Problems with the Measurement of Banking Services in a National Accounting Framework

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Abstract

The paper considers some of the problems associated with the indirectly measured components of financial service outputs in the System of National Accounts (SNA), termed FISIM (Financial Intermediation Services Indirectly Measured). The paper utilizes a user cost and supplier benefit approach to the determination of the value of various financial services in the banking sector. The present paper also attempts to integrate the balance sheet accounts in the SNA with the usual flow accounts. An empirical example of various nominal output concepts that could be applied to the U.S. commercial banking sector is presented.

Journal of Economic Literature Classification Numbers

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Keywords

User costs, banking services, deposit services, loan services, production accounts, System of National Accounts, FISIM, Financial Intermediation Services Indirectly Measured.

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2 The views expressed in this paper are those of the author and should not be attributed to the Bureau of Economic Analysis.

3 The views expressed herein are those of the author and should not be attributed to the IMF, its Executive Board, or its management.
1. Introduction

One of the most controversial areas in the field of economic measurement is the measurement of the real and nominal output of the banking sector. There is little consensus on all aspects of this topic: even the measurement of banking sector nominal outputs and inputs is controversial and there is little agreement on how to measure the corresponding real outputs and inputs. Competing user cost approaches to bank measurement have been developed by Wang and her coauthors and by Hancock, Fixler and Zieschang. There is a third approach to nominal bank output and input measurement that works with bank assets and liabilities rather than user cost flows. The present paper will not deal with this third approach but we will consider the first two user cost based approaches.

There is a broader aspect to our paper than just the measurement of banking sector outputs. Commercial banks are different from other types of financial sector firms in that they are allowed to create money. However, other types of financial firms make loans and trade in financial assets. In addition, many nonfinancial firms generate a substantial amount of revenue from various financial transactions, including loans in particular. Thus it will be useful to develop a general framework that will allow these activities to be part of the production accounts in the System of National Accounts. We attempt to provide such a framework in this paper.

A brief outline of the paper follows. In section 2, we look at a standard model of production that distinguishes beginning of the period capital stocks as inputs and end of the period capital stocks as outputs. In traditional one period production theory, end of the period capital stocks (as well as flow inputs and outputs that take place during the period) are usually discounted by 1 + r, where r is the firm’s one period cost of financial capital. In subsequent sections of the paper, we will adapt this standard model to include financial outputs and inputs.

In section 3, we set up a simple model of an economy that has 4 sectors: a household sector, a banking sector, a nonfinancial sector and an owner occupied housing sector.

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6 See Berger and Humphrey (1997) and Berger and Mester (1997) for a good introduction to this literature.
7 Keuning (1999) attempted to integrate financial capital into the System of National Accounts but he did not use a user cost approach.
8 In an earlier paper, Diewert, Fixler and Zieschang (2012), we had only a 3 sector model, but subsequently, we realized that housing loans were a large part of bank loans and in order to model these loans (and to
Monetary deposits, loans and equity investments are all part of this model. In section 3, the cash flow accounts for the 4 sectors are laid out while section 4 lays out the beginning of the period balance sheet constraints for each sector. In section 5, the balance sheet constraints are integrated with the flow accounts and various asset and liability margins are introduced.

In section 6, we discuss various options for choosing the reference discount rate for each sector in our model. In section 7, we offer some brief comments on how the various nominal monetary flows could be deflated into real flows, although this is not the main focus of the present paper.

In section 8, we present an empirical example of how our suggested measurement approach might work in practice. We do not offer an economy wide empirical example of our suggested accounting approaches but we construct alternative sets of integrated nominal accounts for the U.S. commercial banking sector over the period 2001-2011. The data for this exercise are explained and listed in the Appendix and they are taken from the Federal Deposit Insurance Corporation’s publically available accounting database. In section 8, we offer up nine alternative measures of U.S. banking output. We look at three alternative choices for the banking sector’s reference rate and for each choice of reference rate, we construct three alternative measures of bank output.

In section 9, we compare our single reference rate approach to the measurement of bank outputs with the multiple reference rate methodology used by Basu, Inklaar and Wang (2011).9

Section 10 concludes.

2. The Production Theory Background

In this section, we explain a standard model of production that can deal adequately with the existence of durable inputs. This model is essentially a variant of Hicks’ (1939) general model of production specialized to the case of a single period. The following two quotations explain the essence of the model:

“We must look at the production process during a period of time, with a beginning and an end. It starts, at the commencement of the Period, with an Initial Capital Stock; to this there is applied a Flow Input of labour, and from it there emerges a Flow Output called Consumption; then there is a Closing Stock of Capital left over at the end. If Inputs are the things that are put in, the Outputs are the things that are got out, and if the production of the Period is considered in isolation, then the Initial Capital Stock is an Input. A Stock Input to the Flow Input of labour; and further (what is less well recognized in the tradition, but is equally clear when we are strict with translation), the Closing Capital Stock is an Output, a Stock Output to match the Flow Output of Consumption Goods. Both input and output have stock and flow components; capital appears both as input and as output” John R. Hicks (1961; 23).

9 We also explain a generalization of the Basu, Inklaar and Wang (2011) methodology due to Zieschang (2011).
“The business firm can be viewed as a receptacle into which factors of production, or inputs, flow and out of which outputs flow...The total of the inputs with which the firm can work within the time period specified includes those inherited from the previous period and those acquired during the current period. The total of the outputs of the business firm in the same period includes the amounts of outputs currently sold and the amounts of inputs which are bequeathed to the firm in its succeeding period of activity.” Edgar O. Edwards and Philip W. Bell (1961; 71-72).

Hicks and Edwards and Bell obviously had the same model of production in mind: in each accounting period, the business unit combines the capital stocks and goods in process that it has inherited from the previous period with “flow” inputs purchased in the current period (such as labour, materials, services and additional durable inputs) to produce current period “flow” outputs as well as end of the period depreciated capital stock components which are regarded as outputs from the perspective of the current period (but will be regarded as inputs from the perspective of the next period). 10 The model could be viewed as an Austrian model of production in honour of the Austrian economist Böhm-Bawerk (1891) who viewed production as an activity which used raw materials and labour to further process partly finished goods into finally demanded goods.

We will illustrate this one period Austrian model of production for a producer that produces a single output y (with selling price p), uses a single variable flow input x (with purchase price w) and uses the services of a single durable capital input K (which has beginning of the period purchase price P_K^0 and, at the end of the accounting period, has a selling price of P_K^1). The beginning of the period capital stock is K^0 and the end of the period depreciated capital stock (measured in beginning of the period efficiency units) is K^1 \leq K^0. 11 Assuming that output revenues and variable input costs are collected and paid at the end of the accounting period 12 and assuming that the producer faces the overall cost of capital r, the period 1 Austrian profit maximization problem can be defined as follows:

\[
(1) \max_{y,x,K^0,K^1} \{(1+r)^{-1}(py - wx + P_K^1K^1) - P_K^0K^0 : (y,x,K^0,K^1) \in S^1\}
\]

where S^1 is the period 1 Austrian production possibilities set. Note that we have treated the price p of period 1 output and the price of period 1 variable input w as end of period 1 prices and hence the corresponding value flows are discounted to their beginning of period 1 equivalents using the beginning of period 1 nominal interest rate r. 13 From a practical measurement perspective, it is more useful to work with end of the period equivalents and so if we multiply the objective function in (11) through by (1+r), we obtain the following period 1 (end of period perspective) profit maximization problem: 14

\[
\text{For more on this model of production and additional references to the literature, see Hicks (1939), Malinvaud (1953) and the Appendices in Diewert (1977) (1980).}
\]

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\]

\[
11 \text{ If the capital input is not subject to wear and tear depreciation (e.g., a land input), then K^1 = K^0.}
\]

\[
12 \text{ This convention is consistent with current accounting practice; see Peasnell (1981).}
\]

\[
13 \text{ In later sections of the paper, we will interpret the nominal discount factor r as the average cost of raising financial capital at the beginning of the accounting period for firms and the opportunity cost of capital for households.}
\]

\[
14 \text{ For additional material on the beginning and end of period perspective and the associated user costs, see Diewert (2005a).}
\]
(2) \( \max_{y, x, K^0, K^1} \{ py - wx + P_K^1 K^1 - (1+r)P_K^0 K^0 : (y, x, K^0, K^1) \in S^1 \}. \)

Note that \( P_K^1 K^1 - (1+r)P_K^0 K^0 = -[(1+r)P_K^0 K^0 - P_K^1 K^1] \) and hence the last expression in square brackets is a measure of capital services input and can be seen to be a generalization of the usual end of period user cost of capital \(^{15}\) times the initial capital stock \( K^0 \). To see this, let \( K^1 = (1-\delta)K^0 \) where \( \delta \) is the one period geometric depreciation rate and let \( P_K^1 = (1+i)P_K^0 \) where \( i \) is the (actual or expected) asset inflation rate over the accounting period. Then

\[
(3) (1+r)P_K^0 K^0 - P_K^1 K^1 = (1+r)P_K^0 K^0 - (1+i)P_K^0 (1-\delta)K^0 = [r - i + (1+i)\delta]P_K^0 K^0 = uK^0
\]

and \( u = [r - i + (1+i)\delta]P_K^0 \) is the usual end of period user cost of capital for the geometric model of depreciation. An important point to take away from this discussion is that \((1+r)P_K^0 K^0 - P_K^1 K^1\) is a generalization of the usual expression for the value of capital services rendered by the asset \( K^0 \) over the accounting period. Furthermore, looking at the right hand side of (3), it can be seen that the user cost of capital decomposes into the sum of the following three terms, each of which has an economic interpretation:

- \( rP_K^0 K^0 \) is equal to waiting and risk assumption services; \(^{16}\)
- \( -iP_K^0 K^0 \) is the revaluation term and
- \((1+i)\delta P_K^0 K^0 \) is a measure of wear and tear depreciation.

If we drop the \( r \) in the decomposition (3), it can be seen that the resulting expression, \( P_K^0 K^0 - P_K^1 K^1 \), is equal to the sum of the revaluation and depreciation terms. \(^{17}\) We will utilize this interpretation of this expression (without the \( r \)) in the following sections.

It should be noted that at the beginning of the accounting period, the end of period price of capital, \( P_K^1 \), will not be known. Thus when constructing user costs, there will always be two versions of the concept that could be constructed:

- An ex post version that uses the actual end of period t price as the price \( P_K^1 \) in (2) or
- An ex ante version that uses an anticipated end of period t price as the price \( P_K^1 \) in (2).

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\(^{16}\) See Rymes (1968) (1983) on the concept of waiting services in the user cost of capital literature. Basically, waiting services are simply the payment to suppliers of (risk free) funds for postponing consumption for the accounting period. For any risky sector, we need to add a reward for risk taking to arrive at the nominal supply price for financial capital for that sector.

\(^{17}\) Strictly speaking, we have only derived this equality for the geometric model of depreciation. But it also holds in much more general depreciation models; see Diewert (2010; 766) for a derivation in the more general model of depreciation.
Diewert (1980; 476) and Hill and Hill (2003) endorsed the ex ante version for most purposes, since it will tend to be smoother than the ex post version and it will generally be closer to a rental or leasing price for the asset. However, in this paper, we will not take a position on which version of the user cost of capital should be used for national income accounting purposes.

We conclude this section with a question: how exactly should the discount rate $r$ in (1) be determined? It is not possible to give a definitive answer to this question but it seems likely that the one period interest rate should be closely related to the firm’s marginal cost of raising an additional unit of financial capital. This financial capital is then used to purchase real assets. This is the perspective that we will take in this paper. Moreover, we see a primary role for the banking sector as a financial intermediary sector which collects financial capital from the household sector and allocates it to businesses and borrowing households in a hopefully efficient manner.

In the following section, we outline our highly simplified model of an economy with four sectors: a household sector and three production sectors which consist of a banking sector, a general nonfinancial production sector and an owner occupied housing sector. The model is highly aggregated and there is no explicit investment, government and international trade sectors. Our goal here is to focus attention on some of the vexing problems associated with the measurement of bank inputs and outputs for a system of national income accounts in a very simple framework so that some consensus on how to proceed can be formed before more complex accounting issues are addressed.

3. The System of Flow Accounts

As was mentioned in the previous section, we will consider an economy with a household sector $H$ and three production sectors: (i) a banking sector $B$; (ii) a nonfinancial production sector $N$ and (iii) an owner occupied housing sector $O$. We will start our description of the economy by describing the outputs produced, inputs used and financial flows generated by each of the three production sectors during a reference period $1$.

We start by describing the inputs used and the outputs produced by the banking sector, $B$. The total value of priced banking services delivered to the household sector is $p_{BH}y_{BH}$ where $p_{BH}$ is the price and $y_{BH}$ is the corresponding quantity. Similarly, the total value of priced banking services delivered to the nonfinancial production sector is $p_{BN}y_{BN}$ where $p_{BN}$ is the price and $y_{BN}$ is the corresponding quantity. The banking sector purchases intermediate inputs from the nonfinancial sector, $y_{NB}$, at the price $p_{NB}$. The value of

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18 Hence there are no tax wedges to account for either. There is also no central bank or foreign trade in our model.
19 The Owner Occupied Housing (OOH) sector is singled out as “production” sector for two reasons: (i) in the current System of National Accounts (SNA) includes this sector in the production accounts and (ii) banks make mortgage loans to owners of housing and it is important to take these loans into account in a model that attempts to describe banking activities.
20 For simplicity, we will not attach the time superscript $1$ to our flow variables but for capital stocks, $P^0$ and $K^0$ will denote beginning of the period capital stocks while $P^1$ and $K^1$ will denote the corresponding end of period capital stocks.
explicitly priced (gross) output, $p_{BH}y_{BH} + p_{BN}y_{BN}$, is equal to intermediate plus primary input cost; i.e., the banking sector satisfies the following cash flow identity:

\[
(4) p_{BH}y_{BH} + p_{BN}y_{BN} = p_{NB}y_{NB} + w_{B}x_{B} + [P_{KB}^{0}K_{B}^{0} - P_{KB}^{1}K_{B}^{1} + r_{HM_{H}}^{0} + r_{N}M_{N}^{0} + r_{HB}v_{HB}^{0} + R_{HB}V_{HB}^{0} - r_{BN}v_{BN}^{0} - R_{BN}V_{BN}^{0} - r_{BO}v_{BO}^{0} + \pi_{B}]
\]

where:

- $w_{B}x_{B}$ = the value of labour input used in the banking sector where $w_{B}$ is the wage rate;
- $P_{KB}^{0}K_{B}^{0}$ = the value of the physical capital stock used by the banking sector at the beginning of the period where $P_{KB}^{0}$ is the price and $K_{B}^{0}$ is the quantity;
- $P_{KB}^{1}K_{B}^{1}$ = the end of period value of the initial capital stock used by the banking sector where $P_{KB}^{1}$ is the end of period price and $K_{B}^{1}$ is the corresponding quantity;
- $r_{HM_{H}}^{0}$ = the value of bank interest payments made to household depositors where $r_{H}$ is the household bank deposit rate and $M_{H}^{0}$ is the household’s beginning of the period stock of deposits (or money);
- $r_{N}M_{N}^{0}$ = the value of bank interest payments made to nonfinancial business depositors where $r_{N}$ is the nonfinancial sector’s bank deposit rate and $M_{N}^{0}$ is the nonfinancial sector’s beginning of the period stock of deposits;
- $r_{HB}v_{HB}^{0}$ = interest paid by the banking sector to households where $v_{HB}^{0}$ is the household sector’s beginning of the period stock of loans made to the banking sector and $r_{HB}$ is the corresponding interest rate;
- $R_{HB}V_{HB}^{0}$ = imputed income paid to household equity investors in the banking sector where $V_{HB}^{0}$ is the beginning of the period equity stock and $R_{HB}$ is the equity rate of return that is required in order to induce investors to hold bank equity;
- $r_{BN}v_{BN}^{0}$ = the product of the interest rate that the banking sector charges on loans to the nonfinancial sector $^{21}r_{BN}$ times the beginning of the period stock of loans $v_{BN}^{0}$;
- $R_{BN}V_{BN}^{0}$ = imputed income paid to the banking sector by the nonfinancial sector for the equity investments of sector B in sector N where $V_{BN}^{0}$ is the beginning of the period equity bank investment stock and $R_{BN}$ is the equity rate of return that is required in order to induce the banking sector to invest in sector N;
- $r_{BO}v_{BO}^{0}$ = the product of the mortgage interest rate that the banking sector charges on loans to the owner occupied sector $r_{BO}$ times the beginning of the period stock of mortgage loans $v_{BN}^{0}$;
- $\pi_{B}$ = the residually determined unanticipated or monopoly profits earned by the banking sector during the reference period.

What we will term the explicitly measured value added (equal to priced gross outputs less the value of intermediate inputs) for sector B is given by equation (5) below:\(^{22}\)

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\(^{21}\) This loan rate is equal to the gross loan interest rate less the expected default rate on the type of loan. A similar comment applies to other loan rates; i.e., they are to be considered as net of default interest rates. In the empirical part of this paper, we convert loan loss provisions into our estimates of expected default rates.

\(^{22}\) Implicitly priced financial services or FISIM (Financial Intermediation Services Indirectly Measured) will make their appearance in section 5 below. For now, all interest flows for each sector will be regarded as positive (or negative) components of operating surplus. For simplicity, we assume that the nonfinancial sector does not invest in the banking sector.
The eleven terms on the right hand side of equation (5) are provisionally regarded as primary input flows. The last ten components together comprise explicitly measured gross operating surplus. Thus the explicitly measured banking sector value added is equal to the sum of labour services used in the banking sector \((w_Bx_B)\), revaluation plus depreciation of capital services \((P_{KB}0K_B0 - P_{KB}1K_B1)\) plus bank deposit interest paid to the household and nonfinancial sectors \((r_HM_H0 + r_NM_N0)\) plus bond interest, dividends and imputed equity return paid to households for their financial investments in the banking sector \((r_{HB}V_{HB}0 + R_{HB}V_{HB0})\) less bond interest, dividend income and imputed equity returns from the banking sector’s investments in the nonfinancial sector \((-r_{BN}V_{BN0} - R_{BN}V_{BN0})\) less mortgage interest earned by the banking sector for their loans to owner occupiers of houses \((-r_{BO}V_{BO0})\) plus pure profits \(\pi_B\).

Note that some of the banking sector’s loan and equity investment interest flows that are included on the right hand side of (5) \((-r_{BN}V_{BN0} - R_{BN}V_{BN0} - r_{BO}V_{BO0})\) have negative signs associated with them and thus these items are not really cost charges to the banking sector; instead, these loan and investment flows represent revenues to the sector. In section 5 below, we will discuss whether these flows should be regarded as contributions to bank value added or be left as (negative) primary input flows.

For the most part, all of the flows represented in (5) can be measured once the end of the accounting period has been reached. Some of the problems associated with measuring the beginning and end of period prices of capital stocks (and the corresponding quantities) were mentioned in the previous section and in this section, we will simply assume that these problems associated with the measurement of real capital service flows have been solved. However, there are some additional measurement problems associated with the measurement of the banking sector’s pure profits \(\pi_B\) and the rate of return on household equity investments in the banking sector, \(R_{HB}\). If we take an ex post point of view, we could simply set \(\pi_B\) equal to zero in equation (5) and treat \(R_{HB}\) as a residual item and solve the resulting equation for the ex post balancing rate of return on equity investments in the bank. A potential problem with this method is that the resulting ex post rates of return may not reflect the supply prices of equity capital to the banking sector; the high ex post rates of return on equity that are generally observed may simply reflect

\[ (5) \quad p_{BH}y_{BH} + p_{BN}y_{BN} - p_{NB}y_{NB} \equiv w_Bx_B + P_{KB}0K_B0 - P_{KB}1K_B1 + r_HM_H0 + r_NM_N0 + r_{HB}V_{HB0} + R_{HB}V_{HB0} - r_{BN}V_{BN0} - R_{BN}V_{BN0} - r_{BO}V_{BO0} + \pi_B. \]
Thus we leave open the possibility that we are able to adjust for this potential monopolistic power and to somehow find realistic supply prices for equity capital.

We now describe the inputs used and the outputs produced by the nonfinancial sector, N. The total value of nonfinancial services delivered to the household sector is \( p_{NH}y_{NH} \) where \( p_{NH} \) is the price and \( y_{NH} \) is the corresponding quantity. Similarly, the total value of nonfinancial services delivered to the banking sector is \( p_{NB}y_{NB} \). The nonfinancial sector purchases some priced intermediate input services from the banking sector, \( y_{BN} \), at the price \( p_{BN} \). A derivation of the explicitly measured value added (again equal to priced gross outputs less the value of priced intermediate inputs) for sector N can be made from the sector N cash flow identity. The result is equation (6) below:

\[
(6) \ p_{NH}y_{NH} + p_{NB}y_{NB} - p_{BN}y_{BN} = W_Nx_N + P_{KN}^0K_N^0 - P_{KN}^1K_N^1 - r_NM_N^0 + r_{HN}V_{HN}^0 + R_{HN}V_{HN}^0 + r_{BN}V_{BN}^0 + R_{BN}V_{BN}^0 + \pi_N
\]

where

\( w_Nx_N \) = the value of labour input used in the nonfinancial sector;
\( P_{KN}^0K_N^0 \) = the value of the physical capital stock used by sector N at the beginning of the period where \( P_{KN}^0 \) is the price and \( K_N^0 \) is the quantity;
\( P_{KN}^1K_N^1 \) = the end of period value of the initial capital stock used by sector N where \( P_{KN}^1 \) is the end of period price and \( K_N^1 \) is the corresponding quantity;
\( r_NM_N^0 \) = the value of bank interest payments made to sector N depositors where \( r_N \) is the nonfinancial sector bank deposit rate and \( M_N^0 \) is the sector N beginning of the period stock of deposits (or money);
\( r_{HN}V_{HN}^0 \) = interest paid by the nonfinancial sector to households where \( v_{HN}^0 \) is the household sector’s beginning of the period stock of loans made to the nonfinancial sector and \( r_{HN} \) is the corresponding interest rate;
\( R_{HN}V_{HN}^0 \) = imputed interest and dividends paid to household equity investors in the nonfinancial sector where \( V_{HN}^0 \) is the beginning of the period equity stock and \( R_{HN} \) is the equity rate of return that is required in order to induce investors to hold bank equity;
\( r_{BN}V_{BN}^0 \) = the product of the interest rate that the banking sector charges on loans to the nonfinancial sector \( r_{BN} \) times the beginning of the period stock of loans \( v_{BN}^0 \);
\( R_{BN}V_{BN}^0 \) = imputed income paid to the banking sector by the nonfinancial sector for the equity investments of sector B in sector N where \( V_{BN}^0 \) is the beginning of the period equity bank investment stock and \( R_{BN} \) is the equity rate of return that is required in order to induce the banking sector to invest in sector N;
\( \pi_N \) = the residually determined unanticipated or monopoly profits earned by the nonfinancial sector during the reference period.

Thus conventional nonfinancial sector value added is equal to the sum of labour services used in the sector \( (w_Nx_N) \), revaluation plus depreciation of capital services \( (P_{KN}^0K_N^0 – \)

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\[26\] Alternatively, the high equity returns may simply be a risk premium paid to equity capital due to the high leverage in the banking sector.
less bank deposit interest paid to the nonfinancial sector by the banking sector \((- r_N M_N^0)\) plus bond interest, dividends and imputed equity return paid to households for their financial investments in sector N \((r_{HN V_{HN}}^0 + R_{HN V_{HN}}^0)\) plus bond interest, dividend income and imputed equity returns paid to the banking sector for its investments in the nonfinancial sector \((r_{BN V_{BN}}^0 + R_{BN V_{BN}}^0)\) plus pure profits in the nonfinancial sector \(\pi_N\).

If we make the assumption that the nonfinancial sector is approximately competitive, we can set sector N profits \(\pi_N\) equal to zero, and also set \(R_{HN} = R_{BN} \equiv R_N\) so that the equity returns in sector N are equalized across providers of equity funds and then we can solve the resulting equation (6) for the balancing ex post equity rate of return \(R_N\). Thus in principle, all of the variables which appear in the value added equation (6) for sector N can be determined at the end of the accounting period.

The final production sector we need to consider is sector O, the sector that produces (imputed) housing services from owners of their own houses. The reason for including this sector in the present banking context is that the banking sector is an important contributor to this sector by providing owners of dwelling units with housing loans. Sector O produces only one output, housing services with imputed price \(p_{OH}\) and corresponding quantity \(y_{OH}\). The decomposition of the value of housing services output, \(p_{OH} y_{OH}\), into its primary input components is given by equation (7):

\[
\begin{align*}
(7) \quad p_{OH} y_{OH} &= P_H^0 H^0 - P_H^1 H^1 + r_{HO} V_{HO}^0 + R_{VO} V_{HO}^0 + r_{BO} V_{BO}^0
\end{align*}
\]

where

\[
\begin{align*}
P_H^0 H^0 &= \text{the value of the owner occupied housing stock owned by sector O at the beginning of the period where } P_H^0 \text{ is the price and } H^0 \text{ is the quantity;} \\
P_H^1 H^1 &= \text{the end of period value of the initial housing stock used by sector O where } P_H^1 \text{ is the end of period price and } H^1 \text{ is the corresponding depreciated end of period housing stock measured in constant quality units;} \\
r_{HO} V_{HO}^0 &= \text{interest paid by sector O to other households where } v_{HO}^0 \text{ is the household sector’s beginning of the period stock of loans made to sector O and } r_{HO} \text{ is the corresponding interest rate;} \\
r_{BO} V_{BO}^0 &= \text{mortgage interest paid by sector O to the banking sector where } v_{BO}^0 \text{ is the}
\end{align*}
\]

27 Many national income accountants would object to seeing a revaluation term in the primary income accounts. Having the revaluation term in our accounting framework allows us to utilize the Hicksian one period model of production explained in section 2 in a straightforward way but for the most part, our arguments will not be greatly affected if the revaluation term is deleted from the income accounts and placed elsewhere. For the details on how to delete the revaluation term and define only a depreciation term, see Diewert (2010; 765-766).

28 We have simplified the accounts of the nonfinancial sector. In reality, the nonfinancial sector can make loans to the other sectors and can hold equity positions in the banking sector.

29 It should be noted that \(P_H^1 H^1\) equals the value of the owner occupied housing stock at the beginning of the period, which in turn is equal to \(v_{HO}^0 + V_{HO}^0 + v_{BO}^0\).

30 There are many problems associated with measuring constant quality housing stocks which we are glossing over here. For discussions of these problems, see Verbrugge (2008), Diewert (2009a) (2009b), Diewert and Nakamura (2009), Diewert, Nakamura and Nakamura (2009) and Haan and Diewert (2011).
banking sector’s beginning of the period stock of loans made to sector O and \( r_{BO} \) is the corresponding mortgage interest rate;

\[ R_{HO} V_{HO}^0 = \text{imputed interest foregone by household equity investments in owner occupied housing where } V_{HO}^0 \text{ is the beginning of the period equity value of the owner occupied housing stock and } R_{HN} \text{ is the corresponding imputed interest rate.} \]

Thus the (imputed) value of owner occupied housing services, \( p_{OH} y_{OH} \), is equal to revaluation plus depreciation of housing capital services \( (P_{H}^0 H^0 - P_{H}^1 H^1) \) plus interest paid on direct household loans to owners of housing units \( (r_{HO} V_{HO}^0) \) plus interest paid on bank mortgage loans to owners of housing units \( (r_{BO} V_{BO}^0) \) plus (imputed) homeowner interest foregone on owner housing equity \( (R_{HO} V_{HO}^0) \).

Note that equation (7) has two imputed prices in it: the output price of owned housing services, \( p_{OH} \), and the opportunity cost of investing in housing equity, \( R_{HO} \). There are at least two strategies that can be used to determine these imputed prices:\textsuperscript{31}

- The rental equivalence approach where \( p_{OH} \) is set equal to the rental price of comparable properties and then (7) can be used to determine \( R_{HO} \) residually;
- The user cost approach where \( R_{HO} \) is set equal to an appropriate household sector rate of return that homeowners are giving up by investing in housing equity. Equation (7) is then used to determine \( p_{OH} \) residually.

We do not make a specific recommendation on which approach should be used. For our purposes, we simply assume that all of the flows in (5)-(7) have been determined by the national statistical agency.

Our final sector is the household sector, sector H. We assume that the flows for this sector are simply the sum of the flows across the three production sectors in the economy by commodity and so there is no need to define any new variables. Of course, various intermediate input flows within the aggregate production sector will cancel and making these cancellations, we find that the (conventional) final consumption\textsuperscript{32} of sector H is equal to:

\[
(8) \ p_{NH} y_{NH} + p_{NH} y_{NH} + p_{OH} y_{OH} = w_{B} x_{B} + w_{N} x_{N} + P_{KB}^0 K_{B}^0 - P_{KB}^1 K_{B}^1 + P_{KN}^0 K_{N}^0 - P_{KN}^1 K_{N}^1 + P_{H}^0 H^0 - P_{H}^1 H^1 + r_{H} H_{M}^0 + r_{HB} V_{HB}^0 + R_{HB} V_{HB}^0 + r_{HN} V_{HN}^0 + R_{HN} V_{HN}^0 + r_{HO} V_{HO}^0 + R_{HO} V_{HO}^0 + \pi_{B} + \pi_{N}.
\]

\textsuperscript{31} Diewert (2009a) suggested a third approach: the opportunity cost approach. In this approach housing services are priced at the maximum of their rental equivalent and user cost prices. See also Diewert and Nakamura (2009) and Diewert, Nakamura and Nakamura (2009) for additional material on this approach.

\textsuperscript{32} Because we have no capital formation in our economy, household final uses or final demand is equal to household final consumption. Allowing capital formation would bring in households’ net acquisition of housing assets. To see how capital formation could be modeled in the context of the Hicks (1961) and Edwards and Bell (1961) model of production, see Diewert (2005b).
On the left hand side of (8), we have the delivery of priced outputs to the household sector from sectors B, N and O respectively. On the right hand side, we find that this aggregate final demand flow is equal to the sum of labour services used in sectors B and N \((w_{BX} + w_{NX})\), revaluation plus depreciation of capital services used in the three sectors \((P_{KB}^0K_B^0 - P_{KB}^1K_B^1 + P_{KN}^0K_N^0 - P_{KN}^1K_N^1 + P^0_HH^0 - P^1_HH^1)\) plus bank deposit interest paid to the household sector \((r_{BH}H_0^0)\) plus bond interest, dividends and imputed equity return paid to households for their financial investments in the three sectors \((r_{HB}V_{HB}^0 + R_{HB}V_{HB}^0 + r_{HN}V_{HN}^0 + R_{HN}V_{HN}^0 + r_{HO}V_{HO}^0 + R_{HO}V_{HO}^0)\) plus pure profits generated in the banking and nonfinancial sectors \((\pi_B + \pi_N)\).

The general structure of the economy’s flow accounts will become clearer if we represent all of the entries in equations (5)-(8) in a table where the rows correspond to commodity flows and the columns to the four sectors; see Table 1 below.

The first 5 rows in Table 1 give the disposition of each sector’s production and utilization of the economy’s directly priced outputs and intermediate inputs. The entries in the Sector H column are equal to the sum of the corresponding entries in each row for the 3 production sectors. For each sector, the sum of the column entries in rows 6 to 21 (the net cost components of sectoral gross value added) are equal to the sum of the column entries in rows 1 to 5 (which is equal to gross value added).33

Table 1: The System of Sectoral Flow Accounts

<table>
<thead>
<tr>
<th>Row</th>
<th>Description</th>
<th>Sector H</th>
<th>Sector B</th>
<th>Sector N</th>
<th>Sector O</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Priced</td>
<td>$p_{BH}\ y_{BH}$</td>
<td>$p_{BH}\ y_{BH}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Output</td>
<td>$p_{NH}\ y_{NH}$</td>
<td></td>
<td>$p_{NH}\ y_{NH}$</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Flows and</td>
<td>$p_{OH}\ y_{OH}$</td>
<td></td>
<td>$p_{OH}\ y_{OH}$</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Intermediate</td>
<td>$p_{BN}\ y_{BN}$</td>
<td>$-p_{BN}\ y_{BN}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Input Flows</td>
<td>$-p_{NB}\ y_{NB}$</td>
<td></td>
<td>$p_{NB}\ y_{NB}$</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Labour Services</td>
<td>$w_{BX}x_{B} + w_{NX}x_{N}$</td>
<td>$w_{BX}x_{B}$</td>
<td>$w_{NX}x_{N}$</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Sector B Revaluation And Depreciation</td>
<td>$P_{KB}^0K_B^0 - P_{KB}^1K_B^1$</td>
<td>$P_{KB}^0K_B^0 - P_{KB}^1K_B^1$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Sector N Revaluation And Depreciation</td>
<td>$P_{KN}^0K_N^0 - P_{KN}^1K_N^1$</td>
<td></td>
<td>$P_{KN}^0K_N^0 - P_{KN}^1K_N^1$</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Sector O Revaluation And Depreciation</td>
<td>$P^0_HH^0 - P^1_HH^1$</td>
<td></td>
<td></td>
<td>$P^0_HH^0 - P^1_HH^1$</td>
</tr>
<tr>
<td>10</td>
<td>Deposit Interest B to H</td>
<td>$r_{BH}M_H^0$</td>
<td>$r_{BH}M_H^0$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Deposit Interest B to N</td>
<td>$r_{NB}M_N^0$</td>
<td>$r_{NB}M_N^0$</td>
<td></td>
<td>$-r_{NM}N_N^0$</td>
</tr>
<tr>
<td>12</td>
<td>H Loans to B: Interest</td>
<td>$r_{HB}V_{HB}^0$</td>
<td>$r_{HB}V_{HB}^0$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>H Loans to N: Interest</td>
<td>$r_{HN}V_{HN}^0$</td>
<td>$r_{HN}V_{HN}^0$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>H Loans to O: Interest</td>
<td>$r_{HO}V_{HO}^0$</td>
<td>$r_{HO}V_{HO}^0$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>B Loans to N: Interest</td>
<td>$-r_{BN}V_{BN}^0$</td>
<td>$r_{BN}V_{BN}^0$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

33 The sectoral sums over rows 7 to 21 are equal to sectoral gross operating surplus. Thus these rows provide a decomposition of this SNA aggregate.
The sum of the entries in rows 1-5 of the household column H is a measure of gross value added. In order to get a measure of net value added, it is necessary to subtract the revaluation and depreciation components of gross value added that are listed in rows 7-9 of Table 1. For our purposes, we will interpret the entries in rows 6 to 21 of the H column as household (net) supplies of factors of production. Thus the row 6 entry corresponds to the household sector’s supply of labour services while the row 7 to 9 entries correspond to the household sectors net supply of (physical) capital for use by the production sector during the period under consideration. Roughly speaking, these rows correspond to depreciation services supplied by the household sector to the producing sectors. For producers, these depreciation costs are just as real as labour costs.

Rows 10, 12-14 and 17-19 in column H denote interest (and imputed interest from equity investment) flows from the producing sectors to the household sector and these flows are rewards to the household sector for postponing consumption and investing in the production sectors. Thus these flows are sources of income for the household sector and cost components for the producing sectors.

Rows 10 and 11 in Table 1 correspond to bank deposit interest flows across the various sectors. These interest flows should be distinguished from other loan and equity interest flows since deposits have characteristics that are different from normal debt and equity investments; i.e., deposits can be used as a legal means of payment whereas other financial assets do not have this characteristic. Also, deposits are more expensive for banks to service as compared to debt and equity investments and so a special treatment for this class of monetary asset is justified. Note that the entry in row 11 of column N, \(-r_N^0\), is negative. This entry corresponds to the deposit interest received by sector N and of course, it is an offset to the cost of production rather than being an explicit cost like labour input. There are also negative entries in rows 15, 16 and 20 in the sector B column; these negative entries correspond to interest income received by the banking sector for its loans to sectors N and O and for imputed interest received by sector B for its equity investments in sector N.

Note that our preliminary measure of value added for this economy can be computed in four equivalent ways (as is usual in national income accounting);

\[\text{Pure Profits} = \pi_B + \pi_N \]

\[\pi_B \quad \pi_N\]

---

34 However the resulting measure of net value added is controversial; i.e., most national income accountants would only subtract wear and tear depreciation from gross product in order to obtain a net product measure. The controversy dates back to Pigou (1941), who argued for the exclusion of revaluation terms from definitions of net income and Hayek (1941) and Hill (2000), who argued for their inclusion.
• As the sum of the entries in rows 1 to 5 of the H column;
• As the sum of the entries in rows 6 to 21 of the H column;
• As the sum of the entries in rows 1 to 5 of the B, N and O columns and
• As the sum of the entries in rows 6 to 21 of the B, N and O columns.

We turn now to the balance sheet accounts for each sector at the beginning of the period.

4. The Opening Balance Sheet Accounts

The beginning of the period balance sheet accounts for each sector are much easier to explain than the corresponding flow accounts explained in the previous section. The basic principle is that the value of sector liabilities (sources of financial capital) should equal the value of sector assets (the value of loans plus real assets plus monetary assets). All of the necessary notation has been defined, so we can proceed to list the beginning of the period balance sheet constraints for each of our three production sectors.

The opening balance sheet identity for the banking sector B is defined by (9) below:

\[ (9) \quad M_H^0 + M_N^0 + v_{HB}^0 + V_{HB}^0 = v_{BN}^0 + V_{BN}^0 + v_{BO}^0 + P_{KB}K_B^0. \]

Thus banking sector deposit liabilities to households and businesses \((M_H^0 + M_N^0)\) plus household debt plus equity investments in the banking sector \((v_{HB}^0 + V_{HB}^0)\) are equal to bank loans and equity investments in the nonfinancial sector \((v_{BN}^0 + V_{BN}^0)\) plus mortgage loans \((v_{BO}^0)\) plus the value of the banking sector’s initial stock of physical capital \((P_{KB}K_B^0)\). The only items that require a bit of discussion are the beginning of the period deposits held by the household and nonfinancial business sectors, \(M_H^0\) and \(M_N^0\). Basically, households and businesses are providing loans of financial capital to the banking sector and in return, they get some interest payments (which are generally small) but they also get some banking services associated with their deposits. These services include safety services (i.e., their deposits are a secure store of value) and liquidity services (i.e., these deposits can immediately be used for payment services). These extra (costly) services justify a separate treatment of monetary deposits from other debt and equity supplies of financial capital. Note that deposits are a created asset by the banking sector and are different from coins and bank notes.\(^\text{35}\)

The opening balance sheet constraint for the nonfinancial sector N is:

\[ (10) \quad v_{HN}^0 + V_{HN}^0 + v_{BN}^0 + V_{BN}^0 = P_{KN}K_N^0 + M_N^0. \]

Thus household debt plus equity investments in the nonfinancial sector \((v_{HN}^0 + V_{HN}^0)\) plus banking sector debt plus equity investments in the nonfinancial sector \((v_{BN}^0 + V_{BN}^0)\) are equal to the value of the nonfinancial sector’s initial stock of physical capital \((P_{KN}K_N^0)\) plus its initial holdings of bank deposits \((M_N^0)\).

\(^{35}\) Coins and bank notes should be regarded as real “physical” assets and should be treated as a component of the bank’s physical capital stock. Our neglect of the role of the central bank as a creator of coins, bank notes and commercial bank deposits is an important omission in our model.
The opening balance sheet constraint for the owner occupied housing sector O is:

\[(11) \ v_{HO}^0 + V_{HO}^0 + v_{BO}^0 = P_H^0 H^0.\]

Thus household debt plus equity investments in the owner occupied housing sector \((v_{HO}^0 + V_{HO}^0)\) plus banking sector mortgage loans to sector O \((v_{BO}^0)\) are equal to the value of the sector O initial stock of physical housing capital \((P_H^0 H^0)\).

In our simplified model of the economy, the household sector owns all of the assets in the three production sectors. Thus the household sector’s balance sheet constraint can be set equal to the sum of the three production sector balance sheet constraints. Some of the loans of the banking sector to other sectors (assets to sector B) cancel out with some of the liabilities of sectors N and O. Thus the consolidated household balance sheet constraint for sector H is:

\[(12) \ v_{HB}^0 + V_{HN}^0 + v_{HO}^0 + V_{HB}^0 + v_{HN}^0 + V_{HO}^0 + V_{HO}^0 + v_{BO}^0 + V_{HB}^0 + V_{HN}^0 + V_{HO}^0 + M_H^0 = P_K^0 K_B^0 + P_K^0 K_N^0 + P_H^0 H^0.\]

The left hand side of (12) is equal to the sum of household loans to the three production sectors \((v_{HB}^0 + V_{HN}^0 + v_{HO}^0)\) plus the sum of household equity investments in the three sectors \((V_{HB}^0 + V_{HN}^0 + V_{HO}^0)\) plus household “loans” to the banking sector in the form of bank deposits \((M_H^0)\). On the right hand side of (12), we have the consolidated value of the nonmonetary assets that are used by the three business sectors, namely banking and nonfinancial business capital stocks \((P_K^0 K_B^0 + P_K^0 K_N^0)\) plus the beginning of the period value of the owner occupied housing stock \((P_H^0 H^0)\).

It is useful to relate sector O’s balance sheet constraint (11) to sector O’s value added equation (7) in the previous section. From (11), we see that beginning of the period value of the owner occupied housing stock, \(P_H^0 H^0\), is equal to the sum of loan and equity investments in the sector, \(v_{HO}^0 + V_{HO}^0 + v_{BO}^0\). We also know that total interest paid and imputed interest earned in this sector is \(r_{HO} v_{HO}^0 + R_{HO} V_{HO}^0 + r_{BO} v_{BO}^0\). This interest sum can be set equal to an average rate of interest, \(\rho_O\), earned on the asset base; i.e., define \(\rho_O\) as follows:

\[(13) \ \rho_O \equiv \left[ r_{HO} v_{HO}^0 + R_{HO} V_{HO}^0 + r_{BO} v_{BO}^0 \right]/\left[ v_{HO}^0 + V_{HO}^0 + v_{BO}^0 \right].\]

Now substitute (13) into equation (7), which defined sector O’s value added:

\[(14) \ \rho_{OH} y_{OH} = P_H^0 H^0 - P_H^1 H^1 + r_{HO} v_{HO}^0 + R_{HO} V_{HO}^0 + r_{BO} v_{BO}^0 \]
\[= P_H^0 H^0 - P_H^1 H^1 + \rho_O [v_{HO}^0 + V_{HO}^0 + v_{BO}^0] \quad \text{using (13)}\]
\[= P_H^0 H^0 - P_H^1 H^1 + \rho_O P_H^0 H^0 \quad \text{using (11)}\]
\[= u_O H^0\]

where \(u_O H^0 \equiv (1+\rho_O)P_H^0 H^0 - P_H^1 H^1\) is the value of owner occupied housing capital services and \(u_O\) is the user cost of capital for the beginning of the period owner occupied...
Comparing the new value added decomposition (14) with the previous one (7), it can be seen that (14) has consolidated all of the financial interest flows into a single interest rate $\rho_O$ which is applied to the initial value of the owner occupied housing stock, $P_{OH0}H_0$. Moreover, the usual user cost of capital $u_0$ has made its appearance in (14) and “traditional” production theory can be applied to this sector. Thus the use of an average interest rate and the balance sheet constraint for sector O has considerably simplified the flow accounts for this sector (in the sense that the three supply of financial capital terms, $v_{HO0} + V_{HO0} + v_{BO0}$, have been replaced by the value of the opening stock of OOH, $P_{OH0}H_0$).

The above algebra for sector O shows how the use of an average cost of capital or reference rate $\rho_O$ along with the sector’s balance sheet constraint can bring the sector’s flow accounts closer to a “standard” format which is suitable for traditional production theory. However, the other two sectors in our simple model are more complex and it is not entirely clear what the “right” cost of capital or reference rate should be. Also, for these more complex sectors, we may want to introduce various loan margins and the user cost of money into our framework. Thus in the following section, we will use a modification of the above methodology in order to integrate the balance sheet accounts with the flow accounts but we will not specify an exact value for the reference rate for each sector; we will discuss possible choices for these reference rates in subsequent sections. The way our more general framework will work is as follows: take the balance sheet constraints with the sector’s assets as positive entries and then subtract the sector’s liabilities from these assets, which leads to an equation with a zero on the right hand side. Then multiply this equation by the reference rate for the sector. The resulting expression is then added to the primary input flows for that sector, which leads to a new value added equation for that sector. Thus for the case of sector O, the modified balance sheet equation is the following one:

$$\rho_O[P_{OH0}H_0 - v_{HO0} - V_{HO0} - v_{BO0}] = 0.$$ 

5. The Integrated System of Flow Accounts

Let the reference rate for the banking sector be $\rho_B$. Multiply both sides of the balance sheet constraint (9) for sector B by $\rho_B$ and rearrange terms in order to obtain the following equation:

$$\rho_B[P_{KB0}K_{B0} + v_{BN0} + V_{BN0} + v_{BO0} - M_{H0} - M_{N0} - v_{HB0} - V_{HB0}] = 0.$$ 

36 Recall equation (3) in section 2 above. The last two lines in (14) can be interpreted as follows. At the end of the period, implicit owner occupied housing rents $p_{OH0} = u_0H_0$ are distributed back to the owners along with the depreciated value of the initial housing stock, $P_{OH0}H_0$. But the sum of these two end of period financial flows are just enough for owner investors to earn the overall rate of return $\rho_O$ on the beginning of the period value of the owner occupied housing stock; i.e., we have $u_0H_0 + P_{OH0}H_0 = (1+\rho_O)P_{OH0}H_0$. This type of justification for the user cost approach to pricing capital services dates back to Diewert (1980; 471) at least.
Now add the terms in (16) to the right hand side of the banking sector’s value added equation (5) in order to obtain a new integrated accounts value added decomposition:\(^{37}\)

\[
(17) \quad p_{BH} y_{BH} + p_{BN} y_{BN} - p_{NB} y_{NB} = w_{B} x_{B} + (1 + \rho_{B}) p_{KB}^{0} k_{B}^{0} - p_{KB}^{1} k_{B}^{1} - (\rho_{B} - r_{H}) m_{H}^{0} \\
- (\rho_{B} - r_{N}) m_{N}^{0} + (r_{HB} - \rho_{B}) v_{HB}^{0} + (R_{HB} - \rho_{B}) v_{HB}^{0} - (r_{BN} - \rho_{B}) v_{BN}^{0} - (R_{BN} - \rho_{B}) v_{BN}^{0} \\
- (r_{BO} - \rho_{B}) v_{BO}^{0} + \pi_{B}.
\]

The left hand side of (17) is simply sector B’s conventional value added as in equation (5). However, on the right hand side of (17), some new terms make their appearance. As before, \(w_{B} x_{B}\) is simply the value of labour input for sector B. The next set of terms, \((1 + \rho_{B}) p_{KB}^{0} k_{B}^{0} - p_{KB}^{1} k_{B}^{1}\), can be recognized as the \(value of capital services\) for the banking sector; i.e., recall equation (3) above. Note that \(\rho_{B}\) is the reference interest rate that is used in this user cost. The next two terms, \(-(\rho_{B} - r_{H}) m_{H}^{0} - (\rho_{B} - r_{N}) m_{N}^{0}\), will generally be negative; i.e., the banking sector’s imputed cost of capital, \(\rho_{B}\), will generally be greater than the deposit interest rates paid to households and nonfinancial businesses, \(r_{H}\) and \(r_{N}\) respectively. The negative signs suggest that these deposit margins should be regarded as outputs, rather than as negative inputs. Note that \((\rho_{B} - r_{H})\) is the bank’s \(supplier benefit\) from supplying a dollar’s worth of deposit services to the household sector; it is the bank’s counterpart to the household’s \(user cost of money\).\(^{38}\) The next two terms on the right hand side of (17) are \((r_{HB} - \rho_{B}) v_{HB}^{0} + (R_{HB} - \rho_{B}) v_{HB}^{0}\). These two terms represent \(relative margins\) on the costs of raising financial capital from households via debt and equity respectively. If we chose the bank’s reference rate \(\rho_{B}\) to be the average cost of capital raised through debt and equity so that \(\rho_{B} \equiv [r_{HB} v_{HB}^{0} + R_{HB} v_{HB}^{0}] / [v_{HB}^{0} + v_{HB}^{0}]\), then the sum of the two terms \((r_{HB} - \rho_{B}) v_{HB}^{0} + (R_{HB} - \rho_{B}) v_{HB}^{0}\) would vanish. In this case, since the cost of debt is usually less than the cost of raising financial capital via equity, the term \((r_{HB} - \rho_{B}) v_{HB}^{0}\) would be negative and the term \((R_{HB} - \rho_{B}) v_{HB}^{0}\) would be positive. The next three terms on the right hand side of (16) are (generally) negative \(loan margins\), \(-(r_{BN} - \rho_{B}) v_{BN}^{0} - (R_{BN} - \rho_{B}) v_{BN}^{0} - (r_{BO} - \rho_{B}) v_{BO}^{0}\). Thus usually, the rates of return that the banking sector obtains on its loans to sectors N and O, \(r_{BN}\) and \(r_{BO}\), and its rate of return earned on equity investments in the sector N, \(R_{BN}\), will be greater than the bank’s cost of financial capital, \(\rho_{B}\), and so the three loan margin terms will be sources of bank net revenue rather than cost items.\(^{39}\) This suggests that these three loan margin value flows should be regarded as outputs rather than negative inputs. The final value flow on the right hand side of (17) is \(\pi_{B}\), the pure profits of the banking sector.

We turn now to the nonfinancial sector. Recall that this sector’s value added decomposition was given by equation (6) and its opening balance sheet identity was

\(^{37}\) The rationale for adding (16) to the cost side of the sector’s flow accounts is that net assets could be sold and distributed to the owners of the banking sector at the beginning of the period. Thus to justify holding net assets over the period rather than selling them, they need to be productive enough to cover the reference cost of financial capital, \(\rho_{B}\), and so \(\rho_{B}\) times net assets should be added to the cost side of the bank’s flow accounts.

\(^{38}\) See Diewert, Fixler and Zieschang (2012) for a discussion of user costs and supplier benefits of monetary outputs and inputs.

\(^{39}\) However, bank regulations sometimes cause banks to invest in very safe, low yielding assets so the signs of these three terms could be plus or minus.
given by (10). Multiply both sides of (10) by the sector N reference discount rate $\rho_N$ and, after some rearrangement, we obtain the following equation:

$$ (18) \rho_N [P_{KN}^0 K_N^0 + M_N^0 - v_{HN}^0 - V_{HN}^0 - v_{BN}^0 - V_{BN}^0] = 0. $$

Now add the terms in (18) to the right hand side of the nonfinancial sector’s value added equation (6) in order to obtain a new integrated accounts value added decomposition:

$$ (19) p_{NH} y_{NH} + p_{NB} y_{NB} - p_{BN} y_{BN} = w_{NXN} + (1+\rho_N)P_{KN}^0 K_N^0 - P_{KN}^1 K_N^1 + (\rho_N - \tau_N) M_N^0 
+ (R_{HN} - \rho_N) V_{HN}^0 + (R_{BN} - \rho_N) V_{BN}^0 + (R_{BN} - \rho_N) V_{BN}^0 + \pi_N $$

The left hand side of (19) is simply sector N’s conventional value added as in equation (6). As in the initial decomposition (6), $w_{NXN}$ is simply the value of labour input for sector N. The next set of terms, $(1+\rho_N)P_{KN}^0 K_N^0 - P_{KN}^1 K_N^1$, can be recognized as the value of capital services for the nonfinancial sector. Note that $\rho_N$ is the reference interest rate that is used in this user cost.$^{40}$ The next term, $(\rho_N - \tau_N) M_N^0$, will generally be positive; i.e., the nonfinancial sector’s imputed cost of capital, $\rho_N$, will generally be greater than the deposit interest rate paid to nonfinancial businesses, $\tau_N$. Note that $(\rho_N - \tau_N)$ is the nonfinancial sector’s user cost of money. The next four terms on the right hand side of (19) represent relative margins on the costs of raising financial capital from households and banks via debt and equity. If we chose sector N’s reference rate $\rho_N$ to be the average cost of capital raised through debt and equity so that $\rho_N \equiv \left[ R_{HN} V_{HN}^0 + R_{BN} V_{BN}^0 + R_{BN} V_{BN}^0 + R_{BN} V_{BN}^0 \right] / \left[ V_{HN}^0 + V_{BN}^0 + V_{BN}^0 + V_{BN}^0 \right]$, then the sum of the four terms $(R_{HN} - \rho_N) V_{HN}^0 + (R_{BN} - \rho_N) V_{BN}^0 + (R_{BN} - \rho_N) V_{BN}^0$ would vanish. In this case, since the cost of debt is usually less than the cost of raising financial capital via equity, the terms $(R_{HN} - \rho_N) V_{HN}^0 + (R_{BN} - \rho_N) V_{BN}^0$ would be negative and the terms $(R_{BN} - \rho_N) V_{BN}^0 + (R_{BN} - \rho_N) V_{BN}^0$ would be positive. The final value flow on the right hand side of (19) is $\pi_N$, the pure profits of the nonfinancial sector.

The reference rate for sector O is assumed to be $\rho_O$ and the modified balance sheet constraint for this sector is (15) above. The initial value added decomposition for sector O is (7) and if we add (15) to the right hand side of (7), we obtain the following integrated accounts value added decomposition for the owner occupied housing sector:

$$ (20) p_{OH} y_{OH} = (1+\rho_O)P_{H}^0 H^0 - P_{H}^1 H^1 + (R_{HO} - \rho_O) V_{HO}^0 + (R_{HO} - \rho_O) V_{HO}^0 + (R_{BO} - \rho_O) V_{BO}^0. $$

The left hand side of (20) is sector O’s conventional value added as in equation (7). The set of terms, $(1+\rho_O)P_{H}^0 H^0 - P_{H}^1 H^1$, can be recognized as the value of capital services for the owner occupied housing sector. The next three terms on the right hand side of (20) represent relative margins on the costs of raising financial capital from households and banks via debt and equity. If we chose sector O’s reference rate $\rho_O$ to be the average cost

---

$^{40}$ Recall that the reference rate $\rho_N$ should be interpreted as the opportunity cost of raising financial capital for sector N at the beginning of the accounting period.
of capital raised through debt and equity as in equation (13) above, then the sum of the three terms \((\tau_{HO}-\rho_O)\nu_{HO}^0 + (R_{HO}-\rho_O)\nu_{HO}^0 + (\tau_{BO}-\rho_O)\nu_{BO}^0\) would vanish.

Finally, we turn to the household sector. Recall that this sector’s value added or final demand decomposition was given by equation (8) and its opening balance sheet identity was given by (12). Multiply both sides of (12) by the sector H reference discount rate \(\rho_H\) and after some rearrangement, we obtain the following equation:

\[
(21) \quad \rho_H [P_{KB}^0K_B^0 + P_{KN}^0K_N^0 + P_H^0H^0 - \nu_{HB}^0 - \nu_{HN}^0 - \nu_{HO}^0 - V_{HB}^0 - V_{HN}^0 - V_{HO}^0 - M_H^0] = 0.
\]

Now add the terms in (21) to the right hand side of the household sector’s final demand decomposition equation (8) in order to obtain a new household *integrated accounts final demand decomposition*:

\[
(22) \quad p_{NH}y_{NH} + p_{NH}y_{NH} + p_{OH}y_{OH} = w_Bx_B + w_Nx_N + (1+\rho_H)P_{KB}^0K_B^0 - P_{KB}^1K_B^1 + (1+\rho_H)P_{KN}^0K_N^0 - P_{KN}^1K_N^1 + (1+\rho_H)P_H^0H^0 - P_H^1H^1 - (\rho_H-H)M_H^0 + (\tau_{HB}-\rho_H)\nu_{HB}^0 + (R_{HB}-\rho_H)\nu_{HB}^0 + \nu_{HN}^0 + (R_{HN}-\rho_H)\nu_{HN}^0 + (\tau_{HO}-\rho_H)\nu_{HO}^0 + (R_{HO}-\rho_H)\nu_{HO}^0 + \pi_B + \pi_N.
\]

The left hand side of (22) is simply the household sector’s conventional final demand as in equation (8). As in the initial decomposition (8), \(w_Bx_B+w_Nx_N\) is the value of the aggregate supply of labour. The next set of terms, \((1+\rho_H)P_{KB}^0K_B^0 - P_{KB}^1K_B^1\), can be recognized as the *value of capital services* for the banking sector except that now, the household opportunity cost of capital \(\rho_H\) is used in this user cost formula instead of the bank’s opportunity cost of capital \(\rho_B\). Similarly, \((1+\rho_H)P_{KN}^0K_N^0 - P_{KN}^1K_N^1\) is the household value of capital services provided to sector N valued from the household perspective and \((1+\rho_H)P_H^0H^0 - P_H^1H^1\) is the value of housing stock services provided to owner occupiers by the household sector. The next term, \(-\sigma_{HO}M_H^0\) will generally be negative; i.e., the household sector’s imputed cost of providing financial capital, \(\rho_H\), will generally be greater than the deposit interest rate paid to household depositors, \(\tau_{HO}\). Note that \((\rho_H-H)\) is the household sector’s *user cost of money*. The next six terms on the right hand side of (22) represent *relative margins* on the benefits to households of providing financial capital (both debt and equity) to the three sectors in the economy. If we chose sector H’s reference rate \(\rho_H\) to be the average benefit of providing financial capital to the three sectors so that \(\rho_H = [\tau_{HB}V_{HB}^0 + R_{HB}V_{HB}^0 + \tau_{HN}V_{HN}^0 + R_{HN}V_{HN}^0 + \tau_{HO}V_{HO}^0 + R_{HO}V_{HO}^0] / [V_{HB}^0 + V_{HB}^0 + V_{HN}^0 + V_{HN}^0 + V_{HO}^0 + V_{HO}^0]\), then the sum of these six terms will vanish. The final two terms on the right hand side of (22) are \(\pi_B + \pi_N\), the pure profits of the banking and nonfinancial sectors.

As in section 2, the structure of the economy’s integrated flow accounts will become clearer if we represent all of the entries in equations (17), (19), (20) and (22) in a table where the rows correspond to commodity flows and the columns to the four sectors; see Table 2 below. The “commodities” in rows 1-21 of Table 2 are essentially the same as were listed in Table 1 but the description of the commodities in rows 7 to 20 has changed.
somewhat in Table 2. Thus in Table 2, the entries in rows 7-9 are described as “capital services”, whereas in Table 1, they were described as the “revaluation and depreciation” components of capital services; i.e., in Table 1, waiting services were excluded from rows 7-9 whereas in Table 2, they are included. In Table 1, rows 10 and 11 were described as “deposit interest” flows whereas in Table 2, the entries for these rows are described as “deposit services”; i.e., these flows in Table 2 correspond to the banking sector’s supplier benefits of providing deposit services and user costs of money for the sectors that hold the deposits, sectors H and N. Finally, the descriptions of the flows in rows 12-20 of Table 2 are now called loan and equity margins whereas in Table 1, they were labeled as interest and equity returns.

Table 2: The System of Integrated Sectoral Flow Accounts

<table>
<thead>
<tr>
<th>Row</th>
<th>Description</th>
<th>Sector H</th>
<th>Sector B</th>
<th>Sector N</th>
<th>Sector O</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Priced Final</td>
<td>$P_{BH} Y_{BH}$</td>
<td>$P_{BH} Y_{BH}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Output</td>
<td>$P_{NH} Y_{NH}$</td>
<td>$P_{NH} Y_{NH}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Flows</td>
<td>$P_{OH} Y_{OH}$</td>
<td></td>
<td></td>
<td>$P_{OH} Y_{OH}$</td>
</tr>
<tr>
<td>4</td>
<td>Intermediate</td>
<td>$P_{BN} Y_{BN}$</td>
<td>$-P_{BN} Y_{BN}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Input Flows$^{41}$</td>
<td>$-P_{NB} Y_{NB}$</td>
<td>$P_{NB} Y_{NB}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Labour Services</td>
<td>$w_{B}x_{B} + w_{N}x_{N}$</td>
<td>$w_{B}x_{B}$</td>
<td>$w_{N}x_{N}$</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>B Capital Services</td>
<td>$(1+\rho_H)P_{KB}^{0}K_{B}^{0} - P_{KB}^{1}K_{B}^{1}$</td>
<td>$(1+\rho_B)P_{KB}^{0}K_{B}^{0} - P_{KB}^{1}K_{B}^{1}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>N Capital Services</td>
<td>$(1+\rho_H)P_{KN}^{0}K_{N}^{0} - P_{KN}^{1}K_{N}^{1}$</td>
<td></td>
<td>$(1+\rho_N)P_{KN}^{0}K_{N}^{0} - P_{KN}^{1}K_{N}^{1}$</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>O Capital Services</td>
<td>$(1+\rho_H)P_{H}^{0}H^{0} - P_{H}^{1}H^{1}$</td>
<td></td>
<td></td>
<td>$(1+\rho_O)P_{H}^{0}H^{0} - P_{H}^{1}H^{1}$</td>
</tr>
<tr>
<td>10</td>
<td>H Deposit Services</td>
<td>$-(\rho_{H}-r_{H})M_{H}^{0}$</td>
<td>$-(\rho_{B}-r_{H})M_{H}^{0}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>N Deposit Services</td>
<td>$-(\rho_{H}-r_{N})M_{N}^{0}$</td>
<td>$-(\rho_{N}-r_{N})M_{N}^{0}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>H-B Loan Margins</td>
<td>$(r_{HB}-\rho_{H})v_{HB}^{0}$</td>
<td>$(r_{HB}-\rho_{B})v_{HB}^{0}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>H-N Loan Margins</td>
<td>$(r_{HN}-\rho_{H})v_{HN}^{0}$</td>
<td></td>
<td>$(r_{HN}-\rho_{N})v_{HN}^{0}$</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>H-O Loan Margins</td>
<td>$(r_{HO}-\rho_{H})v_{HO}^{0}$</td>
<td></td>
<td></td>
<td>$(r_{HO}-\rho_{O})v_{HO}^{0}$</td>
</tr>
<tr>
<td>15</td>
<td>B-N Loan Margins</td>
<td>$-(r_{BN}-\rho_{B})v_{BN}^{0}$</td>
<td>$-(r_{BN}-\rho_{N})v_{BN}^{0}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>B-O Loan Margins</td>
<td>$-(r_{BO}-\rho_{B})v_{BO}^{0}$</td>
<td></td>
<td>$(r_{BO}-\rho_{O})v_{BO}^{0}$</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>H-B Equity Margins</td>
<td>$(R_{HB}-\rho_{H})V_{HB}^{0}$</td>
<td>$(R_{HB}-\rho_{B})V_{HB}^{0}$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^{41}$ Excluding intermediate consumption of FISIM. Positive terms along this row are intra-sector transactions while negative terms represent inter-sector transactions.
The integrated system of accounts represented by Table 2 has some major advantages over the conventional system of flow accounts that was represented by Table 1:

- The Table 2 accounts are more closely aligned with traditional production theory\(^{42}\) (traditional user costs of capital make their appearance in Table 2);
- User costs of monetary deposits and loan margins for the banking sector also make their appearance in Table 2 and
- The balance sheet accounts for the economy are fully reconciled with the flow accounts.

Note that rows 10 and 11 in Table 2 (which correspond to deposit services) are grouped together with other primary input flows and in particular, these monetary service flows appear with a negative sign in the banking column. Most economists would regard these monetary deposit services as an output of the banking sector (rather than as a negative input as in Table 2) and so it would be natural to change the signs of the entries in these two rows and group them with the value added output (SNA final uses) rows (1-3) rather than keep them in the primary input rows (10-20). Similarly, it is likely that the loan margin entries in rows 15 and 16 of the banking column B are negative (because the bank makes loans at higher interest rates than its imputed cost of capital \(\rho_B\)) and so again, these rows could be grouped (with the signs of their entries changed) with the output rows (1-3) rather than being kept in the list of primary input entries (10-20).\(^{43}\) Although not consistent with the current SNA, one could also argue that the entries in row 20 (bank equity investment margins in the nonfinancial sector) are likely to be negative and perhaps these services should be grouped (with changed signs) with the list of bank outputs (rows 1-3).

There is a general consensus among national accountants, as represented by the 1993 and 2008 SNA, that both deposit services and bank loans should be regarded as outputs. However, an alternative view is that bank loan margins are not payments for services but simply reflect the borrower’s cost of financial capital. These margins would be excluded from banks’ production accounts but recorded instead as an expense of allocating

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\(^{42}\) By traditional production theory, we mean the introduction of user costs of capital into the production accounts and the use of index number techniques to aggregate inputs and outputs in a manner that is consistent with production theory. Jorgenson and Griliches (1967) pioneered this literature; see also Christensen and Jorgenson (1969) (1973) and Diewert (1976) (1980) for early contributions.

\(^{43}\) This is what is done in the current SNA.
financial capital from lenders to borrowers with no quid pro quo. Taking this point of view means that these bank loan margins would not be regarded as additions to the value of outputs produced by the economy and thus could remain as negative primary input flows as in rows 15 and 16 of Table 2.\textsuperscript{44} Similarly, the banking sector’s profits on its equity investments in the nonfinancial sector could also remain as negative primary input flows as in row 20 of Table 2. The problem is that if we move bank loan and equity margins to the output side of the accounts, then consistency would seem to require that loan and equity margins for the other sectors of the economy should also be moved to the output side. This could be done but this would lead to a more widespread lack of additivity in the output accounts. If only deposit services are regarded as outputs, then the lack of additivity problem is minimized and could be handled in various ways with a minimum number of extra imputations.\textsuperscript{45} However, in this paper, we do not want to be too prescriptive on where these banking margin flows should be placed in the SNA; we simply want to raise alternative possible treatments for discussion.

Note that unless all 4 reference rates $\rho_B$, $\rho_N$, $\rho_O$ and $\rho_H$ are equal, it is no longer necessarily the case that the sum along a row of the entries in the B, N and H columns is equal to the corresponding household H row entry.\textsuperscript{46}

The first 5 rows in Table 1 give the disposition of each sector’s production and utilization of the economy’s directly priced outputs and intermediate inputs. The entries in the Sector H column are equal to the sum of the corresponding entries in each row for the 3 production sectors. For each sector, the sum of the column entries in rows 6 to 21 (the net cost components of sectoral gross value added) are equal to the sum of the column entries in rows 1 to 5 (which is equal to gross value added).\textsuperscript{47}

The integrated system of accounts that is represented by Table 2 also has some major disadvantages over the conventional system of flow accounts that was represented by Table 1:

\textsuperscript{44} In this framework, banks act as an intermediate allocator of household capital (savings) to borrowers and they appropriate an interest rate margin for their loan allocation activities which adds to the borrower’s cost of financial capital.

\textsuperscript{45} The presently implemented 1993 and 2008 versions of the international SNA rule out including the loan and other asset margins in the outputs and intermediate inputs of nonfinancial units in the economy: only the SNA’s financial corporations (which do include non-bank financial intermediaries) are recognized as generating FISIM. Although household FISIM production probably is quantitatively small in most economies, this boundary decision is made primarily because it would open a wide swath of other activities for inclusion in the core national accounts on which national accountants have misgivings about their ability to produce reasonably accurate estimates, such as homemaker services, human capital formation, and services from consumer durables. However, as noted, this boundary condition entails some awkward adjustments to the accounts not only in financial services, but in a number of other areas besides. See Eurostat, IMF, OECD, UN and the World Bank (1993) for the specifics of the 1993 SNA and Eurostat, IMF, OECD, UN and the World Bank (2008) regarding the 2008 SNA.

\textsuperscript{46} This problem was pointed out by Diewert, Fixler and Zieschang (2012).

\textsuperscript{47} The sectoral sums over rows 7 to 21 are equal to sectoral gross operating surplus. Thus these rows provide a decomposition of this SNA aggregate.
• Reference rates $\rho_H$, $\rho_B$, $\rho_N$, and $\rho_O$ must be chosen for each sector of the economy and this may prove to be contentious and
• If the reference rates are not chosen to be all equal to the same rate, then the accounts will no longer be additive along the rows of Table 2; i.e., for each row, the sum of the entries in columns B, N and O will not in general equal the entry in the household column H.

In spite of the lack of additivity across rows in the integrated accounts in Table 2 in the general case of unequal reference rates, aggregate value added for the economy can still be computed in the four equivalent ways that were listed at the end of section 3;

• As the sum of the entries in rows 1 to 5 of the H column;
• As the sum of the entries in rows 6 to 21 of the H column;
• As the sum of the entries in rows 1 to 5 of the B, N and O columns and
• As the sum of the entries in rows 6 to 21 of the B, N and O columns.

However, if we move deposit services and bank loan services out of the primary input section of the accounts into the output side of the accounts, the above equivalence results will no longer hold in general (unless all reference rates are equal). Thus there are many issues to be resolved before the integrated system of accounts can be widely adopted.

It should be noted that our approach to the measurement of the value of bank outputs and inputs is (at first glance) quite different from the approach which has been advocated by Wang and her coauthors, which allows for multiple reference rates.\(^{48}\)

In the following section, we will discuss some options for choosing the reference rates.

**6. Discussion on the Choice of Reference Rates**

Obviously, the integrated accounts are greatly simplified if the reference rates are the same across sectors. But how exactly should this common reference rate be chosen? We consider some options below.

*Option 1: $\rho_B = \rho_N = \rho_O = \rho_H = \rho$ where $\rho$ is a risk free rate of return.*

The advantages of this option are as follows:

• The integrated accounts are additive along each row across columns;
• Each sector faces the same safe rate of return and so this is a suitable common reference rate of return.

Some disadvantages of this option are:

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\(^{48}\) See Wang, Basu and Fernald (2009) and Basu, Inklaar and Wang (2011). Their approach will be contrasted with our approach in section 9 below.
It may not be easy to achieve consensus on exactly what this risk free rate of return is. Even short term government bonds for triple A countries face some inflation risk.

The problem with choosing a safe rate of return as the benchmark discount rate is that it will lead to user costs of capital that are generally too low and to margins on various financial instruments which are too high. This means it will be difficult to apply traditional production theory to the producer sectors in the economy; i.e., it will be necessary to model various margins or to allow for a large unexplained “profit” component in the producer models.\(^4^9\)

Option 2: \( \rho_B = \rho_N = \rho_O = \rho_H = \rho \) where \( \rho \) is the average rate of return on household debt and equity investments.\(^5^0\)

Thus \( \rho \) is defined as the weighted average rate of return for the household investments in rows 12-19 of Table 1; i.e., for this option, we have:

\[
(23) \quad \rho = \rho_H \equiv \left[ r_{HB}v_{HB}^0 + R_{HB}V_{HB}^0 + r_{HN}v_{HN}^0 + R_{HN}V_{HN}^0 + r_{HO}v_{HO}^0 + R_{HO}V_{HO}^0 \right] / \left[ v_{HB}^0 + V_{HB}^0 + v_{HN}^0 + V_{HN}^0 + v_{HO}^0 + V_{HO}^0 \right].
\]

The advantages of this option are as follows:

- The integrated accounts are additive along each row across columns;
- The household accounts are greatly simplified; i.e., the sum of the entries in rows 12-19 in column H of Table 2 is zero and hence these entries can be ignored in a household model of economic behavior.
- The business margin entries in rows 12-20 and columns B, N and O of Table 2 will generally be smaller in magnitude than they were under option 1 above and hence it will be easier to apply traditional (nonfinancial) production theory\(^5^1\) to these sectors than it was under Option 1.

A disadvantage of this option is:

- Although this \( \rho \) is an appropriate supply price of financial capital across the entire household sector, it is not necessarily an appropriate cost of financial capital for each producing sector in the economy. Thus it will be difficult to justify using a household discount rate as the reference rate for sectors B and N.

The above discussion leads us to propose a third option where we give up on achieving exact row additivity of the accounts.

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\(^{49}\) The safe rate of return will generally be below the average cost of capital for nonfinancial industries.

\(^{50}\) A variant of this approach would be to choose the common reference rate for all sectors to be equal to the reference rate that is chosen for the financial sector. This option has the advantage of leading to an additive system of accounts but it has the same disadvantage as noted above for Option 1.

\(^{51}\) Traditional production theory that relies on balancing rates of return in a sector to make the value of nonfinancial inputs equal to the value of nonfinancial outputs ignores sources of financing and so making the margins in Table 2 small in magnitude will bring Table 2 closer to the traditional approach.
**Option 3:** The reference rate for each sector is the average cost of raising debt and equity financial capital for the producing sectors and for the household sector, the reference rate is the average return from financial capital, \( \rho_H \) defined by (23).

Thus for the three production sectors, the reference rate \( \rho_O \) is defined by (13) and the reference rates \( \rho_B \) and \( \rho_N \) are defined as follows:

\[
(24) \quad \rho_B = [r_{HB}v_{HB}^0 + R_{HB}v_{HB}^0]/[v_{HB}^0 + V_{HB}^0]; \\
(25) \quad \rho_N = [r_{HN}v_{HN}^0 + R_{HN}v_{HN}^0 + r_{BN}v_{BN}^0 + R_{BN}v_{BN}^0]/[v_{HN}^0 + V_{HN}^0 + v_{BN}^0 + V_{BN}^0].
\]

The advantages of this option are as follows:

- The accounts are greatly simplified; i.e., the sum of the entries in rows 12-19 in column H of Table 2 is zero, the entries in rows 12 and 16 of column B sum to zero, the entries in rows 12 to 20 of column N sum to zero and the entries in rows 12 to 20 of column O sum to zero and hence these entries can be ignored in producer models of business behavior.
- The reference rates are “reasonable” for each production sector.
- The business margin entries in rows 12-20 and columns B, N and O of Table 2 will generally be smaller in magnitude than they were under Option 1 above and hence it will be easier to apply traditional (nonfinancial) production theory to these sectors than it was under Option 1.

The main disadvantage of this option is:

- Row additivity has been lost in this option; i.e., the entries in columns B, N and H do not necessarily sum to the corresponding column H entry in rows 7-20 of Table 2.

It can be seen that the sum of the entries in rows 7-20 of the H column are equal to the sum of the entries in the B, N and O columns for rows 7-20. Using this fact (along with equations (12), (22), (23) and (24)) leads to the following identity that the four reference rates of return must satisfy under this option:

\[
(26) \quad (\rho_H - \rho_B)P_{KB}^0K_B^0 + (\rho_H - \rho_B)P_{KN}^0K_N^0 + (\rho_H - \rho_O)P_H^0H^0 = (\rho_H - \rho_B)M_H^0 + (\rho_N - \rho_B)M_N^0 + (\rho_B - \rho_O)V_{BN}^0 + (\rho_B - \rho_N)V_{BO}^0 + (\rho_B - \rho_N)V_{BN}^0.
\]

Thus if the right hand side of (26) is close to 0, then the left hand side will also be close to 0 and the value of capital services supplied from the household perspective will be approximately equal to the value of capital services demanded across the three sectors from the producer’s perspective.

Obviously, many additional options for choosing the reference rates could be considered.

We turn now to a brief discussion of deflation issues.
7. How Should Monetary Aggregates be Deflated?

Wang and her coauthors take a transactions perspective to the deflation of banking sector monetary flows such as deposit and loan services; i.e., what does it cost the bank to service a deposit account and a loan account? However, this perspective seems to be unsatisfactory from the viewpoint of the deposit holder and the borrower; i.e., the depositor does not really care how much it costs the bank to service his or her deposit—what is relevant is the real opportunity cost of the financial capital tied up in the deposit. Similarly, the mortgage borrower does not care about the bank’s cost of servicing the loan; the borrower cares about how much house the loan can purchase.

There are 11 financial flow variables that appear in Table 1 and 2:

- Three household loan amounts to the three sectors \( v_{HB}^0, v_{HN}^0 \) and \( v_{HO}^0 \);
- Three household equity investment amounts \( V_{HB}^0, V_{HN}^0 \) and \( V_{HO}^0 \);
- Three bank loan and equity investments \( v_{BN}^0, V_{BN}^0 \) and \( v_{BO}^0 \) and
- Two deposit accounts \( M_H^0 \) and \( M_N^0 \).

Traditional production theory deals only with inputs and outputs that have real quantities associated with them but the above 11 financial flows have no explicit real quantity units associated with them. Thus traditional production theory does not provide much guidance on how to deflate these nominal financial flows into real flows.\(^{52}\)

One approach is to simply deflate all of these financial variables by a general price index, say the index \( P \). Thus the real counterparts to the household loan variables \( v_{HB}^0, v_{HN}^0 \) and \( v_{HO}^0 \) would be the implicit quantities \( q_{HB}^0 \equiv v_{HB}^0/P, q_{HN}^0 \equiv v_{HN}^0/P, q_{HO}^0 \equiv v_{HO}^0/P \) and so on. Thus \( v_{HB}^0, v_{HN}^0 \) and \( v_{HO}^0 \) in Tables 1 and 2 would be replaced by \( P \) times \( q_{HB}^0, P \) times \( q_{HN}^0 \) and \( P \) times \( q_{HO}^0 \), etc. Of course, a problem with this approach is that the choice of the index \( P \) is somewhat arbitrary.

A less arbitrary approach is the following one: look at the liabilities equal assets balance sheet constraints for the 3 production sectors, equations (8), (9) and (10). On the asset side of each of these equations, there is a single nonmonetary asset, \( P_{KB}^0 K_B^0, P_{KN}^0 K_N^0 \) and \( P_H^0 H^0 \) respectively. Use the price of each of these nonmonetary assets to deflate the corresponding terms on the liability side of each of these equations (8), (9) and (10). Thus \( M_H^0, M_N^0, v_{HB}^0 \) and \( V_{HB}^0 \) would be deflated by the price of physical capital used in the banking sector, \( P_{KB}^0, v_{HN}^0, V_{HN}^0, v_{BO}^0 \) and \( V_{BO}^0 \) would be deflated by the price of physical capital used in the nonfinancial sector, \( P_{KN}^0 \) and \( v_{HO}^0, V_{HO}^0 \) and \( v_{BO}^0 \) would be deflated by the price of housing capital, \( P_H^0 \). This deflation strategy would give each of our 11 monetary assets a definite deflator and the strategy seems reasonable: each sector’s liabilities are ultimately directed towards the purchase of physical assets.\(^{53}\)

\(^{52}\) This problem is discussed in more detail in Diewert, Fixler and Zieschang (2012).

\(^{53}\) A modification of this deflation strategy would be to allow for non asset deflation of monetary balances. Household monetary balances could be deflated by a price index relating to household consumption purchases and business monetary balances could be deflated by a price index relating to the payments of
However, it must be conceded that the last word on deflation strategies for monetary aggregates has not yet been written. As Basu (2009) noted, the lack of clarity on the choice of monetary deflators indicates that more explicit theoretical modeling must be done.

In the following section, we will illustrate our integrated accounts approach to the banking sector by constructing alternative sets of accounts for the U.S. banking sector using Federal Deposit Insurance Corporation data for the past 10 years. We will not attempt to develop a comprehensive set of nominal accounts for the entire economy in this paper; we will just develop nominal accounts for the U.S. commercial banking sector.

8. Empirical Example: the Case of the U.S. Banking Sector

In this section, we will attempt to illustrate the likely magnitude of changes in the nominal value of U.S. Commercial banking sector output due to:

- Changes in the reference rate for the banking sector and
- Changes in what bank activities are regarded as outputs versus (negative) inputs.

In Table 2 of section 5, we left all of the banking sector’s FISIM services in the primary inputs section of the accounts. However, virtually all national income accountants agree that bank deposit margins should be part of banking sector output and most agree that loan margins should also be included as outputs. Hence, in this section, we shall see how the U.S. commercial banking accounts change as we: (i) add deposit services to bank output; (ii) add both deposit and loan services to output and (iii) add deposit services plus all bank asset margins to output. As is obvious from the previous sections in this paper, changes in the bank reference rate will affect bank margins or FISIM services. Hence in this section, we will also consider various options for the banking sector’s reference rate \( \rho_b \).

The Federal Deposit Insurance Corporation (FDIC) data on the activities of U.S. commercial banks does not use exactly the same classifications of inputs and outputs as we used in our Tables 1 and 2 above. Thus our first task is to map the notation used in equation (4) above for our classification of inputs and outputs into the FDIC classification of inputs and outputs. Tables A1-A5 in the Appendix list the various FDIC value flows and stocks for the banking sector using \( V \) to denote a quarterly value for an aggregate and a subscript to denote the name of the output, input or stock variable.

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54 For a more detailed discussion of deflation issues, see Diewert, Fixler Zieschang (2011).
55 For example, we were not able to decompose loans into household and business loans on a quarterly basis and similarly, we were not able to decompose deposits into household and business deposits.
We start with the FDIC variables listed in Table A5 in the Appendix. We will define each variable and relate it to the flow variables which appear in our theoretical flow decomposition of banking output that appeared in equation (4) above.

\[ V_Y \equiv \text{the value of explicitly measured banking sector output}; \] this variable corresponds to \( p_{BH} y_{BH} + p_{BN} y_{BN} \) in equation (4) and Table 1;

\[ V_N \equiv \text{the value of intermediate input purchases}; \] this variable corresponds to \( p_{NB} y_{NB} \);

\[ V_E \equiv \text{the value of employee wages and benefits}; \] this variable corresponds to \( w_{BX} \);

\[ V_{D&A} \equiv \text{the value of depreciation and amortization allowances}; \] this variable is equal to \( P_{KB}^{0}K_{B}^{0} - P_{KB}^{1}K_{B}^{1} \);

\[ V_{AI} \equiv \text{accounting income}; \] this variable corresponds to \( R_{HB}V_{HB}^{0} + \pi_{B} \), the returns to household equity capital plus pure profits;\(^{56}\)

\[ V_{EVA} \equiv \text{explicitly measured value added} \] which is equal to \( V_Y - V_N \);

\[ V_{AVA} \equiv \text{accounting value added}; \] this variable will be defined below by equation (30).

We now turn to the definitions of the various beginning of quarter assets held by the banking sector \( V_{A1} - V_{A5} \); see Table A1 in the Appendix for a listing of these asset stocks.

\[ V_{A1} \equiv \text{deposits held by banks}; \] we did not consider these stocks in our simplified model;

\[ V_{A2} \equiv \text{debt securities and trading assets held by banks}; \] this variable corresponds to part of \( v_{BN}^{0} \) (the corresponding flow variable is \( r_{BN}V_{BN}^{0} \));

\[ V_{A3} \equiv \text{bank loans and acceptances}; \] this variable corresponds to the major part of \( v_{BN}^{0} \) and to \( v_{BO}^{0} \) (the corresponding flows are part of \( r_{BN}V_{BN}^{0} \) and \( r_{BO}V_{BO}^{0} \));

\[ V_{A4} \equiv \text{equity and investment fund shares}; \] this variable corresponds to \( V_{BN}^{0} \) (the corresponding flow is \( R_{BN}V_{BN}^{0} \));

\[ V_{A5} \equiv \text{nonfinancial assets}; \] this variable corresponds to \( P_{KB}^{0}K_{B}^{0} \).

Table A3 in the Appendix lists the beginning of quarter liabilities (and equity) of the banking sector, \( V_{L1} - V_{L3} \):

\[ V_{L1} \equiv \text{deposits held by households and the nonfinancial sectors}; \] this variable corresponds to \( M_{H}^{0} + M_{N}^{0} \) (the corresponding interest flows are \( r_{H}M_{H}^{0} + r_{N}M_{N}^{0} \));

\[ V_{L2} \equiv \text{debt securities, loans and other liabilities}; \] this variable corresponds to \( v_{HB}^{0} \) (the corresponding interest flow is \( r_{HB}V_{HB}^{0} \));

\[ V_{L3} \equiv \text{the value of equity}; \] this variable corresponds to \( V_{HB}^{0} \) in equation (9) (the corresponding flow variable is \( R_{HB}V_{HB}^{0} \)).

The beginning of the quarter equity is defined residually as the sum of the five beginning of the quarter asset values less the non equity liability values; i.e., \( V_{L3} \) is defined as follows:\(^{57}\)

\[ (27) \ V_{L3} \equiv V_{A1} + V_{A2} + V_{A3} + V_{A4} + V_{A5} - V_{L1} - V_{L2}. \]

\(^{56}\) For simplicity, we assumed that pure profits \( \pi_{B} \) were 0 so all ex post profits were imputed to the equity rate of return.

\(^{57}\) This is the counterpart to equation (9) using our new notation and classifications.
The *quarterly interest flows* that can be associated with asset classes 1-4 are defined as $V_{AR1}$-$V_{AR4}$ and are listed in Table A2 in the Appendix. The interest flows associated with liability classes 1 and 2 are defined as $V_{LR1}$ and $V_{LR2}$ and are listed in Table A3 in the Appendix. The corresponding *quarterly interest rates* by asset classes 1-4 are $r_{A1}$-$r_{A4}$ and by liability classes 1 and 2 are $r_{L1}$ and $r_{L2}$ and are defined in the obvious ways as follows:

\[(28) \, r_{Ai} \equiv \frac{V_{ARi}}{V_{Ai}} ; \, i = 1,2,3,4 \quad \text{and} \quad r_{Li} \equiv \frac{V_{LRi}}{V_{Li}} ; \, i = 1,2.\]

Note that there is no explicit interest rate associated with asset class 5, nonfinancial capital.\(^{58}\) However, we can impute an ex post rate of return to equity (the third liability class) and we now proceed to do this. It is convenient to define the *value of net interest revenue*, $V_{NETR}$, as follows:

\[(29) \, V_{NETR} \equiv r_{A1}V_{A1} + r_{A2}V_{A2} + r_{A3}V_{A3} + r_{A4}V_{A4} - r_{L1}V_{L1} - r_{L2}V_{L2}.\]

Now add net interest to explicitly measured bank value added to get *accounting value added* $V_{AVA}$:

\[(30) \, V_{AVA} \equiv V_{EVA} + V_{NETR}.\]

Finally, subtract the value of labour and depreciation and amortization services from accounting value added to get (ex post) *accounting income*, $V_{AI}$:

\[(31) \, V_{AI} \equiv V_{AVA} - V_{E} - V_{D&A}.\]

Accounting income can be regarded as the ex post return to equity capital, which has the beginning of the quarter value $V_{L3}$. Thus the *ex post rate of return on equity capital*, $r_{L3}$, can be defined as ex post (net) accounting income divided by the beginning of quarter value of equity:\(^{59}\)

\[(32) \, r_{L3} \equiv \frac{V_{AI}}{V_{L3}}.\]

The quarterly interest rates $r_{A1}$-$r_{A4}$ and $r_{L1}$-$r_{L3}$ are listed in Table A4 of the Appendix for the 41 quarters starting in Q2 of 2001 and ending in Q2 of 2011. This completes our description of the FDIC data for the U.S commercial banking sector.

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\(^{58}\) As we shall see later, we can associate the reference rate of return as the interest rate for this asset class.

\(^{59}\) $r_{L3}$ is our equity capital ex post counterpart to the Internal Rate of Return (IRR) that is defined in Basu, Inklaar and Wang (2011; 240): “The IRR is the return an industry or a firm would need to earn on its fixed capital assets, such as buildings and computers, to exactly cover the rental cost of fixed capital.” Our $r_{L3}$ is the ex post return on equity capital and this return includes waiting services, risk assumption services and monopoly profits. Note that equity capital $V_{L3}$ includes the value of nonfinancial capital $V_{A5}$ as a positive item in (27) but $V_{L3}$ is not necessarily equal to $V_{A5}$. Finally, note that our imputed interest rate for nonfinancial capital in (34) turns out to be the reference rate $\rho$. 
Using our new notation, our old banking sector flow equation (5) can be rewritten as follows:

\[(33) \ V_{EVA} = V_Y - V_N = V_E + V_{D&A} - V_{NETR} + r_L V_L3 \]
\[= V_E + V_{D&A} - r_{A1} V_{A1} - r_{A2} V_{A2} - r_{A3} V_{A3} - r_{A4} V_{A4} + r_{L1} V_{L1} + r_{L2} V_{L2} + r_{L3} V_{L3}. \]

Recall that our beginning of the quarter balance sheet constraint for the banking sector was given by equation (27). Multiply both sides of this equation by the reference rate \(\rho\) and rearrange terms to obtain the following equation (which is a counterpart to (16) above):

\[(34) \ \rho[V_{A1} + V_{A2} + V_{A3} + V_{A4} + V_{A5} - V_{L1} - V_{L2} - V_{L3}] = 0. \]

Now add the terms in (34) to the right hand side of the banking sector’s explicitly measured value added equation (33) in order to obtain a new \textit{integrated accounts (explicitly measured) value added decomposition}:

\[(35) V_{EVA} = V_E + V_{D&A} + \rho V_{A5} + (\rho - r_{A1}) V_{A1} + (\rho - r_{A2}) V_{A2} + (\rho - r_{A3}) V_{A3} + (\rho - r_{A4}) V_{A4} - (\rho - r_{L1}) V_{L1} - (\rho - r_{L2}) V_{L2} - (\rho - r_{L3}) V_{L3}. \]

Comparing the decompositions of explicitly measured bank value added given by (33) and (35), it can be seen that nonfinancial or physical capital plays no role in the accounting decomposition (33); i.e., there is no explicit role for waiting services associated with physical capital in (33) but there is in (35) since the term \(\rho V_{A5}\) can be interpreted as the \textit{waiting services} associated with the fifth asset class, nonfinancial capital. Moreover, note that the sum of the terms \(V_{D&A} + \rho V_{A5}\) can be associated with the usual user cost of (physical) capital.\(^\text{61}\) Note that the terms which follow \(\rho V_{A5}\) on the right hand side of (35) are all \textit{financial margin terms}; i.e., they are differences between the various market interest rates on assets and liabilities and the reference rate times the corresponding beginning of quarter value of the asset or liability. The aggregate influence of these terms could be driven down to zero if we chose the reference rate \(\rho_A\) to be the \textit{average net cost of raising financial capital} at the beginning of the period; i.e., if \(\rho_A\) were defined as follows:

\[(36) \ \rho_A \equiv \frac{[\sum_{i=1}^{3} r_{L_i} V_{L_i} - \sum_{i=1}^{4} r_{A_i} V_{A_i}]/[\sum_{i=1}^{3} V_{L_i} - \sum_{i=1}^{4} V_{A_i}]}{[\sum_{i=1}^{3} r_{L_i} V_{L_i} - \sum_{i=1}^{4} r_{A_i} V_{A_i}]/V_{A_i}} \]

where the last equality follows from (27).

We may want to consider this option for a nonfinancial firm or industry but it is not an appropriate option for the commercial banking sector because it is generally recognized that the above net average cost of capital is \textit{not} the banking sector’s true cost of raising an

\(^{60}\) This is the counterpart to equation (17) using our new notation.

\(^{61}\) We are missing the revaluation term here but it will typically be small.
extra dollar of financial capital; i.e., the banking sector makes some profits on its loans and this source of profits should be recognized. Moreover, the banking sector incurs some extra costs in servicing deposit liabilities and so the deposit interest rate \( r_{L1} \) is an underestimate of the true cost of raising financial capital by this source. Put another way, some of the margin terms on the right hand side of (34) should be taken out of operating surplus and regarded as outputs. In particular, *bank deposit services*, \( (\rho - r_{L1})V_{L1} \), and *bank loan services*, \( (r_{A3} - \rho)V_{A3} \), are generally regarded as outputs of the commercial banking sector.

We define the banking sector’s (net) *asset margin services* for the four types of asset conditional on a chosen reference rate \( \rho \), \( V_{MAi}(\rho) \) as follows:

\[
(37) \quad V_{MAi}(\rho) \equiv (r_{Ai} - \rho)V_{Ai} \quad ; \quad i = 1,2,3,4.
\]

Note that \( V_{MA3}(\rho) = (r_{A3} - \rho)V_{A3} \) which we defined earlier as bank loan services.\(^{62}\) We define (net) *liability margin services* for the three types of liability conditional on the reference rate \( \rho \), \( V_{MLi}(\rho) \) as follows:

\[
(38) \quad V_{MLi}(\rho) \equiv (\rho - \rho)V_{Li} \quad ; \quad i = 1,2,3;
\]

It will prove to be convenient to work with *deposit services*, \( V_{DS}(\rho) \), instead of \( V_{ML1}(\rho) \); i.e., define \( V_{DS}(\rho) \) to be the negative of deposit liability services \( V_{ML1}(\rho) \):

\[
(39) \quad V_{DS}(\rho) \equiv -V_{ML1}(\rho) = (\rho - r_{L1})V_{L1}.
\]

Using our new notation for the various types of margin services defined by (37)-(39), we can rewrite the decomposition of explicitly measured banking sector value added as follows:

\[
(40) \quad V_{EVA} = V_E + V_{D&A} + \rho V_{A5} - \sum_{i=1}^{4} V_{MAi}(\rho) - V_{DS}(\rho) + \sum_{i=1}^{2} V_{MLi}(\rho).
\]

Thus explicitly measured bank value added, \( V_{EVA} \), is equal to wages and salaries, \( V_E \), plus depreciation and amortization expense, \( V_{D&A} \), plus imputed waiting services for nonfinancial capital, \( \rho V_{A5} \), less the value of margin services for the four types of financial assets held by the banking sector, \( -\sum_{i=1}^{4} V_{MAi}(\rho) \), less the value of deposit services, \( -V_{DS}(\rho) \), plus the value of margin services for debt and equity liabilities, \( V_{ML2}(\rho) + V_{ML3}(\rho) \).\(^{63}\)

\(^{62}\) Bank loan services will be positive for “reasonable” choices of the reference rate. It is likely that asset margin services on deposits, \( (r_{A1} - \rho)V_{A1} \), will be negative; i.e., the asset deposit rate \( r_{A1} \) will generally be less than the reference rate \( \rho \). These low yielding assets may be held for regulatory purposes or as a reserve. The sign of asset margin services for assets 2 and 4 (debt and equity assets) is likely to be variable.

\(^{63}\) For “reasonable” choices of \( \rho \), we expect debt margin services \( V_{MSL2}(\rho) \) to be small in magnitude (if we choose \( \rho \) to equal \( r_{L2} \), the average debt interest rate, \( V_{MSL2}(r_{L2}) \), will equal 0) and equity margin services, \( V_{MSL3}(\rho) \), to be fairly large and positive. Equity margin services can be interpreted as a payment for *risk assumption services* on the part of bank investors (*a risk premium*) or as a monopolistic return. Since a
In the tables below, we will consider various options for the reference rate \( \rho \). Once the reference rate is chosen, in addition to explicitly measured bank value added, \( V_{\text{EVA}} \), we will consider the following three alternative measures of bank value added:

\[
\begin{align*}
(41) \quad V(\rho, A) & \equiv V_{\text{EVA}} + V_{\text{DS}}(\rho) ; \\
(42) \quad V(\rho, B) & \equiv V_{\text{EVA}} + V_{\text{DS}}(\rho) + V_{\text{MA}}(\rho) ; \\
(43) \quad V(\rho, C) & \equiv V_{\text{EVA}} + V_{\text{DS}}(\rho) + \sum_{i=1}^{4} V_{\text{MA}_i}(\rho).
\end{align*}
\]

Thus the \textit{Option A} measure of bank nominal output defined by (41) adds deposit services to explicitly measured value added. The \textit{Option B} measure defined by (42) adds loan services to the Option A measure while the \textit{Option C} measure defined by (43) adds all four asset margin services to explicitly measured value added plus deposit services.

The major advantage of Option A is that only one imputed financial service (deposit services) is added to the list of commodity outputs in the economy’s System of National Accounts and thus the additivity of the output and intermediate input production accounts will only be minimally affected by adding deposit services to the commodity classification.\(^{64}\) The advantage of Option B is that it corresponds most closely to the current treatment of FISIM in the SNA; i.e., only bank deposit and loan services are recognized as imputed outputs of the banking sector. The advantage of Option C is that this option, when applied to other nonbanking sectors which have substantial net revenues from financial services, will lead to a consistent treatment of financial services across all sectors of the production accounts.

We will conclude this section by considering three options for the choice of the reference rate \( \rho \):

- **Option 1**: \( \rho_1 \equiv r_{1,2} \); i.e., set the reference rate equal to the average cost of raising financial capital via debt;
- **Option 2**: \( \rho_2 \equiv [r_{1,1}V_{L,1}+r_{1,2}V_{L,2}]/[V_{L,1}+V_{L,2}] \); i.e., set the reference rate equal to the weighted average cost of raising capital via deposits and debt;
- **Option 3**: \( \rho_3 \equiv [r_{1,1}V_{L,1}+r_{1,2}V_{L,2}+r_{1,3}V_{L,3}]/[V_{L,1}+V_{L,2}+V_{L,3}] \); i.e., set the reference rate equal to the weighted average cost of raising capital via deposits, debt and equity.

We regard the Option 1 reference rate as the most plausible approximation to the banking sector’s cost of financial capital. The problem with Option 2 is that raising financial capital via deposits is not the “full” cost of raising capital from this source since servicing deposit accounts takes bank resources. The problem with Option 3 is that the banking sector is likely to have some monopoly profits and thus this sector tends to raise extra monopoly position can always be eroded by regulatory reform, a monopolistic return can also be regarded as a risk premium.

\(^{64}\) Recall that in section 5, we showed that unless a common reference rate was chosen for all production sectors, row additivity of the production accounts would not hold in general.
financial capital via debt or deposits (subject to regulatory constraints) in order to maximize the return to equity capital.

Chart 1 shows the quarterly values of the reference rates $\rho_1 - \rho_3$ (Rho1-Rho3) in percentage points under the three options. In this chart, quarters 1 to 41 correspond to Q2-2001 to Q2-2011. As would be expected, $\rho_2$ is less than $\rho_1$ because $\rho_2$ includes deposits (in addition to debt funding) and the interest cost of deposits is less than the cost of debt. Note that these two reference rates are close together and generally follow the same pattern. The reference rate under option 3, $\rho_3$, is generally much higher because it includes equity funding (except for Q3-2008 when bank equity returns became negative, leading to a very low $\rho_3$). To provide a context for these reference rates, a *Treasury based reference rate*, $\rho_T$ or RhoT, is also included. This reference rate is computed as a unit value; the ratio of interest earned on all Treasury securities held by banks divided by the banking sector’s book value of the stock of Treasuries.\(^\text{65}\) The chart shows that the Treasury rate is generally greater than the reference rates under options 1 and 2. This is explained by the fact that the Treasury rate is an average of short term rates (which are generally low) and longer term rates (which are generally higher). Bank deposit interest rates are generally below short term Treasury Bill rates and bank debt contains a large proportion of money market debt, which also pays very low rates. Thus $\rho_1$ and $\rho_2$ are generally well below the average Treasury interest rate $\rho_T$. Finally, except for the recessions in 2001 and 2007-2010 when bank profits fell sharply, the Treasury rate $\rho_T$ is

\(^{65}\) Data on holdings of Treasuries by the banking sector for Q2-2011 was not available so $\rho_T$ for this quarter was set equal to $\rho_T$ for Q1-2011.
lower than \( \rho_3 \), since rates of return to bank equity are generally very high except during recessions.

We have nine possible measures of banking sector value added to consider: three options for the reference rate times three options for the choice of FISIM margins to add to explicitly measured banking sector value added.

As indicated above, the necessary data required to calculate the various components of banking sector value added for the U.S. Commercial Banking Sector that are in equation (40) above are listed in the data Appendix. These data are drawn from the publically available data at the U.S. Federal Deposit Insurance Corporation (FDIC) and cover all FDIC insured commercial banks in the United States. Tables 3 and 4 list these data using the Option 1 reference rate \( \rho_1 = r_{1,2} \), along with the three alternative banking output concepts, A, B and C, defined by (41)-(43), for the 41 quarters, starting at Quarter 2 in 2001 and ending with Quarter 2 in 2011. Note that the last row in each of the following Tables lists the sample average of the variable in each column.

**Table 3: Explicitly Measured Bank Value Added \( V_{EVA} \), Option 1A, 1B and 1C Measures of Value Added, Employee Costs \( V_E \), Depreciation and Amortization Costs \( V_{D&A} \) and Imputed Interest Cost for Nonfinancial Capital \( \rho_1 V_{A5} \)**

<table>
<thead>
<tr>
<th>Quarter</th>
<th>( V_{EVA} )</th>
<th>( V(\rho_1A) )</th>
<th>( V(\rho_1B) )</th>
<th>( V(\rho_1C) )</th>
<th>( V_E )</th>
<th>( V_{D&amp;A} )</th>
<th>( \rho_1 V_{A5} )</th>
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<td>2001-Q2</td>
<td>17.368</td>
<td>22.929</td>
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<td>60.557</td>
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<td>22.550</td>
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<td>70.988</td>
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<td>42.948</td>
<td>84.396</td>
<td>84.985</td>
<td>32.686</td>
<td>10.914</td>
<td>3.017</td>
</tr>
<tr>
<td>2006-Q1</td>
<td>27.394</td>
<td>49.352</td>
<td>91.228</td>
<td>89.474</td>
<td>35.526</td>
<td>11.482</td>
<td>3.883</td>
</tr>
<tr>
<td>2006-Q2</td>
<td>26.955</td>
<td>47.600</td>
<td>91.376</td>
<td>90.003</td>
<td>34.496</td>
<td>11.070</td>
<td>4.422</td>
</tr>
<tr>
<td>2006-Q3</td>
<td>27.761</td>
<td>47.267</td>
<td>94.444</td>
<td>91.032</td>
<td>35.485</td>
<td>11.316</td>
<td>4.748</td>
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<tr>
<td>2006-Q4</td>
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<td>59.083</td>
<td>103.512</td>
<td>90.812</td>
<td>36.110</td>
<td>11.714</td>
<td>5.893</td>
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<td>93.743</td>
<td>38.060</td>
<td>11.641</td>
<td>5.108</td>
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<td>92.905</td>
<td>91.144</td>
<td>37.358</td>
<td>12.592</td>
<td>5.295</td>
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<tr>
<td>2007-Q4</td>
<td>5.616</td>
<td>17.216</td>
<td>66.876</td>
<td>66.969</td>
<td>36.793</td>
<td>14.305</td>
<td>5.032</td>
</tr>
<tr>
<td>2008-Q1</td>
<td>26.642</td>
<td>38.999</td>
<td>85.398</td>
<td>88.547</td>
<td>38.291</td>
<td>12.925</td>
<td>4.496</td>
</tr>
</tbody>
</table>
It can be seen that explicitly measured value added, $V_{EVA}$, took sudden drops in Q4-2007 and in Q4-2008 (in fact, it became negative in Q4-2008). This is an indication that explicitly measured value added is probably not as well measured as one would expect. The average quarterly explicitly measured banking sector value added was $21.4 billion dollars over the sample period. When we add deposit services to the explicitly measured output, the quarterly average jumps to $33.5 billion; adding loan services leads to a $72.0 billion average and adding other asset services leads to a small increase to $76.4 billion. The average quarterly wages and salary bill was $34.1 billion and the average value of quarterly depreciation and amortization expenses was $11.8 billion. Quarterly imputed interest (or waiting services) on nonfinancial capital averaged only $2.6 billion when the reference rate $r$ was chosen to be the average quarterly debt interest rate $r_{1L2}$.

In Table 4, we list the various asset and liability margin services that are generated by the choice of the reference rate $r_1$; recall equations (37)-(39) for definitions of these services.

**Table 4: Option 1 FISIM Components: Asset Margin Services $V_{MA1}(r_1)$-$V_{MA4}(r_1)$, Deposit Services $V_{DS}(r_1)$ and Other Liability Margin Services $V_{ML2}(r_1)$-$V_{ML3}(r_1)$**

<table>
<thead>
<tr>
<th>Quarter</th>
<th>$V_{MA1}(r_1)$</th>
<th>$V_{MA2}(r_1)$</th>
<th>$V_{MA3}(r_1)$</th>
<th>$V_{MA4}(r_1)$</th>
<th>$V_{DS}(r_1)$</th>
<th>$V_{ML2}(r_1)$</th>
<th>$V_{ML3}(r_1)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008-Q4</td>
<td>-8.017</td>
<td>-2.086</td>
<td>33.304</td>
<td>45.184</td>
<td>34.903</td>
<td>16.342</td>
<td>2.887</td>
</tr>
<tr>
<td>2009-Q1</td>
<td>34.887</td>
<td>38.530</td>
<td>74.731</td>
<td>87.833</td>
<td>40.135</td>
<td>17.732</td>
<td>1.894</td>
</tr>
<tr>
<td>2009-Q2</td>
<td>25.633</td>
<td>32.890</td>
<td>56.891</td>
<td>68.916</td>
<td>38.906</td>
<td>14.363</td>
<td>2.022</td>
</tr>
<tr>
<td>2009-Q4</td>
<td>20.233</td>
<td>33.937</td>
<td>54.659</td>
<td>64.333</td>
<td>39.644</td>
<td>16.996</td>
<td>2.228</td>
</tr>
<tr>
<td>2010-Q1</td>
<td>22.433</td>
<td>40.999</td>
<td>64.096</td>
<td>70.667</td>
<td>39.687</td>
<td>12.793</td>
<td>2.371</td>
</tr>
<tr>
<td>2010-Q2</td>
<td>19.706</td>
<td>33.201</td>
<td>60.339</td>
<td>69.054</td>
<td>41.094</td>
<td>12.713</td>
<td>1.964</td>
</tr>
<tr>
<td>2010-Q3</td>
<td>18.099</td>
<td>31.597</td>
<td>65.165</td>
<td>73.534</td>
<td>40.185</td>
<td>12.773</td>
<td>1.820</td>
</tr>
<tr>
<td>2010-Q4</td>
<td>16.441</td>
<td>32.312</td>
<td>65.127</td>
<td>72.181</td>
<td>41.474</td>
<td>14.358</td>
<td>1.899</td>
</tr>
<tr>
<td>2011-Q1</td>
<td>16.172</td>
<td>32.628</td>
<td>72.282</td>
<td>80.117</td>
<td>43.196</td>
<td>12.625</td>
<td>1.867</td>
</tr>
<tr>
<td>2011-Q2</td>
<td>13.930</td>
<td>31.290</td>
<td>74.477</td>
<td>81.937</td>
<td>42.364</td>
<td>12.607</td>
<td>1.879</td>
</tr>
<tr>
<td>Mean</td>
<td>21.363</td>
<td>33.472</td>
<td>72.031</td>
<td>76.396</td>
<td>34.097</td>
<td>11.848</td>
<td>2.578</td>
</tr>
</tbody>
</table>
From Table 4, we see that margin services for deposit assets are always small and negative (quarterly average equals −$1.8 billion), margin services for debt assets are positive except for Q4-2006 (quarterly average equals $8.4 billion), margin services for loans are always large and positive (quarterly average equals $38.6 billion) and margin services for equity investments are always negative and quite variable (quarterly average equals −$2.3 billion). This means that the deposit interest rate that the banking sector earns as their average rate of return on equity investments is always less than their average cost of debt, leading to (small) negative entries for $V_{MA1}(\rho_1)$ and $V_{MA2}(\rho_1)$ for each quarter. On the other hand, except for one quarter, the rate of interest that the banking sector earned on its debt investments and loans was always larger than the average interest rate that the banking sector paid on its debt, leading to positive entries for $V_{MA2}(\rho_1)$ and $V_{MA3}(\rho_1)$. Banking sector deposit services, $V_{DS}(\rho_1)$, ranged between $3.6$ and $32.5$ billion with an average quarterly value of $12.1$ billion. Liability margin services for bank debt were always zero. This is due to our choice of reference rate; i.e., when $\rho$ equals the average debt interest rate $r_{12}$, $V_{ML2}(\rho)$ will automatically equal zero. Liability margin services for bank equity capital, $V_{ML3}(\rho_1)$, were generally large and positive with the exception of Q4-2006 when these services were negative. $V_{ML3}(\rho_1)$ ranged between −$8.9$ and $40.0$ billion with an average quarterly value of $27.9$ billion. As indicated previously, these financial service margins can be regarded as payments to equity investors for risk assumption services.
We now turn our attention to the Option 2 reference rate where we set the reference rate $\rho_2$ equal to the weighted average cost of raising capital via deposits and debt. Since explicitly measured bank value added, employee costs and depreciation and amortization costs do not change when the reference rate is changed, we do not list these variables in Table 5.

Table 5: Option 2A, 2B and 2C Measures of Value Added, Imputed Interest Cost for Nonfinancial Capital $\rho_2 V_{A5}$ and Deposit Services $V_{DS}(\rho_2)$

<table>
<thead>
<tr>
<th>Quarter</th>
<th>$V(\rho_2,A)$</th>
<th>$V(\rho_2,B)$</th>
<th>$V(\rho_2,C)$</th>
<th>$\rho_2 V_{A5}$</th>
<th>$V_{DS}(\rho_2)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001-Q2</td>
<td>18.880</td>
<td>59.547</td>
<td>62.492</td>
<td>1.685</td>
<td>1.512</td>
</tr>
<tr>
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<td>59.209</td>
<td>63.187</td>
<td>1.572</td>
<td>1.557</td>
</tr>
<tr>
<td>2001-Q4</td>
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<td>62.438</td>
<td>69.336</td>
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<td>2.645</td>
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<tr>
<td>2002-Q1</td>
<td>20.908</td>
<td>60.926</td>
<td>68.414</td>
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<td>1.439</td>
</tr>
<tr>
<td>2002-Q2</td>
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<td>62.337</td>
<td>70.601</td>
<td>1.197</td>
<td>1.798</td>
</tr>
<tr>
<td>2002-Q3</td>
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<td>64.768</td>
<td>72.964</td>
<td>1.135</td>
<td>1.524</td>
</tr>
<tr>
<td>2002-Q4</td>
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<td>1.726</td>
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<td>1.878</td>
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<tr>
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<td>78.787</td>
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<td>1.924</td>
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<tr>
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<td>71.025</td>
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<tr>
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<tr>
<td>2004-Q4</td>
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<td>96.764</td>
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<tr>
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<td>93.139</td>
<td>96.785</td>
<td>3.859</td>
<td>4.422</td>
</tr>
<tr>
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<td>99.933</td>
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<td>4.832</td>
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<tr>
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<td>84.218</td>
<td>3.075</td>
<td>2.257</td>
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<td>89.083</td>
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<td>0.996</td>
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<td>71.366</td>
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</tr>
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<td>63.139</td>
<td>77.216</td>
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<td>3.509</td>
</tr>
</tbody>
</table>

66 We can think of this reference rate as a rough approximation to a safe rate of return.
When we add deposit services to the explicitly measured output, the quarterly average bank output $V(\rho_2,A)$ is only $24.4$ billion, a substantial drop from the average value for $V(\rho_1,A)$, which was $33.5$ billion. This drop is quite understandable; lowering the reference rate will lead to a drop in the value of deposit services.\(^{67}\) Adding loan services to explicitly measured value added plus deposit services leads to a $71.4$ billion average for $V(\rho_2,B)$, which is quite close to the $72.0$ billion average for $V(\rho_1,B)$.\(^{68}\) Adding other asset services leads to a further small increase for the average value of $V(\rho_2,C)$ to $80.4$ billion, which is fairly close to the $76.4$ billion average value for $V(\rho_1,C)$. Quarterly imputed interest (or waiting services) on nonfinancial capital $\rho_2V_{A5}$ averaged only $2.0$ billion, a drop from the $2.6$ billion average for $\rho_1V_{A5}$. The sample average value for deposit services $V_{DS}(\rho_2)$ was only $3.1$ billion, which is a substantial drop from the corresponding average value for $V_{DS}(\rho_1)$ which was $12.1$ billion.

In Table 6, we list the various asset and liability margin services that are generated by the choice of the reference rate $\rho_2$.

**Table 6: Option 2 FISIM Components: Asset Margin Services $V_{MA1}(\rho_2)$-$V_{MA4}(\rho_2)$ and Liability Margin Services $V_{ML2}(\rho_2)$-$V_{ML3}(\rho_2)$**

<table>
<thead>
<tr>
<th>Quarter</th>
<th>$V_{MA1}(\rho_2)$</th>
<th>$V_{MA2}(\rho_2)$</th>
<th>$V_{MA3}(\rho_2)$</th>
<th>$V_{MA4}(\rho_2)$</th>
<th>$V_{ML2}(\rho_2)$</th>
<th>$V_{ML3}(\rho_2)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001-Q2</td>
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<td>6.769</td>
<td>40.667</td>
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<td>32.465</td>
</tr>
<tr>
<td>2002-Q3</td>
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<td>40.694</td>
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<td>1.524</td>
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</tr>
<tr>
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<td>41.575</td>
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<td>1.726</td>
<td>31.100</td>
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<td>42.201</td>
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<td>1.878</td>
<td>35.898</td>
</tr>
<tr>
<td>2003-Q2</td>
<td>-0.712</td>
<td>9.664</td>
<td>42.971</td>
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<td>36.341</td>
</tr>
<tr>
<td>2003-Q3</td>
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<td>36.264</td>
</tr>
<tr>
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<td>1.924</td>
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<td>-1.570</td>
<td>2.779</td>
<td>36.989</td>
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<td>53.504</td>
<td>-1.029</td>
<td>3.925</td>
<td>39.087</td>
</tr>
</tbody>
</table>

\(^{67}\) The sample average $\rho_1$ is equal to the average $r_{L2}$ which was 0.644% per year. The average $\rho_2$ is equal to the weighted average of $r_{L1}$ and $r_{L2}$ which was 0.506% per year.

\(^{68}\) Since the average value of deposit liabilities $V_{L1}$ is quite close to the average value of loan assets $V_{A3}$, it can be seen that $V(\rho,B)$ will be approximately invariant to the value of the reference rate $\rho$. From the Appendix, the average loan share of total assets was $s_{A3} = 0.620$ and the average deposit share of total assets and liabilities was $s_{L1} = 0.662$. 
From Table 6, we see that margin services for deposit assets $V_{MA1}(\rho_2)$ are always small and negative with the exception of Q4-2008 where $V_{MA1}(\rho_2)$ was small and positive (quarterly average equals −$1.0$ billion). Margin services for debt assets $V_{MA2}(\rho_2)$ are positive (quarterly average equals $11.6$ billion), margin services for loans $V_{MA3}(\rho_2)$, are always large and positive (quarterly average equals $47.0$ billion) and margin services for equity investments $V_{MA4}(\rho_2)$ are always negative (quarterly average equals −$1.6$ billion). Liability margin services for bank debt $V_{ML2}(\rho_2)$ were always positive (quarterly average equals $3.1$ billion). This is an increase over $V_{ML2}(\rho_1)$, which was always zero. This increase is due to our choice of reference rate which is lower than the bank liability deposit rate. Liability margin services for bank equity capital, $V_{ML3}(\rho_2)$, were generally large and positive with the exception of Q4-2008 when these services were negative. $V_{ML3}(\rho_2)$ ranged between −$8.2$ and $42.6$ billion with an average quarterly value of $29.4$ billion. The generally positive values for $V_{ML2}(\rho_2)$ and $V_{ML3}(\rho_2)$ can be regarded as payments to debt and equity investors for risk assumption services. \(^{69}\)

We now turn our attention to the Option 3 reference rate where we set the reference rate $\rho_3$ equal to the weighted average cost of raising capital via deposits, debt and equity.

\(^{69}\) Note that $V_{DS}(\rho_2)$ always equals $V_{ML2}(\rho_2)$. This is a consequence of our choice of the reference rate $\rho_2$ as the weighted average of the cost of capital raised by deposits and debt.
Table 7: Option 3A, 3B and 3C Measures of Value Added, Imputed Interest Cost for Nonfinancial Capital $\rho_3 V_{A5}$ and Deposit Services $V_{DS}(\rho_3)$

<table>
<thead>
<tr>
<th>Quarter</th>
<th>$V(\rho_3,A)$</th>
<th>$V(\rho_3,B)$</th>
<th>$V(\rho_3,C)$</th>
<th>$\rho_3 V_{A5}$</th>
<th>$V_{DS}(\rho_3)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001-Q2</td>
<td>35.768</td>
<td>59.691</td>
<td>54.421</td>
<td>2.406</td>
<td>18.400</td>
</tr>
<tr>
<td>2001-Q3</td>
<td>35.126</td>
<td>59.501</td>
<td>55.262</td>
<td>2.298</td>
<td>18.495</td>
</tr>
<tr>
<td>2001-Q4</td>
<td>40.923</td>
<td>62.864</td>
<td>60.316</td>
<td>2.210</td>
<td>20.971</td>
</tr>
<tr>
<td>2002-Q1</td>
<td>41.652</td>
<td>61.847</td>
<td>58.840</td>
<td>2.040</td>
<td>22.182</td>
</tr>
<tr>
<td>2002-Q2</td>
<td>43.778</td>
<td>63.173</td>
<td>60.729</td>
<td>2.236</td>
<td>23.353</td>
</tr>
<tr>
<td>2002-Q3</td>
<td>46.543</td>
<td>65.668</td>
<td>62.172</td>
<td>2.189</td>
<td>23.993</td>
</tr>
<tr>
<td>2002-Q4</td>
<td>41.524</td>
<td>63.629</td>
<td>60.89</td>
<td>1.900</td>
<td>21.976</td>
</tr>
<tr>
<td>2003-Q1</td>
<td>49.753</td>
<td>69.579</td>
<td>65.208</td>
<td>1.942</td>
<td>25.518</td>
</tr>
<tr>
<td>2003-Q2</td>
<td>50.398</td>
<td>70.722</td>
<td>66.347</td>
<td>1.953</td>
<td>26.005</td>
</tr>
<tr>
<td>2003-Q3</td>
<td>48.040</td>
<td>70.283</td>
<td>64.720</td>
<td>1.833</td>
<td>25.376</td>
</tr>
<tr>
<td>2003-Q4</td>
<td>48.423</td>
<td>70.614</td>
<td>67.321</td>
<td>1.911</td>
<td>25.752</td>
</tr>
<tr>
<td>2004-Q1</td>
<td>50.195</td>
<td>72.502</td>
<td>69.033</td>
<td>2.094</td>
<td>27.192</td>
</tr>
<tr>
<td>2004-Q2</td>
<td>48.094</td>
<td>71.793</td>
<td>69.037</td>
<td>2.053</td>
<td>27.138</td>
</tr>
<tr>
<td>2004-Q3</td>
<td>49.461</td>
<td>75.101</td>
<td>71.384</td>
<td>2.536</td>
<td>28.430</td>
</tr>
<tr>
<td>2004-Q4</td>
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<td>77.197</td>
<td>73.728</td>
<td>2.977</td>
<td>26.885</td>
</tr>
<tr>
<td>2005-Q1</td>
<td>54.177</td>
<td>79.556</td>
<td>75.968</td>
<td>3.426</td>
<td>29.574</td>
</tr>
<tr>
<td>2005-Q2</td>
<td>51.912</td>
<td>81.099</td>
<td>76.622</td>
<td>3.712</td>
<td>29.721</td>
</tr>
<tr>
<td>2005-Q3</td>
<td>57.395</td>
<td>85.104</td>
<td>78.497</td>
<td>3.959</td>
<td>30.939</td>
</tr>
<tr>
<td>2006-Q1</td>
<td>60.593</td>
<td>91.714</td>
<td>84.624</td>
<td>4.617</td>
<td>32.998</td>
</tr>
<tr>
<td>2006-Q2</td>
<td>60.435</td>
<td>91.875</td>
<td>84.360</td>
<td>5.314</td>
<td>33.480</td>
</tr>
<tr>
<td>2006-Q3</td>
<td>60.475</td>
<td>94.951</td>
<td>85.177</td>
<td>5.663</td>
<td>32.713</td>
</tr>
<tr>
<td>2006-Q4</td>
<td>62.088</td>
<td>103.586</td>
<td>89.435</td>
<td>6.099</td>
<td>35.511</td>
</tr>
<tr>
<td>2007-Q1</td>
<td>59.836</td>
<td>94.053</td>
<td>85.356</td>
<td>5.631</td>
<td>30.474</td>
</tr>
<tr>
<td>2007-Q2</td>
<td>63.039</td>
<td>97.508</td>
<td>87.812</td>
<td>6.037</td>
<td>32.074</td>
</tr>
<tr>
<td>2007-Q3</td>
<td>53.303</td>
<td>93.229</td>
<td>85.257</td>
<td>6.210</td>
<td>29.097</td>
</tr>
<tr>
<td>2008-Q1</td>
<td>52.317</td>
<td>85.497</td>
<td>82.361</td>
<td>5.470</td>
<td>25.675</td>
</tr>
<tr>
<td>2008-Q2</td>
<td>39.298</td>
<td>73.725</td>
<td>76.714</td>
<td>4.211</td>
<td>17.784</td>
</tr>
<tr>
<td>2008-Q3</td>
<td>30.222</td>
<td>65.215</td>
<td>70.495</td>
<td>3.937</td>
<td>14.372</td>
</tr>
<tr>
<td>2008-Q4</td>
<td>-11.609</td>
<td>33.137</td>
<td>49.836</td>
<td>2.183</td>
<td>-3.592</td>
</tr>
<tr>
<td>2009-Q1</td>
<td>54.419</td>
<td>75.863</td>
<td>80.323</td>
<td>2.924</td>
<td>19.532</td>
</tr>
<tr>
<td>2009-Q2</td>
<td>37.079</td>
<td>57.251</td>
<td>67.012</td>
<td>2.296</td>
<td>11.446</td>
</tr>
<tr>
<td>2009-Q3</td>
<td>28.942</td>
<td>50.983</td>
<td>64.140</td>
<td>1.941</td>
<td>7.412</td>
</tr>
<tr>
<td>2009-Q4</td>
<td>28.332</td>
<td>53.835</td>
<td>66.596</td>
<td>1.857</td>
<td>8.099</td>
</tr>
<tr>
<td>2010-Q1</td>
<td>39.092</td>
<td>63.759</td>
<td>71.382</td>
<td>2.242</td>
<td>16.66</td>
</tr>
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<td>2010-Q2</td>
<td>33.061</td>
<td>60.318</td>
<td>69.115</td>
<td>1.954</td>
<td>13.355</td>
</tr>
<tr>
<td>2010-Q3</td>
<td>35.166</td>
<td>65.702</td>
<td>72.076</td>
<td>2.051</td>
<td>17.068</td>
</tr>
<tr>
<td>2010-Q4</td>
<td>31.346</td>
<td>64.972</td>
<td>72.574</td>
<td>1.837</td>
<td>14.905</td>
</tr>
<tr>
<td>2011-Q1</td>
<td>36.777</td>
<td>73.008</td>
<td>78.558</td>
<td>2.131</td>
<td>20.605</td>
</tr>
<tr>
<td>2011-Q2</td>
<td>36.719</td>
<td>75.592</td>
<td>79.979</td>
<td>2.219</td>
<td>22.789</td>
</tr>
<tr>
<td>Mean</td>
<td>43.851</td>
<td>72.505</td>
<td>71.589</td>
<td>3.157</td>
<td>22.487</td>
</tr>
</tbody>
</table>

When we add deposit services to the explicitly measured output, the quarterly average bank output $V(\rho_3,A)$ jumps up to $43.9$ billion, a large increase from the previous average bank output $V(\rho_2,A)$ level, which was $24.4$ billion. This increase is due to the fact that the new reference rate $\rho_3$ is much higher than $\rho_2$: increasing the reference rate
will lead to an increase in the value of deposit services. Adding loan services to explicitly measured value added plus deposit services leads to a $72.5 billion average for $V(\rho_3,B)$, which is quite close to the $72.0$ and $71.4$ billion averages for $V(\rho_1,B)$ and $V(\rho_2,B)$. This approximate invariance of bank output measures to changes in the reference rate that include both deposit and loan services as outputs is due to the fact that loan assets are roughly equal to deposit assets for the U.S. commercial banking system over this period. This invariance will probably not hold for other countries. Adding other asset services leads to a small decrease for the average value of $V(\rho_3,C)$ to $71.6$ billion. Quarterly imputed interest (or waiting services) on nonfinancial capital $\rho_3 V_{A5}$ averaged only $3.2$ billion, a small increase from the average values for $\rho_1 V_{A5}$ and $\rho_2 V_{A5}$, which were $2.6$ and $2.0$ billion dollars respectively. The sample average value for deposit services $V_{DS}(\rho_3)$ jumped up to $22.5$ billion, a substantial increase from the corresponding average values for $V_{DS}(\rho_1)$ and $V_{DS}(\rho_2)$ which were $12.1$ and $3.1$ billion dollars respectively.

In Table 8, we list the various asset and liability margin services that are generated by the choice of the reference rate $\rho_3$.

Table 8: Option 3 FISIM Components: Asset Margin Services $V_{MA1}(\rho_3)$-$V_{MA4}(\rho_3)$ and Liability Margin Services $V_{ML2}(\rho_3)$-$V_{ML3}(\rho_3)$

<table>
<thead>
<tr>
<th>Quarter</th>
<th>$V_{MA1}(\rho_3)$</th>
<th>$V_{MA2}(\rho_3)$</th>
<th>$V_{MA3}(\rho_3)$</th>
<th>$V_{MA4}(\rho_3)$</th>
<th>$V_{ML2}(\rho_3)$</th>
<th>$V_{ML3}(\rho_3)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001-Q3</td>
<td>-3.133</td>
<td>2.022</td>
<td>24.375</td>
<td>-3.128</td>
<td>-4.598</td>
<td>23.093</td>
</tr>
<tr>
<td>2002-Q4</td>
<td>-2.606</td>
<td>2.387</td>
<td>22.105</td>
<td>-2.520</td>
<td>-5.938</td>
<td>27.914</td>
</tr>
<tr>
<td>2003-Q1</td>
<td>-2.737</td>
<td>0.993</td>
<td>19.827</td>
<td>-2.627</td>
<td>-6.714</td>
<td>32.232</td>
</tr>
<tr>
<td>2003-Q2</td>
<td>-2.575</td>
<td>0.659</td>
<td>20.325</td>
<td>-2.459</td>
<td>-6.615</td>
<td>32.621</td>
</tr>
<tr>
<td>2003-Q3</td>
<td>-2.867</td>
<td>-0.057</td>
<td>22.242</td>
<td>-2.639</td>
<td>-7.235</td>
<td>32.610</td>
</tr>
<tr>
<td>2003-Q4</td>
<td>-2.526</td>
<td>1.967</td>
<td>22.191</td>
<td>-2.734</td>
<td>-6.940</td>
<td>32.692</td>
</tr>
<tr>
<td>2004-Q3</td>
<td>-2.793</td>
<td>1.378</td>
<td>25.641</td>
<td>-2.301</td>
<td>-6.523</td>
<td>34.953</td>
</tr>
<tr>
<td>2004-Q4</td>
<td>-2.428</td>
<td>2.249</td>
<td>28.470</td>
<td>-3.290</td>
<td>-6.069</td>
<td>32.954</td>
</tr>
<tr>
<td>2005-Q2</td>
<td>-2.552</td>
<td>0.892</td>
<td>29.187</td>
<td>-2.818</td>
<td>-5.072</td>
<td>34.794</td>
</tr>
<tr>
<td>2005-Q3</td>
<td>-2.664</td>
<td>-0.865</td>
<td>27.709</td>
<td>-3.078</td>
<td>-5.005</td>
<td>35.943</td>
</tr>
<tr>
<td>2005-Q4</td>
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<td>0.655</td>
<td>31.798</td>
<td>-4.206</td>
<td>-3.091</td>
<td>29.599</td>
</tr>
<tr>
<td>2006-Q1</td>
<td>-2.956</td>
<td>-0.543</td>
<td>31.121</td>
<td>-3.591</td>
<td>-3.750</td>
<td>36.748</td>
</tr>
<tr>
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<td>-2.501</td>
<td>-0.946</td>
<td>31.439</td>
<td>-4.067</td>
<td>-4.395</td>
<td>37.875</td>
</tr>
<tr>
<td>2006-Q3</td>
<td>-2.888</td>
<td>-2.538</td>
<td>34.476</td>
<td>-4.347</td>
<td>-4.586</td>
<td>37.299</td>
</tr>
</tbody>
</table>

---

70 The sample average $\rho_3$ was 0.831%, which is much higher than the averages for $\rho_1$ and $\rho_2$ which were 0.644% and 0.506% per quarter respectively.

71 Recall that the average values for $V(\rho_1,C)$ and $V(\rho_2,C)$ were $76.4$ and $80.4$ billion dollars respectively.
From Table 8, we see that margin services for deposit assets $V_{MA1}(\rho_3)$ are always small and negative with the exception of Q4-2008 where $V_{MA1}(\rho_3)$ was small and positive (quarterly average equals $-2.6$ billion), margin services for debt assets $V_{MA2}(\rho_3)$ are generally positive (quarterly average equals $4.7$ billion), margin services for loans $V_{MA3}(\rho_3)$, are always large and positive (quarterly average equals $28.7$ billion, a big drop from the average value for $V_{MA3}(\rho_2)$, which was $47.0$ billion) and margin services for equity investments $V_{MA4}(\rho_3)$ are always negative (quarterly average equals $-3.0$ billion). Liability margin services for bank debt $V_{ML2}(\rho_3)$ were generally negative with the exception of some positive entries during the period Q3-2009 to Q2-2010 (quarterly average equals $-3.7$ billion), This is a decrease over $V_{ML2}(\rho_2)$, which averaged $3.0$ billion. This decrease is due to our choice of the reference rate $\rho_3$ which is higher than $\rho_2$. Liability margin services for bank equity capital, $V_{ML3}(\rho_3)$, were generally large and positive with the exception of Q4-2008 when these services were negative. $V_{ML3}(\rho_3)$ ranged between $-7.4$ and $37.9$ billion with an average quarterly value of $26.2$ billion.

The nine output concepts that we considered in this section can readily be compared by looking at Chart 2 below.

<table>
<thead>
<tr>
<th>Year-Qtr</th>
<th>$V_{MA1}(\rho_3)$</th>
<th>$V_{MA2}(\rho_3)$</th>
<th>$V_{MA3}(\rho_3)$</th>
<th>$V_{MA4}(\rho_3)$</th>
<th>$V_{ML2}(\rho_3)$</th>
<th>$V_{ML3}(\rho_3)$</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006-Q4</td>
<td>-3.157</td>
<td>-4.177</td>
<td>41.498</td>
<td>-6.816</td>
<td>-1.074</td>
<td>36.585</td>
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</tr>
<tr>
<td>2007-Q1</td>
<td>-3.271</td>
<td>-0.613</td>
<td>34.217</td>
<td>-4.812</td>
<td>-4.484</td>
<td>34.958</td>
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</tr>
<tr>
<td>2007-Q2</td>
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<td>-1.916</td>
<td>34.469</td>
<td>-4.915</td>
<td>-4.631</td>
<td>36.704</td>
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</tr>
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<td>-2.843</td>
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<td>-4.649</td>
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</tr>
<tr>
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<td>-1.451</td>
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<td>50.147</td>
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<tr>
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<td>34.993</td>
<td>-3.001</td>
<td>-2.078</td>
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</tr>
<tr>
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<td>3.768</td>
<td>-7.360</td>
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<td>0.411</td>
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<tr>
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<td>25.503</td>
<td>-1.663</td>
<td>1.625</td>
<td>6.473</td>
<td></td>
</tr>
<tr>
<td>2010-Q1</td>
<td>-2.910</td>
<td>12.808</td>
<td>24.666</td>
<td>-2.275</td>
<td>0.500</td>
<td>16.159</td>
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</tr>
<tr>
<td>2010-Q2</td>
<td>-2.425</td>
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<td>27.256</td>
<td>-1.887</td>
<td>0.044</td>
<td>13.311</td>
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<tr>
<td>2010-Q3</td>
<td>-2.772</td>
<td>11.257</td>
<td>30.536</td>
<td>-2.112</td>
<td>-1.021</td>
<td>18.089</td>
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<tr>
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<td>11.678</td>
<td>33.625</td>
<td>-1.890</td>
<td>0.274</td>
<td>14.631</td>
<td></td>
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</table>
From viewing Chart 1, it can be seen that the measures of banking sector output that include both deposit and loan services (the B options) are tightly clustered and cannot be readily distinguished in the Chart; i.e., the output estimates for the U.S. commercial banking sector represented by $V(\rho_1, B)$, $V(\rho_2, B)$ and $V(\rho_3, B)$ are all very similar. As mentioned in the text, this is due to the fact that the asset value of loans is approximately equal to the liability value of deposits for the U.S. banking sector over our sample period and thus measures of bank output will be approximately invariant to changes in the reference rate.

The banking sector output concepts that include only explicitly measured value added plus deposit services (the A options, $V(\rho_1, A)$, $V(\rho_2, A)$ and $V(\rho_3, A)$) are the lowest three lines in Chart 1. Since the choice of a reference rate changes the value of deposit services rather dramatically, these three curves differ substantially from each other. Thus if these concepts for bank output are used, it is important to choose the “right” reference rate.
The output concepts that include deposit services plus all bank asset services, $V(\rho_1, C)$, $V(\rho_2, C)$ and $V(\rho_3, C)$, lie a bit above the cluster of B measures for the most part, with the exception of $V(\rho_3, C)$, which lies below the cluster until the onset of the Great Recession. As might be expected, the C measures of output are much more variable than the B measures.

9. Comparison with Multiple Reference Rate Methodologies

The (sectoral) single reference rate methodology that we have developed in this paper and our earlier paper, Diewert, Fixler and Zieschang (2012), can be contrasted with the multiple reference rate methodology developed by Basu, Inklaar and Wang (2011). The Wang and coauthors methodology can be broken up into two components: one component that defines nominal bank outputs and inputs and another component that determines the real quantity of the banking sector outputs and inputs. The Basu, Inklaar and Wang (2011) paper focuses only on the determination of nominal bank outputs and inputs and it utilizes a user cost framework and so it is very similar to our empirical work in the previous section. We will now attempt to interpret their methodology for nominal bank output and input measurement using the notation developed in the previous section.

There are two important principles that drive the Wang methodology. The first is that banks mostly transfer risk and waiting services from the household sector to the nonfinancial sector. This principle is not inconsistent with our framework. The second principle that Basu, Inklaar and Wang (2011) (BIW in what follows) use is a matching principle: the value of bank asset services that are not explicitly charged for can be determined by the margin between actual interest earned on the asset less imputed interest that a market debt instrument generates that has the same risk characteristics as the actual asset investment. Thus in principle, there will be a separate reference rate for each financial asset class. However, for all bank financial asset categories except loans, BIW use the market returns on these assets converted into interest rates as the reference rates. Thus the main asset reference rate that BIW have to choose is the loan reference rate.

Using our notation in the previous section, denote the BIW asset reference rates as

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73 While we think that the Wang and coauthors methodology for determining bank nominal outputs and inputs is a very useful contribution to the literature on bank measurement, we are less enthusiastic about their methodology for determining real outputs. We prefer a deflation approach to the measurement of real outputs and inputs whereas they prefer transaction counts as a direct measure of bank financial outputs and inputs.

74 “The risk premium, along with actual interest expenses on bank liabilities, constitutes a pure transfer of capital income. It is part of the factor income generated by the capital used in the borrowing firm’s production or in the consumption of consumers.” Basu, Inklaar and Wang (2011; 232).

75 “In the case of lending services, the pure cost of funds of a loan should be inferred using the rate of return on a market debt security with the same risk characteristics (but without any services attached).” Basu, Inklaar and Wang (2011; 229). The BIW methodology suggests that bank loan customers are indifferent between borrowing from a bank or raising funds in credit markets. But as Fama (1985) pointed out, the main feature of banks is that they provide credit services to borrowers who cannot access credit markets.
$\rho_{A1} = r_{A1}, \rho_{A2} = r_{A2}, \rho_{A3} < r_{A3},$ and $\rho_{A4} = r_{A4}$. Thus the BIW choice of reference rates for three of the four financial asset classes is to simply choose the reference rate to equal the corresponding market interest rate while the loan reference rate $\rho_{A3}$ is chosen to be a rate that will be slightly below the corresponding market rate $r_{A3}$ on average.

BIW also pick reference rates for liabilities. For deposits, they pick their reference rate $\rho_{L1}$ to be a safe interest rate\textsuperscript{76} and for other liabilities, we believe that their reference rates are approximately equal to the corresponding market rates so that $\rho_{L2} = r_{L2}$ and $\rho_{L3} = r_{L3}$.

At this point, the reader should recall equation (34) in the previous section. Essentially, this equation added imputed interest (at the reference rate $\rho$) to all beginning of period assets less imputed interest cost to all beginning of period liabilities and added these terms to the right hand side of the banking sector’s explicitly measured value added equation (33). It is the addition of this equation (whose terms sum to 0) to the explicitly measured components of labour income and gross operating surplus that led to an imputed interest charge for nonfinancial capital (equal to $\rho V_{A5}$) and margins for various banking sector financial outputs and inputs. The counterpart to the key equation (35) in the present multiple reference rate context is the following one:

\begin{equation}
(44) \rho_{A5} V_{A5} - [\rho_{L1} V_{L1} + \rho_{L2} V_{L2} + \rho_{L3} V_{L3} - \rho_{A1} V_{A1} - \rho_{A2} V_{A2} - \rho_{A3} V_{A3} - \rho_{A4} V_{A4}] = 0.
\end{equation}

If the reference rates for liabilities $\rho_{L1}$, $\rho_{L2}$, $\rho_{L3}$ and for financial assets $\rho_{A1}$, $\rho_{A2}$, $\rho_{A3}$, $\rho_{A4}$ have been exogenously chosen, then in order for the left hand side of (44) to equal 0, it can be seen that the reference rate for nonfinancial assets $\rho_{A5}$ must be endogenously determined by (44). Now add the terms on the left hand side of (44) to the right hand side of the banking sector’s explicitly measured value added equation (33) in order to obtain a new multiple reference rates (explicitly measured) value added decomposition:\textsuperscript{77}

\begin{equation}
(45) V_{EVA} = V_E + V_{D&A} + \rho_{A5} V_{A5} - (\rho_{A1} - \rho_{A1}) V_{A1} - (\rho_{A2} - \rho_{A2}) V_{A2} - (\rho_{A3} - \rho_{A3}) V_{A3} - (\rho_{A4} - \rho_{A4}) V_{A4} + (\rho_{L1} - \rho_{L1}) V_{L1} + (\rho_{L2} - \rho_{L2}) V_{L2} + (\rho_{L3} - \rho_{L3}) V_{L3}.
\end{equation}

Making the particular assumptions for the reference rates that were made by BIW leads to the following simplification of (45):

\begin{equation}
(46) V_{EVA} = V_E + V_{D&A} + \rho_{A5} V_{A5} - (\rho_{A3} - \rho_{A3}) V_{A3} - (\rho_{L1} - \rho_{L1}) V_{L1}.
\end{equation}

Now take the last two terms on the right hand side of (46) over to the left hand side and we have the BIW measure of bank output, which is equal to explicitly measured value added $V_{EVA}$ plus loan services ($\rho_{A3} - \rho_{A3}) V_{A3}$ plus deposit services ($\rho_{L1} - \rho_{L1}) V_{L1}$. This

because of the problems of adverse selection and moral hazard. For such borrowers, banks bear default risk and there is no comparable market security whose return could be used as a reference rate for their loans.

\textsuperscript{76} “For insured deposits in the United States, the relevant reference rate should be the risk free Treasury rate ...” Basu, Inklaar and Wang (2011; 232).

\textsuperscript{77} We need to add terms that sum to zero to the right hand side of (33) so that explicitly measured value added remains unchanged. It should be noted that this generalization of the BIW value added decomposition was first derived by Zieschang (2011).
measure of bank output is equal to the sum of employment income $V_E$ plus depreciation and amortization expense $V_{D&A}$ plus imputed interest cost attributed to nonfinancial capital $\rho_{A5}V_{A5}$.\textsuperscript{78}

The main advantage of the BIW and Zieschang multiple reference rate approach is that it could be used to achieve an additive system of accounts and this is a substantial advantage.

However, there are some problems with the BIW and Zieschang multiple reference rate approach:

- The choice of the various reference rates for financial assets and liabilities is not clear cut; in particular, the choice of reference rates for deposits and loans is contestable.\textsuperscript{79}
- The multiple reference rate methodology leads to an indirectly determined imputed interest rate $\rho_{A5}$ for nonfinancial assets via equation (44) that is driven by the choice of reference rates for all other assets and liabilities whereas our reference rate $\rho$ is directly determined as the appropriate cost of financial capital in the banking sector.\textsuperscript{80} Thus our approach to choosing the reference rate for nonfinancial capital in the banking sector is in principle the same as choosing the reference rates for other sectors in the economy.

In spite of the above criticisms of the BIW multiple reference rate approach to choosing reference rates, we do not want to be too critical of this approach, since it could be justified from the viewpoint of a divisional model of banking.\textsuperscript{81} Thus suppose that a bank’s activities are organized into divisions where say Division 1 focuses on deposit management, Division 2 focuses on loans and Division 3 focuses on other assets. Depending on the riskiness of the cash flows in the three divisions, the bank could assign different costs of capital to the three divisions and these different reference rates would appear as different reference rates for deposits, loans and other asset activities. There would be a separate accounting of the type given by (45) for each division. In the end, we would consolidate these divisional activities into one aggregate bank decomposition. In the overall decomposition, the weighted average of the three costs of capital would equal

\textsuperscript{78} We do not have access to the exact reference rates that BIW used but it is likely that the $V(\rho_2,A)$ bank output option described in the previous section will approximate the BIW output measure. This output option uses a relatively low reference rate $\rho_2$ and sets bank value added equal to explicitly measured value added plus deposit services; i.e., loan services are assumed to be zero in this option.

\textsuperscript{79} How are we to determine the market rates for loans that match up with bank loans? Hedge funds, pension funds and other near banks make loans to households and businesses and there is no reason to expect that the interest rates that they charge will differ substantially from bank loans of the same type. This leads one to choose $\rho_{A3} = r_{A3}$ so that BIW loan FISIM collapses to a zero value. Similarly, why is a safe interest rate the “right” reference rate for deposits? From the point of view of a bank, deposits are a source of relatively cheap financial capital and from our perspective, the “right” reference rate is the bank’s average cost of raising capital via debt. Our suggested choice of a reference rate will lead to a larger amount of deposit FISIM.

\textsuperscript{80} Of course, the problem with our approach is that it is not easy to determine what this cost of capital is.

\textsuperscript{81} We are indebted to Susanto Basu for this point.
the overall cost of capital for the bank and we would end up with essentially the BIW and Zieschang multiple reference rate model. The practical problem of determining the divisional reference rates would still be a significant one in this approach.\(^8^2\)

Our conclusion here is that more discussion on the issues surrounding the choice of reference rates and the measurement of banking sector inputs and outputs is needed with the producers and users of the accounts.

10. Conclusion

We have provided a framework for integrating financial sector inputs and outputs into the System of National Accounts. Our approach also integrates the flow accounts with the balance sheet accounts. There is a single reference rate for each sector in our suggested approach which generally should be equal to the cost of raising financial capital in that sector. Unfortunately, different reference rates for different sectors will cause a lack of additivity for various financial services across the suppliers and demanders of financial services which will complicate the construction of an economy wide set of accounts.

Another significant innovation in our paper is the integration of the Owner Occupied Housing and Banking sectors into a coherent sectoral model of the economy.

Our suggested accounting framework has some loose ends. In particular, it is not completely straightforward to decide exactly what the cost of capital is in each sector. Secondly, it is not completely straightforward to decide exactly where a particular financial margin belongs; i.e., should it be regarded as an output or as a part of gross operating surplus. Additional discussion and analysis on these topics is required. Finally, our framework needs to be extended to an open economy with investment and a government sector.

Data Appendix

Our data are from the U.S. Federal Deposit Insurance Corporation (FDIC), publicly available at www.fdic.gov, covering all FDIC-insured commercial banks in the United States. This is the same source that is used in the U.S. national accounts. We have chosen the default, global consolidation basis data (indicated by balance sheet variable codes starting with RCFM where global consolidation is relevant) used on the FDIC Reports of Condition (balance sheets). Data in the US and other official national accounts statistics are on a residency basis and thus would differ slightly from the data we used.\(^8^3\)

\(^8^2\) An equally important problem is that the economic statistician will not have access to the divisional breakdown of outputs and inputs. In particular, the divisions will share various overhead inputs such as accounting services, management and head office expenses and these shared expenses are difficult to allocate.

\(^8^3\) The national accounts residency basis data include all institutional units whose “center of economic interest” is in the United States. Thus, the branches and subsidiaries of US banks resident in other countries are excluded from residency basis statistics. Balance sheet data from FDIC on US residency basis are
The data are quarterly and cover the 42 quarters 2001Q1-2011Q2. FDIC balance sheet data refer to end of quarter. Since we require beginning of the period data on assets and liabilities, our final data set will cover only the 41 quarters 2001Q2-2011Q2. Income data are reported cumulatively through each calendar year, although when mergers occur, the cumulation process can reinitiate in the 2nd, 3rd, or 4th quarters. We have taken account of this in decumulating the data, using an acquisition date variable reported to the FDIC. However, about 1,600 of the roughly 330,000 records over 2001Q1-20011Q2 contain restatements or undocumented mergers that produce negative flows in the affected quarter. We expect that these effects largely wash out at the aggregate level.

We will first list the beginning of quarter asset and liability values for the U.S. aggregate commercial banking sector that are taken from the FDIC balance sheet accounts. We will then list the flow inputs and outputs that are drawn from the FDIC income accounts.

We will distinguish five classes of bank assets in our data set. The five classes of assets are as follows: A1 = deposits; A2 = debt securities and trading assets; A3 = loans and acceptances; A4 = equity and investment fund shares and other security receivables; A5 = nonfinancial assets.

Note that \( V_{A3} \) is the gross end of period value of loan, lease and acceptance assets for the previous quarter less the value of the provisions for loan and lease losses in the previous quarter; i.e., we have adjusted the value of loan and lease assets downwards for expected loan losses. The beginning of the quarter asset values for the five types of assets are listed as \( V_{A1} - V_{A5} \) in Table A1 along with the asset total, \( V_A \). The units of measurement for all tables are in billions of dollars.

### Table A1: Beginning of Quarter Bank Assets by Type of Asset \( V_{A1} - V_{A5} \) and Total Assets \( V_A \)

<table>
<thead>
<tr>
<th>Quarter</th>
<th>( V_{A1} )</th>
<th>( V_{A2} )</th>
<th>( V_{A3} )</th>
<th>( V_{A4} )</th>
<th>( V_{A5} )</th>
<th>( V_A )</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001-Q2</td>
<td>371.117</td>
<td>1450.826</td>
<td>4354.649</td>
<td>314.676</td>
<td>187.574</td>
<td>6678.842</td>
</tr>
<tr>
<td>2001-Q3</td>
<td>394.741</td>
<td>1452.966</td>
<td>4378.548</td>
<td>313.396</td>
<td>190.951</td>
<td>6730.602</td>
</tr>
<tr>
<td>2001-Q4</td>
<td>403.977</td>
<td>1541.848</td>
<td>4404.377</td>
<td>378.833</td>
<td>200.657</td>
<td>6929.692</td>
</tr>
<tr>
<td>2002-Q1</td>
<td>401.607</td>
<td>1567.986</td>
<td>4405.105</td>
<td>362.809</td>
<td>210.558</td>
<td>6948.066</td>
</tr>
<tr>
<td>2002-Q2</td>
<td>347.283</td>
<td>1590.376</td>
<td>4395.426</td>
<td>333.983</td>
<td>220.321</td>
<td>6887.389</td>
</tr>
<tr>
<td>2002-Q3</td>
<td>372.051</td>
<td>1711.249</td>
<td>4485.580</td>
<td>348.235</td>
<td>219.168</td>
<td>7136.283</td>
</tr>
<tr>
<td>2002-Q4</td>
<td>390.230</td>
<td>1782.452</td>
<td>4601.051</td>
<td>361.000</td>
<td>214.457</td>
<td>7349.191</td>
</tr>
</tbody>
</table>

indicated by variables beginning with RCON in the FDIC data. For a description of how banking sector output is measured in the U.S. SNA, see Fixler, Reinsdorf and Smith (2003).

It should be noted that there are many measurement problems associated with our data and so our empirical results are only a rough approximation to the "truth". For a good discussion of some of these measurement problems, see Basu, Inklaar and Wang (2011; 232-240).

In Q2 of 2001, the starting stocks in this asset class were as follows (in billions of dollars): premises and fixed assets = $79.578; other real estate owned = $3.655; goodwill = $62.574 and other intangible assets = $41.767. These numbers are likely to understate the true current value of nonfinancial assets since the value of land and structures in the banking sector will be a historical cost value, which will greatly understate the current market value of these assets. The goodwill asset will probably reduce the amount of this undervaluation but will not completely offset it.

The loan loss variable is defined as quarterly loan interest less loan interest net of chargeoffs. This variable is listed as \( V_{LL} \) in Table A2.
In Table A2, we list the quarterly interest income received for each of the first four asset classes, $V_{A1}$-$V_{A4}$, along with total interest received, $V_{AR}$. There is no explicit interest associated with the fifth asset class, nonfinancial capital, but we will later impute a return to this asset class. The quarterly loan loss series, $V_{LL}$, and the loan loss rate as a fraction of the asset value of loans, $\delta_{LL} = V_{LL}/V_{A3}$, are also listed in Table A2.

**Table A2: Quarterly Interest Earned by Asset Class $V_{A1}$-$V_{A4}$, Total Interest Earned $V_{AR}$, Loan Losses $V_{LL}$ and the Loan Loss Rate $\delta_{LL}$**

<table>
<thead>
<tr>
<th>Quarter</th>
<th>$V_{A1}$</th>
<th>$V_{A2}$</th>
<th>$V_{A3}$</th>
<th>$V_{A4}$</th>
<th>$V_{AR}$</th>
<th>$V_{LL}$</th>
<th>$\delta_{LL}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003-Q1</td>
<td>395.791</td>
<td>1841.251</td>
<td>4671.858</td>
<td>368.299</td>
<td>218.664</td>
<td>7495.863</td>
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</tr>
<tr>
<td>2003-Q2</td>
<td>390.677</td>
<td>1889.005</td>
<td>4750.814</td>
<td>368.187</td>
<td>225.018</td>
<td>7623.746</td>
<td></td>
</tr>
<tr>
<td>2003-Q4</td>
<td>392.762</td>
<td>1916.891</td>
<td>4932.945</td>
<td>434.847</td>
<td>239.173</td>
<td>7916.618</td>
<td></td>
</tr>
<tr>
<td>2004-Q1</td>
<td>397.865</td>
<td>2018.949</td>
<td>4985.005</td>
<td>387.194</td>
<td>258.970</td>
<td>8047.983</td>
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<tr>
<td>2004-Q2</td>
<td>412.262</td>
<td>2136.041</td>
<td>5062.388</td>
<td>387.001</td>
<td>260.598</td>
<td>8258.291</td>
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<tr>
<td>2004-Q3</td>
<td>446.744</td>
<td>2094.081</td>
<td>5259.991</td>
<td>389.157</td>
<td>309.066</td>
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<tr>
<td>2004-Q4</td>
<td>426.879</td>
<td>2061.870</td>
<td>5432.852</td>
<td>403.945</td>
<td>361.904</td>
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<tr>
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<td>2154.385</td>
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<td>394.693</td>
<td>384.750</td>
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<td>5582.969</td>
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<tr>
<td>2005-Q3</td>
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<td>392.446</td>
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</tr>
<tr>
<td>2005-Q4</td>
<td>394.672</td>
<td>2190.186</td>
<td>5895.456</td>
<td>417.052</td>
<td>399.023</td>
<td>9296.388</td>
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<tr>
<td>2006-Q1</td>
<td>410.118</td>
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<tr>
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<td>379.560</td>
<td>2264.419</td>
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<td>401.848</td>
<td>2301.045</td>
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<td>547.191</td>
<td>12665.720</td>
<td></td>
</tr>
<tr>
<td>2011-Q1</td>
<td>953.668</td>
<td>3144.256</td>
<td>7219.472</td>
<td>723.733</td>
<td>557.013</td>
<td>12598.140</td>
<td></td>
</tr>
<tr>
<td>2011-Q2</td>
<td>1100.514</td>
<td>3211.904</td>
<td>7084.780</td>
<td>735.473</td>
<td>557.497</td>
<td>12690.170</td>
<td></td>
</tr>
</tbody>
</table>

The average shares in total assets over the sample period for the 5 types of asset were as follows: $s_{A1} = 0.0558$ (the minimum share was 0.039 and the maximum was 0.087), $s_{A2} = 0.2346$ (0.216 to 0.259), $s_{A3} = 0.6197$ (0.558 to 0.652), $s_{A4} = 0.0500$ (0.045 to 0.060) and $s_{A5} = 0.0400$ (0.028 to 0.048). Thus the largest share of assets (62%) was in the loan and acceptance category. The average asset share of nonfinancial assets was only 4%.
The sample average quarterly loan loss rate, $\delta_{q1}$, was 0.002833 or 1.13% per year. But in the quarters up to the second quarter of 2008 when the Great Financial Crisis started to become apparent, the quarterly loan loss rate was only 0.001730 or 0.69% per year. Over the subsequent period 2008-Q2 through 2011-Q2, the quarterly loan loss rate jumped to 0.005210 or 2.08% per year. This is a very big jump. Note that the return on equity investments was slightly negative in Q4 of 2005 and 2006 but all other returns were positive.
We now list the FDIC beginning of the quarter liability data in Table A3 below. We distinguish three liability classes, $V_{L1}$-$V_{L3}$: (1) deposits; (2) debt (debt securities, loans, acceptances, trading liabilities and other liabilities) and (3) equity. We also list total liabilities, $V_L \equiv V_{L1} + V_{L2} + V_{L3}$. The value of equity, $V_{L3}$, is defined residually as the value of assets less the value of nonequity liabilities; i.e., we have:

$$V_{L3} = V_{A1} + V_{A2} + V_{A3} + V_{A4} + V_{A5} - V_{L1} - V_{L2}.$$

We also list the deposit interest paid by the banking sector $V_{LR1}$ and other interest paid on debt $V_{LR2}$ in Table A3. $V_{LR3}$ listed in Table A3 is the imputed return to equity capital; it is set equal to net accounting income, $V_{AI}$, which will be defined later in this Appendix. Note that accounting income was negative in Q4 of 2008.

Table A3: Beginning of Quarter Bank Liabilities by Type $V_{L1}$-$V_{L3}$, Total Liabilities $V_L$ and Quarterly Interest or Earnings Paid by Liability Class $V_{LR1}$-$V_{LR3}$

<table>
<thead>
<tr>
<th>Quarter</th>
<th>$V_{L1}$</th>
<th>$V_{L2}$</th>
<th>$V_{L3}$</th>
<th>$V_L$</th>
<th>$V_{LR1}$</th>
<th>$V_{LR2}$</th>
<th>$V_{LR3}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001-Q2</td>
<td>4392.038</td>
<td>1640.516</td>
<td>646.288</td>
<td>6678.842</td>
<td>37.942</td>
<td>16.249</td>
<td>31.486</td>
</tr>
<tr>
<td>2001-Q3</td>
<td>4455.208</td>
<td>1619.004</td>
<td>656.390</td>
<td>6730.602</td>
<td>35.122</td>
<td>14.886</td>
<td>30.992</td>
</tr>
<tr>
<td>2001-Q4</td>
<td>4509.300</td>
<td>1733.272</td>
<td>687.121</td>
<td>6929.692</td>
<td>28.683</td>
<td>14.687</td>
<td>32.935</td>
</tr>
<tr>
<td>2002-Q1</td>
<td>4608.862</td>
<td>1638.202</td>
<td>700.002</td>
<td>6948.066</td>
<td>22.477</td>
<td>9.938</td>
<td>34.896</td>
</tr>
<tr>
<td>2002-Q3</td>
<td>4672.705</td>
<td>1730.580</td>
<td>732.998</td>
<td>7136.283</td>
<td>22.671</td>
<td>10.485</td>
<td>38.111</td>
</tr>
<tr>
<td>2002-Q4</td>
<td>4785.183</td>
<td>1811.063</td>
<td>752.945</td>
<td>7349.191</td>
<td>20.425</td>
<td>10.109</td>
<td>34.586</td>
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<tr>
<td>2003-Q2</td>
<td>5029.813</td>
<td>1813.391</td>
<td>780.542</td>
<td>7623.746</td>
<td>17.659</td>
<td>9.127</td>
<td>39.397</td>
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<td>2003-Q4</td>
<td>5183.188</td>
<td>1928.294</td>
<td>805.136</td>
<td>7916.618</td>
<td>15.660</td>
<td>8.466</td>
<td>39.125</td>
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<tr>
<td>2004-Q1</td>
<td>5297.372</td>
<td>1933.620</td>
<td>816.991</td>
<td>8047.983</td>
<td>15.650</td>
<td>8.642</td>
<td>40.794</td>
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<tr>
<td>2004-Q2</td>
<td>5439.103</td>
<td>1980.298</td>
<td>838.890</td>
<td>8258.291</td>
<td>15.710</td>
<td>9.019</td>
<td>40.328</td>
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<tr>
<td>2004-Q3</td>
<td>5593.152</td>
<td>2038.023</td>
<td>867.864</td>
<td>8499.039</td>
<td>17.461</td>
<td>10.199</td>
<td>42.074</td>
</tr>
<tr>
<td>2005-Q1</td>
<td>5825.147</td>
<td>2030.823</td>
<td>974.795</td>
<td>8830.766</td>
<td>22.289</td>
<td>12.657</td>
<td>43.678</td>
</tr>
<tr>
<td>2005-Q2</td>
<td>5922.534</td>
<td>2065.691</td>
<td>985.708</td>
<td>8973.933</td>
<td>26.113</td>
<td>14.402</td>
<td>44.086</td>
</tr>
<tr>
<td>2005-Q3</td>
<td>6018.591</td>
<td>2084.976</td>
<td>1010.495</td>
<td>9114.062</td>
<td>29.774</td>
<td>16.027</td>
<td>46.137</td>
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<tr>
<td>2005-Q4</td>
<td>6145.153</td>
<td>2132.698</td>
<td>1018.537</td>
<td>9296.388</td>
<td>33.969</td>
<td>17.898</td>
<td>39.622</td>
</tr>
<tr>
<td>2006-Q1</td>
<td>6303.701</td>
<td>2103.001</td>
<td>1028.351</td>
<td>9435.053</td>
<td>37.690</td>
<td>19.833</td>
<td>48.280</td>
</tr>
<tr>
<td>2006-Q2</td>
<td>6450.274</td>
<td>2208.645</td>
<td>1075.533</td>
<td>9734.45</td>
<td>42.970</td>
<td>21.782</td>
<td>50.622</td>
</tr>
<tr>
<td>2006-Q3</td>
<td>6619.433</td>
<td>2298.577</td>
<td>1094.688</td>
<td>10012.70</td>
<td>48.975</td>
<td>23.780</td>
<td>50.809</td>
</tr>
<tr>
<td>2006-Q4</td>
<td>6641.924</td>
<td>2373.500</td>
<td>1124.637</td>
<td>10140.06</td>
<td>53.277</td>
<td>30.655</td>
<td>51.620</td>
</tr>
<tr>
<td>2007-Q1</td>
<td>6946.622</td>
<td>2374.626</td>
<td>1145.050</td>
<td>10466.30</td>
<td>52.331</td>
<td>23.822</td>
<td>48.607</td>
</tr>
<tr>
<td>2007-Q2</td>
<td>6939.157</td>
<td>2410.447</td>
<td>1160.885</td>
<td>10510.49</td>
<td>54.501</td>
<td>25.443</td>
<td>51.188</td>
</tr>
<tr>
<td>2007-Q4</td>
<td>7224.290</td>
<td>2722.424</td>
<td>1224.387</td>
<td>11171.10</td>
<td>57.473</td>
<td>26.030</td>
<td>52.545</td>
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<td>2770.046</td>
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<td>11567.41</td>
<td>49.102</td>
<td>22.631</td>
<td>43.249</td>
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<td>7644.428</td>
<td>2951.626</td>
<td>1301.412</td>
<td>11897.47</td>
<td>39.811</td>
<td>18.500</td>
<td>31.327</td>
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<td>7632.260</td>
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<td>11840.91</td>
<td>38.097</td>
<td>17.863</td>
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<td>2008-Q4</td>
<td>7987.338</td>
<td>3160.586</td>
<td>1331.875</td>
<td>12479.80</td>
<td>33.118</td>
<td>15.452</td>
<td>-2.437</td>
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<tr>
<td>2009-Q1</td>
<td>8290.713</td>
<td>3122.628</td>
<td>1332.790</td>
<td>12746.13</td>
<td>25.606</td>
<td>11.016</td>
<td>32.773</td>
</tr>
<tr>
<td>2009-Q2</td>
<td>8201.205</td>
<td>2847.831</td>
<td>1417.500</td>
<td>12466.54</td>
<td>23.695</td>
<td>10.748</td>
<td>18.975</td>
</tr>
</tbody>
</table>
The average share of deposits in total liabilities is 0.662 (minimum is 0.640 and maximum is 0.703), the average share of debt is 0.229 (0.170 to 0.253) and the average share of equity is 0.110 (0.097 to 0.127). A point of some significance is that the average deposit share of liabilities, 0.662, is fairly close to the average share of loans in assets, 0.620.

Given the information on asset and liability values and their returns and costs in the above tables, it is straightforward to calculate average interest rates on the first four asset classes and the three liability classes; i.e., \( r_{Ai} \equiv V_{ARi}/V_{Ai} \) for \( i = 1,2,3,4 \) and \( r \equiv V_{LRi}/V_{Li} \) for \( i = 1,2,3 \). These average interest rates and imputed rates of return are listed in Table A4.

**Table A4: Average Rates of Return on Asset Classes \( r_{A1} \)-\( r_{A4} \), Average Interest Rates Paid on Deposits and Debt \( r_{L1} \) and \( r_{L2} \) and Imputed Return on Equity Capital \( r_{L3} \)**

<table>
<thead>
<tr>
<th>Quarter</th>
<th>( r_{A1} )</th>
<th>( r_{A2} )</th>
<th>( r_{A3} )</th>
<th>( r_{A4} )</th>
<th>( r_{L1} )</th>
<th>( r_{L2} )</th>
<th>( r_{L3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001-Q2</td>
<td>0.00457</td>
<td>0.01365</td>
<td>0.01832</td>
<td>0.00204</td>
<td>0.00864</td>
<td>0.00990</td>
<td>0.04872</td>
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<tr>
<td>2001-Q3</td>
<td>0.00410</td>
<td>0.01343</td>
<td>0.01760</td>
<td>0.00205</td>
<td>0.00788</td>
<td>0.00919</td>
<td>0.04722</td>
</tr>
<tr>
<td>2001-Q4</td>
<td>0.00157</td>
<td>0.01413</td>
<td>0.01599</td>
<td>0.00166</td>
<td>0.00636</td>
<td>0.00847</td>
<td>0.04793</td>
</tr>
<tr>
<td>2002-Q1</td>
<td>0.00239</td>
<td>0.01149</td>
<td>0.01427</td>
<td>0.00168</td>
<td>0.00488</td>
<td>0.00607</td>
<td>0.04985</td>
</tr>
<tr>
<td>2002-Q2</td>
<td>0.00269</td>
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<td>0.01456</td>
<td>0.00210</td>
<td>0.00504</td>
<td>0.00656</td>
<td>0.05098</td>
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<tr>
<td>2002-Q3</td>
<td>0.00246</td>
<td>0.01119</td>
<td>0.01425</td>
<td>0.00206</td>
<td>0.00485</td>
<td>0.00606</td>
<td>0.05199</td>
</tr>
<tr>
<td>2002-Q4</td>
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<td>0.01020</td>
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<td>0.00188</td>
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<tr>
<td>2003-Q1</td>
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<td>0.00371</td>
<td>0.00514</td>
<td>0.05099</td>
</tr>
<tr>
<td>2003-Q2</td>
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<td>0.00903</td>
<td>0.01296</td>
<td>0.00200</td>
<td>0.00351</td>
<td>0.00503</td>
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<tr>
<td>2003-Q3</td>
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<td>0.00902</td>
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<tr>
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<td>0.04300</td>
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<td>0.01352</td>
<td>0.00252</td>
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<tr>
<td>2005-Q2</td>
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<td>0.00441</td>
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<td>2005-Q3</td>
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<td>0.00969</td>
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<td>0.00260</td>
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<td>2005-Q4</td>
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<td>–0.00024</td>
<td>0.00553</td>
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<tr>
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<tr>
<td>2007-Q4</td>
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<td>0.00796</td>
<td>0.00956</td>
<td>0.01841</td>
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</tbody>
</table>
The sample average quarterly interest rates are listed on the last line of Table A4. Annualizing these quarterly average rates, we see that deposit assets earned 1.20% (1.38%, 0.80%) per year on average, debt assets earned 4.03% (4.29%, 3.48%), loan assets earned 5.22% (6.06%, 3.39%) and equity assets earned 0.66% (0.77%, 0.42%) per year on average. Deposit liabilities cost the banking sector an average rate of 1.83% (2.18%, 1.08%) per year and all forms of debt cost the banking sector an average rate of 2.58% (3.01%, 1.64%) per year. Finally, the annualized average before tax rate of return on equity for the banking sector was a rather large 14.22% (18.16%, 5.71%) per year.

We turn now to listing the components of U.S. commercial banking sector value added data using the FDIC quarterly income statements.

We define explicitly measured banking sector value added \( V_{EVA} \) as follows:

\[
(A2) \quad V_{EVA} = V_Y - V_N
\]

where \( V_Y \) equals the value of FDIC explicitly measured outputs \(^{89}\) and \( V_N \) equals the value of intermediate inputs used by the banking sector.\(^{90}\) Note also that accounting value

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\(^{87}\) Note that these rates of return are after loan loss rates of return.

\(^{88}\) Income taxes reduce this rate of return by about 1/3; the quarterly average after tax rate of return was 0.02511 or an annualized rate of 10.04% per year.

\(^{89}\) \( V_Y \) is defined to be total noninterest income plus realized gains (or losses) on held-to-maturity securities plus realized gains (or losses) on available-for-sale securities as defined in the FDIC tables. The sample average value of these three components of \( V_Y \) was $52.539, ~$0.151 and $0.375 billion dollars respectively. Thus the value of realized gains and losses on security transactions was small. However, it is likely that a substantial fraction of noninterest income is in fact difficult to price explicitly.
added, $V_{AVA}$, is equal to explicitly measured value added plus net interest earned by the banking sector; i.e., we have the following identities:

(A3) $V_{AVA} = V_{EVA} + V_{AR1} + V_{AR2} + V_{AR3} + V_{AR4} - V_{LR1} - V_{LR2}$

where $V_E$ is the value of salaries and employee benefits (employment income), $V_{D&A}$ is the value of depreciation and amortization and $V_{AI}$ is accounting income (residually defined as $V_{AVA} - V_E - V_{D&A}$). Note also that the return to equity capital, $V_{L3}$, is defined to be equal to accounting income, $V_{AI}$. All of these newly defined variables are listed in Table A5. Define the nonfinancial asset depreciation and amortization rate $\delta_{D&A}$ as $V_{D&N}/V_{AVA}$. It is also listed in Table A5 and from the last row in this Table, we see that the sample average depreciation and amortization rate was the rather high rate of 3.18% per quarter.

**Table A5: Banking Sector Explicitly Measured Output $V_Y$, Intermediate Input $V_N$, Employee Compensation $V_E$, Value of Depreciation and Amortization $V_{D&A}$ and the Corresponding Rate $\delta_{D&A}$, Accounting Income $V_{AI}$, Explicitly Measured Value Added $V_{EVA}$ and Accounting Value Added $V_{AVA}$**

<table>
<thead>
<tr>
<th>Quarter</th>
<th>$V_Y$</th>
<th>$V_N$</th>
<th>$V_E$</th>
<th>$V_{D&amp;A}$</th>
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<th>$V_{AI}$</th>
<th>$V_{EVA}$</th>
<th>$V_{AVA}$</th>
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$^90$ $V_N$ is defined as other noninterest expense in the FDIC tables; i.e., this variable excludes labour, depreciation and amortization expenses and so we interpret it as intermediate input purchases from the nonfinancial sector.

$^91$ The value of depreciation and amortization expenses, $V_{D&A}$, is the sum of expenses of premises and fixed assets plus amortization expenses of intangible assets plus goodwill impairment losses plus amortization expense and impairment losses for other intangible assets. The sample average value for each of these four categories of expense was 9.319, 0.191, 0.987 and 1.692 billion dollars respectively. Thus the amortization of goodwill charges are small relative to traditional depreciation charges. In Quarter 4 of 2008, there was a massive goodwill impairment loss of 20.655 billion dollars as compared to the corresponding impairment losses of 2.244 in the previous quarter and 4.649 billion in the subsequent quarter. An unusual loss of this magnitude does not belong in the income statement in our judgement and so we set the goodwill impairment loss in Q4 of 2008 equal to the average of the previous and subsequent period.
Explicitly measured value added, $V_{EVA}$, of course excludes net interest income while accounting value added, $V_{AVA}$, includes it and so is much larger.\textsuperscript{92} National income accountants generally regard the first measure of banking sector value added as being too small and the second one as being too large. Thus in the main text, we will consider alternative value added concepts that lead to intermediate measures of banking sector value added. Note that in Q4 of 2008, explicitly measured bank value added $V_{EVA}$ and the return to equity capital or net accounting income $V_{AI}$ were both negative. These negative values are due to a large (unexplained) drop in explicitly measured bank output $V_{Y}$ and an increase in bank intermediate expenditures $V_{N}$ for that quarter.

References


\textsuperscript{92} See the discussion on alternative bank output concepts in Diewert, Fixler and Zieschang (2012).


Federal Deposit Insurance Corporation (2012), various tables from www.fdic.gov [Kim please fill in the appropriate reference]


Hill, P. (2000); “Economic Depreciation and the SNA”; paper presented at the 26th Conference of the International Association for Research on Income and Wealth; Cracow, Poland.


