CAN MONEY MATTER?

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Working Paper No. 4-83

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August 1982

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I. Introduction

Do increases in the real money supply increase appreciably the productive capacity of the economy? A long series of empirical papers, stretching at least from Sinai and Stokes (1972) to Sinai and Stokes (1981), has attempted to answer this question by including real balances in an estimated aggregate production function. (See also References.) Estimates of the output elasticity of real money, using various definitions of money and various methods, range from about 0.02 to about 1.0. Since the growth rate of real money balances is generally between plus or minus 7 percent per annum, these elasticity estimates suggest that fluctuations in the real money supply can explain increases in aggregate supply on the order of either statistical noise, if 0.02 is correct, or typical annual growth in GNP, if 1.0 is correct.

When studies using standard econometric methods are unable to reach a consensus estimate, alternative techniques become valuable. In this paper, I estimate the output elasticity of real balances using a much older and, in this particular case, a much more reliable method. The range of error likely to be associated with my estimates is sufficiently small so that we can settle most interesting economic questions which require an estimate of the aggregate output elasticity of money.

II. Do we care whether money matters?

There is little doubt that real money is strongly associated with output. Figure 1 shows the log of real GNP graphed against the logs of real high-powered money and real M1 using annual observations from 1917 through 1981. Simple correlation coefficients between the log of output and the log of real money are 0.82 and 0.90 for high-powered money and M1 respectively.

Most economists are comfortable with the empirical observation that increases in the real money supply cause increases in real output. Does the

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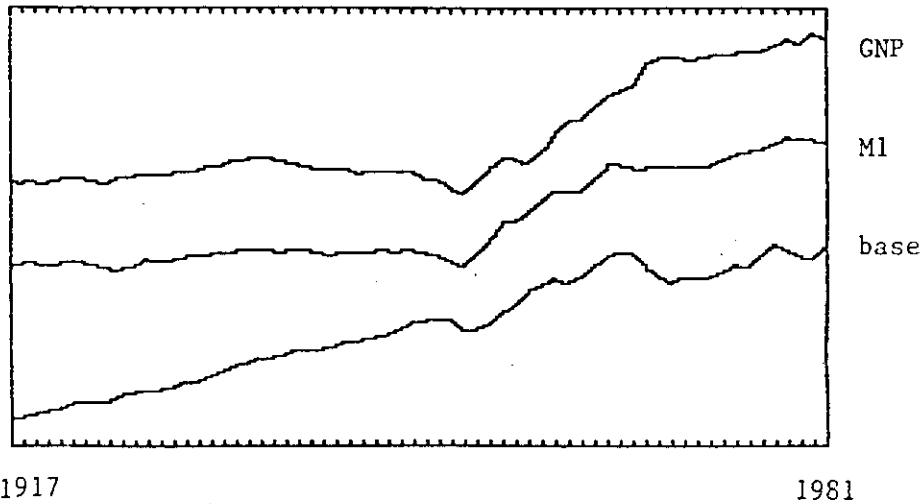Logarithms real GNP, M1, and monetary base

Figure 1

path of causation run through neo-classical, "aggregate supply," channels, or through non-neoclassical, "aggregate demand," channels? If the output elasticity of real balances is large, it is then plausible that money affects output through aggregate supply. Conversely, if the elasticity is small, then perhaps we are justified in looking instead at non-neoclassical models.

III. Estimates of the output elasticity

The "money in the production function" papers have attempted to deal with a number of issues in addition to the question of the output elasticity. In particular, they have examined specification of functional form, estimated elasticities of substitution between money and other input factors, tested for constant returns to scale, and discussed several of the statistical difficulties involved in production function estimation. I will deal only with estimating the output elasticity.

I will assert, without subjecting to test, that real balances can be

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rented in a competitive market (the demand side is competitive, no assumption is made on the supply side) and that the economy exhibits constant returns to scale in the observed range. If we assume that the economy is on the production frontier, then we can apply what I like to call the Solow estimator of output elasticity (see Solow (1957)). The Solow estimator of the output elasticity of money is money's factor share in total output. The annual marginal product of money equals its opportunity cost, measured by the nominal interest rate. Since output elasticity equals marginal product times the amount of the factor used divided by total output, the "Solow estimator" of money's output elasticity is the nominal interest rate times the nominal money stock divided by nominal output.

While the estimates presented below are remarkably insensitive to our choice of data, we do have to pick from among the various monetary aggregates. Results are shown below using both M_1 and high-powered money. (The commercial paper rate and GNP are the nominal interest rate and output variables.) In choosing a monetary aggregate, we may have to adjust the opportunity cost variable at the same time. The short-term nominal interest rate is approximately the opportunity cost of high-powered money. When we consider aggregates that include bank money, explicit or implicit deposit interest reduces the opportunity cost of holding the aggregate.

Consider the extreme case of competitive interest payments on bank money. Let C, D, M, H stand for currency, deposits, "money," and high-powerd money, respectively. Let r, r_D, and k stand for the nominal interest rate, the deposit interest rate, and the reserve ratio, respectively. We have $H=C+kD$, $M=C+D$. If deposit interest is fully competitive, then $r_D=(1-k)r$. The opportunity cost of holding M is $rC + (r-r_D)D$. For fully competitive deposit interest the opportunity cost of holding M reduces to $rC+rkD=rH$.

The question of whether deposit money has historically received a competitive implicit return has been discussed extensively, without having been settled, elsewhere. Since I think there are theoretical, as well as practical, reasons for using outside money, I will simply state my preference for using high-powered money in this instance, and present estimates using both high-powered money and M_1. Both estimators of output elasticity are graphed in Figure 2.

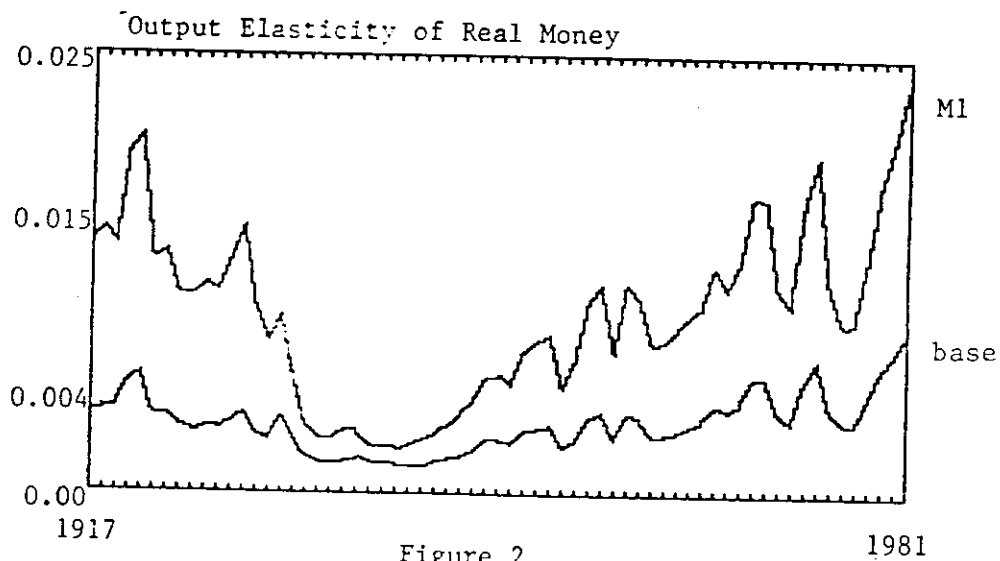Output Elasticity of Real Money

Figure 2

The output elasticity of base money has never been as high as 0.01. It is worth noting that previous econometric techniques have suggested point estimates outside of the historically observed range, though the estimates by Short (1979) are fairly close. As Figure 2 makes clear, the contribution of real money balances to output is negligible.

How might we best reconcile two seemingly contradictory sets of

observations? On the one hand, Figure 2 demonstrates that additions to real balances do not significantly increase aggregate supply. On the other hand, we have both the long established empirical correlation between real balances and real output and a substantial series of econometric studies which appeared to document a much larger output elasticity. If increases in real balances do not increase aggregate supply, then why are the two so closely associated? Two possible answers suggest themselves. First, perhaps the apparent correlation is spurious. For example, unanticipated increases in nominal money might "mislead" agents into increasing both real output and real balances. Second, a very mainstream aggregate demand theory could account for what we observe. Changes in the real money supply change real output, but through aggregate demand, not aggregate supply. Earlier statistical estimates essentially "picked up" this demand side effect.

The estimates presented above tell us little about the value of introducing money into a barter economy or about the damage done by a hyperinflation. However, it is evident that over any reasonable range, changes in the real money supply are irrelevant for the determination of aggregate supply in our economy.

References

Boyes, William J., and David C. Kavanaugh, "Money and the Production Function: A Test for Specification Errors," Review of Economics and Statistics, 61 (Aug. 1979), 442-446.

Fischer, Stanley, "Money and the Production Function," Economic Inquiry, 12 (December 1974), 517-533.

Khan, Mohsin S. and Pentti J. Kouri, "Real Money Balances as a Factor of Production: A Comment," Review of Economics and Statistics, 57 (May 1975), 244-245.

Niccoli, Alberto, "Real Money Balances and Production: A Note," Review of Economics and Statistics, 57 (May 1975), 241-243.

Prais, Zmira, "Real Money Balances as a Variable in the Production Function," Review of Economics and Statistics, 57 (May 1975), 243-244.

_____, "Real Money Balances as a Variable in the Production Function," Journal of Money, Credit and Banking, 8 (Nov. 1976), 535-543.

Short, Eugenie Dudding, "A New Look at Real Money Balances as a Variable in the Production Function," Journal of Money, Credit and Banking, 11 (Aug. 79), 326-339.

Sinai, Allen and Houston H. Stokes, "Real Money Balances: An Omitted Variable from the Production Function?," Review of Economics and Statistics, 54 (Aug. 1972), 290-296.

_____, "Real Money Balances: An Omitted Variable from the Production Function?—A Reply," Review of Economics and Statistics, 57 (May 1975), 247-251.

_____, "Real Money Balances as a Variable in the Production Function—A Further Reply," Journal of Money, Credit and Banking, 9 (May 1977), 372-373.

_____, "Money and the Production Function—A Reply to Boyes and Kavanaugh," Review of Economics and Statistics, 63 (May 1981), 313-318.

Solow, Robert M., "Technical Change and the Aggregate Production Function," Review of Economics and Statistics, 39 (Aug. 1957), 312-320.