Discussion

1. David Stockton[1]

The subject of the paper by David Gruen, Michael Plumb and Andrew Stone — how monetary policy should respond to asset prices — is obviously an important one. The formation of bubbles in asset prices and the eventual demise of those bubbles have the potential to cause damage to our economic and financial systems. Macroeconomic instability in the form of unwelcome variability of output and inflation can be one consequence of bubbles. Moreover, to the extent that private and public economic agents act on distorted signals provided by asset markets, resources can be misallocated — and those misallocations can involve more persistent costs when transmitted through capital spending decisions. And, asset-price bubbles carry with them the potential for heightened financial fragility and the possible feedback of that fragility on economic performance. So limiting the damage associated with asset-price bubbles, if possible, is certainly a worthy objective.

The paper by Gruen *et al* is a very refreshing contribution to the growing literature on the subject of the appropriate response of monetary policy to asset-price bubbles. It is a powerful paper largely because it is modest in its ambitions. Ultimately, policy-makers and those advising them need to be able to answer three questions before implementing policies to counter or lean against the emergence and perpetuation of asset bubbles. Can we with reasonable assurance detect the existence of an asset bubble? Once detected, can we calibrate monetary policy in a manner that with reasonable assurance will reduce the volatility of output and inflation? And finally, can we demonstrate and communicate clearly the effectiveness of that policy in a way that garners the support of the public on whose behalf we take these actions?

In this paper, the authors confine their attention to the question of calibrating monetary policy in the known presence of an asset bubble. Their principal contribution is to demonstrate that the optimal policy depends on the specific stochastic properties of the bubble. That might sound like a rather obvious finding, and it is. But the authors have given at least theoretical life to some of the real-world concerns that monetary policy-makers have about formulating policy in the face of an asset bubble; specifically, in response to a bubble that might continue growing or that might burst, they address the question of whether and when policy should be tighter than might otherwise be recommended and whether and when policy should be looser than would otherwise be recommended. Their work is not entirely unique in that regard (see Kent and Lowe (1997)), but this paper is a clear step forward.

To appreciate the paper, it needs to be placed in the existing literature. Much of the earlier work in this area adopted a framework that employed a linear, or at least linearised, rational expectations model of the economy and sometimes assumed rationality, or near-rationality, of the bubble (see Bernanke and Gertler (2000, 2001), Cecchetti *et al* (2000), and Cecchetti, Genberg and Wadhwani (2003)). In addition most work employed a quadratic loss function in the central bank's objectives, and assumed no preference for asset-price stabilisation *per se*. The assumptions of a quadratic loss function and no specific preferences about asset prices are retained in this paper. But much of the mileage gained by the paper comes from dropping rational expectations. Instead, the authors employ a very simple linear backward-looking model of the economy and, for most of the paper, abandon the assumption of a rational bubble. The authors employ some of the freedom that they have allowed themselves to add the possibility of a bubble process that is endogenous to monetary policy.

The framework employed by previous researchers was chosen for understandable reasons. There was a desire to stick with the tractable linear-quadratic modelling framework. Moreover, there is no generally accepted theory about how policy affects bubbles. And when employed, the assumption of rational bubbles, or nearly rational bubbles, imposed restrictions on the stochastic process for asset prices.

But in some circumstances, there are costs to confining one's attention to tightly parameterised rational expectations models. One is that the world usually works out fairly well for a reasonably competent policy-maker because the expectations formation process of a very well-informed public facilitates the effectiveness of policy in these models. Central bankers do not face especially difficult problems when there are strong self-correcting mechanisms at work in the economy (Mussa 2002). While the assumption of strong self-correcting mechanisms may not be a bad one in most states of the world, it can come close to defining away the problem when considering asset-price bubbles. In the world of a bubble, the normally well-informed rational public may at least temporarily be suffering from a bout of delusion. Central bankers face more daunting challenges when the behaviour of private agents is driving the economy away from equilibrium. For that reason, the authors have taken a useful step by considering the implications of handing back the informational advantage to the policy-makers.

The informational advantage of the policy-makers is shifted to an extreme in the model; the results illustrate the gains that would be available to policy-makers if they could **fully** characterise the stochastic process for the bubble. As noted in the paper, the basic insight is that, using this information, policy should be kept tighter than otherwise when the size of the bubble is known to be small in order to counteract its unwarranted expansionary effect, but should be kept looser than otherwise when the bubble is known to be large in order to cushion the potential sizable negative effects should the bubble collapse.

But perhaps more important than this result is the demonstration in the paper of the information required to implement this policy. In addition to knowing the complete structure of the economy, our policy-maker is assumed to know the following:

(i) the size of the prospective increment to the bubble should it continue (γ); (ii) the probability that the bubble will burst the next period (p); (iii) the sensitivity of the probability of the bubble bursting to changes in the policy interest rate (δ); (iv) the sensitivity of the size of the bubble increment to the policy interest rate (ϕ); and (v) the characteristics of the bubble collapse, when it occurs, in terms of size and duration.

This is one very smart policy-maker. We central bank economists, and our academic colleagues, are indeed a very clever lot. But I am sceptical that we are clever enough to fill in those parameters and solve that model with enough conviction to implement policy. In January 2000, tightening policy in the United States to lean against the bubble, in the end, would have only exacerbated the effects of its impending demise. But, it would have required enormous confidence on the part of monetary policy-makers to have begun an easing of monetary policy at that time to cushion, in expected value terms, the deflation of the then-mounting asset-price bubble. In terms of illustrating the information requirements of implementing an optimal policy in the face of a bubble, the model developed by Gruen *et al* delivers the goods.

Let me note a few aspects of the paper that I found less than fully satisfying. For one, I did not especially care for the distinction made between the sceptical policy-maker and the activist policy-maker. The authors are actually comparing the actions of an ignorant policy-maker and a knowledgeable policy-maker. The differences in the model are not about how these policy-makers confront and respond to uncertainty but rather are about how better information concerning the stochastic process governing the bubble affects the formulation of monetary policy. It should not be surprising that better information leads to better policy — though even here the authors do not provide a sense of the dimensions of the resulting welfare gains. It would perhaps be more illuminating to consider a sceptic to be a policy-maker with diffuse priors about the key parameters of the stochastic process of the bubble and an activist to be a policy-maker more confident of those parameter estimates.

More generally, I would recommend that when extending this work the authors turn their attention to incorporating uncertainty more completely into this framework. After all, coping with risks and uncertainties is the central preoccupation of policy-makers; policy-makers live in a stochastic environment with poorly identified models and many sources of shocks. Hence, it would be helpful to know how optimal monetary policy would be formulated when the policy-maker is concerned both with the consequences of not taking action when there is the possibility that a bubble has formed and with the consequences of taking action in the belief that a bubble has formed when in fact it has not. Those considerations are almost always in play because, as is widely recognised, bubbles often have their origins in unobservable changes in fundamentals. In the United States, the interaction of productivity and asset prices was, and remains, a key feature of the events of the past decade. Adding in uncertainty more explicitly would provide important texture to the policy-setting process that is absent from this model.

Although even the simple model examined in the paper involves considerable informational complexity, a few elaborations should be considered. For one, the endogeneity of the bubble with respect to policy could be more complicated than the simple linear formulations examined in the paper. In particular, non-monotonic responses are possible. Over some plausible ranges, small increases in short-term interest rates could increase, not decrease, the subsequent size of the bubble increment, or similarly lower, not raise, the probability of a subsequent burst of the bubble. This could occur if investors came to view potential market gains as larger or more durable when the bubble survives a modest policy tightening. At some point, the increases would be large enough to depress the asset-price increment or raise the probability of a bubble bust. That type of nonlinearity complicates an incremental strategy for responding to bubbles.

I found the characterisation of the bubble collapse to be another oversimplification that warrants greater attention. The bursting of a bubble could cause asset prices to overshoot on the downside. The volatility that accompanies both the build-up of the bubble and its collapse may lead equity premiums to become elevated for a meaningful period of time. Presumably such a concern would increase the expected contraction associated with the bursting of a bubble, reducing the propensity to lean against a bubble and making policy-makers more anxious to cushion its potential demise. Moreover, this is another area of prominent uncertainty for policy-makers. As equity prices came down over the past few years in the United States, it was at any given point in time hard to tell where we were in the process. It still is. Are equity markets in the United States still overvalued? Or, has there been an overshooting on the downside? One can find respectable adherents to both these positions. So a bit more attention to the stochastic characteristics of bubble collapse would be a useful supplement to this line of analysis.

Of course policy-makers are uncertain not only about the stochastic process generating the bubble, but also about the influence of the bubble on real economic decisions. In a world characterised by uncertainty, economic agents may not respond in a linear fashion to the signals provided by asset prices as suspicions arise that these prices are deviating from fundamentals. Household and business spending might well respond less to changes in asset prices as those prices are perceived to deviate farther from fundamentals.

Some of these suggestions are relatively straightforward extensions of the model that Gruen *et al* have developed in their paper. Others, such as a more careful analysis of the effects of uncertainty on optimal policy, would require more fundamental adjustment of their modeling framework. But none of these comments should be read as calling into question the contribution made by this paper. The complicated information requirements that flow from this simple model of the economy and the simple descriptions of the stochastic processes for bubbles demonstrate just how far we still have to go before addressing the first-order issues surrounding the appropriate policy response to asset-price bubbles.

Indeed, much of the work in this area brings to mind occasional reports from experimental medical science. Those reports often demonstrate the enormous

advances in diagnosis and treatment that will be possible as various technologies are refined, tested, and implemented. But before submitting to these experimental treatments, most of us would probably like some reasonable assurance that these treatments will transfer successfully from the lab to the operating theatre. Similarly, our principals — the publics that we serve — expect from us a reasonable assurance that by acting we can make a situation better, not worse. I believe in recent years, we have just begun to make the case — and not always convincingly — for our ability to conduct macroeconomic stabilisation policy in response to more garden-variety disturbances. I am less confident that central banks can provide the public with an assurance that they can both identify circumstances in which asset prices have deviated from fundamentals and then act in a welfare-improving manner. Gruen *et al* have made a contribution by highlighting some of the information that will be required before those actions can be taken with necessary confidence.

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2.   General Discussion

The main theme to emerge in the discussion of the paper was whether the Gruen, Plumb and Stone model accurately characterised the supply-side consequences of an asset-price bubble. Some participants reiterated views (also expressed in previous sessions) that the primary effect of an asset-price misalignment on the real economy was the misallocation of capital, which may manifest itself as a capital overhang after the bubble bursts. The concerns raised were whether simply augmenting an output gap equation with an asset-price bubble, as was done in the paper, properly

captures these supply-side effects. David Gruen noted, however, that the paper addressed some of these concerns in Section 3.2.2.

Some participants wondered whether the results were substantially influenced by the assumed lag with which policy affects the economy in the model. Under this lag structure, changes in the real cash rate only affect the output gap after one year, so that the policy-maker is assumed to be unable to respond to the bursting of a bubble until the negative effects on output have already fully taken place. David Gruen responded that it would probably be possible to allow policy to have some contemporaneous effect on output, but he did not expect that it would significantly alter the core findings of the paper.

Another related issue that was discussed was the assumption, in the paper's baseline results, that all of the negative effects of the bursting of the bubble are concentrated in one year. It was noted that Warwick McKibbin's simulations suggest that the effects of an asset-price correction may be protracted in nature. Sensitivity analysis in the paper does, however, at least partially address this issue: Section 3.2.4 considers the situation where the negative impact of the bubble's bursting is spread out evenly over two or more years, rather than occurring in a single year.

One participant suggested that the 'sceptical' policy-maker in the Gruen *et al* model could be better characterised as an ignorant policy-maker, and so represented something of a straw man for the comparisons presented in the paper. Another participant disagreed, stating that he considered the sceptical policy-maker construct to provide a useful baseline for the analysis. He noted that a sceptic does not ignore bubbles, in the sense of disregarding the impact which they may already have had on output and inflation. Rather, in each period the sceptic simply operates on the efficient markets assumption that asset prices are now in line with fundamentals, and so would not be expected to change in coming periods.

In all, there appeared to be agreement with the paper's theme that reacting to asset-price bubbles in an activist manner requires a great deal of information about the misalignment, which the policy-makers are often unlikely to have. As a consequence, most participants thought that any 'leaning against' a perceived bubble by policy-makers should typically be only marginal in nature, and certainly not directed towards actively attempting to burst the bubble.