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by Christopher P. Reicher

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This version: May 31, 2010

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Credit Bubbles and Land Bubbles

Chris Reicher (IfW-Kiel)

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Abstract

In modern macroeconomic models it is difficult to obtain explosive price bubbles on assets with positive net supply. This paper shows that it is possible to obtain explosive bubbles in certain situations when assets such as land are used as collateral and lenders are willing to lend freely against it. As land prices rise, collateral constraints become relaxed, and households wish to borrow more. If the financial sector or government is willing to accommodate this by issuing credit indefinitely, this can lead to self-fulfilling equilibria where land has a positive, purely speculative, value. Furthermore, such bubbles need not affect real allocations in the absence of other market imperfections, even when land is a factor in production.

1. Introduction

The major macroeconomic story of the past decade has been the worldwide housing bubble which peaked in 2006 and then crashed, precipitating a large recession. This bubble was characterized by loose credit. Homeowners borrowed money against their rapidly-appreciating houses and attempted to finance consumption; overall household balance sheets were mostly unaffected but both the asset and liability sides of the balance sheet grew strongly. As land prices grew, people began to view this as a form of saving, and lenders were willing to accept land as collateral. This project attempts to model rational explosive land bubbles as the counterpart of credit bubbles. There is also an active literature on rational nonexplosive bubbles in the presence of period-by-period collateral constraints following Kiyotaki and Moore (1997). This paper does not discuss those types of bubbles, which are interesting in their own right.

There is already an extensive literature on rational explosive bubbles. Kocherlakota (1992) and Santos and Woodford (1997) discuss some of the conditions under which rational bubbles can form, where rational bubbles are defined as an expectation of continuing price rises into the infinite future. Abreu and Brunnermeier (2003) and Kocherlakota (2008) have investigated the role of timing and financing constraints in allowing bubbles to form and persist. The problem with getting rational bubbles into standard equilibrium models is that people will try to arbitrage away bubbles by increasing the present value of their consumption and decreasing their asset holdings. Everybody cannot do this in the aggregate, so this should exert downward pressure on asset prices once a bubble forms, thus correcting the bubble. Introducing constraints on debt accumulation can make it impossible to arbitrage these bubbles away in those states where the bubble is at its most extreme, so rational bubbles can appear in this type of environment.

A different approach would involve seeing what happens when households perceive their budget constraints to be loosened during a land bubble by allowing land to serve as collateral. It involves splitting the economy into household and lending sectors. Households borrow from the lending sector in order to finance consumption and land holdings, while the lending sector does nothing but issue credit and pay dividends. When households can borrow against land and lenders are willing to lend against it, then land may trade at a positive price. This occurs because households believe that the land could be sold for a higher value in the future; this is the classic definition of a rational bubble. Blanchard and Watson (1982) offer a good description of the behavior of these types of bubbles in a partial equilibrium setting.

As it turns out, the ability to support an explosive land bubble depends on how much the lender is willing to lend into the infinite future. The more that the lender is willing to lend against the future value of land, the more households will perceive their long-run budget constraints to be relaxed when land prices rise. Households will try to consume more in present value terms, and this results in increased borrowing. In otherwise well-functioning credit markets, this leaves real allocations unaffected. This result reflects the same logic underlying the Fiscal Theory of the Price Level but in reverse, and in fact one can discuss the effects of fiscal and monetary policy on bubbles using this framework. Through the right combination of credit market and interest rate policies, policymakers can prevent bubbles from forming in the first place, though some of these policies take an unorthodox form and might suffer from credibility problems.

2. The simple model - Households

Households belong to a continuum of households who can lend and borrow with each other and with the lending sector. They can do four things with their income: Buy land (L_{t+1})

which yields no dividends and is inelastically and exogenously supplied, buy nominally-indexed bonds (B_{t+1} for which positive values represent net lending by households and negative values represent net borrowing), eat a consumption good (C_t), and pay net lump-sum transfers to the lender (T_t) which would be analogous to taxes in a fiscal policy model. They fund these things through previous landholdings, previous bondholdings, and current income (Y_t) which is exogenous. All of the real allocations are bounded to grow at a rate less than the interest rate.

The period by period budget constraint of each household is the usual one, with stocks denoted as beginning-of-period values. Consumers are never satiated over consumption so the constraint holds with equality:

$$\frac{B_t}{P_t} + P_t^L L_t + Y_t = P_t^L L_{t+1} + C_t + T_t + \frac{B_{t+1}}{R_{t,t+1} P_t}, \tag{1}$$

where P_t is the current price level, P_t^L is the real price of land; and $R_{t,t+i}$ is the gross nominal interest rate from t through t+i.

In equilibrium, land and bond prices must be priced according to a stochastic discount factor $\Lambda_{t,t+i}$ such that:

$$P_t^L = E_t \Lambda_{t+1,t} P_{t+1}^L,$$

and

$$E_t \frac{\Lambda_{t,t+1} R_{t,t+1}}{\Pi_{t,t+1}} = 1,$$

where $\Pi_{t,t+i}$ is the gross inflation rate from t through t+i. This can come from a simple consumption-based asset pricing model, or it can come from a more complicated factor model. This is a very general formulation which does not depend too much on specific utility functions. See Cochrane (2001, page 64) for a discussion of the generality of this setup.

One can iterate through (1) to express the value of household balance sheets as the expected present value of net outlays plus a terminal condition:

$$
\begin{aligned}
\frac{B_t}{P_t} + P_t^L L_t = {} & \lim_{T\to\infty} E_t \sum_{i=t}^{T} \Lambda_{t,t+i} \left(C_{t+i} + T_{t+i} - Y_{t+i} \right) \\
& + \lim_{T\to\infty} E_t \Lambda_{t,t+T+1} \left(\frac{B_{t+T+1}}{P_{t+T+1}} + P_{t+T+1}^L L_{t+T+1} \right).
\end{aligned} \tag{2}
$$

In plain language, what this says is that households' beginning wealth goes toward the present value of net outlays, plus terminal holdings of land and bonds.

In most normal models, the present value of net lending to and by households is constrained to equal zero in all terminal states, so both parts of terminal wealth are each zero. This is not the consequence of a competitive equilibrium. As Wright (1987) points out, this whole class of models has no competitive equilibrium when one lets consumers choose their terminal debt holdings. Consumers will always want to run a Ponzi scheme, sending the terminal value of net debt holdings as far down toward negative infinity as possible. Wright and others have discussed the consequences imposing no-Ponzi-scheme conditions, but these are additional constraints to these model and do not emerge naturally from Walrasian reasoning.

One path might be to relax this, to assume that terminal net borrowings must merely be collateralized by something such as land; this would be the case if people died at a certain rate and estates went to probate. In both of these cases the households will wish to consume all of their wealth subject to these constraints; otherwise one could always improve welfare by consuming more in the current period. This behavior leads to the transversality condition which sets the total value of terminal wealth to zero:

$$
\lim_{T\to\infty} E_t \Lambda_{t,t+T+1} \left(\frac{B_{t+T+1}}{P_{t+T+1}} + P_{t+T+1}^L L_{t+T+1} \right) = 0 . \tag{3}
$$

Nothing in this transversality condition rules out a bubble in either land or credit; what matters to households is that these bubbles offset each other. If there is a land bubble (a positive terminal value for land), this requires a credit bubble to offset it, or else households will bid down the price of land to zero.

3. Lenders and market clearing

Lenders have a debt transition equation which mirrors that of the government sector in most dynamic economic models. They issue nominal debt in reaction to the transfers which they receive or pay out. Their debt transition equation is as follows:

$$\frac{B_t}{P_t} - T_t = \frac{B_{t+1}}{R_{t,t+1} P_t}.$$

In the case of a fiscal authority, this equation would relate the evolution of government debt to primary surpluses. In the case of a foreign lender, this equation would relate the evolution of foreign debt to trade surpluses. In the case of the financial sector, this would represent the funds needed to engage in net lending. One can view the financial sector in this way as engaging in fiscal policy. In present value terms this collapses down to the same debt valuation equation as used in the fiscal theory of the price level:

$$\frac{B_t}{P_t} = \lim_{T\to\infty} E_t \sum_{i=t}^{T} \Lambda_{t,t+i} T_{t+i} + \lim_{T\to\infty} E_t \frac{\Lambda_{t,t+T+1} B_{t+T+1}}{P_{t+T+1}}. \tag{4}$$

As with the fiscal theory of the price level, nothing constrains lenders to honor a transversality condition of their own.

Imposing market clearing in debt by combining (2) and (4) yields the economywide budget constraint:

$$P_t^L L_t = \lim_{T\to\infty} E_t \sum_{i=t}^{T} \Lambda_{t,t+i} \left(C_{t+i} - Y_{t+i}\right) + \lim_{T\to\infty} E_t \Lambda_{t,t+T+1} P_{t+T+1}^L L_{t+T+1},$$

and imposing market clearing in product markets such that consumption equals output and that the demand for land equals the supply (both normalized to one), yields the land pricing equation:

$$P_t^L = \lim_{T\to\infty} E_t \Lambda_{t,t+T+1} P_{t+T+1}^L.$$

Combining the land pricing equation with the transversality condition (3) yields the current price of land as a function of the debt bubble:

$$P_t^L = -\lim_{T\to\infty} E_t \frac{\Lambda_{t,t+T+1} B_{t+T+1}}{P_{t+T+1}}. \tag{5}$$

In this economy, land can have value if and only if some lender is willing to lend into a land bubble. Otherwise, once a bubble hits, households bid land prices down to zero in order to consume as much as possible in present value terms.

4. Monetary and fiscal policy implications

Can monetary policy prevent explosive credit-backed bubbles? This model suggests that the answer is yes. Any monetary policy which sets the debt bubble term at the right hand side of the debt valuation equation (4) to 0 such that

$$P_t = \frac{B_t}{\lim_{T\to\infty} E_t \sum_{i=t}^{T} \Lambda_{t,t+i} T_{t+i}}$$

would suffice. Basically, as the present value of T falls and threatens a debt explosion, P must jump by enough to deflate the real value of the debt. Otherwise people would refuse to hold debt because the present value of debt payments does not equal the market value of the debt. This must happen instantaneously so that the real value of the debt again equals the real value of transfers.

This is exactly the fiscal theory of the price level as applied to credit markets, and it has surprising implications for what a successful monetary rule-based response to a debt bubble would look like. It indicates that to attack an incipient credit-backed land bubble, monetary authorities should inflate the price level to deflate the real value of household debt and to reduce the incentive to hoard collateral. This goes against conventional wisdom but it is exactly the same logic which says that governments have the option to inflate in order to partially default on their debt.

Once a bubble exists, the situation becomes harder for a central bank to manage since to simply deflate it away requires threatening to explode the price level to infinity. The central bank might lack the credibility to hyperinflate a bubble away, so it may wish to consider a less radical policy rule. Combining both asset pricing equations yields a link between expected land prices and interest rates:

$$E_t \frac{\Lambda_{t,t+1} P^L_{t+1}}{P^L_t} = E_t \frac{\Lambda_{t,t+1} R_{t,t+1}}{\Pi_{t,t+1}}.$$

Having the central bank adopt an interest rate rule such that

$$E_t \frac{\Lambda_{t,t+1} P^L_{t+1}}{P^L_t} < E_t \frac{\Lambda_{t,t+1} R_{t,t+1}}{\Pi_{t,t+1}},$$

for all values of land prices above zero will rule out equilibria where land prices satisfy their asset relationship vis a vis interest rates. Nobody will want to hold land if it yields a lower expected return than bonds, and this will collapse the bubble. In this context, the central bank manages expectations in such a way as to make any desire to hold land contradictory with clearing in asset markets. Taking a first order approximation, the central bank can do this by simply raising expected real interest rates more than one for one in response to expected land price inflation. This is the New Keynesian solution to prevent a collateralized asset bubble; it works by convincing households that all off-equilibrium paths are unsustainable and that only the desired equilibrium can be an equilibrium.

Fiscal policy is a more straightforward way to attack a bubble since governments are already large actors in credit markets. This would involve using tax policy to set the present value of T to enforce the bubble term in (4) to equal zero, yielding the equation:

$$\frac{B_t}{P_t} = \lim_{T\to\infty} E_t \sum_{i=t}^{T} \Lambda_{t,t+i} T_{t+i}.$$

In this situation, there is no bubble throughout the economywide credit market; if a foreign government or private actor threatens to issue too much credit to households for too long, the home government would cut taxes, issue debt and remove that credit from the economy. The home government would be the borrower of last resort. Such a policy configuration would correspond with a Ricardian fiscal policy and an active monetary policy. It is when monetary policy and fiscal (or credit market) policy both try to be active that land bubbles can form.

5. A financial sector which issues equity

It is possible to extend the analysis above to include a financial sector which both issues equity and lends to households but does not engage in production.

The household's period-by-period budget constraint now contains a term for equity purchases:

$$\frac{B_t}{P_t} + P_t^L L_t + P_t^X Q_t + Y_t = P_t^L L_{t+1} + P_t^X Q_{t+1} + C_t + T_t + \frac{B_{t+1}}{R_{t,t+1} P_t}\ , \tag{6}$$

where P_t^Q is the cum-dividend equity price of the financial firm, P_t^X the ex-dividend equity price at which new shares are issued, and Q_{t+1} is the number of shares issued by the firm at time t. Iterated forward this now becomes:

$$\begin{aligned}\frac{B_t}{P_t} + P_t^L L_t + P_t^Q Q_t &= \lim_{T\to\infty} E_t \sum_{i=t}^{T} \Lambda_{t,t+i} \left(C_{t+i} - Y_{t+i}\right) \\ &+ \lim_{T\to\infty} E_t \Lambda_{t,t+T+1} \left(P_{t+T+1}^L L_{t+T+1} + \frac{B_{t+T+1}}{P_{t+T+1}} + P_{t+T+1}^Q Q_{t+T+1} \right).\end{aligned} \tag{7}$$

Under the same collateral constraints as before, this yields the transversality condition

$$\lim_{T\to\infty} E_t \Lambda_{t,t+T+1} \left(\frac{B_{t+T+1}}{P_{t+T+1}} + P_{t+T+1}^L L_{t+T+1} + P_{t+T+1}^Q Q_{t+T+1} \right) = 0\,. \tag{8}$$

The financial sector's balance sheet now evolves according to

$$\frac{B_t}{P_t} - P_t^X (Q_{t+1} - Q_t) - T_t = \frac{B_{t+1}}{R_{t,t+1} P_t}\ ,$$

The sequence T is the negative value of the stream of dividends distributed to the old shareholders of the financial firm. This is done to keep notation consistent across sections and to emphasize the idea that the financial sector can engage in fiscal policy.

Shares are valued in the market according to the same stochastic discount factor as before:

$$P_t^Q Q_t = P_t^X Q_t - T_t = E_t \Lambda_{t,t+1} P_{t+1}^Q Q_t - T_t, \tag{9}$$

and the financial firm wishes to maximize its cum-dividend value which is obtained by iterating the asset pricing equation forward:

$$P_t^Q Q_t = -\lim_{T\to\infty} E_t \sum_{i=t}^{T} \Lambda_{t,t+i} T_{t+i} + \lim_{T\to\infty} E_t \Lambda_{t,t+T+1} P_{t+T+1}^Q Q_{T+t+1}. \tag{10}$$

Combining the equity valuation equation with the debt accumulation equation yields:

$$\frac{B_t}{P_t} + P_t^Q Q_t = E_t \Lambda_{t,t+1}\left(\frac{B_{t+1}}{P_{t+1}} + P_{t+1}^Q Q_{t+1}\right).$$

Iterating forward yields the value of the financial firm as simply the value of a financial bubble, since each financial firm's fundamental value is zero:

$$\frac{B_t}{P_t} + P_t^Q Q_t = \lim_{T\to\infty} E_t \Lambda_{t,t+T+1}\left(\frac{B_{t+T+1}}{P_{t+T+1}} + P_{t+T+1}^Q Q_{T+t+1}\right). \tag{11}$$

Nothing has to prevent an incumbent financial firm from being willing to hoard assets in the long run, since its period by period budget constraint and asset pricing conditions are satisfied. This is not possible with new entrants; this type of bubble has the property that it has to have existed since the beginning of time. Since households can now use stock bubbles as collateral on the right hand side of (7), they are indifferent to whether or not that bubble exists or is paid out in the form of dividends.

Substituting the financial sector valuation equation (11) into the transversality condition (8) and then imposing market clearing yields the familiar land bubble condition, whereby land prices equal their terminal value, which in turn equals the terminal value of the financial sector, which now also equals the market value of the financial sector's balance sheet:

$$
\begin{aligned}
P_t^L &= \lim_{T\to\infty} E_t \Lambda_{t,t+T+1} P_{t+T+1}^L \\
&= -\lim_{T\to\infty} E_t \Lambda_{t,t+T+1} \left(\frac{B_{t+T+1}}{P_{t+T+1}} + P_{t+T+1}^Q Q_{t+T+1} \right) \\
&= -\frac{B_t}{P_t} - P_t^Q Q_t . \qquad (12)
\end{aligned}
$$

The new equilibrium conditions merely generalize (5) to include financial sector equity as another asset. Since in this economy the Modigliani-Miller Theorem and the usual asset pricing conditions hold, the mix of financial sector equity and debt is not important, so long as households are net debtors to the financial sector.

6. A production economy and the neutrality of bubbles

Kocherlakota (2008) provides a formal proof of the possible neutrality of bubbles in a production economy. This section extends this logic to a representative-agent economy where land is a factor of production. Capital K_t has an ex-post rental rate (gross of depreciation) r_t^K. Land has a rental rate r_t^K and labor has a return W_t. As in the previous section, assets are priced cum-dividend. Capital is supplied elastically so its real price is one, and it depreciates at rate δ.

Households seek to maximize the discounted utility of consumption subject to a modified version of their budget constraint (6) and transversality condition (7). The household objective function takes the form

$$
\begin{aligned}
V_t = E_t \sum_{i=0}^{\infty} \beta^i u(C_{t+i}, H_{t+i}) - E_t \sum_{i=0}^{\infty} \beta^i \lambda_{t+i} \left[P_t^{LX} L_{t+1} + P_t^X Q_{t+1} + C_t + T_t + K_{t+1} + \frac{B_{t+1}}{R_{t,t+1} P_t} \right] \\
+ E_t \sum_{i=0}^{\infty} \beta^i \lambda_{t+i} \left[P_t^{LX} L_t + P_t^X Q_t + W_t H_t + r_t^L L_t + (1 + r_t^K - \delta) K_t \right],
\end{aligned}
$$

where asset prices with a superscript X are ex-dividend. This results in the first-order conditions

$$-u_H(C_t, H_t) = W_t \lambda_t ,$$

$$u_C(C_t, H_t) = \lambda_t ,$$

and the asset pricing relationships

$$P_t^L = E_t \Lambda_{t+1,t} P_{t+1}^L ,$$

and

$$E_t \frac{\Lambda_{t,t+1} R_{t,t+1}}{\Pi_{t,t+1}} = 1 ,$$

where the stochastic discount factor equals its usual $\Lambda_{t,t+i} = \beta^i \lambda_{t+i} / \lambda_t$.

Producers produce according to a constant returns production function and have the three intratemporal first order conditions:

$$Y_K(K_t, H_t, L_t) = r_t^K ,$$

$$Y_H(K_t, H_t, L_t) = W_t ,$$

and

$$Y_L(K_t, H_t, L_t) = r_t^L .$$

The asset pricing equation for land (cum-dividend) now contains a fundamental component:

$$P_t^L = E_t \Lambda_{t,t+1} P_{t+1}^L + r_t^L = \lim_{T \to \infty} E_t \sum_{i=0}^{T} \Lambda_{t,t+i} r_{t+i}^L + \lim_{T \to \infty} E_t \Lambda_{t,t+T+1} P_{t+T+1}^L . \qquad (13)$$

After pricing every asset cum-dividend, the household budget constraint becomes:

$$\frac{B_t}{P_t} + P_t^L L_t + P_t^Q Q_t + W_t H_t + (1 + r_t^K - \delta) K_t$$

$$= E_t \Lambda_{t+1,t} P_{t+1}^L L_{t+1} + E_t \Lambda_{t+1,t} P_{t+1}^Q Q_{t+1} + C_t + K_{t+1} + \frac{B_{t+1}}{R_{t,t+1} P_t}.$$

Iterating the budget constraint forward and imposing that real income payments and allocations are well behaved (growing at less than the rate of interest) gives the following condition:

$$\frac{B_t}{P_t} + P_t^L L_t + P_t^Q Q_t = \lim_{T\to\infty} E_t \sum_{i=t}^{T} \Lambda_{t,t+i} \left\{ C_{t+i} - W_{t+i} H_{t+i} + K_{t+i+1} - (1 + r_{t+i}^K - \delta) K_{t+i} \right\}$$

$$+ \lim_{T\to\infty} E_t \Lambda_{t,t+T+1} \left(P_{t+T+1}^L L_{t+T+1} + \frac{B_{t+T+1}}{P_{t+T+1}} + P_{t+T+1}^Q Q_{t+T+1} \right).$$

Substituting the financial sector valuation equation (11) cleans things up a bit:

$$P_t^L L_t = \lim_{T\to\infty} E_t \sum_{i=t}^{T} \Lambda_{t,t+i} \left\{ C_{t+i} - W_{t+i} H_{t+i} + K_{t+i+1} - (1 + r_{t+i}^K - \delta) K_{t+i} \right\}$$

$$+ \lim_{T\to\infty} E_t \Lambda_{t,t+T+1} P_{t+T+1}^L L_{t+T+1}. \tag{14}$$

To see that bubbles are neutral in this model, one can look at a 'star' economy as sequence of real aggregates where there are no bubbles; all first order conditions hold, and markets clear. Land is then priced according to (14):

$$P_t^{*L} L_t = \lim_{T\to\infty} E_t \sum_{i=t}^{T} \Lambda_{t,t+i}^* \left\{ C_{t+i}^* - W_{t+i}^* H_{t+i}^* + K_{t+i}^* - (1 + r_{t+i}^{K*} - \delta) K_{t+i}^* \right\}.$$

Income equals expenditure:

$$r_t^{*L} L_t + r_{t+i}^{K*} K_{t+i}^* + W_{t+i}^* H_{t+i}^* = C_{t+i}^* + K_{t+i+1}^* - (1 - \delta) K_{t+i}^*,$$

so land markets also clear and land is priced at its fundamental value:

$$P_t^{*L} L_t = \lim_{T\to\infty} E_t \sum_{i=t}^{T} \Lambda^*_{t,t+i} r^{L*}_{t+i} L_{t+i} .$$

One can show that there is an equivalent economy where the land price differs and satisfies its asset pricing relationship while real allocations are the same as in the star economy. This would take the form:

$$\begin{aligned} P_t^{L} L_t &= \lim_{T\to\infty} E_t \sum_{i=t}^{T} \Lambda^*_{t,t+i} \left(C^*_{t+i} - W^*_{t+i} H^*_{t+i} + K^*_{t+i} - (1 + r^{K*}_{t+i} - \delta) K^*_{t+i} \right) + b_t^L L_t \\ &= \lim_{T\to\infty} E_t \sum_{i=t}^{T} \Lambda^*_{t,t+i} r^{L*}_{t+i} L_{t+i} + b_t^L L_t , \end{aligned}$$

where the bubble is purely speculative, based on expectations of future price increases:

$$b_t^L = E_t \Lambda_{t+1,t} b_{t+1}^L .$$

One can see by inspection that this economy satisfies (13), (14), and all of the same first order and market clearing conditions as the 'star' economy. This result also applies to an economy with many different kinds of goods and assets. Bubbles are neutral because land prices are additively separable between the fundamental component and bubble component, so the bubble component does not affect fundamentals or any other relative price. Furthermore, an offsetting credit bubble (an increase in household liabilities) neutralizes the wealth effect from the land bubble, so consumption decisions also do not change in equilibrium. Outside lenders end up absorbing all of the increase in land prices. In order to get real effects from this type of land bubble, one must introduce some other features such as credit market imperfections into the economy.

7. Conclusion

By applying the thinking behind the fiscal theory of the price level to asset bubbles, one can show that the way that lenders react to bubbles will determine whether or not they can form.

One such case would be when lenders are willing to lend freely on collateral. Even in a cashless economy, fiscal and monetary policy can play an important role in determining when bubbles can and cannot form, and some of these policies might be counterintuitive. An expansionary monetary policy can reduce the real value of borrowing in the economy in response to incipient credit market bubbles, and an expansionary fiscal policy can crowd out the private borrowing which supports the bubble. Less radically, if a bubble is identified, monetary policymakers can attempt to follow interest rate rules which coordinate expectations on the no-bubble equilibrium. One such rule is fairly orthodox-sounding, and it requires the central bank to raise expected real interest rates more than one-for-one in response to expected land price inflation.

Credit-backed land bubbles can appear in a general context. They can persist when one allows the financial sector to issue equity, and they are robust to including land as a factor of production. They are neutral with respect to real allocations, so any real effect of bubbles has to come from some other source apart from wealth effects. One such path might be to extend the thinking underlying the work of Kocherlakota (2009) and Wang and Wen (2009), who analyze stable bubbles with heterogeneous firms who face period by period credit constraints, to the analysis of bubbles which might appear from loosening credit constraints.

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