Is Money Neutral for Agriculture

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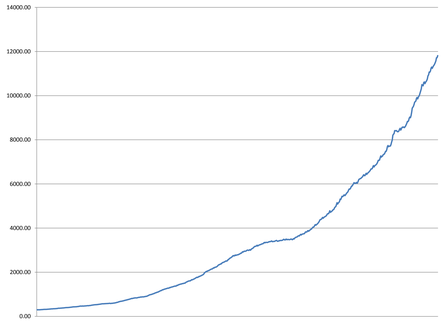
The Problem

Money neutrality is one of the few economic theories that almost all economists believe in one form or another. Classical economists think money neutrality holds in the short to medium term while Keynesians think money neutrality does not hold until the medium to long term. The length of time during which monetary policy might be effective depends crucially on however long money might be non-neutral.

Money Supply (M2), 1960.1-2015.2



Background

Many economists have studied money neutrality, testing specific theories and assumptions that should hold or be rejected depending on the veracity or falsity of money neutrality. However, all these papers are joint tests of money neutrality and a set of assumed hypotheses about economic models or other theory-based restrictions. One notable exception is Poirier (1991) who employed an early application of Bayesian model averaging to test money neutrality without his testing depending crucially on a particular macro worldview. This paper will take a path in the spirit of Poirier, although even farther down the road, by devising a test of money neutrality that is completely independent of any other economic theories. To do so, I rely on the most atheoretic of arenas: forecasting performance.

Theory

Money neutrality at its core posits that changes in the money supply should only affect nominal variables while leaving real variables unaffected. That simple idea suggests a test of money neutrality based on competing forecasting models. If money neutrality holds, adding money to a forecasting model for a real variable should produce no improvement in forecasting performance. If forecasting performance does improve, that result suggests money may be non-neutral. To add robustness to a forecasting test for money neutrality, I rely on two different measures of forecasting performance: one based on forecast precision and one designed to measure accuracy at predicting turning points.

Methodology

Base Model

The forecasting models employed in this paper are simple autoregressive models of varying lag lengths. The base model includes only lagged values of the variable being tested. Mathematically, we can write such models as

yt = ρ1yt-1 + ρ2yt-2 + … + ρpyt-p + εt (1)

where p is the maximum lag length, yt is the period t observation of the series being forecast, the ρi are coefficients to be estimated, and the εt are stochastic terms representing random effects and other things not modeled. For the tests of money neutrality, the lag length will vary from a minimum of p=3 to a maximum of p=12.

Models Augmented with Money

To test money neutrality we need forecasting models with money in them so its ability to enhance forecasting performance can be measured. Therefore, the model in equation (1) is augmented with a set of lagged money supply levels, yielding a model such as

yt = ρ1yt-1 + ρ2yt-2 + … + ρpyt-p + γ1mt-1 + γ2mt-2 + … + γqmt-q + εt. (2)

In equation (2), ms is the money supply in period s, the γi are coefficients to be estimated, q is the maximum lag of money included in the model, and the rest of the model is the same as the base model in equation (1).

How to Test for Money Neutrality

If the money-augmented model in equation (2) out-forecasts the base model in equation (1) that is evidence against money neutrality. If longer lags of money (a larger value of q) improve forecasting performance that implies money stays non-neutral for a long time.

Performance Tests

Henriksson-Merton Test

This test analyzes the correct prediction of some qualitative (or categorical) event for data being studied (Henriksson and Merton 1981, Pesaran and Timmermann 1994). The observed forecast accuracy of the specified event is transformed into probabilities, with being the probability that the event falls in category and the forecast was for category. When the probabilities of categories are represented in a contingency table, it takes on the form of a matrix which we call:

$$P = \begin{bmatrix} P_{11} & P_{12} & \cdots & P_{1k} \\ P_{21} & P_{22} & \cdots & P_{2k} \\ \vdots & \vdots & & \vdots \\ P_{k1} & P_{k2} & \cdots & P_{kk} \end{bmatrix} \quad (3)$$

Each row of measures the probability of correct and various incorrect forecasts of the times when the actual event fell into category . Thus, the main diagonal of holds the probabilities of correct predictions. To test the null hypothesis of no discernible improvement in event prediction from the inclusion of information from some external source, one examines:

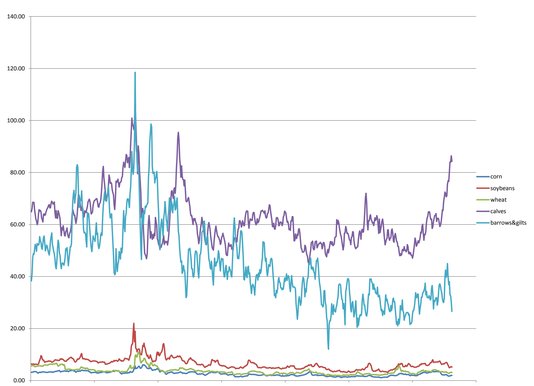
$$H_0^*: \quad \sum_{i=1}^{n} \left(\bar{P}_{ii} - \bar{P}_{i0}\bar{P}_{0i} \right) = 0. \quad (4)$$

In our simple, case, the test simplifies so that the test of is based on the statistic:

$$HM = \sum_{j=1}^{2} \sum_{i=1}^{2} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}, \quad (5)$$

where is the observed number of forecasts that fall in that cell of the contingency table and is the expected number of forecasts in that cell. The test statistic is distributed as a and the expected number of forecasts in a cell is the product of the row and column sums divided by the total number of forecasts.

Real Prices for Five Ag Commodities, 1960.1-2015.2



Harvey, Leybourne, Newbold Test

This test compares MSEs from two forecasting models and has a null hypothesis of equal forecast precision. The test statistic is based on the correlation coefficient between (e1-e2) and (e1+e2) where the ei are the forecast errors.

Data

Prices for corn, soybeans, wheat, calves, and hogs (barrows&gilts) are from NASS and are monthly average prices received by farmers from January 1960-February 2015. The prices are converted to real prices using the PPI for all commodities from FRED. The money supply is represented by M2, not seasonally adjusted, also from FRED.

Results

Table 1. Number of Rejections for Ho: No Improved Forecasting Performance

	Corn	Soybeans	Wheat	Cattle	Hogs
H-M test	7	18*	45*	39*	0
MSE test	0	0	0	0	0

Note: For each box, there are 102 individual tests at the 5% significance level.
* = more rejections than expected.

Conclusions

Money neutrality does not hold in all cases in agriculture when one considers the ability to forecast the direction of change in real prices of agricultural commodities.