Asset Prices, Financial Instability, and Monetary Policy

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What role should asset prices play in the setting of monetary policy? That is a topic of current debate in both central banking and academic circles in the aftermath of the collapse of the recent Japanese and U.S. asset price bubbles. Under one view, exemplified by Alan Greenspan (2002) and Ben Bernanke and Mark Gertler (2001), monetary policy should remain focused on achieving the macroeconomic goals of low inflation and stable growth and should seek to do no more than deal with the fallout from the unwinding of an asset price bubble. An alternative perspective argues that it is better to seek to take preemptive action against the bubble during the upswing in order to limit the potential costs when the bubble collapses (see e.g., Michael Bordo and Olivier Jeanne, 2002; Claudio Borio and Philip Lowe, 2002; Stephen Cecchetti et al., 2002).

At the outset, it should be stressed that the issue is not really about asset price bubbles per se. If the only macroeconomic consequence of booms and busts in asset prices were via conventional wealth effects on aggregate demand, then they would constitute little more than a nuisance to monetary policymakers. Since the lags from changes in wealth to consumer spending seem to be at least as long as those from interest rates, policymakers would be able to offset the impact of asset price swings without much difficulty.

Rather, as stressed by Borio and Lowe and by Bordo and Jeanne, asset price bubbles tend to be associated with a broader set of symptoms, typically including high investment and a buildup of debt. The development of a bubble may initially be prompted by a beneficial supply shock, but subsequently excessive optimism about future returns drives up asset values, prompting increased borrowing to finance further capital accumulation. Moreover, appreciating asset values raise the value of collateral, facilitating the accumulation of debt. During the upswing, balance sheets look healthy as the appreciation in asset values offsets the buildup of debt. But a bursting of the bubble will lead to a sharp deterioration in borrowers' net worth and the possibility of a tightening in credit conditions as financial intermediaries react to those stretched balance sheets. Such a credit crunch is likely to impact on activity more quickly than a conventional wealth effect and, moreover, temporarily reduce the effectiveness of monetary policy. Neutralizing the macroeconomic consequences of such financial instability may thus be difficult to achieve.

A number of the contributions in this area, including some of those above, ask whether the incorporation of asset prices into a Taylor-style reaction function, incorporating (expected) inflation and the output gap, leads to better macroeconomic performance. An affirmative answer may appear to imply that the traditional monetary policy objectives of low inflation and stable growth need to be augmented with an asset price or financial stability objective. But such a conclusion would be unwarranted. Asset price bubbles are of concern precisely because of the financial instability and contraction in output that may result when they burst. A central bank seeking to stabilize inflation and output over a sufficiently long time horizon should therefore necessarily recognize the possible adverse long-term consequences of an asset price bubble in its policy deliberations. Additions to the formal mandates of central banks such as the

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Federal Reserve and the Bank of England[1] are not required, though the rhetoric employed to explain policy may need to be altered (see Charles Bean, 2003).

Though the argument that monetary policymakers should factor in the long-term implications for output and inflation of asset price boom-busts is persuasive in principle, there are a number of serious practical difficulties in implementation. First, the policymaker must judge whether an asset price increase is warranted by the fundamentals or whether it is instead based on misplaced expectations and furthermore poses a threat to future financial and macroeconomic stability. A mechanical response that treats all asset price movements alike, whatever their cause, is unlikely to be appropriate. Given that asset price boom–busts are apt to occur when there has also been an improvement in fundamentals, that is not likely to be a straightforward task, at least in the early stages of the upswing.

Second, once a bubble is large enough to be reliably identified, the presence of lags in the monetary transmission mechanism complicate the calibration of an appropriate policy. Raising official interest rates will be counterproductive if the bubble subsequently bursts, so that the economy is subject to the twin deflationary impulses of the asset price collapse and the effect of the policy tightening. Indeed, in the unlikely event that the policymaker knew that an asset price collapse was imminent, monetary relaxation, rather than tightening, would be called for. David Gruen et al. (2003) show that the informational requirements necessary to render an activist policy effective are extreme once such lags are taken into account. At best there is likely to be only a narrow window during which action is desirable.

Third, a modest increase in interest rates may do little to restrain an asset price boom. But an increase large enough to materially affect the evolution of asset prices is likely to have a significant adverse impact on economic activity. Therefore, the policymaker would need to be confident that the short-term costs of such a strategy are outweighed by the uncertain long-term gains. Moreover, if the key concern is a buildup of debt, higher interest rates will exacerbate the problem if the increase in debt service outweighs the reduction in new borrowing. In any case, expectations of future returns are likely to be a key driver of asset prices, investment, and borrowing, so expectations of future policy actions may be as relevant as current policy settings.

The rest of this paper illustrates some of these issues—in particular the role played by expectations of future, rather than current, policy actions—in a simple New Keynesian model, modified to allow for debt-financed capital accumulation and the possibility of credit crunches. Though asset prices do not appear explicitly, they can be thought of as moving in sympathy with investment and borrowing.

Besides the central bank, there are two types of agents in the economy: households and firms. Households supply labor, consume, and save; for simplicity, labor supply is an increasing function of just the real wage, and savings are a constant fraction of income.[2] Firms are monopolistic competitors, and nominal prices are fixed with a fraction reset each period. Capital lasts a single period, has to be installed in advance, and is financed by borrowing from households. Debt lasts a single period and is denominated in real terms.

Credit crunches occur with a fixed probability, ρ, and their effect is to lower the level of supply in the economy. One rationalization is that a credit crunch leads to bankruptcies, and the associated reorganization of the firm's assets absorbs resources. Another is that firms need access to working capital within the period in order to pay their workers and buy inputs. If firms cannot access the required working capital, then supply will be curtailed. In effect a credit crunch is a negative shock to total factor productivity, though it reflects forces in financial markets rather than a change in the technical capabilities of the economy. Moreover, credit crunches are assumed to be more severe, the higher is the *overall* debt outstanding. It is

[1] The Bank of England is required to pursue an inflation rate for the CPI of 2 percent at all times and, subject to that, to support the Government's objective of high and stable growth and employment.

[2] Assuming households optimize in the usual way complicates the dynamics but leaves the basic insights unchanged.

this that provides the incentive for the central bank to moderate a debt-financed investment boom. Since an individual firm's borrowing decision has negligible impact on overall debt, firms will ignore the impact of their borrowing on the severity of any future credit crunch.

The production function is

$$(1) \qquad y_t = a_t + \alpha k_t + (1 - \alpha)n_t$$

where y_t is output, a_t is total factor productivity, k_t is the capital stock at the start of the period, and n_t is employment. Throughout, variables are in logarithms, inessential constants are normalized to zero, and shocks are assumed to be serially uncorrelated. Total factor productivity depends in turn on the state of technology and whether or not there is a credit crunch:

$$(2) \qquad a_t = e_t - [\gamma + \omega(d_t - E_{t-1}y_t)]\varepsilon_t$$

where e_t is a shock to technology, d_t is debt outstanding in period t and ε_t takes the value unity if a credit crunch occurs and zero otherwise.[3]

The demand for capital, conditional on the expected future level of output, is then:

$$(3) \qquad k_{t+1} = E_t y_{t+1} - E_t a_{t+1} + (1 - \alpha) \times (E_t w_{t+1} - E_t p_{t+1} - r_t + v_t)$$
$$= E_t n_{t+1} + E_t w_{t+1} - E_t p_{t+1} - r_t + v_t$$

where w_t is the nominal wage, p_t is the price level, r_t is the real rate of return on debt and v_t is a shock to "animal spirits." Equating savings to investment using the constant savings rate assumption then gives

$$(4) \qquad y_t = E_t y_{t+1} + E_t m_{t+1} - r_t + v_t$$

where $m_t = w_t - p_t + n_t - y_t$ is both the labor share and marginal cost. This resembles the standard New Keynesian *IS* schedule, though its interpretation is somewhat different, with the terms on the right-hand side being the determinants of investment rather than consumption.

Price changes are staggered as in the standard New Keynesian pricing equation:

$$(5) \qquad \pi_t = \beta E_t \pi_{t+1} + \delta m_t + u_t$$

where u_t is a shock to the markup and β is the discount factor.

Using the labor supply assumption and equation (1), marginal cost may be written as

$$(6) \qquad m_t = (\alpha + \phi)y_t/(1 - \alpha) - (1 + \phi)(a_t + \alpha k_t)/(1 - \alpha)$$

where ϕ is the inverse of the real wage elasticity of labor supply. The flexible price level of output, y_t^{o}, is then obtained by setting $m_t = 0$:

$$(7) \qquad y_t^{o} = \nu(a_t + \alpha k_t)$$

where $\nu \equiv (1 + \phi)/(\alpha + \phi)$. The model may then be condensed into a New Keynesian Phillips curve,

$$(8) \qquad \pi_t = \beta E_t \pi_{t+1} + \kappa x_t + u_t$$

where $x_t \equiv y_t - y_t^{o}$ and $\kappa \equiv \delta(\alpha + \phi)/(1 - \alpha)$, and a corresponding *IS* schedule,

$$(9) \qquad x_t = \eta E_t x_{t+1} + r_t^{o} - r_t + v_t$$

where $r_t^{o} \equiv E_t y_{t+1}^{o} - y_t^{o}$ is the natural real rate of interest and $\eta \equiv (1 + \phi)/(1 - \alpha)$ (which equals $\kappa\nu/\delta$).

The policymaker's loss, L_t, is of the usual quadratic form, except that the objective for output is assumed to be to minimize volatility around the natural rate that would obtain in the *absence* of a credit crunch, $y_t^* = \nu(e_t + \alpha k_t)$:

$$(10) \qquad L_t = E_t\left[\sum_{k=0}^{k=\infty} \beta^k(\pi_{t+k}^2 + \lambda[x_{t+k}^*]^2)\right]$$

where $x_t^* \equiv y_t - y_t^*$. Since $d_t = k_t + r_{t-1}$ (i.e.,

[3] Making the severity of the credit crunch depend on the debt-to-*expected*-output ratio facilitates the analysis while losing nothing of substance.

principal plus interest due), the two output gaps can be related by invoking equations (2) and (3) and using the equality $\kappa x_t = \delta m_t$:

$$(11) \quad x_t^* = x_t - [\nu(\gamma + \omega v_{t-1}) + \omega\eta E_{t-1}x_t]\varepsilon_t.$$

The quantity in square brackets represents the output cost of a credit crunch, with terms reflecting the fact that the debt due for repayment will be high if "animal spirits" were buoyant in the preceding period or if output had been expected to be high. Note that the impact of the credit crunch is *not* directly affected by the interest rate in the preceding period. A higher rate of interest reduces capital formation and debt accumulation, but that is exactly nullified by the higher interest payments on the debt. The total amount to be repaid is thus left unchanged. Hence monetary policy can only influence the severity of any future credit crunch via its impact on the expected future level of activity.

Consider first the optimal policy when the central bank cannot pre-commit. In that case it treats private-sector expectations as unaffected by its current policy choice. Using standard methods the associated optimality condition is

$$(12) \qquad \pi_t = -(\lambda/\kappa)x_t^*.$$

In the absence of a credit crunch today, policy is thus unaffected by the possibility of a future credit crunch. If, on the other hand, there is a credit crunch today, policy is set looser than it would otherwise be. Thus the optimal policy is in effect to ignore the asset boom, but to mitigate the fallout when it collapses. Furthermore the expectation of a looser monetary policy in the event of a future credit crunch raises expected inflation. Consequently there is an upward bias to inflation.

The reason the possibility of future credit crunches does not affect policy in the upswing directly is simple: a current policy tightening has no effect on the future debt–income ratio, because the reduction in borrowing is exactly counterbalanced by higher interest payments. The only way the future debt–income ratio can be affected is by lowering expectations of *future* activity, but that is impossible when the policy-maker cannot pre-commit.

Now suppose the central bank can pre-commit. Then the "timelessly optimal" plan satisfies the conditions, for all $k \geq 0$ (see Bean [2003] for further details):

$$(13) \quad E_t\pi_{t+k} = -[\lambda(1 - \rho\omega\eta)/\kappa] \times (E_t x_{t+k}^* - E_t x_{t+k-1}^*).$$

Assuming that $\rho\omega\eta < 1$, the possibility of a credit crunch is therefore similar in effect to a reduction in the weight on output in the loss function.

That there is less incentive to stabilize current output when the economy is overheating may appear counterintuitive. However, recall that, although policy cannot affect the debt carried through to the next period directly, it is affected by expectations of future policy via the expected output gap. The expectation of a large positive output gap tomorrow boosts capital accumulation today, thereby raising the future debt stock and the costs associated with a credit crunch. Now optimal policy in the standard New Keynesian model is history-dependent because it exploits the fact that a credible commitment to hold output above potential in the future raises inflation today through the expected-inflation term in the Phillips curve. Given the convexity of the loss function, the optimal response to a temporary price (markup) shock thus involves a small, but persistent, output gap, rather than returning inflation to target straightaway through a larger, but more short-lived, one (demand shocks are contemporaneously and fully neutralized).

When there is the possibility of a credit crunch, however, a gradualist response to, say, a beneficial price shock generates additional expected future costs in the shape of a more severe credit crunch, should one occur. The optimal policy therefore involves a *less* accommodative policy today (i.e., more variation in the current output gap, and less persistence than in the standard model). Moreover, the optimal policy under commitment involves a weaker monetary-policy response to the occurrence of a credit crunch than is the case under discretion. That is because the central bank recognizes that a policy of accommodating credit crunches through the loosening of monetary policy has adverse effects on inflation expectations. Consequently there is less monetary response to a credit crunch than under discretion, but average inflation is lower.

This analysis is clearly highly simplified. The direct influence of current interest rates onto future debt levels is absent by construction, and no account is taken of the possible impact of a credit crunch on the effectiveness of policy. Nevertheless, by focusing on the role played by expectations of policy, it provides yet another illustration of the difficulties involved in designing a policy that takes on board the possible threat to future financial and macroeconomic stability posed by an asset-price boom. Though the argument for preemptive action to reduce that threat may seem persuasive in principle, we are still some distance from knowing how best to do so in practice.

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