"Productive Money", Savings, and Economic Growth

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Recently, several studies have emphasized the role of money holdings in economic development and growth. [e.g., Mckinnon (1973)]. According to these studies, money holdings can be complementary to, rather than, as conventionally believed, substitute for, physical capital. Two views are notable in this line: First, real money itself should be considered as a factor in the production function because the monetized society achieves a higher level of output than the barter society where only physical capital and labor are used in production.[1] Second, money holdings in some economies, especially in less developed countries (LDCs hereafter), not only facilitate transactions but also play the role of capital accumulation. That is, in LDCs where the financial market is not well-organized, investment depends mainly upon individuals' self-finance which is realized by their money holdings.[2] Thus, individuals' savings in the form of money can be treated as, at least in part, the supply of physical capital. These two theories provide the crucial theoretical foundation for the argument that monetary policy plays an important role in economic growth.

The first nexus between the money supply and savings is the price level. If the velocity and output remain unchanged, an increase in the supply of money will directly push prices up. This inflation induced from the monetary expansion has two positive effects and one negative effect on *ex ante* savings. First, it may cause the newly created money to be channelled mainly to the corporate sector. This is because the initial use of the newly created money in an inflationary

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1 For example, see Levhari and Patinkin (1968).

2 By this we mean that we assume money holdings are convertible to real physical capital. The recent study by McKinnon (1973) argues that money holdings can be complementary to physical capital in underdeveloped countries. This possibility will be discussed more later.

period will in most cases be to finance business investment (*forced-savings effect*)[3]. Second, when inflation is induced by money expansion, the new money supply is a kind of tax that government imposes on everybody in the society (*tax effect*). Both the forced-savings and tax effect are positive to savings because the savings ratio of the corporate or the government sector has been observed to be greater than that of the personal sector.[4] Inflation may have adverse effect on savings. That is, when it is excessive, individuals will economize on money holdings, viewing inflation as a heavy tax on money (*excessive inflation effect*). This decrease in voluntary savings in the form of money may be greater than the sum of the first two positive effects of inflation on savings.

In this paper, we treat money as a producer's good and we derive the *ex ante overall savings ratio* (i.e., conventional physical savings *plus* money holdings divided by national income), using Patinkin-Levhari's money-growth model (1968). We view that savings play the dominant role for capital formation and *ex ante* overall savings are the indicator of the potential capital availability. We thus attempt to relate the expansion of "productive money" to the overall savings ratio, assuming the latter is our objective variable to be maximized. Finally, we investigate the "optimum" monetary expansion in three groups of countries; high income countries, middle income countries, and low income countries.

Money as a Producers' Good

Using Patinkin-Levhari's Model (1968), total real income ($\tilde{Y}$) including real balances as a producers' good is:

$$\tilde{Y}_t = Y_t\left[K_t, L_t, \left(\frac{M}{p}\right)_t\right] + d\left(\frac{M}{p}\right)_t$$

$$= Y_t\left[K_t, \; L_t, \left(\frac{M}{P}\right)_t\right] + \left(\frac{M}{p}\right)_t \; (\mu - \pi)$$

where Y_t is physical income produced by using capital, labor, and real balances as production factors during the period, $(M/P)_t$ is real balances, and $(M/P)_t \; (\mu - \pi)$ is the increment in real money generated by changes in the price level. μ and π are the rate of change in money stock and the price level, respectively. Thus, equation (1) implies that the imputed services of money holdings are implicitly included in the production function and the changes

3 See Wonnacott, P., *Macroeconomics*, P. 304.

4 For example, see Houthakker (1965), Pazos (1953), Singer (1958), Rao (1953), Williamson (1968).

in the real value of cash balances are reflected in disposable income. Individuals want to maximize utility for all points in time, and the aggregate utility function is $U=U(C)$ where C denotes "physical" consumption. Capital formation in this period is, without time subscripts;

$$I=\frac{dk}{dt}=Y-C \tag{2}$$

that is, physical capital formation per time period is equal to physical income minus physical consumption. We assume here that consumption is a function of "total" real income, as we can write

$$\begin{aligned} C &= (1-s)\ \tilde{Y} \\ &= (1-s)\left[Y(K, L, \frac{M}{P}) + \frac{M}{P}(\mu-\pi)\right] \end{aligned} \tag{3}$$

where s represents the *overall savings ratio*. From (2) and (3), we get

$$\frac{dk}{dt}=Y\left[s-(1-s)\ b\ (\mu-\pi)\right] \tag{4}$$

where b is the ratio of real-balance holdings to output: i.e.,

$$b=(M/P)/Y$$

The right-hand side of equation (4) represents the *physical* (i.e., conventional) *savings* in the GNP accounts. Let σ denote the physical savings ratio, that is,

$$\sigma=s-(1-s)\ b\ (\mu-\pi) \tag{5}$$

From (5) we can derive the overall savings ratio:

$$s=\frac{\sigma+b(\mu-\pi)}{1+b(\mu-\pi)} \tag{6}$$

This overall savings ratio is our major interest and concern. If money's service is one of the production factors as well as a part of disposable income, then overall capital accumulation, and thereby economic growth, will be explained better by s. Note that, in the normal case where the monetary expansion rate is greater than the inflation rate, the overall savings ratio is greater than the physical savings ratio. This is intuitively ovbious from equation (6). In the stationary and stable economy μ will be equal to π and there is no difference between s and σ.

Let us now investigate the determinants of the overall savings ratio, s. A change in s must be attributed to changes in σ and the other variables, i.e., b, μ, π. While σ depends mainly upon structural changes, for example, income redistribution, other variables (i.e.,

b. μ, π) are affected mainly by changes in monetary conditions. Since s depends upon changes in both of these factors as shown by (6), we can specify it as follows:

$$s = s\ (\sigma, b, \mu, \pi) \tag{7}$$

$$\sigma = \sigma\ (y, g, \pi) \text{ or } \sigma = \sigma\ (y, \pi)^5 \tag{8}$$

$$b = b\ (i, y) \tag{9}$$

where i denotes the nominal rate of interests and y represents per capita real income, and

$$g = \frac{dy}{dt}\ \frac{1}{y}.$$

Equation (7), (8), and (9) form a simultaneous structure among the dependent variables s, σ, and b. However, this simultaneous system can be simplified when we specify the relationship between s and π. As mentioned earlier, overall savings during the inflationary period may be either a positive or a negative function of π, depending upon the balance of three forces: forced-savings effects, tax effect, and excessive inflation effect. We have started with the hypothesis that the overall savings ratio is positively related to π when it is mild, but negatively related to it when it is excessive and unexpected. From this relationship, we can formulate a quadratic function of s with respect to π. That is,

$$S = s\ (\pi, \pi^2) \tag{10}$$

Alternatively, equation (10) can be rewritten as

$$s = s\ [(\mu - g), (\mu - g)^2] \tag{11}$$

because we may assume that the expected rate of price change is positively related to the difference between μ and g.[6] Likewise, equations (8) and (9) can be rewritten as

$$\sigma = \sigma(y, g, \mu) \text{ or } \sigma = \sigma\ (y, \mu) \tag{12}$$

Equation (9) is modified assuming that $i = r + \pi$ as

$$b = b\ (r, \pi, y) \tag{13}$$

From equations (11), (12), and (13), we derive[7]

$$s = s\ (r, y, g, \mu, \mu^2)$$

or in terms of its linear approximation, we may write

5 Based upon the life-cycle hypotheses of saving we may use the first one. But the absolute income hypotheses will give us the other physical savings function. Both are estimated in table 1 below.

6 For this argument see Hadjimichalakis (1971).

7 We dropped g term in estimation because most of the variation was captured by g itself in our later regressions.

$$s = \beta_0+\beta_1 r+\beta_2 y+\beta_3 g+\beta_4 \mu+\beta_5 \mu^2+\varepsilon \qquad (14)$$

Data and Results

Data on y, g, μ were obtained from *International Financial Statistics* (International Monetary Fund) over the period 1960-1970 in 53 countries. Money is defined as M_1, that is, currency outside banks plus demand deposits. Data for r are not directly available, so, as its proxy, we used the long-term government bond yield $(r_{\beta t})$ minus the weighted average of current π and three lag values of π, that is,

$$r_t = r_{\beta t} - (0.1\pi_{t+0} \cdot 2\pi_{-1} + 0.3\pi_{t-2} + 0.4\pi_{t-3}), \qquad (15)$$

assuming that there exists an increasing impact of price changes on the money interest rate as maturity lengthens.[8] The data on the dependent variable s in equation (14) was computed by using the formula in (6) above.

For the regression of equation (14) we averaged the 11-year time-series values for each country for each variable. We ran the regression for four different groups of countries[9] – all countries (n=53), low income countries (y≤\$200, n=17), middle income countries (\$200<y≤\$800, n=19) and high income countries (y>\$800, n=17). Countries in each group are listed in Table 1. We also ran the model for three different combinations of independent variables. That is, in the first run we include all independent variables in equation (14), we excluded g in the second, and we excluded y in the third. By doing this, we could also check the differences between the life-cycle hypothesis and the absolute income hypothesis of the savings function.

Table 2 summarizes the estimation results of various cases mentioned above. Coefficients of μ^2 are significant when we use all countries (n=53) regardless of y or g. We also have found strong quadratic relationships between s and μ for the high income countries (n=17) and low income countries (n=17). In the case of middle income countries the quadratic relationship is somewhat vague (R^2=.22), although the signs of the coefficient for μ^2 are consistent with the others. For low income countries, all three equa-

8 For empirical examples, see Gibson (1970).

9 The Goldfeld-Quandt coefficient between high income and middle income countries was 4.45. The coefficients between high and low group and between low and middle group are 5.72 and 4.69, respectively.

Table 1

Three Groups of Countries Based on Average of 1960-70 per Capita Income

I. Low Income Countries ($y \leq \$200$)

Bolivia	Kenya	Sudan
Ceylon	Morocco	Thailand
Ecuador	Nigeria	U.A.R.
Ghana	Pakistan	Taiwan
Indonesia	Paraguay	Honduras
Iran	Sierra Leone	

II. Middle Income ountries ($\$800 < y \leq \$800$)

Costa Rica	Ireland	Philippines
Cyprus	Jamaica	Portugal
Dominican Rep.	Malaysia	Spain
El Salvador	Malta	Trinidad & Tob.
Guatemala	Mexico	Turkey
Guyana	Nicaragua	Venezuela
		S. Africa

III. High Income ountries ($Y > \$800$)

Australia	France	Norway
Austria	W. Germany	Sweden
Belgium	Iceland	Switzerland
Canada	Israel	U.K.
Denmark	Italy	U.S.
Finland	Netherlands	

tions are very highly significant, and for high income countries the estimation with all variables included gives us 70% of R^2 and high t-values.[10]

Two empirical findings are notable. First, inflationary monetary policy can be conducive to an increase in the savings ratio, but its effect diminishes and even becomes negative beyond a certain point as the rate of money expansion develops. Second, the rate of money expansion associated with the maximum overall savings ratio tends

10 The major reason for insignificant statistical results for the middle income countries seems that many countries in this group have had a considerably long period of price regulations and controls. The mean inflation rate of middle income countries is only 0.020 over the 11-year period of time, while the same in the low and high income group are 0.097 and 0.039, respectively. Some of the extreme cases of the regulated inflation rate are: Venezuela (0.008), Guatemala (0.002), El Salvador (0.003), and Cyprus (0.009).

to decrease as an economy grows. From the estimated quadratic function, we confirmed this rate that maximizes s as follows:

All countries:

$$\frac{\partial s}{\partial \mu} = 3.1892 - 31.722\,\mu = 0$$

$$\mu = 0.1005$$

Low income countries:

$$\frac{\partial s}{\partial \mu} = 2.8828 - 12.8170\,\mu = 0$$

$$\mu = 0.1124$$

Middle income countries:

$$\frac{\partial s}{\partial \mu} = .5749 - 6.3586\,\mu = 0$$

$$\mu = 0.0904$$

High income countries:

$$\frac{\partial s}{\partial \mu} = 3.9605 - .51.1960\,\mu = 0$$

$$\mu = 0.0774$$

It is also notable that the maximum level of s gets higher as an economy grows. Using the mean values of r, y, and g, the maximum savings ratios are 0.094, 0.156, and 0.288 in low income, middle income, and high income countries, respectively.

Implications

Highlighting the S-μ relationships as found above, we can draw three parabolas as shown in Figure I. We need some explanation as to why the function shifts this way as an economy changes in terms of per capita income. That is, as an economy grows, μ for the maximum s falls, and the maximum s itself grows. The first can be interpreted as *monetary effects*, that is, money in less developed countries can be interpreted as a complementary asset to physical assets over a considerable range of μ, and a significant part of capital formation actually depends upon individuals' money holdings.[11] In developed countries the role of money in savings is also significant, but money supply associated with the maximum savings ratio need not be so large as in underdeveloped countries because there are sophisticated and well-organized financial markets through which the major part of savings is absorbed and then

11 McKinnon (1973) called this role of money "conduit" for growth; that is, an increase in money holdings will be embodied into the physical capital formation as an individual converts his money holdings to the fund for purchasing machines and equipments to be used for production.

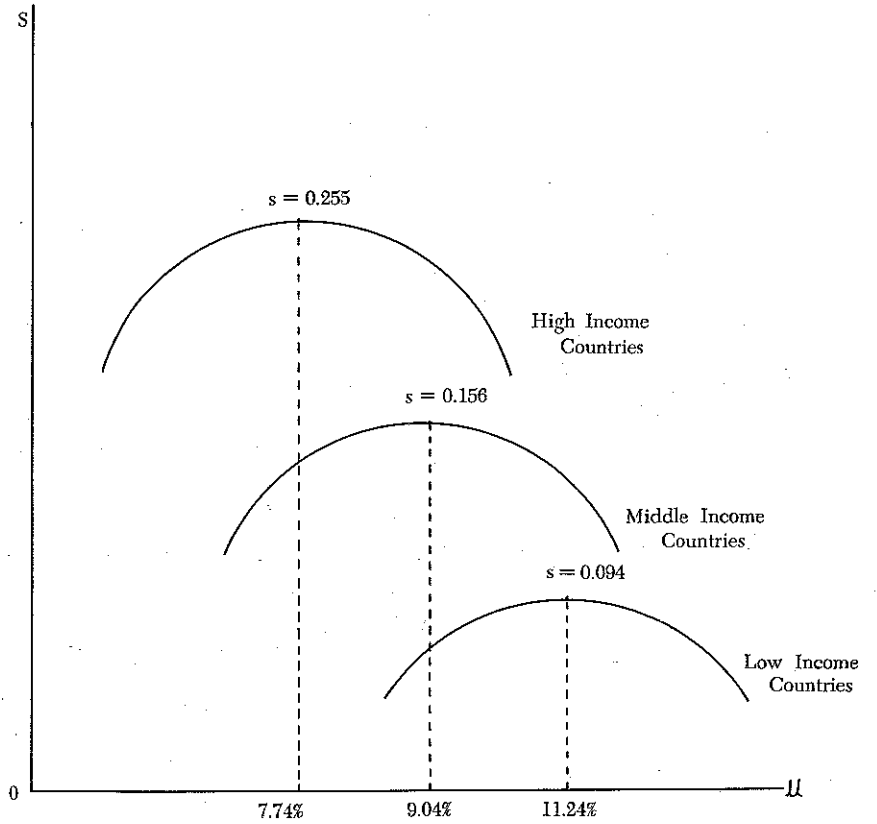
Table 2

Equation of the Overall Savings Ratio(s):
Quadratic with Respect to M When Money is a Producers' Good

	Constant	r	y	g	μ	μ^2	R^2	μ^*
All Countries · (n=53)	−.0481	.6922 (3.1730)[a]	.0001 (5.7077)[a]	.4275 (.7591)	3.1892 (6.6749)[a]	−15.8610 (−7.2299)[a]	.97	10.05%
Means: r=.017 y=658.75 y=.0488	−.0324	.7643 (3.9101)[a]	.0001 (5.8240)[a]		3.1774 (6.6833)[a]	−15.4560 (−7.2857)[a]	.97	10.28%
	−.0154	.3713 (1.3682)[c]		.7134 (.9877)	3.5077 (5.7410)[a]	−18.7280 (−6.8110)[a]	.95	9.37%
Low Income (n=17)	−.0388	1.0786 (4.1065)[a]	−.0002 (−.8720)	.3496 (.6689)	2.8818 (3.4405)[a]	−12.8170 (−3.8719)[a]	.99	11.24%
Means: r=−.018 y=131.25 y=.047	−.0183	1.1846 (5.7933)[a]	−.0002 (−.8732)		2.6855 (3.5049)[a]	−11.7850 (−4.1200)[a]	.99	11.39%
	−.0487	1.1178 (4.3630)[a]		.3363 (.6499)	2.6393 (3.3743)[a]	−11.9880 (−3.8189)[a]	.99	11.01%
Middle Income (n=19)	.1168	−.1239 (−.3049)	.0001 (1.6759)[c]	−.3745 (−.4188)	.5749 (.3926)	−3.1793 (− .3396)	.22	9.04%
Means: r=.045 y=375.05 y=.051	.1008	−.1016 (−.2600)	.0001 (1.7195)[c]		.4730 (.3377)	−2.5855 (− .2880)	.21	9.15%
	.1556	−.2503 (−.5901)		−.3452 (−.3634)	.8068 (.5208)	−4.8351 (− .4887)	.06	8.34%
High Income (n=17)	.1008	−.9128 (1.2475)[c]	−.0000 (−1.3064)[c]	1.1170 (.8966)	3.9605 (3.0069)[a]	−25.5980 (−3.5681)[a]	.70	7.74%
Means: r=.022 y=1506.10 y=.049	.1580	−.7689 (−1.0859)[c]	−.0002 (−1.2990)[c]		3.5416 (2.8997)[a]	−22.0910 (−3.1436)[a]	.68	8.02%
	.0407	−.6481 (−.8958)		1.0837 (.8456)	4.4425 (3.4144)[a]	−27.1270 (3.7245)[a]	.66	8.19%

NOTE: The values in the parentheses are student-statistics: that is,
a: Statistically significant at 1% level b: Statistically significant at 5% level c: Statistically significant at 15% level

Figure I


S
s = 0.255
High Income Countries
s = 0.156
Middle Income Countries
s = 0.094
Low Income Countries
0
7.74%
9.04%
11.24%
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easily channeled to investment. The second aspect of monetary effects may be that the mobility of resources in developed countries is so high and thereby, sensitive to the inflation rate that only a small change in money supply is much more effective on the overall savings ratio in developed countries than in underdeveloped countries.

The second fact that the maximum savings ratio increases as an economy grows can be considered as *income effects*. The first equation (i.e., for all countries) in Table 1 shows a strong statistical positive relationship between income and the overall savings ratio. Considering y=$131.25 in average in underdeveloped countries and y = $1506.10 in developed countries, it is not surprising to see that the level of the overall savings ratio for the latter is much higher as shown in Figure I.

Our findings are very close to those in some earlier studies [e.g., Harberger (1964), Johnson (1966)] in that the optimum rate of growth of the money supply in underdeveloped countries is between 9 and 11% and in developed countries 6 - 8%, when "tolerable" price stability is defined as 4 - 6% of inflation a year in underdeveloped countries and 1 - 2% in developed countries. While their studies are based upon their stabilization assumption, ours is computed by using the estimated overall savings function and the given levels of r, y and g.[12] The overall savings ratio here is the parameter indicating the capital availability, so it is crucial to relate economic policy to its desirable level. If we consider money as not merely an asset or a medium of exchange but also a conducive factor to production as we postulated, we should maximize the overall savings ratio rather than the physical savings ratio to achieve the highest rate of economic growth.

Conclusion

An increase in the rate of growth of the money supply is apparently conducive to an increase in the overall savings ratio, but its effect is limited by offsetting forces when inflation is excessive and it is induced by an excessive money supply. A quadratic form reasonably fits this relationship when we use the international cross-section data. The empirical evidence shows that this function tends to shift upward to the left as the economy grows. The maximum overall savings ratio is achieved with a rate of growth of μ at 11 - 12% in underdeveloped countries, whereas it is associated with 6 - 8% rate of growth of μ in developed countries. There may be

12 Thirlwall (1973) presented that the overall savings ratio is maximized when inflation is 7-9% using 68 countries. A study by The Bank of Korea (1974) shows that the optimal level of μ in Korea is 10% when y=5% and the associated overall savings ratio is 15%, using Korea's 1954-1973 time-series data.

two factors which explain this. The first is monetary effects. That is, the advanced financial system in developed areas provide various alternative means to save and the high resource mobility in developed countries makes the overall savings ratio sensitive to money expansionary or inflationary policy. The second is income effects. The very strong positive relationship between the overall savings ratio and income gives us the left higher savings function.

Whether monetary saving is always productive still remains to be proved. The limitation to the conduciveness of money growth to economic growth suggests adopting a relatively more conservative monetary policy than many underdeveloped countries have already passed through, thus avoiding severe inflation.

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