

# ***Does Money Matter in Developing Economies? Some Evidence from the Solow Estimator***

Ali F. Darrat  
*Louisiana Tech University*

Yousif K. Al-Yousif  
*The United Arab Emirates University*

Building on the Solow seminal approach for estimating the output elasticity of money stock and on Startz's (1984) implementation of it, this article explores the role of money in the production process in Kuwait, Saudi Arabia, and the United Arab Emirates. Due to lack of necessary data on interest rates in these countries, we use alternative measures of credit constraints as proxies. In contrast to Startz's conclusion for the U.S., our empirical results systematically reveal significant output elasticities of money in each of the three developing countries under study. This is consistent with the neoclassical monetary theory and its incorporation of real money balances as an important input in the production function. Moreover, as the McKinnon-Shaw hypothesis contends, money appears to be complementary to physical capital in the three developing countries. Hence, policy-makers must not hinder the development of their money (financial) markets if they desire to promote economic growth.

## **Introduction**

Theories of a neoclassical persuasion have long established that real money stock is an important input in the aggregate production function. In particular, the monetary growth models of Friedman (1969), and Stein (1970) argue that money is an essential input because it releases capital and labor from the distribution and exchange processes, thus allowing them to be more effectively used in producing

---

Direct all correspondence to: Ali F. Darrat, Department of Economics and Finance, Louisiana Tech University, Ruston, LA 71272.

---

Copyright © 1998 by JAI Press Inc. 1058-3300

goods and services. Accordingly, it has become a common procedure to include real money stock as an input when estimating production functions. Such a practice is not, of course, without criticism. Moroney (1972) contends that this approach is naive since money has broader implications in the production process than can be captured by simply treating money as a factor of production. Fischer (1974) also questions the ability of typical data on money to truly reflect the savings of resources from the use of money as an exchange device. Moreover, Ben-Zion and Ruttan (1975) argue that money affects real output through aggregate demand rather than aggregate supply channels in accordance with the non-neoclassical thinking.

Overall, however, the theoretical literature seems generally supportive of money as an input in the production function since at issue is primarily to what extent, rather than whether, theory buttresses money as an input. The empirical evidence on the subject, on the other hand, appears more controversial. Sinai and Stokes (1972), who pioneered the empirical work on the role of money as a production factor, conclude that real money stock when added to a Cobb-Douglas production function proves highly significant for the United States. While several follow-up studies lend some support to Sinai-Stokes' finding (e.g., Short, 1979; Simos, 1981; and Sinai and Stokes, 1989), others do not (e.g., Niccoli, 1975; Prais, 1975; and Nguyen, 1986). Estimates of the output elasticity of real money reported in these studies vary considerably from under 0.01 to more than 1.0. The estimates also are highly sensitive to a host of specification issues including the list of variables, the specific definitions of the money input used, the functional forms, and time periods analyzed, among others.

The aggregate production function approach, therefore, seems unable to settle the debate regarding the role of money in the production process. Several researchers (e.g., Fischer, 1974; Nguyen, 1986) contend that the production function approach is inherently difficult and largely useless for the purpose at hand.

Startz (1984), building on the work of Solow (1957), has skillfully proposed a simpler and perhaps a more reliable alternative way to study the contribution of money to aggregate production which potentially avoids the shortcomings of the standard production function approach. Using annual U.S. data, Startz concludes that the output elasticity of real money is very negligible and, as such, "changes in the real money supply are irrelevant for the determination of aggregate supply in our economy," p. 384.

We adopt Startz's insightful procedure and examine the role of money in the production process in three developing economies; namely, Kuwait, Saudi Arabia, and the United Arab Emirates. The following two sections discuss some reasons for selecting these countries, highlight the Startz procedure, and present the empirical results. We close with some conclusions and policy implications.

### Some Relevant Issues

The role of money in economic growth has long occupied a central position in the economics literature. This issue assumes more prominence in the case of developing countries that are aspiring to achieve better living standards and

improve their macroeconomic performance. If Startz's conclusion against the productivity of money is generalizable, the implications could be particularly damaging to developing countries. Almost without exception, these countries have devoted much attention and scarce resources to improving the scope and operation of their monetary systems. Such a posture is based on the premise that financial (monetary) deepening is an engine of economic growth. This presupposition is so vividly clear in the case of the developing countries chosen for examination in this article. In recent years, these countries have persistently implemented policies designed to expand their banking systems and accelerate the public's accumulation of real money balances. Indeed, in addition to implementing such policies, these countries also appear to have voiced academic support for the notion that money and banking systems play a dominant role in economic development.<sup>1</sup>

As we mentioned earlier, the proposition that money plays an important role in the economic growth of developing countries is predicated on solid theoretical grounds. McKinnon (1973) and Shaw (1973), for example, have long theorized that the financial system is a key determinant of economic growth particularly in developing countries. McKinnon argues that developing countries typically suffer from fragmented and embryonic capital markets. Under these circumstances, real money stock becomes a complement rather than a substitute for physical capital. Therefore, larger holdings of real money balances would enhance, rather than inhibit, private incentives to accumulate physical capital. The case of the developing countries under study may lend further support to McKinnon's complementary hypothesis since private investors in these countries are predominately self-financed (see Ghatak, 1995).

In this light, an interesting question emerges: Are policies implemented in the three countries to promote their banking systems and encourage the accumulation of real money balances in the private sector misguided and in fact irrelevant to their economic development? In other words, how much has real money supply contributed to aggregate output in these developing countries? The next section attempts to answer this important question using the Startz approach. We should emphasize at the outset that our main objective in this paper is only to evaluate *qualitatively* the impact of changes in the breadth and depth of financial markets (i.e., credit availability) on economic growth in the three developing countries. No claim, therefore, is made here that our results represent the precise contribution of money in the production process in the countries examined.

### **The Startz Approach and the Empirical Results**

Drawing on Solow's work, Startz (1984) derives what he dubs the "Solow estimator" of the output elasticity of money which is the money's factor share in total output.<sup>2</sup> The annual marginal product of money equals its opportunity cost as reflected in nominal interest rates. Thus, the output elasticity of any factor can be defined as the factor's marginal product times the amount of the factor used in production divided by total output. Consequently, thinking of money as a physical input, the Solow estimator of money's output elasticity can be computed as the nominal interest rates times nominal money stock divided by nominal output.

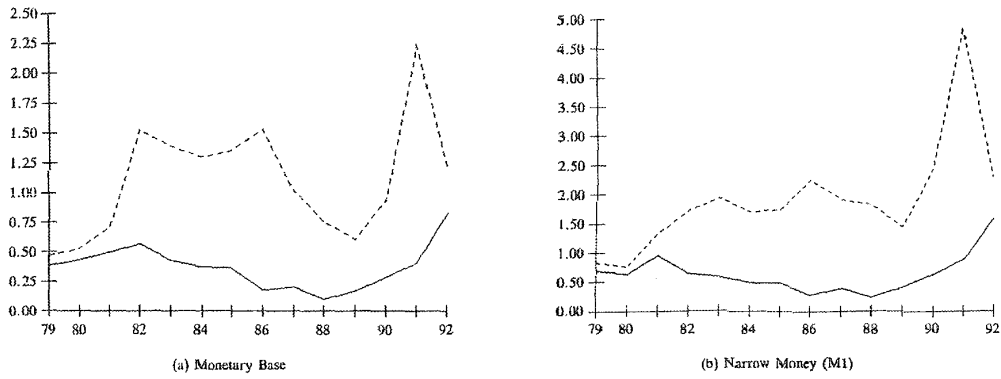


Figure 1. Output elasticity of real money in Kuwait

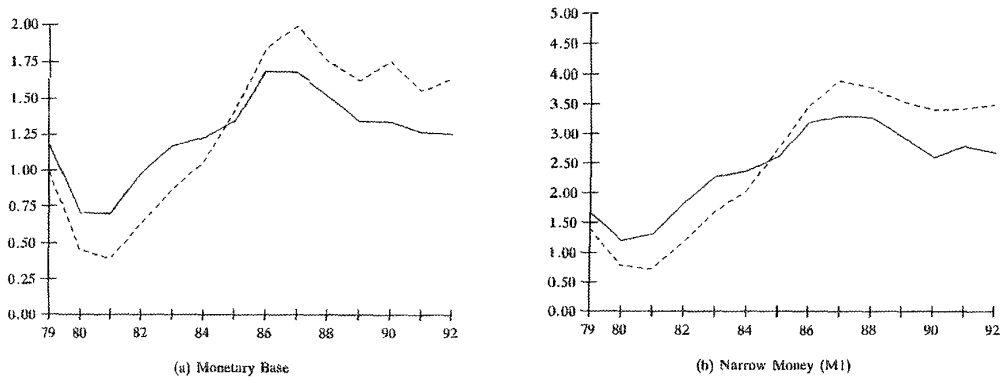


Figure 2. Output elasticity of real money in Saudi Arabia

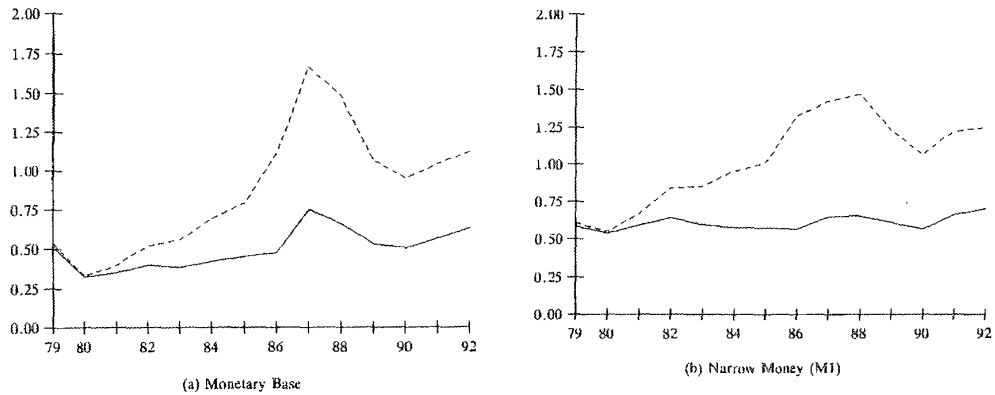


Figure 3. Output elasticity of real money in Saudi Arabia  
(-using W1; --using W2)

In computing the output elasticity of money in the three developing countries, we use nominal GDP and two alternative measures of money stock: the monetary base and the narrow money stock (M1). In congruence with Startz's approach, we use *total* real balances without distinguishing between money balances held by business firms and those held by households, although only the former should, in principle, be used.<sup>3</sup> Before computing the Solow estimator, a major obstacle had to be overcome; namely, measuring nominal interest rates. As is well-recognized in the literature, data on interest rates in most developing countries (including those examined here) is either non-existent or, at best, not very reliable. Indeed, financial and capital markets outside commercial banks in these countries are extremely rudimentary. Consequently, there exists very little substitutability between money and other financial assets. Furthermore, to the extent that some financial assets were available, governments in developing countries usually impose tight controls on their yields, thus allowing interest rates to change only infrequently.

Therefore, alternative measures of the opportunity cost of holding money must be found in order to compute the Solow estimator for the three countries. In this study, we draw on the seminal work of Wong (1977) who suggests the use of some proxies of credit restraint in the case of developing countries where interest rates are inoperative. Wong recommends, in particular, two of his proxies. The first is W1, which is the ratio of expected total deposit flow to actual total deposit flow in commercial banks. This variable approximates credit market conditions and the degree of credit rationing. Following Wong, we define the expected total deposit flow as the average flow over the preceding (three) periods, adjusted for the average growth of deposits over the estimation period. When expected deposits rise relative to actual deposits, credit becomes tighter and banks tend to ration credit, a signal of higher interest rates, although interest rates may not actually rise due to government controls. A second proxy of nominal interest rates is W2, calculated as one minus the ratio of domestic credit to national income. This proxy has the advantage of expressing the degree of credit restraint relative to the overall economic activity. As domestic credit expands in relation to growth in the economy, credit becomes abundant and W2 should fall, indicating easy credit market conditions.<sup>4</sup>

We employ these two alternative proxies of nominal interest rates (W1 and W2) to calculate the output elasticity of money (using both base money and M1) for each of the three developing countries over the estimation period 1972–1992 (before adjustments for lags).<sup>5</sup> Figure (1a) depicts the output elasticity of real base money for Kuwait employing the two alternative proxies of nominal interest rates, and Figure (1b) does the same for real M1. Figures 2 and 3 present the results in a similar fashion for Saudi Arabia and the United Arab Emirates, respectively.

It is clear from these figures that real money, however defined, contributes a great deal to output in each of the three countries. These results are in sharp contrast to those of Startz for the United States. While the output elasticity of real base money in the U.S. as reported by Startz never exceeded 0.01, the output elasticity of real base money in the three developing economies is much higher, ranging from its lowest value of 0.29 in Kuwait (using the W2 proxy) to its highest

value of 2.23 scored also in Kuwait (using the W1 proxy). Similar high values are also found for the output elasticity of real M1. In particular, the elasticity for real M1 never falls below 0.23 (in Kuwait using the W2 proxy) and it reaches the remarkable high value of 4.81 (also in Kuwait using the W1 proxy). As to the other two countries (Saudi Arabia and the UAE), the output elasticities of real money (both base and M1) are also very significant. For example, the output elasticity for real base money using the W1 proxy is in the range of 0.39 to 1.99 for Saudi Arabia, and in the range of 0.33 to 1.67 for the United Arab Emirates.<sup>6</sup> Given the acknowledged difficulty of measuring credit availability, along with the dramatic changes in the market for crude oil and their economic implications in these oil-based countries during the estimation period, it is not totally unreasonable to expect that some individual estimates of output elasticities will differ from one. Indeed, the qualitative evidence supporting money productivity in these economies may be found in the consistently positive and significant estimates of the output elasticity of money (several of which appear to have a mean around one) for all three countries across alternative money supply measures and credit restraint proxies.

### Conclusions and Policy Implications

The empirical results obtained from the Solow/Startz methodology for the three developing countries unequivocally answer the question posed in the title of this article in the affirmative. For both measures of money (base money and M1), and using alternative proxies of the opportunity costs of holding money, the results in this study systematically show that the contribution of real money balances to output in each of the three countries is quite significant. Over the estimation period, the output elasticity of real money averages slightly below unity for base money, and slightly above unity for the narrow money stock, depending on the country and the interest rate proxy used.

The evidence, therefore, is consistent with the neoclassical monetary theory and its incorporation of real money balances as a productive input. The results also accord well with the McKinnon-Shaw hypothesis that money is complementary to physical capital in developing economies and, as such, is highly productive. Given the brevity of our sample, and in light of common difficulties encountered with data from developing countries, the empirical results in this paper are only suggestive and should be interpreted with caution. At the very least, though, the results do suggest that money does matter, and matters a great deal for the determination of aggregate production in the three developing countries examined in the study.

Consequently, policymakers in these countries must not hinder the development of their financial markets if they desire to propel economic growth. We further note that policies in these countries should avoid promoting inflation for stabilization purposes. Higher inflation can lead to lower demand for real money. Since money is most likely complementary to physical capital in these countries, the outcome would be detrimental to aggregate output. The results also imply that, given the relatively large estimates of the output elasticities in the Gulf countries,

changes in real money stock appear to have impacted real output in these countries directly through the aggregate supply channel, rather than through aggregate demand. Therefore, an aggregate production function estimated for developing countries in general, and for our three economies in particular, should include real money balances as an input factor. Failure to do so would result in a serious specification bias in the aggregate production function.

**Acknowledgments:** We wish to thank the Editor of this *Review*, an anonymous referee, and M. Chopin for several helpful comments and suggestions. The usual disclaimer applies.

### Notes

1. For example, the United Arab Emirates has recently hosted a major conference on Financial Market Developments in the Middle East Region in May 1996 under the auspices of the Arab Monetary Fund and the Economic Research Forum of the Arab Countries, Iran and Turkey.
2. We take Startz's procedure as given and make no attempt in this article to investigate the validity of his underlying assumptions of constant return to scale and long-run competitive equilibrium, both of which may not hold exactly in the case at hand.
3. Our attempt to separate out money balances held by businesses failed due to data unavailability. Consequently, elasticity estimates we report here are only valid for constant returns to scale and should therefore be interpreted with that caveat in mind.
4. Observe that Wong's variables are only *proxies* for the underlying credit conditions. As such, they share the usual deficiencies common in all proxies. One major problem, for example, is that they solely focus on the supply-side, ignoring any demand-side factors.
5. Consistent data after 1992 is unavailable for the three countries examined. All data series are obtained from the IMF, *International Financial Statistics CD-ROM Datatape*.
6. These apparently strong contributions of real money stock to output are further corroborated by the equally potent correlations between the two variables in the three countries. For example, the simple correlation coefficients between the log of real money and the log of real output in the UAE are 0.81 and 0.88 for the base money and M1, respectively. However, as Startz (1984) correctly points out, these correlations are not, by themselves, sufficient to substantiate or negate the productivity of money.

### References

- Ben-Zion, U., and V. Ruttan. 1975. Money in the Production Function: An Interpretation of Empirical Results. *Review of Economics and Statistics* 61 (May): 246.
- Fischer, S. 1974. Money in the Production Function. *Economic Inquiry* 12 (December): 517-533.
- Friedman, M. 1969. *The Optimum Quantity of Money and Other Essays*. Chicago: Aldine Publishing Company.
- Ghatak, S. (ed.). 1995. *Monetary Economics in Developing Countries*. (Second Edition) New York: St. Martin's Press.
- McKinnon, R.I. 1973. *Money and Capital in Economic Development*. Washington, D. C.: The Brookings Institution.
- Moroney, J.R. 1972. The Current State of Money and Production Theory. *American Economic Review, Papers and Proceedings* 62 (May): 335-343
- Nguyen, H.V. 1986. Money in the Aggregate Production Function. *Journal of Money, Credit and Banking* 18 (May): 141-151.

- Niccoli, A. 1975. Real Money Balances: An Omitted Variable From the Production Function? A Comment. *Review of Economics and Statistics* 57 (May): 241-243.
- Prais, Z. 1975. Real Money Balances as a Variable in the Production Function. *Journal of Money, Credit and Banking* 7 (November): 535-544.
- Shaw, E.S. 1973. *Financial Deepening in Economic Development*. New York: Oxford University Press.
- Short, E.D. 1979. A New Look at Real Money Balances as a Variable in the Production Function. *Journal of Money, Credit and Banking* 11 (August): 326-339.
- Simos, E. 1981. Real Money Balances as a Productive Input: Further Evidence. *Journal of Monetary Economics* 7 (March): 207-225.
- Sinai, A., and H.H. Stockes. 1972. Real Money Balances: An Omitted Variable from the Production Function? *Review of Economics and Statistics* 54 (August): 290-296.
- \_\_\_\_\_. 1989. Money Balances in the Production Function: A Retrospective Look. *Eastern Economic Journal* 15 (October/December): 349-363.
- Solow, R.M. 1957. Technical Change and the Aggregate Production Function. *Review of Economics and Statistics* 39 (August): 312-320.
- Startz, R. 1984. Can Money Matter? *Journal of Monetary Economics* 13: 381-385.
- Stein, J.L. 1970. Monetary Growth Theory in Perspective. *American Economic Review* 60 (March): 85-106.
- Wong, C. 1977. Demand for Money in Developing Countries. *Journal of Monetary Economics* 3 (January): 59-86.