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Measuring Banking Output: Integrating Production and Hedonic Approaches

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Note: This paper was written for more than one purpose. It is primarily an internal BEA issue paper, written to generate discussion of conceptual questions in advance of the forthcoming GNP benchmark revision. Secondarily, it serves as a proposal and/or background document for an external to BEA conference. Reflecting its dual purpose, it is on the order of a progress report--somewhat more than the usual conference proposal, but substantially less than a complete paper. At its present stage, it is not for general circulation outside BEA; moreover, since the paper is both incomplete and not an official BEA position paper, it should not be interpreted as necessarily presenting the measurement that will appear in the 1990 GNP benchmark revision.

I. Background

One can distinguish at least three different literatures on measuring the services of banks.

1. Traditional SNA Approach

In the national accounts literature, discussion of banking output measurement usually appears under the heading: "The banking imputation problem." The imputation problem arises partly out of a view of the economic functions of banks and partly as a consequence of the treatment of interest flows as transfers in nonfinancial industries (and in government). Bailey's (1971) textbook summarizes the rationale for the latter:

"...[W]hen an enterprise receives capital from the public and transfers it to other enterprises...it is reasonable to follow the general rule that the income and product originating in a firm shall depend on its net interest payments, that is, interest paid minus interest received. Such a rule produces negative value added for banks."

See also Jaszi (1958), Gorman (1969), and OECD (1986); Gorman colorfully remarks that the national accounts treatment of interest flows, unless adjusted, leaves the "commercial bank...portrayed as a leech on the income stream."

To overcome negative measured value added, banks are assumed to provide unpriced or "free" services to depositors, services whose value equals the net proceeds from their lending operations.* The resulting economic model of banking is also stated in Bailey (p. 260):

"A commercial bank in effect converts illiquid assets into liquid, readily transferable ones.... In exchange for its services in connection with deposits, and for their comparative liquidity, it receives these deposits at low interest compared with what the depositor could earn on alternative, less liquid assets."

Implied is that depositors must receive services (either in the form of check cashing and the like, or as a liquidity premium) equal to the difference between interest on deposits and, say, that on a personal or commercial loan. This view of the economic function of banks is shared in most of the national accounts literature; the appropriate treatment of imputed bank service charges, so defined, is the measurement question addressed in this literature.

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* In the U.N.'s System of National Accounts (SNA), as quoted in OECD, 1986: "The excess of the property income received by banks and similar intermediaries on loans and other investments made from the deposits they hold, over the interest paid out on those deposits...."

Some variations occur: For example, it has been proposed that the imputation be spread among borrowers as well as depositors. Other variants would have banks treated as governments (output measured by employment and inputs purchased from other sectors), or have banks' purchases of nonfinancial goods and services treated as a final-demand category. The variations have in common, however, the fact that the problem they address arises out of the negative value of banks' net interest payments.

The national accounts literature's economic model of banking can be criticized as one that has banking flows going in the wrong direction--that is, interest received by banks is viewed as a negative component in their economic activity, rather than as the revenue from what banks "sell." Indeed, this criticism is quite old (see, for example, Bowman and Easterlin, 1958, p. 165). Recent statements are Sunga (198x) and Zee (1981). As developed below, I agree with the criticism.

It is important to emphasize that alternative models of a bank's "production process" carry with them implications for changes elsewhere in the accounts. If the analysis of banks suggests, for example, implications for the treatment of interest in nonfinancial sectors, those problems also need to be worked out. A banking measurement proposal cannot proceed as if problems that have been discussed for so many years in the national accounts literature have never been raised. However, determining the appropriate measure of banking output should depend on an economic analysis of banks, and not flow as a residual from application of rules for handling interest in nonfinancial sectors. This paper is concerned with banking output, in other words, and not with the general problem of interest in the accounts.

2. Monetary System Approach

A second literature on banking is also part of the national accounts literature, but has as its distinguishing feature the consideration of the monetary system, and not solely of financial firms. Examples include a series of papers by Rymes (1985, 1987), Haig (1985).

Rymes (1985) argues that a bank deposit is analogous to a share in a mutual fund; this view of the economic function of banks is identical to that in the rest of the national accounts literature, as noted above (see the passage quoted from Bailey). When banks pay out unpriced services to depositors, it is, Rymes asserts, because of regulations--the monetary authorities set reserve requirements incorrectly, and also regulate interest payments. Rymes reasons that regulatory errors ought not to be included in the output of the economy (and accordingly that banks should be eliminated from the accounts). Haig's position is somewhat similar, in that he argues that the services of banks are to be viewed as "facilitating general economic activity" (Haig, 1985), that is, that the measurement issue involves the economic contribution of the monetary system, not the economic functions of individual banks.

Though these papers suggest some issues that have not been considered in the remainder of the bank measurement literature, they do not contribute very much to resolving bank output measurement issues. It is undoubtedly true that the old U.S. "Regulation Q," which imposed ceilings on deposit interest, was evaded by banks' provision of "free" depositor services; but even after the demise of Q's price controls on deposit interest payments, unpriced bank services to depositors remain. Rymes' explanation

for that (non-optimal regulation of banks' reserves) is unconvincing. A reserve requirement greater than optimal is equivalent to a tax on banks, but since banks cannot evade the tax by offering unpriced check cashing (instead of charging for the service), the bank tax cannot be the reason that banks offer in-kind services in payment to depositors.* As Anna Schwartz remarked of one of Rymes' papers (CRIW Savings and Wealth conference, 1987), his model has little or nothing to do with the banking imputation problem, so the "Keynesian" and "Neoclassical" theoretical frameworks he proposes do not advance understanding of banking output.

There are, however, some unexplored issues. An individual bank does not, of course, create money under the fractional reserve system; the banking system does so (regulated or not). The economic theory of measurement (whether price or quantity) is a theory that pertains to an individual economic unit: It is a micro-theory, erected on the assumption of a Marshallian "representative firm," or something similar. Accordingly, in the micro theory of measurement, the money-creation function of the banking system is irrelevant (because money creation is not the function of any individual bank).

However, economic measurements aggregate individual economic units; the extension from the micro-theory to the macro-aggregate is one of the unresolved issues in measurement theory, as it is in the rest of economics. If we want a measurement theory for the aggregate output of banks (and not just for the output of a bank), it is less clear that the money creation activity is outside the range of interesting issues. Perhaps

* It has also been suggested, with more justification, that the personal income tax is connected with banks' payments to individual with services in kind.

money creation of the banking system in the aggregate is something like an externality to the micro-analysis of banks. The only attempt to bring money creation into the bank measurement literature that I know of is the informal presentation of Wycoff (1988), who was unable to wring measurement proposals out of it. Some additional work on this problem appears appropriate.

One example of a macro-measurement theory is Pollak (1981), though Pollak's contribution does not address the present issue.

3. Bank Production Function Approaches

A third approach to measuring bank output arises in the bank regulation literature. Here, the bank output measure is a by-product of dealing with other research problems. For example, if there are substantial economies of scale or economies of scope in banking, large banks would have competitive advantages over small banks, so that bank deregulation might increase concentration in banking. To explore such questions, researchers have estimated explicit multi-output production or cost functions, using either Cobb-Douglas or translog functional forms, where various bank "outputs" (numbers and dollar values of different kinds of loans, for example) and the usual capital-labor inputs are specified. Examples include a series of articles by David Humphrey and a number of coauthors (e.g., Benston, Hanweck, and Humphrey, 1982; Berger, Hanweck and Humphrey, 1985), and Kolari and Zardkoohi (1987). A dozen studies or this kind are surveyed in Clark (1988).

a. The activity approach

One strand of the bank production function literature might be termed the "activity" approach: One simply counts all of the activities of banks.* No distinction is made between inputs and outputs; or perhaps more precisely, anything a bank does--such as accept deposits--is defined as a bank output. Benston, Hanweck and Humphrey (1982, p. 440) remark: "Output should be measured in terms of what banks do that cause operating expenses to be incurred."

Berger, Hanweck, and Humphrey (1987) use in their analysis the number and average size of five types of accounts (demand deposits, time or savings deposits, real estate loans, commercial loans, and installment loans); Benston, Hanweck, and Humphrey (1982) use the same five accounts, aggregated into total bank output with an index number, whose weights are average cost shares. Kolari and Zardkoohi (1987) use several measures, including total loans and total deposits. Kim (1986), using a sample of Israeli banks, specified demand deposits, foreign currency deposits, securities (i.e., brokerage), and loans. The BLS banking productivity measure uses an output concept that is essentially the activity approach--bank output includes counts of loan and deposit activities, which are weighted together, following the usual BLS methodology, by the labor hour inputs associated with the various activities.

In the bank production function literature, authors frequently insert a comment to the effect that it is difficult to determine whether particular activities (one presumes that deposits are the questionable

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* In the bank production function literature, this is, inexplicably, known as the "production" approach, a tradition I have not followed, partly to avoid the confusion that inevitably would arise from having a "production" variant of the "production function" approach.

ones) are bank inputs or outputs. One "wrinkle" identified with the work of Hancock (1985), and followed in a BLS paper by Fixler and Zieschang (1988), eschews determining whether a particular banking activity is an input or an output. In Hancock's banking model, whether an activity is an input or an output is determined by the sign of its derivative in a bank profit function, which she estimates empirically. This empirical approach reflects the notation used for modern production theory, where all of the arguments of the production function are written as a single vector, and inputs are distinguished from outputs according to sign. Hancock reports that time deposits are inputs (which is reasonable), but that demand deposits are outputs. Demand deposits are precisely the bank inputs for which in-kind payment occurs, and such in-kind payments are omitted from Hancock's "price" variable; I thus consider her demand deposit result to be evidence of mis-specification in her model. Further discussion appears below.

b. The intermediation approach

A second production function procedure has been termed the "intermediation" approach. In this case, one distinguishes between banking activities that are concerned with processing the bank's inputs and those banking activities that are properly considered the outputs of a bank.

An example is Mester (1987, p. 428), who assumes, of savings and loan institutions, that "output is best measured by the dollar value of earning assets of the firm, with inputs being labor, capital, and deposits." Three outputs (two types of loans, plus other assets) and three deposit inputs (passbook, NOW accounts, and certificates) were specified. Though

Mester does not incorporate unpriced services (such as unpriced check cashing on NOW accounts) in her empirical work, she subtracts explicit service charges from interest payments by S&Ls in estimating a price for deposits.

Some, though not all, of the intermediation literature--and indeed, perhaps the choice of name--confounds measures of value added with those of output. Thus, "intermediation" may be viewed as the "service" of moving funds between sources and uses, so that net interest is viewed as the banks' (positive) output, rather than the gross interest from loans. Because the same ambiguity arises in the national accounts literature, further discussion is deferred to a special section on value added, in part II.

c. Output in the bank production function literature

Characteristic of the entire bank production function literature, so far as I have been able to determine, is that the banking imputation problem is ignored. That is, whether activity or intermediation approaches are used, measures of bank prices and of bank inputs or outputs do not incorporate the value of unpriced bank services. Some studies do adjust prices for the value of explicitly priced services.

Much of this literature appeals for justification to Barnett's (1980) notion of the "user cost of money." In an insightful comment on Barnett's original contribution, Offenbacher (1980) notes that Barnett assumes that one can "treat regulated own rates of return on monetary assets as the true own rates," in particular, that the interest rate (then zero) on demand deposits was the true price at which banks acquired demand deposits. This comment has been ignored in the bank production function literature apparently because, paradoxically, the replacement of Barnett's assumption (which implied infinite substitution elasticities among certain money

supply assets) with Offenbacher's (which empirically showed the elasticities to be near zero!) made no difference in the results in which the original money-supply researchers were interested. But for measuring bank output, or for bank production function studies, the assumption that banks obtain checking accounts at no cost, or only pay a cost when there is an explicit money interest payment for them, is unsupportable and inappropriate.

Beyond the preceding point, the bank production function literature can be characterized--as can so much of the production function literature on nonfinancial goods and services--as more concerned with the intricacies of production function estimation than with the measurement of the variables employed in that estimation.

4. Conclusion: Three Literatures on Banking Output

Each of the separate literatures on measuring banking provides some insights into banking output. The SNA literature points to the substantial amount of banking output that is unpriced and is rendered in the form of in-kind services to depositors. The activities approach in the bank production function literature points to loans as the primary bank output; moreover, the empirical work that has been carried out so far suggests data sources that can be used for measurement, and documents the relative advantages and disadvantages of alternative data sources. The intermediation approach in the bank production function literature treats deposits as an input to the bank production process.

What is lacking is an overall conception of a bank's economic "production" process that would encompass the unique insights that have been developed in the separate literatures. In the absence of such an integrative model, each of the literatures has flaws, noted above. I propose in

the next section a model of the economic function of banks that will integrate the alternative approaches that have been followed so far, but avoid the shortcomings and confusions that are also present in each body of literature.

II. Proposal

1. Literature Review

The fact of two completely separate sets of economic literature, which do not cite each other and do not overlap, makes an integration essential to assure that contributions from both are put into a common measurement framework. Moreover, any new BEA proposal for measuring banking needs to address an SNA audience; it can hardly expect to get a formal hearing if it does not exhibit familiarity with, and cover the concerns in, the "SNA" literature. The first part of the final paper will consist of a thorough, integrative, literature review.

2. A Proposal for Measuring Bank Outputs and Inputs

It seems straightforward that what a bank does is to buy funds in one market and sell them in another. It "buys" from depositors and pays them for the use of their deposits; and it "sells" to borrowers, from whom it gets its revenue. In this respect, economic analysis of a bank is no more arcane than that of a used car dealer: In both cases, the trick to making a profit is to know where one can buy more cheaply than one can sell.

Consider, for illustration, a simple bank that only makes commercial and consumer installment loans, and whose sources of funds consist only of demand deposits and saving deposits. Demand depositors--only--receive "free" check cashing and use of automatic teller machines (ATM). In addition, the bank rents safety deposit boxes.

This simple bank has three directly measured outputs: The number of commercial loans, the number of consumer loans, and the number of safety deposit boxes (the size of loans--and of the safety boxes--is considered later, where size is viewed as analogous to the conventional price index "quality problem"). The bank also has two unpriced outputs--checks cashed, and automatic teller machine (ATM) transactions--the prices for which must be imputed, though the quantities can in principle be observed. The bank has as inputs the usual capital and labor, plus the numbers of demand deposits and of savings deposits.

This measurement proposal follows the bank production function literature in viewing banking as a multiple output process, which has a number of advantages in focusing attention on what banks do. Loans are outputs of banks (and not transfers, as in the SNA literature), because the interest flows go from the borrower to the bank: The direction of this flow of payment indicates that loans are what banks "sell."

Most of the bank production function literature, however, follows the "activities" approach, which fails to model explicitly which bank activities are inputs and which are outputs. In the present proposal, outputs are distinguished from inputs according to whether the activity generates revenues for the bank or causes the bank to pay for the use of an economic flow.

The treatment of safety deposit boxes is unambiguous: When individuals deposit cash in a safety deposit box, and therefore purchase the service "security," banks charge for the service. Moreover, banks cannot use these funds to earn revenue elsewhere. The security services provided by safety deposit boxes are accordingly unambiguously a bank output.

Savings deposits are one bank input. From the depositor's side, it might appear there are no unpriced services on savings deposits (NOW accounts are assumed not to exist). However, an insured savings account is nearly as secure as a safety deposit box, so there may be a security service that is important to depositors and is not directly priced, except implicitly in terms of interest forgone on more risky types of deposits. However, from the bank's perspective time deposits are distinguished from cash in a safety deposit box by the fact that the bank can use the former funds to earn revenue elsewhere. Thus, the bank makes monetary payments for savings deposits (whether passbook savings accounts or certificates of deposit), where it receives payments for the use of safety deposit boxes. Money payments from banks to depositors can be taken as (almost) the total payment for these bank inputs. One can distinguish among different types of savings deposits, and among deposits of different sizes, maturities, and liquidities as if this were an aspect of the quality problem in price measurement (see the section on "quality," below).

Demand deposits are also a bank input. They differ from savings deposits in that banks pay for the use of demand deposits with in-kind services provided to depositors. In the example, the in-kind services consist of check cashing and ATM services; the value of these services would need to be estimated (this is discussed in more detail below).

Note that value added, in this proposal, consists of the "spread" between what is paid out to depositors in the form of explicit interest and the interest that is received from loans. This differs from both the SNA literature (where the spread is conceived of as the services provided to depositors) and the view that emerges or is implicit in some of the

intermediation literature (where the spread is the services that are provided to borrowers). Further discussion appears in the section on value added. Note also that the unpriced in-kind services, though part of output, are not part of value added--because they are services paid out as compensation for bank purchases from other sectors.

3. Discussion

In the banking literature, whether loans are outputs is controversial, and controversy also surrounds the question of whether deposits are inputs or outputs. A large part of this controversy is, I believe, fueled by confusion that arises because part of bank output is provided, in the form of in-kind services, as compensation to suppliers of one of the banks' major inputs. Stating the matter as I have implies the analytical framework. To help motivate that framework, the following analogy is proposed as a heuristic aid to straighten out what seems unduly murky in the banking literature.

Consider a dairy farm, where some workers are employed in bringing bales of hay to the cows, and other workers are employed in processing and delivering the milk. The activity approach followed in the bank production function literature (and in the BLS productivity measure) would, if applied to dairies, count the number of bales of hay and the number of gallons of milk as output.

Deposits, I maintain, are to a bank what bales of hay are to a dairy farmer. They are inputs. No one would measure the output of a dairy farm by combining hay (even if grown on the farm) and milk, nor measure dairy farm productivity by combining measures of hay per hay-baling worker and milk per milk-processing worker. Similarly for banking: Banking output should count outputs--what banks sell--and not activities,

some of which may involve processing inputs or creating intermediate goods for the banks' own uses. Banking labor productivity should be measured by dividing bank output by all workers and not by dividing each banking activity by the workers employed in it.

Moreover, the rule that "an output is something that contributes to cost" (which has been proposed in the banking literature) does not determine whether an activty is an output: All activities contribute to cost. Distributing bales of hay to the cows involves a cost, but the cost does not make purchased hay an output rather than an input. Bank deposits are similar: The activity of taking deposits generates bank costs, but the fact that deposits require workers and capital to process them does not mean that they are outputs rather than inputs.

The response from the "activity" branch of bank production function researchers might be: The production function will tell you that bales of hay are dairy inputs because they will enter the profit function with a negative sign. This reasoning founders on another aspect of banking--the fact that depositors are compensated in part by in-kind services.

To close the bank-dairy analogy, assume that hay suppliers or dairy workers were paid partly in milk, that is, payment in kind, as are banking depositors. Ignoring payment in kind on the dairy farm would understate the cost of dairy inputs and as well understate farm output. A correct measure involves adding to direct wages the value of milk provided "free" to workers, and also accounting for the gallons of milk provided to workers in the output measure of the dairy. Similarly, I add the value of unpriced check cashing and ATM services to any direct interest "price" paid for deposits, and aggregate the quantities of check cashing and ATM services into the bank's output measure.

Finally, I should note that there is nothing conceptually "wrong" in measuring or exploring the productivity of any activity. For some purposes, the productivity of the hay baling workers or of the workers who process time deposits may be of interest. The point is that one does not obtain the productivity of dairy farms, or of banks, by aggregating the productivity of input activities with the productivity of output activities. This confusion is present in one form in the activity branch of the bank production function literature and in another in the BLS bank labor productivity measure.

4. A New Banking Imputation

In the former U.S. period of regulated banking, it was not possible to produce an imputation for detailed bank services: Interest-bearing accounts and accounts generating in-kind services were disjoint sets. Now, however, this has all changed.

In the present deregulated bank environment, a very large number of different types of bank accounts are offered. Depending on the type of account, the account holder's minimum or average balance, or other characteristics of the account, the account holder may receive varying amounts of interest, and may pay varying monthly amounts in explicit service fees or as explicit charges for check cashing and other services. Conversely, depending on the type of account and the characteristics of the account, the account holder will receive varying amounts of "free" services, such as check cashing and the like.

Thus, the account holder's nominal monthly cost of a bank account may be positive or negative, depending on whether the explicit charges for bank services are greater or lesser than the explicit interest earnings

paid on the account's balances. But the the true monthly cost of a bank account differs from the nominal cost, and requires imputing values to the number of "free" checks and also to the implicit monthly service charge.

Two possible imputation methods present themselves. Some accounts contain explicit check cashing charges. One could value "free" check cashing in accounts which have this privilege by using the explicit charges where these are assessed, and similarly for monthly charges.

However, it is generally the smaller accounts where explicit check cashing charges and explicit monthly service fees appear. For a variety of reasons, the price for such services is probably not constant across all sizes of accounts, so that using the explicit charges would (probably) overstate the value of the unpriced services.

As an alternative approach, one can view the monthly cost of a bank account as consisting of charges for a "bundle" of priced and unpriced services. We assume that the net, total return to the depositor will be equal across various kinds of accounts (e.g., a "NOW" account with limited free check cashing and explicit interest, compared with a "normal" checking account with unlimited check cashing and no explicit interest payments). The imputed payments that the bank makes for unpriced services come from the imputed interest the depositor forgoes relative to an account of a similar size where explicit interest is paid. A hedonic model is accordingly a natural tool for disaggregating the bundle of priced and unpriced banking services and payments.

Empirically, the banking hedonic model differs from the one encountered in most price index literature (see Griliches, 1971). In the customary

model, the value of the transaction is known and appears on the left hand side of the equation (e.g., the price of an automobile); though the quantities in the characteristic bundles are known, none of the characteristics prices are known, and therefore all must be estimated. In the banking case, the total value of the transaction is not known (because it includes imputed services), only the explicitly priced portion of the transaction is known; prices for some of the elements in the bundled transaction are known, but others are not.

A model sharing many of the banking model's properties appears in labor economics. Researchers have been interested in determining the "trade offs" between nonpecuniary benefit portions of compensation--or between improvements in working conditions--and direct wage payments. See Smith and Ehrenberg (1983), and Thaler and Rosen (1976). In these labor market cases, the full value of the transaction (the value of total compensation) or of "full income" (the worker's opportunity locus--see Atrostic, 1981) must be imputed by determining a valuation for the unpriced elements of compensation; a hedonic or quasi-hedonic approach has been used in these studies.

A crucial assumption for the labor economics work is that workers will trade compensation for nonpecuniary components (not necessarily on a dollar-for-dollar basis--see Triplett, 1983b), so that the value of the nonpriced components may be inferred from variations in wages associated with quantities of the nonpecuniary elements. A parallel assumption is that bank account holders choose the type of account that, given their estimated usage, minimizes the full cost of the account (rather than minimizing explicit charges or maximizing explicit interest receipts). Though there are some seldom-acknowledged problems with the application of the hedonic model in these situations, the parallels are close enough to provide a

suggested starting point for developing the hedonic model for banking imputation.

As is typical with hedonic studies, obtaining appropriate data is a problem. It appears that the data used for the bank production function studies (see above) lack the appropriate detail. Thus, full implementation of a hedonic model for banking imputation would entail a direct, dedicated data collection. For exploratory purposes, I propose collecting the publicly available price lists, or account descriptions, from a sample of local commercial banks and S&Ls. This will still not provide some of the quantity data that are desirable, but I have not spent much time at this stage of the project on the data issues.

ATM's pose special problems of two types. First, although initial introduction of ATM's offered the service to some accounts and not to others (thus fulfilling a requirement for estimating a hedonic model), my impression is that ATM's are now almost universal across different types of accounts. If there is no variation in a particular variable, one cannot estimate its hedonic price. Moreover, when ATM's were introduced, banking regulations were still in full force (no interest on checking and no checks on interest bearing accounts), so that hedonic models also could not be employed for the historical period when ATM's were not universal.

A second problem is conceptual: It appears possible that the resource cost value of ATM service, relative to its closest alternative, would go in a different direction from a user value measure. For example, it is clear that account holders for the most part regard ATM's as an increase in convenience (transactions outside of normal banking hours) or as time saving (relative to waiting in teller lines). Hence, the move from exclusively teller service to ATM's might be regarded as either greater

utility or lower cost--bank output should go up and bank price indexes fall. However, it is my impression that banks originally brought out ATM's not so much to offer customers additional services (though, of course, if the customers had not perceived the ATM's as an additional service, the ATM would not have gained acceptance), but rather to relieve themselves of serious peak load, mid-day demands on teller services. Thus, from the bank's perspective, ATM's were cost saving, not costly; the standard interpretation of output quality change from the producer's side implies evaluation by resource cost in production (see Triplett, 1983a).

The ATM conceptual issue thus backs into a more fundamental question: What concept is wanted in the National Income and Product Accounts? For banking industry output (for example, in the input-output tables, or for the output portion of a double-deflation calculation of GNP originating) the standard interpretation of industry output is appropriate. If ATM's were introduced to save on bank labor, this already will show up in bank productivity numbers, and an additional output adjustment risks double counting. On the other hand, banking in the personal consumption expenditures (PCE) portions of the NIPA's requires an input measure (that is, input into consumption), and therefore evaluation of "quality change" by a user value criterion (Triplett, 1983a).

Though resolution of such conceptual problems runs too far afield for the purposes of the present paper, some additional attention to these matters will be undertaken in the final paper.

5. Quality Problems in Bank Output Measurement

In the bank production function literature, authors take different positions with respect to the metric in which loans and deposits are being measured. Some researchers, for example, use the numbers of accounts, without any attention to their size. The BLS banking productivity measure follows this lead. Kolari and Zardkoohi (1987), on the other hand, state the case for using total dollars of loans and deposits, and ignoring the number of accounts. More typically, researchers enter into the production or profit function both the numbers of the various accounts and their dollar values, treating them as separate variables.

Viewing the various positions taken by researchers in the banking literature from the perspective of the price index measurement literature helps resolve the points at issue. It is clear that, both for the bank and for its depositors or borrowers, the size of the account matters. The size of a bank account is analogous to the "package-size problem" in the conventional price index literature--that is, account size is, in the context of a price or output measurement program, a "quality problem."

When both quantities of accounts and their dollar values are entered into a bank production function, this procedure can be interpreted as entering both the quantity (the numbers of accounts) and the "quality" (the dollar values) in the same regression. On this interpretation, the procedure followed in the banking literature has very old antecedents in the price and consumer demand literature (for example, Houthakker, 1952, discusses use of measures of quantity and scalar "quality" in consumer demand research).

Other quality problems in banking measurement involve the liquidity of various deposits, the riskiness of different classes of loans, etc. Liquidity, or safety, or size are aspects of the quality of bank inputs, or of the unpriced service. Accounts greater than $100,000, for example, are probably considered more desirable by banks, but less desirable by depositors (because the Federal insurance guaranty covers only the first $100,000).

Quality problems in measuring bank output do not seem different from, or more intractable than, those problems faced in the conventional literature, and could probably be handled in conventional ways. One conventional option is to subdivide all of the units (such as different classes of loans) in an attempt to get more or less homogeneous groupings. The prices and quantities of each of the groupings or categories or "qualities" are treated as if they were separate goods. A second alternative is some sort of hedonic function, which would estimate the interest rate "price" associated with liquidity, riskiness, and so forth.

The final version of this paper will explore the quality issues more thoroughly.

6. Output and Value Added Problems

It was noted above (section I) that in two of the literatures on banking, output (alternatively, value added) is conceived of as the service of moving funds from one sector to another. In the national accounts literature the service is provided to bank depositors; in the intermediation literature, the service is provided to bank borrowers. In both cases, the service would be measured by the spread between borrowers'

and depositors' rates.* In the present proposal, the spread is regarded as value added (or value added per "unit"), and not the output measure itself.

What we call output and what we call value added is partly a view of the economic or production process, and partly a matter of pure definitions, but is largely a distinction that rests on institutional matters of ownership and business custom.

It may be true, as sometimes asserted, that the distinction between output and value added is more obscure or more ambiguous in the case of services than it is in the case of goods. Hill (1977) noted that a repair "service" could be thought of as a production process that has as one input a repairable good, and as the output the repaired good. Consider a car mechanic who buys "junkers" and fixes them up for resale: The output is the operating car, the junker is one input, and value added is the difference between the price of the junker and the price of the repaired car. If the mechanic performs the same services on a car owned by someone else, what was value added when the mechanic owned the junker appears as the output of his shop, viewed as a "service" establishment.

* An additional complication is that in a good part of the SNA literature on banking the terms "output" and "value added" are frequently used as synonymous (because only the value added portion of an industry's output goes into the calculation of gross domestic product).

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