Transaction Costs and Money Holdings in Various Stages of Economic Development

Jang H. Yoo*

I. Introduction

The role of monetary policy in economic development has recently drawn a great deal of attention from many of development economists. Three hypotheses in this line are notable: First, money is included either in the consumers' utility function or in the aggregate production function, reflecting its general services in the economy as a whole [Tobin (1965, 1968), Johnson (1967), Levhari-Patinkin (1968), Stein (1969), Wallich (1969), Purvis (1971), Sinai-Stokes (1972)]; Second, money holdings are considered as a conduit in the system through which individuals save and finance their own productive needs [Shaw (1973), McKinnon (1973), Wai (1972), Gupta (1970)]; Third, money holdings are conducive to economic growth through the labor market; that is, individuals can save transactional time when they increase their money holdings and the amount of time so saved can be converted to production activities [Saving (1971, 1972), Purvis (1971), Friedman (1959), Bailey (1971), Classen (1975), Dutton-Gramm (1973), Ben-Zion & Karni (1976)].

The last version is our major concern here. In embodying the effect of real money holdings which help reduce transactions time, it argues that the transactions time saved is allocated somehow between two activities—consumption and production—depending upon the society's evaluation of marginal productivity of holding money vis-a-vis its marginal utility. [Saving (1971, 1972), Dutton-Gramm (1973), Purvis (1971), Benzion & Karni (1976)]. It would be essential for the monetary policy-making to identify how much out of the transaction time saved would be channeled to the production and the consumption sector.

In this paper, we present a simple model relating real money holdings to aggregate production, treating money as a medium of exchange which reduces transactions time. We then use international

*The author is assistant professor of economics, Virginia Commonwealth University, Richmond, Virginia.

data to verify whether money holdings contribute more to production than to consumption of leisure in the various stages of economic development. The significance of this hypothesis testing lies in that we may be able to provide a useful theoretical basis to answer whether or not monetary policy is really effective to economic development in the underdeveloped countries (UDCs hereafter).

II. Model

Th aggregate production function we use takes the form:

$$Y=F\ (N,\ \overline{K}) \tag{1}$$

where Y=aggregate output, N=porductive labor, and K=capital stock. In the short run, K is assumed to be fixed. Total time available for an average individual, T, is also fixed and allocated as

$$\overline{T}=N+L+t \tag{2}$$

where L=Leisure time and t=transactions time. Transactions time, t, decrease as real money holdings (m) increase, but the rate of decrease in t diminishes. That is,

$$t=t(m),\quad t_m<O,\ t_{mm}<O \tag{3}$$

Substituting (3) into (2) and solving for N and L, we get

$$N=\overline{T}-L-t(m) \tag{4}$$

$$N_m=\frac{\partial N}{\partial t}\cdot\frac{\partial t}{\partial m}>O,\qquad N_{mm}<O \tag{4a}$$

$$L=\overline{T}-N-t(m) \tag{5}$$

$$L_m=\frac{\partial L}{\partial t}\cdot\frac{\partial t}{\partial m}>O,\ L_{mm}<O \tag{5a}$$

In general, both ∂n/∂t and ∂L/∂t are negative but less than unity in their absolute values. Assuming the indiviual represents an average household as well as an average firm, then the values of ∂N/∂t and ∂L/∂t are determined by maximizing his utility by choosing his income and leisure properly subject to his income and time constraints. That is[1],

1 It may seem unusual to assume that an individual firm maximizes its utility instead of its profit. It is natural, however, if the firm is a self-owned or a proprietor type, it can be regarded as a consumer as well as producer. For the analysis of a utility maximizing firm, See Olsen (1973) and Auster-Silver (1976).

$$\text{Maximize } U(Y, L) \tag{6}$$

$$\text{subject to } Y = wN \tag{7}$$

$$\text{and} \quad \bar{T} = N + L + t, \tag{8}$$

where w represents the wage rate. The first order conditions for (6), (7), and (8) are

$$\frac{U_Y}{U_L} = \frac{1}{w} \tag{9}$$

$$\frac{U_Y}{U_m} = \frac{1}{wt_m} \tag{10}$$

$$\frac{U_L}{U_m} = \frac{1}{t_m} \tag{11}$$

$$\bar{T} = N^*(m) + L^*(m) + t^*(m) \tag{12}$$

where N^*, L^*, and t^* denote the utility maximizing values of N, L and t. The solutions for Y, N, L given money holdings are highlighted in Figure 1. Let us start with the case where there is no money. Total time available less transactions time (i.e., $\bar{T}$-t(m)) is depicted by the budget line E_0E_0' in the southwest quadrant. The budget line is most likely 45° because the price N (i.e., the wage rate) is the same as the opportunity cost of leisure, that is, the price of L. The individual will determine the quantity demanded for N and L at point A_0 based upon his utility function. L_0 and N_0 are chosen in the no-money case and Y_0 is produced. When money is introduced and an average person holds it by m_1, the amount of time available for both N and L, that is, the opportunity set, for work and leisure expands from E_0E_0' to E_1E_1' according to equations (4) and (5). The new optimum combination between N and L is determined by equations (6)-(8) satisfying conditions (9)-(12). If both income and leisure are normal goods, then the solution in general should be somewhere between C and B, such as A_1 in the southwest quadrant.

Whether the new solution A_1 is close to C or B is our theoretical and impirical concern here. The productivity of money depends upon how much of transaction time saved goes to production sector. First, following some development theorists, such as Lewis (1955), Nurkse (1953), and Haberler (1957), we may say that the addition of one more unit of labor to the existing working hours in UDCs will have very little effects on aggregate production in the short run, because capital is so scarce in UDCs that an increase in labor will only deteriorate the capital-labor ratio, and thereby, its marginal productivity will be minimal. Thus, the amount of time saved will very likely convert more to leisure than to labor. Second, the wage rate in UDCs is very low, and so is the opportunity cost of leisure. Therefore, it

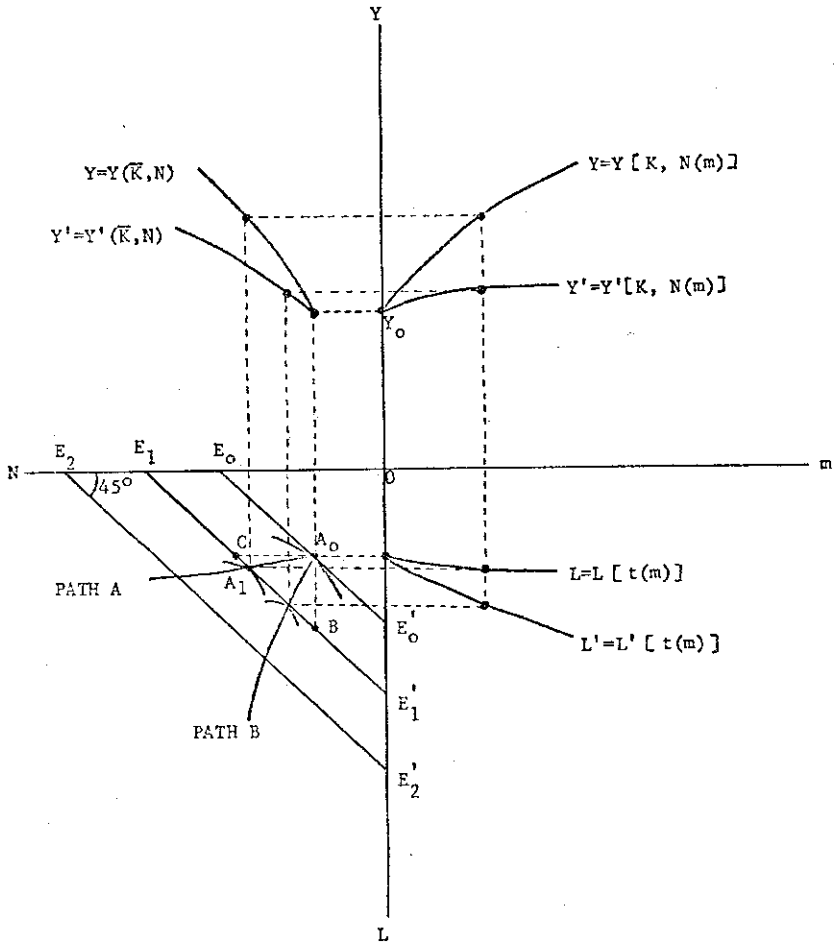
Y
Y=Y(K̄,N)
Y'=Y'(K̄,N)
Y=Y[K, N(m)]
Y'=Y'[K, N(m)]
Y_o
E_2
E_1
E_o
N
45°
0
m
C
A_o
A_1
PATH A
B
E'_o
L=L[t(m)]
L'=L'[t(m)]
E'_1
PATH B
E'_2
L

Figure I

is reasonable to say that low income countries tend to "consume up" this extra amount of time for leisure. Conversely, high income countries (or developed countries in general) would more likely use it for production activities because the marginal returns on this extra amount of time is considerably larger. Choosing the independent variables from equations (9)-(12), we may specify the labor supply (or the equilibrium quantity of labor supplied) equation as

$$L^* = L^* (w,m), \tag{13}$$

or, to improve the specification we may add an asset variable to equation as in Christensen-Jorgenson (1968) and Rucas-Rapping (1969) model, then we may have a refind version such as

$$L^* = L^* (w,m,V), \tag{13a}$$

where V stands for some asset representing a country's real wealth.

III. Estimation

We employ the logarithms form of equation (13a) to estimate especially the elasticity of labor supply with respect to real money holdings:

$$\log L^* = a + \log w + c \log m + d \log V + E \tag{14}$$

where E is the disturbance term, and b, c, d are the elasticity of the labor supply with respect to the real wage rate (w), real money (m) and asset (V), respectively. Data for L, w, and m were collected for 10 countries. That is, five of them (S. Korea, Taiwan, Philippines, Costa Rica, Panama) are UDCs, and the other 5 countries (Belgium, France, Germany, Japan, U.S.A.) are developed countries. They were chosen to reflect a variety of development experience and country size. Also, data from these countries are consistent and continuous. Data of money were taken annually from various issues of IMF's *International Financial Statistics*, 1952-1970, and L and w were obtained from various issues of ILO's *International Labor Statistics*, 1952-1970. L and w reflects total employment and the real wage rate in the non-agricultural sectors. Real money balances (m) are M_1 (i.e., currency plus demand deposit) divided by the cost-of liivng index or the GNP deflator when available. For the asset variable, however, it was very difficult, if not impossible, to find or generate a series of data for capital stock, stocks of securities, other financial assets, and the like in UDCs. As an expendiency, we uniformly used real income in place of assets. Real income is frequently highly correlated to assets, so it is not an unacceptable idea, although the latter is merely a flow variable fluctuating more widely. (The basic data used are available from the author upon request).

Table I shows the estimation results of equation (13), the first being without a time trend, and the second with it. In the table, the first five are developed countries and the last five are UDCs. In developed countries, the coefficients associated with the real

Table 1

Estimation of Labor Supply by Country with t-values

(1) $\ln L^* = \alpha + \beta \ln Y + \gamma \ln m_1 + \sigma \ln w + \varepsilon$

(2) $\ln L^* = \alpha + \beta \ln Y + \gamma \ln m_1 + \sigma \ln w + \lambda t + \varepsilon$

Country		$\hat{\alpha}$	$\hat{\beta}$	$\hat{\gamma}$	$\hat{\sigma}$	λ	R^2	D.W.
Belgium	(1)	5.876	.484 (4.652)**	.148 (1.408)*	−.560 (−5.306)**		.947	1.700+
	(2)	5.899	.477 (3.358)**	.142 (1.043)	−.572 (−2.906)**	.002 (.073)	.947	1.695+
France	(1)	−4.707	2.951 (1.774)*	1696 (1.479)*	−3.526 (−1.656)*		.871	1.338
	(2)	−12.221	4.527 (2.246)**	1.368 (1.993)**	−1.854 (−.762)	−.323 (−1.316)	.886	1.566+
Germany	(1)	15.335	−.683 (−.764)	1.635 (4.403)**	−.102 (−.123)		.875	1.678+
	(2)	12.881	−.225 (−.255)	1.625 (4.652)**	.467 (.549)	−.086 (−1.685)*	.898	1.504+
Japan	(1)	10.107	−.007 (−.139)	.187 (4.101)**	−.039 (−.772)		.984	1.328−
	(2)	11.044	−.061 (−1.540)*	.018 (.339)	−.015 (−.404)	.023 (3.880)**	.993	1.244−
U.S.A.	(1)	9.544	.246 (2.867)**	.260 (1.560)*	−.036 (−.276)		.988	1.479+
	(2)	8.673	.389 (5.726)**	.041 (.615)	.131 (−4.141)**	−.014	.995	1.684+

Table I

continues

S. Korea	(1) 4.214	.126 (11.477)**	.016 (1.606)*	.024 (.894)		.994	1.530+
	(2) 4.426	.061 (2.881)**	.005 (1.252)	.012 (.569)	.018 (3.319)**	.997	2.129+
Taiwan	(1) 4.340	.317 (1.198)	.161 (1.493)*	−.336 (−1.085)		.942	.792-
	(2) 5.607	−.373 (−.693)	−.038 (−.221)	−.368 (−1.231)	.121 (1.455)*		
Philippines	(1) 7.488	.654 (3.269)**	.069 (1.512)*	−.926 (−1.964)		.947	1.143-
	(2) 7.659	.565 (2.535)**	.067 (1.498)*	−.867 (−1.813)**	.006 (.925)	.950	1.230-
Costa Rica	(1) 8.982	.082 (.588)	.071 (.790)	−.239 (−1.749)*		.549	.616
	(2) 13.280	−.342 (−1.717)*	−.059 (−.655)	−.025 (−.178)	.037 (2.633)**	.706	.975-
Panama	(1) 7.569	.376 (4.254)**	.052 (1.968)**	−.133 (−1.090)		.995	1.564+
	(2) 7.533	.377 (4.565)**	.033 (.652)	−.238 (−1.849)**	006 (3.751)**	.996	1.706+

NOTE: ** Statistically significant at the 95% confidence interval
* Statistically significant at the 90% confidence interval
+ There is no autocorrelation.
- The Durbin-Watson test is inconclusive.

money balances are generally significant and their magnitudes are quite large. It varies between .960 to 1.635 using the first equations. The coefficients for Y and w are sometimes negative because we are dealing with the observations along the equilibrium path over time. This simultaneous bias does not produce any serious problems here in interpreting money's role because we are only concerned about the overall effect of money holdings on the equilibrium quantity of labor.

In underdeveloped countries, $\hat{\gamma}$ s are either insignificant or small in their magnitude. The value of $\hat{\gamma}$ varies from .024 to .161, referring to the first equation. In all the countries where the time variation plays a statistically significant role in the second equation, it seems that it tends to cut into coefficient $\hat{\gamma}$, so makes the latter insignificant. This is consistent with Sinai-Stokes' argument (1972) that the role of real money balances may have been represented or taken off by the time variable which very often encompasses the systematic variations in the monetary sector over time. Therefore, the first equations in general give us more satisfactory statistical results as far as the money's role is concerned. Thus, from the examination of Table I, we can draw a conclusion that the role of money in increasing productive labor has been statistically more significant and meaningful in its magnitude in developed countries than in UDCs.

This finding is also confirmed by the estimation using time-series-cross-section-pooling data. Table II shows the estimation results of the first and the second equation shown in Table I for the two groups of countries; developed and underdeveloped. Since the Durbin-Watson statistics are generally in the acceptable range, we only corrected heteroskedastiaties in the data-pooling process by using the weighted least-squares method (Murphy, 1973, pp. 356-367). When we examine Table II, it becomes even more obvious that coefficient $\hat{\gamma}$ in developed countries is much greater than in UDCs. Furthermore, the labor supply in the former is elastic to an increase in real money balances; that is, the elasticity of the labor supply with respect to m_1 is 1.268 according to the first equation. In UDCs, however, the elasticity is very small (0.043) which clearly indicates that the money's effect on the labor supply through the transactional timesaving process is only a trifle in UDCs. What does this finding imply in Figure I? The money-leisure relationship in the southeast quardrant will significantly differ between developed countries and UDCs. Function L indicates the relationship in the former and L′ is for the latter. We notice that the shape of L′ is much steeper than that of L. Transmitting this into the Y-m relationship in the northeast quadrant, using the production functions in the northwest quardrant,

it is much steeper in developed countries than in UDCs. The productivity of money is, thus, much smaller in UDCs than in developed countries. It is also worth noting that in developed countires, the time-expansion path due to an increase in the money supply will be something like path A in Figure I, whereas the same in UDCs will be similar to path B (Ferguson, 1969 pp. 142-153).

Policy Implications

Whether moneary policy is as effective as fiscal policy for economic development remains yet to be answered. However, one of the most crucial roles that money plays—i.e.. the more money we hold, the more transactions time we save and the more productive time available—is not as significant in UDCs as is in developed countires. The elasticity of the productive labor with respect to money seems to be greater than unity in developed countries, but it is minimal in UDCs. This empirical finding should, however, be interpreted with caution, because we have dealt with only 10 countries.

Table II

Estimation of Labor Supply
by Using Time-Series-Cross-Section-
Pooling Data (Heteroskedasticity Corrected; t-Statistics in Parentheses)

(1) $\ln L^* = \alpha + \beta \ln Y + \gamma \ln M_1 + \sigma \ln w + \varepsilon$
(2) $\ln L^* = \alpha + \beta \ln Y + \gamma \ln M_1 + \sigma \ln w + \lambda t + \varepsilon$

		$\hat{\alpha}$	$\hat{\beta}$	$\hat{\gamma}$	$\hat{\sigma}$	λ	R^2	D. W.
Developed Countries (5 countries)	(1)	8.147	.265 (1.781)**	1.268 (1.695)**	−.774 (1.796)**		.861	1.619+
	(2)	8.004	.249 (1.384)*	1.119 (1.491)	−.499 (1.415)*	−.017 (1.476)*	.884	1.595+
UDCs (5 countries)	(1)	6.204	.312 (2.496)**	.043 (1.711)**	−.611 (.914)		.911	1.741+
	(2)	6.114	.204 (1.764)**	.017 (1.071)	−.543 (.907)	.041 (1.546)*	.849	1.616+

Note: ** indicates that the estimation is statistically significant at the 95 percent confidence interval.
* indicates the same at the 90 percent confidence interval.
+ indicates there is no autocorrelation.

References

Auster, R. D. and Silver, M., "Comparative Statics of the Utility Maximizing Firm," *Southern Economic Journal,* April 1976.

Bailey, M. J. *National Income and the Price Level,* 2nd Ed. New York 1971.

Ben-Zion, U. and Karni, E., "The Utility of Money and the Transactions Demand for Cash," *Canadian Journal of Economics.* February 1976.

Claassen, E., "On the Indirect Productivity of Money," *Journal of Political Economy.* April 1975.

Dutton, D. S. and Gramm, W. P., "Transaction Costs, the Wage Rate and the Demand for Money," *American Economic Review,* September 1973.

Ferguson, C. E., *The Neoclassical Theory of Production and Distribution.* Cambridge, 1969.

Friedman, M., "The Demand for Money: Some Theoretical and Empirical Results," *Journal of Political Economy,* August 1959.

Gupta, K. L., "Personal Saving in Developing Nations: Further Evidence," *Economic Records,* June 1970.

Haberler, G., "Critical Observations on Some Current Notions in the Theory of Economic Development," *L'Industria,* No. 2, 1957.

Johnson, H., "Money in a Neo-classical One Sector Growth Model." *Essays in Monetary Economics,* London, 1967.

Lewis, W. A., *The Theory of Economic Growth,* Homewood, 1955.

Levhari, D. and Patinkin, D., "The Role of Money in a Simple Growth Model," *American Economic Review,* September 1968.

Lucas, R. E. and Rapping, L. A., "Real Wages, Employment, and Inflation," *Journal of Political Economy.* Sept./Oct. 1969.

McKinnon, R. I., *Money and Capital in Economic Development,* Brookings, Washington, D.C., 1973.

Nurkse, R., Problems of Capital Formation in Underdeveloped Countries. Oxford, 1953.

Olsen, E. O., "Profit and Utility Maximization by an Owner-Manager," *Southern Economic Journal,* January 1973.

Patinkin, D., *Money, Interest and Prices,* New York, 1965.

Purvis, D. D., "Introducing Useful Money into a Growth Model," *Canadian Economic Journal,* August 1971.

Saving, T., "Transaction Costs and the Firms' Demand for money," *Journal of Money, Credit, and Banking,* May 1972.

———, "Transaction Cost, and the Demand for Money, *American Economic Review,* June 1971.

Shaw, E., *Financial Deepenings in Economic Development,* Oxford, 1973.

Sinai, A. and Stokes, H., "Real Money Balances: An Omitted Variable from the Production Function?", *Review of Economics & Statistics,* 1972.

Stein, J., "Neo-Classical and Keynes-Wicksell Monetary Growth Models," *Journal of Money, Credit and Banking,* I, 1969.

Tobin, J., "Money and Economic Growth," *Econometrica,* Oct. 1965.

———, "Notes on Optimal Monetary Growth," *Journal of Political Economy,* 1968.

Wai, U. T., *Financial Intermediaries and National Savings in Developing Countries,* IMF, 1972.

Wallich, H. C., "Money and Growth: A Country Cross-Section Analysis," *Journal of Money, Credit and Banking,* May 1969.