and supported more broadly by demand from new immigrants. There was, however, also evidence of short-term speculative demand. Against this backdrop, the stamp duty concession was withdrawn in December 2006 and buyers were required to pay the stamp duty within 14 days of accepting their Option-To-Purchase (OTP).[6] The DPS was withdrawn in October 2007.

The Global Financial Crisis in Q3 2008 had a severe impact on the Singapore property market. The PPI declined by about 25% from its peak, and transaction activity waned. In response, the government suspended the supply of land to developers and allowed them to phase the construction and sale of their projects. Demand recovered strongly after Q2 2009, however, as economic recovery gained traction and interest rates fell. The PPI rose 15.8% in Q3 2009, the largest q-o-q increase since Q1 1981. The government announced measures on 14 September 2009 aimed at pre-empting a speculative bubble. It increased land supply, withdrew loan schemes that could have encouraged speculation, and decided not to renew the aforementioned concessions for developers.

New sales of private residential property moderated following these measures. However, transaction activity rebounded in 2010, prompting further measures in February and August 2010. Once again, moderation was temporary, prompting further tightening of LTV limits and sellers' stamp duty (SSD) terms on 13 January 2011.

Cluster analysis

Cluster analysis refers to a collection of methods used to segregate a set of observations into groups based on their similarity/dissimilarity. Leung et al (2008) showed how one such method, called the K-means method, could be used to place the Hong Kong property market in one of several such groups, to reflect the stability of the property market at any one point in time. We use the K-means method as well, but extend the analysis to include supply-side variables.

The K-means method groups observations in a dataset into K clusters based on how close an observation is to the mean of the observations in each cluster. There are three steps.[7]

1. Assign observations to K clusters. (We do this randomly, but it is possible to optimise the initial assignment.)
2. Calculate the (squared) distance of each observation from the mean of each cluster. If an observation sits closer to the mean of another cluster than the one it currently resides in, reassign the observation to that cluster, and recalculate the means of both clusters.
3. Repeat the process until none of the observations needs to be reassigned.

[6] An interested buyer can pay 1% of the price of a property for the exclusive right to decide within 14 days whether or not to buy the property. This is called an Option-to-Purchase (OTP).

[7] In order to ensure that each variable receives equal weight in the procedure, we standardise each series by subtracting its sample mean and dividing by its sample standard deviation.

The final step is to calculate a "***cluster score***" for each cluster by adding up the means of each variable for the cluster.

Cluster analysis provides a quick summary statistic of the state of the market as explained by a combination of indicators. It provides a basis for comparing moderate states of the market, as opposed to states with extremely high or low values. The ability to monitor the moderate states is useful as it facilitates preparation for policy action. One shortcoming of this approach is that results are sensitive to the initial allocations and data updates. We find that, while results do vary slightly as new data points are included, the trend remains broadly the same in our case.

Data and construction of cluster score

Various forces have shaped the behaviour of the private property market, each exerting its influence more or less strongly at different points in time. These forces are domestic demand, both underlying and speculative demand; external demand; supply-side factors, including construction costs; and financing conditions. While an analysis that attempts to address all of the different factors would likely be intractable, we want our choice of variables to reflect as wide a range of forces as possible. We consider 13 variables, listed in Table 1, some of which have been considered in other studies. Data are quarterly, from Q1 1996 to Q4 2010.

Of the 13 variables, we choose the eight listed in bold font. GDP growth is excluded as the STI does a better job of capturing overall domestic investment sentiment. SIBOR, although an important reference rate for mortgages, has been low for several years and is unlikely to be a significant driver of the recent evolution of the market. M3, meanwhile, does not track PPI well. We exclude pipeline supply because the vacancy rate already reflects supply conditions and does so with less lag. Finally, we omit population growth as the data are annual.

We use nine clusters in our analysis. While a common rule of thumb[8] suggests six clusters may be sufficient, we opt for a larger number to allow us to make finer distinctions between observations (but not so large as to make these distinctions ambiguous). Bayesian-type information criteria also favour a larger number of observations.

Results and analysis

Figure 2 and Table 2 display the results of the cluster analysis. The coloured bars in Figure 2, read against the left-hand axis, give the cluster scores. A higher cluster score corresponds to a higher degree of upward price pressure or exuberance. For comparison, we have plotted the PPI on the same chart, as one measure of the state of the property market. The cluster scores trace the evolution of the property market reasonably well, including the peaks in 1996 and 2007. The prolonged slump from the late 1990s to the middle of the last decade is also captured.

Identifying the drivers of the property market at different parts of the cycle would enable a better understanding of the dynamics of the market, which would go some way to facilitate appropriate policy thinking and responses. The peaks in 1996 and 2007 (Cluster 9 or red

[8] Number of clusters = square root of half the number of observations.

bars) reflected strong contributions from indicators of speculative activity. Investment sentiment was also high, as suggested by the contribution of the real stock index. It was common during these periods for investors to engage in "flipping" properties, that is, placing a modest initial deposit to secure ownership of a newly launched property, and then selling it to realise capital gains before more substantial payments came due. Demand from foreigners and companies and low vacancy rates also contributed to price pressures.

Thus, there was a multitude of factors that propelled property prices to historic highs: it is for this reason that property market measures in Singapore tend to involve more than one tool. Also, not all indicators are necessarily at their individual maximum values in the cluster with the highest score (ie Cluster 9), so there is a need to monitor a range of indicators.

The drops in cluster score from the two peaks suggest that the anti-speculative measures introduced in May 1996, and the termination of the DPS, land sales and the deferment of public construction projects after 2006 helped. The cluster score fell between Q2 and Q3 1996. Likewise, it moved from level 9 in Q4 2007 to level 7 in Q1 2008.

The property market stayed between Clusters 1 and 3 in the late 1990s and the mid-2000s. With the market already cooling down in late 1996, the AFC and the ensuing recession took the wind out of the sails of the market very quickly. Weakness persisted through 1998 in spite of the withdrawal of some of the tightening measures taken two years before. Between Q1 1998 and Q4 1999, all eight indicators contributed negatively to the cluster score. This was true as well between Q3 2001 and Q4 2004, after the collapse of the dot-com bubble, the September 2001 attacks and the SARS crisis.

After 2004, however, robust global growth provided the basis for a nascent recovery in the property market. The cluster score rose to level 4. Our analysis suggests that the strongest contributor to the resurgence of the property market in 2006 was demand from foreigners and companies. This was likely, at least in part, due to the series of policy changes in 2005 that removed some of the restrictions on foreign participation in the property market.

Favourable macroeconomic conditions persisted into 2007, but the sudden upturn in the market suggests that other factors were at play as well. Supply was unable to keep up with demand. Perhaps as a result, potential buyers turned to the rental market, driving the yield on investment in property higher. Investors may have been encouraged by healthy rental returns to place their funds in the property market. Indeed, the share of sub-sale transactions rose dramatically in a short time. Positive wealth and income effects from other asset markets may have bolstered ebullience. Rising construction costs were another factor.

The PPI fell for four consecutive quarters from Q3 2008, but recovered sharply. The property market has since continued to face price pressures, with cluster scores between level 6 and level 8. However, the decomposition shows sub-sales contributing less to these pressures, reflecting the effect of the government's measures. Indeed, other drivers seem to have taken over, notably transaction activity and spillovers from public housing. A strong rebound in equity markets may also have boosted investment sentiment. In addition, a further tightness on the supply side, seen from the vacancy rate, pushed prices upward. While the government has carried out a number of land sales exercises, it will take a while for new properties to be completed.

Conclusion

Academics and policy institutions have taken several approaches to monitoring and understanding the behaviour of property markets. Clustering analysis is one such approach. It offers a tractable characterisation of the property market, which is particularly informative when the market is in a moderate state. Applied to the last 15 years of data on Singapore's property market, the methodology identifies periods of ebullience and sluggishness in prices,

and captures the effects of events that had a bearing on the property market over that time. It also shows tentative evidence of the efficacy of recent policy measures to promote stability in the market.

At the same time, we recognise the limitations of this approach, such as its sensitivity to the initial allocation of observations to clusters and the inclusion of new data points, and that it is not designed to evaluate the statistical significance or importance of the variables used.

As a concluding remark, this paper focuses exclusively on the private property market, although approximately 80% of housing in Singapore is public housing. We focus on the private housing market because access to public housing, which is subsidised by the government, is governed by strict rules and restrictions to ensure that it fulfils its aim of providing affordable housing for Singaporeans. A study of the interaction of the private and public property markets is a topic for future research.

Table 1

Potential drivers of the property market

Domestic demand	
Population growth	One way of gauging the rate of household formation, which contributes to housing demand, is to look at population growth.
Real HDB Resale Price Index	HDB "upgraders" could be a significant source of demand in the private market, if the valuation of private properties becomes relatively more attractive.
GDP growth	National economic activity affects household incomes and wealth, and therefore has a bearing on the demand side of the property market.
Real STI	The Straits Times Index (STI) is the benchmark stock index in Singapore. We use it as a proxy for domestic investment sentiment.
Speculative activity	
Sub-sale share of transactions	A sub-sale occurs when the seller of a property has not yet received the title to the property.[1] Sub-sales are commonly seen as a proxy of speculative buying and selling of properties in Singapore.
Transactions/ Stock	Transactions, expressed as a percentage of the housing stock to account for growth over time, are an indicator of exuberance in the market.
External demand	
Foreigner and company share of transactions	Purchases by foreigners and corporate buyers are more likely to be correlated with the business cycle than purchases by Singaporeans.
Other investment inflows into the banking sector	Some of the funds foreign investors use to buy property in Singapore appear in this component of the balance of payments statistics. The series is smoothed by taking a two-quarter moving average.
Supply	
100,000/Unsold units in the pipeline	The number of unsold property units in the pipeline is a direct measure of property availability and supply in the market. We divide 100,000 by this figure to yield a number of a convenient order of magnitude.
100/Vacancy rate	The vacancy rate reflects the percentage of the existing stock of properties that is currently unoccupied. We invert it to reflect that we expect the vacancy rate to be low when the property market is in a state of exuberance, and vice versa.
Construction costs	
Real Tender Price Index	The Tender Price Index, compiled by the Building and Construction Authority (BCA), is an index of construction costs that incorporates the cost of materials, manpower, plants and machinery, as well as overheads and profits
Financing and liquidity conditions	
M3 growth	Although not a perfect gauge, we explore domestic broad money growth as a measure of liquidity conditions.
Interest rates	The benchmark interest rate in Singapore is the Singapore Interbank Offered Rate, or SIBOR. It is also the reference rate for most mortgages; mortgage borrowers pay a spread over SIBOR. As Singapore uses the exchange rate rather than interest rates as a monetary policy tool, external factors exert a strong influence on interest rates.

[1] A sub-sale refers to "the sale of a unit by one who has signed an agreement to purchase the unit from a developer or a subsequent purchaser before the issuance of the Certificate of Statutory Completion and the Subsidiary Strata Certificates of Title or the Certificates of Title for all the units in the development". (URA)

Table 2

Contributions of indicators to cluster scores

	HDB RPI/GDP Deflator	STI/ GDP Deflator	Sub-sale Share	Trans-actions/ Stock	Foreign + Co. Share	Oth. Inv. Inflows (2qma)	100/ Vacancy Rate	TPI/ GDP Deflator	Cluster Score
Cluster 1	-0.53	-1.12	-0.58	-0.74	-0.48	-1.21	-0.81	-0.28	**-5.74**
Cluster 2	-0.64	-0.20	-0.57	-0.17	-0.49	-0.28	-0.57	-0.85	**-3.78**
Cluster 3	-0.12	-0.33	0.11	-0.72	-0.62	0.99	-0.79	-0.92	**-2.41**
Cluster 4	-0.81	0.63	-0.75	0.12	1.84	0.95	0.00	-0.18	**1.80**
Cluster 5	1.15	-0.38	0.70	-0.36	-0.16	0.38	0.08	0.60	**2.01**
Cluster 6	1.85	0.93	0.51	1.31	-0.26	-0.53	1.33	0.43	**5.58**
Cluster 7	0.65	0.49	1.09	-0.73	0.10	1.14	0.74	2.58	**6.07**
Cluster 8	2.30	1.31	-0.26	0.93	-0.10	0.92	2.26	0.20	**7.56**
Cluster 9	-0.36	1.32	1.46	1.75	1.49	0.72	1.22	0.85	**8.44**

Figure 1: Private residential property price and transaction trends and key policy measures introduced since 1990

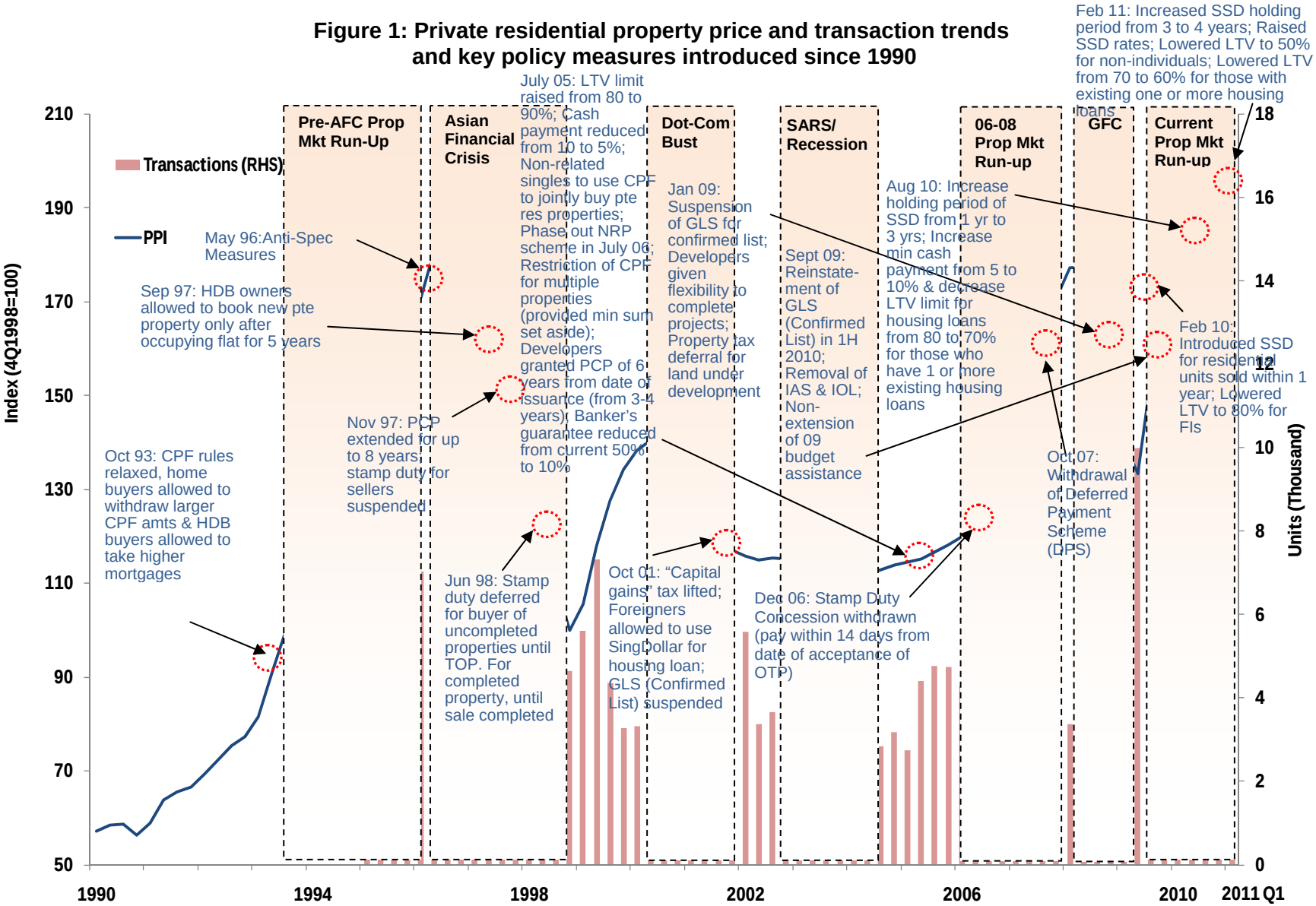
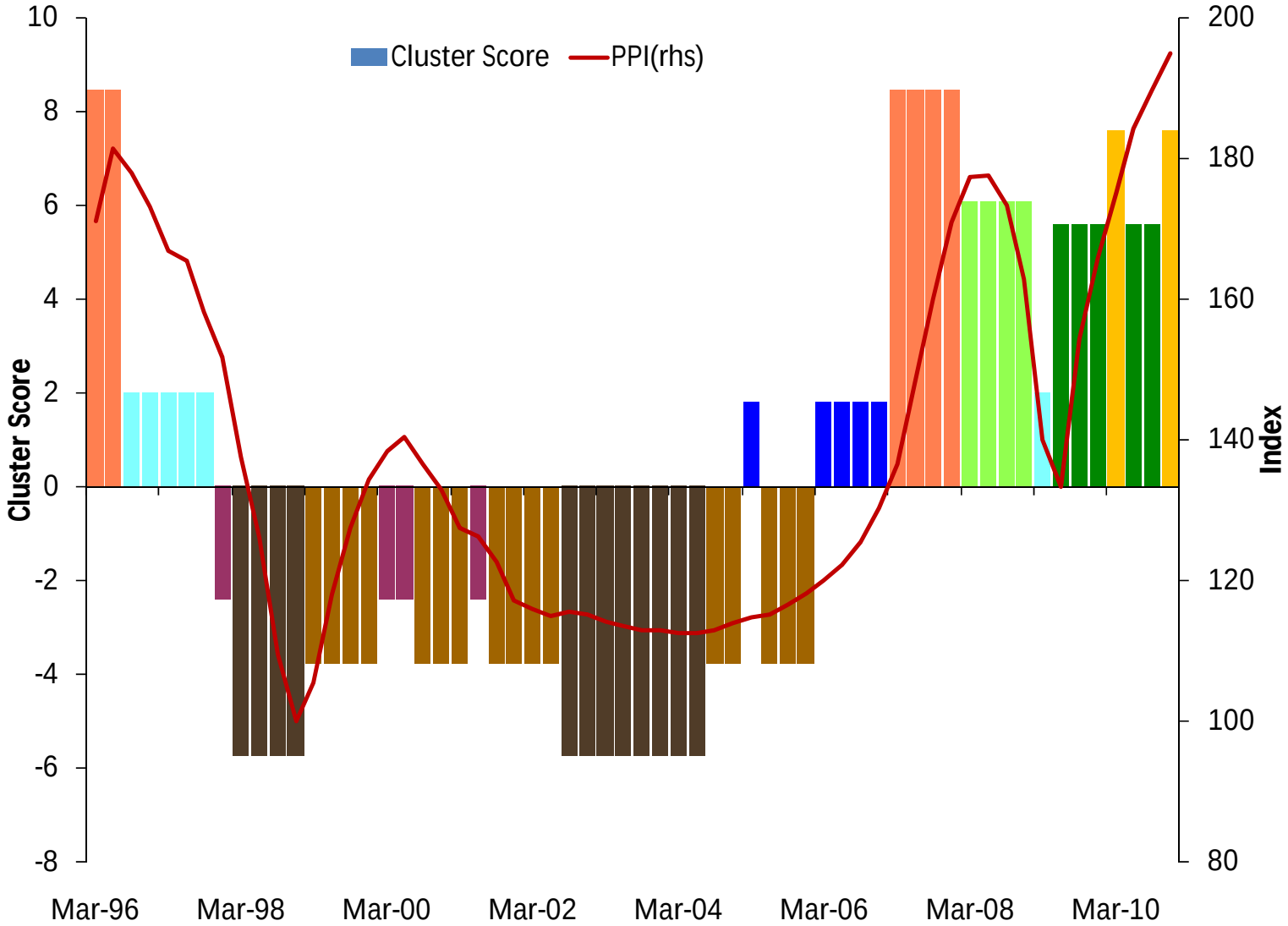


Figure 2: Cluster scores and PPI



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Discussant remarks on Chan Lily, Ng Heng Tiong and Rishi Ramchand's paper "A clustering analysis approach to examining Singapore's property market"

Sock-Yong Phang[1]

Chan Lily, Ng Heng Tiong and Rishi Ramchand have written a highly policy-relevant paper, which starts with a review of the recent literature on boom-bust cycles in housing, describes the historical evolution of Singapore's property market, and then presents findings on the use of the clustering analysis approach to monitor the state of the market.

I. The property cycle

I am glad to note that the authors are all with the Monetary Authority of Singapore (MAS), an indication of MAS' close monitoring of the property market. The volume of literature on boom-bust cycles in housing has itself witnessed a boom in the recent decade, with momentum decidedly increasing since the financial crisis of 2008. This recent attention to the property cycle from both policymakers and researchers is certainly in marked contrast to an earlier period not too long ago when housing hardly figured in either central bank research or in macroeconomics textbooks.

The recent boom in Asian real estate prices in particular has been followed up with much interest. Traditional and standard ways to track cycles identify the peaks and troughs, and use these to mark out the upturns and downturns of a series. These approaches require a long-dated time series, which is often not present in the property markets of many emerging countries. For Asian countries, there was only a concerted effort to develop relevant housing market datasets in the post-Asian Financial Crisis period. The lack of readily available data rather than the lack of interest has been a major constraint for researchers studying Asian property cycles.

The question arises as to whether the factors driving the Asian real estate boom are "different this time" from the 1990s boom. We are certainly seeing international spillover effects of a different kind and from a different source. The US Federal Reserve's Quantitative Easings 1 and 2 and its recent forward commitment to zero rates for two years have led to massive capital flows into Asian countries. Asian central banks' attempts to resist currency appreciation have resulted in conditions that have contributed to the Asian housing boom.

Focusing on Singapore, the authors have provided a detailed description of one property cycle from 1996 to 2010. Similar to the situation in many East Asian economies in the post-financial crisis period, housing market price indices are currently at all-time highs, as are population and employment numbers, GDP and GDP per capita figures (both real and nominal), as well as measures of money supply and housing loans. The Singaporean dollar has also tested historic highs vis-à-vis the US dollar, while the Swap Offer Rate, one of the key interest rates to which many housing loans are pegged, entered the negative territory in recent months. Is there a bubble in the housing market? Or has policy intervention been

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effective in preventing the development of a bubble? This paper attempts to provide answers to these important questions.

II. Policy measures to regulate the property cycle

Countercyclical policies are a major challenge given the extreme openness of Singapore's economy to external trade, capital and labour flows. Section 3 of the paper provides a comprehensive chronology of countercyclical policy measures utilised to "regulate" the Singapore property cycle since 1996. This history is useful in tracing the changes in the Singapore government's policy on property market intervention over the past two decades.

What is unusual about Singapore's overall housing market is the extent to which it has always been subject to policy intervention. With four-fifths of the housing stock built by the government housing agency, the Housing and Development Board (HDB), numerous rules governing the HDB resale or secondary market impact the private housing market. For example, deregulation of HDB and Central Provident Fund rules for resale housing loans in the 1993 period contributed significantly to the housing boom then.

The year 1996 marked the implementation of the first anti-speculative package for private housing. This occurred after much policy debate on the merits of leaving private housing prices to market forces. The period of the Asian Financial Crisis (1997 to 2005) witnessed policy measures that tried to stimulate the housing market. In the more recent housing boom, the hesitation by policymakers to intervene in order to stabilise the housing market that was evident in the pre-1996 period has all but disappeared. Between September 2009 and January 2011, there were in all three rounds of anti-speculation measures to cool the market.

The recent developments represent the "triumph" of market regulators. The market stabilisation measures implemented have not been confined to central bank measures of loan-to-value (LTV) ratios and criteria for housing loans. They have been complemented by fiscal measures which include taxation of capital gains from short-term holding of property, seller stamp duties, as well as other measures in the HDB sector.

Governments and central banks in many East Asian countries have also been proactive in intervening in their property sector. In 2010 alone, the list of countries which carried out such intervention includes China, Hong Kong SAR, India, Korea, Malaysia, and Thailand. Other than conventional interest rates and LTV ratios, lending criteria rules and exposure limits have been used. In some countries, measures specifically target cities and even districts within a city, and specific market segments within the housing market. As housing supply elasticity numbers can vary widely across a country and housing bubbles are often localised geographically, these targeted micro policies on lending are rational and understandable once a macroprudential decision has been taken to intervene.

The question then arises as to why East Asian governments and central banks have been so much more "interventionist" in their housing cycles in comparison with their counterparts elsewhere. There are some who consider interest rates and LTV ratios as too vicious in their effects and therefore overly blunt as instruments for policy intervention. Moreover, directed lending or non-lending may not be possible or acceptable in the institutional and political context of many countries. However, despite the limitations of these instruments, Basel III's solution to introduce a countercyclical capital charge (CCC) appears to be even more blunt in comparison and potentially less effective than the policy tools which Asian central banks and governments have been using. As these issues will be analysed and debated in greater depth by other paper presenters at this workshop, the next section of my discussion will contain comments more specific to the K-means clustering analysis approach used by the authors.

III. Clustering analysis approach to monitoring housing cycles

This is the first paper to use the clustering analysis approach to examine the Singapore housing cycle and represents a valuable contribution to the local literature. The authors have incorporated factors that are known to contribute to property market booms and busts into the analysis in a relatively simple manner. The eight factors (listed in Table 1 of the paper) include:

- external demand and international transmission mechanisms through "foreigner and company share of transactions" and "BOP banking flows";
- domestic demand and migration across other asset markets through "HDB resale price index" and "STI";
- speculative activity through "transactions volume" and "subsale share of transactions"; and
- supply side constraints through "vacancy rate" and "tender price index".

The authors have shown that the approach can be useful as one of the tools to evaluate policy. It provides useful answers to the following important questions. In which state is the property market? What are the main drivers? Is further policy action necessary? Or are measures implemented working? What are the potential policy risks of further intervention?

The approach is particularly useful in a context where there is a relatively short time series and certainly scores well for ease and visual simplicity in the presentation of results. Instead of having to examine eight different variables, there is only the need to track the cluster score which is presented in Chart 3 of the paper. However, information on individual variable contributions to each cluster score is still available for analysis in Table 2 of the paper.

From Table 2 of the paper, it is interesting to note that the HDB price effect is rather small in clusters 1 to 4 when the private housing market is in the doldrums, but that its effect becomes more pronounced in clusters 5 to 8. This can perhaps be explained by the effective cushion for HDB resale flat prices that is provided by prices for new HDB flats – another market stabilisation policy that is often not recognised as such. To illustrate, during the post-Asian Financial Crisis period, the HDB generally maintained its new flat prices despite having to hold a large inventory of unsold flats.

As shown in Chart 3, the cluster scores track the market well and are potentially a useful leading indicator for the Property Price Index. However, as the authors have pointed out, the results are sensitive to the initial allocation of the observations, the number of clusters (states), and new data becoming available. The predictive ability of the technique has also not been ascertained, and more research in this area is warranted.

Although the K-means method has its shortcomings and limitations, it is another useful approach to monitoring the housing market. There is a need for more rather than fewer tools for monitoring and macroprudential surveillance. Multiple approaches are needed, and it would be interesting to compare the authors' findings with other approaches and forecasting techniques currently used by the MAS.

IV. Final comment

The property cycle is a more challenging cycle to track than the business cycle, since it is much more sensitive to "animal spirits". The role of expectations is a factor that is currently not considered within the framework of this approach. Other than expectations of market variables such as interest rates and exchange rates, expectations of policy intervention at

various stages of the property cycle could serve to temper irrational exuberance as well as mute the effects of intervention.

To conclude, the authors have written a thought-provoking and valuable paper on monitoring the state of the Singapore property market and the role of policy intervention to stabilise the market. This is an increasingly important policy area – certainly controversial – and I am certain the paper will contribute to informing the debate in Singapore and elsewhere.

Dealing with real estate booms and busts

Deniz Igan[1]

Introduction

The global financial crisis changed the way we view macroeconomic policy, especially in the context of housing and mortgage markets. The main policy tenet in dealing with a real estate boom used to be "benign neglect" (Bernanke (2002)): better to wait for the bust and pick up the pieces than to attempt to prevent the boom. Two assumptions underlie this advice: the belief that it is extremely difficult to identify unsustainable booms, or "bubbles", in real time and the notion that the distortions associated with preventing a boom outweigh the costs of cleaning up after a bust. But the crisis has shown that post-bust policy intervention can be of limited effectiveness, and thus the costs associated with a bust can be daunting. While early intervention may engender its own distortions, it may be best to undertake policy action on the basis of a judgment call if there is a real risk that inaction could result in catastrophe.

Yet a call for a more preventive policy action raises more questions than it provides answers to. What kind of indicators should trigger policy intervention to stop a real estate boom? If policymakers were fairly certain that intervention was warranted, what would be the policy tools at their disposal? What is their impact? What are their negative side effects and limitations? What practical issues would limit their use? This short paper explores these questions.

It should be recognised at the outset that there is no silver bullet. A more proactive policy stance can help reduce the risks associated with real estate booms, but will inevitably entail costs and distortions, and its effectiveness will be limited by loopholes and implementation problems. With this in mind, we reach the following conclusions. Policy efforts should focus on booms that are financed through credit, and when leveraged institutions are directly involved, as the following busts tend to be more costly. In that context, monetary policy is too blunt and costly a tool to deal with the vulnerabilities associated with increased leverage, unless the boom occurs as a result of or at the same time as broader economic overheating. Fiscal tools may be, in principle, effective. But in practice they would likely create distortions and are difficult to use in a cyclical fashion. Macroprudential tools (such as limits on loan-to-value ratios) are the best candidates to deal with the dangers associated with real estate booms as they can be aimed directly at curbing leverage and strengthening the financial sector. But their careful design is crucial to minimise circumvention and regulatory arbitrage. Further, they will entail a cost to the extent that some agents find themselves rationed out of credit markets.

In what follows, we first give a summary of how real estate boom-bust cycles may threaten financial and macroeconomic stability. Then we discuss different policy options to reduce the risks associated with real estate booms, drawing upon several country experiences (a more

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detailed analysis of country cases is in Crowe et al (2011)). We conclude with a brief discussion of guiding principles in dealing with real estate booms.

The case for policy action

Leverage and the link to crises

From a macroeconomic stability perspective, what matters may be not the boom in itself, but how it is funded. Busts tend to be more costly when booms are financed through credit and leveraged institutions are directly involved. This is because the balance sheets of borrowers (and lenders) deteriorate sharply when asset prices fall. When banks are involved, this can lead to a credit crunch with negative consequences for real economic activity. In contrast, booms with limited leverage and bank involvement tend to deflate without major economic disruptions. For example, the burst of the dot-com bubble was followed by a relatively mild recession, reflecting the minor role played by leverage and bank credit in funding the boom.

Real estate markets are special along both these dimensions. The vast majority of home purchases and commercial real estate transactions in advanced economies involve borrowing. And banks and other levered players are actively involved in the financing. Moreover, homebuyers are allowed leverage ratios orders of magnitude higher than for any other investment activity. A typical mortgage loan carries a loan-to-value ratio of 71 per cent on average across a global sample of countries. In contrast, stock market participation by individuals hardly ever relies on borrowed funds. And when it does, loans are subject to margin calls that prevent the build-up of highly leveraged positions.

During the current crisis, highly leveraged housing markets had a prominent role, but this pattern is not limited to the United States, nor is it new to this crisis. The amplitude of house price upturns prior to 2007 is statistically associated with the severity of the crisis across countries (Claessens et al (2010)). Put differently, the US market may have been the initial trigger, but the countries that experienced the most severe downturns were those with real estate booms of their own. And, historically, many major banking distress episodes have been associated with boom-bust cycles in property prices (Reinhart and Rogoff (2008)). A distinguishing feature of “bad” real estate boom-bust episodes seems to be coincidence between the boom and the rapid increase in leverage and exposure of households and financial intermediaries. In the most recent episode, almost all the countries with “twin booms” in real estate and credit markets (21 out of 23) ended up suffering from either a financial crisis or a severe drop in GDP growth rate. Eleven of these countries actually suffered from both damage to the financial sector and a sharp drop in economic activity. In contrast, of the seven countries that experienced a real estate boom but not a credit boom, only two went through a systemic crisis and they, on average, had relatively mild recessions.

Wealth and supply-side effects

Real estate is an important, if not the most important, storage of wealth in the economy. Additionally, the majority of households tend to hold wealth in their homes rather than in equities. Typically, in advanced economies less than half of households own stock (directly or indirectly), while the home ownership rate hovers around 65 per cent. In addition, the supply-side effects can be substantial. In most advanced economies, house price cycles tend to lead credit and business cycles (Igan et al (2009)). This suggests that fluctuations in house prices create ripples in the economy through their impact on residential investment, consumption and credit, while the reverse effect is not as prominent, implying that the housing sector can be a *source* of shocks. Recessions that coincide with a house price bust tend to be deeper and last longer than those that do not, and their cumulative losses are three times the damage done during recessions without busts. Again, by contrast, recessions

that occur around equity price busts are *not* significantly more severe or persistent than those that do not (Claessens et al (2008)).

Illiquidity, opacity and network effects

Boom-bust cycles are an intrinsic feature of real estate markets. This reflects delays in supply response to demand shocks, and the slow pace of price discovery due to opaque and infrequent trades, as well as illiquidity owing to high transaction costs and the virtual impossibility of short sales. In other words, real estate prices and construction activity can be expected to display large swings over long periods, even absent the distortions due to institutional features of real estate finance and policy actions. Network externalities also complicate the picture. Homeowners in financial distress have diminished incentives to maintain their properties and do not internalise the effects of this behaviour on their neighbours. Similarly, foreclosures reduce the value of neighbouring properties beyond their effect through fire sales. The double role of real estate as investment and consumption good may reduce mobility and increase structural unemployment, as households in negative equity may be reluctant or unable to sell and take advantage of job opportunities elsewhere. Hence, a housing bust may weaken the positive association between employment growth and mobility.

Policy options

The crisis has lent some support to the camp favouring early intervention in real estate boom-busts. If we accept that intervention may be warranted although it is difficult to separate good from bad booms, the question arises as to which policy is the best to stop the latter. The main risks from real estate boom-busts come from increased leverage in both the real (in particular, households) and financial sectors. Then policies should, whenever possible, aim at containing these risks rather than price increases. In that context, policies should target two, non-mutually exclusive objectives: (i) preventing real estate booms and the associated leverage build-up altogether, and (ii) increasing the resilience of the financial system to a real estate bust.

What follows are explorations. The narrative focuses on residential real estate, but several (although not all) of the measures discussed would easily apply to commercial real estate booms as well. We examine the potential role of monetary, fiscal, and macroprudential policies by discussing the benefits and challenges associated with each option and using case studies of countries with experience in the use of particular measures and, where possible, cross-country evidence.

Monetary policy

Can monetary tightening stop or contain a real estate boom? An increase in the policy rate makes borrowing more expensive and reduces the demand for loans. Besides, higher interest payments lower affordability and shrink the number of borrowers that qualify for a loan of a certain amount. Indirectly, to the extent that monetary tightening reduces leverage in the financial sector, it may alleviate the financial consequences of a bust even if it does not stop the boom (De Nicolo et al (2010)).

Yet monetary policy is a blunt instrument for this task. First, it affects the entire economy and is likely to entail substantial costs if the boom is limited to the real estate market. Put differently, a reduction in the risk of a real estate boom-bust cycle may come at the cost of a larger output gap and the associated higher unemployment rate (and possibly an inflation rate below the desired target range). Obviously, these concerns are diminished when the boom occurs in the context (or as a consequence) of general macroeconomic overheating.

A second concern is that, during booms, the expected return on real estate can be much higher than what can be affected by a marginal change in the policy rate. It follows that monetary tightening may not directly affect the speculative component of demand. If that is the case, it may have the perverse effect of leading borrowers towards more dangerous forms of loans. For instance, in the Czech Republic, Hungary and Poland, monetary tightening led to decreased domestic currency lending but accelerated foreign currency-denominated loans (Brzoza-Brzezina et al (2007)). Moreover, under free capital mobility, the effectiveness of monetary policy may be limited, especially for not fully flexible exchange rate regimes. Finally, the structure of the mortgage market also matters: in systems where mortgage rates depend primarily on long-term rates, the effectiveness of monetary policy will depend on the relationship between long and short rates.

To a large extent, empirical evidence supports these concerns, leading to the bottom line that monetary policy could in principle stop a boom, but at a very high cost. Policymakers would have to "lean against the wind" dramatically to have a meaningful impact on real estate prices and credit, with large effects on output and inflation. This is confirmed by a panel vector autoregression, which suggests that, at a 5-year horizon, a 100 basis point hike in the policy rate would reduce house price appreciation by only 1 percentage point, compared to a historical average of a 5 per cent increase per year (see Crowe et al (2011) for details). But it would also lead to a decline in GDP growth by 0.3 percentage points.

Fiscal tools

A variety of fiscal measures (transaction taxes, property taxes, deductibility of interest payments) has a bearing on the decision to invest in real estate. The result is often a socially driven favourable treatment of home ownership (and sometimes housing-related debt). In theory, some of these fiscal tools could be adjusted cyclically to influence house price volatility, while preserving the favourable treatment of home ownership on average over the cycle.

Yet if the net present value of all future taxes are capitalised in property prices, adjusting taxes countercyclically around the same expected mean would not affect the prices. Also, the evidence on the relationship between the tax treatment of residential property and real estate cycles is inconclusive: during the most recent global house price boom, real house prices increased significantly in some countries with tax systems that are highly favourable to housing (such as Sweden), as well as in countries with relatively unfavourable tax rules (such as France). Similarly, appreciation was muted in countries with both favourable systems (eg Portugal) and unfavourable ones (eg Japan). Overall, taxation was not the main driver of house price developments during the recent global housing boom (Keen et al (2010)).

Technical and political economy problems may further complicate implementation of cyclically adjusted fiscal measures. In most countries, tax policy is separated from monetary and financial regulation policies, making it extremely hard to implement changes in tax policies as part of a cyclical response with financial stability as the main objective. Instead, local governments may use lower property or transaction taxes to attract residents during good times if the burden in the case of a bust is shared with other jurisdictions. The ability of cyclical transaction taxes to contain exuberant behaviour may be further compromised if homebuyers do not respond to these taxes fully, because they consider them to be an acceptable cost for an investment with high returns and consumption value. Also, during a boom phase, the incentives to "ride the bubble" may increase efforts to circumvent the measure by misreporting property values or folding the tax into the overall mortgage amount. Finally, as with most tax measures, the distortions created by a cyclical transaction tax may make it more difficult to evaluate a property, which already tends to be a hard task, and also make the mobility of households more difficult, with potential implications for the labour market.

Macroprudential regulation

At least in theory, macroprudential measures, such as higher capital requirements or limits on various aspects of mortgage credit, could be designed to target narrow objectives (for instance, household or bank leverage) and tackle the risks associated with real estate booms more directly and at a lower cost than with monetary or fiscal policy.

Against the benefit of a lower cost, these measures are likely to present two shortcomings. First, it may be easier to circumvent them as they target a specific type of contracts or group of agents. When this happens, these measures can be counterproductive, as they may lead to liability structures that are more difficult to resolve/renegotiate in busts. Second, they may be more difficult to implement from a political economy standpoint since their use could be considered an unnecessary intrusion into the functioning of markets and since winners and losers would be more evident than in the case of macroeconomic policies.

We focus our analysis on three specific sets of measures: (1) capital requirements or risk weights that change with the real estate cycle, (2) dynamic provisioning (the practice of increasing banks' loan loss provisions during the upswing phase of the cycle), (3) cyclical tightening/easing of eligibility criteria for real estate loans through loan-to-value (LTV) and debt-to-income (DTI) ratios. These tools may be able to achieve both objectives: (i) reducing the likelihood and/or magnitude of a real estate boom (for instance, by imposing measures to limit household leverage), and (ii) strengthening the financial system against the effects of a real estate bust (for example, by urging banks to save in good times for rainy days).

A major limitation in assessing the effectiveness of macroprudential tools stems from the fact that macroprudential policy frameworks are still in their infancy, and only a handful of countries have actively used them. And these measures have been typically used in combination with macroeconomic policy and direct interventions to the supply side of housing markets (such as in Singapore), further complicating the challenge of attributing outcomes to specific tools.

Yet much can be learned from case studies. Following the Asian crisis, some countries in the region took a more heavy-handed approach to dealing with the risks posed by real estate booms. Countries in Central and Eastern Europe experimented with various measures to control the rapid growth in bank credit to the private sector in the 2000s. Others put in place a dynamic provisioning framework. On the whole, success stories appear to be few, perhaps to some extent reflecting the learning curve in expanding the policy toolkit, improving the design of specific tools, and sorting out implementation challenges. But when policy succeeded in slowing down a boom and avoiding a systemic crisis in a bust, it almost always involved some macroprudential measures (a detailed account of these cases is in Crowe et al (2011)).

Higher capital requirements/risk weights

Capital regulation has a procyclical effect on the supply of credit. During upswings, better fundamentals reduce the riskiness of a given loan portfolio, improving a bank's capital adequacy ratio and its ability to expand its assets. In a downturn, the opposite happens. Procyclical capital requirements could help reduce this bias. Further, by forcing banks to hold more capital in good times, it would help build buffers for future losses.

For real estate loans, the procyclical element of capital regulation is largely absent. In most countries, existing rules do not take collateral values into consideration or reflect the heterogeneity among loans backed by real estate, other than the commercial-residential distinction. Under Basel II's standard approach, risk weights for property loans are fixed (50 per cent for residential mortgages and 100 per cent for commercial property loans). As a result, mortgage loans with predictably different default probabilities (for instance, because of different LTV ratios or exposure to different aggregate shocks) are often bundled in the same risk category and no adjustment is made over time to account for the real estate cycle. In this

context, capital requirements or risk weights linked to real estate price dynamics could help limit the consequences of boom-bust cycles. By forcing banks to hold more capital against real estate loans during booms, these measures could build a buffer against the losses during busts. And by increasing the cost of credit, they might reduce demand and contain real estate prices themselves. Finally, weights could be fine-tuned to target regional booms.

A few caveats are in order. First, absent more risk-sensitive weights, an across-the-board increase in risk weights (or capital requirements) carries the danger of pushing lenders in the direction of riskier loans. Thus, the introduction of procyclical risk weights for real estate loans should be accompanied by the implementation of a finer cross-sectional risk classification as well. Second, as with any other measure increasing the cost of bank credit (when credit is in high demand), procyclical risk weights may be circumvented through recourse to nonbank intermediaries, foreign banks, and off-balance sheet activities. Third, these measures will lose effectiveness when actual bank capital ratios are well in excess of regulatory minima (as often happens during booms). Fourth, while improving the resilience of the banking system to busts, tighter requirements are unlikely to have a major effect on credit availability and prices. Put differently, they are unlikely to reduce vulnerabilities in the real (household) sector. Finally, regulators may be reluctant to allow banks to reduce risk weights during a bust (when borrowers become less creditworthy).

The empirical evidence on the effectiveness of these measures is mixed. In an effort to contain the rapid growth in bank credit to the private sector and the associated boom in asset markets, several countries have raised capital requirements and/or risk weights on particular groups of real estate loans. Some attempts (such as in the cases of Bulgaria, Croatia, Estonia, and Ukraine) failed to stop the boom; others (such as in the case of Poland) were at least a partial success. Yet it is not easy to say why measures taken in one country may have been more effective than those taken elsewhere or how much other developments account for the observed changes. Furthermore, even in countries where tighter capital requirements appeared to produce some results in controlling the growth of particular groups of loans, real estate price appreciation and overall credit growth remained strong.

Dynamic provisioning

Dynamic provisioning (the practice of mandating higher loan loss provisions during upswings, one of the elements in Basel III) can help limit credit cycles. The mechanics and benefits are similar to those of procyclical capital requirements. By forcing banks to build (in good times) an extra buffer of provisions, it can help cope with the potential losses that come when the cycle turns (see, for example, the case of Spain). It is, however, unlikely to cause a major increase in the cost of credit, and thus to stop a boom. That said, one advantage over cyclical capital requirements is that dynamic provisioning would not be subject to minima as capital requirements are, so it can be used when capital ratios maintained by banks are already high. Provisioning for property loans could be made a specific function of house price dynamics. In periods of booming prices, banks would be forced to increase provisioning, which they would be allowed to wind down during busts. As in the case of risk weights, provisioning requirements could depend on the geographical allocation of a bank's real estate portfolio.

This measure is primarily targeted at protecting the banking system from the consequences of a bust rather than having a significant impact on credit and containing other vulnerabilities, such as increases in debt and leverage in the household sector. In addition, practical issues and unintended effects, such as calibration of rules with rather demanding data requirements and earnings management (which may raise issues with tax authorities and securities markets regulators), should be discussed in each country's context to design a framework that best fits the country's circumstances. There are also other shortcomings, similar to those of procyclical risk weights (being primarily targeted at commercial banks, dynamic provisioning may be circumvented by intermediaries outside the regulatory perimeter). Lastly,

application of the measure only to domestically regulated banks may hurt their competitiveness and shift lending to banks abroad, raising cross-border supervision issues.

The experience with these measures suggests that they are effective in strengthening a banking system against the effects of a bust, but do little to stop the boom itself. Spain led the countries that have adopted countercyclical provisioning and constitutes an interesting case study for a preliminary assessment of its effectiveness. Starting in 2000, and with a major revision in 2004, the Bank of Spain required banks to accumulate additional provisions based on the "latent loss" in their loan portfolios (for more details on the Spanish dynamic provisioning framework, see Saurina (2009)). Dynamic provisions forced banks to set aside, on average, the equivalent of 10 per cent of their net operating income. Yet household leverage grew by a still-high 62 per cent in Spain. At the end of 2007, just when the real estate bust started, total accumulated provisions covered 1.3 per cent of total consolidated assets, in addition to the 5.8 per cent covered by capital and reserves (for some perspective, the value of the housing stock has, so far, decreased by roughly 15 per cent in real terms). Hence, Spanish banks had an important buffer that strengthened their balance sheets when real estate prices started to decline and the economy slipped into recession.

Limits on loan-to-value and debt-to-income ratios

A limit on LTV ratios can help prevent the build-up of vulnerabilities on the borrower side. The lower the leverage, the greater the drop in prices needed to put a borrower into negative equity. This will likely reduce defaults when the bust comes as more borrowers unable to keep up with their mortgages will be able to sell their houses. In addition, in case of default, lenders will be able to obtain higher recovery ratios. On the macroeconomic front, a limit on LTV ratios will reduce the risk that a large sector of the real economy ends up with a severe debt overhang. In addition, it will reduce the pool of borrowers that can obtain funding (for a given price) and thus will reduce demand pressures and contain the boom.

Similar to limits on LTV ratios, limits on DTI ratios will rein in the purchase power of individuals, reducing the pressure on real estate prices. In particular, they will be effective in containing speculative demand: they will screen out borrowers that would qualify for a mortgage only on the assumption the house would be quickly turned around. They will also reduce vulnerabilities, as borrowers will have an "affordability" buffer and will be more resilient to a decline in their income or temporary unemployment.

Careful design of these measures is the key to limiting circumvention. For instance, in Korea, lower LTV limits for loans with less than three years of maturity spurred a boom in loans originated with a maturity of three years and one day. In the United States, during the housing boom, the practice of combining two or more loans to avoid mortgage insurance, which kicked in when the LTV ratio exceeded 80 percent, became common. Similarly, an obvious way to get around a DTI limit would be to extend sequential loans and report the ratios separately. In Hong Kong SAR, where regulators impose maximum limits on the debt service ratio, which takes into account the payments the borrower has to make on non-mortgage loans as well, supervisors often encounter cases where lenders do not report all outstanding debt obligations. Circumvention may entail significant costs, as it may result in liability structures that can complicate debt resolution during busts (for example, in the United States, it is often second-lien holders that object to restructuring). In addition, circumvention may also involve shifting of risks not only across mortgage loan products, but also outside the regulatory perimeter, through expansion of credit by nonbank, less-regulated financial institutions and/or by foreign banks, which may result in increased currency mismatches as the proportion of foreign currency-denominated loans rises.

The narrow target nature of these measures may increase political economy obstacles (as happened in the case of Israel), particularly since the groups more impacted by LTV and DTI limits tend to be those more in need of credit, such as poorer and younger individuals. In addition, unlike with more "macro" measures, the consequences of these limits are

immediate and transparent. Beyond these political economy considerations, LTV and DTI limits, by rationing sensitive groups out of credit markets, will entail a cost in terms of diminished intertemporal consumption smoothing and lower investment efficiency.

The scant existing empirical evidence suggests that these are promising measures. For example, in a simple cross-section of 21 (mostly) developed countries, maximum LTV limits are positively related to house price appreciation between 2000 and 2007. And back-of-the-envelope calculations suggest that a 10 percentage point increase in maximum LTV allowed by regulations is associated with a 13 per cent increase in nominal house prices (see also Duca et al (2010)).

Experiences of countries that experimented with changing mandatory LTV limits in response to real estate market developments also suggest that doing so can be quite effective. When the Korean authorities introduced LTV limits in September 2002, the month-on-month change in house prices decreased by 3 percentage points immediately and remained low until April 2003. A similar pattern applies to DTI limits, with month-on-month change dropping by 2 percentage points in August 2005 with the introduction of the measure. Interestingly, the measures had a much smaller (or no) impact on prices in "non-speculative" areas where the limits were untouched. The impact on year-on-year changes, however, has been smaller, since prices tend to start increasing at a faster pace again after the first immediate reaction. In Hong Kong SAR, prudent lending practices guided by LTV and DTI limits have been credited with pausing the house price boom briefly in 1994 and guarding the system against the fallout from the crash in 1997 (Wong et al (2004); also see Wong et al (2011)).

Conclusion

The correct policy response to real estate booms is, like many other policymaking decisions, an art more than a science. Macroprudential measures seem to be the best option to achieve the objective of curbing real estate prices and leverage because they attack the problem at its source, adapt to specific circumstances in different locations at different times, and give the added benefit of increasing the resilience of the banking system.

Ultimately, policy recommendations depend on the characteristics of the real estate boom in question. In particular, if property prices are out of sync with income and rent and leverage is increasing rapidly, taking action is advisable. In deciding which policy option to choose, policymakers should adopt a wider view of the economy and complement targeted measures with broader macroeconomic tightening if the boom is a part or a reflection of general overheating in the economy.

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Discussant remarks on Deniz Igan's paper "Dealing with real estate booms and busts"

Veronica Cacdac Warnock[1]

This paper addresses a timely and important question: how should policymakers deal with real estate booms? Its most important contribution is the assembling and presentation of a range of information on policy tools that have been used in various countries. Most readers will want to go straight to this information, which is presented in Table 3 (which summarises by country some background information, the actions taken, and the outcomes) and Appendix Table 1 (which provides some detail on policy frameworks, including monetary policy, tax systems, and regulatory structure by country) of the original paper.[2]

The paper sets out to address two principal questions: What kind of indicators should trigger policy intervention to stop or slow down a real estate boom? What policy tools are at the disposal of policymakers, and for each tool, what is its impact, what are its negative side effects and limitations, and what are the practical issues that might limit its use?

On the first question, the authors are mostly silent. They state that "better yardstick indicators (such as price-income and price-rent ratios, measures of credit growth and leverage) can be developed to guide the assessment of the risks". But what are these better yardstick indicators? The paper has nothing additional on this important point. Do we know when rapid house price increases are problematic (a bubble) and when they are benign (perhaps in line with fundamentals)? To adequately answer the first question the authors pose in the introduction, much more is needed to help distinguish between "bad" booms and more benign (even beneficial) ones.

On the tools, the paper describes three, namely monetary policy, fiscal policy, and macroprudential regulation. Two objectives are to prevent real estate booms and the associated leverage build-up and to increase the resilience of the financial system to real estate busts. In their assessment of the policies, the authors also discuss how these were able to control sharp increases in house prices, curb speculative demand, or reduce default risk, whether the measure directly targets a narrow aspect of the real estate cycle or the economy more broadly, and the potential costs.

In the policy tools section of the paper, country cases are discussed rather cursorily. It would have been valuable if the authors had delved deeper into country cases for Australia and Sweden (on monetary policy), Spain (on dynamic provisioning), and Hong Kong (on loan-to-value and debt-to-income limits). In order to carry out the objective of the paper, these discussions could be on the salient points of the whys and hows of the policy actions. More information on country cases (for many countries) is in the two tables mentioned above. A bit more depth for a few countries would be helpful.

In the conclusion, the authors rather forcefully state that, from their analysis, some "core principles in guiding policymakers to design an effective policy toolkit to deal with real estate booms emerge". Four core principles are listed. It is not clear, however, that there is a link from the analysis in the paper to these policy recommendations. It seems that most of the

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[2] Christopher Crowe, Giovanni Dell'Ariccia, Deniz Igan and Pau Rabanal, "How to deal with real estate booms: lessons from country experiences," IMF Working Paper No. 11/91.

recommendations emerge from a highly stylised DSGE model tacked onto the end of the paper. It is less clear that any of the recommendations follow from the careful (and useful) information assembled in Table 3 and Appendix Table 1. This is a bit of a lapse. The paper's subtitle is "Lessons from country experiences", but then the lessons seem to come from a theoretical model and not from the country cases. It would be useful if the lessons drawn in the conclusion came from the information on the country experiences brought together in this paper.

To summarise, two lapses detract from this paper. First, it states that it will address an important question (What indicators should trigger policy intervention?), but never does. Second, it states conclusions ("core principles in guiding policymakers") that do not follow from the country experiences it presents. Both of these points are easily addressed. If the authors do not assess the types of indicators that should trigger policy responses, they should just remove that from the introduction and move it to the conclusion as an important area for future work. Moreover, the lessons drawn from the analysis and highlighted in bullet points in the conclusion should be lessons from country experiences, as implied by the title, not conclusions that emerge from a stylised theoretical model (a model that should probably be removed from the paper).

With these two adjustments, the reader can focus on the paper's strength – the assembling and presentation of a range of information on policy tools that have been used in various countries. The literature will benefit significantly from the paper's compilation of policy actions as well as each country's monetary policy, tax systems and regulatory structure.

Capital inflows, financial innovation and housing booms

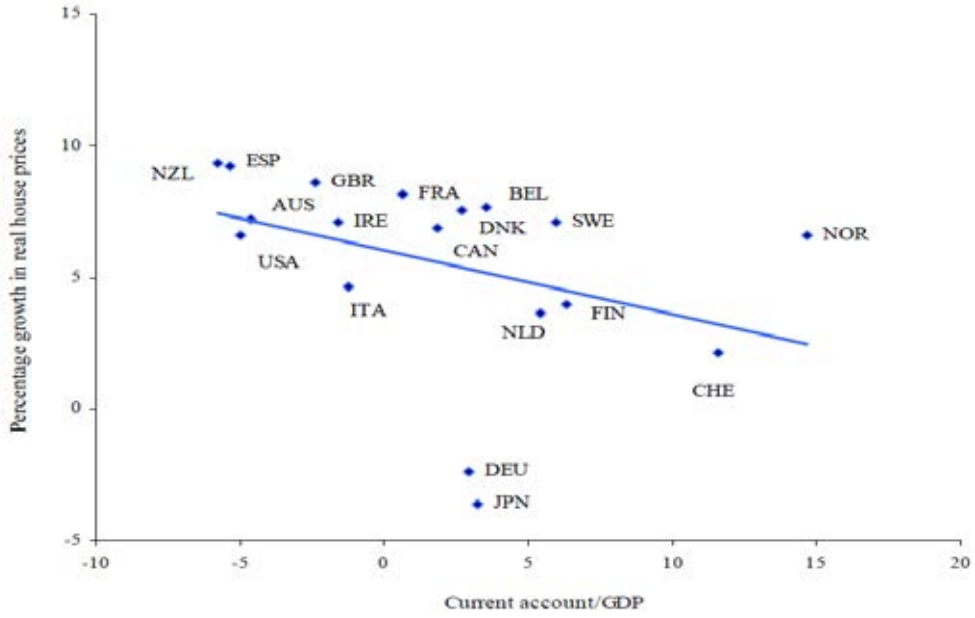
Filipa Sá, Pascal Towbin and Tomasz Wieladek[1]

1. Summary

The run-up to the recent global financial crisis was characterised by an environment of low interest rates and a rapid increase in housing market activity across OECD countries. Some scholars argue that expansionary monetary policy was responsible for the low level of interest rates and the subsequent house price boom.[2] Others contend that the low degree of financial development in emerging market economies led to capital inflows to developed countries, depressing long-term interest rates and stimulating an increase in the demand for housing.[3] Figure 1 provides support for this hypothesis, showing that in the period from 1999 to 2006, house prices rose by more in countries with larger current account deficits. This negative correlation suggests the presence of an important link between the current account balance and the housing sector, but the direction of causality is unclear.

Figure 1

House prices and the current account



Notes: Data are averages over the period 1999 Q1 to 2006 Q4. Current account/GDP is from the OECD Economic Outlook. Real house price index is from the BIS Property Price Statistics.

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[2] This is the view in Hume and Sentance (2009) and Taylor (2009).

[3] See, for example, Caballero et al (2008), Warnock and Warnock (2009) and Bernanke (2010).

One other factor which is thought to have played a role in amplifying the effect of interest rate movements on housing activity is financial innovation. In more developed mortgage markets, consumers have easier access to credit and tend to be more leveraged. In the presence of financial frictions, the impact of changes in interest rates on consumer wealth and the housing market should become stronger when leverage is higher. This is the idea behind the financial accelerator effect developed by Bernanke and Gertler (1989) and Kiyotaki and Moore (1997). In addition to this effect, there may also be amplification through securitisation. Diamond and Rajan (2009) argue that excessive securitisation has led to a misallocation of capital to the real estate sector, exacerbating the effect of interest rate movements on housing activity.

Each of these explanations has different policy implications. Should policymakers try to address external imbalances, increase financial regulation or redesign the monetary policy framework to prevent future boom and bust episodes in the housing market?

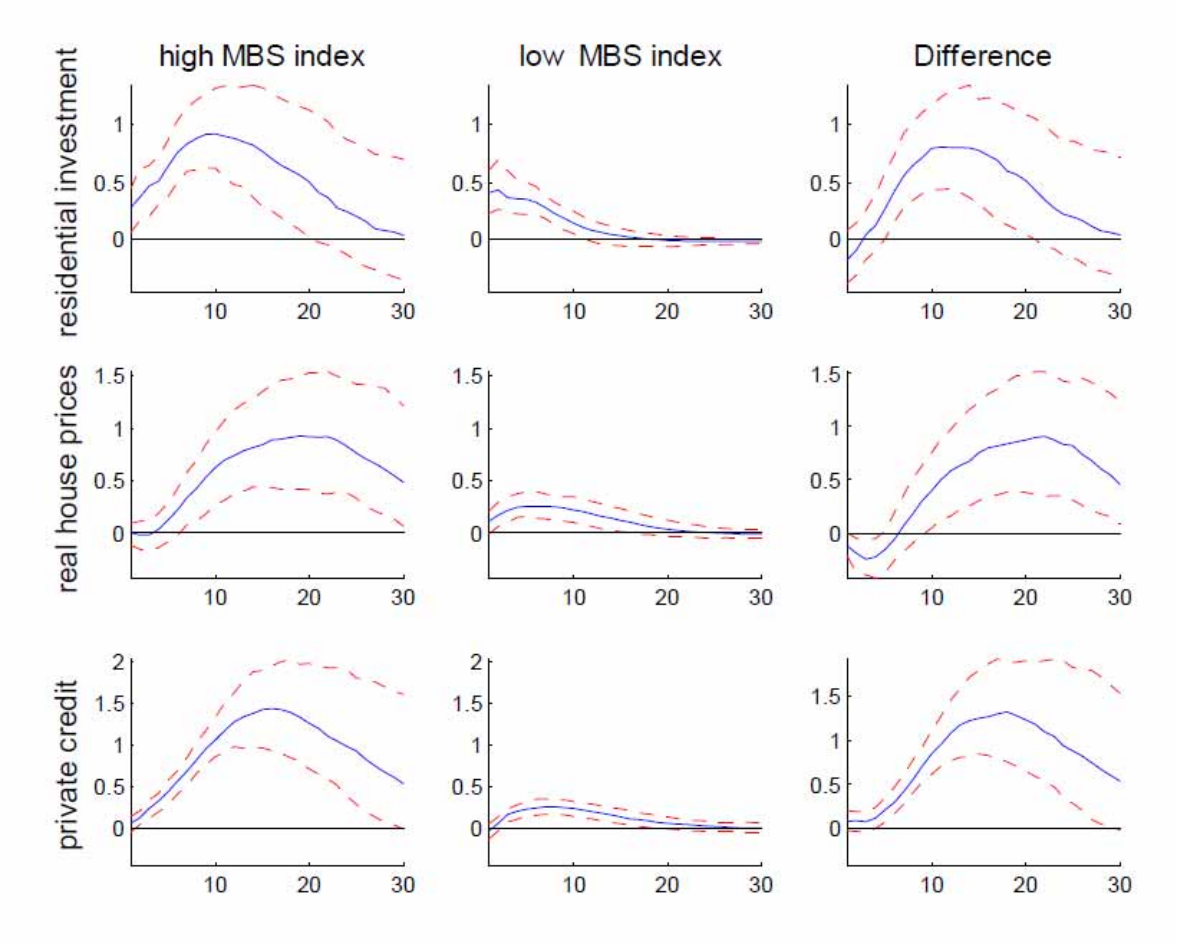
In Sá et al (2011), we estimate a Vector Auto Regressive (VAR) model for a panel of 18 OECD countries and look at the effects of capital inflows, monetary policy and financial innovation on the housing sector. Monetary policy and capital inflows shocks are identified using the sign restrictions approach developed by Canova and de Nicoló (2002) and Uhlig (2005). We look at the effect of both types of shocks on real credit to the private sector, real residential investment, and real house prices. We also assess whether the degree of mortgage market development or legislation permitting issuance of mortgage-backed securities amplifies or dampens the impact of these shocks on the housing sector.

Our results suggest that both monetary policy and capital inflows shocks have a significant and positive effect on house prices, credit to the private sector and residential investment. A reduction of 10 basis points in long-term nominal interest rates caused by an expansionary monetary policy shock raises real credit and house prices by about 0.3% and 0.2%, respectively, after ten quarters and real residential investment by about 0.25% after three quarters. A similar reduction in long-term rates caused by a capital inflows shock has a larger effect, with the rise in real credit to the private sector and real house prices reaching a peak of about 0.4% after ten quarters. The response of real residential investment to capital inflows shocks is quicker and more short-lived, peaking at 0.6% after two quarters.

The effects of both shocks are greater in countries with a higher degree of mortgage market development. This suggests that excessive financial innovation may act as a propagation mechanism. The existence of mortgage-backed securities has a much larger effect on the transmission of capital inflows shocks. Legislation permitting the issuance of mortgage-backed securities increases the impact of capital inflows shocks on real house prices, real residential investment and real credit to the private sector by a factor of two, three and five, respectively (see Figure 2). This may be explained by the fact that securitisation packages mortgages together and slices them in different levels of risk. The riskiest tranches can be bought by investors with higher risk appetite, while the AAA tranches can be sold to international investors who look for safe assets. In this way, securitisation increases the share of foreign capital inflows allocated to home mortgage loans, amplifying the effect of capital inflows on the domestic housing market.

Figure 2

Response of housing variables to capital inflows shocks in countries with high and low levels of securitisation



Notes: The MBS index is a de jure measure of whether securitisation is allowed in the country. It takes the value one for countries that have a fully liberalised MBS market and zero for countries where no securitisation is allowed. If a limited degree of securitisation is allowed, the index takes the value 0:3. The blue lines represent the median and the red lines represent the 16th and 84th percentiles of the distribution of impulse responses. Changes in housing variables are in per cent, and the horizontal axis denotes quarters after the shock.

2. Conclusions and policy implications

We find that both capital inflows and monetary policy shocks have a significant and positive effect on real house prices, real credit to the private sector and residential investment. Housing variables respond more strongly to both shocks in countries with a more developed mortgage market and where securitisation is more prevalent. This is consistent with the presence of a financial accelerator mechanism. In highly developed mortgage markets, households can pledge a larger fraction of their house as collateral, which results in higher leverage. If households are highly indebted, they are more sensitive to changes in the value of collateral. We find that the propagation effect of securitisation is stronger for capital inflows than for monetary policy shocks. The response of housing variables to capital inflows shocks is larger and longer-lasting in countries where securitisation is allowed. A potential explanation is that securitisation transforms illiquid, low-grade loans into publicly traded assets of higher quality which are attractive to international investors. In this way,

securitisation increases the share of foreign capital inflows allocated to home mortgage loans, amplifying the effects of capital inflows on the domestic housing market.

The run-up to the present crisis was characterised by a housing boom in most OECD countries. Our results suggest that persistent capital inflows, coupled with securitisation, played a significant role in the housing boom. This implies that countries with more developed mortgage markets and a high degree of securitisation should be wary of large external imbalances and work towards their reduction. Nevertheless, more research is necessary in order to improve our understanding of the interaction between capital inflows and the housing market. With better organisation and more transparency in securitisation markets, for example, the amplification effect may be reduced.

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Discussant remarks on Filipa Sá, Pascal Towbin and Tomasz Wieladek's paper "Capital inflows, financial innovation and housing booms"

Kenneth N Kuttner[1]

1. Introduction

Since the global financial crisis of 2007–09, economists and policymakers have struggled to understand the causes of asset price booms and busts. The challenge is illustrated in Figure 1, which shows the path of real property prices from 2000 through 2010 for seven advanced economies (Austria, Canada, Denmark, Ireland, Norway, the United Kingdom and the United States). One question is why property prices in all seven of these countries (and many more besides) all rose and fell over roughly the same period. Was a common factor at work across countries, and if so, what was it? The second question is why the size of the boom differed across countries. What explains the fact that house prices doubled in the United Kingdom, but appreciated only slightly in Austria?

This paper presents an empirical analysis of these difficult questions, paying particular attention to the effects of interest rates, capital flows, and financial structure. A large number of papers have analysed the effects of each of these factors individually, but this is the first that I am aware of that examines all three in a single empirical framework.

2. Summary of the model

The analysis employs a state-of-the-art partially identified 12-variable panel vector autoregression (VAR) for 18 OECD countries. Monetary policy and capital flows are modelled as structural shocks, identified via sign restrictions. Specifically, the identification scheme assumes that monetary policy shocks have the standard macroeconomic effects: expansions increase consumption, investment and inflation and lead to a real depreciation. Similarly, capital inflows increase consumption and investment and lead to a real appreciation, while reducing the long-term interest rate.

The paper takes two complementary approaches to assessing the impact of financial structure. One is to split the sample according to the level of financial market development, measured by an IMF index of mortgage market sophistication. The other is to interact an index measuring the prevalence of mortgage securitisation with a subset of the VAR coefficients.

The authors' approach is eminently reasonable. The panel VAR method allows them to estimate an extremely rich model while imposing just enough structure to allow for a sensible economic interpretation. I would be hard-pressed to improve on their method, but I nonetheless have two reservations.

One is that while the identification scheme yields impulse responses with the desired signs, the dynamics are implausible. An expansionary monetary policy shock, for example, causes

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an immediate jump in the price level. This is in marked contrast to conventional monetary VARs, such as those reported in Christiano et al. (1999), in which the inflation response is quite sluggish, rising gradually over a period of one to two years.

A second point is that the identification strategy allows for the identification of only two structural shocks. This is both a strength and a weakness. The strength is that it minimises the assumptions needed to obtain results for the two structural shocks of interest, and indeed a very large number of restrictions would be required to fully identify a 12-variable system. But it is also a limitation to the extent that it does not allow the impact of other structural shocks to be estimated. The analysis is therefore silent on the other contributors to real estate price fluctuations.

3. The main findings

Like most VAR analyses, the paper's results are presented in terms of the impulse response functions and variance decompositions. The findings are reassuring: the estimated responses are statistically significant, and the signs are consistent with theoretical priors.

With regard to monetary policy shocks, the baseline model estimates show that a 25 basis point monetary policy shock causes a 0.3% change in house prices at a horizon of roughly two years, gradually diminishing after that. The variance decompositions indicate that monetary policy shocks account for 5.7% of house price variance at the three-year horizon.

The results also reveal a link between the current account balance and property prices. A one-standard-deviation current account shock causes a 0.6% change in house prices, and the shocks account for 13.7% of house price variance at the three-year horizon.

One important implication is that expansionary monetary policy must have played a minor role in the past decade's property price bubble, contrary to Taylor's (2009) assertion. Taking the paper's finding at face value, a huge 200 basis point expansionary shock would have led to only a 2.4% house price appreciation, far less than the observed double-digit increases. The small size of the interest rate effects are consistent with those reported by a number of other recent papers, including those of Jarociński and Smets (2008), Dokko et al. (2009), and Glaeser et al. (2010).

With a somewhat larger share of the variance decomposition, current account shocks may have played a somewhat more important role in the bubble, and the paper makes a valuable contribution in highlighting this channel. Even so, a 2.6-standard-deviation inflow (a one in 25 year event) would have resulted in an appreciation of only 1.6%.

The role of mortgage market sophistication is discernable but modest. In countries that score high on the IMF mortgage market development index, a 25 basis point monetary policy shock causes a roughly 0.5% change, compared with 0.2% for those with unsophisticated markets; the shares of house price variance attributable to monetary policy shocks at the three-year horizon are 7.1% and 4.3%, respectively. The difference for capital flow shocks is comparable: a peak response of 0.9% for countries with sophisticated mortgage markets, versus 0.6% for those with less developed markets, and variance contributions of 9.6% and 14.1%, respectively.

4. Interpreting the responses to monetary policy shocks

As noted in the paper's introduction, a number of theories are capable of explaining the response of property prices (and asset prices more generally) to interest rates. The most basic is the venerable and much-maligned user cost (UC) model. Some have suggested that

credit and risk-taking channels are also operative. All three models deliver an inverse relationship between the interest rate and the property price, which is qualitatively consistent with the paper's findings on the effects of monetary policy shocks.

Of course, one would also like to know whether the results were *quantitatively* consistent with these models' implications. A natural question to ask in this context is whether the standard UC model can explain the magnitude of the estimated interest rate response. If not, then one would need to appeal to some additional effect, like those implied by the credit and risk-taking channels.

The quantitative implications of the UC model are easy to work out, thanks to its direct link between the interest rate and the property price. The model is based on the assumption that people should be indifferent on the margin between renting and owning. The relationship is embodied in an equation linking the rent-to-price ratio, *R*/*P*, to the user cost,

$$\frac{R_t}{P_t} = UC_t = (i + \tau_t^P)(1 - \tau_t^Y) + \delta - \pi_t^e$$

where i is the relevant interest rate, τ^P is the property tax rate, τ^Y is the income tax rate, δ is the rate of physical depreciation, and π^e is the expected rate of property price appreciation. Naturally, given the imperfections and frictions in both the rental and owner-occupied markets, it is unrealistic to expect that this relationship would hold at every moment in time. It is nevertheless a useful benchmark for assessing the likely magnitude of the interest rate effects.

The basic UC equation can be differentiated to obtain the elasticity of the house price with respect to the interest rate holding rent constant,

$$\frac{dP}{di}\frac{i}{P} = -\frac{i(1-\tau^Y)}{(i+\tau^P)(1-\tau^Y)+\delta-\pi^e}$$

In the absence of taxes and depreciation and with π^e = 0, the elasticity is 1; for plausible values of τ^P, τ^Y and δ, the elasticity is roughly 0.75.

Armed with this relationship, it is straightforward to calculate the UC-implied contribution of low interest rates to the housing boom in the United States. As shown in Figure 2, the rent-to-price ratio fell by 25% from 2001 to 2005, mostly driven by the steep increase in house prices. Over the same period, the real UC fell from roughly 6% to 5%, a decline of one percentage point, or 18%. Using an elasticity of 0.75, the UC reduction should have led to a 13.5% drop in the rent-to-price ratio, roughly half of the observed decline. The UC model therefore goes a long way towards explaining rising property values during the boom period.

Relative to this benchmark, the paper's VAR model delivers a much smaller estimate of the interest rates' contribution. Specifically, given the link between long- and short-term interest rates, the VAR results suggest that roughly ten 25-basis-point expansionary monetary policy shocks would have been required to produce a one percentage point reduction in the long-term interest rate observed in the data. The total impact of these ten rate cuts on house prices would have been a mere 5%. This is much less than the appreciation implied by the UC model, and it comprises only a small fraction of the observed appreciation.

The fact to be explained, then, is not what can account for the positive effect of expansionary monetary policy on house prices; the conventional UC model is perfectly capable of explaining that relationship. Instead, the puzzle is why the response is so much *smaller* than would be implied by the UC framework. Since the credit and risk-taking channels would presumably accentuate the impact of monetary policy, incorporating these effects would only

deepen the mystery. What is needed instead is a theory to explain the *in*sensitivity of house prices to interest rates, relative to the UC benchmark.[2]

5. Interpreting the responses to capital flow shocks

One of the significant contributions of the paper is to highlight the possible role of capital flows (the current account balance) in driving asset price fluctuations. This has long been an issue in emerging markets, and the paper shows that similar forces have been at work in industrialised countries. In the case of the United States, Figure 3 clearly shows that the sharp post-2000 rise in property prices (the decline in the rent-to-price ratio) coincided with a widening current account deficit.

The pattern is evident in other countries as well. As shown in Figure 4, the link between capital flows and house prices appears strong in the United States, New Zealand, Ireland, and the United Kingdom, all of which ran persistent current account deficits over the relevant period. Similarly, Spain and Canada moved from surplus to deficit during the period as property prices escalated. Austria, whose current account went from deficit to surplus, experienced the lowest rate of house price appreciation. More puzzling is the observation that countries with persistent surpluses, such as Denmark and Norway, also experienced robust house price growth.

Discerning the economics underlying the response to capital flow shocks is more difficult than in the case of the monetary policy shocks, however. One reason is that house prices and capital flows are jointly determined in equilibrium, as functions of various other behavioural relationships and exogenous variables.

Specifically, the current account is usually modelled as the difference between investment and the sum of private and government saving. Net foreign saving also enters the picture, to the extent that it affects the interest rates faced by domestic consumers and businesses. What the paper labels a capital flow shock, therefore, may result from any one of a number of things: changes in government saving, changes in consumers' expectations or preferences, investment shocks, or exogenous shifts in the supply of net foreign saving. It is therefore hard to know exactly what is meant by a capital flow shock, and whether one should expect the response of house prices to be the same regardless of the source of the shock.

Moreover, the direction of causality between capital flows and property prices is unclear. A plausible alternative explanation of the observed co-movements has property prices driving capital flows, rather than the other way around. According to this view, positive property price shocks increased households' net worth, leading to a reduction in saving, and it was this decline in saving that led to growing current account deficits.

Of the likely sources of capital flow shocks, perhaps the most interesting from a policy perspective is the change in net foreign saving, which corresponds to Ben Bernanke's "global savings glut" idea. This hypothesis, which provides a plausible explanation for the observed global co-movement in property prices, implies a cross-country correlation in capital flow shocks. A worthwhile extension or alternative to the framework used in the paper would therefore incorporate a factor structure, as in the models of Del Negro and Otrok (2007) and Otrok and Terrones (2005).

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[2] Glaeser et al. (2010) provide one explanation of why the standard UC model overpredicts the impact of interest rates on house prices. Their hypothesis is that the option to refinance, combined with high labour mobility, reduces the effective duration of housing investment, rendering its price less interest-sensitive.

6. Conclusion

This is an excellent contribution to a growing literature that seeks to explain property price booms and busts in terms of macroeconomic fundamentals and financial structure. Using impressive econometric technique, the authors' results corroborate other studies' finding of a relatively small interest rate effect, while documenting an intriguing link between capital flows and property prices. The effects are larger in countries with more sophisticated mortgage markets, although the differences are perhaps less pronounced than one might have suspected. All told, monetary policy and capital flows account for no more than 25% of property price fluctuations in industrialised countries. The ineluctable conclusion is that while identifiable economic fundamentals are important factors, there is still a lot we do not know about the forces driving house price booms and busts.

Figure 1

Real Property Price Appreciation in Seven Advanced Economies

2000–2010

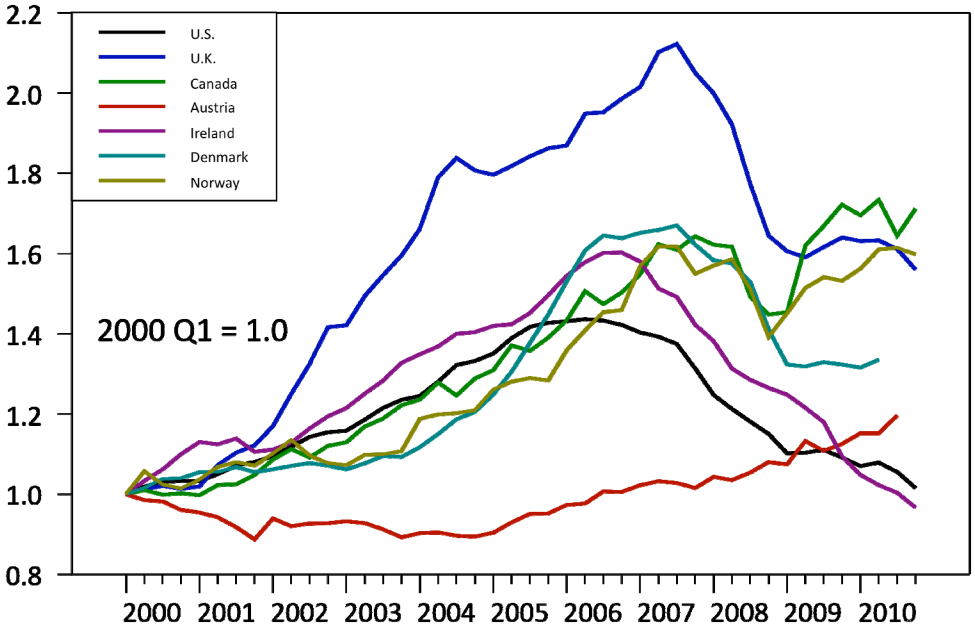


Figure 2

Rent-to-Price Ratio and User Cost in the U.S.

1985–2010

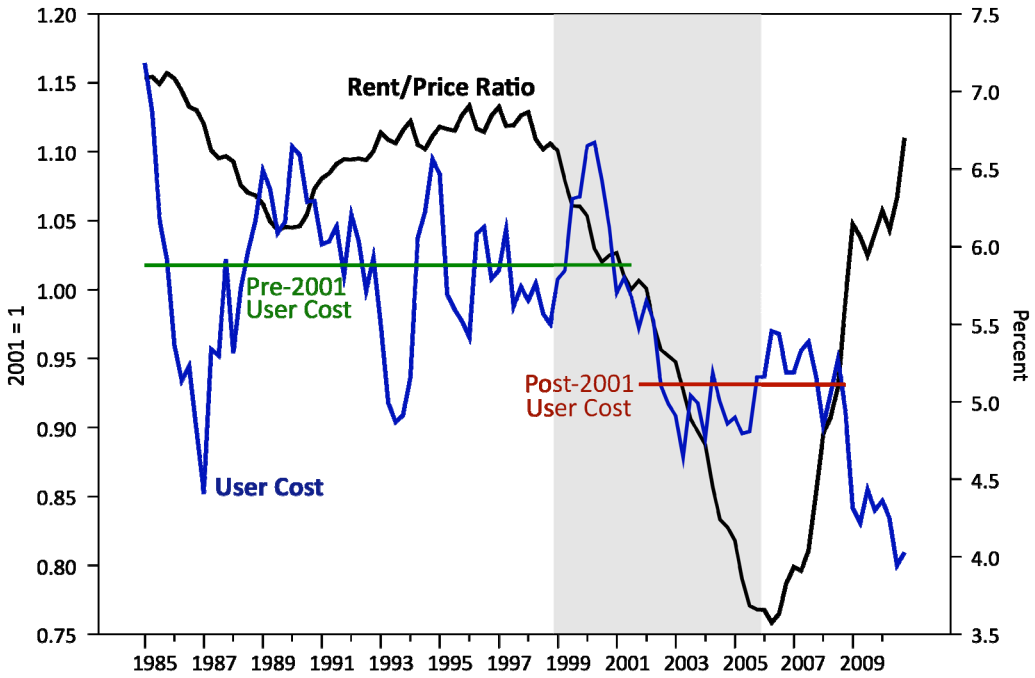


Figure 3

Current Account Balance and the Rent-Price Ratio in the U.S.

1985–2010

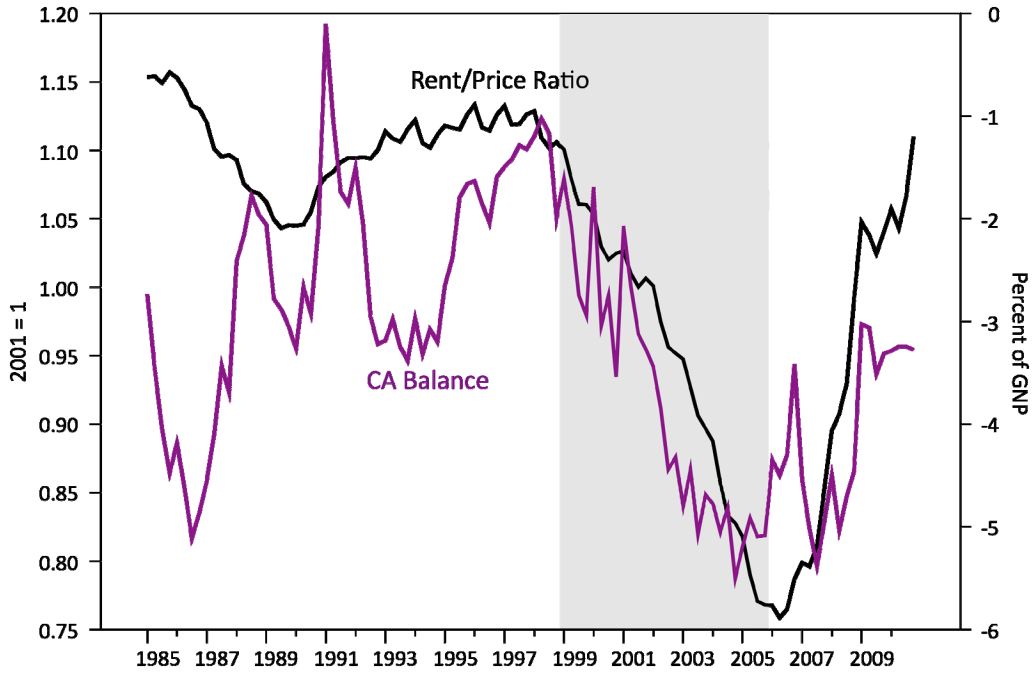
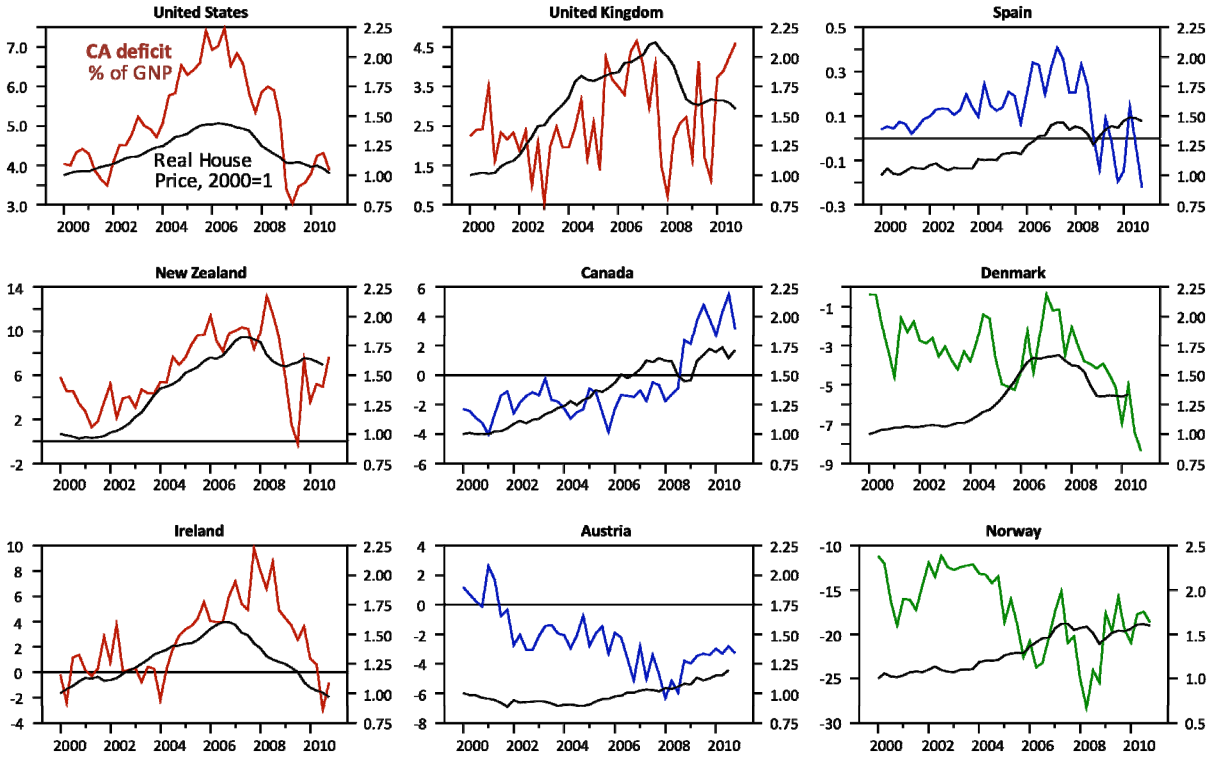


Figure 4

Current Account Balance and Property Prices in Nine Advanced Economies

2000–2010



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Credit standards and the bubble in US house prices: new econometric evidence

John V Duca,[1] John Muellbauer[2] and Anthony Murphy[3]

1. Introduction

Many commentators link the US house price boom and bust of the past decade to an unsustainable easing of mortgage credit standards. However, few existing empirical house price models take account of changes in credit standards, since they are hard to measure. As a consequence, most models perform poorly during the recent boom and bust in US house prices (see Duca et al. (2011a, 2011b), Gallin (2006) and Geanakoplos (2010), inter alia). We circumvent this problem by incorporating a plausible measure of mortgage credit standards – the average loan-to-value ratio for first-time homebuyers – into an inverted housing demand model explaining US house prices. We show that this measure of mortgage credit standards is weakly exogenous and is not simply a proxy for expected future house price capital gains or losses.

During the subprime boom, mortgage loans were extended to riskier borrowers, who would previously have been denied loans. Many of these loans were for adjustable rate mortgages which particularly benefited from the then lowest interest rates for decades. The rise in house prices, set in train by these credit-supply and interest-rate changes, fooled many people into thinking that such rises would be sustained. Fundamentals began changing in 2003, as interest rates began to return to more "normal" levels and high rates of building expanded the housing stock, while house prices became increasingly overvalued. As the extent of bad loans became clear, the fundamentals changed again as the supply of credit for all types of mortgages contracted, inducing an unwinding of earlier rises in house prices (Duca et al., (2010)).

Glaeser et al. (2010) found no convincing evidence that movements in the average loan-to-value (LTV) ratio, which only changed modestly between 2001 and 2005, explained the recent house price boom. Unfortunately, the average LTV ratio is highly endogenous. It also masks different trends in the LTV ratios of former owner-occupiers and first-time buyers. Former owners benefited from the house price boom, so their average LTV ratio fell as they rolled over their capital gains into a new property. By contrast, the average first-time buyer LTV ratio rose sharply from about 88 per cent in the mid- to late 1990s to a peak of 94 per cent in 2005. This is the reason we measure shifts in mortgage credit standards using the LTV ratio for first-time homebuyers, rather than all buyers. Mian and Sufi (2009) address the link between credit and house prices using micro data and conclude that the expansion in mortgage credit was more likely to be a driver of house price growth than a response to it.

We find that shifts in credit standards help account for the boom and bust in US house prices, consistent with previous inverted demand results for the United Kingdom (Cameron et al. (2006), Meen (2001), Muellbauer and Murphy (1997)) and with our house price-to-rent

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results for the United States (Duca et al. (2011a)).[4] In contrast to standard models, our model yields stable long-run relationships and speeds of adjustment, plausible income and price elasticities, better model fits, and sensible estimates of tax credit effects and a possible upturn in real house prices in the next few years.

2. The inverted demand model of house prices

The simplest theory of what determines house prices is to treat supply – the stock of houses – as given in the short run, with prices driven by the inverted demand for housing services (*h*) that are proportional to the housing stock (*hs*). Let housing demand be given by:

$$\ln hs = -\alpha \ln hp + \beta \ln y - \ln hs - \gamma \ln uc - \delta \ln cc + z \quad (1)$$

where *hp* is real house price, *y* is real income, *uc* is real user cost of housing, *cc* is credit standards, and *z is* other demand shifters. The own price elasticity of demand is $-\alpha$ and the income elasticity is β. Inverting Equation (1) implies that equilibrium house prices are a function of income, the housing stock, user costs and credit standards:

$$\ln hp = {}^{1}\!/_{\alpha}\left(\beta \ln y - \ln hs - \gamma \ln uc - \delta \ln cc + z\right) \quad (2)$$

Our house price model is a dynamic version of Equation (2).

Our real house price (*hp*) series is the Freddie Mac repeat sales index, deflated by the personal consumption expenditure price index. For income (*y*), we use a measure of real per capita permanent income, generated from the discounted path of forecast non-property (labour plus transfer) income, adjusted for temporary tax effects. The real user cost of housing (*uc*) reflects the fact that a house is a durable investment good. We let $uc = r + \delta + t + \rho - \pi^{e}_{hp}$, where *r* is the real after-tax mortgage rate, δ is the depreciation rate, *t* is the property tax rate, ρ is an allowance for transaction costs and a risk premium, and π^{e}_{hp} is the expected real rate of house price appreciation. Studies suggest that many homebuyers have extrapolative expectations, so lagged appreciation is a good proxy for expected house price gains or losses, π^{e}_{hp}. We use the lagged annual rate of change in real house prices over the prior four years, adjusted for the cost of selling a home. We also adjust *uc* for the first-time homebuyer tax credit in 2009 and 2010.[5]

3. Measuring shifts in mortgage credit standards

We measure credit standards using data updated through mid-2009 on average LTV ratios for first-time homebuyers – the marginal group most affected by credit constraints – from Duca et al. (2011b). The raw LTV series, which comes from the biennial American Housing

[4] Standard house price-to rent models are reduced form models, with no explicit role for housing supply or income. The approach assumes that rental and owner-occupied housing are close substitutes and is not applicable in many countries where the government regulates the rental market.

[5] We subtract the 4.1 per cent effective value of the tax credit for first-time homebuyers from *uc* from 2009 Q1 to 2010 Q3. Our *uc* variable is always positive.

Survey, is adjusted for several factors, such as the change in the unemployment rate.[6] We find that it captures mostly exogenous shifts in credit standards, and not borrower or lender expectations of future house price capital gains or losses.

Consistent with a weakening of credit standards during the subprime boom, the LTV series in Figure 1 is positively correlated with the share of mortgages outstanding that were securitised into private label mortgage-backed securities (MBS's). Because our adjusted LTV series reflects credit standards on new mortgages, it leads the private MBS share of the stock of home mortgages by about two years. The rise of LTVs through the mid-2000s also coincided with a large rise in the home ownership rate of younger households (Bardhan et al. (2009)). Since many of these households had limited savings, the timing is consistent with the view that the rise of LTVs for first-time homebuyers in the early 2000s eased credit constraints for the marginal homebuyer, bolstering the effective demand for housing.

The two large shifts in our LTV-based measure of mortgage credit standards coincide with major changes in government mortgage policy and financial innovations. The upshift of the early to mid-1990s coincides with the Congress directing Fannie Mae and Freddie Mac to increase home ownership by funding low down-payment mortgages (Gabriel and Rosenthal (2010)), either by easing underwriting credit standards or by purchasing private label MBS's.

The second large shift in our measure occurs between 2000 and 2005 during the subprime boom. Innovations in structural finance, the rise of hedge funds and SIVs, as well as changes in the origination, pricing and funding of nonprime mortgages, led to a rise in the issuance of private label MBS's, especially subprime MBS's.[7] Regulatory changes included adopting Basel II capital requirements, which induced banks to hold more MBS's, and the Congress raising the GSEs' home ownership goals, so they started buying nonprime MBS's.[8]

4. Some empirical results

We estimated various dynamic – vector error correction (VEC) and autoregressive distributed lag (ARDL) – models with and without our adjusted loan-to-value measure of mortgage credit standards. For example, our ARDL model is:

$$\begin{aligned}\Delta \ln hp_t = {} & \alpha_1 \left(\ln hp_{t-1} - \beta_0 - \beta_1 \ln y_{t-1} - \beta_2 \ln hs_{t-1} - \beta_3 \ln uc_{t-1} - \beta_4 \ln ltv_{t-2} \right) \\ & + \sum\nolimits_s \gamma_s \Delta \ln hp_{t-s} + \sum\nolimits_j \gamma_{1s} \Delta \ln y_{t-s} + \sum\nolimits_s \gamma_{2s} \Delta \ln hs_{t-s} + \sum\nolimits_s \gamma_{3s} \Delta \ln uc_{t-s} \\ & + \sum\nolimits_s \gamma_{4s} \Delta \ln ltv_{t-s} + \gamma_0 + \sum\nolimits_k \delta_k z_{k,t} + u_t \end{aligned} \quad (3)$$

where u is a random error term, $\ln ltv$ replaces cc, and z is a vector of tax, monetary policy and regulatory factors which proved significant in previous research.

Adding the adjusted LTV/mortgage credit standards variable improves our house price models by yielding more stable long-run relationships, more sensible estimated income and price elasticities, better and more stable speeds of adjustment, and better model fits. The VEC and ARDL models yield similar estimated long-run relationships that imply higher LTVs

[6] Our average LTV series comes from small samples, so, in our empirical models, we smooth the LTV series using a three-quarter moving average.

[7] For example, credit scoring technology, earlier used in consumer credit, was increasingly used by loan originators to sort and price riskier nonprime mortgages.

[8] The estimates in Frame (2008) suggest that that the GSEs funded one quarter of nonprime mortgages.

drove up house prices. For example, the full sample (1981 Q2 to 2009 Q3) long-run cointegrating relationship in the VEC model is:

$$\ln hp = 4.71 + \underset{(7.9)}{2.80} \ln y^p - \underset{(6.7)}{2.07} \ln hs - \underset{(23.4)}{0.24} \ln uc + \underset{(5.5)}{0.97} \ln ltv \qquad (4)$$

with *t*-statistics shown in parentheses. Our measure of credit standards is positive and highly significant. The implied price and income elasticities of housing demand are 1.35 and –0.48 respectively, close to the average estimates obtained in earlier studies. We obtained similar results using other house price indices, such as the Freddie Mac house prices adjusted for home improvements or the CoreLogic house price index.

The estimated coefficient on our adjusted LTV/mortgage credit standards variable and the long-run cointegrating relationship are stable over time. We verified this by estimating our models over shorter samples that ended in mid-2002, before the steep rise in the LTV series and the start of the subprime boom.[9] In our "short" sample, variations in mortgage lending standards in the early 1990s allow us to identify the LTV effect. Ignoring feedback effects from looser mortgage credit to higher incomes, etc., the model suggests that the loosening of mortgage credit standards from 2001 onwards generated over half of the 29 per cent rise in real house prices between 2001 Q4 and 2005 Q4.[10] If the LTV ratio were endogenous, the interpretation of Equation (4) would be very problematic. However, our evidence is that the LTV ratio is weakly exogenous in our model and, contrary to the claims of some commentators, is not picking up expectations of *future* house price gains or losses. There is, however, a non-linear feedback effect from *past* house price changes. Higher foreclosures, which depend on past house price falls, generate tighter mortgage credit standards and a higher down-payment ratio/lower LTV ratio.

5. Where are house prices heading?

To shed some light on where US house prices might be heading, we simulated house prices out of sample (post-2009 Q3), using the full sample coefficient estimates from cointegration models with and without our LTV-based measure of mortgage credit standards. We carried out the simulations in autumn 2010. We assumed that the adjusted LTV ratio would remain at its 2009 Q2 value (close to its 2002 value). Actual non-LTV data are used through 2010 Q2. We used published data to specify reasonable values for future income, interest rates and the housing stock, etc.[11] Because an error-correction model is used, with lagged house price change and real user cost terms, the model captures the "bubble builder" and "bubble burster" dynamics stressed by Abraham and Hendershott (1996), inter alia. In Figure 2, house prices undershoot during the bust and then gradually revert back to their long-run "fundamental" level.

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[9] The estimated speeds of adjustment are stable at 12 and 11 per cent per quarter in the shorter, pre-subprime boom (1981 Q2 to 2002 Q2) and full (1981 Q2 to 2009 Q3) samples, respectively. By contrast, the estimated speeds of adjustment in models omitting the LTV ratio plunge from 16 to 5 per cent, respectively, reflecting a breakdown in the underlying long-run relationships.

[10] The long relationship in Equation (4) suggests that the loosening of mortgage credit standards would have raised real house prices by about 7 per cent. The rest of the effect is a short-run "bubble builder" or feedback effect from higher prices to larger expected capital gains, which, in turn, induced further increases in house prices.

[11] We used the average Blue Chip Economic Indicators forecasts of incomes and interest rates and assumed that housing starts would gradually rise from 0.6 million units in 2010 to 1.4 million units in early 2015.

The dynamic simulations from the model with our LTV-based measure of mortgage credit standards (the "LTV-model") imply that real house prices may fall 10 per cent further from their actual 2010 Q2 levels before hitting bottom in early 2012, with nominal prices falling 8 per cent by 2012 Q1. The declines are less dramatic in the misspecified "non-LTV model", where real house prices bottom out 3 per cent below their actual 2010 Q2 levels. In the five quarters following 2009 Q3 for which we have actual house price data, the LTV and non-LTV model simulations straddle actual real prices, with the LTV model tracking notably better. In the simulations, the nominal level of the Freddie Mac house price series only recovers its 2007 Q2 subprime boom peak in early 2015.

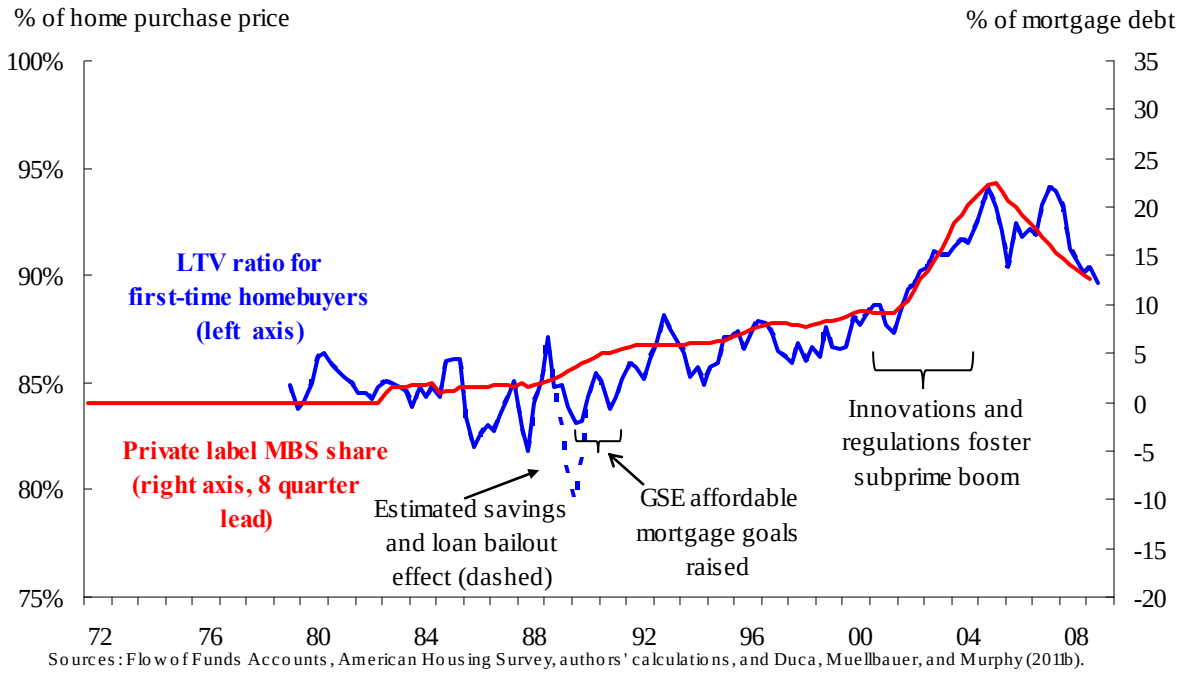
The simulations, of course, are based on projections of house price determinants which are hard to predict. For example, our permanent income path is based on a 2010 Blue Chip Survey forecast of a modest economic recovery. Another source of uncertainty is changes in public policy affecting the foreclosure process or the availability of mortgages from federal programs. We believe that the simulation results are reasonably robust to alternative definitions of house prices and to endogenising housing supply, but we have not yet completed our analysis of these issues. For these reasons, the simulation results should be treated with caution.

6. Conclusion

Our findings indicate that swings in credit standards played a major, if not the major, role in driving the recent boom and bust in US house prices. Because standard time series models ignore changes in mortgage credit standards, they are misspecified and unstable over time. They also fail to track house prices well in contrast to models using our measure of mortgage credit standards – the cyclically adjusted LTV ratio for first-time homebuyers.

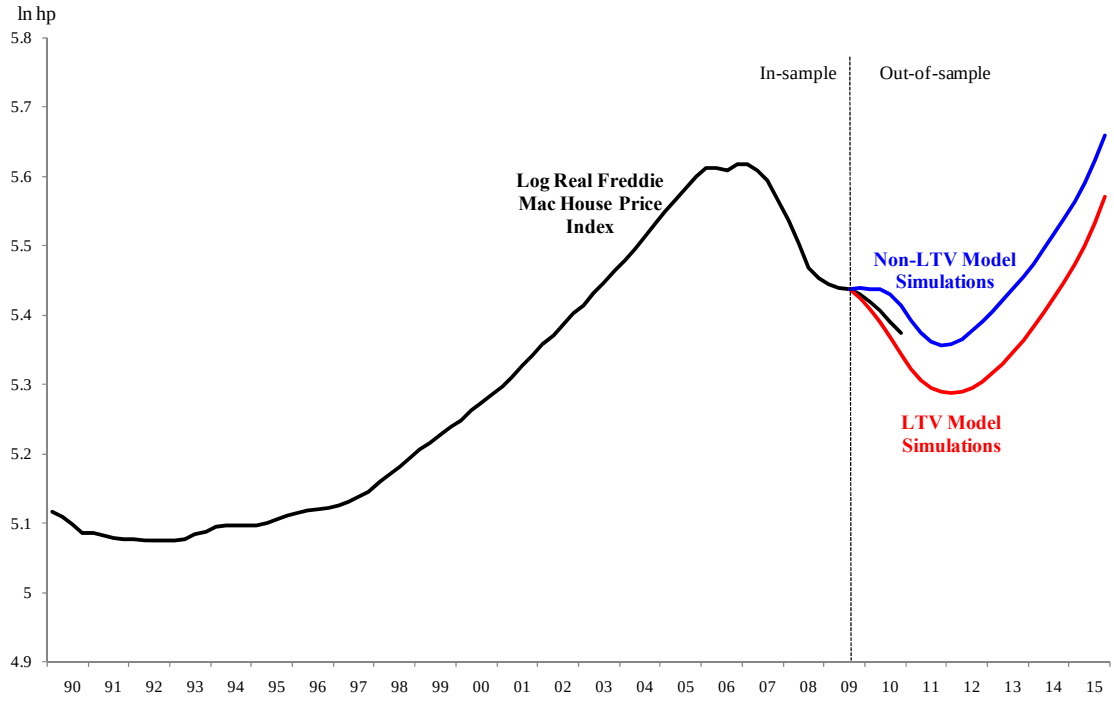
Overall, our findings support the view that many asset bubbles are fuelled by unsustainable increases in the availability of credit or use of non-robust financial practices. They also suggest a potential role for macroprudential policies that specify maximum LTV ratios or require lenders to fund high LTV mortgages with more regulatory bank capital, as suggested by the experience of Hong Kong (Wong et al. (2011)).

Figure 1: LTV Ratios for First-Time Homebuyers Trend with Share of Mortgages Packaged into Private Label Mortgage Backed Securities



Sources: Flow of Funds Accounts, American Housing Survey, authors' calculations, and Duca, Muellbauer, and Murphy (2011b).

Figure 2: Real House Prices Fall More In Line With Simulations From the LTV Than the Non-LTV Model



Sources: Freddie Mac and Duca, Muellbauer, and Murphy (2011b).

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Discussant remarks on John V Duca, John Muellbauer and Anthony Murphy's paper "Credit standards and the bubble in US house prices: new econometric evidence"

Frank Warnock[1]

The main thought one has when setting out to write a discussion of this paper is that it is one of many in this research agenda.[2] As such, it is difficult to disentangle its contribution. If I had one main comment for the authors (other than how much I like the paper and the research agenda), it is to spend some time helping the reader differentiate each paper's contribution.

As of now it is difficult to differentiate one paper in this research agenda from another. Duca, Muellbauer and Murphy (2011) state the following: "Most US house price models break down in the mid-2000s, due to the omission of exogenous changes in mortgage credit supply … from house price-to-rent ratio and inverted housing demand models.[3] Previous models lack data on credit constraints facing first-time homebuyers. Incorporating a measure of credit conditions … into house price-to-rent ratio models yields stable long-run relationships, more precisely estimated effects, reasonable speeds of adjustment and improved model fits." They also state that "(s)imilar results are obtained using … an approach which inverts the demand function (available in an appendix)". The abstract of the current paper seems identical, but with this sentence added: "Our first-time buyer LTV series is weakly exogenous and captures shifts in the supply of mortgage credit and not expectations of future house price appreciation." Just from that simple comparison it seems that, relative to Duca, Muellbauer and Murphy (2011), the current paper spills a bit more ink on the exogeneity of the main explanatory variable. More needs to be done to help the reader understand the value added of each paper in this research agenda. In sum it is obvious; paper by paper it is not easy for the reader to differentiate.

This paper applies an inverted demand function model of house prices. If it is assumed that in the short run supply is fixed, then demand determines price. Demand in this model is a function of price, permanent income, and other factors such as real user cost of housing and credit constraints. Inverting the demand function yields price as a function of permanent income, housing stock, real user cost, and credit constraints. Of course, many other factors can drive house prices; the authors use a vector error correction (VEC) model to capture adjustment to stock and flow disequilibria. The main takeaway from the empirical exercise is that US house price models – be they house price-to-rent or inverted housing demand models – that do not include an exogenous measure of changes in mortgage credit supply break down in the mid-2000s. In particular, the cyclically adjusted loan-to-value ratio (LTV) for first-time homebuyers is an important variable omitted from many previous home price papers.

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[2] See, among others, Duca, Johnson, Muellbauer and Murphy (2011), Duca, Muellbauer and Murphy (2009), Duca, Muellbauer and Murphy (2010), and Duca, Muellbauer and Murphy (2011).

[3] Real user costs are given by real after-tax interest rate of borrowing plus depreciation rate plus property tax rate less expected rate of capital appreciation. House prices are Freddie Mac's of repeat home sales. Housing stock is flow of funds estimated replacement cost of households' residential housing structures.

A reader comes away with an appreciation of the paper's main points, but also some questions.

The measure of credit standards – LTVs for first-time homebuyers, based on American Housing Survey data (for conventional mortgages) – is a critical component of this paper. The authors argue that first-time homebuyer LTV has less of an endogeneity issue than a price-to-income (PTI) ratio, which is affected by shifts in two other determinants of house prices (interest rates and income), and that the LTV measure should capture exogenous shifts in credit standards, not expectations of future house price changes. Reasonable people might disagree. For example, Crowe et al (2011) noted that "because of the feedback loop between mortgage credit availability and house price movements, endogeneity remains a concern". Since reasonable people might question whether the authors' LTV measure is truly exogenous, more discussion on this important point is necessary. One way to dispel all doubts on this point is for the authors to assume that the LTV measure is endogenous. How would that alter the main results?

Another main point in the paper is that most house price models omit a credit standards variable, and including one (the LTV measure) improves the model's fit. But Figures 2 and 3 in the conference version of the paper seem somewhat inconsistent. The text around Figure 2 states the following: "As a result of lower down payment requirements, the effective demand for housing rose in the mid-2000s, pushing up prices and construction. This fed into higher house-price expectations among borrowers and lenders, further boosting prices." This sounds right to me. But looking at the figure, the improved out-of-sample fit during 2003–2006 owes to the fact that the LTV model has a smaller increase in home prices than the non-LTV model. This seems odd. For Figure 3, the non-LTV model has a smaller increase throughout and does just fine until mid-2008. The authors state that home price models break down in the mid-2000s, but to my eyes Figure 3 suggests the breakdown is more like 2008 (when many models broke down). I would like a more complete discussion of this. Even in the short forecast section at the end of the paper, the LTV and non-LTV models produce similar forecasts. The magnitudes of forecasted price changes differ, but both suggest US home prices will bottom out in the next six months and then begin a sharp appreciation. Do we know that the LTV model is really superior? I think the answer is yes, but I am not exactly sure why.

I have two primary suggestions. The first concerns the LTV measure. The reader is asked to believe that the LTV measure improves the fit of home price models. I think I can buy that. But what drives changes in the LTV series? In the conference version of the paper, this is dealt with in words only. We are told that the major shifts in the LTV series (in the early to mid-1990s and between 2000 and 2005) coincide with major changes in government mortgage policy and financial innovation. Are there ways to model this (other than adding more dummies to the paper, which already has more than its share of dummy variables)? Are some changes in the LTV series benign and others likely to be more problematic? Do we have any way to differentiate? I think the readers deserve a better understanding of what drives movements in the LTV series.

The second suggestion is that the paper should be repackaged to sharpen its contribution. Right now it comes across as derivative, far too similar to other papers in this research agenda. The question the authors should address front and centre is, what can we learn from this that we could not have learned from past work? Instead of focusing on what is done (improving the fit of a home price model), I would like to see some focus on how it informs (and who it informs).

To summarise, I really enjoyed this paper as well as Duca et al (2009, 2010, 2011a, 2011b). In this research agenda, these authors have made substantial contributions to an important topic. For this particular paper, I would like more analysis of the LTV series, which is key to the paper, as well as a sharpened focus on what we learn from this paper that we could not have learned from previous work. How does this paper change our thinking? Are there

mistakes we have made that would have been prevented had we known this? And how should this work inform policymakers?

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Credit conditions and the real economy: the elephant in the room

John Muellbauer[1] and David M Williams[2]

1. Introduction

We explore crucial but unobserved influences on the real economy due to structural shifts in non-price credit supply conditions. The global financial crisis (GFC) of 2007–09 demonstrated that shifts in credit conditions are the "elephant in the room" for economies with liberalised financial markets: large, and ignored at one's peril. We chose Australia as an interesting case study because over the three decades to 2008 it experienced one of the most rapid increases in household balance sheets and house prices in the world.

The literatures on consumption, house prices and credit suggest that credit conditions may operate on the real economy through several channels. First, financial liberalisation and innovation (FLIB) enhances the ability of all households to smooth housing and non-housing consumption across periods. Second, FLIB relaxes the mortgage down payment constraint on young, first-time home-buying households. Third, FLIB introduces a collateral channel from housing capital gains to real activity. Households with existing housing wealth can extract capital gains for other purposes through mortgage refinancing or home equity withdrawal products. However, rising house prices not only boost collateral for existing homeowners but also raise the mortgage deposit requirement. The balance of these two effects on the economy depends on the state of credit conditions and, to a lesser extent, the age distribution of the population. When credit conditions are easy, the positive collateral benefit of higher house prices to existing homeowners outweighs the negative effect on non-home-owning households who must now save for a larger deposit. Under these conditions, rising house prices raise consumption, mortgage debt and housing equity withdrawal (HEW).

We have chosen the acronym "latent interactive variable equation system" (LIVES) to describe our method. A common unobserved factor – a credit conditions index – determines intercept and parameter shifts in equations for consumption, house price, mortgage credit and HEW. This methodology provides a powerful technique for handling evolving and far-reaching structural change in an economy – a serious problem for econometric modellers. Our system extends the single equation house price and consumption modelling for Australia in Williams (2009, 2010), consumption equations for the United Kingdom, the United States and Japan in Aron et al (2011), and multi-equation work using UK credit data in Fernandez-Corugedo and Muellbauer (2006). Strong priors about the institutional environment and rich controls for other economic and demographic variables allow interpretation of the latent variable as credit conditions shifts due to FLIB. We represent this as a spline function consisting of smoothed step dummies. Credit conditions enter each equation as a common intercept term and through their interaction with interest rates, income growth expectations, housing collateral and so on.

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[2] New College and Department of Economics, Oxford University.

This paper summarises the results for the consumption equation only. See the full version of the paper, Muellbauer and Williams (2011), for discussion of the equations for house prices, mortgage stock and HEW.

2. Methodology

Shifts in the credit supply schedule are not directly observable. Indirect measures such as debt to income suffer from obvious endogeneity with other economic and demographic variables. An alternative strategy is a common factor or latent variable approach. Stock and Watson (1988) suggest that some time series may be cointegrated by possessing the same stochastic trend. Hendry (1997) discusses co-breaking where a common unobserved regime change affects the mean of several economic variables. Maravall (1995) reviews the unobserved components literature, including economic applications such as the business cycle, natural unemployment rate, credibility of the monetary authority and so on.

Our LIVES method is more general. A single latent variable, the CCI, captures an evolutionary structural shift that affects not only the intercept of each equation, but also interacts with some of the other variables. We do not rely on "black box"-type statistical methods because economic theory provides exploitable prior information for a more disciplined approach. This includes information about the direction of the change in the latent credit conditions index and its impact.

We represent the CCI as a linear combination of smoothed step dummies, the SDMMAs, that form a smooth non-linear curve. An important set of priors are those for the slope coefficients in the spline function since, in principle, this function could be very general. These priors rely on knowledge of the institutional environment described in the full version of the paper. They suggest: non-negative coefficients on the SDMMA terms from 1982 to 1990; non-positive for around 1992 to 1994; non-negative until 2006; and non-positive from 2007 due to the GFC. The method also uses priors about the sign and magnitude of other economic and demographic influences in the specification and their interaction with the latent variable. Eleven parameters are needed to fit CCI subject to these priors.

The system consists of equilibrium correction models for house prices, consumption, mortgage credit and HEW:

$$\Delta y^*_{it} = \varphi_i (\alpha_{i0} + \zeta_i CCI_t + \alpha_{i1} Z_t - y^*_{i,t-1}) + \beta_i \Delta X_t + \varepsilon_{it}, \text{ for } i \in [1,4] \quad (1)$$

$$CCI_t = \sum_{s=1} a_s SDMMA_{st} \quad (2)$$

y^*_i is the dependent variable when correctly measured[3], φ_i is the equilibrium adjustment speed for equation i, ζ_i is the intercept effect of credit conditions (CCI_t) in equation i, Z_t is a vector of long-run variables (including interaction effects with CCI), and ΔX_t is a vector of I(0) short-run dynamic terms. Several key explanatory variables such as interest rates and income growth expectations in each equation are interacted with the credit conditions in the form $CCI_t(x_{j,t-1} - (\text{mean})x_j)$, where x_j is the explanatory variable and (mean)x is the post-1979 arithmetic mean. The speeds of adjustment (φ_i), the long-run coefficients (α_i) and the short-run coefficients (β_i) are uniquely identified in Equation 1. Identification of the coefficients requires that one of the ζ_i is normalised to one. This is done for the house price equation.

[3] We allow for some measurement bias in pre-1986 house price data and pre-1988 mortgage debt data.

3. Consumption and the credit channel

The consumption to income ratio in Australia rose substantially from the late 1970s to 2008. Standard life cycle models of the Ando and Modigliani (1963) kind suggest that part of the explanation lies in wealth effects. The log linearisation of the simple life cycle model with habits suggest the following model, where A is net worth; see Aron et al (2011):

$$\Delta \log c_t = \varphi(\alpha_0 + \gamma A_{t-1}/y_t + \psi \log(y^p/y)_t + \log y_t - \log c_{t-1}) + \varepsilon_t \quad (3)$$

The model implies partial adjustment of log real per capita consumption to a long-run target defined by the first four terms in the parentheses. y^p is permanent real per capita non-property income and the log ratio to current income (y) is:

$$\log(y^p/y)_t = E_t \sum^k_{s=1} (1-\eta)^{s-1} \log y^{t+s} / \sum^k_{s=1} (1-\eta)^{s-1} - \log y_t \quad (4)$$

Thus, log y^p is the annualised discounted future value of log income. We assume that households discount future income at roughly 20 per cent per annum ($\eta = 0.05$), with a ten-year horizon ($k = 40$). While not exactly the same as the log of the discounted future value of the level of income, it is a very good approximation. The strict version of the hypothesis implies that the weight on $\log(y^p/y)_t$ should be equal to one minus the risk-adjusted real interest rate ($\psi = 1 - \eta$), implying an upper bound of 0.95 for ψ when $\eta = 0.05$. One must then impute some information set to households in forming expectations about $\log(y^p/y)_t$. Williams (2010) canvassed several alternatives and we rely on the "sophisticated" household information set from that paper to generate households' expected future income growth.

The concept of net worth used in the Ando-Modigliani model aggregates all assets minus debt into a single figure. Net worth includes housing wealth, so this imputes the same wealth effect to liquid assets and to housing as to all other types of wealth. However, the wealth effect from housing implied by the life-cycle theory is suspect and hence so must be the theory's net worth concept. If there is a credit channel, systematic rises in consumption can result from increases in the collateral values of houses. The presence of mortgage down payment constraints faced by first-time buyers introduces another link between house prices and consumption. Shifts in credit accessibility will affect the size of these linkages and the balance of house price effects on consumption. When access to credit is restricted, a rise in house prices, given the down payment constraint, can actually result in a fall in aggregate consumption, particularly if home equity loans are hard to access.

There is also a liquidity argument for not aggregating liquid with illiquid financial assets since the buffer stock role of liquid assets gives them a higher marginal propensity to consume (MPC) than for illiquid assets. Similarly, but contingent on the availability of home equity loans and cheap refinancing, housing equity can play a buffer stock role against unanticipated income fluctuations (Miles (1992), Parkinson et al (2009)). Thus, the combination of the collateral and liquidity arguments suggests a three-fold disaggregation of wealth into liquid assets minus debt, illiquid financial assets, and housing wealth interacted with an index of credit liberality.

The original Ando-Modigliani model took no explicit account of income uncertainty, the precautionary motive for saving, or of time-varying interest rates. A more comprehensive model could include a simple proxy for income uncertainty such as the change in the unemployment rate, with this role possibly diminishing as credit conditions ease. Also, real interest rates affect consumers because they influence intertemporal substitution choices and the user cost effects for goods with some durability. Further, since three quarters of Australian mortgage debt is at floating rates, changes in nominal interest rates could affect household cash flows, again dependent on credit conditions. Finally, as credit access improves, so the role of income growth expectations should increase because households can then borrow to consume ahead of the expected income rise.

The above considerations and the three potential credit interaction effects have been combined in an empirical model for the United Kingdom, the United States and Japan in Aron et al (2011):

$$\Delta \log c_t = \varphi (\alpha_{0t} + \alpha_{1t} r_{t-1} + \alpha_{2t} \theta_t + \gamma_{1t} HA_{t-1}/4y_t + \gamma_2 IFA_{t-1}/4y_t + \gamma_3 NLA_{t-1}/4y_t + \psi_t \log(y^p/y)_t + \log y_t - \log c_{t-1}) + \beta_{1t} \Delta \log y_t + \beta_{2t} \Delta_4 i_{t-1} \times (CR_{t-1}/4y_t) + \varepsilon_t \quad (5)$$

The speed of adjustment is φ; r is the real interest rate; θ is uncertainty; $HA_{t-1}/4y_t$ is the ratio of housing wealth to annualised non-property income; $IFA_{t-1}/4y_t$ is the ratio of illiquid financial assets to income; $NLA_{t-1}/4y_t$ is the ratio of liquid assets minus debt to income; $\Delta_4 i_{t-1} \times (CR_{t-1}/4y_t)$ measures the cash flow impact on borrowers of changes in nominal mortgage rates (i) scaled by the household debt to income ratio. The parameters γ_i measure the MPCs for each of the three asset types. The log income growth term can be rationalised by aggregating over credit-constrained and unconstrained households. Equation 5 reduces to the "classical" consumption equation (Equation 3 earlier) with the following testable restrictions:

$$\alpha_{1t} = \alpha_{2t} = 0 \; ; \; \gamma_{1t} = \gamma_2 = \gamma_3 \; ; \; \beta_{1t} = \beta_{2t} = 0 \; ; \; \psi_t = \psi \quad (6)$$

There is time variation in some of the parameters of Equation 5 induced by shifts in credit availability. The credit channel enters the consumption function through the different MPCs for net liquid assets and for housing, through the cash flow effect for borrowers, and by allowing for possible parameter shifts. As noted above, credit market liberalisation should raise the intercept α_0, implying a higher level of log(c/y); shift the real interest rate coefficient α_1 in a negative direction; raise α_3 by increasing the impact of expected income growth; and increase the MPC for housing collateral, γ_1. It could also lower the current income growth effect, β_1, and the cash flow impact of the change in the nominal rate, β_2.

4. Some consumption equation results

The consumption to non-property income ratio for Australia rose by 14.4 percentage points across 1978–2008. Estimated jointly with the house price, mortgage stock and HEW equations within our LIVE system, we find that the long-run consumption to income ratio is determined by credit conditions shifts, household income growth expectations, a three-fold disaggregation of household net worth, variable real interest rates, and the change in the proportion of the population of working age (15–64 years) and of first-home-buying age (22–34 years). The demographic variables have negative coefficients since the working age population save for retirement and the young save to invest in housing. The long-run coefficients on housing collateral, income growth expectations and real interest rates are all time-varying depending on the degree of credit liberality. In the short run, our parsimonious consumption model includes the change in the log unemployment rate, the lagged four-quarter log change in consumption, risk aversion to negative housing returns and some outlier dummies.

Figures 1 and 2 plot the partial equilibrium long-run influences on the log consumption to non-property income ratio. During the 1980s, the major positive influences on consumption are easing of credit conditions, initially low house prices relative to income, rising illiquid financial wealth and age-demographic effects. The latter broadly reflect the ageing of the post-WWII "baby-boomer" generation. The easing of the down payment constraint through CCI contributes about 0.10 to the log consumption to income ratio across 1978–1992, subtracts about 0.02 during the early 1990s, and contributes another 0.06 from 1998 until the GFC in 2007.

The relaxation of the housing collateral constraint, effected through the interaction between housing wealth (to annualised income) and CCI, contributes a further 0.09 to the log consumption to income ratio between 1998–2007. The estimated long-run wealth MPCs are 0.049 for housing assets (at the peak of credit liberality in 2007), 0.022 for illiquid financial assets and 0.159 for net liquid assets. Rising optimism about future income begins to play a positive role from the early 1990s, offset by higher real interest rates and rising household indebtedness (negative net liquid assets to annualised income). The exception is during the period 2000–2004, when low real interest rates contributed positively to consumption. This was perhaps an unnecessary policy setting, given the easy state of credit conditions.

The full version of the paper discusses the house price, mortgage stock and HEW equations in the system. It also discusses our robustness checks. First, we estimated the CCI, excluding the consumption equation from the system. Second, we estimated the income forecasting equation from Williams (2010) as a fifth equation in the system. Third, we estimated the system over two shorter samples to check parameter stability. Fourth, we included a measure of household property income instead of relying on non-property income alone. Fifth, we constructed a generalised cointegration test on the consumption equation. Our estimates and conclusions are robust to these variations.

Figure 1

Contributions to long-run log consumption to income (I)

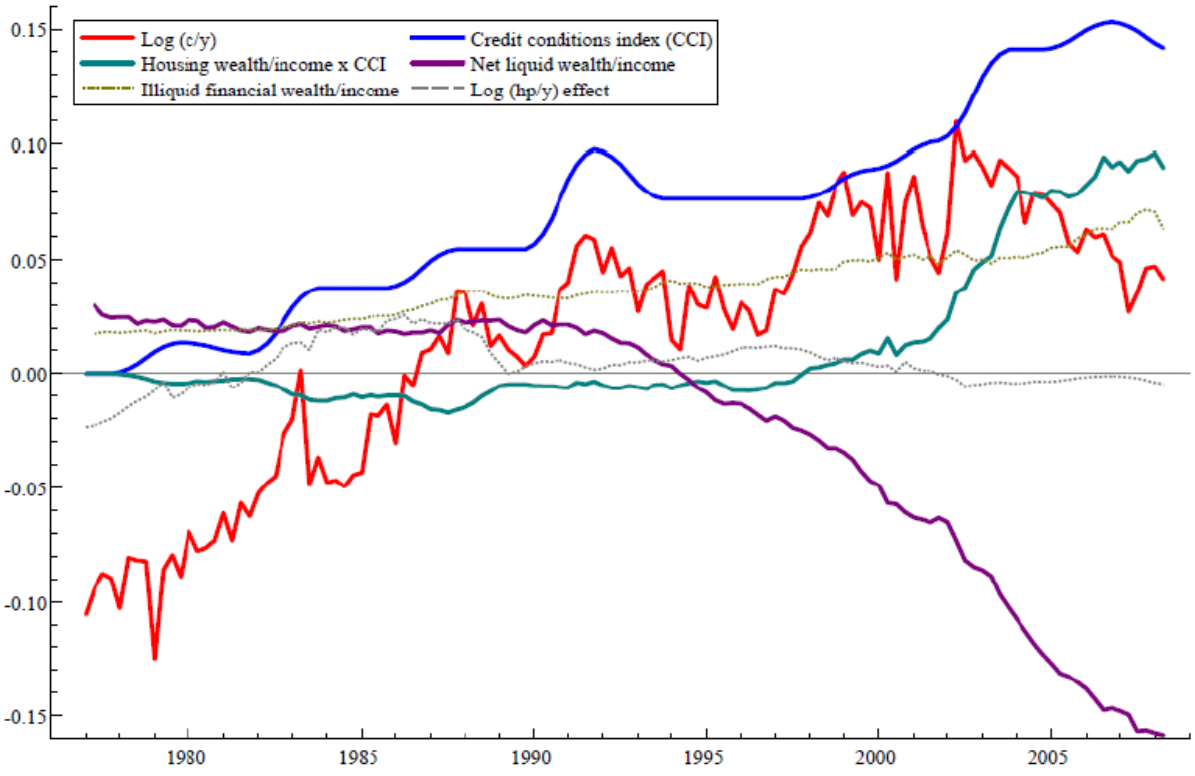
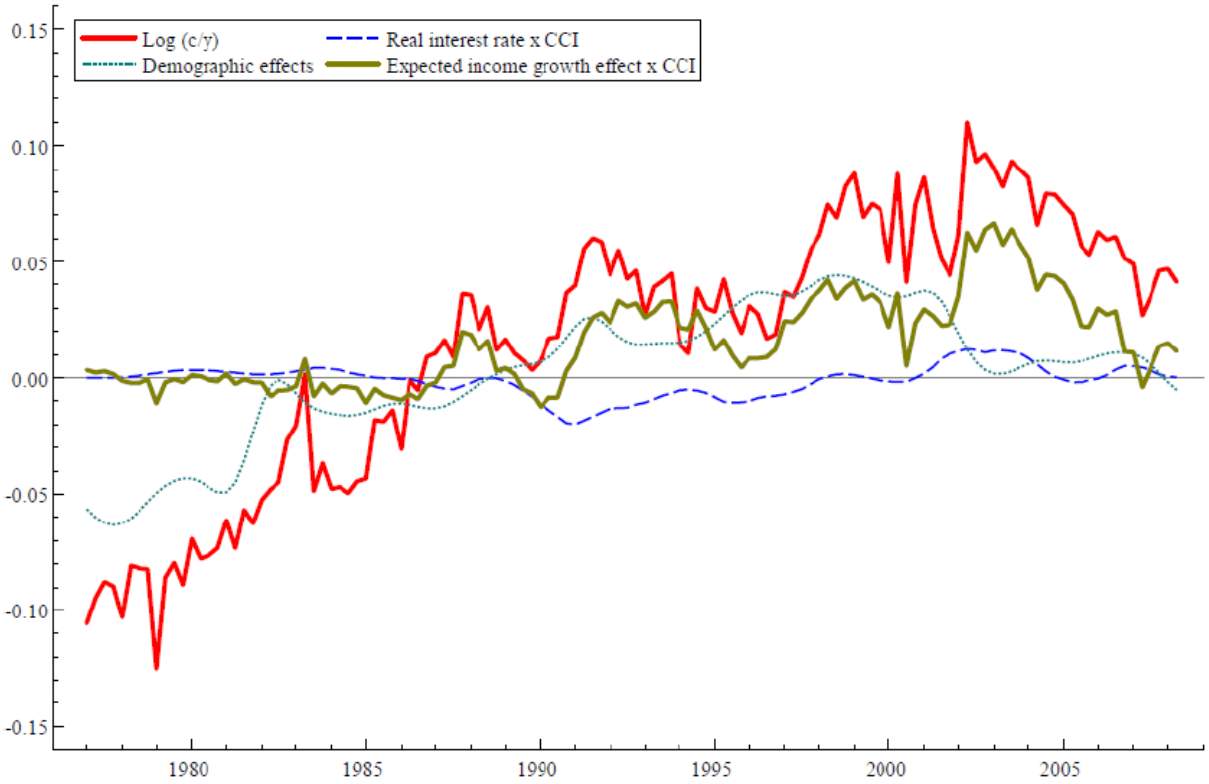


Figure 2

Contributions to long-run log consumption to income (II)



Notes: Figures 1 and 2 show the de-meaned contributions from the interaction terms (and net of their intercept effect, if any). Interaction effects are constructed as $\alpha_{ij}CCI_t(x_{jt-1} - (\text{mean})x_j)$, where α_{ij} is the long-run coefficient on explanatory variable x_j.

5. Conclusion

Unobserved shifts in credit conditions help explain many of the stylised facts about the Australian economy over the last three decades. These include sustained increases in consumption and house prices relative to income, an unprecedented expansion in household balance sheets, increased mortgage refinancing activity, and an increase in the level and volatility of housing equity withdrawal (HEW). Australia was high on the OECD's list of countries with greatly overvalued house prices in the mid-2000s, but there are few signs of the kinds of distress suffered by the United States after 2007. Among the reasons are better financial regulation and hence the absence of poor quality sub-prime lending, better monetary policy which in part headed off excessive house price euphoria, the absence of a speculative house building boom, and Australia's good economic fortune in riding the commodities boom fuelled by China and other emerging markets.

We show that credit conditions operate on the real economy through several channels. First, the relaxation by lenders of the mortgage down payment requirement facing young, first-time homebuyers raises long-run mortgage demand, house prices and consumption. Second, debt product innovation introduces a collateral channel from house prices to real activity. Older households with existing wealth benefit from cheap mortgage refinancing and home equity loans (popular since about the mid-1990s). Through HEW, housing capital gains can be accessed and redirected towards immediate consumption, asset portfolio rebalancing or debt consolidation. However, for young households without collateral, higher house prices

require saving for a larger deposit. The balance of house price effects on consumption and mortgage demand thus hinges on the state of credit conditions. Third, easing of credit conditions makes intertemporal consumption smoothing possible. This raises the importance of real interest rates and income growth expectations in household decisions, and diminishes the importance of economic uncertainty. With liberal credit conditions, mortgage credit and housing equity are increasingly used to smooth fluctuations in economic conditions.

Our latent interactive variable equation system (LIVES) presents a solution to the difficult macroeconometric challenge of handling large, unobserved structural changes. The method relies on institutional knowledge, economic theory, and consistency in logic and empirical findings across the equations (with common roles played by the latent credit conditions index (CCI), income growth expectations and other variables). Our system throws a good deal of light on the underlying shocks driving the economy and on the workings of the monetary policy transmission mechanism. Evidence of non-linearities and shifts in marginal responses with the CCI imply that the underlying impulse response functions are far from constant. These findings have obvious application for policymakers, since existing models without credit conditions effects are misspecified and are likely to lead to policy errors.

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Discussant remarks on John Muellbauer and David M Williams' paper "Credit conditions and the real economy: the elephant in the room"

Chris Thompson[1]

I would like to begin by thanking the MAS and the BIS for organising this workshop and inviting me to discuss this excellent paper by John Muellbauer and David Williams. The key finding of the paper is that non-price credit supply conditions have had important structural influences on the Australian macroeconomy. At the Reserve Bank of Australia (RBA), we have spent a lot of time analysing the effects of financial sector liberalisation and innovation on the Australian economy and financial sector. Credit conditions are clearly important and have played a major role in explaining trends in Australian household sector saving, borrowing and investment patterns over recent decades. One of the difficulties, though, is measuring credit conditions. This is something the authors have tackled in this paper, deriving some interesting and useful results.

The authors employ a novel empirical approach to estimate a mortgage credit conditions index (CCI) for Australia as a single latent variable in a system of four error correction models for consumption, house prices, mortgage debt and housing equity withdrawal. They find that the CCI has significant effects on the intercepts of the long-run cointegrating relationships of each equation, and also interacts with key parameters in sensible ways. For example, their results suggest that the marginal propensity to consume out of housing wealth increases with the CCI, consistent with an easing of credit constraints making it easier for people to access the accumulated equity in their homes.

The estimated CCI points to an almost continual easing of non-price credit conditions in Australia since the early 1980s. This overall direction is broadly sensible and consistent with the financial deregulation, competition and innovation that have taken place over this period. That said, some of the shorter-term movements in the CCI seem difficult to explain, though it is hard to verify in any case given the lack of alternative measures. For example, the relatively large increase in the estimated CCI between 1990 and 1992 seems hard to reconcile given the difficulties in the Australian banking sector at the time, as is the flat period around the mid-1990s when a lot of financial innovation in the mortgage market was taking place, spurred by the rise of non-bank mortgage originators using securitisation as a funding source. I was also surprised to see that the increase in the estimated CCI over the 1980s was almost as large as the rise over the remainder of the authors' sample period (to 2008). The initial effects of financial deregulation in Australia in the 1980s were mostly focused on expanding the availability of business credit rather than housing credit, and this was one of the factors behind the boom and subsequent bust in commercial property lending in the late 1980s and early 1990s. It was not until the 1990s that lenders began to focus more on expanding the availability of housing credit, particularly given the competitive pressures associated with the rise of the non-bank mortgage originators.

In regard to the estimation process, I note that the authors have imposed a fair bit of structure on their CCI – using priors to define periods when the index is either non-increasing or non-decreasing – together with a lot of smoothing. Given the questions that arise about some of the short-term movements in the CCI, it would be interesting to see the results from

[1] Reserve Bank of Australia.

an approach that imposes less structure, such as an unobserved components framework where the CCI is assumed to follow a random walk with drift.

Another broad comment I have about the paper is that it does a nice job of motivating the consumption and house prices equations in the four-equation system, drawing on the established theory, but relatively less time is spent motivating the equations for mortgage debt and housing equity withdrawal. The inclusion of these latter two equations, however, is arguably one of the paper's innovative features.

Among the factors that have contributed to the rise in mortgage debt in Australia, one factor that I think deserves more discussion in the paper is the role of the disinflation in the early 1990s and the associated shift to lower nominal interest rates. One of the ways lenders traditionally restrict lending in Australia, apart from the usual down payment constraint, is to set the maximum loan size such that initial repayments are no more than a given share of a borrower's income. For example, it was common for this repayment constraint to be about 30 per cent of gross income in Australia, although it has been relaxed over time. A decline in inflation that reduces nominal interest rates therefore eases this credit constraint by allowing people to borrow more for the same initial repayment ratio. Moreover, to the extent that lower inflation also implies lower nominal income growth, the repayment-to-income ratio will diminish more gradually over time (the so-called "mortgage tilt" effect), and borrowers' debt-to-income ratios will remain higher for longer.[2] Together, these effects suggest that a permanent disinflation would raise the equilibrium debt-to-income ratio.

Australia is likely to have been particularly affected by this, given the extent of the reduction in inflation that occurred in the 1990s. There has been some research that has tried to model these effects of changing nominal interest rates and income growth on household debt in Australia, with the results suggesting that the 1990s disinflation might explain roughly a doubling of the household debt-to-income ratio.[3] The actual increase in this ratio has been far more than this, however, confirming that other factors have also been in play.

In Muellbauer and Williams' paper, the mortgage debt model does include both real and nominal interest rates as explanatory variables. However, the effect of nominal interest rates on mortgage debt is found to be quite small. This raises the question in my mind of whether the disinflation effect is partly being picked up through the increasing CCI, given potential difficulties in separately identifying these channels. From an econometric standpoint, there may also be problems in trying to identify the impact of what is essentially a step decline in nominal rates that is expected to have an effect on debt levels only over a long period of time.

The authors also estimated a model for housing equity withdrawal (HEW) in Australia to help condition their estimates of the CCI. The results indicate that a large part of the increase in HEW in Australia in the 2000s can be explained by the increase in the CCI. This is attributed to debt product innovation making it easier for people to borrow against their accumulated equity for consumption purposes. One surprising finding, as the authors also acknowledge, is that housing wealth has no effect on HEW in their model. The RBA conducted a detailed household-level survey on HEW in 2005 (Schwartz et al 2006). One of the main findings of this study was that most of the value of housing equity withdrawn in 2004 was associated with property transactions, and less so with people borrowing against the accumulated equity in their existing property for consumption purposes. This suggests that debt product innovation and other forms of easing credit constraints were a less important driver of the increase in HEW than increases in housing wealth and turnover in the property market, contrary to the authors' results. Given the apparent link between HEW and housing market

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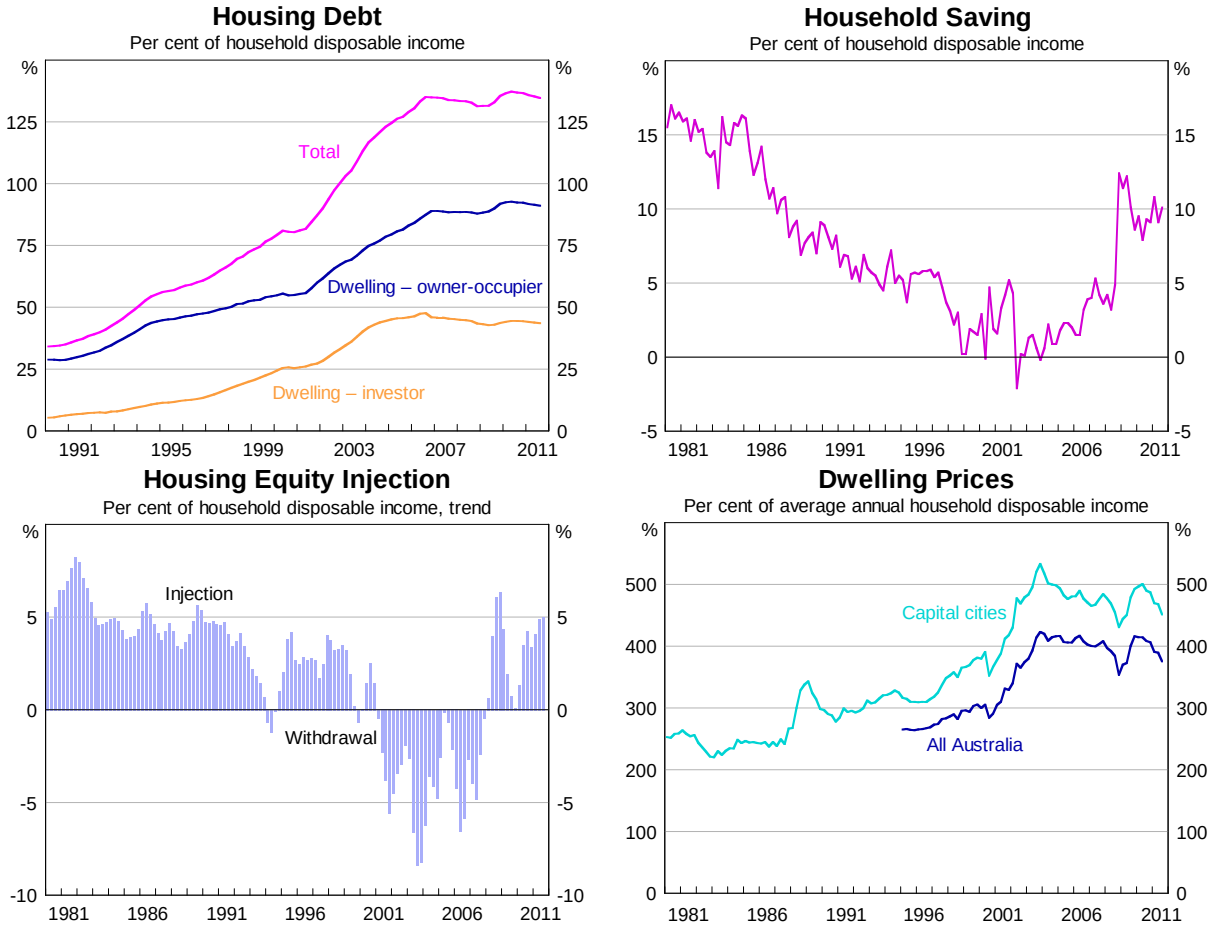
[2] See, for example, Stevens (1997), RBA (2003), Debelle (2004) and Ellis (2006).

[3] See, for example, RBA (2003).

turnover, it would be interesting to explore whether turnover has a significant role in their HEW model.

The final point I wanted to make is to note that a lot has changed in the period since the end of the authors' sample period in 2008 (Figure 1). After a 10–15 year period during which households increased their gearing and reduced their saving rate, they have returned to a more conservative, and traditional, pattern of saving and borrowing behaviour in recent years.[4] With the benefit of hindsight, what appears to have happened is that the period of structural adjustment of household balance sheets to financial deregulation/innovation and the shift to a lower inflation environment ran its course by about the mid-2000s. Since then, the pace of household debt accumulation has been more in line with income growth, so the debt-to-income ratio has been broadly unchanged. The large trend decline in the household saving rate has been reversed, with the saving rate in the past year or so returning to around its mid-1980s level. Slower growth in housing debt has translated into a resumption of positive housing equity injection in the past few years, following the period from around 2001 to 2007 in which the household sector was making net housing equity withdrawals. And compared with the previous decade or so, housing prices in Australia have not grown especially rapidly in most parts of the country in the period since 2004. The apparently more cautious attitude of the household sector in recent years has likely been reinforced by the global financial crisis, which has led some households to rethink their spending and borrowing decisions.

Figure 1



[4] For discussions of the recent change in household behaviour, see Stevens (2011), Lowe (2011) and RBA (2011).

The significant shift in household financing behaviour in recent years raises the obvious question of how the authors' model would account for this. It would be interesting, therefore, to see the results of the authors' model estimated over the updated sample period. This would provide an opportunity to examine what has happened to credit conditions, which is a relevant policy issue at the moment, given the slower pace of housing credit growth seen in recent years. While part of the weakness in credit growth is likely to be demand-driven, credit supply conditions are also likely to have tightened since the global financial crisis. We know, for example, that mortgage lending standards have tightened since 2008, which has been evident in a reduced share of high loan-to-value-ratio and low-doc loans (see, for example, RBA 2011). Funding pressures have been a relevant factor here, where the weakness in the securitisation market, in particular, has led to a contraction in the non-bank mortgage originators sector, to the advantage of the larger banks. The authors' estimated CCI was beginning to turn down at the end of their sample, but it would be interesting to see how much further it has declined in the period since then.

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