OUTPUT MEASUREMENT FOR THE BANKS: A REVIEW AND ILLUSTRATION OF THE VARIOUS APPROACHES

Tarek M. Harchaoui

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Article abstract

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ABSTRACT

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JEL Classification Number: G2

RÉSUMÉ

Les banques jouent un rôle vital dans l'économie en tant qu'intermédiaires financiers et agents principaux du système de paiements. Au Canada, comme dans plusieurs autres pays, les banques constituent d'importants fournisseurs de services financiers. De plus, les effets extérieurs générés par les banques à travers leur rôle de premiers intermédiaires financiers, rôle qui représente le fil conducteur de la politique monétaire, justifient amplement l'intérêt d'exiger à leur égard une protection et une supervision gouvernementale substantielle. L'un des aspects les plus problématiques face aux comptes nationaux est de mesurer le produit final afférent au secteur bancaire. Cet aspect a toujours représenté une problématique particulière considérant qu'il n'existe pas de consensus ferme sur la définition du produit financier final. Tels sont les buts de cet article de revoir et de démonter les différentes approches qui existent actuellement en prenant l'expérience canadienne comme toile de fond.

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The author:

Tarek M. Harchaoui is economist at Statistics Canada.

■ INTRODUCTION

Recent developments in financial markets such as deregulation, securitization, globalization, financial instability and the generally growing importance of financial services in economic activity in the advanced countries have all put an increasingly sharp focus on the activities of banks. One of the most problematic areas facing economists is in measuring the output accruing to the financial services (most notably banking) sector. This has always been an especially difficult undertaking since there exists no firm consensus as to what constitutes financial output.

The best example of this difficulty is in classifying one of the sector's largest and most widely used product, the demand deposit. Should a demand deposit be classified as an output or input? On the one hand, demand deposits serve as the raw material used for making loans. Should they therefore be classified as an intermediate input? The question is complicated by the fact that demand deposits also provide certain streams of services to depositors, over and above any simple interest paid on deposit balances. Depositors place value on the record keeping, safekeeping, and chequability characteristics of demand deposits. Further complicating the issue is the fact that these services are generally supplied without a corresponding explicit service charge. That is, bank's recover costs implicitly from the differential existing between demand deposit and loan rates of interest (the spread). In this light, demand deposits are clearly a service sought out by and paid for by depositors, and thus, they are properly classified as an output.

The appropriate method of measuring output for banks is controversial. However, financial intermediaries show many similarities to other firms producing goods and services. They use labour, capital and goods and services of all kinds purchased from other industries. There is much evidence that they behave and are motivated by the same factors as other firms that produce goods and services. Much confusion results from the fact that many services are paid implicitly. These problems must be overcome by developing a clear conceptual framework and then by devising solutions to the measurement problems.

Despite all the difficulties surrounding the measurement of banking output, it is important to examine the problem of measuring output in the banking services, as it constitutes 20 percent of GDP of the finance insurance and real estate sector (net of owner-occupied housing). In addition, the externalities that banking generates through its role as the nation's primary financial intermediary

and conduit for monetary policy are considered to be enough to require substantial government protection and supervision. Correspondingly, this paper attempts to review the issue of measurement of banks output with a special reference to the Canadian experience.

The remainder of the paper is organized as follows: Section II describes the various types of services provided by banks and section III overviews the different approaches currently available for measuring banks (nominal) output and illustrates each of them by using simple examples based on banks accounting records. Section IV discusses the issue of measuring real output and provides some avenues to overcome the lack of reliable price deflators for bank services. Section V concludes this paper.

■ BANK SERVICES

In our analysis, the financial firm (bank) may be thought of simply as a profit maximizing firm engaged in the production of intermediate services between borrowers and lenders. Basically, the bank serves as a conduit for surplus loanable funds. From the depositor's perspective, banks offer a number of desirable services. First and foremost, the bank acts broadly as the depositor's portfolio manager, locating a productive (interest earning) use for the depositor's idle cash balances. This service is very important to depositors who (faced with information asymmetries and diseconomies of scale) have neither the time nor expertise to identify productive, risk-free uses for its idle cash. Therefore, a bank locates a productive use for these balances, paying the depositor interest on deposits. However, it must be remembered that the bank does not explicitly charge depositors (in the conventional sense) for this intermediary service. Rather, payment is recovered through the interest differential existing between borrowed and loaned funds.

In addition to these intermediary services, banks provide other valuable services to the depositor (see table 1). Demand deposits are bundled with sets of record-keeping, safe-keeping, and payments services that are also without explicit charge. Chequable demand deposits (and now, automatic bank and teller machines (ATM) and point-of-purchase debit cards) offer a simple, convenient payments feature that may or may not be explicitly charged for (most demand deposits offer a set number of "free" cheques per month). Further, regular balance and transaction statements, passbooks, and ATM's

also provide valuable services to depositors. While explicit service charges generally exist for chequing services and ATM transactions, other services (passbook updating, monthly statements) carry no explicit service charge while certainly incurring input costs for the bank. Once again, fees for these services are derived from the interest spread earned by the bank. Other services include safe-keeping (no explicit charge), traveler's cheques services (explicit charges in most cases), and currency exchange (also explicitly charged for).

On the asset side, banks provide a number of services. First and foremost, their intermediary services (locating loanable funds for borrowers) in the areas of mortgage loans, credit card loans, commercial and agricultural loans, lines of credit, banker's acceptances, call and day loans, and other personal and business loans. Some types of loans/guarantees carry explicit service charges (i.e. stamping fees levied against banker's acceptances, annual fees on revolving lines of credit) and other charges for loan services (i.e. balance requirements, bundling with payment services). However, a great deal of services carry no explicit service charges, but implicit charges once again recovered from the interest spread. The important distinction here is between those services explicitly charged-for, and those implicitly charged-for.

■ MEASURING BANK OUTPUT

☐ Overview

The process of intermediation can be organized in a variety of ways. It may occur through deposit intermediaries (say banks) or through market intermediaires (agents and brokers). In many instances marked differences of form among intermediaries may have little significance with respect to the processes performed by these intermediaries and their economic importance. To the extent that similar services are performed in apparently different forms, they should be treated in a like manner in the national accounts. A problem arises for national accounting because of the differences among intermediaries in the way they charge for their services. The form of payment for market intermediaries is relatively uncomplicated as they charge an explicit fee for their services. In contrast, the payments to banks is much more complex. Sometimes they charge an explicit fee which constitutes the total payment for their services; at other times, they are paid through the spread between lending and borrowing rates.

TABLE I		
MAJOR TYPES OF BANK SERVICES		
LOANS (ASSETS)		
Mortgages	– CMHC Insured Residential Mortgages	
	– Other Residential Mortgages	
	– Non-Residential Mortgages	
Individual	– Personal Loans	
	– Credit Card Loans	
	– Other Personal Loans	
Business	– Business And Other Commercial Loans	
Other Loans	– Day, Call, Short Loans	
	– Bank Loans	
	– Provincial Loans	
	– Lease Receivables	
DEPOSITS (LIABILITIES)		
Demand	– Individual PCAs	
	– Banks	
	– Government Balances	
	– Other Demand Deposits	
Personal	– Chequable Daily Deposits	
	– Chequable Other Deposits	
	– Non-Chequable Daily Deposits	
	– Non-Chequable Other Deposits	
	– Fixed Deposits	
Non-Personal	– Chequable (Banks, Government, Other) Deposits	
	– Non-Chequable (Banks, Government, Other) Deposits – Fixed (Banks, Government, Other) Deposits	
OTHER SERVICES (EXPLICITLY CHARGED-FOR)		
	– Currency Exchange	
	– Traveler's Cheque Services	
	– Money Orders, Certified Cheques, Bank Drafts	
	– Safety Deposit Box Rental	
	– Commercial Services (corporate payments, banker's acceptances)	
	– Underwriting Fees, Consulting Fees	
	– All Other Explicitly Charged-For Services	

The present methods of national income accounting require the use of an imputation to produce a measure of the output (value added) for banks. This imputation is required because of the present treatment of interest in the national accounts. Since the inception of the national accounts financial capital been seen as a factor of production

– in conformity with the way physical capital was in conventional production functions. By implication, interest is being seen as a factor payment for the paying sector and as a transfer for the receiving sector and not as operating expense and revenue, respectively. Thus, for GDP purposes, interest payments are added and interest receipts are substracted to arrive at sector's operating surplus.

Yet, the SNAs distinguish between "productive" and "unproductive" interest. The former contains interest payments associated with the business sector, mortgages, foreign-held public debt and the "administrative part" of consumer debt and is included in GDP; the latter contains interest payments for the remaining part of the consumer debt and those made to resident holders of the public debt and is not included in GDP (see Statistics Canada 1990).

Adherence to this treatment of interest creates a serious anomaly in the accounts. Net interest payments are counted as output of the paying sector on the production side – value added being equal to wages and salaries plus operating surplus – and as distribution of surplus of the income side. Accounting consistency requires that this practice be carried out across all sectors of the economy. This, of course, implies that the banking sector would have an extremely low or even negative output – depending, mainly, on the magnitude of the explicit charges on depositors and borrowers. This is so because, by and large, banking output is not paid for by explicit prices but rather through net interest paid by clients and received by banks which, by the working convention, must be subtracted. The fact that net interest received by the banking sector is the mirror image of net interest paid by all the other sectors combined, attests to that the measured economy-wide output be lower than the true output by the value of the final consumption of banking services. The undesirability of having such an output measure for the banking sector has led to the problem of imputation.

Based on the logic that banks and depositors short-circuit the market by "bartering" services for foregone interest instead of having explicitly quoted prices for them, an imputed value for these services is arrived at. In other words, it is presumed that lower interest is paid on deposits than would have been paid if depositors had to pay for all the services the banks provide them with. Logically, the spread between the interest paid on deposits and that received from loans, plus the explicit charges, exactly equals the total market value of the services provided by banks, to both depositors and borrowers.

Other attribute the need for the imputation to the regulation of banks (Rymes 1985, 1986). The presence of reserve requirements – on which the central bank does not pay competitive interest – and the imposed caps on explicit bank charges distort the market mechanism and result in non-optimal monetary arrangements and cause the banking puzzle. Under perfect markets, there would be no interest rate spread and all services would be explicitly charged – since all deposits would be loaned. Also, at equilibrium, the marginal "physical" product of high-powered money (reserves with the central bank) would be zero. Under such a scenario, no need for imputation arises. Although there is little doubt that regulation affects the way the banking business is carried out, it cannot be thought of as being the cause for the imputation in the same sense the treatment of interest does. It may be necessary but certainly not a sufficient condition. After all, many other industries are regulated and the same question has not even been asked.

The "banking dilemna" has been described by many as one of the most controversial issues in national accounting. Several objections to the existing treatment have been voiced over the years (e.g., Speagle and Silverman 1958; Ruggles and Ruggles 1982). The most extreme suggests the alternative of viewing all interest as payment for services and treating it accordingly (Sunga 1967, 1984) (see Fixler and Zieschang 1991 for a review). Acceptance of this view of interest would not seriously affect the aggregate accounts compared to the imputation method. For instance, all debt would be viewed as production with corporate debt an input to production and consumer debt final consumption. The value-added by non-financial industries would be reduced. However, this would necessitate the creation of a productive (vs. consumptive) household sector.[1]

Others such as Hancock (1986) and Fixler and Zieschang (1991) suggest a more middle-of-the-ground approach based on the microeconomics of the financial firm. Their user cost approach determines whether a financial product is an input or an output on the basis of its net contribution to bank revenue. If the financial returns on an asset exceed the opportunity cost of funds or if the financial costs of a liability are less than the opportunity cost, then the instrument is considered to be a financial output. Otherwise, it is considered to be a financial input.

The next section illustrates the imputation approach and the user cost approach, as the two most important contributions to the issue of banking output. The former differs from the latter in that it considers all liability and asset categories to have some output

characteristics rather than distinguishing inputs from outputs in a mutually exclusive way. A significant difference from the user cost approach is that the value added approach explicitly uses operating cost data rather than determining these costs implicitly as that part of the return or cost not accounted for by the difference between measured financial flows and marginal opportunity costs (see section III.3 for a comparison between the various approaches).

☐ Illustration of the Approaches

A – The Value Added Approach

The value added approach to the calculation of national income measures the output of any sector by the sum of payments that it makes for productive inputs. These payments include wages and salaries, rent, interest and profit. Any payments to other firms for their products are not included and are treated as payments for intermediate inputs. The use of the value added approach avoids double counting in the contribution of different enterprises in the production of final output.

a) **The Nature of the Problem.** The current SNA approach to measuring bank output builds on the foundation of the SNA. Gross domestic product at factor cost originating (GDPO) in an industry is the sum of labour and property income accruing from that industry's production, gross of depreciation. This is also equal to income

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TABLE 2
THE REPRESENTATIVE BANK'S INCOME STATEMENT

REVENUE	
Mortgage Interest Received (@ 8%)	1,760
Commercial Interest Received (@7.25%)	2,247.5
Explicit Mortgage Charges	110
Explicit Commercial Charges	125
Explicit Demand Deposit Charges	85
Explicit Time Deposit Charges	60
Total Explicit Charges	380
Gross Revenue	**4,387.5**
EXPENSES	
Labour	850
Demand Deposit Interest Paid (@2.5%)	212.5
Time Deposit Interest Paid (@3.5%)	392
Other Expenses	1,000
Earnings Before Income Taxes	**1,933**

accruing from production less intermediate inputs. The present convention of treating net interest paid as part of GDPO leads to an anomaly in the case of banks which receive more interest than they pay out (which is more often than not the case). Consider the following income statement of a representative bank to illustrate this anomaly.

The bank receives 4,007.5 interest on loans, as well as 380 in various service fees (ostensibly for services such as corporate payments, cheque handling, ATM fees etc.). Our bank has expenses of 850 for labour, 1,000 for selling, general and administration, and interest paid on deposits of 604.50, leaving profits of 1,933. Using this data, GDPO is calculated as (see table 3.1) labour income (850) plus profit (1,933) less an adjustment for net interest received (3,403), which leaves GDPO of -620. From this, it is clear that GDPO will be negative if service charges are less than intermediate purchases. In Canadian System of National Accounts (CSNA), this negative figure is adjusted to restore GDPO to a positive figure.

b) **Imputing the value of implicit services**. The standard analysis begins from the observation that banks receive the bulk of their receipts for the services they perform from net interest received and not from the levy of explicit service charges. Depositors are partly reimbursed for the use of their funds in the form of services for which no explicit charge is made and partly reimbursed via

TABLE 3.1 MEASUREMENT OF GDP IN THE BANKING INDUSTRY	
REVENUE	
Interest received	4,007.5
Service Charges	380
Gross Revenue	**4,387.5**
EXPENSES	
Labour Expense	850
Selling, general & Administration	1,000
Deposit Interest Paid	604.5
Total Expenses	**2,454.5**
GDP ORIGINATING	
Labour Income	850
Profit (before taxes)	1,933
Plus: Interest paid	604.5
Less: Interest received	-4,007.5
GDP	**-620**

explicit interest payments. This short-circuiting of the normal market process (in the sense that bank services are bartered in exchange for deposits) justifies an imputation for the value of the "free services" to depositors and the imputations is added to bank GDP originating. The practice is to use net interest received by banks as an estimate of the value of "free" services provided to depositors. The results of adding this imputation are shown in Table 3.2.

As mentioned above, depositors barter away a part of their interest "entitlements" in exchange for a certain set of bank services. In recognition of this, the CSNA adds a figure on the income side (of the income and expenditure accounts) for imputed interest received by deposit holders, while on the expenditure side, an identical imputed value is added in the guise of "bank services purchased."

c) **Parallel with the Measurement of Property and Casualty Insurers' Output.** The traditional approach to the measurement of

TABLE 3.2
MEASUREMENT OF GDP WITH IMPUTATIONS
IN THE BANKING INDUSTRY

REVENUE	
Interest received	4,007.5
Service Charges	380
− Imputed service charges to depositors (Net interest income)	3,403
Revenue (paid and imputed)	**7,790.5**
EXPENSES	
Labour Expense	850
Selling, general & Administration	1,000
Deposit Interest Paid	604.5
− Imputed interest paid to depositors (equals imputed service charges to depositors)	3,403
Total Expenses	**5,857.5**
GDP ORIGINATING	
Labour Income	850
Profit (before taxes)	1,933
Plus: Interest paid	
Cash	604.5
Imputed	3,403
Less: Interest received	-4,007.5
GDP	**2,783**

property and casualty (P&C) insurers' gross output is (see Harchaoui 1997 for more details)

$$\text{Gross Output} = \text{premiums} - \text{Claims},$$

and

$$\text{GDP} = \text{Gross Output} - \text{Intermediate Expenses}.$$

However, it is not uncommon for GDP to be negative. The P&C industry's financial health is preserved by net receipts of investment income which are not included in the traditional approach of GDP originating in the industry.

P&C insurers perform a joint activity: a "pure" insurance activity where premiums are received prior to the payment of claims. The other activity is a financial intermediation activity, arising from the fact that premiums are paid in advance of claims. The interest income earned on these premiums need to be added to interest receipts and expenditures of the insurance firm. This argument parallels the argument for imputed interest in the banking industry. In both banking and P&C insurance, the industry is bartering services for the use of customers' funds.

A simplified example is presented in Table 4 which reports figures for the Canadian P&C industry. For the purpose of illustration, the average rate of return on the industry's investments is used as a proxy for the rate of return. The imputed interest income recorded in Table 4, which equals the imputed premium payments by policyholders, is estimated as the proportion of reported investment income of the industry attributable to policyholders. This proportion is the ratio of liabilities to policyholders (unearned premiums plus additional policy reserves plus provisions for unpaid claims) to total liabilities plus equity. This ratio is 0.62.

As shown in Table 4, the results of the proposed imputation are rather substantial, almost doubling GDP from $619 million to $1,056 million. The effect on surplus as calculated in the CSNA is even greater, increasing it from $97 million to $534 million. Since the CSNA surplus figure for this industry has been negative in about fifty percent of recent years, the effect of the proposed imputation would be to eliminate an anomalous result very similar to the anomalous negative surplus which would be recorded for banks in the absence of the imputations made by the CSNA for that industry. The effect of the new treatment of P&C insurance on aggregate GDP would be to raise it by about one tenth of one percent via increased investment income of persons of about $218 million and

	1968 SNA	IMPUTATIONS	1993 SNA
TABLE 4 **EFFECT OF THE 1993 SNA ON THE MEASUREMENT OF PROPERTY AND CASUALTY INURANCE GDP**			
Gross Output (premiums earned less claims incurred)	2,184	437 (imputed premiums)	2,621
Less Intermediate Expense	1,564		1,565
GDP	619		1,056
Less Labour Expense	522		522
Surplus (underwriting gain)	97		534
Add Interest received	706		706
Subtract Interest paid	3		440
Reported Profit (underwriting gain *plus* net interest received)	800	437	800

increased personal consumption expenditure on insurance services of the same amount. This follows from the fact that very nearly fifty percent of cash insurance premiums (and therefore of imputed premiums) are paid to the personal sector with the remainder almost entirely allocated to the business sector. The imputed value of insurance services to business changes the industrial distribution of output in favour of the property and casualty insurance industry and does affect aggregate output.

d) Banks in a Hypothetical Economy with All Service Charges Explicit. To make things more clear, let us apply CSNA procedure to our bank, but with the additional assumption that all services are explicitly priced. In our simple example, depositors are paid the same "pure" rate of interest as that paid by borrowers. Further, banks make explicit service charges for every service performed (both deposit and loan). Basically, borrowers pay service charges associated with the loan (i.e. handling charges) as well as the rate of pure interest. A depositor is paid this same pure rate, and explicit service charges are levied for all services provided. Returning to our example (see table 5), of the 4,242.5 paid by borrowers to banks, 1,783 represents service charges (this is simply an arbitrary figure for explanatory purposes) levied to cover loan costs, while the remaining 2,459.5 (representing a pure rate of 4.64%) is pure interest passed on to depositors. Depositors are charged explicit service charges of 2,000 (once again, an arbitrary figure).

The figures in table 5 parallels the current CSNA conventions. Techniques used in the CSNA therefore recognize bank services to borrowers (not just lenders). Banks themselves pay very close attention to the costs of servicing a loan (over and above the basic cost of funds) when loan rates are set and it is this attention that enables national income accountants to estimate imputed values of deposit as well as loan services.

A bank's traditional source of revenue has always been the interest margin, or spread. While revenue from explicit service charges has been a growing source of revenue (due to diversification into non-traditional financial services, expansion in services offered, recent changes to the types of services that are explicitly charged-for), net interest still makes up the majority of a bank's revenue. The main measurement problem encountered is the indirect method of paying for banking services, which is in itself, related to the appropriate treatment of interest (both paid and received). In the case of banks, the SNA recognizes that net interest received by banks represents the value of services performed by the banks, for which there is no explicit charge (as has already been discussed), normally referred to as imputed bank service charges.

TABLE 5
MEASUREMENT OF GDP IN THE BANKING INDUSTRY
WITH ALL SERVICE CHARGES EXPLICIT

REVENUE	
Service Charges to Borrowers	1,783
Service Charges to Depositors	2,000
Pure Interest Received from Borrowers	2,459.5
Revenue	**4,387.5**
EXPENSES	
Labour Expense	850
Selling, general & Administration	1,000
Pure Interest Paid to depositors	2,459.5
Total Expenses	**4,309.5**
GDP ORIGINATING	
Labour Income	850
Profit (before taxes)	1,933
Plus: Interest paid	2,459.5
Less: Interest received	-2,459.5
GDP	**2,783**

B – The Pure Interest Approach

Banks can be viewed as providing three main categories of services: loan services, deposit services, and other services. When depositors buy demand deposits from banks, they are essentially bartering part of their expected interest entitlement away in return for the provision of other services (already described in detail above). The interest rate that depositors are paid is assumed to be lower than otherwise by the amount of these free services. Essential to this view is the assumption that there is an intermediate interest rate between deposit and loan interest rates that represents the "pure" rate of interest. This rate is pure in the sense that it is the price to rent funds without any loan or deposit intermediation charges. Thus, the interest rate paid to depositors is the pure interest rate less the value of deposit-related intermediary services. For loans, the interest payments are assumed to include the pure rate plus explicit service charges related to the loan. Thus, we have:

$$u_d = i + f^d - i^d$$
$$u_l = i^l + f^l - i, \tag{1}$$

where

u^d = nominal rate of deposit services,

u_l = nominal rate of loan services,

i = pure rate,

i^l = nominal interest received on loans,

i^d = nominal interest paid on deposits,

f^l = explicit loan charges,

f^d = explicit deposit charges,

and nominal values of services are

$$V_d = u_l \cdot D$$
$$V_l = u_d \cdot L, \tag{2}$$

where V_j = Nominal values of services $j = D$(deposits), L(loans).

We may consider an example here based on the hypothetical simple bank described in table 2. In order to add an element of realism, we assume different rates for different types of loans/deposits, and a lower rate on deposits. Although explicit service charges are assigned to various loans and deposits we may aggregate these charges into a total explicit service charge figure. We assume that

TABLE 6
BALANCE SHEET FOR A HYPOTHETICAL BANK

CURRENT ASSETS		CURRENT LIABILITIES	
Mortgage Loans	22,000	Demand Deposits	8,500
Commercial Loans	31,000	Time Deposits	11,200

all liabilities and assets are current, and that equity income may not be loaned out.

Using published interest rates is not appropriate since they do not reflect actual levels of interest that would result from various maturities of loans and deposits with different term's. Therefore, rather than using published rates we may calculate loan and deposit rates using values of interest paid or received divided by the corresponding average loan or deposit balances during the period (averages are used since they more accurately reflect deposit or loan values than beginning or end of period values). Thus

$$i^l = \frac{I_t^l}{L_t}$$

$$i^d = \frac{I_t^d}{D_t}.$$

(3)

Another area of concern is in calculating the pure rate of interest. The pure rate may be calculated in many different ways (i.e. highest rate on loans, lowest rate on deposits, average of all interest rates on loans and deposits). An attractive method is to use a weighted average rate of interest on loans and deposits seems to function best. Alternatively, banks usually have an internal method of assigning interest received on loans and paid on deposits, calculating a net interest rate for loan and deposit products. This data may be used in estimating the pure rate.

Using the financial statements of our sample bank (tables 2 and 6), we may estimate our pure rate as a weighted average of all rates, where weights are the proportion of the specific (i.e. mortgage or commercial; demand or time) stocks of loans and deposits outstanding. Our weight for the mortgage class of loan is determined by $22,000 \div 72,700$, which equals 0.3026; for commercial: $31,000 \div 72,700 = 0.4264$; for demand deposits: $8,500 \div 72.700 = 0.1164$; and for time deposits: $11,200 \div 72,700 = 0.1541$. Our pure rate calculation proceeds as follows:

$$(0.3026\times0.08)+(0.4264\times0.0725)\times(0.1164\times0.025)\times(0.1541\times0.035)$$
$$=0.06341.$$

Multiplying our weights by their corresponding interest rates (i.e. the demand deposit weight multiplied by the interest rate paid on demand deposits) and summing yields a pure rate of interest of 6.341%. We may now calculate our nominal rate of loan services as:

$$0.0756 + 0.00443 - 0,06341 = 0.01662,$$

where 0.0756 represents a weighted average of loan interest rates (i.e. proportion of mortgages as percent of total loans multiplied by mortgage rate of interest plus proportion of commercial loans as percent of total loans multiplied by commercial loan rate), 0.00443 represents the explicit loan service charge rate (found as total explicit service charges divided by total loans outstanding), and 0.06341 is of course, our pure rate of interest.

On the deposit side, we calculate a weighted average deposit rate (demand deposits divided by total deposits yields a weight which is multiplied by the demand deposit rate of interest and added to a similar calculation for time deposits to yield a weighted average deposit interest rate of 0.0307, or 3.07%); and an explicit deposit service charge rate (total explicit deposit service charge income divided by total stock of deposits outstanding, yielding a service fee rate of 0.00736, or 0.736%). Proceeding, our nominal rate of deposit services is calculated as:

$$0.06341 + 0.00736 - 0.0307 = 0.0401.$$

Treating these nominal rates as prices to be multiplied by our stocks of loans and deposits outstanding, a nominal value of all services is

$$(0.01662 \times 53,000) + (0.0401 \times 19,700) = 1,670.83.$$

Thus, we have a nominal output figure for our sample bank of $1,670.83. A weighted average explicit charge rate would be preferable (i.e. weighted in tenns of relative sizes of loan or deposit service that the fees are applied to), although our simple average rate illustrates the concept without detracting from the simplicity of the method.

C – User Cost Approach

A number of bank services may arguably be viewed as intermediate inputs as well as final outputs (for example demand deposits and data processing services). The user cost approach may be used

to determine whether a financial product is an input or an output on the basis of its net contribution to bank revenue. If the financial returns on an asset exceed the opportunity cost of the funds used to purchase the asset, or if the financial costs of a liability are less than the opportunity cost of money, then the instrument is considered to be a financial output; otherwise it is considered to be an input. Thus, the user cost approach offers a method of determining whether or not a product is an input or output.

The user cost of a bank service is the appropriate characterization of the financial services price since it measures the economic return to the bank for providing the financial service. The form of a service's user cost depends on its asset/liability status. User cost for the $j-th$ asset in period t is found as

$$u_{aj}^t = \rho - \left(r_{aj}^t + c_{aj}^{t-1} + s_{aj}^t - \ell_j^t \right), \qquad (4)$$

where:

ρ = opportunity cost of capital

r_{aj}^t = interest rate received

c_{aj}^{t-1} = ex-post capital gains

s_{aj}^t = service charges applicable (expressed as a rate)

ℓ_i^t = provision for loan losses

The user cost $j-th$ for the liability in period j is found as

$$u_{lj}^t = \left(r_{lj}^t + d_{lj}^t + k^t \rho - s_{lj}^t \right) - \rho \qquad (5)$$

where

r_{lj}^t = interest rate payable

k^t = reserve requirement (if applicable)

s_{lj}^t = service fees applicable (expressed as a rate)

d_{lj}^t = deposit insurance premiums.

Within this framework, we may now make the following statements: If the user cost is negative then the service is an output (since it contributes to output), while if the user cost is positive then the service is an input. These user costs of nominal rates per dollar of a financial product may now be used as financial services prices.

User costs incorporate non priced for financial services. We can see this by considering the following example. Assume a bank provides one asset (earning an interest rate of r_a and a service fee of s_a) and one liability (deposit) paying an interest rate of r_l and charges a service fee of s_l. Ignoring reserve requirements, and deposit insurance premiums, the absolute value of the user cost of an asset is written as:

$$\left|-\left[s^a - (\rho - r_a)\right]\right|, \qquad (6)$$

and the absolute value of the liability user cost is written as

$$\left|-\left[(\rho - r_l) + s_l\right]\right|.$$

Economic variable profit is found as

$$\Pi = \left|-\left[s_a - (\rho - r_a)\right]\right| \cdot A + \left|-\left[(\rho - r_l) + s_l\right]\right| \cdot L \qquad (7)$$

where A and L are stocks of assets and liabilities respectively. Assuming perfect financial markets where $\rho = r_a = r_l$, variable profit becomes

$$\Pi = s_a \cdot A + s_l \cdot L \qquad (8)$$

which is simply equal to service fee revenue. Since financial markets are imperfect and banks act as intermediaries, implicit service fees are a fact of economic life. Suppose now that $r_l < \rho < r_a$. The bracketed term in the user cost of an asset represents the sum of service fee revenue and return to the asset net of the opportunity cost of money, the asset is a financial output. The bracketed term in user cost of a liability represents the net rate earned on deposit funds relative to the overall alternative uses of money and service fee revenue. Therefore, the value of nonpriced demand deposit services is given by $\rho - r_l$ and thus, the liability is an output.

As should be visible, user cost expressions include the return to intermediation, with the imputation for nonpriced financial services. To illustrate, assume that the holding cost for a deposit product was the interest rate paid less a per dollar service fee, and that the opportunity cost of money is simply the loan rate. Then we may write our user cost for a deposit product as [(loan rate – interest rate paid) + service fee. If the loan rate is exactly equal to the interest rate paid to depositors, then the value of services provided would simply be the service fee charged. If the loan rate exceeds the rate paid on deposits, then the value of services provided would be the implicit charges (net interest) plus any explicit service fee.

In general, a user cost may be thought of as a price which, when applied to asset and liability quantities, generate revenue or cost measures.

$$\text{Asset Revenue } (or \text{ Cost}) = u_a \times A$$

and

$$\text{Liability Revenue } (or \text{ Cost}) = u_l \times L,$$

where u_a, u_l are, respectively, calculated user costs of assets (A) and liabilities (L). The user cost approach is like the previous approaches, except in the latter case outputs and inputs are determined prior to any measurement.

Returning to our earlier example, it may be helpful here to observe how the user cost approach works. We must make some assumptions; the opportunity cost of money is simply equal to 6%, we disregard capital gains rates (since our asset products are not readily marketable without discounting anyway, this assumption is close to reality), no deposit insurance premiums, and that all outstanding loans booked are in good standing (i.e. no defaults and no need for a bad debt allowance). Our weighted average loan rates are calculated in an identical manner as that of the value added approach (so that mortgage loans divided by total loans yields a weight which, when multiplied by its corresponding interest rate, yields a weighted average interest rate to be added to the corresponding figure for commercial loans to yield a weighted average rate. In our example, mortgage loans account for 41.51% of all loans, while commercial loans account for one minus this amount, or 58.49% of all loans. These weights, when multiplied by the interest rates they correspond to, and summed, yields a weighted average loan interest rate). Our user cost for asset products may be found as (using (4) and assuming capital gains and loan losses are zero):

$$u'_{aj} = 0.06 - (0.4151 \times 0.08) + (0.5849 \times 0.0725) + 0.00443$$

$$= 0.06 - 0.008003$$

$$= -0.02003.$$

which is unambiguously negative and hence, our asset class may be viewed as an output. In the above example (as already explained), we have used a weighted average of loan interest rates and expressed asset explicit service charges as a rate. Applying our price (user cost) to our quantity (loan stocks), we may find an (asset-side) output value of

$$V_a = u'_{aj} \cdot A$$
$$= 0.02003 \times 53{,}000$$
$$= 1{,}061{,}6.$$

Turning to liabilities (using (5)), we have

$$u'_{lj} = (0.4315 \times 0.025) + (0.5685 \times 0.035) - 0.0076 - 0.06$$
$$= 0.0233 - 0.06$$
$$= 0.03667,$$

which is once again, unambiguously negative, and hence, we may make the conclusion that the liabilities on our balance sheet are also outputs. Multiplying our prices and quantities, we have:

$$V_l = u'_{lj} \cdot L$$
$$= 0.03667 \times 19{,}700$$
$$= 722.4.$$

To find the aggregate value of bank output, we simply add the two distinct (current dollar) outputs to yield a 199X output of 1,783.99. We may note that this figure is quite close (albeit higher) to the figure yielded by the pure interest rate approach. Working through the mechanics makes it clear that the use of 6% as a proxy for opportunity cost is at least partially responsible for this discrepancy.

From our example, it is clear that all financial services (in an imperfect market) are part of the output set. It should be remembered that bank output primarily stems from the role of the bank as an intermediary. This role is affected by two things: the existence of imperfect capital markets, and the set of regulations designed to minimize the probability of bank failure and to control money supply. Information asymmetries between lenders (depositors) and borrowers, which implies the existence of substantial transaction costs for depositors to discover information about potential borrowers, give banks a substantial comparative and absolute advantage over individuals. The banks ability to reduce these information asymmetries and, thereby, transaction costs are crucial to its role as intermediary and thus, provide justification for implicit as well as explicit service fees.

■ COMPARISON BETWEEN THE VARIOUS APPROACHES

There is long-standing disagreement over exactly what is that banks produce. The strengths and weaknesses of the various approaches presented above are discussed here.

The user cost approach determines whether an asset or liability category contributes to the financial output of a bank. The operating costs involved in producing nonfinancial services associated with the asset or liability are not explicitly considered. However, under relatively standard assumptions, these operating costs (including a normal return on capital) are simply the dual of the user cost and are included implicitly. An optimizing bank value added earns (in financial revenue less operating costs) exactly its opportunity cost of funds at the margin on each asset and pays (in financial costs plus operating costs) exactly its opportunity cost at the margin on every liability. Thus, to the extent that that the user cost approach accurately measures marginal financial revenues and opportunity costs, its allocation is largely on the basis of excluded operating costs, which almost the same as the basis of the value-added approach. However, there are some difficulties in measuring financial revenues and marginal opportunity costs that make the user cost approach to distinguishing outputs from inputs subject to significant measurement error and sensitive to changes in the data over time. Another difficulty is the apparent sensitivity for turning outputs into inputs and vice versa with slight changes in the data and assumptions. One would expect banking technology to remain sufficiently constant that the determination of inputs and outputs should not change so often.

The value-added approach differs from the asset and user cost approaches in that it considers all liability and asset categories to have some output characteristics rather than distinguishing inputs from outputs in a mutually exclusive way. A significant difference from the user cost approach is that the value-added approach explicitly uses operating cost data rather than determining these costs implicitly as that part of the return or cost not accounted for by the difference between measured financial flows and marginal opportunity costs.

■ MEASURING THE REAL OUTPUT

The standard method of measuring real output (for example using a base-weighted quantity index of the volumes of various products produced, with base-year prices as weights) is currently unavailable in banking due to the lack of explicit prices and the difficulty in defining quantities. There are a number of reasons for this difficulty including the fact that a number of bank services are

"subsidized" by other services (in other words cross-subsidized services), introducing a wedge between actual and effective prices. Further, a great deal of price discrimination is evident in banking, based on size of account, type of client, and other client assessments. Also, implicit charges proliferate.

It is possible that for non-loan services, a "price" (made up of unit cost and unit profit) may be estimated (after assuming that unit profits are proportional to unit costs). A quantity index using base-year unit costs as weights is identical to a quantity index using prices which are proportional to unit costs. Using our fictional bank, we may proceed to estimate these prices as follows. First, it may be helpful here to restate the costs and profits faced by our bank. Total costs (made up of labour costs plus selling, general and administration costs) total 1,850. Since we are dealing with only non-loan services, we must estimate the proportion of costs and profits accruing to the deposits (liabilities side) side of our banks balance sheet. Using a simple weighted average (demand deposits make up 11.64% of all products, while time deposits make up 15.41%, thus these weights, applied to total costs and profits, yields a simple proportionally assigned product cost and profit). Thus we may calculate the following product costs as:

$$\text{Demand Deposit} = 0.1264 \times 1,850 = 215.34$$

$$\text{Time Deposit} = 0.1541 \times 1,850 = 285.09,$$

which sums to 500.4 (disregarding errors due to rounding). Dividing these proportional cost figures by specific deposit product values yields a unit cost for each product:

$$\text{Demand Deposit} = 215.34 \div 8,500 = 0.025$$

$$\text{Time Deposits} = 285.09 \div 11,200 = 0.025,$$

the two are identical since our product specific costs are assigned based on a weighted average of total costs, thus, we know that each dollar of deposit services will cost the bank $0.025. Since we know that bank profits are 1,933, we may treat unit profits in the same way, yielding a unit profit figure of $0.027 per dollar of deposit product. These unit profits and costs may then be summed to yield a price of $0.052 per dollar of deposit product. These prices are now our base year prices which, when applied to the deflated average dollar volume of deposits, yields a constant dollar measure of deposit-side output.

We can treat loan services in the following manner. Due to the diversity of loan products, it would be incorrect to assume that unit

profits are proportional to unit operating costs (as is assumed for non-loan services). Interest rates are usually a function of such factors as loan size, type of borrower, credit rating and so on. Therefore, since loan-based profits are (at least partially) a function of the level of interest rates charged, a change in the mix of loans could produce a change in real output which would not be identified by a cost-weighted index of the number of loans. Loan output may be found as the product of a base-year gross margin (i.e. average interest rate earned on loans less the cost of funds or, alternatively, cost plus profit per dollar of loans outstanding, all in base-year figures) multiplied by the deflated average dollar volume of loans outstanding during the year. The product for each loan category is then summed to obtain output valued at base-year prices. Turning again to our fictional bank, we may utilize the weighted average loan interest rate found earlier of 7.56%. We are now faced with the problem of estimating the cost of funds. For our purposes, we may use a weighted average of deposit interest rates, which we know to be 3.07%, yielding an interest margin of 4.49%, representing the net interest received by our bank. Once again, multiplying deflated average dollar volume of loans (deflated to base-year dollars) by this interest rate margin or loan price, yields a constant dollar measure of output. Thus, we have a base-year deposit product price of $0.052 and a base-year loan product price of $0.0449. Using a base-year index of 100, we may now measure growth in constant dollar output utilizing this index (similar to the way that inflation is measured using the rate of change of the Consumer Price Index). For our example, we have a total base year output of. 0.052 (deposit price) × 19,700 (stock of base year deposits) = 1,024.4 plus 0.0449 (loan price) × 53,000 (stock of base year loans) = 2,379.7; for a total base-year output of 3,404.1. Our index is derived as (3,404.1 ÷ 3,404. 1) × 100 = 100.

This price index approach may be feasible as a result of revisions to the Bank Act. Quarterly data reports showing balances of deposits and loans along with their associated interest expenses, revenue figures and a great deal of detail on commission and fee income for some of the broad loan/deposit categories, could prove to be extremely useful. For example, for each category of deposit, we may define the value of services per dollar of deposit in terms of a margin

Deposit Margin = Cost of Funds − Interest paid + Commission and Fees,

where the cost of funds is the bank's marginal cost of funds, approximated by the rate paid on deposits having a negligible service component in their costs. Since banks attract depositors by paying a mix

of "free" services and explicit interest payments, the marginal cost of attracting depositors will be equalized across various types of deposits. For example, assume that the rate paid on deposits with only a negligible service component attached is 5% (i.e. non-chequable, long term notice deposits). Thus the bank's marginal cost of one dollar of funds is $0.05. Our fictional bank (from section 4. 1) pays a (weighted) average deposit rate of 3.07%, or $0.0307 per dollar of funds deposited (also from our example in section 4.1) and collects a total of $0.00736 in explicit service fees per dollar of deposited funds. Our deposit margin is thus 0.05 − 0.0307 + 0.00736, or $0.02666 per dollar of deposited funds. This is now our base period price of deposits which, when applied to our stock of deposits outstanding, yields a deposit services output of 525.202 (0.02666 × 19,700).

Next, for each category of loans, margin measures the value of the services provided by banks per dollar of loans outstanding

Loan Margin = Average Loan Interest Rate − Cost of Funds
+ Loan Service Fees − Loan Loss Rate.

Once again, relying on our fictional bank from previous sections, we have that the loan margin is 0.076 − 0.05 + 0.00443 − 0 = 0.03003. Thus, our base period loan price is $0.03003 per dollar of loans, and our base period loan output is found as 0.03003 × 53,000, or 1,591.59. Therefore, our total base period output is found as 1,591.59 + 525.202, or 2,116.79. Our base year index is calculated simply as $\left(\frac{2,116.79}{2,116.79}\right) \times 100$, or 100. An output measure may be calculated as the product of base period margins multiplied by the average balances (deflated and expressed in base-year dollars). The validity of this measure rests on the assumption that the majority of changes in the volume of services per dollar of loan/deposit products is captured by shifts from one type of deposit/loan to another. Changes in the real value of services per dollar of deposit/loan products within each category are assumed to be negligible.

■ CONCLUSION

This paper identified conceptual problems regarding bank output and how it may be measured. As well as being important in itself, a measure of output is crucial to estimation of productivity. As is well known, measurement of output is problematic in all industries, due to problems such as aggregation and quality. But the

output of banks presents particular difficulties: many of the services are joint or interdependent – providing one service may entail providing others which cannot be separated or priced separately (for example safekeeping and accounting services in a current account) or which it is cheaper to produce together than separately (economies of scope); not all services are paid for directly (demand deposits) and banking is subject to regulations that may affect costs, prices or level of output.

This survey suggests that output in banking and related economic performance indicators remain difficult to assess theoretically, and even harder to measure. Nor is this merely due to the problem of quality change, although this clearly has important implications. It arises at a more basic level from disagreement over the nature of bank output – a concept to which at least three approaches can be distinguished, each with their own advantages as well a serious disadvantages. The difficulties with output make assessment of productivity more problematic.

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☐ Note

1. There has always been an understandable reluctance to ever admit such a sector in GDP calculations. Households have been traditionally viewed as the consumption decision-making units and suppliers of labour services and not as directly producing output.