

Long-Run Neutrality and Superneutrality in an ARIMA Framework: Comment

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In a recent paper in this *Review*, Mark E. Fisher and John J. Seater (1993) (henceforth, FS) derive reduced-form tests of long-run neutrality (LRN) of money that do not require specific assumptions about the underlying structure of the economy. They test this hypothesis (along with that of superneutrality) with U.S. annual data over the 1869–1975 period and they report estimates of the long-run relationship between money and real output that supports a rejection of long-run neutrality.

In a recent comment in this *Review*, John F. Boschen and Christopher M. Otrok (1994) (henceforth, BO) argue that FS's rejection of long-run neutrality is based on the exceptional period from 1930 to 1939 when an extraordinary number of bank failures generated significant financial market disruption. During a period of financial disintermediation, there is no presumption of money neutrality even in models which embed this feature within their framework. (See for example the discussion in Robert J. Barro and Lucas, 1994 Ch. 17.) BO provide evidence (p. 1472) to support their contention that, "The variability and comovement of M2 and output over this decade constitute a large and unusual event during the 124-year sample period." Accordingly, BO replicate FS's results and then estimate the model over the samples, 1869–1929, 1940–1992, and 1869–1992, using a

dummy variable that allows the intercept parameter to shift during the decade of the 1930's. On the basis of their findings with the new tests, BO conclude that, with the exception of the 1930's, long-run neutrality is supported by the data.

In this note we provide evidence from the Canadian experience to independently test the conjecture of BO that FS's rejection of LRN is based on the anomalous period of the 1930's. Canadian data is useful in this regard since the Canadian system of branch banking was not susceptible to the banking panics that characterized the U.S. banking system throughout this period. (There were no reported bank failures in Canada between 1930 and 1939.) Thus, if BO are correct, the Canadian data should support long-run neutrality without resort to the use of a dummy variable for the 1930's.

I. Econometric Results

Briefly, the FS analysis yields a simple test of long-run neutrality. If money and real income are integrated of order one, the long-run derivative of real income with respect to money is equal to the slope coefficient of a regression of growth rates of real income on growth rates of money. Thus, long-run neutrality is supported if this slope coefficient tends to zero as the span over which these growth rates are calculated tends to infinity. Formally, let y denote the log of real income and m , the log of money. Then, b_k is given by equation (1),

$$(1) \quad (y_t - y_{t-k-1}) \\ = a_k + b_k(m_t - m_{t-k-1}) + e_{kt}.$$

Both FS and BO obtain estimates of b_k for values of k ranging from one to 30 over the periods 1869–1975 and 1869–1992, respectively. They plot the estimates of b_k (along with the

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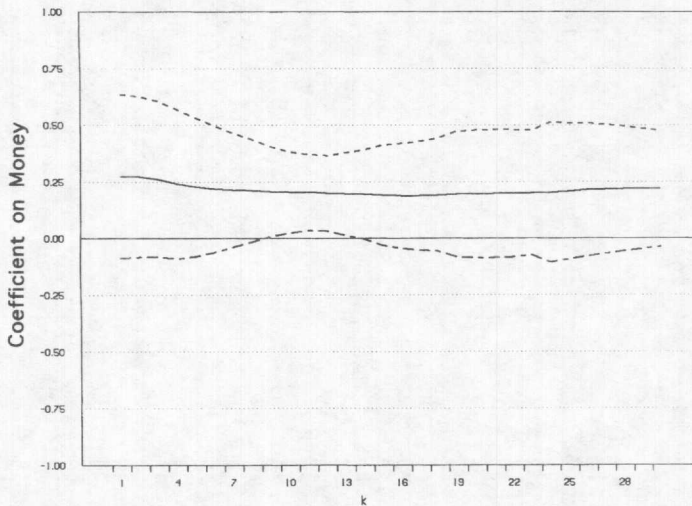


FIGURE 1. CANADIAN OUTPUT ON MONEY: 1914-1994

95-percent confidence intervals) versus the values of k , an approach we follow below.

FS's long-run derivative is defined under the assumption that changes in the money supply are exogenous. Estimation of equation (1) using Canadian data must therefore take into account the fact, as documented by Trevor J. O. Dick and John E. Floyd (1992), that from 1869 to 1914 Canadian banks operated under a de facto gold standard. Without a central bank, nor a mechanism for borrowing from the federal government, Canadian private banks held sterling and gold reserves as backing for bank notes and deposits. In this environment a resource boom and accompanying inflow of capital, such as that which occurred between 1902 and 1914, leads to an increase in the Canadian money supply as the sterling or gold proceeds of securities sales abroad are deposited in domestic banks and converted to domestic currency. Domestic money supply changes cannot, therefore, be treated as exogenous during this period. In 1914 the passage of the Finance Act provided for chartered bank borrowing from the government and this institutional change broke the link between the Canadian money supply and sterling and gold reserves of chartered banks. Thus, our sample period runs from 1914 to 1994.

First, we conducted a number of unit-root tests on the data.¹ We conclude that, as with the U.S. numbers, the data are integrated of order one, or equivalently, that they are consistent with permanent changes in log money and log real output.² Figure 1 depicts the results of estimating equation (1) over the period 1914-1994 without a dummy variable for the period 1930-1939.³ The main contrast with the findings of FS and BO is that the point estimates for b_k are insignificant except for values of k between 10 and 13.⁴ We interpret this

¹ The data for nominal gross national product and the associated implicit deflator for 1870-1926 are taken from Malcolm C. Urquhart (1986), for 1927-1946 from Statistics Canada, National Income and Expenditure Accounts, 1926-1974, Catalogue 13-531, and for 1947-1994 from Canadian Socio-Economic Information Management (Cansim), series D20056 and D20556. The 1870-1967 data for M2 are from Michael D. Bordo and Lars Jonung (1987), and for the period 1968-1994, from Cansim, series B1630.

² The tests were Dickey-Fuller tests with a time trend included. We experimented with the number of autoregressive lags set at zero to four.

³ Following FS and BO, we use the Whitney K. Newey and Kenneth D. West (1987) procedure with four lags to obtain the 95-percent confidence band around the point estimates.

⁴ Figure 2 of FS and Figure 1 of BO depict positive and significant values of b_k over the full sample.

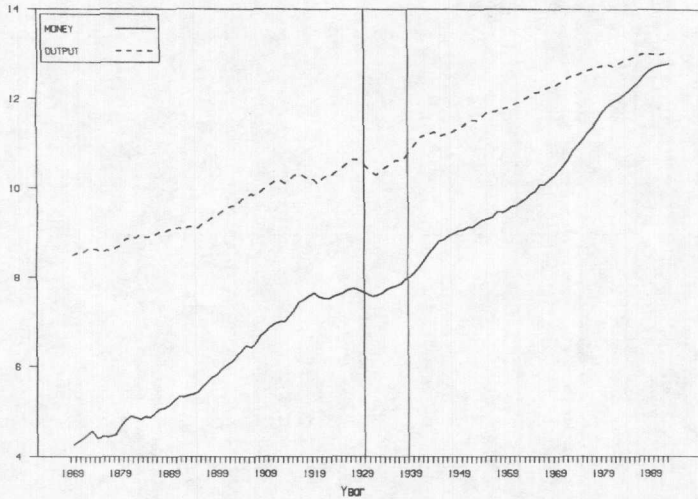


FIGURE 2. CANADIAN MONEY AND OUTPUT: 1870-1994

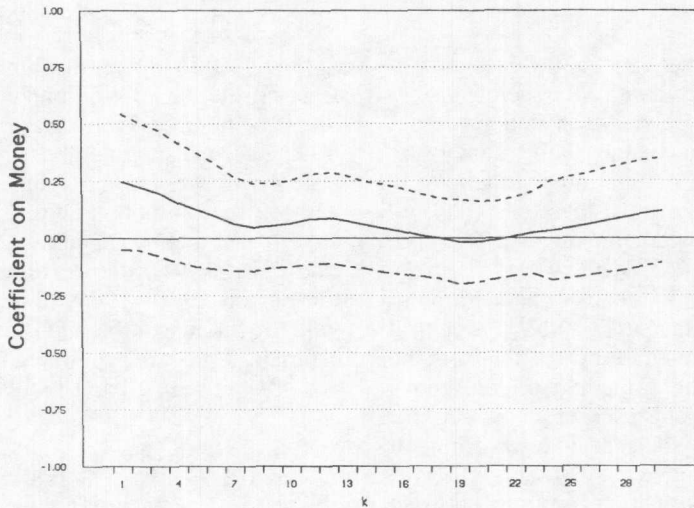


FIGURE 3. CANADIAN OUTPUT ON MONEY: 1914-1994 WITH 1930's DUMMY

result as independent support for the conjecture of BO that FS's rejection of LRN is based on the anomalous period of the 1930's.

Even though the Canadian banking system did not undergo the same degree of disruption in the form of financial disintermediation that the U.S. system did, there was still a comovement of money and real income during this period that was unusual by comparison to

pre- and post-1930's experience. Figure 2 replicates BO's Figure 5 and demonstrates that both variables underwent a large parallel downward movement similar to the U.S. experience, notwithstanding the relative stability of the Canadian financial system. Thus, we have reestimated equation (1) with a dummy for the 1930's and the results are depicted in Figure 3. The results support LRN even more

strongly, as the point estimates of b_k track the zero line closely and are insignificant for all values of k . Figure 3 suggests that the financial-market disruption which characterized the 1930's in the United States is not the only reason for the rejection of LRN in this period, for the Canadian data indicates that even in the absence of this disruption the Great Depression was an anomalous period in terms of the money-output relationship.

II. Conclusions

We have conducted the reduced-form neutrality test of FS with Canadian data and have shown that over the period 1914–1994 the data support LRN for the most part without resort to the use of a dummy variable for the Great Depression as proposed by BO. Since the Canadian financial system did not undergo the same degree of disruption as the U.S. system during this depression, we infer this result supports the conjecture of BO that the FS rejection of LRN for the 1869–1975 U.S. experience is based on the anomalous period of the 1930's. Nevertheless, the addition of a dummy for the 1930's does strengthen the support for LRN in the Canadian data and we conclude that there is more to the breakdown of the money-income relationship during this period than can be explained by financial disintermediation alone.

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