Property-price cycles and monetary policy

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Introduction

Recent increases in equity and bond prices in many countries have renewed interest in the implications of asset-price changes for monetary policy. The reasons for this interest are clear. Rising asset prices can provide policy-makers with useful information about the likely future path of the economy; they can lead to increases in aggregate demand and inflation; and perhaps most importantly, they can sow the seeds for future financial-system problems.

This paper focuses on the last of these influences, paying particular attention to the interaction of cycles in property prices and corporate borrowing. Increases in real-estate prices generate collateral for additional loans; this stimulates credit growth and prolongs the upswing of the business cycle. However, if the price increases turn out to be unsustainable, much of this collateral can disappear, causing large losses for financial institutions and other firms. The outcome can be a pronounced and protracted slowdown in economic activity.

The fact that changes in asset prices can adversely affect the process of financial intermediation means that asset-price fluctuations can have important implications for bank supervisors and for central banks in their role as custodian of the stability of financial system. While rising asset prices might also increase expected inflation in the short run, in many cases the more important issue for central banks will be preserving the stability of the financial system. While this task is generally thought to be the responsibility of bank regulatory policy, we argue that in some circumstances monetary policy can also play a role. In particular, if the central bank can affect the probability of an asset-price bubble bursting by changing interest rates, it may be optimal to use monetary policy to influence the path of the bubble, even if it means that expected inflation deviates from the central bank's target in the short term.

Clearly, regulatory policy needs to be responsive to the destabilising effects of asset-price bubbles on the financial system. But a monetary-policy framework which is concerned with both the expected inflation rate and the variability of inflation may see monetary policy respond to asset-price bubbles in a way that also helps preserve the stability of the system. By seeking to change the path of the bubble, monetary policy may be able to simultaneously contribute to maintaining financial-system stability and to reducing the variance of inflation.

In line with the topic of this conference, this paper pays particular attention to the monetary-policy implications of asset-price changes.

The structure of the paper is as follows. Section 1 uses a simple model to analyse at a conceptual level the links between monetary policy and asset prices. It pays particular attention to the issues of how monetary policy should respond to bubbles in asset prices and how the advent of low inflation can affect the behaviour of asset prices and the response of monetary policy to changes in these prices. The important contribution of the model is that it incorporates the effect of falling

nominal asset prices on inflation through the adverse effects that these falls have on financial intermediation.

Section 2 discusses cycles in asset prices in Australia and highlights the important link between property prices, credit and activity. We show that cycles in property prices are closely linked to cycles in credit and output while the link between equity prices and credit is much weaker. Furthermore, we suggest that property-price falls contribute to the breakdown in financial intermediation, thereby prolonging the process of recovery during downturns in activity.

We focus attention on the commercial property-price cycles of the early 1970s and late 1980s. In both cases there were substantial increases in the real price of property which were later unwound. In both cases the decline in the real price was over 50%, although in the latter period much more of the adjustment occurred through falls in nominal property prices. The effect of these cycles in property prices can be clearly seen in the ratio of credit to GDP. Despite differences in the extent of bank regulation, this ratio rose strongly during both property-price booms and then fell considerably during the downturn in property prices. We argue that the decline in credit contributed to the slow recoveries from the mid-1970s and early-1990s recessions. In contrast, the recovery from the early-1980s recession was comparatively quick, partly because the headwinds caused by declining property prices were much weaker.

Section 3 presents some econometric evidence suggesting that the property-price cycle helps to explain the business cycle and that falls in nominal property prices are particularly important. Finally, Section 4 brings together the conceptual and empirical sections of the papers by drawing some broad lessons for monetary policy.

1. Asset prices and monetary policy

In an inflation-targeting regime how should monetary policy respond to movements in asset prices? Recently, this question has received more than the usual degree of attention. Yet, the only broadly based consensus that exists is that the question is a difficult one. At one end of the debate are those who argue that asset prices should be included in the overall price index targeted by the central bank, while at the other end are those who argue that asset prices are relevant to monetary policy only in so far as they affect forecasts of future goods and services price inflation. There are also those who see a role for monetary policy in responding to asset-price movements which might threaten the stability of the financial system.

Examining all the complex interactions between asset-price movements, the macroeconomy and the health of the financial system is a difficult task and is beyond the scope of this paper. Instead we set ourselves the modest task of highlighting some relevant issues regarding the interaction of asset prices and monetary policy.

The existing theoretical literature makes two reasonably robust points. First, in assessing possible implications of asset-price changes for monetary policy, it is important to understand the source of the change in prices. Second, the prices of assets that are used as collateral for loans from financial institutions are likely to be more relevant to the setting of monetary policy than are the prices of other assets. We briefly discuss these two points and then turn to the following two questions:

• If asset price changes are not based on fundamentals what should monetary policy do?

• Does low inflation of goods and services prices affect how monetary policy should respond to changes in asset prices?

1.1 The source of the change is important

The first general point is that not all asset-price changes are the same. Prices can move for a variety of reasons and understanding those reasons is important in determining the appropriate monetary-policy response (see Smets (1997)).

In Australia's case, the most obvious example of this point is the exchange rate. As the terms of trade rise, the exchange rate tends to appreciate (see Gruen and Dwyer (1995), Smets (1997) and Tarditi (1996)). This appreciation helps reduce any inflationary impact that would otherwise be associated with the increase in the terms of trade; thus the case for an easing of monetary policy in response to an appreciation of the currency is less than clear. In contrast, if the exchange rate appreciation is not based on underlying fundamentals, there is a much stronger case for a change in monetary policy, especially if the appreciation is likely to reduce expected inflation.

Another example is the stock market. If a rise in equity prices reflects an improved outlook for corporate profits as a result of faster underlying productivity growth, the central bank's forecast of future inflation may actually fall. In contrast, if the rise in equity prices has no fundamental justification, expected inflation might be higher, particularly if aggregate demand responds to perceptions of higher wealth.

In practice, the difficult problem is accurately assessing the reason for the change in asset prices. The Sydney housing market in the late 1980s is a good example. The Sydney region had benefited from the deregulation of the financial system earlier in the decade and the increasing international integration of the Australian economy. There was a general perception that these improved "fundamentals" justified a rise in the real price of property. This perception appears to have been correct; over the four years to 1997 the average *real* price of a house in Sydney has been almost 40% higher than the average real price over the years 1983 to 1987. However, while real housing prices are now clearly higher than in the mid-1980s, they have fallen considerably from their peak in 1989. (For further details see Section 2.) While most observers thought that a real increase in property prices was justified, there were no objective criteria for determining whether the increase should be 20, 40 or 80%.

A further complication which this example illustrates is that an improvement in fundamentals often generates dynamics which cause asset prices to move by more than the fundamentals would suggest. Not only do policy-makers need to identify the source of the improved fundamentals but they also need to assess how much of a given change in prices is justified by the fundamentals. These are difficult tasks.

1.2 Property prices are important

The collateral for most loans is real estate; this means that changes in the price of real estate not only have potential effects on aggregate demand, but also on the health of the financial system. If nominal property prices actually fall, and if financial institutions have made loans with relatively high loan-to-valuation ratios, the underlying collateral may be insufficient to match the face value of the loan. The result can be substantial losses by the financial system, which can have adverse effects on the future availability and cost of intermediated finance.

Changes in property prices can affect the balance sheets of corporations, as well as financial institutions. A fall in prices reduces the net value of firms and, due to imperfections in credit markets, makes it more difficult to attract intermediated finance for a given investment project (see Bernanke and Gertler (1990), Gertler (1992), Kiyotaki and Moore (1995) and Lowe and Rohling (1993)). As a result, a financial accelerator acts to amplify any downturn in economic activity (Fisher (1933)). To some extent this effect is likely to work regardless of whether the fall in property prices is in real terms or nominal terms; falling real property prices are likely to constrain access to intermediated finance, even if nominal prices are rising. In contrast, a given fall in real property prices is much more likely to generate the type of adverse financial-system consequences discussed above if

the fall occurs in a low-inflation environment, with *nominal* asset prices actually falling. We return to this issue in Section 1.4.

In Australia, relatively little lending by financial intermediaries has been secured against equities. Hence booms and busts in equity prices need not have the same direct implications for the balance sheets of financial institutions that changes in property prices have had. Nevertheless, movements in equity prices can still affect the stability of the financial system. As the experience of the United States in 1987 shows, a major fall in equity prices can create problems in the payments system, with potentially quite large adverse consequences. Further, if a share market crash leads to a severe contraction in aggregate demand, borrowers may find themselves unable to repay their loans.[1] As share ownership becomes more widespread, the aggregate demand effects of changes in equity prices may become more pronounced.[2] Continued financial innovation may also see the growth of lending secured against equities which would add to the exposure of balance sheets of financial institutions to changes in equity prices. Such a change in the pattern of financial intermediation would increase the relevance of stock prices for monetary policy.

2.3   Monetary policy and bubbles: a simple model

In this subsection we take it as given that the increase in asset prices is not justified by underlying fundamentals and that the central bank knows this. We loosely refer to increases of this kind as bubbles. To discuss their implications for monetary policy we use the following simple model of the economy:

$$\pi_t = \alpha A_t + \beta D_t \Delta A_t - R_{t-1} \tag{1}$$

where π_t is the deviation of inflation from the central bank's target, A_t is the deviation of the asset price from its fundamental value, R_t is the deviation of the policy interest rate from its neutral level and D_t is a dummy variable which takes a value of 1 if the asset price has fallen, and 0 otherwise. While the target variable is taken to be inflation, the following analysis would apply equally if the target were the deviation of output from its potential level. Note that monetary policy is assumed to affect the inflation rate with a lag of one period.

In this model, the effect of a change in the asset price on inflation is asymmetric. This asymmetry arises from the effect that declines in nominal prices have on the health of the financial system.

If the asset price is originally at its fundamental value and then *increases*, economic activity expands, and inflation increases. A higher asset price creates perceptions of greater wealth, leading to an expansion of aggregate demand and rising inflationary pressures, as there is no improvement on the supply side of the economy; the larger α is the larger is the effect. However, when the bubble bursts and the asset price returns to its fundamental value, not only are the stimulatory effects of the higher asset price withdrawn, but there are additional contractionary effects. These effects arise from the balance-sheet problems discussed above and act as a disinflationary force on the economy; the larger β is, the more powerful is this force. The experience of the past decade suggests that β is likely to be larger for property prices than for equity prices.

When the asset price is above its fundamental value, there is some probability p that it will return to its fundamental value next period. This probability is assumed to be a function of the

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[1]   Equity prices can influence aggregate demand through wealth effects and through their effect on the cost of capital (see Anderson and Subbaraman (1996) and de Roos and Russell (1996)).

[2]   The 1997 Australian Sharemarket Survey finds that 34% of the Australian adult population has direct or indirect share holdings. This percentage would be considerably higher if account was taken of employer-funded pension schemes.

deviation of the interest rate from its neutral level. Higher interest rates increase the debt servicing on purchases of the asset and make a downturn in the business cycle more likely; these changes increase the probability that the bubble will collapse. In addition, a decision by the central bank to increase interest rates could be accompanied by remarks regarding the high level of asset prices and the unsustainability of current trends; such remarks might also make the continuation of the bubble less likely.

We model the relationship between today's interest rate and the probability of the bubble collapsing in the next period as follows:

$$p_{t+1} = \phi + \varphi R_t \tag{2}$$

The larger φ is, the larger is the effect of the interest rate on the probability of the bubble collapsing. If the bubble does not burst it is assumed to grow at rate g^* so that:[3]

$$A_{t+1} = gA_t \tag{3}$$

where $g = 1 + g^*$.

Further, we assume that the economy operates for three periods; that a bubble emerges in the first period; and that if the bubble collapses in the second period it does not subsequently re-emerge in the third period.[4] While this last assumption is crucial in deriving the results below, it is not important that it holds exactly; what is important is that that the probability of the bubble re-emerging is relatively small, at least in the near term. An examination of real-world bubbles suggests that this requirement is not a stringent one (see Section 2).

Having observed that a bubble has emerged in period 1, the task for the central bank is to minimise the (undiscounted) sum of the squared deviations of inflation from its target. Since the central bank cannot affect the current rate of inflation, this amounts to minimising:

$$E_1(\pi_2^2) + E_1(\pi_3^2) \tag{4}$$

where E denotes the expected value and subscripts refer to time periods. This objective function assumes that the central bank is not only concerned about the expected value of inflation but also the variability of inflation; this latter concern may reflect risk aversion or the real costs associated with variability in the inflation rate.

We solve this problem recursively, solving first for the two possible interest rates in period 2; one for the case in which the bubble bursts in period 2 and one for the case in which the bubble does not burst. Using these solutions we then solve for the optimal interest rate in period 1.

The solutions are analytically quite complicated since non-linearities are introduced by making the probabilities of various outcomes a function of the interest rate.[5] Thus, rather than present

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[3] We have assumed that the growth rate of a surviving bubble (g*) is independent of the probability of the bubble collapsing. However, rational expectations require that the growth rate of the bubble increases as the probability of the bubble collapsing increases. In addition, under rational expectations, an increase in interest rates (which increases the probability of collapse of the bubble), also would lead to a discrete fall in the current size of the bubble. While our model is not compatible with rational expectations, we regard it as realistic to assume that the central bank takes as exogenous the growth rate of a surviving bubble.

[4] Three periods is the minimum number needed to generate interesting results.

[5] The analytical solutions were derived with Mathematica Version 3.0.

the algebraic solution we discuss the solutions for a few different parameter sets. A summary of the results is presented in Table 1.

Table 1

Model results

Parameter/ Variable	Definition	Case 1			Case 2	
		1a	**1b**	**1c**	**2a**	**2b**
g	Growth rate of bubble	2.0	2.0	3.0	2.0	2.0
ϕ	Exogenous probability of collapse	0.5	0.5	0.5	0.2	0.2
φ	Effect of interest rates on probability of collapse	0.0	0.2	0.2	0.0	0.2
β	Cost of bubble collapse	2.0	2.0	2.0	2.0	2.0
R_1	Interest rate in period 1	0.0	0.6	2.1	1.2	1.0
p_1	Probability of collapse in period 1	0.5	0.62	0.92	0.2	0.4
$E_1(\pi_2)$	Expected inflation in period 2	0.0	-1.1	-3.7	0.0	-0.6

Note: The inflationary effect of the bubble, α, and the initial size of the bubble, A_1, are always set equal to 1.

In the following examples we set $\alpha = 1$, $\beta = 2$ and the size of the bubble in the first period (A_1) equal to 1. These parameter values imply that a collapse in asset prices has a large negative effect on output relative to the expansionary effect of the bubble. Initially we set $g = 2$ (if the bubble survives, it doubles in size each period) and $\phi = 0.5$ (if the interest rate is at its neutral level, the probability of the bubble bursting next period is 0.5).

Now suppose that changing the interest rate has *no* effect on the probability of the bubble bursting ($\varphi = 0$); this is case 1a in Table 1. In this example the optimal policy is to leave the interest rate unchanged (at the neutral rate); if the bubble continues next period, inflation will equal +2, if it collapses inflation will equal -2. Given that these two events have the same probability of occurring, the expected loss from the bubble crashing is equal to the expected loss from the bubble continuing. The expected variance of inflation in period 2 is 4 and this cannot be reduced by changing the interest rate.

In this example, monetary policy cannot affect the probability of the bubble bursting and so possible events beyond the standard transmission lag (one period) have no bearing on the current setting of policy. Of course, possible events next period are important; if we increase the growth rate of the bubble, reduce the probability of the bubble collapsing, or reduce the costs associated with a bubble collapse, interest rates should be increased, rather than held constant.

Now instead, suppose that the central bank can affect the probability of the bubble bursting (say $\varphi = 0.2$). In this case (1b in Table 1) the optimal policy is to raise the interest rate by 0.6 above the neutral rate.[6] The higher interest rate increases the probability of the bubble collapsing from

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[6] The units are not important here, as they could be rescaled by introducing a parameter on the interest rate in Equation (1).

0.5 to 0.62. The effect of this policy is to cause expected inflation to be below target in the second period.

Where does this result come from? Monetary policy has two effects in this model: one standard and one non-standard. First, if the central bank takes the probability of the bubble collapsing as fixed, it faces the usual problem of making decisions under uncertainty. The bank solves this problem by determining the possible levels of inflation in the second period and then, taking the relevant probabilities as given, solves for the interest rate that minimises the expected variance of inflation around the target. The expected rate of inflation is equal to the bank's target.

The second, and non-standard, effect of monetary policy is on the probability of the bubble collapsing. If the central bank can affect this probability, it needs to take into account not only possible outcomes in period 2, but also possible outcomes in period 3. While the standard transmission lag is only one period, monetary policy can affect the probability of events occurring in subsequent periods. If policy can burst the bubble in period 2, the probability of the bubble bursting in period 3 is reduced to zero. In this example, it makes sense for the central bank to raise the interest rate to increase the probability of the bubble bursting in period 2 and thereby reduce the probability of even more extreme outcomes in period 3.

As the growth rate of the bubble increases, the optimal interest rate increases at an increasing rate. A higher growth rate of the bubble increases the variance of possible outcomes in each of the following periods, with the effect being substantially larger for the third period. As a result, the pay-off to bursting the bubble in period 2 rises. For example, if g equals 3 rather than 2 (so that the bubble triples in size each period, rather than doubles), the optimal interest rate in the first period is 2.1 above the neutral level and the probability of the bubble collapsing increases to 0.92 (case 1c in Table 1). In a sense, the large increase in the interest rate amounts to a strategic attack on the bubble. Policy is tightened to such an extent that it is almost certain the bubble will break. The policy-maker knows that this will be quite contractionary; not only will growth be retarded by the lagged effect of the high interest rate, but it will also be adversely affected by the flow-on effects of the fall in asset prices. Yet failing to increase the interest rate results in a much higher probability of a larger crash at some later point.

In case 1a above, optimal policy involves maintaining the interest rate at zero when the probability of the bubble bursting is exogenous, but increasing the interest rate when the probability is endogenous. We now consider a case in which the optimal policy is to increase the interest rate when the probability of the bubble bursting is exogenous. To do this we reduce ϕ (the exogenous probability of collapse) from 0.5 to 0.2, while keeping all other parameters unchanged (case 2a). With a reduced probability of the bubble bursting next period, it is more likely that the inflation will be above target in the second period and so the interest rate in period 1 is higher than it was in the earlier case (1.2 compared to 0). If we now make the probability of collapse endogenous ($\varphi = 0.2$), the optimal policy again sees interest rates increasing (to 1.0; case 2b), but the increase is smaller than the increase when the probability of collapse is not influenced by monetary policy. Once again, the higher interest rates increase the probability of the bubble bursting in period 2 from 0.2 to 0.4.

In this example, the higher interest rate needed to counteract the expansionary effect of the asset-price bubble also increases the probability of the bubble collapsing; this amplifies the expected effect of the tightening of policy. This allows the central bank to increase the interest rate by a smaller amount than would otherwise be the case.

This result comes partly from the way we have modelled the probability of the bubble collapsing (Equation 2). If this probability is a function not of the deviation of the interest rate from the neutral level, but of the difference between the interest rate and the rate needed to offset the standard expected demand effects of the bubble (1.2 in the above example), then monetary policy would always be tightened by more than the standard analysis would suggest.

The above examples highlight a few general points:

- If the probability of a bubble bursting is related to the current level of interest rates, the central bank may wish to raise interest rates to increase the probability of the bubble breaking, even if an increase in interest rates cannot be justified on more conventional grounds. Such a policy would cause an expected slowdown or contraction in activity with inflation falling below target; the gain would be a reduction in the variance of possible outcomes in the following period.

- The monetary authorities need to be concerned with possible outcomes beyond the period of the normal transmission lag. If the probability of a bubble collapsing is endogenous, the expected path of the economy beyond the control lag is affected by today's interest-rate decision.

- If interest rates need to be increased to offset the expansionary effect of a bubble, the size of the optimal interest-rate increase may be smaller if the probability is endogenous rather than exogenous. By adding what amounts to an additional transmission channel, the size of the optimal response may decline.

Finally, in the above model we have assumed that the parameters α and β are fixed and independent of monetary policy. If these parameters could be lowered, the need for monetary policy to respond to changes in asset prices would be reduced. In the limit, if they were both zero, no monetary response to asset-price bubbles would be required. Alternatively, if β could be reduced to zero (so that falls in asset prices did not have implications for the health of the financial system) monetary policy could just be concerned with the standard demand effects of asset-price changes. However, while it might be desirable to reduce these parameters, there is probably little that monetary policy can do in this regard.

One alternative might be to use financial regulation as a second instrument. For example, if the supervisory authorities thought that a serious bubble had emerged, they might be able to reduce α and β (or g) by raising capital requirements on property loans, and/or by imposing low maximum loan-to-valuation ratios. By limiting the extent to which financial institutions could make loans collateralised against property, such policies might reduce the contractionary effects when the bubble finally bursts; they might also increase the probability of the bubble bursting. In general, if such a policy option is available it may be preferable to using interest rates; a primary advantage would be that when the bubble bursts, the economy would not also be dealing with the lagged effects of high interest rates.

Notwithstanding this advantage, the use of financial regulation to affect asset prices is not without considerable difficulties. Foremost amongst these is that imposing regulations on the banking sector may simply induce a shift towards institutions that are more lightly regulated. In a sense this was the experience in Australia in the early 1970s. Large increases in property prices were accompanied by rapid growth of non-bank financial institutions as well as other vehicles for investing in property. When the property crash came, losses were concentrated in these institutions rather than in the banks, but there were still considerable contractionary effects on the economy (see the discussion in Section 2). Another difficulty is that imposing and lifting regulation may affect the efficiency of the financial system.

1.4 Implications of low inflation

The 1990s have seen a remarkable convergence amongst OECD countries in goods and services price inflation, with most countries now having inflation rates of 3% or less. For those countries with previously high rates of inflation, the advent of stability of goods and services prices has a number of implications for asset prices and the interaction of asset prices and monetary policy. We briefly discuss four of these.

First, low inflation should reduce the likelihood of a bubble originating. In an environment in which inflation is high and variable, property acts as a hedge against inflation and there are also often substantial tax advantages to investing in property. In contrast, in an environment

with low and stable inflation, the incentive to purchase property is diminished. These changed incentives should reduce the likelihood of speculative increases in property prices.

Second, and perhaps most importantly, if an asset-price bubble does occur, a low-inflation environment makes it more likely that the inevitable correction in *real* asset prices will occur through a decline in *nominal* asset prices. The Australian experience is again instructive. After the property-price boom of the early 1970s, real property prices declined significantly; while this involved some fall in nominal prices, the high background rate of goods and services price inflation accounted for much of the adjustment in real prices. In contrast, in the low-inflation 1990s, relatively more of the adjustment in real property prices took place through the nominal price of property falling (see Section 2). Given that in a low-inflation environment, financial institutions are less likely to realise the full nominal value of collateral if borrowers fail to repay their loans, loan-to-valuation ratios should decline. If this does not occur, a correction in real property prices, through declining nominal prices, can significantly exacerbate the business cycle. If this is the case, it makes it more important that monetary policy responds relatively early in the life of the bubble.

Third, lower nominal interest rates associated with lower inflation reduce the liquidity constraints that previously restricted the access of some borrowers to intermediated finance. In Australia, it is not uncommon for financial institutions to determine the maximum amount an individual can borrow for the purchase of a house by calculating the size of the loan which would generate initial repayments equal to 30% of the individual's income. As a result, lower interest rates mean larger loans and more individuals qualifying for a housing loan (see Stevens (1997)). This is likely to increase the dispersion of house prices in any local market, and may affect the average price as well. Upward pressure on prices might also occur if reduced liquidity constraints lead to an increased rate of household formation.

Finally, average real interest rates are likely to be lower in a period of sustained low inflation than they are in the period of disinflation. This reflects not only the easing of the previously restrictive monetary policy, but also lower risk premia associated with low and stable rates of inflation. Lower expected real interest rates should lead to a rise in real asset prices. In addition, a number of authors have argued that low inflation reduces the "equity risk premium", and that, as a result, real equity prices should increase as low inflation becomes entrenched.[7] These effects can be quite substantial. If one uses the discounted dividend equity-valuation model, a one percentage point decline in the real interest rate, or the equity premium, generates an increase in the equity price of 25% if the initial dividend yield is 4%.

In summary, a move from moderate to low inflation rates might justify some fundamental increase in real asset prices, although as usual, determining the extent of this effect is difficult, and improving fundamentals can themselves be conducive to generating bubbles. While, in the medium term, low and stable inflation should probably reduce the likelihood of bubbles occurring, if a bubble does occur, there are perhaps stronger implications for the health of the financial system. As a result, the returns to early action to increase the probability of the bubble collapsing may be higher.

2.   Cycles and bubbles in Australian asset prices

In this section of the paper we study cycles in the prices of Australian equities, commercial property and residential dwellings over the past three decades. We identify three broad cycles. The first begins from the late 1960s for equity prices and in the early 1970s for property prices, the second cycle starts in the late 1970s and the third cycle starts after 1985. Of the three cycles, the early-1970s and late-1980s cycles are clearly the more significant.

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[7] See Modigliani and Cohn (1979) for a theoretical justification of this argument and Blanchard (1993) and Kortian (1997) for empirical evidence.

Figure 1
Australian nominal asset price cycles
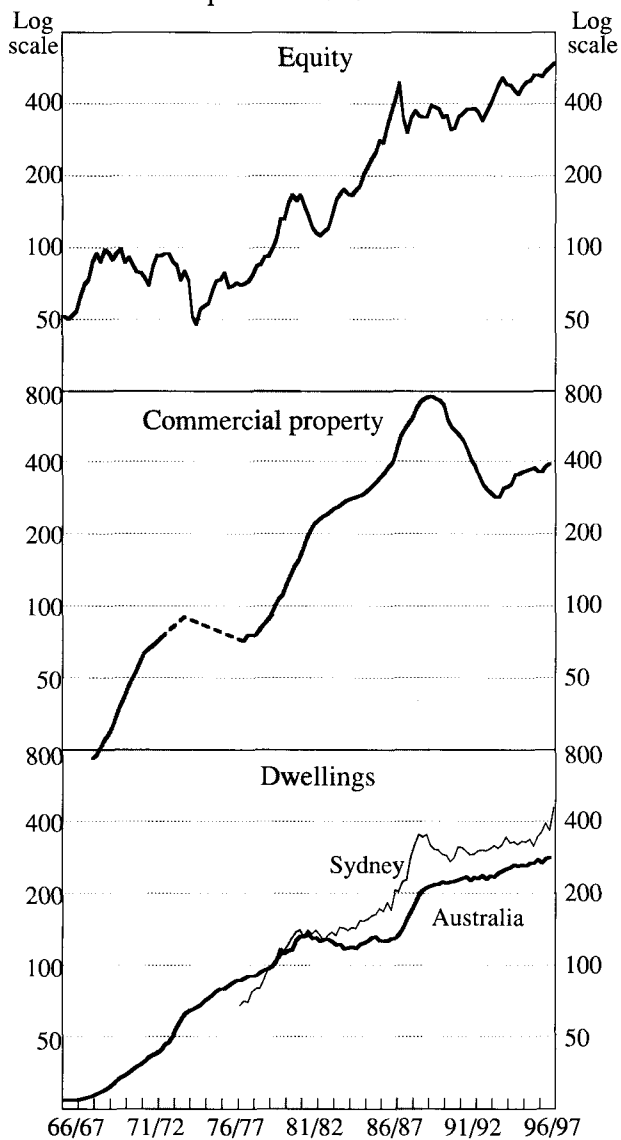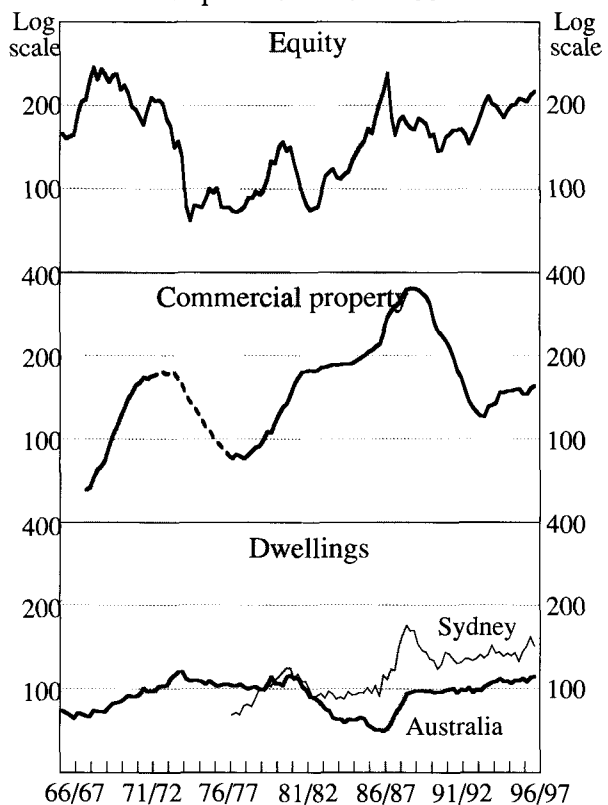
September 1979 = 100

Figure 2
Australian real asset price cycles

September 1979 = 100

Note: Shading indicates the upturn phase of each cycle. Broken line segment is an estimate (see the Appendix).

Figure 1 shows these three cycles in nominal terms and Figure 2 shows them in real terms (the upswings of the cycles are shaded). Table 2 provides details of the precise size, duration and growth rates of each phase of each of these cycles - upturns, downturns and periods in between. Details of the data and the dates of each phase of the cycle are recorded in the Appendix. Our goal is to indicate the broad patterns in asset prices rather than to pick the exact dates of each phase in the cycle.[8]

Between March 1968 and March 1997, nominal equity prices increased eight-fold, commercial-property prices seventeen-fold, and dwelling prices ten-fold. The percentage increases in

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[8] It could be argued that the start of the most recent cycle in commercial property prices was a couple of years earlier than we have shown. However, the same could be said of equity prices. These sorts of minor adjustments would not change our main observations nor the substance of our arguments.

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real terms over the same period were 7, 137 and 39% for equity, commercial property and dwelling prices respectively. The largest swings through cycles were in commercial property, whereas movements in dwelling prices were comparatively muted (Table 2).

Table 2

Cycles in real asset prices

Average annualised quarterly growth rate (in per cent),
duration (in quarters)and size (percentage change)

	Equity			Commercial property			Dwellings		
	Growth rate	Duration	Size	Growth rate	Duration	Size	Growth rate	Duration	Size
Early-1970s cycle									
(in between)	-	-	-	-	-	-	3	20	15
Upturn	20	13	71	19	23	164	7	11	21
Downturn	-21	19	-71	-17	15	-51	-3	21	-14
(in between)	4	13	9	0	3	0	-	-	-
Late-1970s/ Early-1980s cycle									
Upturn	18	13	69	21	15	106	4	9	10
Downturn	-34	5	-41	2	12	7	-11	12	-31
(in between)	15	8	30	9	8	19	-3	10	-7
Late-1980s cycle									
Upturn	35	12	141	20	10	57	20	7	38
Downturn	-9	21	-45	-23	16	-65	0	16	0
(in between)	11	17	55	8	14	29	4	16	15

Note: The "in between" portion of the early-1970s cycle for dwellings occurs prior to the upturn. The 1970s downturn for dwellings ends with the late-1970s upturn.

The most recent cycle, which followed the deregulation of the financial system, was in many ways more pronounced than earlier cycles. For equity and dwelling prices, the late-1980s upturn was the most rapid and largest of the three cycles. Also, the 1990s downturn in commercial-property prices was the largest and most rapid (in both nominal and real terms). Despite the significant rise in commercial-property prices in the late 1980s, the percentage increase in *real* prices was actually smaller than in the early-1970s cycle, and the duration of the cycle was shorter. These observations remain true even after we control for differences in the level of real activity across the three cycles - that is, by examining the ratio of nominal asset prices to nominal GDP.

A pattern emerges when we examine the timing of cycles across different asset classes. Namely, equity-price cycles lead property-price cycles; commercial-property and dwelling prices turn down together. The fact that equity prices move before property prices could reflect two things. First, although property prices are set in forward-looking markets, equity markets are much more liquid; therefore, we expect equity prices to move first and fastest. The relatively volatile behaviour of equity prices is apparent in Figures 1 and 2. Second, as equity markets turn down, investors seek to move out

of equities and into other assets, including property, which at the time would be seen as both safer and more likely to provide better returns. Daly (1982) argues that this switching between asset types was partially responsible for the early-1970s upturn in property prices, and the same may also be true of events following the October 1987 share-market crash.[9] Finally, the observation that commercial property and dwelling prices turn down together may simply reflect the fact that the downturns in both of these markets are closely associated with recessions (see below).

We do not formally attempt to identify asset-price bubbles. Instead we simply assert that *ex post*, large downward corrections in real asset prices occurring immediately after a period of rapid real increases indicate that the boom did have a substantial bubble component. Using this criterion a number of cycles stand out as having a substantial bubble component; in particular, the cycles in commercial-property prices in the early 1970s and late 1980s, as well as the cycles in both equity and Sydney dwelling prices during the mid to late 1980s. In each of these cases, large and rapid real increases were promptly followed by rapid real falls in asset price (see Figure 2 and Table 2).

Figure 2 suggests that bubbles do not restart once the real price has started to fall. There is a considerable interval between bubbles (and between price cycles more generally). This is consistent with the key assumption of the model in Section 1 that once bubbles burst they stay burst (for a reasonably long period).

The more general point to make here is that bubbles are often closely linked to the business cycle (Blundell-Wignall and Bullock (1992)). The expansion phase of a cycle justifies some fundamental increase in the real asset price. If this expansion is accompanied by other factors that support a real increase in asset prices (such as financial deregulation), then further real asset price increases will occur. However, it becomes difficult to determine to what extent these real asset price rises are justified by fundamentals and to what extent they constitute the beginning of a speculative bubble. There is no evidence of bubbles occurring during times of weak fundamentals (like recessions). Similarly, the collapse of a bubble is more likely when fundamentals are expected to worsen.

The relationships between asset prices, the business cycle and the cycle in credit are shown graphically in Figure 3.[10] Three patterns emerge. First, a recession coincides with each fall (or major slowing) in real property prices. Recessions in 1974, 1982/83 and 1990/91 occurred within only a few quarters of the end of the upturn phases of the commercial-property and dwelling price cycles.[11] This close link is not apparent for equity prices; most notably, the fall in real equity prices in 1987 was not associated with any significant slowdown in activity.

Second, credit cycles are closely linked to cycles in property prices. The ratio of credit to GDP has been steadily rising through time; this is consistent with financial deregulation and with the positive correlation between GDP per head and the extent of financial intermediation. The largest deviations from this trend increase in credit coincide with the early-1970s and late-1980s property-price cycles. Credit rose more rapidly during the substantial upturns in commercial-property prices in these two cycles, but then fell (as a share of GDP) during the downturn in the property market. The importance of property prices in influencing developments in credit is underlined by a comparison of these two cycles with the experience in the early 1980s. Despite a very severe recession in 1982/83,

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[9] Kent and Scott (1991) show that there was a marked increase in office construction and investment by the finance sector at about this time. It is interesting to note that the October 1997 equity price collapse did nothing to dampen investment by the finance sector.

[10] For a comprehensive review of these relationships across a wider range of countries see Borio, Kennedy and Prowse (1994).

[11] Of course, this does not imply causation running from asset price falls to recessions. The linkages we discussed above run both ways and asset prices are forward looking.

Figure 3

Real asset prices, real GDP growth and credit

Asset prices: September 1979 = 100
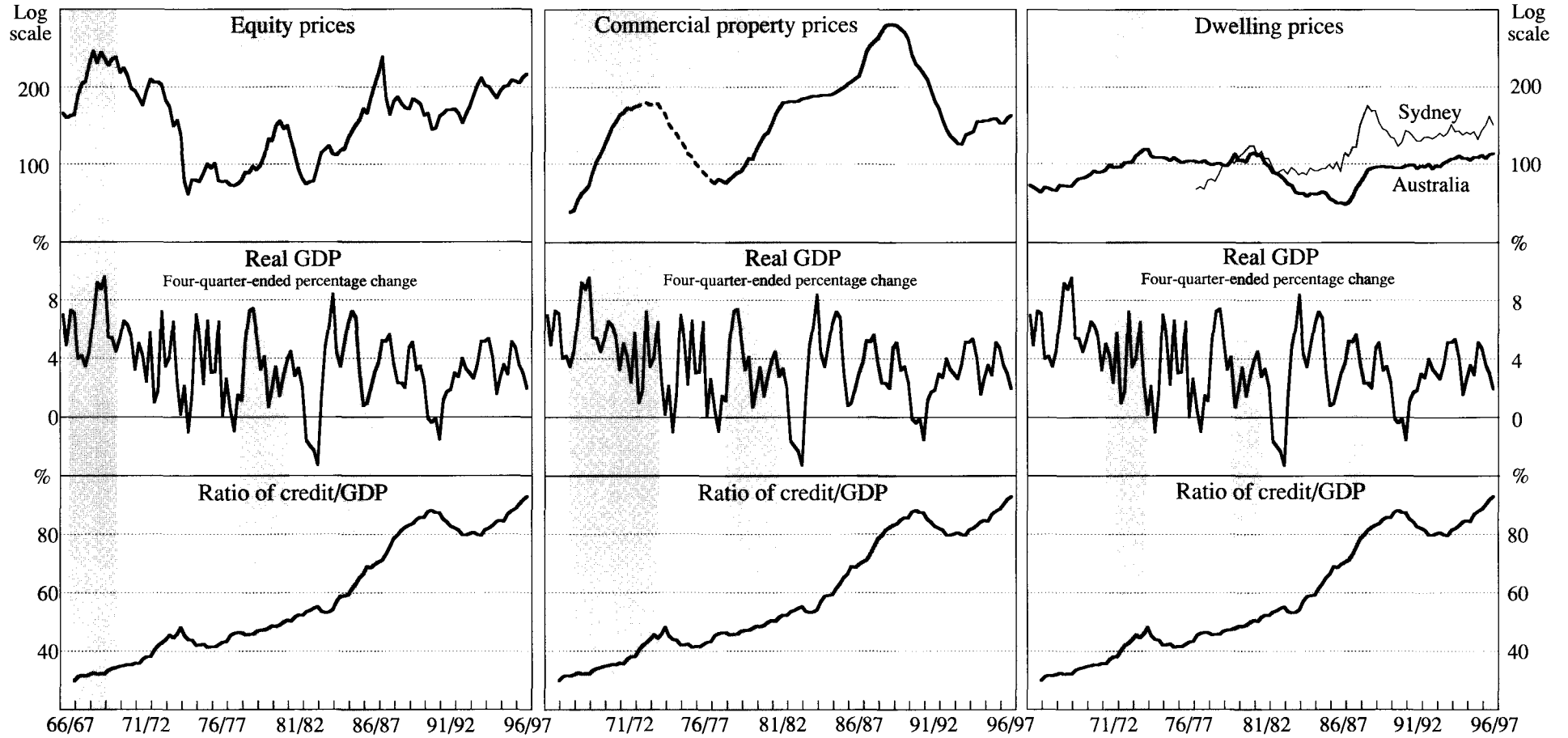
Note: Shading indicates the upturn phase of each cycle. Broken line segment is an estimate (see the Appendix).

the ratio of credit to GDP fell only marginally, and quickly recovered its earlier level. In contrast, in the other two cases it took over 5 years for the ratio of credit to GDP to recover its earlier peak. A plausible explanation for this difference is that the muted property-price cycle in the late 1970s/early 1980s led to a muted cycle in the ratio of credit to GDP. In other words, falling property prices in the early 1970s and early 1990s led to greater falls in credit and more protracted recessions (see below) because falls in the value of collateral caused falls in the degree of financial intermediation.

Third, in contrast, equity-price cycles appear to be unrelated to cycles in credit. In fact, credit continued to grow strongly during each downturn in equity prices.

The early-1970s and late-1980s cycles in commercial-property prices are particularly interesting because they occurred in very different financial and inflation environments and yet they were surprisingly similar in many ways.

Daly (1982) highlights a number of factors that led to, or sustained, the boom in property prices in the early 1970s. These factors include the increasing internationalisation of the Australian economy and the growth of non-bank financial institutions (in part through an influx of foreign merchant banks). There was a general increase in the demand for office space which was fuelled by the minerals boom of the late 1960s, the subsequent development of Sydney as a major financial centre and generally favourable business expectations.[12] Relatively easy monetary conditions also played a role.

In the early 1970s there were tentative steps towards deregulation of the financial system, with quantitative controls on lending being suspended in 1971 and the deregulation of some bank lending rates in 1972 (see Grenville (1991)). Despite these changes, the banking system remained heavily regulated; there were controls on banks' deposit and lending rates and on the composition of banks' balance sheets. These controls meant that banks were constrained in their ability to make additional loans on the back of higher property prices. This created an incentive for other financial institutions to provide real estate loans and, as a result, there was extremely rapid growth of the less-heavily regulated non-bank financial institutions; these included building societies, finance companies (some of which were bank owned) and merchant banks (see Figure 4). In addition, large capital inflows were channelled directly into commercial property, either through development companies (domestic and foreign) or through finance companies.

Monetary policy was relatively loose in the early years of the 1970s; a strong external sector saw a current account surplus and a rapidly increasing money supply. Monetary policy was not tightened until mid 1973, almost at the same time that the property-price cycle reached its peak. In April of 1973, reserve requirements were increased; in July and August, quantitative controls were again placed on bank lending;[13] and in September, (regulated) bank interest rates were raised.

Property prices peaked and turned towards the end of 1973. The initial casualties were the property developers. This led to further falls in prices and the eventual collapse of some large finance companies; in a number of cases, bond holders in these companies experienced substantial losses. In other cases, foreign-bank parents supported their Australian subsidiaries. The fact that the core banking system did not engage in the same degree of property lending as the non-bank financial institutions meant that they were less affected by the decline in property prices. However, they were not insulated completely, as some bank-owned finance companies incurred substantial losses. The most notable example was the Bank of Adelaide which was eventually merged with the ANZ Bank (albeit not until 1979).

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[12] By 1976 Sydney was ranked as the ninth largest international investment centre in the world, a long way ahead of Melbourne (ranked twenty-ninth) which had traditionally been Australia's financial centre (Davis (1976), p. 28).

[13] Trading banks were "requested" to achieve an appreciably lower level of new lending and savings banks were asked to limit their total housing loan approvals in the half year to December to not more than twice the level in the June 1973 quarter (Reserve Bank of Australia (1974)).

Figure 4

Total assets of financial institutions

As a percentage of GDP
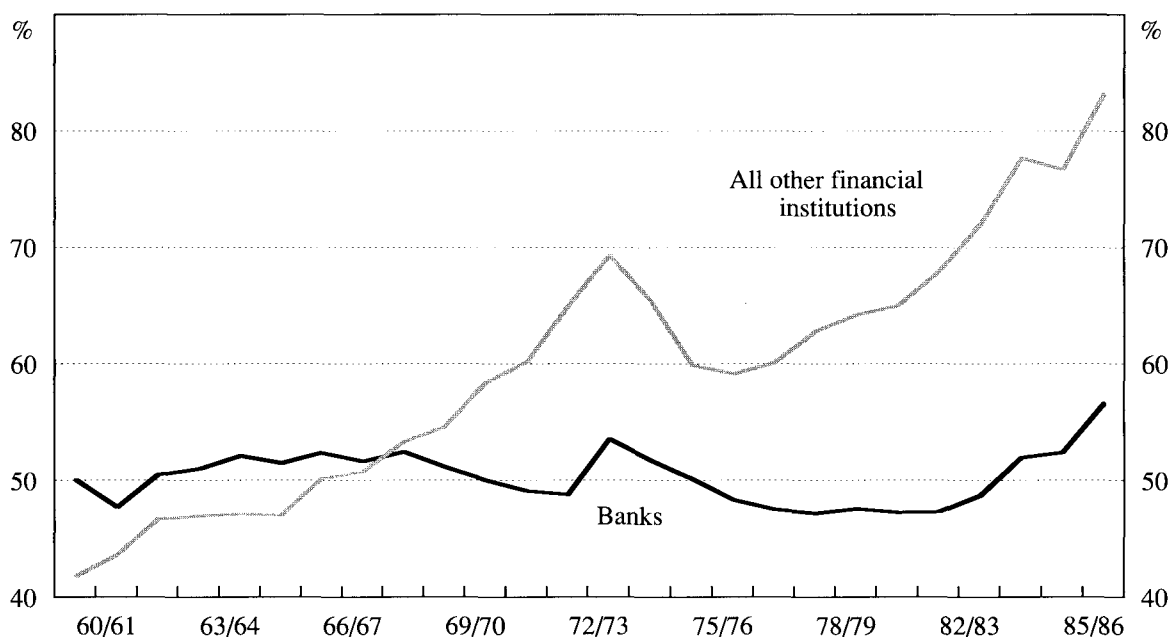
The commercial property price cycle in the late 1980s shares many of the characteristics of the early-1970s cycle. The precursors were familiar: namely, financial liberalisation and increasing internationalisation (Blundell-Wignall and Bullock (1992)). In the late 1980s, however, another factor was also at work; the previous decade or so of high inflation had made it clear to people that there were considerable tax advantages to purchasing property in a high-inflation environment. This added to the demand for real estate. Another familiar characteristic in the late-1980s episode was the substantial increase in the ratio of credit to GDP.[14] While the *percentage point* increase in this ratio was certainly larger in the late 1980s, the *percentage* change in this ratio was actually higher in the 1970s.[15] A third common characteristic was the large losses by financial institutions following the boom.

A key difference between the two cycles is that in the late-1980s cycle, banks were not as restricted in their lending activities. While some lending again took place through the banks' non-bank subsidiaries, substantially more of the ultimate impact was felt in bank profitability (see Figure 5). It is difficult to pinpoint whether the decline in credit was in response to this fall in profitability, or simply reflected reduced demand for credit by firms. In all probability both explanations play a role. Falling asset prices exacerbated the already high debt-to-equity ratios of many companies, with the result that investment plans were delayed while corporate balance sheets were repaired. The demand for credit was probably further weakened by the increase in the banks' lending rates relative to official interest rates (second panel of Figure 5). Banks also adopted more cautious lending practices as they came to grips with falling property prices.

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[14] For further details on the credit cycle in the late 1980s see Macfarlane (1989) and (1990).

[15] In the five years to June 1974 the credit to GDP ratio increased by 16 percentage points to 48% (which was an increase of 50%). In the five years to December 1990 the ratio increased by 25 percentage points to 89% (which was an increase of 40%).

Figure 5

Returns on bank shareholder funds and bank margins
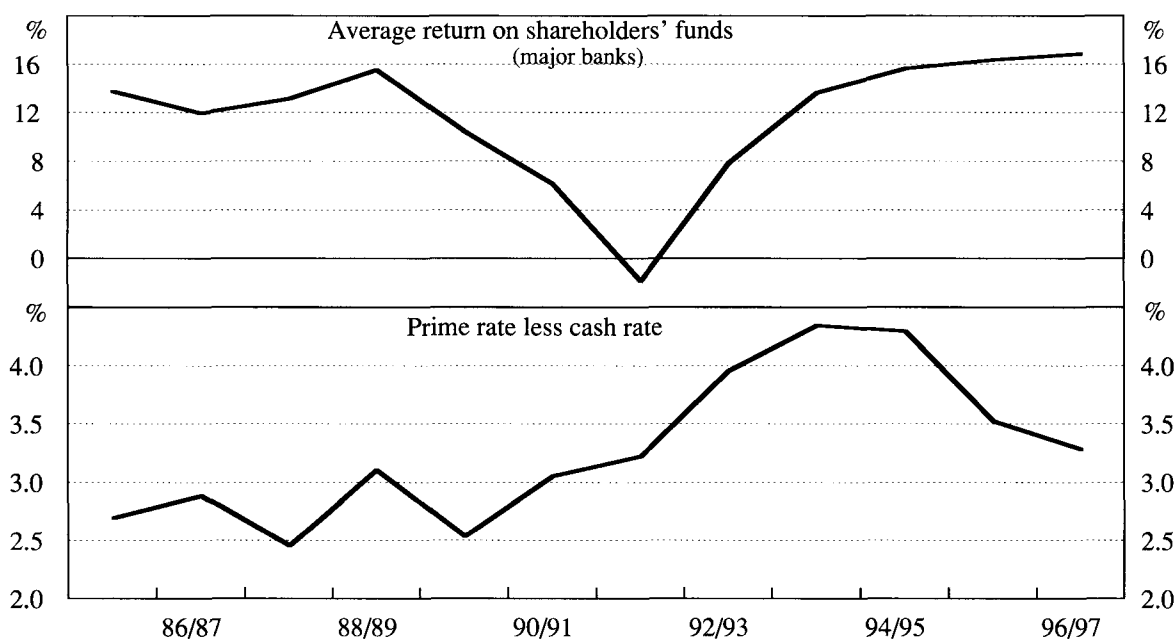
Another difference is the way that monetary policy operated. In the early episode, the property-price cycle turned at about the same time that monetary policy was tightened. In the late-1980s episode, a relatively long period of tight monetary policy preceded the turnaround in property prices; interest rates were first increased in April 1988 but the property-price cycle did not turn until late in 1989. During this period, domestic demand was growing quite strongly and inflationary pressures were building. While the high interest rates were designed to deal with these pressures, the rapidly rising asset prices were also of concern. Macfarlane (1989) argued that high inflation had led people to conclude that purchasing assets was the road to increased wealth, and that this was leading to a severe misallocation of resources. While asset prices were not a target of monetary policy, the combination of rising real asset prices and high rates of inflation was thought to be untenable (see Macfarlane (1991) and Grenville (1997) for a more detailed discussion).

In neither episode did monetary policy set out explicitly to break the bubble in property prices, although, in both cases, some effect on property prices was expected. In the 1970s episode, quantity controls on bank lending, and slower growth in the money supply resulting from a deterioration in the balance of payments, appear to have had a relatively rapid effect on property prices, although the boom had probably been running out of steam at the time that monetary conditions were tightened. In the 1980s episode, the entrenched inflation culture made affecting property prices more difficult. With large increases in property prices expected, real interest rates (calculated using expected property-price inflation) were very low, despite more-conventionally measured real interest rates being quite high. Only sustained high financing costs and an increased probability of a significant slowdown in the pace of economic activity brought the boom to an end. As a consequence, when the decline in property prices occurred, the economy was also struggling under the lagged effect of high real interest rates.

A third difference between the two cycles is in the underlying inflationary environment. Two aspects are important here: the inflation rate preceding the boom and the inflation rate after the boom. First, as discussed above, by the mid 1980s, Australia had already experienced over a decade of high inflation, and leveraged asset purchases appeared to many to be a successful investment strategy. This perception helped propel the boom. Second, while inflation was higher going into the 1980s boom than it was going into the 1970s boom, it was much lower during the bust; over the period 1974 to 1977, the inflation rate averaged 14%, while over the period 1990 to 1993, it averaged just 3%. So

while the fall in real commercial property prices was of a similar magnitude in both cases (51% compared to 65%; see Table 2), the percentage fall in the nominal asset price was almost three times as large after the 1980s boom (21% in the 1970s downturn compared to 62% in the 1990s downturn). This large fall in nominal prices contributed to the losses recorded by some financial institutions.

Figure 6

Real GDP

Cyclical peak = 100

Quarters after peak in real GDP
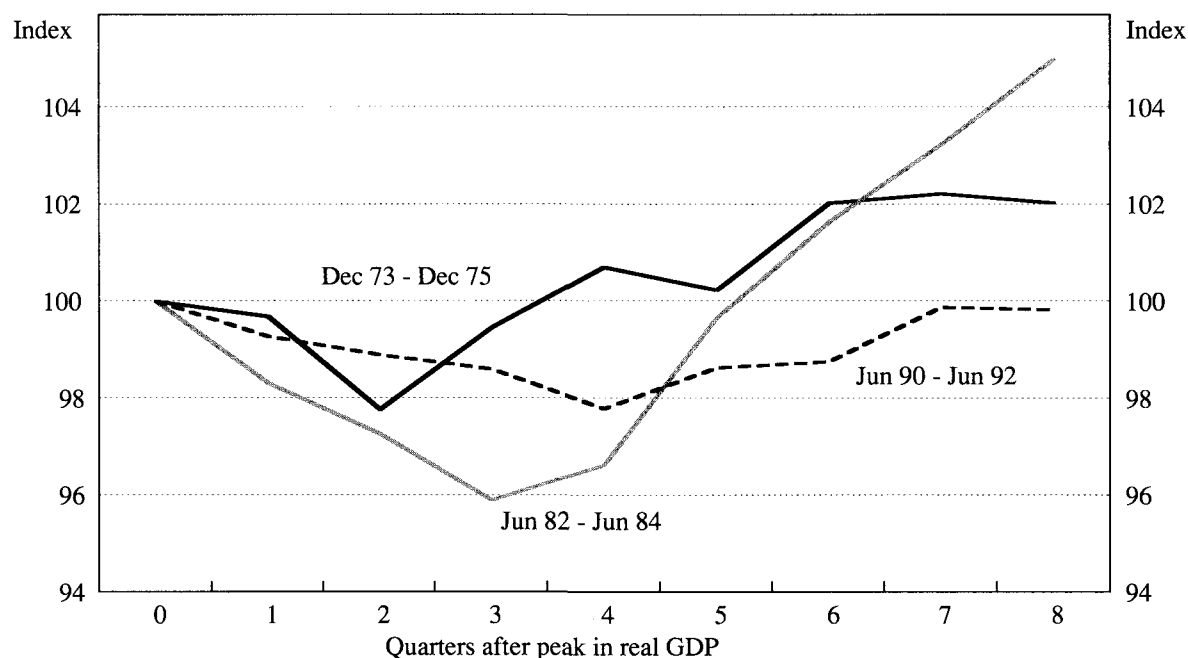
Finally, output took much longer to recover from the recessions in 1990/91 than from the recessions in the early 1970s and early 1980s (see Figure 6). A plausible explanation is that the substantial decline in nominal property prices led to a more protracted recession. We now turn to an econometric evaluation of this explanation that allows us to control for other factors, such as monetary policy and foreign output.

3.   Asset prices, real GDP growth and inflation

Our starting point is the basic model of real GDP growth originally developed by Gruen and Shuetrim (1994) and most recently updated by Gruen, Romalis and Chandra (1997). The model we use has a long-run relationship between the level of Australian non-farm real GDP and US real GDP. The dynamics of the business cycle are influenced by the growth rate of GDP in the United States, the level of real short-term interest rates in Australia, and the output of the farm sector.[16] While it would be preferable to estimate the model from the early 1970s to include the first property-price boom, earlier work suggests that the deregulation of the Australian economy and financial markets changed some of the estimated relationships. Accordingly, we estimate the model over the

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[16] See Debelle and Preston (1995), de Brouwer and Romalis (1996), de Roos and Russell (1996), and Kortian and O'Regan (1996) for a detailed discussion of these relationships

period from September 1980 to March 1997. Precise details of the data series and their construction are included in the Appendix.

Model 1 in Table 3 shows the estimated parsimonious version of this model for real non-farm GDP. The coefficient on the lagged level of Australian non-farm GDP is significant, which provides evidence of cointegration between the levels of Australian and US GDP. The sum of coefficients on lags of real cash rates is significant and negative, suggesting that tight monetary policy does slow economic growth.

Table 3

Australian non-farm GDP growth regression

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	-2.52	-2.80	-2.21	-2.58	-2.51
	(-6.98)	(-11.32)	(-9.88)	(-10.50)	(-6.99)
Lagged Australian GDP	-0.41	-0.46	-0.36	-0.42	-0.41
(log level)	(-6.90)	(-11.22)	(-10.09)	(-10.48)	(-6.95)
Lagged US GDP	0.50	0.56	0.44	0.51	0.50
(log level)	(6.97)	(11.32)	(10.01)	(10.53)	(7.00)
Real cash rate	-0.33	-0.34	-0.29	-0.30	-0.32
(lags 2 to 6)	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}
Farm output % change	0.005	0.01	0.005	0.01	0.01
(lags 2 to 4)	{0.03}	{0.00}	{0.00}	{0.00}	{0.01}
US GDP % change	-0.46	-0.65	-0.38	-0.51	-0.55
(lags 0 to 4)	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}
Variable for cumulative falls in nominal commercial property prices		-0.01 (-4.04)			
Real asset prices (log change)					
Equity (lags 2 to 8)			0.04 (2.16) {0.00}		
Commercial property (lags 0 to 2)				0.04 (3.07) {0.00}	
Dwellings (lags 3 to 5)					-0.04 (-1.16) {0.01}
$\bar{R}^2$	0.63	0.66	0.64	0.67	0.69
LM test for 4th-order autocorrelation	6.76 {0.15}	10.74 {0.03}	12.26 {0.02}	8.75 {0.07}	6.00 {0.20}

Notes:

(a) Models estimated using OLS on quarterly data over the period 1980:3 to 1997:1. Numbers in parentheses () are t-statistics. Numbers in braces { } are p-values of the joint significance test that all lags of the variable are equal to zero.

(b) Standard errors obtained by using the ROBUSTERRORS command in RATS when there was evidence of 4th-order autocorrelation in the residuals at the 10% significance level.

The residuals from Model 1 are plotted in Figure 7. While the residuals exhibit no evidence of serial correlation, the residuals from the period from June 1991 to December 1993 are especially noticeable. During this period (shown as the shaded portion of Figure 7), the model *over-predicts* economic growth in 9 of the 11 quarters.[17] The discussion in Sections 1 and 2 suggests that this unlikely outcome is the result of falling property prices, and more particularly, falling nominal property prices.

To test this proposition we added a variable to the model that takes a value of zero when the nominal price of commercial property is either rising or steady. Otherwise, the variable takes the value of the percentage fall from the previous peak in the nominal price when prices have been falling consistently from that peak. This variable captures the special effect of falling nominal property prices discussed in Sections 1 and 2 and represented by the second element on the right-hand-side of Equation (1). The results are reported as model 2 in Table 3. The coefficient on this variable is negative and significant; indicating that falls in property prices slow economic growth. The size of the coefficient is also economically quite important. By December 1992 the nominal price had fallen by almost 60% from its peak in September 1989, which means that quarterly growth was 0.6 of a percentage point below what it otherwise would have been.[18]

Figure 7

Residuals from the benchmark parsimonious model

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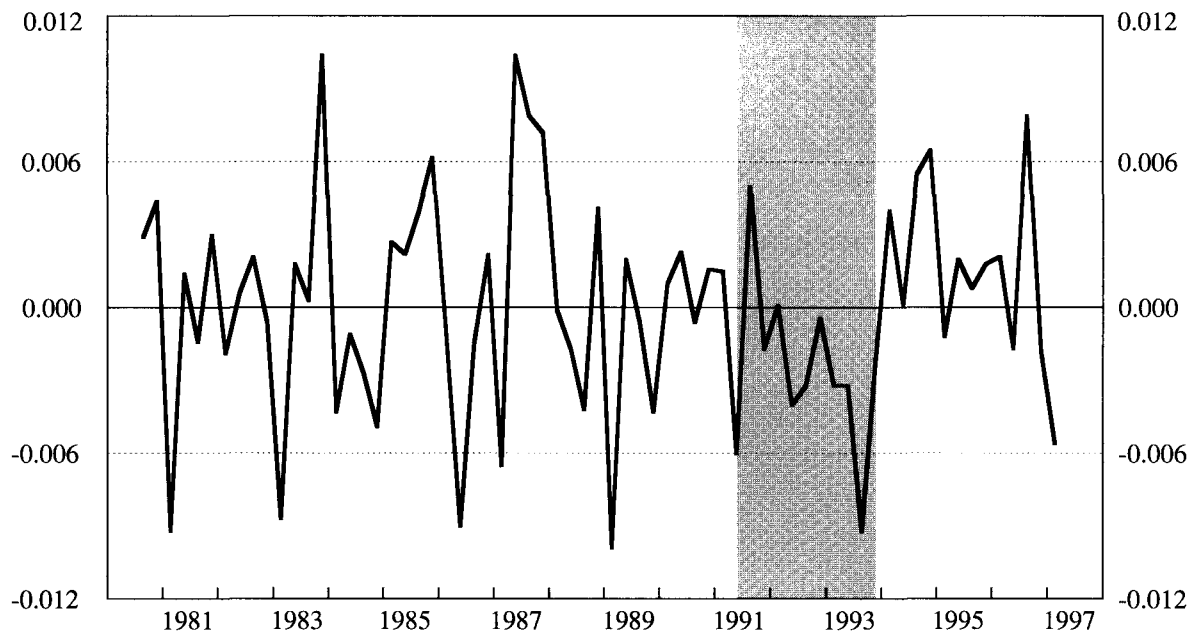
[17] If we include a dummy variable for the period, it has a negative sign and is significant at the 1% level.

[18] We examined a model which used a standard dummy variable in place of our preferred measure of nominal price falls; that is a dummy variable that takes the value of one when the nominal price of commercial property is falling, and zero otherwise. The results imply that a fall in nominal prices in any quarter reduces quarterly growth by 0.4 of a percentage point. When this dummy variable was added to model 2 it was not significant, while our preferred measure of nominal price falls remained significant. In support of our specification we also investigated models which included other types of dummy variables. A standard dummy variable for nominal price falls interacted with quarterly nominal price changes was not significant. A standard dummy variable for real price falls was not significant. We examined a version of model 2 which also included a variable that measured cumulative property-price increases since previous troughs; while the coefficient on this additional variable was significant and negative it was small in absolute value.

We take this result, together with the pattern of the above residuals, as evidence that the property-price cycle had a significant impact on the business cycle. To a considerable degree the protracted nature of the early-1990 recession can be attributed to the working out of the balance-sheet problems generated by the decline in nominal property prices and the reduction in financial intermediation in the first half of the 1990s.

To further examine the links between asset-price changes and GDP growth, we estimate variants of the benchmark model by including, one at a time, changes in the various real asset-price indices (models 3 through 5). The discussion earlier in the paper suggested that growth might be positively related to growth in real asset prices in the short run. To test this hypothesis we supplement the basic growth model with up to eight lags of the log difference of each real asset-price series. We report the results for the parsimonious regressions.

As models 3 and 4 show, both equity prices and commercial property prices are significant and the sum of the coefficients is positive. For equity prices, coefficients on only the second and eighth lags are individually significant, whereas for commercial property all the lags in the parsimonious model are individually significant. The sum of coefficients on lags of dwelling prices is negative but insignificantly different from zero, although individual coefficients are all significant. In each of the three cases, the inclusion of asset prices increases the goodness of fit of the model as measured by the adjusted R-squared.

It is important to note that we are measuring the combined effect of two different types of relationships between asset prices and growth. The first relationship is the direct effect of changes in asset prices on growth through the wealth effect and the cost of capital. The second relationship between asset prices and growth is not causal; instead, it reflects the fact that asset markets are forward looking. Changes in real asset prices should reflect additional information (which is not available to the econometrician) about future growth prospects. This "informational role" should be more relevant for equity markets because they are more liquid and cover a wider range of economic activities.

When we compare the dynamic structure of models 3 and 4 we note that only the earlier lags on the coefficients of commercial property prices are significant and these coefficients are larger than those on early lags of equity prices. Whereas longer lags of changes in property prices are not significant, the coefficient on the eighth lagged change in real equity prices is positive and individually significant (at the 10% level). A plausible explanation of these results is that the direct effects of commercial-property prices are relatively strong and occur rapidly. Also, the ability of asset prices to provide *extra* information on future growth rates is likely to be evident over longer horizons, as appears to be the case for equity prices.

In summary, equity prices appear to have informational value in predicting future growth in the economy. More importantly, the above results support the idea that the working out of the asset-price bubble of the late 1980s helps explain why economic growth in the early 1990s was slower than that suggested by standard explanations of the pace of economic growth.

As part of our empirical work, we also added percentage changes in the real asset-price series to models of goods and services price inflation. These models include lagged levels and changes in unit labour costs and import prices as well as the output gap. In none of the models that we estimated did we find a significant role for any of the asset-price series. This is hardly surprising, since asset prices are expected to have their main effect on inflation through affecting the dynamics of the business cycle. Falling asset prices which cause a protracted recession are likely to lead to a decline in wage pressures and firms' margins, and thus to lower inflation. However, once we have controlled for these effects, there is little, if any, independent role left for asset prices.

4. Lessons for monetary policy

We draw four broad lessons from the above discussion:

1. Property-price cycles and credit cycles go hand in hand.

Over the past thirty years, the two large cycles in the ratio of credit to GDP have coincided with the two large cycles in commercial-property prices. Furthermore, downturns in property prices have been associated with slow recovery phases in activity. These links make property prices particularly important to monetary policy.

2. Monetary policy can burst property-price bubbles. Under some circumstances, it may make sense to do so, even if it means that expected inflation is below the central bank's target. The case for attempting to influence equity prices is weaker than for property prices.

Monetary policy can burst bubbles in property prices by increasing the cost of speculative behaviour and by slowing down the growth rate of economic activity. If the only instrument of policy is short-term interest rates, a protracted period of tight policy is probably required. This means that when the bubble bursts, losses are likely in the financial system and economic growth is likely to be below trend. But once a bubble has emerged, avoiding such an outcome will prove even more difficult. By bringing forward the collapse of the bubble, monetary policy can reduce the scale of the inevitable slowdown in economic activity. The main difficulties with such a policy are in identifying that a bubble does indeed exist and generating the necessary public acceptance of a period of tight monetary policy.

In contrast, bubbles in equity markets are likely to have much weaker implications for the health of the financial system. While policy-makers need to be alert to changes in patterns of financial intermediation which might change this situation, Australian experience suggests that equity-price bubbles can burst without detrimental effects on financial intermediation.

3. Financial liberalisation matters (but not as much as we might think).

The liberalisation of the financial sector played a role in the property boom of the late 1980s. Competition, combined with a lack of credit-assessment skills, saw a lowering of credit standards and this contributed to a larger increase in the ratio of credit to GDP than would likely have occurred in a more regulated environment. However, it is easy to overstate the importance of financial deregulation. The property boom of the 1970s shared many of the characteristics of the boom of the late 1980s. Regulation prevented the banks from being full participants in the earlier boom, but this simply encouraged other institutions to supply the credit. Despite the regulation there was still a very large cycle in credit and the economy experienced the contractionary effects of the bust of the property cycle and reduced financial intermediation.

One, often overlooked, aspect of financial deregulation that can contribute to booms in property prices is the effect that deregulation has on the underlying value of commercial property. The limited deregulation of the early 1970s and the comprehensive deregulation of the mid-1980s led to a significant increase in the demand for prime CBD office space. This put upward pressure on the fundamental price, which made it easier for a bubble to emerge.

4. The inflationary environment matters for bubbles.

Low inflation should make bubbles less likely but if they emerge nevertheless, low inflation can make their bursting more costly. If an asset-price bubble does occur, a low-inflation environment makes it more likely that the inevitable correction in *real* prices will occur through a decline in *nominal* prices. This increases the risk of financial-system instability and can lead to a protracted period of weak growth in financial intermediation. This increases the case for the central bank to tighten policy relatively early in the life of a property-price bubble.

Appendix : The data

All data are quarterly except those marked with a * which are measured for the year ending 30th June.

Equity price index. Quarterly average of the Australian All Ordinaries share price index. Source: Datastream code – AUSTALL.

Capital Value Indicator (CVI) for Sydney CBD property. The average capital value per square metre of net lettable area. Source: Jones Lang Wootton (JLW) Advisory Services.

Dwelling Price Index. Constructed by splicing together the most appropriate prevailing house price series. Sources: BIS Shrapnel average house prices for Sydney and Melbourne (March 1960 to December 1969); Abelson weighted average of house prices (March 1970 to September 1981); REIA median prices of established houses (December 1981 to March 1984); Commonwealth Bank of Australia Housing Industry Association (CBA-HIA) (April 1984 to present).

Median prices of established houses in Sydney. Source: Real Estate Institute of Australia (REIA).

Real asset prices series are calculated by deflating nominal prices by the implicit price deflator derived from the seasonally adjusted expenditure measure of GDP. Source: ABS National Accounts Cat. No. 5206.0.

Real gross domestic product, GDP(E). Expenditure measure of GDP (seasonally adjusted). Source: ABS National Accounts Cat. No. 5206.0.

Credit to the private sector by all financial intermediaries. Loans and advances, plus bank bills discounted (break-adjusted, seasonally adjusted). Prior to August 1976, annual seasonally adjusted data is interpolated. Source: Reserve Bank of Australia Bulletin - Table D3.

Total assets of financial intermediaries. The sum of total assets of banks and all other financial institutions. These series are taken as a ratio to the income measure of GDP. Source: Reserve Bank of Australia Bulletin - Table D5.

Average return on shareholder's funds (major banks)*. Source: Australian Stock Exchange.

Prime lending rate*. Business indicator rate on bank's large, variable rate business loans. Source: Reserve Bank of Australia Bulletin - Table F4.

Output Gap. Deviation of GDP(A) from potential output based on linked peaks of multifactor productivity. Source: Reserve Bank of Australia.

Real gross domestic product, GDP(A). Average of output, production and income measures of GDP (seasonally adjusted). This series combines farm and non-farm output measures used in regression analysis. Source: ABS National Accounts Cat. No. 5206.0.

Underlying Consumer Price Index (CPI). Treasury underlying consumer price index. Source: Consumer Price Index, ABS Cat. No. 6410.

Cash rate. Source: Reserve Bank of Australia Bulletin - Table F1.

*United States real GDP.* US GDP chain linked. Source: Datastream code - USGDP...D.

Stock price index for Australian property developers. Source: Datastream code - PRPTYAU.

Estimating Sydney commercial property prices between 1973 and 1977

Figure A1 shows the original series for the Sydney commercial property Capital Value Index. Between March 1973 and September 1977 the original series exhibits no variation because only one valuation was conducted during this period. Furthermore, the small nominal price fall from June 1972 to March 1973 is inconsistent with the detailed discussion in Daly (1982). We replace the original series with an estimate from June 1972 to September 1977. In line with Daly (1982) our estimate peaks in December 1973 and then declines linearly back to the level of the original series in

September 1977. The level of the peak is obtained by setting the growth rate of the estimated CVI equal to the average growth rate of the original series over the year 1971/72.

Figure A1

Commercial property prices – original and estimated CVI

March 1973 = 100
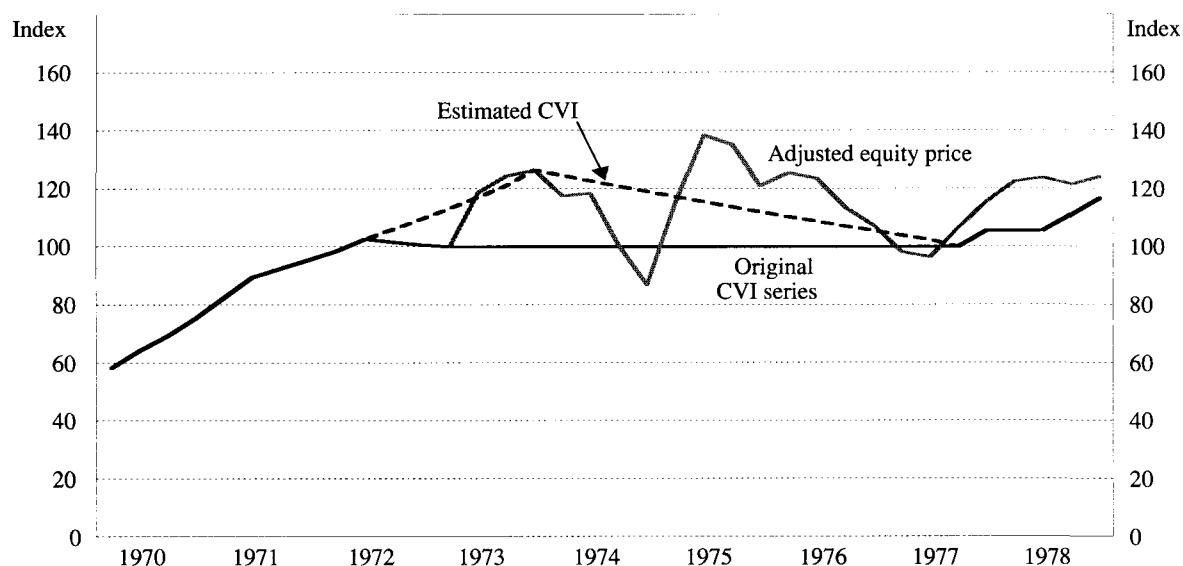
For comparison we also show the movement in an index of equity prices of companies that were involved in the development of commercial property in Sydney (available from March 1973). We have adjusted this series to account for its correlation with the aggregate Australian stock price index (by taking the residuals from a regression of the commercial property stock price index on the All Ordinaries index). Compared to our estimated CVI, the adjusted property equity price index displays more volatility, but a similar growth rate before and after the peak in December 1973.

Timing of asset price cycles

	Equity	Commercial property	Dwellings
	Starting dates of each phase		
Early-1970s cycle			
(in between)			66:3
Upturn	66:4	68:1	71:3
Downturn	70:1	73:4	74:2
(in between)	74:4	77:3	
Late-1970s/Early-1980s cycle			
Upturn	78:1	78:2	79:3
Downturn	81:2	82:1	81:4
(in between)	82:3	85:1	84:4
Late-1980s cycle			
Upturn	84:3	87:1	87:2
Downturn	87:3	89:3	89:1
(in between)	92:4	93:3	93:1

Note: The cycles are delineated according to either turning points or points of inflection in nominal asset prices. If instead we used real asset prices the timing would change marginally for only a few phases.

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