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Alternative Measures of the Real Output and Productivity of Commercial Banks

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COMMERCIAL banks play a major role in creating money, in exchanging money, and in financial intermediation. Despite the strategic role that commercial banks play in monetary theory and in the real world, there is little agreement on what it is that banks produce. This paper examines the conceptual basis of alternative approaches to measuring bank output. Finally, two of these approaches—the liquidity hypothesis and the transaction hypothesis—will be carried through using U.S. statistics for the period 1948 to 1966 to give an empirical notion of the difference between the two approaches.

The conceptual framework of the discussion will be organized around the treatment of a simple bank which has only demand deposits as liabilities; which levies no service charges; which purchases nothing from other firms; and whose reserve and other cash holdings are equal to its capital accounts. By stripping away all these real-world complications we will be better able to focus on the essential questions in dispute, while keeping the algebra fairly simple. Before moving on to introducing the empirical material, we will introduce the further complications we have excluded from the theoretical discussion.

The empirical data indicate that there are quite wide differences between the liquidity and transactions measures of output: one approach yields a decline in output per man-hour between 1948 and

1966, while the other shows an increase in labor productivity over the same period. Further, the two measures react differently to changes in monetary policy.

COMMERCIAL BANK OUTPUT IN CURRENT PRICES

The income statement of our simple commercial bank, when prepared in accordance with the rules of the bank regulatory agencies, would show interest earned equal to wages paid and profits, as shown in the following T-account:

Wages	6	Interest earned	10
Profits	4		
	10		10

In the standard national accounting treatment, interest earned is not part of the output of the receiving firm; if it is part of output at all it is part of the output of the paying firm. Following the normal procedure would yield a measure of gross product originating in our simple commercial bank equal to zero. In effect our simple commercial bank would be portrayed as a leech on the income stream. While some people might agree with such a portrayal it is not consistent with the fact that our commercial bank provides services to its customers.

Service or Imputation?

There are two ways by which we could overcome the anomaly of zero output [1] for our simple commercial bank: we could redefine interest transactions as being the sale and purchase of services; or we could impute an output to the intermediary. Both of these techniques yield identical results for the current-price measure of the output of our simple commercial bank, which becomes equal to 10, the sum of wages and profits. However, the two techniques have different

[1] If intermediate purchases were made, as in the real world they are, the commercial bank gross product might be negative.

effects on the measures of total national product and of output originating in nonfinancial industries.

Exhibit 1 shows the effects of the three possible treatments of our simple commercial bank on the production accounts of the debtor firm, our simple commercial bank, and the nation. Under present practice, if no imputation were made, the output of the debtor firm, the bank, and the nation would all be zero. If interest transactions were redefined as the sale and purchase of services, the debtor firm's output would be reduced by the amount of interest paid, the bank's output would be increased by interest received, while the nation's output would be zero. If the present treatment of monetary interest transactions were maintained, but an imputed transaction added, the debtor firm's output would be zero; the commercial bank's and the nation's output would become 10.

Insofar as interest transactions are between nonfinancial firms and commercial banks, the service treatment would simply shift output from the debtor firms to the commercial banks, with no effect on total national output. This treatment has the drawback of making the contribution of capital to the production of a firm depend upon whether the capital was borrowed or owned; and this drawback is a major reason why the United States has not adopted the service treatment. Further, the service treatment would require that interest paid by consumers and government be included in GNP: both items are now excluded from the United States' (and most other countries') measure of GNP.

Implications of Adoption of Imputation Procedure

Having chosen to measure nonfinancial firms' output so that the volume originating in an industry would not be affected by the ownership of the capital employed in producing the output, and wishing to have a positive measure of commercial bank output, the United States adopted the imputation procedure. The principle consequence of the rejection of the service treatment and adoption of the imputation treatment is that the output of commercial banks—whatever it is—must be some service provided to depositors rather than a service provided to borrowers.

This limitation of the possible outputs of commercial banks to

EXHIBIT 1

Alternative Treatments of Commercial Banks

	Debtor firm				Commercial bank				Nation			
Present practice, but no imputation	Interest	10	Sale	0	Wages	6			Wages	6		
	Profit	−10			Interest	−10			Interest	0		
					Profit	4			Profit	−6		
		0		0		0			GNP	0		
	Debtor firm				**Commercial bank**				**Nation**			
Service treatment of interest transactions			Sale	0	Wages	6	Sale	10	Wages	6		
			−Purchase	10	Profit	4			Profit	−6		
	Profit	−10										
		−10		−10		10		10	GNP	0		
	Debtor firm				**Commercial bank**				**Nation**			
Present practice, with imputation			Sale	0	Wages	6	Sale [a]	10	Wages	6	Consumption [a]	10
	Interest	10			Interest	0			Interest [a]	10		
	Profit	−10			Paid	[a] 10						
					−Received	10						
					Profit	4			Profit	−6		
		0		0		10		10	GNP	10	GNP	10

[a] Imputed transaction.

those provided to depositors is enforced by the need for consistency in a set of integrated national income and product accounts. That is, the same thing cannot be both the output of a borrower and of a lender. The discipline of the consistency requirement forces the abandonment of a plausible solution to the measurement of commercial bank output—the service treatment—and constrains our choice of output to something rendered to depositors.

COMMERCIAL BANK OUTPUT IN CONSTANT PRICES

We have now defined the current price measure of the output of our simple commercial bank as equal to the factor incomes earned, or alternately as equal to interest received. Now we must identify the quantity of services provided by our simple bank and the relevant price index.

The services provided to depositors by our simple bank can be classified into those relating to the volume of deposits held, and those relating to the volume of transactions. Among the former are such services as liquidity and safety, among the latter are such services as bookkeeping and check clearing. The two groupings of possible outputs lead to radically differing views of the functions of commercial banks and the relation of bank output to monetary policy. Adoption of the first view is equivalent to viewing banks as providers of money to hold, and has the consequence that bank output increases faster during an easy monetary policy than during a tight monetary policy. Adoption of the second view is equivalent to viewing banks as facilitators of money payments, and has the consequence that bank output need not be affected by changes in monetary policies if compensating changes in the velocity of circulation are possible. We shall now go into both options more deeply.

Banks Produce Money to Hold

The first approach to the output of commercial banks which we shall consider is the liquidity hypothesis. Returning to our simple commercial bank, we defined current price output (P_1Q_1) as equal to interest received. Let r = interest rate earned by banks, and D = average demand deposits held. The interest received and current price output in period 1 both equal r_1D_1. Note that this is also equal to the

income foregone by the depositors in period 1, due to holding deposits, rather than investing directly. Thus, the depositors implicitly valued the bank's services as equivalent to r_1D_1.

Now what service is measured by interest foregone? One foregoes possible interest earnings and holds cash in order to satisfy one's liquidity preference. If one had no liquidity preference, one would presumably invest directly and earn the interest which could be earned on direct investment. From the standpoint of depositors' behavior, the output of commercial banks can be viewed as the satisfaction of depositors' liquidity preferences.

If the general price level does not change between two periods, then the change in liquidity preferences satisfied by holding bank deposits can be expressed in terms of base year prices by multiplying current period deposits by base period yields foregone. Thus:

$$P_0Q_1 = r_0D_1 = (r_0D_0)\left(\frac{D_1}{D_0}\right) \tag{1.1}$$

The implicit price deflator in this case becomes equal to the index of interest rates earned by banks:

$$\frac{P_1}{P_0} = \frac{r_1}{r_0} \tag{2.1}$$

Since the general price level is always changing, the foregoing expressions are, of course, inadequate for measuring real output and prices.

An increase in the general price level may be viewed as requiring a proportionate increase in demand deposits to provide the same amount of liquidity in the current period as was provided by the amount held in base period. Thus if Π is an index of the general price level, the real output of commercial banks becomes:

$$P_0Q_1 = (r_0D_0)\left(\frac{\Pi_0}{\Pi_1}\right)\left(\frac{D_1}{D_0}\right) \tag{3.1}$$

and the price deflator becomes:

$$\frac{P_1}{P_0} = \frac{r_1 D_1}{(r_0 D_0)\left(\frac{\Pi_0}{\Pi_1}\right)\left(\frac{D_1}{D_0}\right)} = \left(\frac{r_1}{r_0}\right)\left(\frac{\Pi_1}{\Pi_0}\right) \tag{4.1}$$

which is equivalent to saying the deflator is the product of an index of the general price level, and an index of interest rates earned by banks.

Equation 3.1 means that changes in the real output of commercial banks are directly proportional to changes in the volume of deposits held and inversely proportional to changes in the general price level. Thus, an easy money policy will tend to increase commercial bank output, as long as such a policy does not induce a countervailing price rise. Conversely, a tight money policy will tend to reduce commercial bank output, as long as such policy does not induce an equivalent fall in general prices.

Banks Produce Money to Spend

The second approach to measuring commercial bank output is the transaction hypothesis.

The previous approach related bank output to the generation of money balances to hold. However, the vast bulk of the observable activities in commercial banks relate to the processing of checks and other transactions: banks would need a very small labor force indeed if nobody ever spent their deposits. Therefore on this view the function of a bank is to help depositors spend money, and the volume of commercial bank output is proportional to the volume of transactions handled, V. In place of equation 1.1 we have:

$$P_0 Q_1 = (r_0 D_0)\left(\frac{V_1}{V_0}\right) \tag{5.1}$$

and the implicit price deflator becomes:

$$\frac{P_1}{P_0} = \left(\frac{r_1}{r_0}\right)\frac{\left(\frac{V_0}{D_0}\right)}{\left(\frac{V_1}{D_1}\right)} \tag{6.1}$$

Equations 5.1 and 6.1 implicitly assume no change in the general price level, yet it would seem that a measure of the real volume of transactions should not increase just because the general price level increases. If we deflate the dollar volume of transactions by an index of the general price level, we obtain the following equation for the real output of a simple commercial bank:

$$P_0Q_1 = (r_0D_0)\left(\frac{\Pi_0}{\Pi_1}\right)\left(\frac{V_1}{V_0}\right) \tag{7.1}$$

If output is a function of transactions, and we deflate transactions by a general price level index, the equation for the implicit price deflator of a simple commercial bank becomes:

$$\frac{P_1}{P_0} = \left(\frac{r_1}{r_0}\right)\left(\frac{\Pi_1}{\Pi_0}\right)\frac{\left(\frac{V_0}{D_0}\right)}{\left(\frac{V_1}{D_1}\right)} \tag{8.1}$$

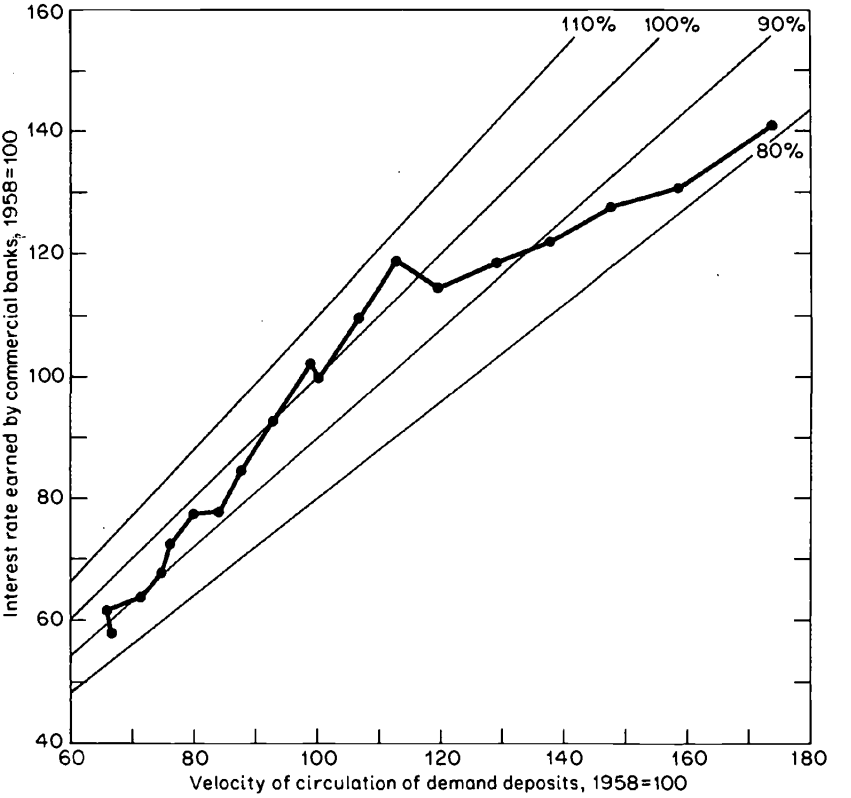
Equation 7.1 states that, if the transaction hypothesis is adopted, the real volume of the output of a simple commercial bank is proportional to changes in the dollar volume of transactions handled, and inversely proportional to changes in the general price level. The connection of such an output measure with monetary policy is rather indirect: only as monetary policy affects the volume of transactions or the price level, will it affect the real output of commercial banks.

This disjunction between monetary policy and the real output of commercial banks is brought out clearly by equation 8.1, the equation for the implicit price index. Here the implicit price index is shown as the product of the relatives of interest rates, the general price level, and the inverse of the relatives of the velocity of circulation.

There is a correlation between the movement of interest rates and the velocity of circulation. This relation is shown in Chart 1. Up to 1960, the index of interest rates tended to rise faster than the velocity of circulation. Since 1960, the velocity of circulation has risen faster. But the important point, in the context of the measurement of bank output, is that in so far as the two are related at all, they tend to

CHART 1

Commercial Bank Interest Rate Related to the Velocity of Circulation of Demand Deposits



SOURCE: U.S. Department of Commerce, Office of Business Economics.

cancel each other in equation 8.1. Thus the price that responds to monetary measures (r_1/r_0) does not get fully reflected in the deflator.

Holding or Spending?

Having separately examined the two approaches to measuring the output of a simple commercial bank, let us now examine the two approaches to bring out more clearly the differences between the two measures.

The measure of bank output on the liquidity approach is given by equation 3.1.

$$P_0Q_1 = (r_0D_0)\left(\frac{\Pi_0}{\Pi_1}\right)\left(\frac{D_1}{D_0}\right) \tag{3.1}$$

The measure of bank output on the transaction approach is given by equation 7.1.

$$P_0Q_1 = (r_0D_0)\left(\frac{\Pi_0}{\Pi_1}\right)\left(\frac{V_1}{V_0}\right) \tag{7.1}$$

Thus, it is easily seen that the two approaches differ only in the final term of the equation, that is the liquidity approach is based on deposits, and the transaction approach is based on transactions.

Let equation 7.1 be divided by equation 3.1.

$$\frac{(r_0D_0)\left(\frac{\Pi_0}{\Pi_1}\right)\left(\frac{V_1}{V_0}\right)}{(r_0D_0)\left(\frac{\Pi_0}{\Pi_1}\right)\left(\frac{D_1}{D_0}\right)} = \frac{\left(\frac{V_1}{V_0}\right)}{\left(\frac{D_1}{D_0}\right)} = \frac{\left(\frac{V_1}{D_1}\right)}{\left(\frac{V_0}{D_0}\right)} \tag{9.1}$$

This shows that the ratio between the two constant price measures is proportional to the index of the velocity of circulation, assuming the same general price level index is used in both approaches.

If there were no changes in the velocity of circulation, the two approaches would yield identical results, and there would be no necessity to choose between these two approaches when describing the real output of a simple commercial bank. The issue would reduce to the aesthetic preferences of the national accountant in how he wishes to describe the services of banks. However, the velocity of circulation does change, thus the two measures will differ, and a choice has to be made between transactions and deposits in measuring the real output of commercial banks.

Now, as noted in equation 9.1, if the velocity of circulation increases from period 0 to period 1, the index of real product measured by the transaction approach is greater than the index of real product measured by the liquidity approach in the same ratio as the velocity

of circulation in period 1 is to the velocity of circulation in period 0. Since the index of the velocity of circulation in fact tends to move with the index of interest rates for long periods, as shown in Chart 1, this is equivalent to saying that movements in interest rates directly affect the transaction approach measure of real output.

Now, the liquidity approach does not include the velocity of circulation, and indirectly, interest rates in the measure of the real output of simple banks. Also it is directly relatable to the decision to hold deposits, that is, if depositors wish to hold more deposits, the liquidity-based measure of commercial bank output will increase, while the transaction-based measure need show no change.

The above comparison of the two approaches has been based on the assumption that the same price index would be used in each approach. It may be argued that the general price index relevant to transactions would differ from that relevant to liquidity, since the former would relate to items bought, while the latter would relate to items not bought. If such a hypothesis were adopted, the two output measures would differ not only by interest rates, but by the ratio of the two sets of prices. While the distinction is quite logical, I don't think it has much practical relevance because in holding money we hold it against all kinds of contingencies. I see little reason for the trend of the general prices of the various contingencies to differ systematically from the trend of the general prices of the actualities.

ALLOWING FOR THE COMPLEXITIES OF OBSERVABLE COMMERCIAL BANKS

So far our discussion has been centered around a simple bank, which of course has little relation to the banks to be found in the real world. This radical simplification spotlighted the implications of the choice between two candidates for the measurement of the real output of commercial banks, the liquidity hypothesis or the transaction hypothesis.

We will now start to introduce real world operations other than the demand deposit function in order to flesh out our picture of commercial banks. We shall first introduce interest-bearing time deposits; followed by the sale of services for monetary remuneration (e.g., safe deposit boxes); then the purchase of goods and services from other firms, the maintenance of reserve balances and other cash items, and

finally the role of the capital contributed by the stockholders in a commercial bank. In the development of this complication, we shall build on equations 1.1, 3.1, 4.1, 7.1, 8.1 and 9.1. As each additional complication is introduced into the system of equations the number after the decimal will increase.

Time Deposits

The first complication will be that we will allow our simple bank to accept time deposits (T) and pay interest on them (R). The equation for current dollar output of a simple bank was:

$$P_1Q_1 = r_1D_1$$

The equation for current dollar output of a bank accepting time as well as demand deposits becomes:

$$P_1Q_1 = r_1D_1 + (r_1 - R_1)T_1 \tag{1.2}$$

Note that the second term (relating to time deposits) is also conformable to the hypothesis of output as being the satisfaction of liquidity, because we are measuring the output associated with time deposits by the excess of the amount foregone by the depositor by not investing directly over the amount actually received by the depositor from holding time deposits.

The real output of a simple bank on the liquidity approach was defined as:

$$P_0Q_1 = (r_0D_0)\left(\frac{\Pi_0}{\Pi_1}\right)\left(\frac{D_1}{D_0}\right) \tag{3.1}$$

The expansion to account for time deposits will introduce a term for real output similar to the demand deposit measure, assuming the same general price level index is relevant to both demand and time deposits. The real output of a bank accepting both demand and time deposits then becomes:

$$P_0Q_1 = (r_0D_0)\left(\frac{\Pi_0}{\Pi_1}\right)\left(\frac{D_1}{D_0}\right) + T_0(r_0 - R_0)\left(\frac{\Pi_0}{\Pi_1}\right)\left(\frac{T_1}{T_0}\right) \tag{3.2}$$

or alternately:

$$P_0Q_1 = \left(\frac{\Pi_0}{\Pi_1}\right)\left[(r_0D_0)\left(\frac{D_1}{D_0}\right) + T_0(r_0 - R_0)\left(\frac{T_1}{T_0}\right)\right]$$

In similar manner, the implicit price deflator of the more complex bank on the basis of the liquidity approach is transformed from:

$$\frac{P_1}{P_0} = \frac{r_1D_1}{(r_0D_0)\left(\frac{\Pi_0}{\Pi_1}\right)\left(\frac{D_1}{D_0}\right)} = \left(\frac{\Pi_1}{\Pi_0}\right)\left(\frac{r_1}{r_0}\right) \tag{4.1}$$

to:

$$\frac{P_1}{P_0} = \left(\frac{\Pi_1}{\Pi_0}\right)\left[\frac{r_1D_1 + (r_1 - R_1)T_1}{r_0D_1 + (r_0 - R_0)T_1}\right] \tag{4.2}$$

Here the deflator does not reduce to as simple a form as it does in equation 4.1, but the elements of the general price level index and an index of interest rates are clearly visible, although the deflator's movement over time will also reflect shifts in the proportion of demand versus time deposits.

If the transaction approach were rigorously adhered to, then the real output of a bank accepting time as well as demand deposits would depend on the volume of transactions in time deposits (V_T) as well as the volume of transactions in demand deposits (V_D).

Restating equation 7.1, which related to the constant-price output of a simple commercial bank:

$$P_0Q_1 = (r_0D_0)\left(\frac{\Pi_0}{\Pi_1}\right)\left(\frac{V_{D_1}}{V_{D_0}}\right) \tag{7.1}$$

We now expand equation 7.1 to allow for transactions in time deposits:

$$P_0Q_1 = \left(\frac{\Pi_0}{\Pi_1}\right)\left[(r_0D_0)\left(\frac{V_{D_1}}{V_{D_0}}\right) + T_0(r_0 - R_0)\left(\frac{V_{T_1}}{V_{T_0}}\right)\right] \tag{7.2}$$

Let us now compare equation 7.2—the real bank output on the transactions-based method—with equation 3.2—the real bank output on the liquidity-based method. Equation 7.2 is divided by equation 3.2:

$$\frac{\left[(r_0D_0)\left(\frac{V_{D_1}}{V_{D_0}}\right)+T_0(r_0-R_0)\left(\frac{V_{T_1}}{V_{T_0}}\right)\right]}{\left[(r_0D_0)\left(\frac{D_1}{D_0}\right)+T_0(r_0-R_0)\left(\frac{T_1}{T_0}\right)\right]} \tag{9.2}$$

Equation 9.2 is very similar to equation 9.1, except that the effects of changes in the velocity of circulation only enter indirectly through other ratios.

Now we will expand equations 4.1 and 8.1 in order to get the respective deflators. The liquidity approach gives the following deflator for a bank having both demand and time deposits:

$$\frac{P_1}{P_0}=\left(\frac{\Pi_1}{\Pi_0}\right)\left[\frac{r_1D_1+(r_1-R_1)T_1}{r_0D_1+(r_0-R_0)T_1}\right] \tag{4.2}$$

The transaction approach will yield this deflator:

$$\frac{P_1}{P_0}=\left(\frac{\Pi_1}{\Pi_0}\right)\left[\frac{r_1D_1+(r_1-R_1)T_1}{(r_0D_0)\left(\frac{V_{D_1}}{V_{D_0}}\right)+T_0(r_0-R_0)\left(\frac{V_{T_1}}{V_{T_0}}\right)}\right] \tag{8.2}$$

These rather complex equations consist of a general price level index times a weighted total of interest rates foregone on demand and time deposits. In the liquidity approach, the weights are current-period demand and time deposits; in the transaction approach, the weights are generally the velocity of circulation.

The preceding discussion has made the implicit assumption that if we chose either the liquidity or the transaction approach for demand deposits, we would use the same approach for time deposits. One might wish to measure the constant dollar output of demand deposits on the basis of transactions, on the grounds that demand deposits are spending money. At the same time if one viewed time deposits as liquidity money *par excellence,* one might want to measure the time deposit portion of bank output on the basis of the liquidity approach.

Such an eclectic approach would combine the front half of equation 7.2 with the rear half of equation 3.2, as in:

$$P_0Q_1 = \left(\frac{\Pi_0}{\Pi_1}\right)\left[(r_0D_0)\left(\frac{V_{D_1}}{V_{D_0}}\right) + T_0(r_0 - R_0)\left(\frac{T_1}{T_0}\right)\right] \qquad (10.2)$$

I think this approach is not a good one, since if idle balances are held as demand deposits, they give rise to no output, while if they are held as time deposits, they give rise to output. Thus a shift of idle balances from one form to the other will change the method of measuring bank output. This cannot happen in either the liquidity or transaction approaches. I shall therefore ignore this possibility in the rest of this paper.

In the liquidity approach, such a shift in idle balances will only change bank output by the ratio of $(r - R)$ to r; in the transaction approach, no change will occur from the form in which idle balances are held. The change in bank output on the liquidity approach when idle balances are shifted to time deposits is consistent with the basic intention of valuing bank services by what the depositor has foregone.

Service Charges

We now leave the area of imputation and move on to observable transactions, where banks charge explicit fees for performing services such as handling special accounts, furnishing safe deposit boxes, or managing trust accounts. Here we are faced with only the ordinary ambiguities—and in some of these cases they are substantial—involved in separating the price (P_S) and quantity (Q_S) elements of any service. In the following I will assume that we have successfully made this identification.

The current-price measure of commercial bank output, where the bank charges for services, as well as has demand and time deposits, becomes:

$$P_1Q_1 = r_1D_1 + (r_1 - R_1)T_1 + P_{S_1}Q_{S_1} \qquad (1.3)$$

The constant-price measure of commercial bank output, where the liquidity approach is used for the imputed portion becomes:

$$P_0Q_1 = \left(\frac{\Pi_0}{\Pi_1}\right)\left[(r_0D_0)\left(\frac{D_1}{D_0}\right) + T_0(r_0 - R_0)\left(\frac{T_1}{T_0}\right)\right] + P_{S_0}Q_{S_1} \quad (3.3)$$

And the implicit price deflator in this case becomes:

$$\frac{P_1}{P_0} = \frac{r_1D_1 + (r_1 - R_1)T_1 + P_{S_1}Q_{S_1}}{\left(\frac{\Pi_0}{\Pi_1}\right)\left[(r_0D_0)\left(\frac{D_1}{D_0}\right) + T_0(r_0 - R_0)\left(\frac{T_1}{T_0}\right)\right] + P_{S_0}Q_{S_1}} \quad (4.3)$$

The constant-price measure of commercial bank output, where the transaction approach is used for the imputed portion becomes:

$$P_0Q_1 = \left(\frac{\Pi_0}{\Pi_1}\right)\left[(r_0D_0)\left(\frac{V_{D_1}}{V_{D_0}}\right) + T_0(r_0 - R_0)\left(\frac{V_{T_1}}{V_{T_0}}\right)\right] + P_{S_0}Q_{S_1} \quad (7.3)$$

This discussion has been in terms of one type of service. Of course banks render different services, with differing price schedules. These can be allowed for in the equations by simply dividing P_S Q_S into as many subcategories as can be separately deflated. There is no point of principle here that need detain us.

Intermediate Purchases

In the real world, commercial banks are not Robinson Crusoe operations; they purchase a substantial volume of goods and services from other firms. Thus a full statement of their production requires that the value of purchases from other firms—P_IQ_I—be deducted. The current-dollar measure of commercial bank output thus becomes:

$$P_1Q_1 = r_1D_1 + (r_1 - R_1)T_1 + P_{S_1}Q_{S_1} - P_{I_1}Q_{I_1} \quad (1.4)$$

There is no theoretical difficulty in identifying the price and quantity elements of intermediate purchases, other than those surrounding marketed goods and services in general. The formula for the constant-price output of commercial banks, where the liquidity approach is used in measuring the imputed portion, and account is taken of service charges and intermediate purchase becomes:

$$P_0Q_1 = \left(\frac{\Pi_0}{\Pi_1}\right)\left[(r_0D_0)\left(\frac{D_1}{D_0}\right) + T_0(r_0 - R_0)\left(\frac{T_1}{T_0}\right)\right] + P_{S_0}Q_{S_1} - P_{I_0}Q_{I_1} \tag{3.4}$$

and the implicit price deflator in this case becomes:

$$\frac{P_1}{P_0} = \frac{r_1D_1 + (r_1 - R_1)T_1 + P_{S_1}Q_{S_1} - P_{I_1}Q_{I_1}}{\left(\frac{\Pi_0}{\Pi_1}\right)\left[(r_0D_0)\left(\frac{D_1}{D_0}\right) + T_0(r_0 - R_0)\left(\frac{T_1}{T_0}\right)\right] + P_{S_0}Q_{S_1} - P_{I_0}Q_{I_1}} \tag{4.4}$$

The constant-price measure of commercial bank output, where the transaction approach is used in measuring the imputed portion, and account is taken of service charges and intermediate purchases becomes:

$$P_0Q_1 = \left(\frac{\Pi_0}{\Pi_1}\right)\left[(V_0D_0)\left(\frac{V_{D_1}}{V_{D_0}}\right) + T_0(r_0 - R_0)\left(\frac{V_{T_1}}{V_{T_0}}\right)\right] + P_{S_0}Q_{S_1} - P_{I_0}Q_{I_1} \tag{7.4}$$

and the implicit price deflator becomes:

$$\frac{P_1}{P_0} = \frac{r_1D_1 + (r_1 - R_1)T_1 + P_{S_1}Q_{S_1} - P_{I_1}Q_{I_1}}{\left(\frac{\Pi_0}{\Pi_1}\right)\left[(r_0D_0)\left(\frac{V_{D_1}}{V_{D_0}}\right) + T_0(r_0 - R_0)\left(\frac{V_{T_1}}{V_{T_0}}\right)\right] + P_{S_0}Q_{S_1} - P_{I_0}Q_{I_1}} \tag{8.4}$$

Cash and Capital

The discussion to this point has not taken account of bank holdings of cash nor of the contribution of stockholders' capital. The equations developed so far for current and constant price output are correct only if all the funds supplied by deposits are invested in interest-earning assets, and if none of the funds supplied by stockholders are invested in interest-earning assets.

Our already complex equations could be fixed for these two complications by reducing the output allocated to deposits by applying the ratio of cash held by banks (C) to total assets ($D + T + E$), where E = stockholders' equity, and by adding a term for interest earned on stockholders' equity, rE. If these additions were made, our equation for current-price output would become:

$$P_1Q_1 = r_1D_1\left[1 - \frac{C_1}{D_1 + T_1 + E_1}\right] + (r_1 - R_1)T_1\left[1 - \frac{C_1}{D_1 + T_1 + E_1}\right]$$
$$+ r_1E_1\left[1 - \frac{C_1}{D_1 + T_1 + E_1}\right] + P_{S_1}Q_{S_1} - P_{I_1}Q_{I_1} \quad (1.5)$$

While this transformation formally solves the two problems, I think it is an unnecessary complication.

It is unnecessary practically, since the total of reserves and other cash items (exclusive of bank float) has exceeded the amount of stockholder's equity by a small margin over the period under review. In terms of equation 1.5, the growth in E was matched and offset by a growth in C.

Stockholders' equity can be increased by issuing new stock or by retaining earnings. From the standpoint of the individual bank, a new stock issue brings in cash, thus increasing both accounts at the same time by the same amount. Under the U.S. fractional reserve system, the total of interest-earning assets and deposits is built up by a multiple of this amount, and bank cash will continue to approximate bank capital for this bank if there are no cash drains. If there is a cash drain from bank A to bank B, cash and capital will be equal for the banking system as a whole although not for any particular bank.

The alternate route—earnings retention—arises because the inflow of cash to the bank exceeds the outflow. Again, the consequence is a rise in loans and deposits which is a multiple of the increase in cash.

If the total cash were fixed—by Federal Reserve action—then one bank's gain would have to be another bank's loss, and while the capital accounts would increase, the cash account and therefore the volume of loans and deposits would not increase but would simply be redistributed between banks. In such a circumstance, it can be seen that increases in aggregate bank capital would add nothing to aggregate bank earnings, and therefore output.

But in a situation where the Federal Reserve is putting new money into the system, and depositors are willing to hold the increase in deposits engendered by the increase in reserve availability there is an increase in bank output. However, the increase in bank capital is irrelevant to such an increase in earning power.

Thus, since stockholders' capital adds nothing to the growth of bank earnings, I do not think we need add a specific term for any contribution of bank capital to our output equation.

Further, since the cash is a limit to the volume of deposits, I don't think we need take specific account of it in our equation. It can be viewed either as a portion of deposits carrying a zero rate of return, or the r's in the equation can be viewed as applying to the yield on deposits rather than on loans. Thus adjustments for cash and capital are unnecessary on a conceptual basis.

Interest a Foregone Yield

The liquidity approach to measuring bank output rests upon the assumption that depositors could have earned r, the rate the bank earned, by investing directly, rather than by holding deposits. In addition to the problem of bank cash holdings discussed above, this assumption may be questioned on the grounds that: (1) individuals in fact cannot invest in the assets a bank does because of rigidities in loan size; (2) the bank's rate is inappropriate to the depositors' decision because it is an average of past yields, rather than the ones currently available; or (3) the bank's rate is inappropriate because individuals might choose higher rates if forced to invest directly.

The first objection can be met by noting that there are many opportunities for direct investment in small amounts that would yield approximately the same rates that banks average, providing individuals were willing to surrender their liquidity. That is to say the liquidity hypothesis does not require that the investment option open to the depositor be identical to the bank's portfolio, but only that the yields be in the same neighborhood.

The second objection is of course true, but at least in the case of commercial banks, which hold large quantities of short-dated loans and securities or installment loans, not very important. Due to the ability of banks to turn over their portfolios fairly quickly, the overall earning rate does not lag far behind current rates.

The only counterargument to the third objection is the weak one that since banks do in fact invest in just about every kind of interest-bearing asset, the higher-yielding instruments that some depositors

might wish to acquire if they were to become illiquid are represented in the over-all bank earnings rate.

In my view it is best to consider the banks' earning rate as a statistical estimate of the rates foregone when individuals hold deposits rather than direct investments. The imperfection of such an estimate in terms of strict logic is not so great on the practical level because bank earning rates are not so far different from those available to individuals, either in level or in movement.

THE EMPIRICAL RECORD

Table 1 presents six variants of measures of constant-price output: for each of three general price level indexes, the table shows the results given by the liquidity and transaction approaches. Table 2 presents the implicit price deflators for each variant shown in Table 1, while Table 3 shows the estimates of output per man-hour worked yielded by each of the six variants. In each table, column 1 gives the figures that are now included in the Office of Business Economics' estimates of GNP and of gross product originating by industry.

None of the measures presented in Tables 1 through 3 incorporates separate deflation of service charges or intermediate purchases, as would be required by equations 3.4, 4.4, 7.4, or 8.4. Instead, the net of service charges less intermediate purchases in the base year is extrapolated by the real value of the imputed portion of bank output. Thus, in Table 1 the constant price output measures based on the liquidity approach actually follow this formula:

$$P_0Q_1 = \left(\frac{\Pi_0}{\Pi_1}\right)\left[(r_0D_0)\left(\frac{D_1}{D_0}\right) + T_0(r_0 - R_0)\left(\frac{T_1}{T_0}\right) + (P_{S_0}Q_{S_0} - P_{I_0}Q_{I_0})\left(\frac{D_1 + T_1}{D_0 + T_0}\right)\right] \quad (3.5)$$

while the constant price measures in Table 1 which are based on the transaction approach follow this formula:

$$P_0Q_1 = \left(\frac{\Pi_0}{\Pi_1}\right)\left[(r_0D_0)\left(\frac{V_{D_1}}{V_{D_0}}\right) + T_0(r_0 - R_0)\left(\frac{V_{T_1}}{V_{T_0}}\right) + (P_{S_0}Q_{S_0} - P_{I_0}Q_{I_0})\left(\frac{V_{D_1} + V_{T_1}}{V_{D_0} + V_{T_0}}\right)\right] \quad (7.5)$$

TABLE 1

Alternative Measures of Gross Product Originating in U.S. Commercial Banks, 1948–66 (billions of 1958 dollars)

Year	Liquidity Hypothesis			Transaction Hypothesis		
	Consumer Prices [a]	Wholesale Prices	Consumer and Stock Prices	Consumer Prices	Wholesale Prices	Consumer and Stock Prices
1948	5.2	4.9	6.6	3.6	3.5	4.4
1949	5.2	5.2	6.6	3.6	3.6	4.4
1950	5.4	5.2	6.5	4.1	3.9	4.7
1951	5.4	5.0	6.2	4.2	3.9	4.8
1952	5.6	5.5	6.2	4.4	4.3	4.9
1953	5.7	5.7	6.3	4.7	4.7	5.2
1954	5.8	5.8	6.2	5.0	5.0	5.3
1955	6.1	6.1	6.1	5.4	5.4	5.5
1956	6.2	6.1	6.1	5.8	5.7	5.8
1957	6.0	5.9	6.0	6.0	5.9	6.0
1958	6.1	6.1	6.1	6.1	6.1	6.1
1959	6.3	6.3	6.1	6.7	6.7	6.5
1960	6.3	6.5	6.2	7.1	7.2	6.9
1961	6.6	6.8	6.3	7.7	8.0	7.3
1962	6.9	7.2	6.7	8.6	9.0	8.3
1963	7.1	7.5	6.8	9.2	9.8	8.8
1964	7.4	8.0	7.1	10.1	10.8	9.5
1965	7.9	8.4	7.5	11.2	11.9	10.4
1966	8.1	8.6	7.8	12.5	13.1	11.6

SOURCE: Office of Business Economics, U.S. Department of Commerce.

[a] This measure is currently incorporated in the U.S. national income and product accounts for the years 1948–64.

TABLE 2

Alternative Measures of Price per Unit of Gross Product [a] Originating in U.S. Commercial Banks, 1948–66
(dollars)

	Liquidity Hypothesis			Transaction Hypothesis		
Year	Consumer Prices [b]	Wholesale Prices	Consumer and Stock Prices	Consumer Prices	Wholesale Prices	Consumer and Stock Prices
1948	.489	.514	.385	.697	.734	.580
1949	.517	.522	.409	.751	.758	.623
1950	.558	.580	.470	.745	.775	.647
1951	.647	.694	.565	.828	.887	.731
1952	.687	.700	.615	.872	.891	.783
1953	.749	.747	.672	.911	.909	.823
1954	.773	.769	.723	.901	.898	.849
1955	.794	.795	.786	.894	.893	.880
1956	.881	.898	.890	.935	.952	.935
1957	.974	.986	.972	.981	.995	.974
1958	1.000	1.000	1.000	1.000	1.000	1.000
1959	1.080	1.073	1.108	1.013	1.008	1.037
1960	1.178	1.155	1.205	1.060	1.040	1.078
1961	1.152	1.112	1.194	.983	.950	1.032
1962	1.142	1.094	1.174	.913	.875	.946
1963	1.162	1.095	1.204	.893	.842	.938
1964	1.189	1.109	1.243	.873	.815	.932
1965	1.180	1.104	1.235	.832	.778	.889
1966	1.257	1.181	1.308	.814	.778	.880

SOURCE: Office of Business Economics, U.S. Department of Commerce.

[a] This is price of producing one 1958 dollar's worth of gross product at current period costs. It is equal to the implicit price deflator, with the decimal shifted two places to the left.

[b] This measure is currently incorporated in the U.S. national income and product accounts for the years 1948–64.

TABLE 3

Alternative Measures of Output Per Man-Hour Worked in U.S. Commercial Banks, 1948–66
(1958 dollars)

Year	Liquidity Hypothesis			Transaction Hypothesis		
	Consumer Prices [a]	Wholesale Prices	Consumer and Stock Prices	Consumer Prices	Wholesale Prices	Consumer and Stock Prices
1948	7.31	6.95	9.28	5.12	4.87	6.16
1949	7.31	7.24	9.26	5.03	4.98	6.06
1950	7.46	7.18	8.86	5.58	5.37	6.43
1951	6.85	6.39	7.85	5.35	5.00	6.06
1952	6.63	6.51	7.42	5.23	5.12	5.82
1953	6.39	6.41	7.12	5.26	5.27	5.82
1954	6.31	6.35	6.75	5.43	5.44	5.74
1955	6.35	6.35	6.42	5.66	5.65	5.73
1956	6.24	6.13	6.18	5.90	5.78	5.88
1957	5.84	5.76	5.84	5.80	5.71	5.84
1958	5.73	5.73	5.73	5.73	5.73	5.73
1959	5.66	5.69	5.51	6.03	6.06	5.89
1960	5.47	5.58	5.35	6.08	6.20	5.97
1961	5.45	5.65	5.26	6.39	6.62	6.09
1962	5.52	5.77	5.38	6.92	7.22	6.68
1963	5.50	5.84	5.32	7.17	7.59	6.82
1964	5.53	5.94	5.30	7.53	8.07	7.07
1965	5.55	5.94	5.31	7.88	8.42	7.36
1966	5.47	5.82	5.26	8.46	8.90	7.81

SOURCE: Office of Business Economics, U.S. Department of Commerce.

[a] This measure can be derived currently from the U.S. national income and product accounts for the years 1948–64.

This particular approach was adopted in the name of statistical expediency. The net of service charges and intermediate purchases in no year accounted for more than 9 per cent of gross product originating measured in current prices, and in most years the net was well under 5 per cent. Further, there are no readily available price indexes that comprehensively cover either service charges earned or intermediate purchases. Even if such indexes were to be developed at sometime in the future, I believe they would be unlikely to affect seriously the analysis in the subsequent parts of this article.

The General Price Level

Equations 3.5 and 7.5 both include the reciprocal of an index of the general price level: (Π_0/Π_1). Thus the empirical measures of real gross product originating in commercial banks depends upon the general price level index chosen by the investigator.

In the United States there are presently three indexes which could be used to represent the general price level: the GNP deflator; the Consumer Price Index; and the Wholesale Price Index. The GNP deflator cannot be used as the general price level index in measuring bank output because the deflator for the imputed portion of commercial bank output is a portion of the over-all GNP deflator, which cannot be derived until the commercial bank deflator has been settled. Further, the GNP deflator is a Paasche-type index, and its movements from period to period reflect both changes in prices and changes in the weights of goods and services purchased.

We are left, therefore, with a choice between the Consumer Price Index and the Wholesale Price Index. Table 1 shows the results obtained for commercial bank output by using each of these indexes for both the liquidity and transaction hypothesis. Use of the Wholesale Price Index rather than the Consumer Price Index would have added ½ of 1 per cent a year to the growth rate of commercial bank output, on either the liquidity or transaction hypothesis.

The additional output yielded by the use of the Wholesale Price Index rather than the Consumer Price Index occurs because the Wholesale Price Index rose less than the Consumer Price Index between 1948 and 1966 and the bank output measure depends upon the

inverse of whatever general price index is chosen: (Π_0/Π_1). The slower growth in the Wholesale Price Index than in the Consumer Price Index between 1948 and 1966, stems largely from the exclusion of services in the former index, and their inclusion in the latter index. As is well known, service prices have tended to increase faster than goods prices over the period under review.

The inclusion of service prices in the Consumer Price Index makes it a better candidate for use as a general price level index in measuring bank output. Therefore the official OBE series on bank output uses the Consumer Price Index, and in most of the balance of the article I will compare alternate hypotheses based on using the Consumer Price Index as the measure of the general price level.

It could be contended that we do not need a general price level index, but rather specific price level indexes for each class of depositor. One such approach would be to use the Consumer Price Index for personal deposits, and the Wholesale Price Index for business deposits. This can only be done at present for the liquidity based measure of bank output, because, while we have fairly satisfactory measures of year-end deposit holdings by persons and business, we do not have readily available measures of bank debits to personal or business deposits. As might be expected from the distribution of deposits, a liquidity type measure of real gross product originating in commercial banks using the Consumer Price Index for personal deposits and the Wholesale Price Index for business deposits, falls roughly halfway between the two measures using either price index exclusively. This result, however, is vitiated by the exclusion of business service prices, whose inclusion in the price level index for business deposits would probably bring such a measure closer to the Consumer Price Index results.

The Consumer Price Index has shortcomings as a general price index. Among the more important of these, it excludes the prices of capital goods, government purchases, and financial claims. Judging by the price movements shown by the OBE deflators for capital goods and government purchases, their inclusion would tend to lower the increase in the measure of real gross product originating in commercial banks below that shown by the Consumer Price Index-based meas-

ures in Table 1. Because of the ambiguity of the price information for these items I have not attempted to include them in the general price level indexes shown in this paper.

I did, however, attempt to make an allowance for the sixfold rise in common stock prices which occurred between 1948 and 1966. The results of this calculation are shown in the third and sixth columns of Tables 1, 2 and 3. The allowance was made by assuming that bank debits and the associated deposits in New York City should be deflated by the Standard and Poor's price index for 500 common stocks, and all other deposits and debits should be deflated by the Consumer Price Index. Such a calculation yields a measure of real gross product originating in commercial banks which rises at a much slower pace—on either the liquidity or transaction hypothesis—than the consumer price index approach. The attribution of all debits and deposits in New York City to stock market transactions is of course an overstatement about New York City, and an understatement about the rest of the United States; and this measure is introduced only to give some feel for the magnitudes of possible alternatives. In any event, the figures shown are quite rough, and little credence should be placed in them.

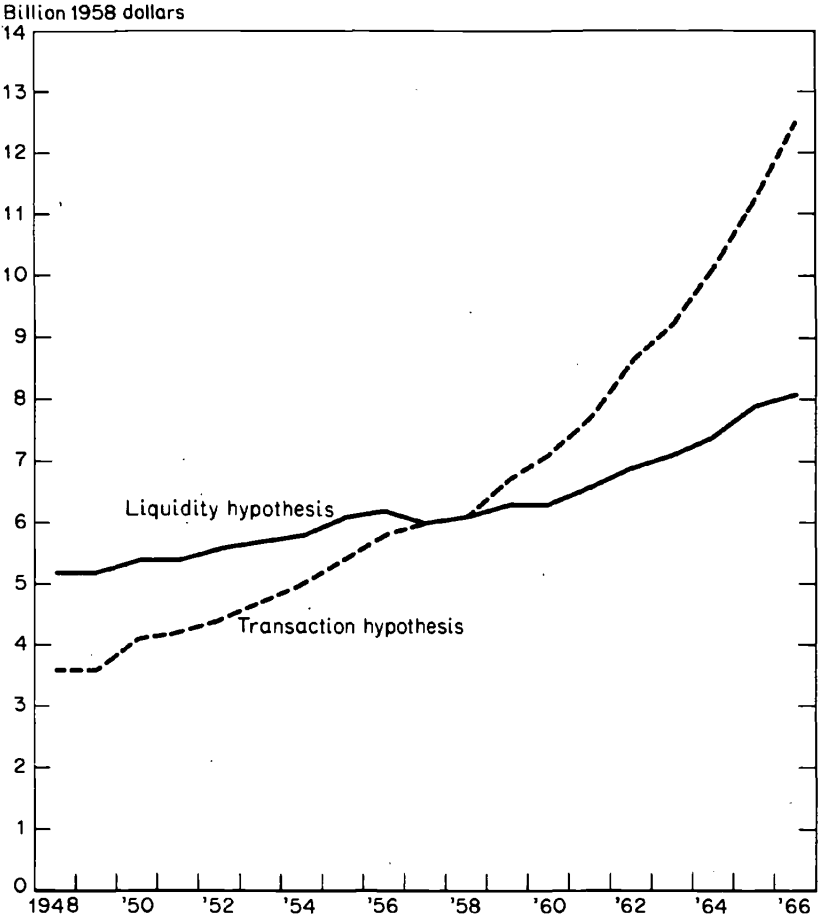
To sum up this discussion, the use of the Consumer Price Index is unsatisfactory as a general price level indicator when measuring bank output. However, likely augmentations are difficult to prepare on the basis of present knowledge, and most would tend to reduce the measure of real gross product originating in commercial banks below the measures yielded by the use of the Consumer Price Index.

Long-run Comparison of Alternative Measures

While the selection of the appropriate price level index makes a substantial difference in the empirical measure of commercial bank output, the choice of the liquidity or transaction hypothesis is far more important. The two measures of real gross product originating are compared in Chart 2; the two price deflators are compared in Chart 3; and the output per man-hour series are plotted in Chart 4. In all three charts, the general price level was measured by the Consumer Price Index: the only difference between the plotted measures comes from the hypothesis used for bank output.

CHART 2

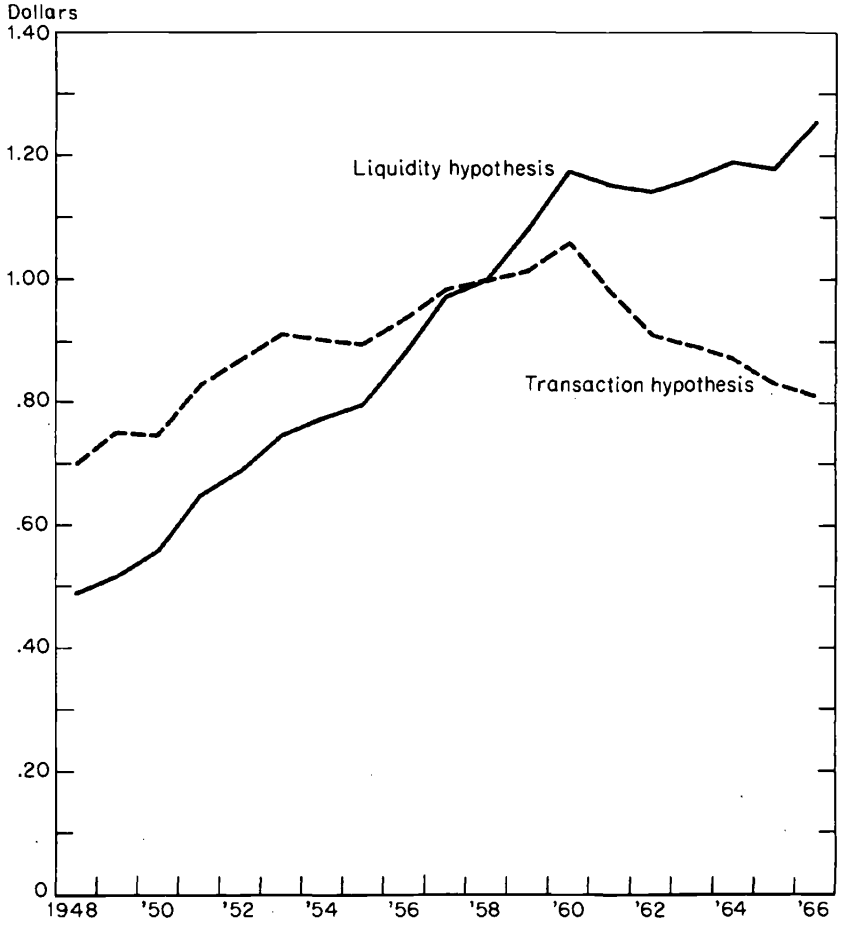
Alternative Measures of Real Gross Product Originating in U.S. Commercial Banks



NOTE: Consumer Price Index used to measure general prices.
SOURCE: U.S. Department of Commerce, Office of Business Economics.

CHART 3

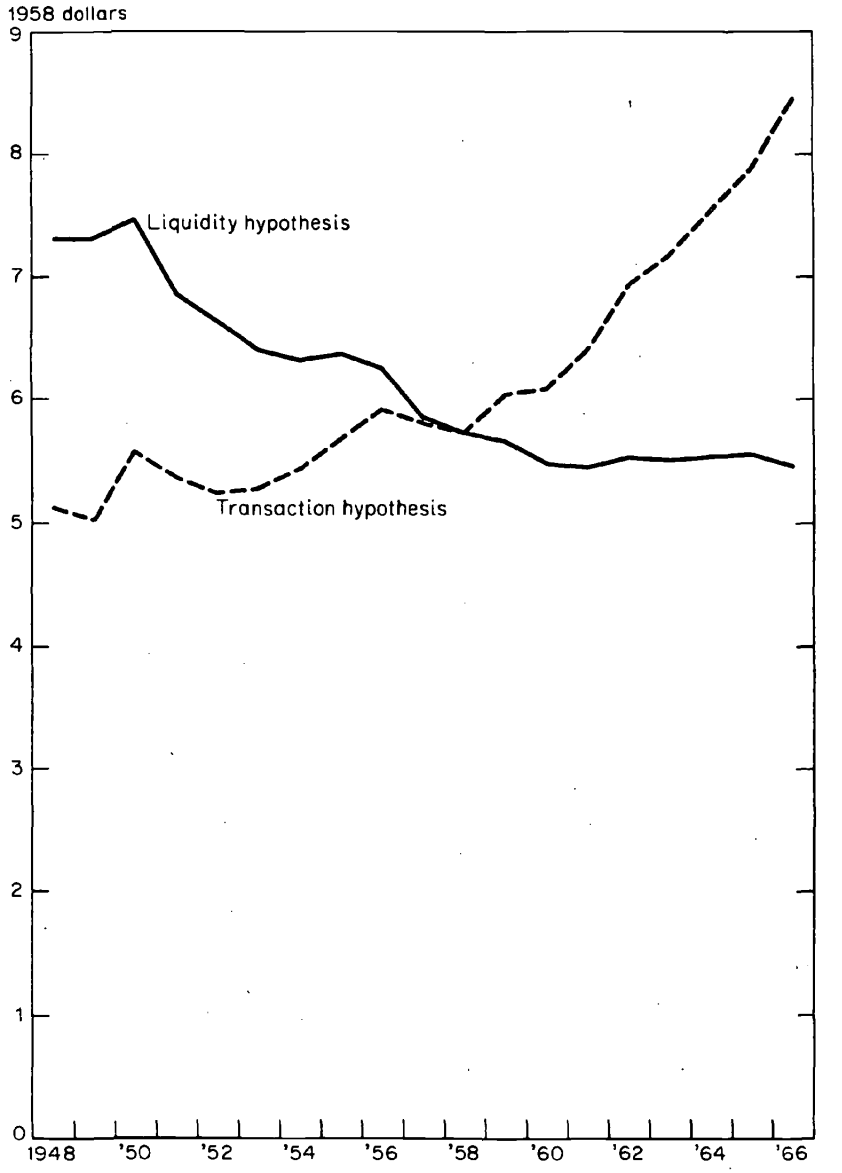
Alternative Measures of Price per Unit of Gross Product Originating in U.S. Commercial Banks



NOTE: Consumer Price Index used to measure general prices.
SOURCE: U.S. Department of Commerce, Office of Business Economics.

CHART 4

Alternative Measures of Output per Man-Hour Worked in U.S. Commercial Banks



NOTE: Consumer Price Index used to measure general prices.
SOURCE: U.S. Department of Commerce, Office of Business Economics.

Over the entire period 1948 to 1966, real gross product originating in commercial banks rose at an average annual rate of 2½ per cent when measured on the liquidity basis. If the measurement was made on the transactions basis, the growth rate would be 7 per cent. The greater rise in the transaction measure than in the liquidity measure of course reflected the threefold rise in the velocity of circulation, as would have been expected from equation 9.2.

The price deflator for real gross product on the liquidity basis rose at the substantial rate of 5½ per cent a year, while the deflator on the transaction hypothesis rose less than 1 per cent a year between 1948 and 1966. Such a difference is in accord with the results of equations 4.2 and 8.2, which indicate that the deflator generated by the liquidity approach would tend to approximate the product of an index of interest rates and the index of the general price level, while the deflator yielded by the transaction approach tends to approximate an index of the general price level modified by the shifting relationships between an index of interest rates and the inverse of an index of the velocity of circulation. Both of the observed deflators have been reduced by the switch to time deposits in the 1960's as the net earnings rate on time deposits ($r - R$) declined while over-all interest rates rose. This switch from demand to time deposits had the effect of reducing growth rates by about 1 per cent a year.

Turning now to real gross product per man-hour worked—labor productivity—we find that the liquidity approach yields an average annual decline of 1½ per cent from 1948 through 1966 while the transaction approach yields an average annual increase of 2¾ per cent over the review period. Again, this difference can be traced back to the threefold rise in the velocity of circulation between 1948 and 1966. Thus, we return once again to our concern with the role of the velocity of circulation in measuring bank output.

There is no doubt that an increase in the velocity of circulation will require a rise in the labor employed in commercial banks in the absence of further automation. In addition to the direct influence of a rising velocity of circulation, bank manpower requirements were augmented by the movement towards branch banking, and by a shift in lending from labor-saving government securities to labor-intensive consumer and mortgage loans. These developments added nothing to

bank output under either the liquidity or transaction hypotheses, although they did add to labor requirements.

The Effect of Monetary Policy on Bank Output

The calendar-year data presented in this paper cannot be readily associated with the alternate easing and tightening of monetary policy which accompanied the economic fluctuations of the past eighteen years, since the recessions and expansions which occurred within this period cut across calendar-year ends. However there were three periods when the general tone of monetary policy could be described as easy (1948–50), relatively tight (1951–60), or relatively easy (1961–65). Monetary policy during the year 1966 can be characterized quite unambiguously as tight. We will now examine how our alternate real output measures behaved within these differing monetary policy climates.

During the 1948–50 period, the Federal Reserve System was pegging the price of U.S. government bonds. The technique by which this objective was accomplished was for the Federal Reserve to purchase any Treasury securities offered to it, giving the banks reserve balances in exchange. Such a technique meant that the Federal Reserve System had little control over the aggregate volume of bank reserves, and therefore money was relatively easy. During this period the liquidity-based measure of commercial bank output grew at a 2½ per cent annual rate, while the transaction-based measure expanded at a 5¾ per cent pace.

In 1951, the Federal Reserve System and the Treasury Department reached an accord removing the Federal Reserve's obligation to support the bond market. From then until the close of the Eisenhower Administration, the general stance of monetary policy was considerably tighter than in prior years—although, of course, it was very easy at the troughs of the two business recessions that occurred in that period. The tighter control of bank deposit creation in this period was mirrored in a slowing of the growth rate of the liquidity-based real gross product measure to 1½ per cent a year, a pace about three-fifths as large as the prior period's. The transaction-based measure of gross product originating on the other hand, grew at a pace little different from the earlier one.

From the advent of the Kennedy Administration in 1961 until the

closing month of 1965, monetary policy was oriented towards the stimulation of the longer-term growth of the economy. However, this shift towards stimulation of the domestic economy occurred concurrently with the necessity to overcome a substantial balance of payments deficit. Under these circumstances, monetary policy was expressed in a simultaneous easing of reserve availability to stimulate the domestic economy, and in a sharp escalation in permissible time deposit rates. These policies were reflected in a sharp rise in the pace at which bank output expanded: the annual growth rate on the liquidity hypothesis rose to 4½ per cent—three times the 1950–60 pace —while on the transaction hypothesis real gross bank product rose 9½ per cent between 1960 and 1965—almost twice as fast as in 1950–60.

Increased pressure on productive capacity and an accelerated price rise induced a swing to a tight money policy in 1966. This tightening was reflected in a slowing of the rise in bank output to 3 per cent when measured in conformity with the liquidity hypothesis. No such influence of monetary tightness is observed when bank output is measured in conformity with the transaction hypothesis: 1966 was the year when commercial bank real output so measured scored the second most rapid yearly gain on record, 12 per cent.

In summary, if commercial bank output is measured in conformity with the liquidity hypothesis, it has a clear relation to monetary policy: an easy monetary policy will spur the growth of bank output, and a tight monetary policy will inhibit it. On the other hand, if commercial bank output is measured in conformity with the transaction hypothesis, there is little relation to monetary policy. Such a result is not surprising since, as indicated by equation 9.2, the transaction-based measure will exceed the liquidity-based measure by a ratio which is equal to the index of the velocity of circulation. In the United States during the review period the velocity of circulation proved to be quite variable. The effects of tight money on aggregate spending was often offset by an increase in the velocity of circulation.

Monetary Policy and Labor Productivity

Chart 4 summarizes the story on the labor productivity estimates yielded by the liquidity and transaction approaches to measuring bank output. In general, the productivity comparisons confirm the

output comparisons: productivity is directly a function of monetary policy if bank output is measured in conformity with the liquidity hypothesis, while there would be no clear relation between monetary policy and labor productivity if the transaction hypothesis were to be adopted.

Thus, the two easy money periods were marked by gains in output per man-hour and the two tight money periods featured absolute declines in labor productivity, when gross product is measured on the liquidity hypothesis. If the transaction approach is used there is no consistent relation: the lowest annual rate of gain is shown in the tight period from 1950 to 1960, while the highest is recorded for tight money 1966.

The sensitivity of the liquidity-based productivity measure to monetary policy changes is no accident. The numerator of the ratio is directly related to bank deposits, and thus tends to decline with tight money and expand with easy money. The denominator of the ratio is man-hours worked, which tends to rise faster in tight money periods than in easy money periods, along with transactions in the economy as a whole.

TRANSACTIONS OR LIQUIDITY?

We have now reviewed the statistical estimates yielded by the transaction and liquidity hypotheses to measuring commercial bank output. Because the 1948–66 period was marked by a tripling in the velocity of circulation, the two approaches yield significantly different results.

If the transaction hypothesis were adopted, real output in commercial banking would score one of the fastest growth rates of real gross product originating in U.S. industry, and output per man-hour would rise at a pace approximating that in the nonfinancial economy. Such results would satisfy the aesthetic preferences of many practical men, who tend to disbelieve statistical results for any industry that are out of line with general experience in the absence of identifiable reasons. But how can such men be comfortable with the rapid drop in the implicit price deflator yielded by the transaction hypothesis from 1960 to 1966, when most implicit deflators were rising?

If the liquidity hypothesis were adopted, real output in commercial banking would rise at a slower pace than in other industries, and out-

put per man-hour would decline. On the other hand, the implici price deflator would rise over the entire period.

The principal argument for the liquidity approach is that it is directly relatable to the decision to hold deposits. If one holds deposits one foregoes the yield that could have been earned by holding those deposits, at the cost of becoming relatively illiquid. Once depositors have been induced to hold deposits, banks can then invest the funds and earn profits. Thus, the current dollar output measure is in part a function of the decisions made by depositors to hold deposits. In this view, the costs involved in facilitating transactions—check cashing, bookkeeping, etc.—become intermediate costs that the banks are forced to assume in making their deposits liquid enough for depositors to hold them.

The liquidity hypothesis determines output on the basis of the volume of liquidity desired by depositors. If the Federal Reserve were to create more reserves than were required to support the volume of deposits depositors wished to hold, then by the well known mechanism, enough inflation would ensue to reduce real balances, and therefore bank output, to the volume desired by depositors. Thus the liquidity hypothesis produces an elegant correspondence between national accounting conventions and monetary theory.

APPENDIX—TECHNICAL NOTE

Current dollar output of commercial banks is measured from the income side of the accounts and is equal to gross product originating. Wages and salaries are based upon Bureau of Employment Security data. Supplements to wages and salaries were generally estimated at national levels and allocated to the industries by the distribution of wages and salaries. Net interest was equated to zero, by definition. Corporate profits before tax was based on Internal Revenue Service data, adjusted as shown in Table 7.5 of *The National Income and Product Accounts of the United States, 1929–65;* it should be noted that actual bad debt losses, computed from the Federal Deposit Insurance Corporation's data, were substituted for the bad debt expense contained in the Internal Revenue Service's data. Indirect business taxes were allocated to industries on the basis of data for individual types of taxes. Business transfer payments consist of consumer bad debts—estimated by allocating FDIC bad debt losses by the ratio of consumer loans to total loans—and contributions to nonprofit organizations reported by the Internal Revenue Service. Capital consumption allowances were as reported by the Internal Revenue Service.

Constant dollar output-liquidity hypothesis was obtained by extrapolating 1958 output by indexes of deposit liabilities divided by the appropriate price indexes. This would give the same result as equation 3.5 and is a lot easier to compute. The 1958 total current dollar bank output was first divided into demand deposit and time deposit portions by the distribution of average deposit liabilities, reported by the Federal Deposit Insurance Corporation. The average demand deposits and average time deposits for other years were from the same source. The Consumer Price Index and the Wholesale Price Index were shifted to a 1958 base before the calculation was made. The estimate of New York bank deposits used in conjunction with the Standard and Poor Stock Price Index was derived by dividing debits at New York banks by the turnover of deposits at New York banks: both series for 1948–64 were adjusted to the new levels introduced in 1965. The New York deposit series so derived was subtracted from the FDIC total demand deposits, and the resulting series was deflated by the consumer price index.

Constant dollar output-transaction hypothesis was obtained by extrapolating 1958 output by indexes of debits divided by appropriate price indexes. A debits series for demand deposits at New York banks was obtained by extrapolating the post-1965 FRB series by the prior one. A debit series for non-New York banks was constructed by multiplying total demand deposits, excluding New York deposits, by the turnover ratio published by the Federal Reserve for banks outside New York. This turnover ratio for 1948–64 was adjusted to the new levels introduced in 1965.

Man-hours worked was estimated by: (1) distributing OBE's full- and part-time employment in banking by the three-digit distribution of Bureau of Employment Security employment, adjusted to include the Federal Reserve System; (2) multiplying by the Bureau of Labor Statistics' figures on average hours paid for, adjusted to a yearly basis; and (3) multiplying by an over-all ratio of hours worked to hours paid for on the basis of the Monthly Labor Report.

DISCUSSION

DONALD R. HODGMAN, University of Illinois

In his lucid and provocative paper John Gorman first develops the theoretical rationale for both his "liquidity" and "transactions" approaches to the measurement of bank output for national accounting purposes and then presents productivity indexes based on each output measure for the period 1948–65. The productivity results contradict each other: based on the "liquidity" measure productivity *declines* at

an annual rate of 1½ per cent over the period while based on the transactions measure productivity *increases* at an average annual rate of 2¾ per cent for the same period. Thus a substantial difference is involved in the choice of approach. Gorman prefers the "liquidity" approach for theoretical reasons and because he finds some supplementary empirical evidence to support the thesis of declining labor productivity in banking. In my remarks I shall challenge Gorman's theoretical rationale for viewing bank services as exclusively for depositors as distinct from borrowers and for preferring the liquidity to the transactions measure of output. I shall also cite some evidence which tends to support the credibility of rising rather than falling productivity, and thus of the transactions rather than the liquidity approach if these are the only two empirically feasible alternatives.

Gorman's view that bank output consists of services to depositors rather than to borrowers derives from the principle in national income and product accounting that interest flows are regarded as output of the paying rather than the receiving industry. This principle in turn is employed in national accounting in order that the contribution of capital to the output of a firm need not depend upon whether the capital is borrowed or owned. The bulk of bank income is interest earned on loans and investments. With this explicit interest barred by national income accounting principles from inclusion in bank output, Gorman and his colleagues in the Office of Business Economics have been led to the ingenious imputation rationale stated in his paper. But an alternative resolution of the difficulty posed by interest payments is possible without violating the principles established for interest in national accounting. To understand this we must first consider several concepts of bank output from monetary analysis.

In monetary theory banks are viewed as firms that monetize private debt by exchanging for it their own deposit obligations and so managing their affairs that these obligations are at all times exchangeable at par for legal money. From this perspective bank output has been regarded as deposits or credit or as both. Clearly this approach has much in common with Gorman's discussion of a choice between services to depositors and services to borrowers and his use of the interest rate as the relevant price by which to value each type of service. However, a closer examination of banking activity and banking costs will

reveal that *financial services* (rather than deposits or loans) are the products of banking and that these services can be grouped into three main categories: (1) management of the national payments mechanism, (2) intermediation between borrowers and lenders, and (3) specialized financial services (such as trust department and foreign department services, portfolio advisory services and the like).[1] Payments mechanism services are provided to demand depositors, intermediation services (receiving money in exchange for interest or for valuable banking services, security and credit analysis, record-keeping, handling the flow of credit documents, and so on) are provided both to depositors and borrowers, and other specialized financial services are provided to depositors, borrowers, and other customers.

When banks are viewed as financial service firms we see that the banking product sold to *borrowers* is not only credit but intermediation and that a portion of a bank's interest receipts is paid by the borrower to cover the costs of intermediation rather than as a payment for liquidity or consumption foregone by the ultimate lender. Thus, from the national accounting viewpoint the portion of interest paid to a bank for intermediation should be viewed as the purchase of services by the borrower rather than a capital charge. This portion of "interest" received by banks should be regarded as part of their gross value product in the national accounting sense. The remainder of interest paid to banks will, under competitive conditions, be paid in turn by the banks to the ultimate lenders who are depositors and stockholders. Conceptually, therefore, the *net* interest received by banks should be included in gross product originating rather than set to zero by definition as in the Gorman paper.

An approach from the income side to gross product originating in banking when corrected to include net interest will provide an empirical counterpart to the theoretically correct concept of gross product in current prices. There remains the problem of an appropriate price deflator or real output extrapolator to construct an output series in constant prices. Empirical problems make the construction of a price deflator unfeasible at the present time. Accordingly, Gorman proposes

[1] See Frederick W. Bell and Neil B. Murphy, *Economies of Scale in Commercial Banking*, Federal Reserve Bank of Boston, 1967, Table 1, p. 3, "Functional Cost and Employment for the Typical Commercial Bank" for cost data that support this view.

two alternative methods to obtain physical volume indexes directly. These are his "liquidity" and "transactions" methods. For reasons advanced in his paper Gorman prefers the liquidity approach. In what follows I shall argue that the transactions approach is the better of the two, although not ideal.

A major difficulty with the liquidity approach to bank output is that gains in labor productivity produced by technological innovation in banking will not show up if competitive economic conditions prevail together with certain established banking practices. Suppose costs of bank services are reduced by a technological innovation. Suppose further that competition forces banks to pass these cost savings on to customers but that the form which this takes is primarily an increase in financial services per dollar of deposit. Suppose finally that, following banking practice, no explicit charge is made for the bulk of such services. Such a development in banking will find no expression whatsoever in Gorman's liquidity index of output and productivity. The additional financial services, being implicitly priced, will not increase measured bank output but will offset the labor and other savings made by the technological innovation. The situation is analogous but not identical to unmeasured quality improvements in manufacturing.

Certain aspects of present-day banking are very similar to the hypothetical example just presented. In the past ten years or so banking has been experiencing a technological revolution linked to computerized record-keeping and data processing, automatic sorting of checks bearing magnetic ink symbols, automated statement preparation and other technological innovations.[2] These developments have greatly reduced labor requirements for bookkeeping, transit, and posting operations required in providing the national payments mechanism and in savings-deposit and instalment-loan accounting. At the same time competition in banking has become more vigorous and banks have increased rapidly the quantity and variety of financial services provided to demand deposit customers in order to retain and attract deposits. For the most part demand depositors receive these services

[2] The role of capital equipment in banking is greater than casual observation might suggest. "In the demand deposit function the value of major machinery per banking employee (including officers) was almost $3,200, considerably higher than the average of $2,200 for all manufacturing employees." *Ibid.*, p. 15. Unfortunately, no time series is available for the capital-labor ratio in banking.

in exchange for deposit balances rather than in return for explicit charges.

Gorman's liquidity measure of output does not reflect this growth in implicitly priced services provided by banks because it assumes that all such services are necessary to guarantee the "liquidity" of demand deposits and it ignores any change in quantity or quality of such services. By contrast Gorman's measure of labor input into banking, being comprehensive, does include the labor required for such services. Thus his liquidity measure of productivity in banking must be presumed to understate the growth in that productivity.

His transactions measure, however, is free of this particular shortcoming. It is essentially a physical volume output index in which the number of transactions (V/π) is the output measure. When the index of labor inputs into banking is related to this physical volume index of output, the increase in labor productivity made possible by the use of computers and electronic data processing in banking is revealed. Since changes in the physical volume of transactions are only a proxy for changes in the volume of a rich variety of financial services performed by banks, the transactions measure also is subject to inaccuracies. But these are certainly of lesser importance than the inability of Gorman's liquidity measure of productivity to reflect the effects of technological innovation in banking.

Gorman advances several general observations in favor of his liquidity approach as compared with the transactions approach. In support of the decline in labor productivity revealed by the liquidity approach he cites the increased relative importance of branch banking, on the one hand, and of labor-intensive loans versus labor-cheap investments in government securities in bank asset portfolios, on the other. But he overlooks the economies-of-scale which branch banking confers as an offset to rising costs of administration and communication.[3] And he ignores the rise in intermediation service as an output that accompanies the portfolio shift in banking from government securities to private loans. Certainly the information gathering and processing activities that enable banks to serve as efficient intermediaries between ultimate lenders and borrowers and that make loans

[3] For a discussion of the balance between scale economies and branching diseconomies see *ibid.*, pp. 8–10.

more labor intensive than investments in government securities also give rise to an intermediation service to borrowers which is marketable and increases bank output. Thus, the increased relative importance of branch banking and of loans in bank portfolios need not have resulted in decreased labor productivity in banking as Gorman suggests.

Gorman attributes the excess of his transactions measure of output over his liquidity measure to the rise in velocity which occurred over the period 1948–1965. In this he is algebraically correct, as he shows in his expression 9.1. What Gorman fails to realize is that this fact supports the transactions index rather than the liquidity index. A rise in velocity is defined as an increase in spending relative to the money stock. The spending flow has both a price level and a physical transactions dimension. The construction of Gorman's transactions and liquidity measures of output is such that an increase in transactions will increase his transactions index while an increase in the price level relative to the money stock will *decrease* his liquidity measure. Thus the effects of a change in velocity are *distributed* between the two output indexes and not confined to the transactions index as Gorman implies on page 165 of his paper. The transactions measure of output reflects only changes in transactions; it corrects for changes in the price level. This is certainly desirable since a mere change in numeraire of bank transactions does not increase their processing cost to the bank.

The liquidity measure, on the other hand, ignores changes in clearing transactions but responds directly to changes in the money level of deposits and inversely to changes in the general price level. Since the level of bank deposits depends upon actions of the monetary authorities and the public while the price level depends upon the public, the role of labor and capital in the banking industry in producing changes in bank output is obscure under the liquidity concept. Moreover, the theoretical rationale for the liquidity measure of bank output assumes that the price level is at its equilibrium value in relation to the money stock, i.e., that real cash balances are at their desired level. However, it is well known that wartime finance and price controls resulted in substantial repressed inflation and the accumulation of excess real cash balances during World War II, so that the immediate postwar years were characterized by open inflation,

a process given further impetus by the Korean war. Thus there is reason to believe that the low rate of growth in bank output according to the liquidity measure in the period 1948–1952 in particular reflects lagged adjustment of the price level to disequilibrium conditions inherited from the years of the war. Indeed, lagged adjustment of the price level to a change in the money stock is a persistent problem for the liquidity measure. For example, if an equilibrium in real cash balances is disturbed by action of the monetary authorities and price level adjustments lag the change in money stock, the liquidity measure will vary directly with monetary policy. Gorman presents convincing empirical evidence that this has been the case. But the measured change in liquidity in these circumstances is spurious in terms of the rationale for the liquidity measure, so that we have a further reason for preferring the transactions measure.

In conclusion, I believe that the transactions measure of output and productivity in banking is superior to the liquidity measure both for theoretical reasons and because trends in labor productivity in banking revealed by the transactions measure are more consistent with the fragmentary empirical evidence on technological innovation in banking in recent years. Even the transactions measure, however, is at best a rough proxy for changes in the *financial services* that constitute the output of the banking industry. To measure these more accurately is a challenging task for the future. Meanwhile we should be grateful for a scholarly paper such as Gorman's which does much to advance our understanding by expressing so clearly the rationale for his two measures of bank output and then implementing both statistically so as to pose sharply the issues involved in choosing between them.

COMMENTS

NESTOR E. TERLECKYJ, Bureau of the Budget

I would like to cite two earlier attempts to measure the output of commercial banks in physical terms and compare those earlier measurements with the results obtained by Gorman.

One such attempt was made by Speagle and Kohn.[1] These authors

[1] Richard E. Speagle and Ernest Kohn, "Employment and Output in Banking, 1919–1955," *The Review of Economics and Statistics,* February 1958, pp. 22–35.

considered alternative ways to measure output: by deposits, by loans and investments, by debits, all in constant dollars, and by the number of checks processed.

Another attempt was made in connection with the study of growth and location of employment in the financial institutions in the New York area in which I took part.[2] In that study we used as outputs the categories of services from which banks derive their income and which the banks themselves advertise to the public: i.e., loans of different types, investments, trust department services, deposit account services, and safe deposit services. After experimenting with different types of data and trying different statistical formulas, we came up with a weighted index of consumer loans, all other loans, and investments, all measured in constant dollars, and an indicator for trust services.

The relevance of these earlier studies to Gorman's paper is that they both show considerable productivity increases over the periods studied. Moreover, quantitatively the rates of productivity change based on the physical indicators correspond to Gorman's estimates based on the transaction hypothesis.

Speagle and Kohn conclude that over the four decade period they considered, output rose roughly three to four times depending on the measurement unit while manpower increased by only 71 per cent. In the study conducted by Sidney Robbins and myself, we have found an increase of about 25 per cent from 1938–1956, but of over 30 per cent from 1947 through 1956.

For the period for which the data more nearly overlap, the following comparisons may be made:

Robbins and Terleckyj, weighted index, 1947–1956	+32 per cent
Speagle and Kohn, checks per employee, 1947–1955	+22 per cent
Gorman, transactions, consumer prices, 1948–1956	+15 per cent
Gorman, transactions, wholesale prices, 1948–1956	+19 per cent
Gorman, transactions, stock and consumer prices, 1948–1956	−5 per cent

The transaction hypothesis yields estimates comparable in magnitude to those obtained by the more "physical" measurements. (I do not know how to interpret the stock price deflation.)

During that period important shifts occurred in the mix of credit

[2] Sidney N. Robbins and Nestor E. Terleckyj, *Money Metropolis,* Cambridge, Mass., 1960, pp. 68–73 and 204–217.

services away from the "wholesale banking" and towards the much more (about ten times per million dollars of assets) labor intensive "retail banking." Any output indicator which makes distinctions—between these types of service—would show considerably more output, and hence also productivity growth than an aggregate indicator. In our earlier study for the period 1947–1956, the estimated increase in bank employment attributable to growth in total assets (constant dollars) alone was 16 per cent while that attributable to changes in mix of assets alone was 65 to 70 per cent.

The period for which these comparisons are made is in the fairly distant past, but updated and refined measures could be worked out and are probably worth trying.

SOLOMON FABRICANT, New York University

I cannot believe that output per man-hour in commercial banks declined over the postwar period. Gorman's liquidity hypothesis seems to me to be untenable.

Gorman speaks of the "practical men, who tend to disbelieve statistical results for any industry that are out of line with general experience in the absence of identifiable reasons." I suppose I am one of these men, but not because of "aesthetic preferences." My reasons arise, in fact, out of "general experience."

This does not mean that I expect all industries to show similar rates of increase in output per man-hour. We have learned from productivity studies that there is great variation in these rates of increase. But we have learned also—this too is part of our general experience—that the trend of output per man-hour has been upward in virtually every industry, if not in all. When a measurement seems to indicate a decline—over a period long enough to iron out erratic and cyclical fluctuations—investigation has shown that the measurement is wrong, usually because the index of output has failed to take adequate account of quality change. In the case of the commercial banks, the statistical results are out of line not only with this general experience but also with the particular experience of the banks.

Let us recall that change in output per man-hour can be con-

veniently decomposed into three groups of factors: (1) change in average labor quality, (2) change in tangible capital per man-hour, and (3) change in technology and the host of other factors that determine change in total factor productivity (i.e., in output per unit of labor and capital combined). It is not obvious to me that any of these has been negative, and still less obvious that the net balance among them, properly weighted, has been negative. If anything is obvious—or in line with general experience over a period as long as eighteen years—it is the contrary.

The transactions hypothesis does not arouse the same suspicion, though there is of course a question whether all the services provided by banks are correctly measured by the deflated bank debits used by Gorman. Surely there is more to it than checks cleared. One of the services of banks is holding cash balances for their customers, and somehow this service must get into the measure of output. Gorman's liquidity hypothesis suggests a way of estimating this but only this, particular item of service.

The fact that the implicit price deflator yielded by the transactions hypothesis for the period 1960–66 went down rapidly does not bother me as much as it seems to bother Gorman. It is part of our general experience that, as a result of the great variation in the rate of decline of output per man-hour, there is also great variation in price change. With the GNP implicit price deflator rising at a relatively modest rate, it is not at all surprising that many industries should have declining prices and some even rapidly declining prices. Is anyone surprised to find the price of antibiotics or television sets falling during the postwar period?

The fact that "the liquidity hypothesis produces an elegant correspondence between national accounting conventions and monetary theory," as Gorman states, suggests to me only that the national accounting conventions now being followed in the treatment of commercial banking need reexamination. Indeed, I consider the contribution of Gorman's paper to be precisely the fact that, by exploring the implications of the present treatment, he raises this question. It is a major contribution.

National accounting conventions are still largely those set up in the tripartite agreement of twenty years ago. There have been many

improvements in data and detail since, but few in the structure of the accounts. Surely it is time to take a look at the system of accounts in the light of experience, including the kind of test Gorman has made. I expect that this examination would suggest revisions in the treatment of commercial banks, of interest in general, and even of rents—and probably also other items of concern to those anxious to improve the measurement of output and productivity in the service industries.