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Computing Real Bank Services

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Abstract: Real output of banks in the National Income and Product Accounts is currently estimated from the index of total bank output published by the BLS Office of Productivity and Technology. The implicitly priced portion of this output is estimated as the residual that remains after subtraction of deflated explicitly priced output of banks. One possible alternative for estimation of real implicitly-priced services of banks is the use of separate output indexes of depositor services and borrower services. A second possible alternative is direct deflation of implicitly-priced depositor and borrower services by Fisher indexes of the user-cost prices of these services. We focus on the direct deflation method. To insure that our price indexes for depositor and borrower services are not excessively volatile, we develop smoothing methods for the user-cost prices. We then construct Fisher indexes for depositor services and for borrower services from these smoothed user-cost prices. Compared with the method that is currently used, deflation by a Fisher index raises the estimated real growth rate of implicit depositor services by an average of more than 7 percent per year. The corresponding effect on the estimated real growth rate of borrower services is more than 4 percent per year.

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I. Introduction

Banks provide a variety of financial services to their customers. For some of these services banks charge explicit fees while for others banks charge implicit fees. Measuring the latter is complicated by the fact that they are attached to implicitly provided financial services. Some examples of these implicit services are safekeeping, bookkeeping, providing liquidity by making funds available for immediate withdrawal at a convenient time and place, making payments to third parties on the customers' behalf, receiving payments from third parties on customers' behalf, and providing investment opportunities and advice. Furthermore, the value that depositors place on these bank services is evident from their willingness to pay for them implicitly by forgoing the higher rates of interest that they could earn by investing instead in credit market instruments, such as bonds.

How to measure the nominal values, prices and volumes of the implicit financial services has been the subject of much debate in the economics and national income accounting literature. Some methods for computing the nominal value of the implicit services include the use of net interest (interest received less interest paid), operating cost (Berger and Humphrey 1992), input cost (Haig 1973) and interest received (Speagle and Silverman 1953, Ruggles and Ruggles 1982 and Sunga 1984 and 1987). Triplett and Bosworth (2004, 201-204) recently proposed a scheme in which the interest paid by borrowers is treated as a payment for the productive service of provision of finance and a portion of this service arises from a resale of a service purchased from depositors—the purchase price is the interest and the value of the implicitly-services that they receive. Before December 2003, the US National Income and Product Accounts (NIPAs) used the net interest approach to compute the value of bank implicit financial services which was entirely earned by depositors in the form of imputed interest. The amount of the imputed interest paid to depositors was sufficient to raise total interest paid by banks up to the estimated level of the total interest received by banks.

Treating all the implicitly-priced services of banks as services to depositors amounts to accepting a view of banks as agents of depositors who simply seek investment opportunities for depositors' funds, retaining the net interest spread as a kind of commission. One problem with this view of banks is that not all the interest-bearing assets held by banks are financed with funds from depositors, nor, indeed, is there a direct link from funds deposited to funds loaned out in a fractional reserve system that allows banks to create deposits by making loans. In addition, the bookkeeping and record keeping services provided to bank borrowers are on a par with those provided to depositors. However, the main problem with this view of banks is its failure to recognize the complex process of financial asset transformation that banks perform to make funds available in a manner that suits the needs of borrowers. Scholtens and van Wensveen (2000, p. 1250), describe this process: "In the course of qualitative asset transformation—with respect to maturity, liquidity, risk, scale, and location—[the financial intermediary] adds value for ultimate savers and investors."

Furthermore, by making funds available as needed, banks provide liquidity services to many of their borrowers. Most commercial lending occurs through drawdowns of lines of credit, and much consumer borrowing occurs through the use of credit cards or other lines of credit. The liquidity services provided through these arrangements are often indistinguishable from the kinds of liquidity services provided to depositors. Many business borrowers, especially small businesses, would be severely hampered or even unable to function without the credit and liquidity provision services of a bank, so the aggregate supply of such services can affect the level of business activity.[1] Accordingly, a measure of bank output should reflect borrower services along with depositor services.

In its December 2003 comprehensive revision to the NIPAs, BEA adopted a methodology that recognized both depositors and borrowers as receiving implicitly-priced services. The methodology was based on the user cost of money concept, as will be described below, and focused on the nominal value of these services. The methodology for the estimation of the volume of these services was not changed. This paper examines the current method for estimating the volume of implicit services and examines two alternative methods.

II. Measurement of Nominal Implicit Services of Banks

A. The User Cost of Money

We draw on the literature on user cost of money models to develop measures of services to bank borrowers and to depositors that fit in the conceptual framework of the national accounts.

In the "user cost of money" framework set out in Donovan (1978), Diewert (1974), and Barnett (1978) and applied to banking by Hancock (1985), Fixler (1993), and Fixler and Zieschang (1999), the user cost concept originally developed for measuring the services of fixed capital assets is extended to financial assets. In the fixed capital asset case, in a competitive marketplace

[1] Many papers present evidence for business cycle effects of bank loan supply; some examples are Peek, Rosengren and Tootell (2003), Nilsen (2002), Kishan and Opiela (2000), Kashyap and Stein (2000), Morgan (1998), Kashyap, Stein and Wilcox (1993), and Blinder and Bernanke (1988 and 1992). Also, effects arising from disintermediation are discussed in Wojnilower (1980), and effects arising from bank undercapitalization are discussed by Peek and Rosengren (2000, 1995a and 1995b), Lown and Peristiani (1996), Boyd and Gertler (1994) and Bernanke and Lown (1991) for the US, and by Hoshi and Kashyap (2004), Woo (2003), Bayoumi (2001), and Motonishi and Hiroshi (1999) for Japan. Evidence for bank finance as a driver of long run growth is discussed in King and Levine (1993).

where economic profits are zero, the rental price for the asset must equal the difference between its starting value, p_t, and the present value of the asset at reference rate of interest, r_t^r, at the end of the rental period, or $p_{t+1}/(1+r_t^r)$. Setting the user cost uc_t equal to the equilibrium rental price $p_t - p_{t+1}/(1+r_t^r)$, and letting the growth rate of the asset's value from period *t* to period *t*+1 include a depreciation component δ_t and an expected rate of increase in asset prices π_t, yields:

$$uc_t = p_t[1 - (1 + \pi_t - \delta_t)/(1 + r_t^r)]$$

$$= p_t(r_t^r - \pi_t + \delta_t)/(1 + r_t^r). \qquad (1)$$

Alternatively, if uc_t is to be paid at the end of the period, then $uc_t = p_t(r_t^r - \pi_t + \delta_t)$.

The reference rate in the user cost formula should reflect the opportunity cost of the funds invested in the capital asset. For assets that belong to a bank, the reference rate may be taken as the rate r_t^r that the bank could earn on an asset that entails no provision of costly services to the borrower, including the bearing of risk.[2] The bank will earn a zero economic profit on a loan if the interest earned covers the costs of providing services to the borrower plus the value of the foregone opportunity to earn r_t^r. Hence, the reference rate can be used as a guide to lending decisions. Similarly, if the marginal return on funds invested (net of costs of providing borrower services) is r_t^r, then the marginal economic profit on deposits will be zero if the interest paid to the depositor equals r_t^r less the cost of providing depositor services. Hence r_t^r can be also used as guide for decision-making in managing bank liabilities. In Barnett (1995), for example, the benchmark asset provides no services other than its yield, and a single benchmark rate applies to all types of transactions.

A expression for a user cost formula for a financial asset i with a rate of return of r_{it}^A that is parallel to equation (1) would equal the difference between the asset's immediate cash value in period t, assumed to be y_{it}^A, and the present value of selling the asset for an expected price of $y_{it+1}^A = (1 + \pi_t)y_{it}^A$ in period t+1 after receiving income of $y_{it}^A r_{it}^A$. Here, π_t represents expected changes in asset prices, including those due to changes in creditworthiness for debt instruments. The user cost of holding an asset with a rate of return of r_{it}^A then becomes:

[2] Most applications of the reference rate, including the guidelines for national income accounting in the United Nations' System of National Account of 1993, view the reference rate as a risk-free rate. However, Barnett (1978) describes the reference rate as a minimum rate of return that accounts for risk, and Wang, Basu and Fernald (2004) develop a model that supports the inclusion of a risk premium.

$$y_{it}^{A}\left[1-\frac{1+r_{it}^{A}+\pi_{t}}{1+r_{t}^{r}}\right]=y_{it}^{A}\left[\frac{r_{t}^{r}-r_{it}^{A}-\pi_{t}}{1+r_{t}^{r}}\right] \tag{2}$$

The user cost formula in equation (2) assumes that interest is paid at the end of the period and that the asset and its user cost are valued at the beginning of the period. An alternative formula that values the user cost as of the end of the period is $r_t^r - r_{it}^A - \pi_t$. This version of the user cost formula is appropriate for use with data on interest flows that occur throughout the year or quarter and on average values of asset or liability items during the year or quarter. Average interest rates are calculated with these data by comparing interest flows during a period to the average stock of the items yielding the flow.

B. Prices for Assets and Liabilities based on the Theory of the User Cost of Money

User costs also represent implicit prices for financial services received by bank borrowers and by depositors. Typically, banks' financial assets have negative user costs and their liabilities have positive user costs because the rate of the return on assets usually exceeds the reference rate, which in turn exceeds the rate paid on liabilities.[3] To make the signs more intuitive for our purposes, we define the ***user-cost price*** of an asset as the negative of the user cost, and we define the user-cost price of a liability as its user cost. As a result, whenever a financial product contributes positively to economic profits, its price is positive.

For any type i of bank asset, the user-cost price equals the spread between the interest rate received by the bank and the reference rate:

$$p_{it}^{A} = r_{it}^{A} - r_{t}^{r}. \tag{3}$$

For any liability product i, the user-cost price is the spread between the reference rate and the rate paid by the bank, r_{it}^D:

$$p_{it}^{D} = r_{t}^{r} - r_{it}^{D}. \tag{4}$$

Liability products consist primarily of deposits, so for convenience we will refer to services connected with them as depositor services.

[3] This feature serves to identify the role of various products in the financial operation of a bank and avoids the exogenous assignment common in the bank literature.

Our user-cost price formulas do not include the terms for fees such as service charges, which Hancock (1985, p. 863) and others include in expressions for user costs, because these fees are counted in banks' explicit sales of services in the NIPAs. A complete economic model of banks' decision-making process would, of course, have to account for these fees in some way. Moreover, because holding gains or losses are not part of the national accounts concept of current production and because changes in the market value of a debt instrument have no effect on the borrower, the term for expected holding gains or losses in the user cost equation (2), π_t, is omitted from the user-cost price.[4] Since credit losses are regarded as holding losses, the effect of omitting π_t is significant.[5] Finally, terms adjusting the reference rate to include a risk-premium component, which have been advocated by Wang (2003a; 2003b; 2003c) and Wang, Basu and Fernald (2004) (hereafter WBF), are omitted from the user-cost prices because they have some conceptual disadvantages and are impractical for inclusion in the official NIPAs.[6] Use of a risk-free reference rate is also consistent with the international guidelines set forth in the United Nations' System of National Accounts of 1993 (SNA93).

The reference rate of interest in the user-cost price formulas is the rate that banks can earn on a highly liquid security that entails no credit risk or provision of costly services to the borrower. The reference rate represents an opportunity cost of funds that banks consider in their deposit-taking and lending decisions. On the deposit side, a bank could pay interest equal to the full amount that it earns by investing depositors' funds in the reference rate asset, and charge explicit fees for all the services provided to them. Furthermore, large banks that are perceived as very safe are able to borrow at approximately the reference rate in securities markets, thereby avoiding the costs of providing services to depositors. If these banks are indifferent at the margin between raising funds from depositors and raising funds in securities markets, the spread between the reference rate and the rate paid on deposits must approximately equal the marginal cost of providing services to depositors.

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[4] There is considerable discussion among national accountants about the need to include expected holding gains in national accounts, especially in the case of financial related transactions such as banking, insurance and pensions.

[5] Since 1974, commercial banks' provisions for credit losses have usually ranged from about 10 percent to about 20 percent of net interest income. Realized net credit losses (net charge-offs) have been slightly lower than provisions for credit losses, partly because of timing differences and survivorship bias. As we observe below, the treatment of expected holding gains and losses in national accounts is an important topic for future research.

[6] WBF argue that one component of this spread, compensation for risk bearing, is not a payment for a productive service, but rather a distribution of the income generated by the productive activities of business borrowers. Because of the gap between the risk-adjusted reference rate for loans, r_A^*, and the risk-adjusted reference rate for deposits, r_D^*, under the WBF approach an amount of interest proportional to $r_A^* - r_D^*$ would be categorized as income distributed to, and absorbed by, the banking industry. This treatment is conceptually plausible for loans to business, but in the case of consumer debt, the implied reductions in personal income, in national income and in GDP are harder to defend. Also, the amount categorized as income absorbed by banks cannot be large, or else the measure of the banking industry's net operating surplus would become implausibly small. Yet, if this amount is kept down by raising the risk premium component of the depositor reference rate, the imputation for unpriced banking services would have a larger and more volatile effect on the measure of GDP. The reason for the larger effect on GDP is that depositors are disproportionately households (whose consumption is final demand rather than intermediate inputs.)

For loans, banks could in principle charge interest at the reference rate to cover the opportunity cost of the funds advanced and, in addition, charge explicit fees to cover all costs of providing borrower services, including the bearing of risk. The spread between the reference rate of return and the lending rate is the implicit price that the bank receives for providing financial services to borrowers. The spread must equal the marginal cost of providing borrower services if the bank is to be indifferent at the margin between investing in the reference-rate asset and investing in higher yielding loans. In a marketplace where competition keeps loans from being priced at levels that yield profits in excess of a normal return on capital, we can expect an equilibrium where banks are indifferent between loans and the reference rate security at the margin.[7]

The interpretation of the user-cost price from the point of view of the banks' customers is also critical for purposes of the national accounts, which use buyers' prices for valuation of commodities. Fortunately, use of a single, risk-free reference rate results in user-cost prices that have an interpretation as equilibrium opportunity costs for bank customers, just as they do for the bank. In particular, the margin between the reference rate and the deposit rate represents an opportunity cost paid by depositors for the services that they receive from the bank. For example, in 2002, an Internet bank with limited services paid an average rate of 4 percent on deposits while similar-sized conventional banks paid an average rate of 3 percent.[8] Depositors who chose the lower average deposit rate in order to obtain more services from a conventional bank thus paid an implicit price of 1 percent per year for those services. Taking this logic one step further, depositors could dispense with the services of a bank entirely and invest their money in securities paying the reference rate of interest. Depositors who forego the opportunity to earn the reference rate in order to obtain the services of a bank pay an implicit price for depositor services equal to the margin between the reference rate and the deposit rate.

Borrowers from banks are willing to pay a margin over the reference rate because they need lender services that issuers of credit-market instruments bearing the reference rate of interest do not receive. For many, borrowing in capital markets is very costly or impossible because of the problems of asymmetric information noted earlier, and liquidating financial assets as an alternative to borrowing is also impossible. For marginal loan customers, however, either liquidating assets that earn the reference rate or borrowing at approximately the reference rate in capital markets are alternative ways to obtain needed funds. In particular, both household and business borrowers often choose to hold financial assets when they could liquidate those assets and reduce their loan balances. For the marginal users of the borrowed funds, the spread between the loan rate and the reference rate represents the net marginal cost borne by borrowers for liquidity man-

[7] Note that indifference arguments do not apply at corner solutions or if quantity constraints are binding, so banks are presumed to be indifferent at the margin only between types of assets that they hold in non-negligible amounts.
[8] This example is based on individual bank data at www3.fdic.gov/idasp/main.asp.

agement, inducing the bank to accept their risk and other services provided by the lender. This difference can therefore be viewed as an implicit price paid for credit services.

The interest rates used to calculate the user-cost prices could be either book rates or market rates. We choose the book rate approach. In national income accounting, borrowers and creditors must be treated symmetrically, but for borrowers the relevant values of liabilities are generally book values, not market values. Multiplying book values of assets and liabilities by market interest rates would generally imply interest flows different from those actually observed because individuals generally hold fixed-rate assets and liabilities that they acquired at various times in the past. Furthermore, even if market rates were theoretically preferable, the level of detail available on holdings of financial assets and liabilities is usually insufficient to assign the correct market rates. As a result, all interest rates in the examples below are computed by dividing an interest flow (receipt or expense) by an estimate of the average stock of the corresponding financial product over the corresponding interval of time.[9] This method of computation implies that all of the interest rates used in the user-cost prices reflect the maturity mix of the underlying financial product. In particular, the computed reference rate reflects all the maturities of US Treasury securities held by banks, the computed loan rate reflects the maturities of outstanding loans, and the deposit rate partly reflects the maturities of the time deposits.[10]

C. Measure of Implicitly-Priced Services of Banks

Using equations (3) and (4), the total implicit financial services of banks, V, can be written as the user-cost price of assets times the volume of assets plus the user-cost price of liabilities times the volume of liabilities,

$$\begin{aligned} V &= \sum_i p^A_{it} y^A_{it} + \sum_i p^D_{it} y^D_{it} \\ &= \sum_i (r^A_{it} - r^r_t) y^A_{it} + \sum_i (r^r_t - r^D_{it}) y^D_{it} \,. \end{aligned} \tag{5}$$

In the last line of equation (5), the first term represents the value of implicitly-priced services that the bank provides to borrowers, and the second term shows the value of the implicitly-priced services that it provides to depositors and other creditors of the bank. A rearrangement of the terms in equation (5) reveals that V equals net interest income minus the user cost of the own funds used to acquire assets:

[9] As described in Fixler, Reinsdorf and Smith (2003) the change in the valuation of implicit services in the national accounts also employed a unit value computation of interest rates.

[10] In the July 2005 annual revision the computation of the reference rate was changed to eliminate mortgage-backed securities, which had become risky because of the discovery of accounting irregularities at the issuing firms.

$$V = \left[\sum\nolimits_i r^A_{it_i} y^A_{it_i} - \sum\nolimits_i r^D_{it_i} y^D_{it}\right] - r^r_t \left[\sum\nolimits_i y^A_{it_i} - \sum\nolimits_i y^D_{it_i}\right]. \tag{6}$$

Because we include all earning assets, we can safely assume that own funds will be positive.[11] The reduction in the total value of implicit services implied by positive own funds inside the brackets of the last term in equation (6) reflects the absence of services to depositors when a bank uses its own funds for lending. Profits on the lending of stockholders' equity must be treated as a distribution of income to the bank, not an implicit payment for services, or else the channeling of the equity financing through a bank will artificially inflate GDP. These profits equal the gross return on lending of own funds less the cost of providing borrower services.[12]

Most of the data used to estimate V come from the Reports of Condition and Income (the Call Reports) that banks have to file quarterly with the Federal Deposit Insurance Corporation. The allocation of the consumption of the depositor and borrower services to the different sectors of the economy is primarily based on the Federal Reserve Board's Flow of Funds Accounts, however. For example, the household portion of bank implicit financial services is determined by looking at the household share of deposits and loans in the Flow of Funds data. These allocations change annually. The Call Reports contain very limited information on the breakdown between persons and other sectors, or among industries, of the consumers of implicit services of banks, although there are exceptions—for example, commercial and industrial loans can be assigned to the business sector.

III. Measurement of Real Implicitly-Priced Services of Banks

A. Description of the Current Method

The current method of computing the volume of implicit financial service output was adopted in 1999. Annual changes in the real value of banks' imputed output, from 1968 onward, are estimated by assuming that banks' total output grows at the same rate as the output of the banking industry in the Bureau of Labor Statistics (BLS) estimates of productivity by industry.[13]

The bank output index published by the BLS Office of Productivity and Technology is based on a weighted average of various indexes of bank activity, including bank transactions (for

[11] The 1988 Basel Capital Accord and its Basel II revision require that banks have more assets than liabilities. In the US, the FDIC Improvement Act of 1991 also places punitive restrictions on banks with tangible capital below 6 percent of assets, and requires closure of banks with tangible capital below 2 percent of assets.
[12] We therefore depart from SNA93, paragraph 6.125, by excluding from implicitly-priced bank output only the reference rate times the amount of own funds, rather than all interest received from lending of own funds. We are, however, consistent with the SNA in the way that we measure of own funds.
[13] Prior to 1968, annual changes in the real value of imputed output continue to reflect the rate of growth in the hours worked by banks' employees with no adjustment for changes in these employees' productivity.

example, checks cleared, ATM transactions, and electronic funds transfers), the number of outstanding loans of various types, and the number of trust accounts.[14] The index aggregates direct measures of quantities of transactions or activities with weights based on the Federal Reserve Board's *Functional Cost Analysis* survey. Its constituents (which themselves have more detailed components) are quantity measures of checks written, electronic payments made, time account deposits and withdrawals, new and existing loans, and trust activities.[15]

Let T_t^Q denote the BLS index of total bank output at time t and let T_0^N denote nominal total bank output in 2000. Then bank output T_t^K in constant dollars of year 2000 equals $T_0^N T_t^Q$.

Constant-dollar explicitly-priced depositor services D_t^{XK} are calculated by deflating nominal explicitly-priced depositor services D_t^{XN} by a price index for these services. A similar deflation procedure is used to find constant-price explicit borrower's services B_t^{XK}. Total real explicitly-priced services are $T_t^{XK} = D_t^{XK} + B_t^{XK}$.

To estimate chain-dollar real imputed output, BEA calculates a Fisher aggregate of a Laspeyres constant-dollar measure and a Paasche constant-dollar measure. Each constant-dollar measure of banks' imputed output equals (a) the constant-dollar value of banks' total output (estimated by extrapolating the base-year (2000) current-dollar estimate of banks' total output by the BLS estimate of the growth in banks' total output) less (b) the constant-dollar value of banks' explicitly priced output (estimated by deflating banks' service charges on deposit accounts and other noninterest income with the CPI for checking account and other bank services and then adding an estimate of banks' real fiduciary activities based on the growth of the number of trust department discretionary accounts.) Thus constant-dollar implicit banking services are the residual:

$$T_t^{MK} = T_t^K - T_t^{XK} \quad . \tag{7}$$

This real implicit service output measure is then used to obtain an implicit price index (current dollar divided by constant dollar) for the implicit bank services. Observe that this price index does not directly relate to the user-cost prices presented above. The price index for implicit banking services is the ratio of nominal implicit services to both depositors and borrowers to its constant-dollar counterpart:

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[14] The BLS methodology is explained in Kent Kunze, Mary Jablonski, and Mark Sieling (1998). BLS does not have a separate measure of the imputed output of banks.

[15] Starting with 2001 BEA began constructing and using its own quantity indicator for trust activities because of questions about the reliability of the BLS measures. Additional reliability questions concerning the check component of BLS's index are discussed in Humphrey (2004, 214.)

$$T_t^{MP} = (D_t^{MN} + B_t^{MN})/T_t^{MK} \tag{8}$$

Separate deflators have not yet been developed for implicit depositor and implicit borrower services, so $D_t^{MP} = B_t^{MP} = T_t^{MP}$. This implies that:

$$D_t^{MK} = T_t^{MK} \{D_t^{MN} / [D_t^{MN} + B_t^{MN}]\} \tag{9}$$

$$B_t^{MK} = T_t^{MK} \{B_t^{MN} / [D_t^{MN} + B_t^{MN}]\} \tag{10}$$

Thus the implicit depositor and borrower services output are fractions of the total implicit output where the fraction is determined by the current value share.

B. Weaknesses of the Current Method

The current procedure has two disadvantages. First, changes in the nominal values of implicitly-priced depositor and borrower services caused by changes in their relative user-cost prices are counted as real changes; this follows from (9) and (10). This is a direct consequence of the lack of separate price indexes for implicitly-priced depositor and borrower services. Implicitly-priced depositor and borrower services share a common price index, so differences in their nominal growth rates must translate into different real growth rates regardless of the source of those differences.

Second, the BLS bank output indicator T_t^Q may not fully reflect some of the fee-based services included in $D_t^{XK} + B_t^{XK}$. In nominal terms, the trend over the last twenty years has been for fee-based banking services to account for a growing share of total bank output, so any omission of these services would likely cause a downward bias in the growth rate of T_t^Q. For example, payment processing and other administrative services on loans that have been sold to investors (which are included in the priced output of banks in the NIPAs) have grown rapidly but they are not included the BLS borrower services index. Another example is the fees that banks charge for "bounce protection" for depositors, a technically illegal but growing practice of payment of overdrafts for customers who have no formal line of credit agreement.

Even if the downward bias in the BLS index of total bank output is small, the bias in the growth rate of the residual that is used to estimate the implicitly-priced component of bank output could be substantial. For periods after the base period, T_t^{MK} is, in effect, calculated as the solution to the equation $s_{t-1}^{M}(T_t^{MK}/T_{t-1}^{MK}) + s_{t-1}^{X}(T_t^{XK}/T_{t-1}^{XK}) = T_t^{Q}/T_{t-1}^{Q}$, where s_{t-1}^{M} is the share of implicit output in total bank output in period t–1, $s^X_{t-1} = 1 - s^M_{t-1}$, and all variables other than T^{MK}_t are known in advance. Errors in the growth rate of T^Q_t therefore have a leveraged effect on the growth rate of T^{MK}_t and no effect on the growth rate of T^{XK}_t The growth rate of the price index for the imputed output is, of course, biased upward by the same amount as any downward bias in the real measure.

The table below suggests these effects are more than hypothetical. The large gap between the total bank output index and the priced bank output index produces growth rate estimates for implicitly-priced bank services that look implausibly low.

Growth Rate of Implicitly-Priced Real Bank Services Calculated from the BLS Total Bank Output Index[a]

	1998	1999	2000	2001	2002
BLS total bank output index (T^K_t)	–1.6	0.6	0.5	–1.4	2.5
Priced real bank services ($D^{XK}_t + B^{XK}_t$)	4.4	2.6	5.9	3.5	3.1
Implicit real bank services ($D^{MK}_t + B^{MK}_t$)	–5.1	–2.2	–2.9	–3.4	1.2

a. Based in part on non-NIPA sources: first and last lines are based on information on BLS's web site in 2006. Top line of table is a share-weighted average of the second and third lines.

IV. Alternatives for Measuring Real Bank Output

A. Use of Separate Depositor and Borrower Components of the BLS Bank Output Index

The BLS banking output index includes unpublished components for depositor services, borrower services and trust services, so a possible solution to the lack of separate deflators would be to measure combined priced and imputed depositor services using the BLS depositor services output index and to measure combined priced and imputed borrower services using the BLS borrower services output index. Yet this solution is still susceptible to the problem of amplification of possible downward biases in the BLS indexes. The table below illustrates this point using experimental data based on older vintages of data from the NIPAs. (We used older data because NIPA data based on the most recent revision of the BLS's bank output indexes for services to depositors and for services to borrowers have not been released yet.) The last two lines in the table indicate that the use of the separate depositor and borrower BLS indexes generally does not yield significantly different output growth rates. The one exception is the recession year of 2001, when a plunge in priced borrower services raised the residual allocated to implicit borrower services under the method that uses separate depositor and borrower indexes .

Growth Rates of Implicitly-Priced Real Depositor and Borrower Services Calculated from Separate BLS Output Indexes[a]

	1998	1999	2000	2001	2002
Real total depositor services	1.6	2.6	2.5	–0.1	–0.2
Real priced depositor services	3.9	5.5	5.5	6.8	9.3
Imputed depositor services	0.8	1.5	1.3	–2.7	–4.3
Real total borrower services	–3.2	3.1	0.7	0.0	4.7
Real priced borrower services	1.0	6.0	5.6	–27.9	–2.9
Imputed borrower services	–4.2	2.4	–0.5	7.4	6.1
Sum of imputed depositor and imputed borrower services	–2.3	2.1	0.2	3.5	2.3
Sum using BLS total index from same vintage data	–0.5	2.9	1.5	–0.3	1.9

a. For illustrative purposes only—not necessarily consistent with published NIPA data. In each panel, top line is weighted average of the two lines beneath it.

B. Deflation by Indexes of User-Cost Prices

An alternative to the use of the BLS output indexes is to calculate indexes directly from the user-cost prices of depositor and borrower services. We illustrate this approach for the case of implicit deposit services. Denote the ith component of nominal implicit deposit services D_t^{MN} by D_{it}^{MN}. From equation (4), the user-cost price of this component is $p_{it}^D = r_t^r - r_{it}^D$, where r_{it}^D is the rate paid on deposit product i. Also, let P_t^* be an aggregate price index, which we will specify as the index for gross domestic purchases. Then the Laspeyres version of the price index for implicit depositor services is:

$$D_{t+1}^{MP\_Lasp} = (P_{t+1}^*/P_t^*)(1/D_t^{MN}) \sum_i D_{it}^{MN}(p_{it+1}^D / p_{it}^D) \qquad (11)$$

For the corresponding Paasche index, $D_{t+1}^{MP\_Paasche}$, we use the D_{it+1}^{MN} as weights in a harmonic mean of the user-cost price relatives, and then multiply by the aggregate price index as before. The user-cost Laspeyres and Paasche price indexes for borrower services are analogous weighted arithmetic and harmonic averages of user-cost prices for borrower services.

The user-cost price index formulas include the term P_{t+1}^*/P_t^* because the interest rate spreads measured by the user-cost prices must be multiplied by the cost of the items that the deposits or loans are used to purchase if they are to measure a change in a price that is denominated in dollars per unit. Suppose, for example, that the number of constant-quality cars financed by bank loans is constant but the price of each car doubles. With no adjustment to the borrower services price index for the change in price of the items purchased, the financing of the same real quantity of cars would be misleadingly counted as a doubling of real borrower services. More generally, the total cost of the consumption paid for with funds from deposits includes the user-cost price of the depositor services required to complete the associated transactions and, similarly, the total cost of the consumption paid for with funds from loans includes the user-cost price of the borrower services used in completing the transactions. The cost of these total baskets can be decomposed into an index of the prices of the consumption items themselves and an index of associated transactions cost. Because the transactions cost embodied in the depositor or borrower services represent a kind of margin added to the purchase price itself, the index for the depositor or borrower services must include the change in the price paid of the consumption items P^*_{t+1}/P^*_t and the change in the margin, which in the depositor services case is $(1/D^{MN}_t)\sum_i D^{MN}_{it}(p^D_{it+1}/p^D_{it})$. Note that without the term P^*_{t+1}/P^*_t, the depositor and borrower services indexes would tend to show an average inflation rate near zero over the long run.

Indexes of user-cost prices such as $D^{MP\_Lasp}_{t+1}$ and $D^{MP\_Paasche}_{t+1}$ assume that the real implicit services from a deposit account are proportional to the real purchasing power of the average account balance. A more formal theoretical justification for this kind of index under special assumptions is developed by Basu and Wang (2006). One of the assumptions is that implicit services come just from one type of account, the transactions account T. When deposit type T is the only kind of deposit, $D^{MP\_Lasp}_{t+1}$ and $D^{MP\_Paasche}_{t+1}$ both become:

$$D^{MP\_T}_{t+1} = (P^*_{t+1}/P^*_t)(1/D^{MN}_t)(p^D_{T,t+1}/p^D_{Tt}). \tag{12}$$

Basu and Wang's approach is based on Feenstra's (1986) demonstration that deposit balances that provide liquidity services and reduce the transactions cost of consumption may be included along with consumption goods in an augmented utility function. In these models (which are based on Tobin's transactions demand for money framework), the cost of each restocking of the transactions account is τ_t and the combined monthly cost of restocking and maintaining balances in the transactions account is $N_t\tau_t + \bar{B}_{Tt}\, p^D_{Tt} = N_t\tau_t + D^{MN}_{Tt}$, where N_t is the number of restockings of the transactions account T and $\bar{B}_{Tt}$ is the average account balance in account type T. (As before, the user-cost price of the transaction accounts services is p^D_{Tt}.) The total spending on goods and non-financial services that can be paid for out the transactions account in any month t is $2N_t\bar{B}_{Tt}$ Therefore N_t and $\bar{B}_{Tt}$ are two factors of production in an increasing-returns-to-scale Cobb-Douglas production function for transacting payments. (Returns to scale are increasing because the exponents sum to 2, whereas in the usual constant-returns-to-scale Cobb-Douglas function $y=x_1^a x_2^{1-a}$, they sum to 1.) Because of the increasing returns to scale, implicit purchases of depositor services D_{Tt}^{MN} will rise at *half* the rate of overall spending (in log-change terms) if τ_t and p_{Tt}^{D} are constant. Specifically, the solution to the consumer's Cobb-Douglas cost minimization problem yields N_t and $\bar{B}_{Tt}$ such that $N_t\tau_t = D_{Tt}^{MN}$, so with constant prices, N_t and $\bar{B}_{Tt}$ will each rise in proportion to the square root of overall spending.

The implication of this model is that the frequency of transaction account restocking rises at the same rate as the square root of nominal spending seems implausible for at least two reasons. First one source of spending growth is growth in population, which would imply growth in the number of accounts, not in the average spending per account. Second, rather than charging a fee like τ_t for each withdrawal, most financial investments (mutual funds, money market funds, and time deposits) restrict the number of withdrawals. In practice, a large component of τ_t may be the opportunity cost of the depositor's time, which is likely to grow along with income. Thus, it is reasonable to assume that the frequency of account restocking is unaffected by spending growth, so that $\bar{B}_{Tt}$ is proportional to nominal spending. Under this assumption the appropriate deflator for the implicit depositor services is $D_{t+1}^{MP\_T}$.

Another possible source of change in the ratio of $\bar{B}_{Tt}$ to spending is technological change. In some time periods, technological change may have enabled consumers to economize on implicit depositor services by lowering the average balance in their transactions account and increasing the frequency of transfers of cash from accounts that pay high rates of interest. Basu and Wang (2006) illustrate how $D_{t+1}^{MP\_T}$ can provide a misleading measure of financial services when technological progress reduces τ_t. A crucial feature of their illustration is that the financial services innovation is not within the bank—consumers take investments from an investment firm (a mutual fund provider) and transform them into transactions deposits at a bank, and it is the investments firm that experiences the technological change. If one considers a consumer with both investment and transactions accounts at a bank, then a technological change would affect balances, user-cost prices and explicit fees on both kinds of accounts. Technological change is also likely to be associated with quality changes in bank services that are hard to measure. Fixler and Zieschang (1999) find that the changes in the average deposit and loan volumes as well as the number of accounts affects the user-cost prices and that not adjusting the prices for these changes would lead to erroneous estimates of the volume of financial services.

In their model, these characteristics were viewed as characteristics of the quality of financial service provided by banks. For example, suppose that in period t a deposit product has a minimum balance requirement that in period t+1 the minimum balance requirement is dropped. Because there is a change in the quality of the service—the customer has more of the amount of deposit available to him, one would want to adjust the user-cost price for the change in the quality of the service.[16] Fixler and Zieschang (1999) demonstrate one way of adjusting the user-cost prices for changes in the quality of financial services. The price indexes constructed in the next section are not adjusted for changes in service quality. This omission largely derives from the absence data on indicators or components of service quality. More specifically, information on transaction restrictions (such as minimum balance requirements or number of checks allowed per month) or the number of ATMs is neither collected by the regulatory authorities (the prime source of bank data), nor by the Bureau of the Census in the Economic Census for banks. Nevertheless, quality adjustments to price indexes for bank services may be the conceptually appropriate way to account for the effects of innovations such as sweep accounts, ATMs and internet banking.

C. Alternative Estimates of Prices and Volumes

We calculated price and volume indexes for depositor services and borrower services using the current approach (which is based on the BLS quantity index for total bank output) and using an alternative approach. For the alternative approach, we constructed price relatives from user-cost prices for different types of depositor and borrower products for 1996 to 2004 and calculated Laspeyres indexes and Paasche indexes for implicit depositor services and for implicit borrower services from them. (Equation (11) above describes the depositor services Laspeyres index; the other indexes are analogous.) We then combined these into Fisher price indexes for depositor services and borrower services. The interest rates in the user costs were computed as unit values, by dividing income or expenses from the Call Reports by the book value of the corresponding asset or liability. (For details, see Fixler, Reinsdorf and Smith, 2003.) As noted above, the price indexes are adjusted for an aggregate price change, which we measure by the price index for Gross Domestic Purchases.

Under the current approach, the total implicit real output is computed first and divided between depositor services and borrower services based on the nominal values of these services. As a result, the implicit price index is the same for both types of services. The growth rate of this shared index from 1996 to 2003 is shown in the prices line in Figure 1. The stability of the price index translates into volatility of the quantity indexes, and the movements in the real implicit depositor and borrower services are mirror images of one another. As explained above, the identical price index for borrower and depositor services means that shifts in the relative nominal magnitudes of depositor and borrower services are counted entirely as real effects.

[16] In some instances the characteristics of the financial product and the financial service coincide. If the characteristic set of a deposit product were amended to include internet banking, then there would simultaneously be a new form of transaction service. However it is viewed, a quality adjustment would be necessary.

The Fisher index constructed from the user-cost prices of implicit depositor services is shown in Figure 2. Our first version of this index is based on unsmoothed user-cost prices. It is more volatile than the current method price index. The reason appears to be inertia in the reference rate: turning points in the reference rate tend to lag the turning points in the deposit and loan rates. Banks may be willing to hold Treasury securities with longer maturities partly because of collateral or regulatory requirements; for example, under the Basel II Accords on risk-based capital requirements, holdings of Treasury securities do not tie up any capital. The inertia in the reference rate affects the user-cost prices and the relative nominal values of depositor and borrower services. This can cause a shift between depositor and borrower services in the allocation of implicit bank output. Borrower services largely go to intermediate consumption by businesses, while depositor services are predominantly consumed by persons, so the measure of nominal GDP is affected by such shifts. Real GDP is also affected under the current method, but with separate user-cost price indexes for depositors and borrowers, it is the GDP deflator that changes. More important, perhaps, is the effect on the personal consumption expenditures (PCE) deflator, which is closely watched by many users of the national accounts.

Because the interest flows used to calculate the user-cost prices reflect mixtures of interest rates contracted for at different points of time, it is unrealistic to think that high-frequency variation in user-cost prices can be measured with any precision. Instead, our goal is to measure medium-term and long-term trends in user-cost prices. Accordingly we adjusted the reference rate for the misalignment of turning points caused by reference rate inertia.

The years when this problem occurs can be identified by the presence of outliers in two indicator series. One is the user cost of interest-bearing deposits expressed as a fraction of the overall spread between the loan rate and the interest rate paid on deposits, which is a measure of the relative position of the reference rate in between the deposit rate and the loan rate. The other is the spread between the rate paid on repurchase agreement liabilities and the rate paid on interest-bearing deposits, expressed again as a fraction of the overall spread between the loan rate and the interest rate paid on deposits. The repurchase agreement rate can help with the identification of turning points because it adjusts even more quickly than the average rate paid on deposits when there is a change in the interest rate environment. This enables us to identify outlier years in real time—if we used changes in the reference rate itself to identify outliers we would have to wait a year to see if an abrupt change was subsequently reversed. Another reason why we look at the position of the repurchase agreement rate to identify outlier years is that we want to avoid use of a reference rate that is below this rate.

When the relative repurchase agreement rate is at an outlier value above 0.25 and the relative reference rate below its average level of 0.44, or when the repurchase agreement is at an outlier value below –0.05 and the relative reference rate is above its average level, we hold the relative reference rate at its preceding value in our calculations of user-cost prices. In the years from 1985 to 2004, this happens in 1989, 1995, 2000 and 2002. In addition, we further smooth by use of a centered 3-period moving average, where the middle year has a weight of ½ and the neighboring years each have weights of ¼. The result is shown in Figure 2.

An alternative to the above would simply be to smooth the relative reference rate position and use the smoothed values to calculate the user-cost prices. Indeed, using a centered moving average of the changes in the relative reference rate share and identifying outliers that have changes greater than one standard deviation, we find that the same turning points are again identified.[17] This method also identifies an additional turning point, however. That turning point is missed under with the first outlier measure method because its value is just under the critical value. We employ the first outlier detection method because in a real time setting it would not be possible to construct a centered moving average—one would need data on two future periods.

As noted above, effects on the estimates of depositor services are of more consequence than effects on estimates of borrower services for GDP and for the PCE price index. Figure 3 shows the nominal implicit depositor services as measured from the smoothed user-cost prices along with three different measures of real implicit depositor services. The smoothed prices imply a higher level of real depositor services than the unsmoothed prices because the base year of 2000 was an outlier year. The reference rate of 6.2% in 2000 becomes 6.6% after smoothing, which raises the share of banks' implicit output allocated to depositors from 40 percent to 47 percent. Both the smoothed and the unsmoothed user-cost prices imply higher rates of growth for real depositor services than is implied by the BLS total output index. These measures of real depositor services also grow faster than nominal depositor services. The slow growth of the nominal depositor services reflects price declines after 2000 caused by shrinking spreads between loan rates and deposit rates and by a falling share of this spread allocated to depositor services.

Figure 4 shows the rates of growth of real depositor output. The estimates of implicit depositor services implied by deflation using the Fisher index of user-cost prices is much less volatile than the implicit deposit service output derived under the current method.

Figure 5 shows the percentage changes in various price and quantity measures for borrower services. The illustrated measures correspond to the ones shown in Figures 2 and 4 for depositor services. The smoothed Fisher price index exhibits much less volatile rates of change than does the unsmoothed Fisher price index. Recall that the implicit price index for borrower services under the current method is the same as the price index in Figure 1. Regarding the output measures, the quantity index obtained from the smoothed Fisher price index is far less volatile than the out-

[17] The centered moving average consist of 5 periods; a particular period two lagged periods and two lead periods.

put measure under the current method. Note that in 2001, the current method the output measure records a huge decline in implicit borrower services while the alternative quantity index shows an increase in output.

Another alternative approach to measuring real depositor and borrower services is illustrated in Figures 6 and 7. This approach uses separate indexes from BLS of output of depositor services and borrower services. In both figures, the output measure is less volatile when the specific borrower or depositor output index is used instead of the total output index from BLS. However, there are some differences between the BLS-based indexes and the ones obtained via direct deflation. Figure 6 shows that in the case of implicit depositor services, both of the BLS output indexes generally imply lower rates of growth. Figure 7 shows that the current measure of borrower services is generally below the direct deflation measure, but after 2000 the implicit borrower services measure implied by the BLS output index of borrower services grows faster than the direct deflation measure. In the 2001 recession, real explicitly priced borrower services fell sharply. (This fall may have been partly caused by price reductions in commercial loan fees not reflected in the deflator for explicitly priced borrower services.) These real explicit services are subtracted from the estimate of all borrower services based on the BLS output index for borrower services to obtain the implicit services residual, so a sharp decline in the explicit services turned the weak slowdown in the BLS index into a *rising* estimate of implicit borrower services. At the same time, real loan growth slowed substantially, resulting in sluggish growth in the direct deflation measure of real borrower services.

Finally, Figure 8 shows the productivity measurement implications of the alternative approaches to bank output measurement. For the period 1996-2002, the BLS estimate of bank productivity growth averages 0.4 percent per year, while the productivity growth implied by the direct deflation output measure combined with the BLS hours series averages nearly 5 per cent per year. The growth rates have mostly parallel trends, but with a level difference of over 4 percent per year. The similarity of the trends derives from the use of the same labor hours series for both measures and similarity of the trends of the output series. Our measure of productivity growth is qualitatively similar to the growth rate reported by Triplett and Bosworth for commercial banks in the period 1995-2001, which was about 3%.[18]

V. Conclusion

The method currently used to measure real implicit services of banks may understate its growth and it can mischaracterize certain kinds of price effects as changes in real depositor and borrower services. Direct deflation by Fisher indexes of user-cost prices seems to be the most

[18] Triplett and Bosworth (2004) page 100.

promising solution to the former problem, but the latter problem can also be addressed by the use of separate output indexes from BLS for depositor and borrower services. However, all solutions to the latter problem pose a risk of introducing possibly spurious volatility into the PCE deflator arising from volatility in the price index for depositor services.

We investigate both direct deflation and the use of separate output indexes, but we focus on the direct deflation method. To insure that our price indexes for depositor and borrower services are not excessively volatile, we develop smoothing methods for the user-cost prices. We then construct Fisher indexes for depositor services and for borrower services from these smoothed user-cost prices. Compared with the method that is currently used, deflation by a Fisher index raises the estimated real growth rate of implicit depositor services by an average of more than 7 percent per year. The corresponding effect on the estimated real growth rate of borrower services is more than 4 percent per year. Furthermore, the behavior of the Fisher price and quantity measures appears quite plausible.

References

Barnett, William, 1978. "The User Cost of Money," *Economic Letters*, 2, 145-49. Reprinted in William A. Barnett and Apostolos Serletis, 2000, *The Theory of Monetary Aggregation*, North Holland, Amsterdam.

Barnett, William. 1995. "Exact Aggregation Under Risk," in *Social Choice, Welfare and Ethics, Proceedings of the Eighth International Symposium in Economic Theory and Econometrics*, Cambridge University Press, 353-374.

Berger, Allen and Humphrey, David, 1992. "Measurement and Efficiency issues in Commercial Banking" in *Output and Measurement in the Service Sector*, Studies in Income and Wealth Vol. 56, Zvi Griliches, editor, University of Chicago Press (for the National Bureau of Economic Research.)

Boyd, John H. and Gertler, Mark. 1994. "Are Banks Dead? Or are the Reports Greatly Exaggerated?" Federal Reserve Bank of Minneapolis *Quarterly Review*, Summer: 2-18.

Diewert, W.E., 1974. "Intertemporal Consumer Theory and the Demand for Durables," *Econometrica*, 42, 497-516

Donovan, D., 1978. "Modeling the Demand for Liquid Assets: An Application to Canada," *IMF Staff Papers*, 25, 676-704

Feenstra, Robert C. 1986."Functional Equivalence between Liquidity Costs and the Utility of Money," *Journal of Monetary Economics*, 17 no. 2, March: 271-291

Fixler, Dennis, 1993, "Measuring Financial Service Output of Commercial Banks," *Applied Economics*, 25, 983-99

Fixler, Dennis J., Reinsdorf, Marshall B. and Smith, George M. 2003. "Measuring the Services of Commercial Banks in the NIPAs: Changes in Concepts and Methods." *Survey of Current Business*, 83 (Sept.): 33-44.

Haig, B.D., 1973, "The Treatment of Banks in the Social Accounts," *Economic Record*, 49, December, 624-28.

Hancock, Dianne, 1985. "The Financial Firm: Production with Monetary and Non Monetary Goods," *Journal of Political Economy*, 93, 859-80

Humphrey, David B. 2004. "Comment." In Triplett, Jack E. and Bosworth, Barry P. *Productivity in the U.S. Services Sector: New Sources of Economic Growth*. Washington: Brookings Institute Press, 211-229.

King, Robert G. and Ross Levine. 1993. "Finance and Growth: Schumpeter Might be Right." *Quarterly Journal of Economics* 108, No. 3. (Aug.): 717-737.

Kashyap, Anil K. and Stein, Jeremy C. 2000. "What Do a Million Observations on Banks Say about the Transmission of Monetary Policy?" *American Economic Review* 90, No. 3. (June): 407-428.

Kashyap, Anil K., Stein, Jeremy C. and Wilcox, David W. 1993. "Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance." *American Economic Review* 83, No. 1. (Mar.): 78-98.

Kishan; Ruby P. and Opiela,Timothy P. 2000. "Bank Size, Bank Capital, and the Bank Lending Channel," *Journal of Money, Credit and Banking* 32, No. 1. (Feb.): 121-141.

Kunze, Kent, Mary Jablonski and Mark Sieling, 1998. "Measuring Output and Labor Productivity of Commercial Banks (SIC 602): A Transactions-based Approach", presented at the Brookings Institution Workshop on Banking Output, Washington, DC, November 20, 1998

Lown, Cara S. and Peristiani, Stavros, 1996. "The Behavior of Consumer Loan Rates during the 1990 Credit Slowdown." *Journal of Banking and Finance* 20, December: 1673-94.

Morgan, Donald P. 1998. "The Credit Effects of Monetary Policy: Evidence Using Loan Commitments." *Journal of Money, Credit and Banking* 30, No. 1. (Feb.): 102-118

Nilsen, Jeffrey H. 2002. "Trade Credit and the Bank Lending Channel". *Journal of Money, Credit, and Banking* 34, No. 1 (Feb.): 226-253

Peek, Joe, and Rosengren, Eric. 1995a. "Bank Regulation and the Credit Crunch." *Journal of Banking and Finance* 19, nos. 3-4, (June): 679-92.

Peek, Joe, and Rosengren, Eric. 1995b. "The Capital Crunch: Neither a Borrower nor a Lender Be." *Journal of Money, Credit and Banking* 27, No. 3. (Aug.): 625-638.

Peek, Joe, and Rosengren, Eric. 2000. "Collateral Damage: Effects of the Japanese Bank Crisis on Real Activity in the United States." *American Economic Review* 90, No. 1. (Mar.): 30-45.

Peek, Joe, Rosengren, Eric and Tootell, Geoffrey M.B. 2003. "Identifying the Macroeconomic Effect of Loan Supply Shocks." *Journal of Money, Credit and Banking* 35, No. 6, (Dec.): 931-946.

Ruggles, R., and Ruggles, N.D., 1982, "Integrated Economic Accounts four the United States, 1847-1980,"*Survey of Current Business*, May, 1-16.

Scholtens, Bert and van Wensveen, Dick. 2000. "A Critique on the Theory of Financial Intermediation"*Journal of Banking & Finance* 24, 1243-1251.

Speagle, R.E., and Silverman, L., 1953, "The Banking Income Dilemma," *Review of Economics and Statistics*, 35, May, 128-39.

Sunga, P.S., 1967, "The Treatment of Interest in the National Accounts Framework," *Review of Income and Wealth*, March, 26-35.

__________, 1984, "An Alternative to the Current Treatment of Interest as Transfer in the United Nations and Canadian Systems of National Accounts, *Review of Income and Wealth*, 30(4), 385-402.

United Nations, 1993. See Commission of the European Communities, *et al.*

Triplett, Jack E. and Bosworth, Barry P. 2004. *Productivity in the U.S. Services Sector: New Sources of Economic Growth*. Brookings Institution Press: Washington.

Wang, J. Christina. "Loanable Funds, Risk, and Bank Service Output", Federal Reserve Bank of Boston working paper, July 2003a. Available at http://www.bos.frb.org/economic/wp/index.htm.

Wang, J. Christina. "Service Output of Bank Holding Companies in the 1990s and the Role of Risk." Federal Reserve Bank of Boston working paper, September 2003b. Available at http://www.bos.frb.org/economic/wp/index.htm

Wang, J. Christina. "Productivity and Economies of Scale in the Production of Bank Service Value Added" Federal Reserve Bank of Boston Working Paper, September 2003c. Available at http://www.bos.frb.org/economic/wp/index.htm

Wang, J. Christina, Basu, Susanto and Fernald, John G. 2004. "A General-Equilibrium Asset-Pricing Approach to the Measurement of Nominal and Real Bank Output" Presented at the CRIW Conference on Price Index Concepts and Measurement, Vancouver, Canada, June 28-29. Available at http://www.ipeer.ca/papers/Wang_Basu_Fernald_Oct_15_2004.pdf .

Wojnilower, Albert M. 1980. "The Central Role of Credit Crunches in Recent Financial History." *Brookings Papers on Economic Activity 1980*, no. 2. 277-326.

Figure 1: Growth rate price and imputed output current method

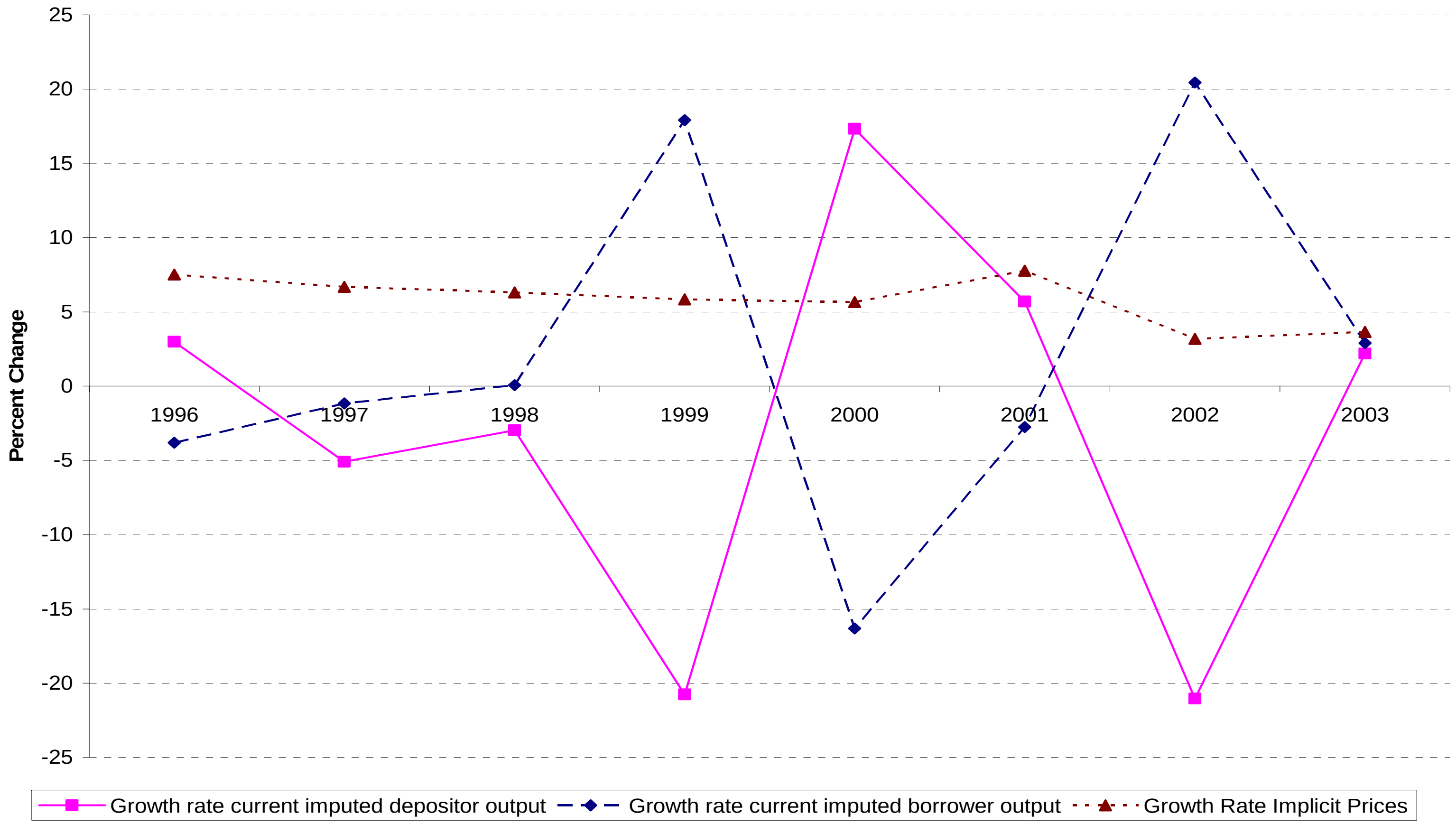

Figure 2: Price index growth rates for implicit depositor services

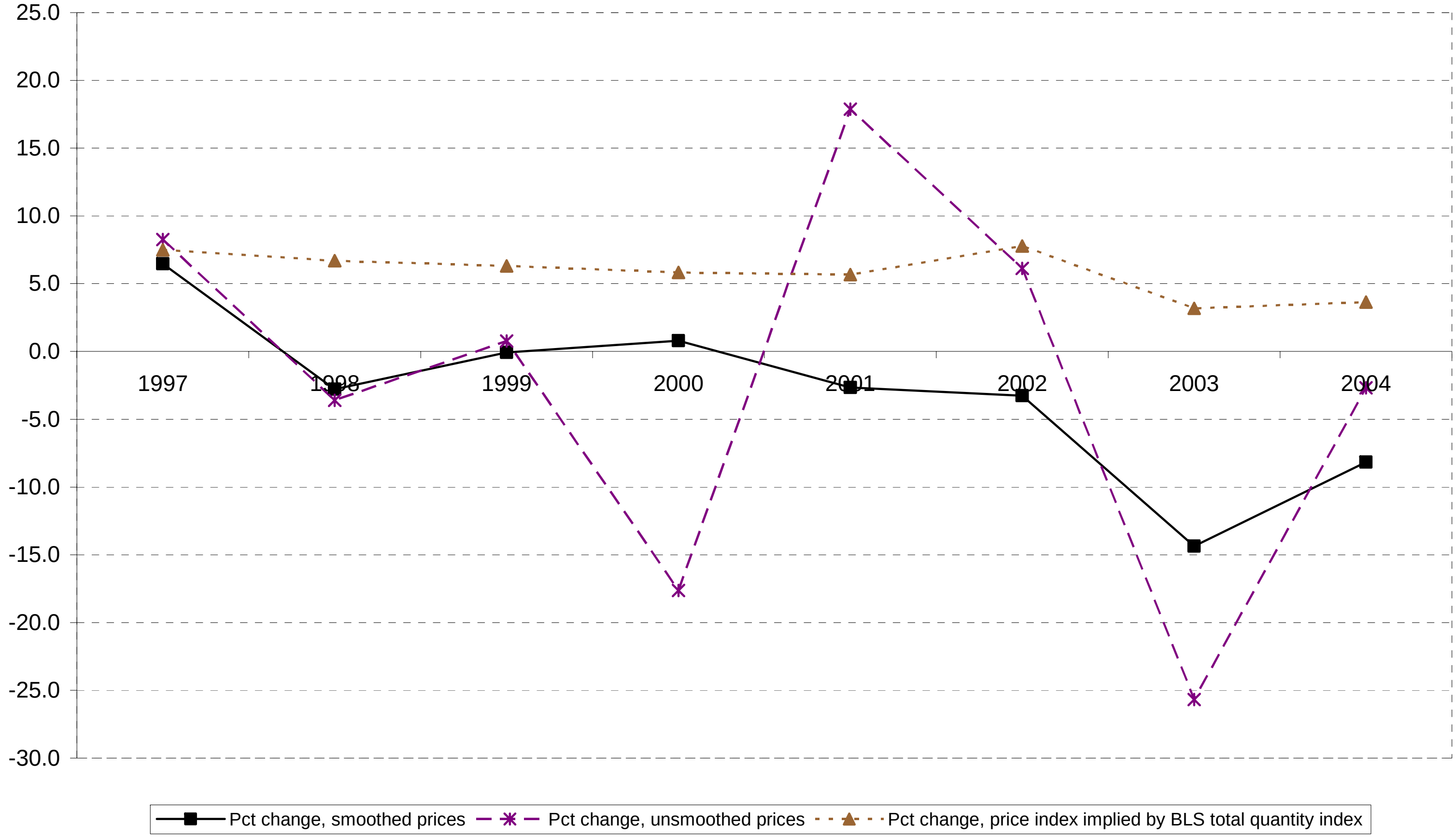

Figure 3: Alternative Measures of Implicit Depositor Services

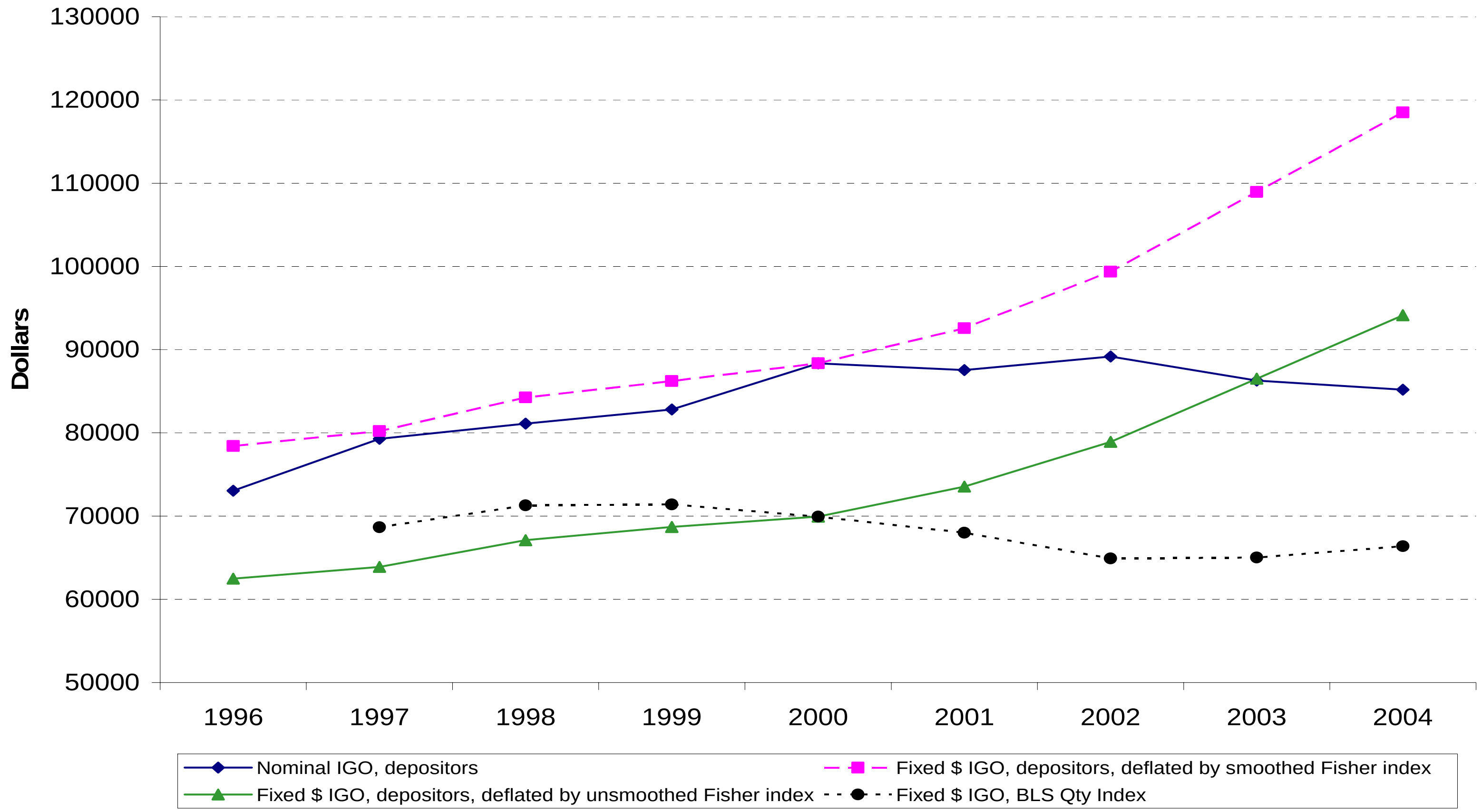

Figure 4: Quantity Growth Rates for Implicit Depositor Services

Figure 5: Percent Changes in Price and Quantity, Borrower Services

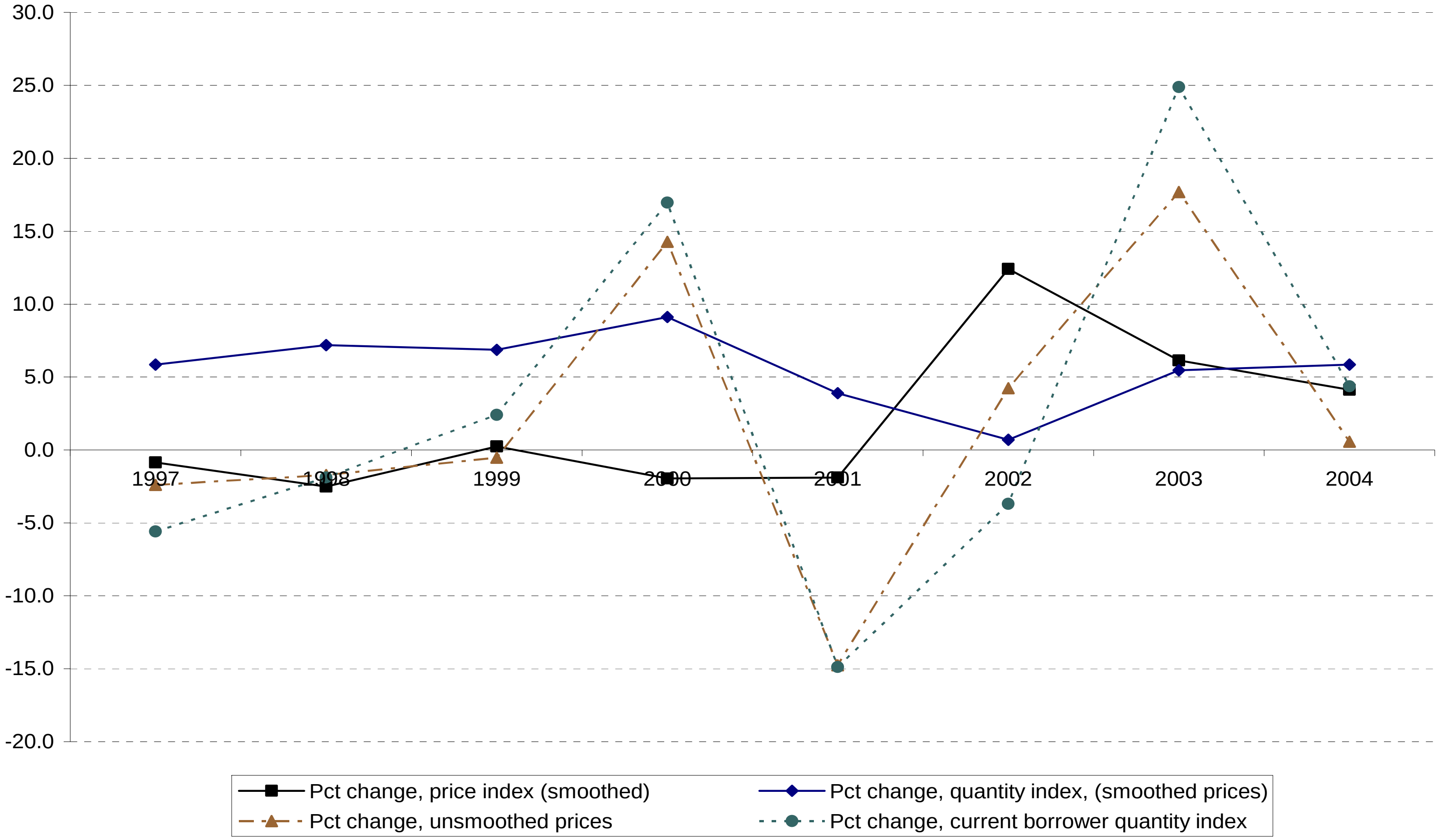

Figure 6: Pct change, implicit deposit serivces

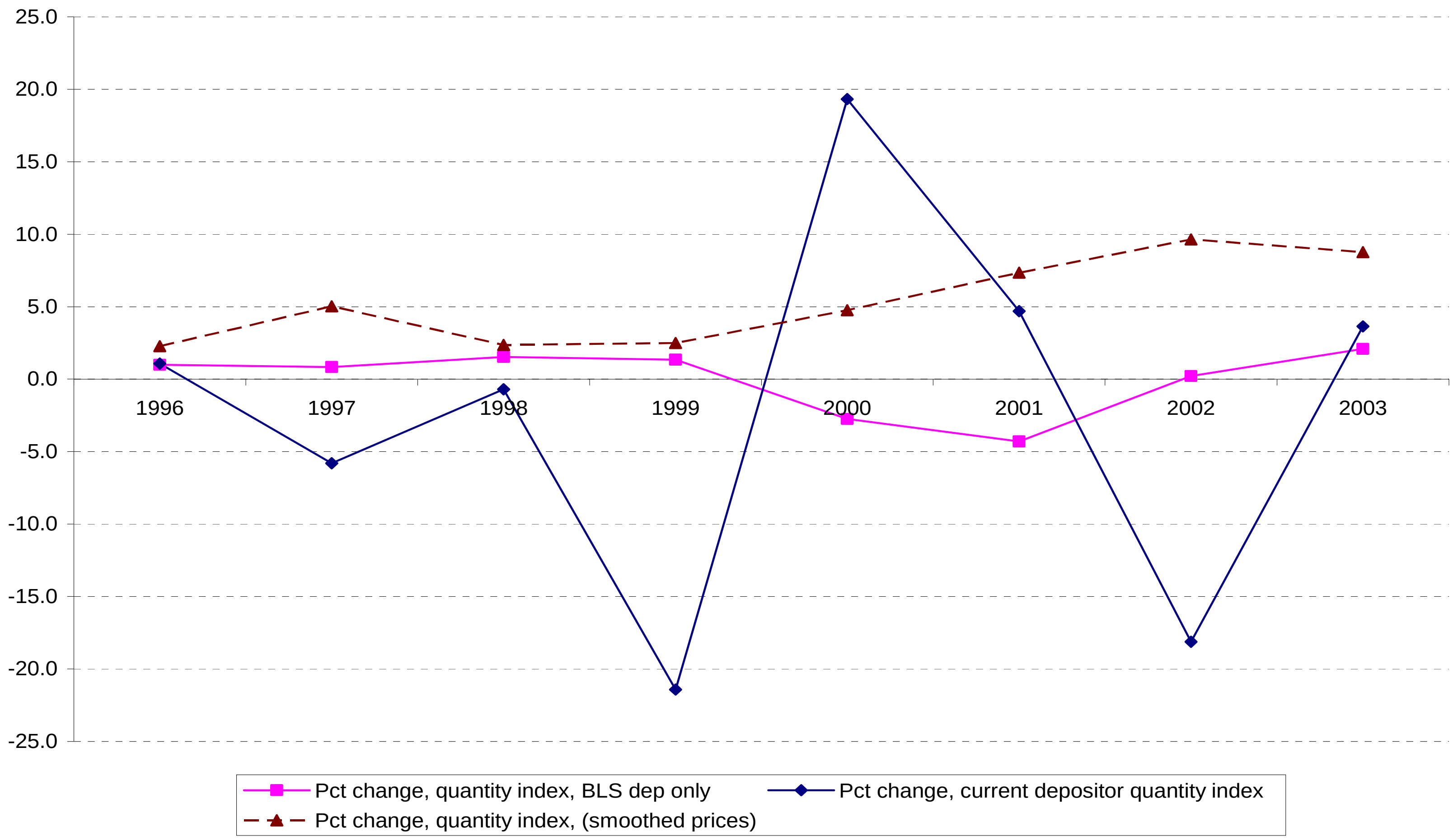

Figure 7: Pct change, implicit borrower quantity indexes

Figure 8: Productivity Growth Estimated from Direct Deflation Measure of Real Bank Output