ELSEVIER

European Economic Review 38 (1994) 1282–1285

EUROPEAN ECONOMIC REVIEW

Comments

Rational bubbles during Poland's hyperinflation: Implications and empirical evidence *by* M. Funke, S. Hall and M. Sola

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A number of papers have tested for rational bubbles in the post-World War I hyperinflation in Germany. The present paper – henceforth FHS – does so in Poland around the time of the 'big bang'. It finds some evidence that 'the main determination of the hyperinflation was a rational bubble' but cautiously notes that conventional structural models might also explain the hyperinflation. I salute their technically sophisticated investigation of this interesting question, but in the end find their evidence distinctly less suggestive of bubbles than do they.

This evidence comes from a nice extension of techniques suggested by Diba and Grossman (1984) and Hamilton and Whiteman (1985), and applied to the German hyperinflation by Hamilton and Whiteman (1985). Using the Cagan model, that paper noted that in the absence of bubbles, prices will have the same order of integration as does money; if money is, say, $I(2)$ – so that what is stationary is changes in the growth rate of money but not the growth rates themselves – then prices should be $I(2)$ as well. But bubbles cause explosive growth, so no level of differencing will induce stationarity in a variable driven wholly or even in part by a bubble. Hamilton and Whiteman (1985) found that prices and money appeared to be $I(2)$ in the German hyperinflation, and concluded that bubbles probably were not present.

Evans (1991) in turn pointed out that if (a) bubbles periodically grow and collapse, and (b) there are not a whole lot of observations during which the bubble was growing, the Hamilton and Whiteman (1985) test will likely fail to find bubbles. And tests are likely to find that prices and money are

*I thank the National Science Foundation and the Graduate School of the University of Wisconsin for Financial support, and Stephen Hall for supplying his data.

SSDI 0014-2921(93)E0140-G

cointegrated (an implication of the standard specification of the Cagan demand function), even though the two variables in fact will not be cointegrated in the presence of bubbles. The basic idea is that if prices and money are growing smoothly in much of the sample, mechanical application of standard tests will have a hard time picking up the fact that there are a few brief episodes in which the bubble is causing explosive growth.

Stimulated by Evans (1991), Hall and Sola (1993) proposed using Hamilton's (1989) regime switching technique to separate the data into two regimes, and to apply unit root tests within regimes. The hope is that the periods in which bubbles are rising will be put in a distinct regime, and the unit root tests will indeed find that prices and maybe other variables are explosive within the bubble regimes. The procedure is too computationally intensive to permit a full Monte Carlo evaluation, but a very small set of simulations in Hall and Sola (1993) indicated that the procedure will indeed tend to find rational bubbles when they are present.

Enter Funke, Hall and Sola. They begin by applying unit root and cointegration tests. Consistent with both Hamilton and Whiteman (1985) and Evans (1991), these tests do not suggest bubbles. They then apply the Hall and Sola (1993) technique, allowing for bubble regimes not only for the price level and the exchange rate but also for the money supply. They fail to reject the presence of bubbles. For each of the variables, there is a regime in which the variable grows explosively, another in which it does not. The explosive regimes are concentrated around the hyperinflation period.

FHS stress that this evidence should be interpreted with care. I would like to (1) underline the need for caution, and then (2) suggest how one might get a better feel for whether or not rational bubbles underlie the occasional periods of explosive behavior.

(1) Fig. 1 plots the log levels of the money supply, exchange rate and price level, using the FHS data. The boxes mark the months that FHS estimate to have a probability greater than 0.5 of being in the explosive regime; these months would be the same for cutoff probabilities of 0.75 and 0.25. This was constructed from inspection of FHS's Fig. 2. We see from Fig. 1 that the money supply is in an explosive regime for the six months from October 1989 through March 1990, as is the exchange rate in October 1988, July 1989 and November 1989 through January 1990; the price level is in such a regime from August 1989 to February 1990.

The good news is that the sophisticated econometric technique often picks up explosive growth where one's eye picks it up as well. One would be quite worried if the technique found a price bubble in 1987 but not 1989–90! In addition, it may be that one could (although FHS do not) tell stories about what triggered the start or stop of at least some of the bubble episodes. Exchange rates were liberalized in January 1990, for example (Lipton and

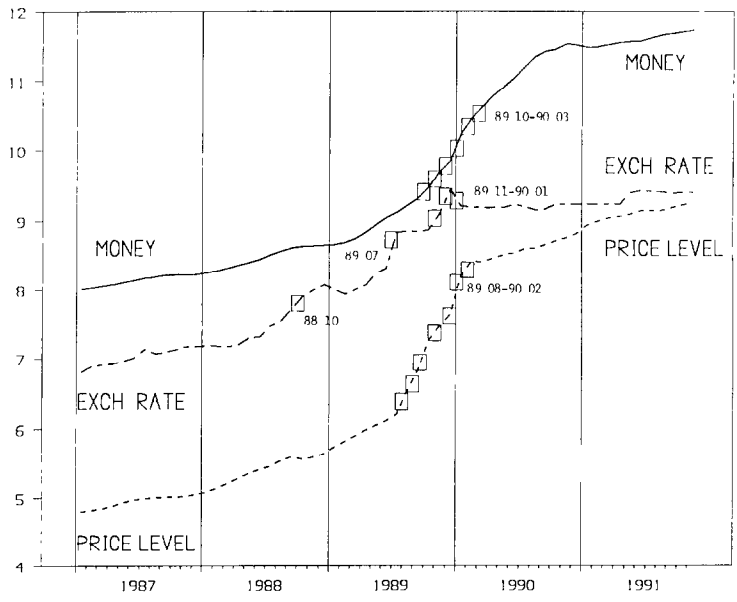

Fig. 1.

Sachs, 1990, p. 113; Calvo and Coricelli, 1992, p. 181), and one might be able to argue that the introduction of a new, liberal regime burst a bubble.

On the other hand, it is not difficult to tell conventional, non-bubble stories, and not just for the exchange rate. Consider the price level. Many food prices were decontrolled in August 1989, as were many other prices in January 1990 (Lipton and Sachs, 1990, pp. 110–114; Calvo and Coricelli, 1992, p. 181). Since the controlled prices seem to have been well below market clearing levels, a rapid rise in measured prices is to be expected, even in the absence of a bubble. ('Measured' because the official price level does not reflect time spent waiting in line, which, one supposes, might have been substantial prior to decontrol.)

In addition, the time series pattern in my Fig. 1 is broadly consistent with a forward looking monetary model. As noted in the introduction to FHS, in such models the exchange rate depends on the expected present discounted value of future values of fundamentals such as the money supply, and, indeed, in Fig. 1 we see that the exchange rate tends to rise (depreciate) and fall (appreciate) in advance of the money supply. Similarly, in the rational expectations version of the Cagan model, the price level depends on the expected present discounted value of future values of the money supply.

Once again, we see in Fig. 1 that prices do indeed rise and fall in advance of the money supply.

(2) What might FHS do in future research to help discriminate between bubble and non-bubble explanations? FHS seem reluctant to use structural modelling, so let me begin with a suggestion that requires only atheoretical time series. Their unit root tests indicate that most variables are $I(2)$. Use simulations to tell us how your procedure behaves if the data are $I(2)$ without bubbles. (The Hall and Sola (1993) simulations do not include any with $I(2)$ data.) What are the odds that the procedure will spuriously find two regimes, one with explosive behavior?

Second, it would help to present informal evidence on what caused the start and stop of bubble regimes. For the money supply, none was apparent in the handful of papers that I read in preparation for this discussion.

Finally, while, as argued above, forward looking, non-bubble models are consistent with the qualitative pattern of exchange rates and prices (given the behavior of the money supply), it may be that a closer, and more quantitative examination, will show that the fit of such a model is better when one allows for bubbles. (I gather that something like this is asserted in Section 5 of FHS, although it is not clear to me that the procedure used there in fact adds a lot to the one used in Section 4.) So specify a model, for exchange rates as well as for prices and money. Use these to compute the expected present discounted values that, according to the model, determine the price level and exchange rate. How close are the observed and the predicted values? Is it difficult to reconcile discrepancies with the historical record on surprises in monetary, exchange rate and price policies?

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