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

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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.
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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[4] and by Hancock, Fixler and Zieschang.[5] There is a third approach to nominal bank output and input measurement that works with bank assets and liabilities rather than user cost flows.[6] 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.[7]

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.[8]

[4] See Wang (2003), Wang, Basu and Fernald (2009), Basu, Inklaar and Wang (2011), Wang and Basu (2012), Colangelo and Inklaar (2012) and Inklaar and Wang (2012).
[5] See Hancock (1985) (1991), Fixler and Zieschang (1991) (1992a) (1992b), Fixler (2009) (2012), Diewert, Fixler and Zieschang (2012) and Schreyer and Stauffer (2012).
[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).

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avoid double counting of outputs), it is necessary to have an explicit Owner Occupied Housing (OOH) sector.

[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]

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[10] 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).
[11] If the capital input is not subject to wear and tear depreciation (e.g., a land input), then $K^1 = K^0$.
[12] This convention is consistent with current accounting practice; see Peasnell (1981).
[13] 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] For additional material on the beginning and end of period perspective and the associated user costs, see Diewert (2005a).

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

Note that $P_K^1K^1 - (1+r)P_K^0K^0 = -[(1+r)P_K^0K^0 - P_K^1K^1]$ 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 δ 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) $(1+r)P_K^0K^0 - P_K^1K^1 = (1+r)P_K^0K^0 - (1+i)P_K^0(1-\delta)K^0 = [r - i + (1+i)\delta]P_K^0K^0 = uK^0$

and $u \equiv [r - i + (1+i)\delta]P_K^0$ 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 $(1+r)P_K^0K^0 - P_K^1K^1$ 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:

- $r\, P_K^0K^0$ is equal to *waiting and risk assumption services*;[16]
- $- i_KP_K^0K^0$ is the *revaluation term* and
- $(1+i)\delta P_K^0K^0$ 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, $P_K^0K^0 - P_K^1K^1$, 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).

[15] The user cost of capital idea can be traced back to Walras (1874). For more recent derivations, see Jorgenson and Griliches (1967), Christensen and Jorgenson (1969) (1973), Diewert (1974) (2010) and Jorgenson (1989).

[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[18] 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.[19] 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.[20]

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*

[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:

$$(4)\ p_{BH}\, y_{BH} + p_{BN}\, y_{BN} \equiv p_{NB}\, y_{NB} + w_B x_B + [P_{KB}{}^0 K_B{}^0 - P_{KB}{}^1 K_B{}^1 + r_H M_H{}^0 + r_N M_N{}^0 + r_{HB} v_{HB}{}^0 + R_{HB} V_{HB}{}^0 - r_{BN} v_{BN}{}^0 - R_{BN} V_{BN}{}^0 - r_{BO} v_{BO}{}^0 + \pi_B]$$

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;
$r_H M_H{}^0$ = 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 $v_{BN}{}^0$;
π_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]

[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.

$$(5)\ p_{BH}\, y_{BH} + p_{BN}\, y_{BN} - p_{NB}\, y_{NB} \equiv w_B x_B + P_{KB}{}^0 K_B{}^0 - P_{KB}{}^1 K_B{}^1 + r_H M_H{}^0 + r_N M_N{}^0 + r_{HB} v_{HB}{}^0 + R_{HB} V_{HB}{}^0 - r_{BN} v_{BN}{}^0 - R_{BN} V_{BN}{}^0 - r_{BO} v_{BO}{}^0 + \pi_B.$$

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*.[23] Thus the explicitly measured banking sector value added is equal to the sum of labour services used in the banking sector ($w_B x_B$), revaluation plus depreciation of capital services ($P_{KB}{}^0 K_B{}^0 - P_{KB}{}^1 K_B{}^1$) plus bank deposit interest paid to the household and nonfinancial sectors ($r_H M_H{}^0 + r_N M_N{}^0$) plus bond interest, dividends and imputed equity return paid to households for their financial investments in the banking sector ($r_{HB} v_{HB}{}^0 + R_{HB} V_{HB}{}^0$) less bond interest, dividend income and imputed equity returns from the banking sector's investments in the nonfinancial sector ($-r_{BN} v_{BN}{}^0 - R_{BN} V_{BN}{}^0$) less mortgage interest earned by the banking sector for their loans to owner occupiers of houses ($- r_{BO} v_{BO}{}^0$)[24] plus pure profits π_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) ($-r_{BN} v_{BN}{}^0 - R_{BN} V_{BN}{}^0 - r_{BO} v_{BO}{}^0$) 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 π_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 π_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.[25] 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

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[23] Equation (5) can be regarded as a collapsed version of the banking sector's production and allocation of primary income accounts.

[24] Note that we do not include any bank equity investments in the owner occupied housing sector. Banks may make equity investments in real property but these investments should be included as investments in the nonfinancial business sector and the output of these investments should be regarded as conventional rental housing, which is a priced service.

[25] This is what we do in the empirical part of our paper. In a variant of this method for completing the flow data, we could compute a time series of ex post rates of return on equity for the banking sector and then use these rates to predict a current rate which would then be used in equation (5) and π_B would be defined residually.

monopolistic power.[26] 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:

$$(6)\quad p_{NH}\, y_{NH} + p_{NB}\, y_{NB} - p_{BN}\, y_{BN} = w_N x_N + P_{KN}{}^0 K_N{}^0 - P_{KN}{}^1 K_N{}^1 - r_N M_N{}^0 + r_{HN} v_{HN}{}^0 + R_{HN} V_{HN}{}^0 + r_{BN} v_{BN}{}^0 + R_{BN} V_{BN}{}^0 + \pi_N$$

where

$w_N x_N$ = the value of labour input used in the nonfinancial sector;
$P_{KN}{}^0 K_N{}^0$ = 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;
$P_{KN}{}^1 K_N{}^1$ = 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;
$r_N M_N{}^0$ = 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;
π_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 ($w_N x_N$), revaluation plus depreciation of capital services ($P_{KN}{}^0 K_N{}^0$ −

[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.

$P_{KN}^1K_N^1$)[27] less bank deposit interest paid to the nonfinancial sector by the banking sector ($-\, r_NM_N^0$) 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 π_N.[28]

If we make the assumption that the nonfinancial sector is approximately competitive, we can set sector N profits π_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):[29]

$$(7)\ p_{OH}y_{OH} = P_H^0H^0 - P_H^1H^1 + r_{HO}v_{HO}^0 + R_{HO}V_{HO}^0 + r_{BO}v_{BO}^0$$

where

$P_H^0H^0$ = the value of the owner occupied housing stock owned by sector O at the beginning of the period where P_H^0 is the price and H^0 is the quantity;
$P_H^1H^1$ = the end of period value of the initial housing stock used by sector O where P_H^1 is the end of period price and H^1 is the corresponding depreciated end of period housing stock measured in constant quality units;[30]
$r_{HO}v_{HO}^0$ = interest paid by sector O to other households where v_{HO}^0 is the household sector's beginning of the period stock of loans made to sector O and r_{HO} is the corresponding interest rate;
$r_{BO}v_{BO}^0$ = mortgage interest paid by sector O to the banking sector where v_{BO}^0 is the

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[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 $P_H^0H^0$ 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;

$R_{HO}V_{HO}{}^0$ = imputed interest foregone by household equity investments in owner occupied housing where $V_{HO}{}^0$ is the beginning of the period equity value of the owner occupied housing stock and R_{HN} 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 ($P_H{}^0H^0 - P_H{}^1H^1$) 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 forgone 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:[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*[32] of sector H is equal to:

$$(8)\ p_{NH}\, y_{NH} + p_{NH}\, y_{NH} + p_{OH}\, y_{OH} = w_Bx_B + w_Nx_N + P_{KB}{}^0K_B{}^0 - P_{KB}{}^1K_B{}^1 + P_{KN}{}^0K_N{}^0 - P_{KN}{}^1K_N{}^1 + P_H{}^0H^0 - P_H{}^1H^1 + r_HM_H{}^0 + r_{HB}v_{HB}{}^0 + R_{HB}V_{HB}{}^0 + r_{HN}v_{HN}{}^0 + R_{HN}V_{HN}{}^0 + r_{HO}v_{HO}{}^0 + R_{HO}V_{HO}{}^0 + \pi_B + \pi_N.$$

[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.

[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 ($w_Bx_B + w_Nx_N$), revaluation plus depreciation of capital services used in the three sectors ($P_{KB}{}^0K_B{}^0 - P_{KB}{}^1K_B{}^1 + P_{KN}{}^0K_N{}^0 - P_{KN}{}^1K_N{}^1 + P_H{}^0H^0 - P_H{}^1H^1$) plus bank deposit interest paid to the household sector ($r_HM_H{}^0$) 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

Row	Description	Sector H	Sector B	Sector N	Sector O
1	Priced	$p_{BH}\,y_{BH}$	$p_{BH}\,y_{BH}$		
2	Output	$p_{NH}\,y_{NH}$		$p_{NH}\,y_{NH}$	
3	Flows and	$p_{OH}\,y_{OH}$			$p_{OH}\,y_{OH}$
4	Intermediate		$p_{BN}\,y_{BN}$	$-p_{BN}\,y_{BN}$	
5	Input Flows		$-p_{NB}\,y_{NB}$	$p_{NB}\,y_{NB}$	
6	Labour Services	$w_Bx_B + w_Nx_N$	w_Bx_B	w_Nx_N	
7	Sector B Revaluation And Depreciation	$P_{KB}{}^0K_B{}^0 - P_{KB}{}^1K_B{}^1$	$P_{KB}{}^0K_B{}^0 - P_{KB}{}^1K_B{}^1$		
8	Sector N Revaluation And Depreciation	$P_{KN}{}^0K_N{}^0 - P_{KN}{}^1K_N{}^1$		$P_{KN}{}^0K_N{}^0 - P_{KN}{}^1K_N{}^1$	
9	Sector O Revaluation And Depreciation	$P_H{}^0H^0 - P_H{}^1H^1$			$P_H{}^0H^0 - P_H{}^1H^1$
10	Deposit Interest B to H	$r_HM_H{}^0$	$r_HM_H{}^0$		
11	Deposit Interest B to N		$r_NM_N{}^0$	$-r_NM_N{}^0$	
12	H Loans to B: Interest	$r_{HB}v_{HB}{}^0$	$r_{HB}v_{HB}{}^0$		
13	H Loans to N: Interest	$r_{HN}v_{HN}{}^0$		$r_{HN}v_{HN}{}^0$	
14	H Loans to O: Interest	$r_{HO}v_{HO}{}^0$			$r_{HO}v_{HO}{}^0$
15	B Loans to N: Interest		$-r_{BN}v_{BN}{}^0$	$r_{BN}v_{BN}{}^0$	

[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.

16	**B Loans to O: Interest**		$-r_{BO}v_{BO}^{0}$		$r_{BO}v_{BO}^{0}$
17	**H Equity in B: Returns**	$R_{HB}V_{HB}^{0}$	$R_{HB}V_{HB}^{0}$		
18	**H Equity in N: Returns**	$R_{HN}V_{HN}^{0}$		$R_{HN}V_{HN}^{0}$	
19	**H Equity in O: Returns**	$R_{HO}V_{HO}^{0}$			$R_{HO}V_{HO}^{0}$
20	**B Equity in N: Returns**		$-R_{BN}V_{BN}^{0}$	$R_{BN}V_{BN}^{0}$	
21	**Pure Profits**	$\pi_B + \pi_N$	π_B	π_N	

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.[34] 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, $-r_NM_N^{0}$, 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);

[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) $M_H^0 + M_N^0 + v_{HB}^0 + V_{HB}^0 = v_{BN}^0 + V_{BN}^0 + v_{BO}^0 + P_{KB}^0 K_B^0$.

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 ($P_{KB}^0 K_B^0$). 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.[35]

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

(10) $v_{HN}^0 + V_{HN}^0 + v_{BN}^0 + V_{BN}^0 = P_{KN}^0 K_N^0 + M_N^0$.

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 ($P_{KN}^0 K_N^0$) 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) $v_{HO}^0 + V_{HO}^0 + v_{BO}^0 = P_H^0H^0$.

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 ($P_H^0H^0$).

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) $v_{HB}^0 + v_{HN}^0 + v_{HO}^0 + V_{HB}^0 + V_{HN}^0 + V_{HO}^0 + M_H^0 = P_{KB}^0K_B^0 + P_{KN}^0\,K_N^0 + P_H^0H^0$.

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 ($P_{KB}^0K_B^0 + P_{KN}^0K_N^0$) plus the beginning of the period value of the owner occupied housing stock ($P_H^0H^0$).

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, $P_H^0H^0$, 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, ρ_O, earned on the asset base; i.e., define ρ_O as follows:

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

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

$$
\begin{aligned}
(14)\ p_{OH}\,y_{OH} &= P_H^0H^0 - P_H^1H^1 + r_{HO}v_{HO}^0 + R_{HO}V_{HO}^0 + r_{BO}v_{BO}^0 \\
&= P_H^0H^0 - P_H^1H^1 + \rho_O[v_{HO}^0 + V_{HO}^0 + v_{BO}^0] && \text{using (13)} \\
&= P_H^0H^0 - P_H^1H^1 + \rho_O\,P_H^0H^0 && \text{using (11)} \\
&\equiv u_OH^0
\end{aligned}
$$

where $u_OH^0 \equiv (1+\rho_O)P_H^0H^0 - P_H^1H^1$ 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

housing stock.[36] 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 ρ_O which is applied to the initial value of the owner occupied housing stock, $P_H^0H^0$. Moreover, the usual user cost of capital u_O 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, $v_{HO}^0 + V_{HO}^0 + v_{BO}^0$, have been replaced by the value of the opening stock of OOH, $P_H^0H^0$).

The above algebra for sector O shows how the use of an average cost of capital or reference rate ρ_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:

(15) $\rho_O[P_H^0H^0 - v_{HO}^0 - V_{HO}^0 - v_{BO}^0] = 0.$

5. The Integrated System of Flow Accounts

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

(16) $\rho_B[P_{KB}^0K_B^0 + v_{BN}^0 + V_{BN}^0 + v_{BO}^0 - M_H^0 - M_N^0 - v_{HB}^0 - V_{HB}^0] = 0.$

---

[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 $p_{OH}y_{OH} = u^0H^0$ are distributed back to the owners along with the depreciated value of the initial housing stock, $P_H^1H^1$. But the sum of these two end of period financial flows are just enough for owner investors to earn the overall rate of return ρ_O on the beginning of the period value of the owner occupied housing stock; i.e., we have $u_OH^0 + P_H^1H^1 = (1+\rho_O)P_H^0H^0$. 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]

$$(17)\ p_{BH}\,y_{BH} + p_{BN}\,y_{BN} - p_{NB}\,y_{NB} = w_Bx_B + (1+\rho_B)P_{KB}{}^0K_B{}^0 - P_{KB}{}^1K_B{}^1 - (\rho_B - r_H)M_H{}^0 - (\rho_B - r_N)M_N{}^0 + (r_{HB} - \rho_B)v_{HB}{}^0 + (R_{HB} - \rho_B)V_{HB}{}^0 - (r_{BN} - \rho_B)v_{BN}{}^0 - (R_{BN} - \rho_B)V_{BN}{}^0 - (r_{BO} - \rho_B)v_{BO}{}^0 + \pi_B.$$

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_Bx_B is simply the value of labour input for sector B. The next set of terms, $(1+\rho_B)P_{KB}{}^0K_B{}^0 - P_{KB}{}^1K_B{}^1$, can be recognized as the *value of capital services* for the banking sector; i.e., recall equation (3) above. Note that ρ_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, ρ_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 ρ_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 (17) 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, ρ_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 π_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

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[37] The rational 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, ρ_B, and so ρ_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 ρ_N and, after some rearrangement, we obtain the following equation:

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

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) $p_{NH}\, y_{NH} + p_{NB}\, y_{NB} - p_{BN}\, y_{BN} = w_Nx_N + (1+\rho_N)P_{KN}{}^0K_N{}^0 - P_{KN}{}^1K_N{}^1 + (\rho_N-r_N)\, M_N{}^0$
$+ (r_{HN}-\rho_N)v_{HN}{}^0 + (R_{HN}-\rho_N)V_{HN}{}^0 + (r_{BN}-\rho_N)v_{BN}{}^0 + (R_{BN}-\rho_N)V_{BN}{}^0 + \pi_N$

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_Nx_N is simply the value of labour input for sector N. The next set of terms, $(1+\rho_N)P_{KN}{}^0K_N{}^0 - P_{KN}{}^1K_N{}^1$, can be recognized as the *value of capital services* for the nonfinancial sector. Note that ρ_N is the reference interest rate that is used in this user cost.[40] The next term, $(\rho_N-r_N)M_N{}^0$, will generally be positive; i.e., the nonfinancial sector's imputed cost of capital, ρ_N, will generally be greater than the deposit interest rate paid to nonfinancial businesses, r_N. Note that (ρ_N-r_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 ρ_N to be the average cost of capital raised through debt and equity so that $\rho_N \equiv [r_{HN}v_{HN}{}^0 + R_{HN}V_{HN}{}^0 + r_{BN}v_{BN}{}^0 + R_{BN}V_{BN}{}^0]/[v_{HN}{}^0 + V_{HN}{}^0 + v_{BN}{}^0 + V_{BN}{}^0]$, then the sum of the four terms $(r_{HN}-\rho_N)v_{HN}{}^0 + (R_{HN}-\rho_N)V_{HN}{}^0 + (r_{BN}-\rho_N)v_{BN}{}^0 + (R_{BN}-\rho_N)V_{BN}{}^0$ 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 $(R_{HN}-\rho_N)V_{HN}{}^0 + (R_{BN}-\rho_N)V_{BN}{}^0$ would be positive. The final value flow on the right hand side of (19) is π_N, the pure profits of the nonfinancial sector.

The reference rate for sector O is assumed to be ρ_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) $p_{OH}\, y_{OH} = (1+\rho_O)P_H{}^0H^0 - P_H{}^1H^1 + (r_{HO}-\rho_O)v_{HO}{}^0 + (R_{HO}-\rho_O)V_{HO}{}^0 + (r_{BO}-\rho_O)v_{BO}{}^0$.

The left hand side of (20) is sector O's conventional value added as in equation (7). The set of terms, $(1+\rho_O)P_H{}^0H^0 - P_H{}^1H^1$, 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 ρ_O to be the average cost

[40] Recall that the reference rate ρ_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 $(r_{HO}-\rho_O)v_{HO}^0 + (R_{HO}-\rho_O)V_{HO}^0 + (r_{BO}-\rho_O)v_{BO}^0$ 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 ρ_H and after some rearrangement, we obtain the following equation:

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

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*:

$$(22)\ p_{NH}\, y_{NH} + p_{NH}\, y_{NH} + p_{OH}\, y_{OH} = w_Bx_B + w_Nx_N + (1+\rho_H)P_{KB}^0K_B^0 - P_{KB}^1K_B^1 + (1+\rho_H)P_{KN}^0K_N^0 - P_{KN}^1K_N^1 + (1+\rho_H)P_H^0H^0 - P_H^1H^1 - (\rho_H-r_H)M_H^0 + (r_{HB}-\rho_H)v_{HB}^0 + (R_{HB}-\rho_H)V_{HB}^0 + (r_{HN}-\rho_H)v_{HN}^0 + (R_{HN}-\rho_H)V_{HN}^0 + (r_{HO}-\rho_H)v_{HO}^0 + (R_{HO}-\rho_H)V_{HO}^0 + \pi_B + \pi_N.$$

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 ρ_H is used in this user cost formula instead of the bank's opportunity cost of capital ρ_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, $-(\rho_H-r_H)M_H^0$ will generally be negative; i.e., the household sector's imputed cost of providing financial capital, ρ_H, will generally be greater than the deposit interest rate paid to household depositors, r_H. Note that (ρ_H-r_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 ρ_H to be the average benefit of providing financial capital to the three sectors so that $\rho_H \equiv [r_{HB}v_{HB}^0+R_{HB}V_{HB}^0+r_{HN}v_{HN}^0+R_{HN}V_{HN}^0+r_{HO}v_{HO}^0+R_{HO}V_{HO}^0] /[v_{HB}^0+ V_{HB}^0+v_{HN}^0+V_{HN}^0+v_{HO}^0+V_{HO}^0]$, 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

Row	Description	Sector H	Sector B	Sector N	Sector O
1	Priced Final	$p_{BH}\, y_{BH}$	$p_{BH}\, y_{BH}$		
2	Output	$p_{NH}\, y_{NH}$		$p_{NH}\, y_{NH}$	
3	Flows	$p_{OH}\, y_{OH}$			$p_{OH}\, y_{OH}$
4	Intermediate		$p_{BN}\, y_{BN}$	$-p_{BN}\, y_{BN}$	
5	Input Flows[41]		$-p_{NB}\, y_{NB}$	$p_{NB}\, y_{NB}$	
6	Labour Services	$w_B x_B + w_N x_N$	$w_B x_B$	$w_N x_N$	
7	B Capital Services	$(1+\rho_H)P_{KB}{}^0 K_B{}^0 - P_{KB}{}^1 K_B{}^1$	$(1+\rho_B)P_{KB}{}^0 K_B{}^0 - P_{KB}{}^1 K_B{}^1$		
8	N Capital Services	$(1+\rho_H)P_{KN}{}^0 K_N{}^0 - P_{KN}{}^1 K_N{}^1$		$(1+\rho_N)P_{KN}{}^0 K_N{}^0 - P_{KN}{}^1 K_N{}^1$	
9	O Capital Services	$(1+\rho_H)P_H{}^0 H^0 - P_H{}^1 H^1$			$(1+\rho_O)P_H{}^0 H^0 - P_H{}^1 H^1$
10	H Deposit Services	$-(\rho_H - r_H)M_H{}^0$	$-(\rho_B - r_H)M_H{}^0$		
11	N Deposit Services		$-(\rho_B - r_N)M_N{}^0$	$(\rho_N - r_N)M_N{}^0$	
12	H-B Loan Margins	$(r_{HB} - \rho_H)v_{HB}{}^0$	$(r_{HB} - \rho_B)v_{HB}{}^0$		
13	H-N Loan Margins	$(r_{HN} - \rho_H)v_{HN}{}^0$		$(r_{HN} - \rho_N)v_{HN}{}^0$	
14	H-O Loan Margins	$(r_{HO} - \rho_H)v_{HO}{}^0$			$(r_{HO} - \rho_O)v_{HO}{}^0$
15	B-N Loan Margins		$-(r_{BN} - \rho_B)v_{BN}{}^0$	$(r_{BN} - \rho_N)v_{BN}{}^0$	
16	B-O Loan Margins		$-(r_{BO} - \rho_B)v_{BO}{}^0$		$(r_{BO} - \rho_O)v_{BO}{}^0$
17	H-B Equity Margins	$(R_{HB} - \rho_H)V_{HB}{}^0$	$(R_{HB} - \rho_B)V_{HB}{}^0$		

[41] Excluding intermediate consumption of FISIM. Positive terms along this row are intra-sector transactions while negative terms represent inter-sector transactions.

18	**H-N Equity Margins**	$(R_{HN}-\rho_H)V_{HN}^0$		$(R_{HN}-\rho_N)V_{HN}^0$	
19	**H-O Equity Margins**	$(R_{HO}-\rho_H)V_{HO}^0$			$(R_{HO}-\rho_O)V_{HO}^0$
20	**B-N Equity Margins**		$-(R_{BN}-\rho_B)V_{BN}^0$	$(R_{BN}-\rho_N)V_{BN}^0$	
21	**Pure Profits**	$\pi_B + \pi_N$	π_B	π_N	

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 ρ_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

[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.[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.[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 ρ_B, ρ_N, ρ_O and ρ_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.[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).[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:

[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.

[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.

[46] This problem was pointed out by Diewert, Fixler and Zieschang (2012).

[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 ρ_H, ρ_B, ρ_N, and ρ_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 ρ 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:

[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.[49]

Option 2: $\rho_B = \rho_N = \rho_O = \rho_H = \rho$ where ρ is the *average rate of return on household debt and equity investments*.[50]

Thus ρ 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:

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

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[51] to these sectors than it was under Option 1.

A disadvantage of this option is:

- Although this ρ 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, ρ_H defined by (23).

Thus for the three production sectors, the reference rate ρ_O is defined by (13) and the reference rates ρ_B and ρ_N are defined as follows:

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

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 O 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:

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

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, $P_{KB}^0K_B^0$, $P_{KN}^0K_N^0$ and $P_H^0H^0$ 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_{BN}^0 and V_{BN}^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]

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[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.[54] 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 ρ_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.[55] 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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the business for labour and intermediate inputs. This type of monetary deflation can be theoretically justified in the context of the cash in advance models of Feenstra (1986) (for households) and Fischer (1974) (for businesses).

[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.

$V_Y \equiv$ 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;
$V_N \equiv$ the *value of intermediate input purchases*; this variable corresponds to $p_{NB}\, y_{NB}$;
$V_E \equiv$ the *value of employee wages and benefits*; this variable corresponds to $w_B x_B$;
$V_{D\&A} \equiv$ the *value of depreciation and amortization allowances*; this variable is equal to the depreciation component of $P_{KB}{}^0 K_B{}^0 - P_{KB}{}^1 K_B{}^1$;
$V_{AI} \equiv$ *accounting income*; this variable corresponds to $R_{HB}V_{HB}{}^0 + \pi_B$, the returns to household equity capital plus pure profits;[56]
$V_{EVA} \equiv$ *explicitly measured value added* which is equal to $V_Y - V_N$;
$V_{AVA} \equiv$ *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.

$V_{A1} \equiv$ *deposits held by banks*; we did not consider these stocks in our simplified model;
$V_{A2} \equiv$ *debt securities and trading assets held by banks*; this variable corresponds to part of $v_{BN}{}^0$ (the corresponding flow variable is $r_{BN}v_{BN}{}^0$);
$V_{A3} \equiv$ *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 $r_{BO}v_{BO}{}^0$);
$V_{A4} \equiv$ *equity and investment fund shares*; this variable corresponds to $V_{BN}{}^0$ (the corresponding flow is $R_{BN}V_{BN}{}^0$);
$V_{A5} \equiv$ *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}:

$V_{L1} \equiv$ *deposits* held by households and the nonfinancial sectors; this variable corresponds to $M_H{}^0 + M_N{}^0$ (the corresponding interest flows are $r_H M_H{}^0 + r_N M_N{}^0$);
$V_{L2} \equiv$ *debt securities, loans and other liabilities*; this variable corresponds to $v_{HB}{}^0$ (the corresponding interest flow is $r_{HB}v_{HB}{}^0$);
$V_{L3} \equiv$ 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 π_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) $r_{Ai} \equiv V_{ARi}/V_{Ai}$; $i = 1,2,3,4$ and $r_{Li} \equiv V_{LRi}/V_{Li}$; $i = 1,2$.

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) $r_{L3} \equiv V_{AI}/V_{L3}$.

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.

[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 ρ.

Using our new notation, our old banking sector flow equation (5) can be rewritten as follows:

$$\begin{aligned}(33)\ V_{EVA} &= V_Y - V_N \\ &= V_E + V_{D\&A} - V_{NETR} + r_{L3}V_{L3} \\ &= V_E + V_{D\&A} - r_{A1}V_{A1} - r_{A2}V_{A2} - r_{A3}V_{A3} - r_{A4}V_{A4} + r_{L1}V_{L1} + r_{L2}V_{L2} + r_{L3}V_{L3}.\end{aligned}$$

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 ρ 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 *integrated accounts (explicitly measured) value added decomposition*:[60]

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

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 ρV_{A5} can be interpreted as the *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.[61] Note that the terms which follow ρV_{A5} on the right hand side of (35) are all *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 ρ_A to be the *average net cost of raising financial capital* at the beginning of the period; i.e., if ρ_A were defined as follows:

$$\begin{aligned}(36)\ \rho_A &\equiv [\textstyle\sum_{i=1}^{3} r_{Li}V_{Li} - \sum_{i=1}^{4} r_{Ai}V_{Ai}]/[\sum_{i=1}^{3} V_{Li} - \sum_{i=1}^{4} V_{Ai}] \\ &= [\textstyle\sum_{i=1}^{3} r_{Li}V_{Li} - \sum_{i=1}^{4} r_{Ai}V_{Ai}]/V_{Ai}\end{aligned}$$

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 *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 ρ, $V_{MAi}(\rho)$ as follows:

(37) $V_{MAi}(\rho) \equiv (r_{Ai} - \rho)V_{Ai}$; 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 ρ, $V_{MLi}(\rho)$ as follows:

(38) $V_{MLi}(\rho) \equiv (r_{Li} - \rho)V_{Li}$; 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) $V_{DS}(\rho) \equiv - V_{ML1}(\rho) = (\rho - r_{L1})V_{L1}$.

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

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, ρV_{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]

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[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 ρ. 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 ρ, we expect debt margin services $V_{MSL2}(\rho)$ to be small in magnitude (if we choose ρ to equal r_{L2}, the average debt interest rate, $V_{MSLi}(r_{L2})$, 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 ρ. Once the reference rate is chosen, in addition to explicitly measured bank value added, V_{EVA}, we will consider the following *three alternative measures of bank value added*:

(41) $V(\rho,A) \equiv V_{EVA} + V_{DS}(\rho)$;
(42) $V(\rho,B) \equiv V_{EVA} + V_{DS}(\rho) + V_{MA3}(\rho)$;
(43) $V(\rho,C) \equiv V_{EVA} + V_{DS}(\rho) + \sum_{i=1}^{4} V_{MAi}(\rho)$.

Thus the *Option A* measure of bank nominal output defined by (41) adds deposit services to explicitly measured value added. The *Option B* measure defined by (42) adds loan services to the Option A measure while the *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 ρ:

- *Option 1*: $\rho_1 \equiv r_{L2}$; i.e., set the reference rate equal to the average cost of raising financial capital via debt;
- *Option 2*: $\rho_2 \equiv [r_{L1}V_{L1}+r_{L2}V_{L2}]/[V_{L1}+V_{L2}]$; i.e., set the reference rate equal to the weighted average cost of raising capital via deposits and debt;
- *Option 3*: $\rho_3 \equiv [r_{L1}V_{L1}+r_{L2}V_{L2}+r_{L3}V_{L3}]/[V_{L1}+V_{L2}+V_{L3}]$; 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.

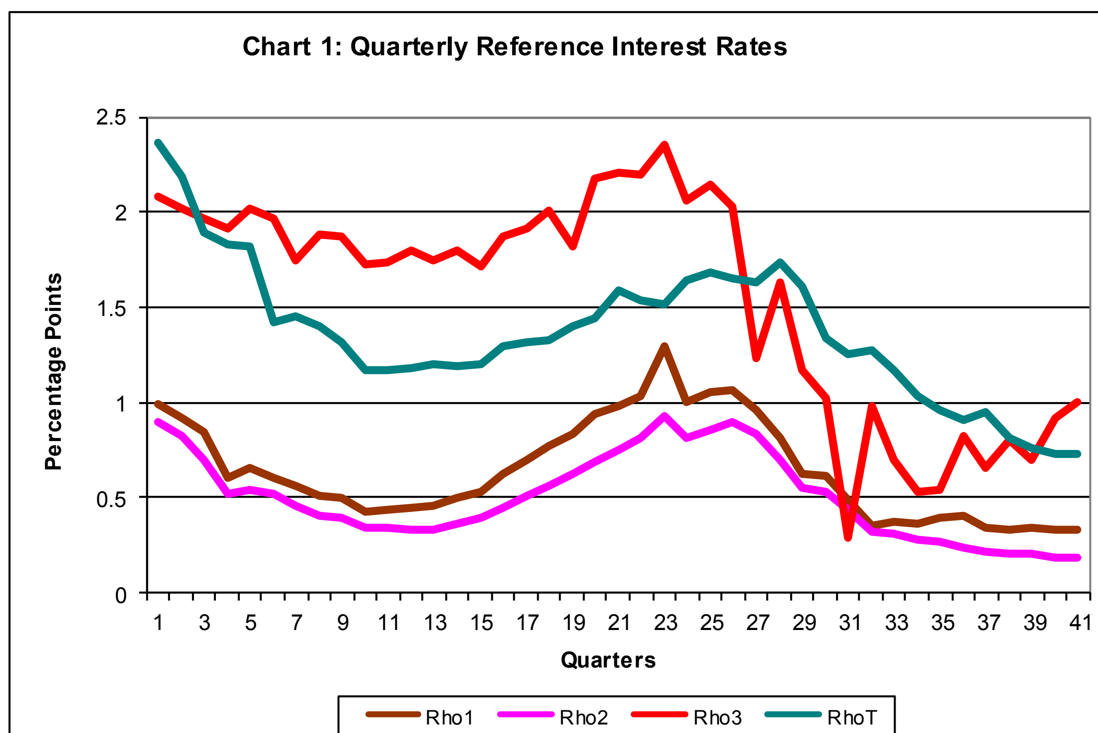

Chart 1 shows the quarterly values of the reference rates ρ_1-ρ_3 (Rho1-Rho3) in percentage points under the three options. In this chart, quarters 1 to 41 correspond to Q2-2001 to Q2-2011. As would be expected, ρ_2 is less than ρ_1 because ρ_2 includes deposits (in addition to debt funding) and the 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 Q$-2008 when bank equity returns became negative, leading to a very low ρ_3). To provide a context for these reference rates, a *Treasury based reference rate*, ρ_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.[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 ρ_1 and ρ_2 are generally well below the average Treasury interest rate ρ_T. Finally, except for the recessions in 2001 and 2007-2010 when bank profits fell sharply, the Treasury rate ρ_T is

[65] Data on holdings of Treasuries by the banking sector for Q2-2011 was not available so ρ_T for this quarter was set equal to ρ_T for Q1-2011.

lower than ρ_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 $\rho_1 \equiv r_{L2}$, 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 $\rho_1 V_{A5}$

Quarter	V_{EVA}	$V(\rho_1,A)$	$V(\rho_1,B)$	$V(\rho_1,C)$	V_E	$V_{D\&A}$	$\rho_1 V_{A5}$
2001-Q2	17.368	22.929	59.582	60.557	24.442	9.173	1.858
2001-Q3	16.631	22.473	59.283	61.182	25.046	9.423	1.756
2001-Q4	19.953	29.480	62.598	65.949	26.983	10.153	1.700
2002-Q1	19.470	24.957	61.105	66.545	26.068	8.550	1.277
2002-Q2	20.425	27.356	62.536	68.250	26.169	8.971	1.445
2002-Q3	22.550	28.190	64.933	70.988	26.481	9.509	1.328
2002-Q4	19.549	25.834	63.025	68.594	27.705	9.309	1.197
2003-Q1	24.235	31.281	68.591	73.969	28.336	9.413	1.124
2003-Q2	24.392	32.049	69.705	74.989	28.791	9.597	1.133
2003-Q3	22.665	28.693	69.154	74.083	28.252	9.260	0.983
2003-Q4	22.671	29.767	69.713	76.298	29.546	10.112	1.050
2004-Q1	23.004	31.030	71.372	78.047	30.001	9.746	1.157
2004-Q2	20.956	30.018	70.541	77.540	30.078	9.768	1.187
2004-Q3	21.030	31.559	74.035	79.695	29.894	10.524	1.547
2004-Q4	21.842	32.193	76.529	81.507	31.979	11.886	1.921
2005-Q1	24.603	38.617	78.689	82.969	32.161	10.807	2.398
2005-Q2	22.191	37.370	80.266	83.147	32.015	11.173	2.745
2005-Q3	26.457	42.948	84.396	84.985	32.686	10.914	3.017
2005-Q4	21.821	39.422	79.765	78.253	32.721	11.109	3.349
2006-Q1	27.594	49.352	91.228	89.474	35.526	11.482	3.883
2006-Q2	26.955	47.600	91.376	90.003	34.496	11.070	4.422
2006-Q3	27.761	47.267	94.444	91.032	35.485	11.316	4.748
2006-Q4	26.577	59.083	103.512	90.812	36.110	11.714	5.893
2007-Q1	29.362	46.718	93.593	91.111	37.712	11.540	4.739
2007-Q2	30.965	49.709	97.132	93.743	38.060	11.641	5.108
2007-Q3	24.207	40.303	92.905	91.144	37.358	12.592	5.295
2007-Q4	5.616	17.216	66.876	66.969	36.793	14.305	5.032
2008-Q1	26.642	38.999	85.398	88.547	38.291	12.925	4.496

2008-Q2	21.514	29.617	73.632	81.393	39.986	14.734	3.503
2008-Q3	15.850	24.755	65.168	73.099	37.323	14.863	3.527
2008-Q4	−8.017	−2.086	33.304	45.184	34.903	16.342	2.887
2009-Q1	34.887	38.530	74.731	87.833	40.135	17.732	1.894
2009-Q2	25.633	32.890	56.891	68.916	38.906	14.363	2.022
2009-Q3	21.530	30.249	51.124	63.587	39.916	14.871	2.029
2009-Q4	20.233	33.937	54.659	64.333	39.644	16.996	2.228
2010-Q1	22.433	40.999	64.096	70.667	39.687	12.793	2.371
2010-Q2	19.706	33.201	60.339	69.054	41.094	12.713	1.964
2010-Q3	18.099	31.597	65.165	73.534	40.185	12.773	1.820
2010-Q4	16.441	32.312	65.127	72.181	41.474	14.358	1.899
2011-Q1	16.172	32.628	72.282	80.117	43.196	12.625	1.867
2011-Q2	13.930	31.290	74.477	81.937	42.364	12.607	1.879
Mean	21.363	33.472	72.031	76.396	34.097	11.848	2.578

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 ρ_1 is chosen to be the average quarterly debt interest rate r_{L2}.

In Table 4, we list the various asset and liability margin services that are generated by the choice of the reference rate ρ_1; recall equations (37)-(39) for definitions of these services.

Table 4: Option 1 FISIM Components: Asset Margin Services $V_{MA1}(\rho_1)$-$V_{MA4}(\rho_1)$, Deposit Services $V_{DS}(\rho_1)$ and Other Liability Margin Services $V_{ML2}(\rho_1)$-$V_{ML3}(\rho_1)$

Quarter	$V_{MA1}(\rho_1)$	$V_{MA2}(\rho_1)$	$V_{MA3}(\rho_1)$	$V_{MA4}(\rho_1)$	$V_{DS}(\rho_1)$	$V_{ML2}(\rho_1)$	$V_{ML3}(\rho_1)$
2001-Q2	−1.981	5.431	36.653	−2.475	5.561	0	25.085
2001-Q3	−2.012	6.148	36.810	−2.238	5.842	0	24.957
2001-Q4	−2.788	8.721	33.117	−2.583	9.528	0	27.113
2002-Q1	−1.476	8.507	36.148	−1.591	5.488	0	30.650
2002-Q2	−1.343	8.546	35.180	−1.490	6.931	0	31.665
2002-Q3	−1.340	8.787	36.743	−1.392	5.640	0	33.670
2002-Q4	−1.326	8.231	37.191	−1.337	6.286	0	30.383
2003-Q1	−1.256	7.883	37.310	−1.249	7.046	0	35.097
2003-Q2	−1.150	7.550	37.655	−1.116	7.657	0	35.468
2003-Q3	−1.254	7.285	40.461	−1.102	6.028	0	35.589
2003-Q4	−1.112	8.866	39.946	−1.169	7.096	0	35.590
2004-Q1	−1.018	8.791	40.341	−1.097	8.026	0	37.143
2004-Q2	−1.098	8.942	40.523	−0.845	9.062	0	36.508
2004-Q3	−1.364	8.080	42.476	−1.056	10.529	0	37.731
2004-Q4	−1.182	8.270	44.335	−2.110	10.352	0	35.721

2005-Q1	−1.226	6.971	40.072	−1.465	14.014	0	37.603
2005-Q2	−1.571	6.262	42.896	−1.809	15.179	0	37.214
2005-Q3	−1.726	4.408	41.448	−2.092	16.491	0	38.369
2005-Q4	−1.738	3.829	40.342	−3.602	17.602	0	31.075
2006-Q1	−2.225	3.311	41.876	−2.840	21.757	0	38.582
2006-Q2	−1.746	3.560	43.776	−3.187	20.645	0	40.015
2006-Q3	−2.076	2.109	47.177	−3.445	19.506	0	39.484
2006-Q4	−2.976	−3.136	44.429	−6.588	32.506	0	37.094
2007-Q1	−2.435	3.854	46.874	−3.902	17.356	0	37.120
2007-Q2	−2.076	2.695	47.424	−4.008	18.743	0	38.934
2007-Q3	−1.982	4.194	52.602	−3.972	16.096	0	35.899
2007-Q4	−1.482	5.090	49.659	−3.514	11.601	0	10.839
2008-Q1	−1.478	7.823	46.399	−3.196	12.357	0	32.836
2008-Q2	−0.684	11.079	44.015	−2.634	8.103	0	23.171
2008-Q3	−0.979	11.514	40.413	−2.604	8.905	0	17.386
2008-Q4	−0.174	14.351	35.390	−2.296	5.931	0	−8.948
2009-Q1	−2.043	16.785	36.201	−1.641	3.642	0	28.071
2009-Q2	−2.425	16.298	24.001	−1.847	7.257	0	13.625
2009-Q3	−2.112	16.356	20.874	−1.781	8.719	0	6.771
2009-Q4	−2.805	14.612	20.722	−2.132	13.703	0	5.465
2010-Q1	−3.135	12.145	23.097	−2.439	18.567	0	15.816
2010-Q2	−2.443	13.058	27.130	−1.900	13.503	0	13.284
2010-Q3	−2.336	12.507	33.568	−1.801	13.498	0	18.757
2010-Q4	−2.296	11.323	32.815	−1.973	15.871	0	14.451
2011-Q1	−1.979	11.531	39.654	−1.718	16.456	0	22.428
2011-Q2	−2.341	11.585	43.187	−1.783	17.360	0	25.086
Mean	−1.761	8.394	38.559	−2.269	12.108	0	27.873

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 $V_{MA4}(\rho_1)$ 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 ρ equals the average debt interest rate r_{L2}, $V_{ML2}(\rho)$ will automatically equal zero. Liability margin services for bank equity capital, $V_{ML3}(\rho_1)$, were generally large and positive with the exception of Q4-2008 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 ρ_2 equal to the weighted average cost of raising capital via deposits and debt.[66] 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 $V_{DS}(\rho_2)$

Quarter	$V(\rho_2,A)$	$V(\rho_2,B)$	$V(\rho_2,C)$	$\rho_2 V_{A5}$	$V_{DS}(\rho_2)$
2001-Q2	18.880	59.547	62.492	1.685	1.512
2001-Q3	18.188	59.209	63.187	1.572	1.557
2001-Q4	22.598	62.438	69.336	1.394	2.645
2002-Q1	20.908	60.926	68.414	1.092	1.439
2002-Q2	22.223	62.337	70.601	1.197	1.798
2002-Q3	24.074	64.768	72.964	1.135	1.524
2002-Q4	21.274	62.850	70.833	0.993	1.726
2003-Q1	26.113	68.314	76.420	0.895	1.878
2003-Q2	26.421	69.392	77.639	0.881	2.029
2003-Q3	24.305	68.899	76.207	0.790	1.641
2003-Q4	24.595	69.463	78.787	0.811	1.924
2004-Q1	25.150	71.025	80.813	0.870	2.146
2004-Q2	23.374	70.081	80.665	0.869	2.419
2004-Q3	23.842	73.575	83.278	1.120	2.812
2004-Q4	24.621	76.223	85.069	1.437	2.779
2005-Q1	28.226	78.110	87.644	1.711	3.623
2005-Q2	26.116	79.620	88.197	1.997	3.925
2005-Q3	30.700	83.795	90.486	2.218	4.243
2005-Q4	26.355	79.234	84.106	2.500	4.535
2006-Q1	33.037	90.522	96.512	2.817	5.443
2006-Q2	32.221	90.779	96.764	3.353	5.266
2006-Q3	32.789	93.888	97.45	3.744	5.027
2006-Q4	35.135	102.918	101.78	4.248	8.558
2007-Q1	33.784	93.139	96.785	3.859	4.422
2007-Q2	35.797	96.740	99.933	4.138	4.832
2007-Q3	28.447	92.609	96.514	4.461	4.240
2007-Q4	8.791	66.791	70.959	4.418	3.175
2008-Q1	29.968	85.330	92.742	3.835	3.326
2008-Q2	23.771	73.576	84.218	3.075	2.257
2008-Q3	18.302	65.112	76.173	3.042	2.452
2008-Q4	−6.335	33.229	47.260	2.572	1.681
2009-Q1	35.884	74.542	89.083	1.723	0.996
2009-Q2	27.503	56.427	71.366	1.670	1.871
2009-Q3	23.615	50.409	66.395	1.582	2.085
2009-Q4	23.314	53.098	68.621	1.525	3.081
2010-Q1	26.292	61.497	76.180	1.375	3.859
2010-Q2	22.781	58.820	73.364	1.254	3.075
2010-Q3	21.101	63.584	77.821	1.140	3.003
2010-Q4	19.950	63.139	77.216	1.113	3.509

[66] We can think of this reference rate as a rough approximation to a safe rate of return.

2011-Q1	19.538	69.991	85.038	1.034	3.366
2011-Q2	17.317	71.606	86.976	1.006	3.387
Mean	24.414	71.404	80.397	2.004	3.050

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 \$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 $\rho_2 V_{A5}$ averaged only \$2.0 billion, a drop from the \$2.6 billion average for $\rho_1 V_{A5}$. 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 ρ_2.

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

Quarter	$V_{MA1}(\rho_2)$	$V_{MA2}(\rho_2)$	$V_{MA3}(\rho_2)$	$V_{MA4}(\rho_2)$	$V_{ML2}(\rho_2)$	$V_{ML3}(\rho_2)$
2001-Q2	−1.639	6.769	40.667	−2.185	1.512	25.680
2001-Q3	−1.632	7.546	41.021	−1.936	1.557	25.588
2001-Q4	−2.171	11.075	39.840	−2.005	2.645	28.161
2002-Q1	−1.124	9.884	40.017	−1.272	1.439	31.265
2002-Q2	−0.953	10.331	40.114	−1.115	1.798	32.465
2002-Q3	−1.013	10.295	40.694	−1.086	1.524	34.315
2002-Q4	−0.954	9.930	41.575	−0.993	1.726	31.100
2003-Q1	−0.842	9.811	42.201	−0.863	1.878	35.898
2003-Q2	−0.712	9.664	42.971	−0.704	2.029	36.341
2003-Q3	−0.889	8.950	44.593	−0.753	1.641	36.264
2003-Q4	−0.720	10.779	44.868	−0.735	1.924	36.393
2004-Q1	−0.576	11.032	45.875	−0.667	2.146	38.050
2004-Q2	−0.595	11.551	46.707	−0.372	2.419	37.532
2004-Q3	−0.747	10.969	49.733	−0.519	2.812	38.928
2004-Q4	−0.611	11.028	51.601	−1.570	2.779	36.989
2005-Q1	−0.520	10.814	49.884	−0.761	3.623	39.342
2005-Q2	−0.812	10.418	53.504	−1.029	3.925	39.087

[67] The sample average ρ_1 is equal to the average r_{L2} which was 0.644% per year. The average ρ_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 ρ. 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.

2005-Q3	−0.932	8.878	53.096	−1.256	4.243	40.426
2005-Q4	−0.899	8.486	52.878	−2.715	4.535	33.241
2006-Q1	−1.163	8.905	57.484	−1.751	5.443	41.244
2006-Q2	−0.841	8.959	58.558	−2.132	5.266	42.579
2006-Q3	−1.185	7.204	61.099	−2.456	5.027	41.878
2006-Q4	−1.527	5.161	67.783	−4.772	8.558	41.149
2007-Q1	−1.610	8.259	59.356	−3.004	4.422	39.252
2007-Q2	−1.253	7.506	60.943	−3.061	4.832	41.262
2007-Q3	−1.198	8.266	64.162	−3.164	4.240	37.863
2007-Q4	−0.953	8.009	58.000	−2.888	3.175	12.266
2008-Q1	−0.887	10.863	55.362	−2.564	3.326	34.366
2008-Q2	−0.287	13.123	49.805	−2.195	2.257	24.166
2008-Q3	−0.531	13.728	46.810	−2.136	2.452	18.492
2008-Q4	0.200	15.788	39.564	−1.957	1.681	−8.240
2009-Q1	−1.706	17.672	38.659	−1.426	0.996	28.497
2009-Q2	−1.771	18.129	28.924	−1.419	1.871	14.556
2009-Q3	−1.402	18.613	26.795	−1.226	2.085	7.941
2009-Q4	−1.554	18.321	29.784	−1.243	3.081	7.376
2010-Q1	−1.403	17.257	35.205	−1.171	3.859	18.465
2010-Q2	−1.156	16.706	36.039	−1.006	3.075	15.228
2010-Q3	−1.057	16.183	42.483	−0.889	3.003	20.721
2010-Q4	−0.887	15.875	43.188	−0.911	3.509	16.762
2011-Q1	−0.552	16.234	50.453	−0.636	3.366	24.816
2011-Q2	−0.617	16.618	54.289	−0.630	3.387	27.612
Mean	−1.017	11.600	46.990	−1.590	3.050	29.398

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 ρ_3 equal to the weighted average cost of raising capital via deposits, debt and equity.

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[69] Note that $V_{DS}(\rho_2)$ always equals $V_{ML2}(\rho_2)$. This is a consequence of our choice of the reference rate ρ_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 $V_{DS}(\rho_3)$

Quarter	$V(\rho_3,A)$	$V(\rho_3,B)$	$V(\rho_3,C)$	$\rho_3 V_{A5}$	$V_{DS}(\rho_3)$
2001-Q2	35.768	59.691	54.421	2.406	18.400
2001-Q3	35.126	59.501	55.262	2.298	18.495
2001-Q4	40.923	62.864	60.316	2.210	20.971
2002-Q1	41.652	61.847	58.840	2.040	22.182
2002-Q2	43.778	63.173	60.729	2.236	23.353
2002-Q3	46.543	65.668	62.172	2.189	23.993
2002-Q4	41.524	63.629	60.89	1.900	21.976
2003-Q1	49.753	69.579	65.208	1.942	25.518
2003-Q2	50.398	70.722	66.347	1.953	26.005
2003-Q3	48.040	70.283	64.720	1.833	25.376
2003-Q4	48.423	70.614	67.321	1.911	25.752
2004-Q1	50.195	72.502	69.033	2.094	27.192
2004-Q2	48.094	71.793	69.037	2.053	27.138
2004-Q3	49.461	75.101	71.384	2.536	28.430
2004-Q4	48.727	77.197	73.728	2.977	26.885
2005-Q1	54.177	79.556	75.968	3.426	29.574
2005-Q2	51.912	81.099	76.622	3.712	29.721
2005-Q3	57.395	85.104	78.497	3.959	30.939
2005-Q4	48.328	80.127	74.265	3.927	26.508
2006-Q1	60.593	91.714	84.624	4.617	32.998
2006-Q2	60.435	91.875	84.360	5.314	33.480
2006-Q3	60.475	94.951	85.177	5.663	32.713
2006-Q4	62.088	103.586	89.435	6.099	35.511
2007-Q1	59.836	94.053	85.356	5.631	30.474
2007-Q2	63.039	97.508	87.812	6.037	32.074
2007-Q3	53.303	93.229	85.257	6.210	29.097
2007-Q4	16.723	66.871	67.203	4.996	11.108
2008-Q1	52.317	85.497	82.361	5.470	25.675
2008-Q2	39.298	73.725	76.714	4.211	17.784
2008-Q3	30.222	65.215	70.495	3.937	14.372
2008-Q4	−11.609	33.137	49.836	2.183	−3.592
2009-Q1	54.419	75.863	80.323	2.924	19.532
2009-Q2	37.079	57.251	67.012	2.296	11.446
2009-Q3	28.942	50.983	64.140	1.941	7.412
2009-Q4	28.332	53.835	66.596	1.857	8.099
2010-Q1	39.092	63.759	71.382	2.242	16.66
2010-Q2	33.061	60.318	69.115	1.954	13.355
2010-Q3	35.166	65.702	72.076	2.051	17.068
2010-Q4	31.346	64.972	72.574	1.837	14.905
2011-Q1	36.777	73.008	78.558	2.131	20.605
2011-Q2	36.719	75.592	79.979	2.219	22.789
Mean	43.851	72.505	71.589	3.157	22.487

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 ρ_3 is much higher than ρ_2: increasing the reference rate

will lead to an increase in the value of deposit services.[70] 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.[71] 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 ρ_3.

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

Quarter	$V_{MA1}(\rho_3)$	$V_{MA2}(\rho_3)$	$V_{MA3}(\rho_3)$	$V_{MA4}(\rho_3)$	$V_{ML2}(\rho_3)$	$V_{ML3}(\rho_3)$
2001-Q2	−3.066	1.190	23.923	−3.395	−4.796	23.195
2001-Q3	−3.133	2.022	24.375	−3.128	−4.598	23.093
2001-Q4	−3.813	4.809	21.941	−3.544	−4.398	25.369
2002-Q1	−2.931	2.828	20.195	−2.904	−5.933	28.115
2002-Q2	−2.590	2.835	19.395	−2.690	−5.752	29.105
2002-Q3	−2.802	2.066	19.125	−2.760	−6.797	30.791
2002-Q4	−2.606	2.387	22.105	−2.520	−5.938	27.914
2003-Q1	−2.737	0.993	19.827	−2.627	−6.714	32.232
2003-Q2	−2.575	0.659	20.325	−2.459	−6.615	32.621
2003-Q3	−2.867	−0.057	22.242	−2.639	−7.235	32.610
2003-Q4	−2.526	1.967	22.191	−2.734	−6.940	32.692
2004-Q1	−2.457	1.486	22.306	−2.498	−6.996	34.187
2004-Q2	−2.468	1.843	23.699	−2.131	−6.581	33.720
2004-Q3	−2.793	1.378	25.641	−2.301	−6.523	34.953
2004-Q4	−2.428	2.249	28.470	−3.290	−6.069	32.954
2005-Q1	−2.285	1.216	25.378	−2.519	−5.425	34.999
2005-Q2	−2.552	0.892	29.187	−2.818	−5.072	34.794
2005-Q3	−2.664	−0.865	27.709	−3.078	−5.005	35.943
2005-Q4	−2.310	0.655	31.798	−4.206	−3.091	29.599
2006-Q1	−2.956	−0.543	31.121	−3.591	−3.750	36.748
2006-Q2	−2.501	−0.946	31.439	−4.067	−4.395	37.875
2006-Q3	−2.888	−2.538	34.476	−4.347	−4.586	37.299

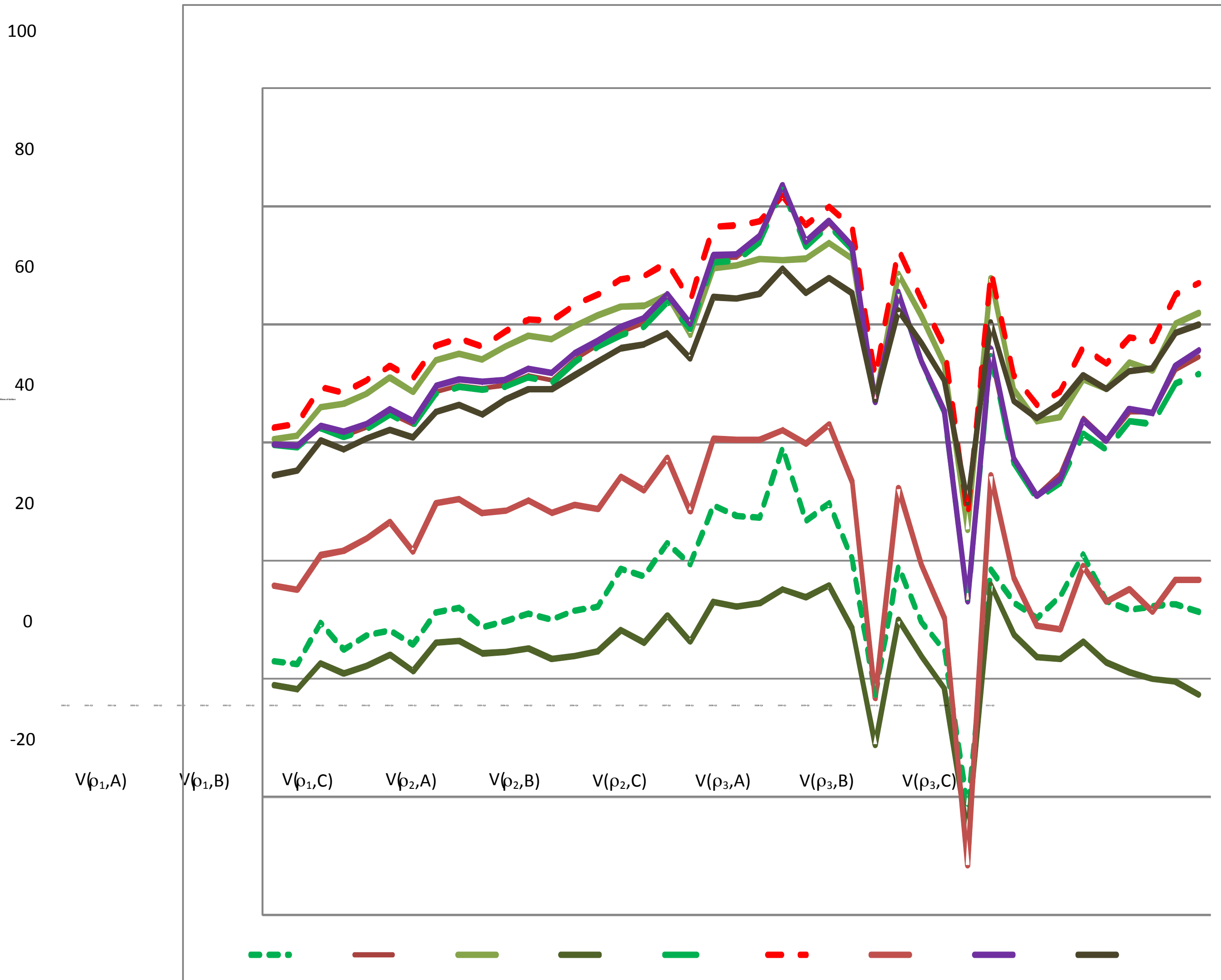
[70] The sample average ρ_3 was 0.831%, which is much higher than the averages for ρ_1 and ρ_2 which were 0.644% and 0.506% per quarter respectively.
[71] Recall that the average values for $V(\rho_1,C)$ and $V(\rho_2,C)$ were $76.4 and $80.4 billion dollars respectively.

2006-Q4	−3.157	−4.177	41.498	−6.816	−1.074	36.585
2007-Q1	−3.271	−0.613	34.217	−4.812	−4.484	34.958
2007-Q2	−2.864	−1.916	34.469	−4.915	−4.631	36.704
2007-Q3	−2.843	−0.271	39.926	−4.858	−4.649	33.746
2007-Q4	−1.451	5.261	50.147	-3.477	0.186	10.922
2008-Q1	-2.349	3.340	33.180	-4.127	-4.904	30.579
2008-Q2	-1.341	7.693	34.426	-3.362	-3.738	21.522
2008-Q3	-1.358	9.638	34.993	-3.001	-2.078	16.449
2008-Q4	0.665	17.571	44.745	-1.536	3.768	-7.360
2009-Q1	-4.065	11.459	21.444	-2.935	-5.985	25.517
2009-Q2	-2.934	14.874	20.172	-2.180	-1.455	12.901
2009-Q3	-1.972	16.801	22.041	-1.671	0.411	7.002
2009-Q4	-2.145	16.569	25.503	-1.663	1.625	6.473
2010-Q1	-2.910	12.808	24.666	-2.275	0.500	16.159
2010-Q2	-2.425	13.110	27.256	-1.887	0.044	13.311
2010-Q3	-2.772	11.257	30.536	-2.112	-1.021	18.089
2010-Q4	-2.186	11.678	33.625	-1.890	0.274	14.631
2011-Q1	-2.431	10.041	36.232	-2.061	-1.067	21.671
2011-Q2	-3.011	9.629	38.873	-2.231	-1.316	24.105
Mean	−2.555	4.665	28.654	−3.026	−3.727	26.214

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 ρ_3 which is higher than ρ_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.

Chart 2: Alternative Banking Sector Output Measures



From viewing Chart 2, 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).[72] 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.[73] 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.[74] 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.[75] Using our notation in the previous section, denote the BIW asset reference rates as

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[72] The theoretical foundations for this paper are explained more fully in Wang (2003) and Wang, Basu and Fernald (2009). For other empirical applications of the Wang methodology, see Alon, Fernald, Inklaar and Wang (2011), Colangelo and Inklaar (2012) and Inklaar and Wang (2012).

[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 ρ_{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 ρ_{L1} to be a safe interest rate[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 ρ) 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 ρV_{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:

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

If the reference rates for liabilities ρ_{L1}, ρ_{L2}, ρ_{L3} and for financial assets ρ_{A1}, ρ_{A2}, ρ_{A3}, ρ_{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 ρ_{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*:[77]

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

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

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

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 $(r_{A3} - \rho_{A3})V_{A3}$ plus deposit services $(\rho_{L1} - r_{L1})V_{L1}$. This

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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.

[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).

[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 $\rho_{A5}V_{A5}$.[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.[79]
- The multiple reference rate methodology leads to an *indirectly determined* imputed interest rate ρ_{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 ρ is *directly determined* as the appropriate cost of financial capital in the banking sector.[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*.[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

[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 ρ_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.

[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.

[80] Of course, the problem with our approach is that it is not easy to determine what this cost of capital is.

[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.[82]

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.[83]

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[82] 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.

[83] 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.[84]

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.[85] 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.[86] 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

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

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).

[84] 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).

[85] 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.

[86] 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.

2003-Q1	395.791	1841.251	4671.858	368.299	218.664	7495.863
2003-Q2	390.677	1889.005	4750.814	368.187	225.018	7623.746
2003-Q3	432.396	1968.746	4885.516	412.108	227.947	7926.712
2003-Q4	392.762	1916.891	4932.945	434.847	239.173	7916.618
2004-Q1	397.865	2018.949	4985.005	387.194	258.970	8047.983
2004-Q2	412.262	2136.041	5062.388	387.001	260.598	8258.291
2004-Q3	446.744	2094.081	5259.991	389.157	309.066	8499.039
2004-Q4	426.879	2061.870	5432.852	403.945	361.904	8687.450
2005-Q1	396.235	2154.385	5500.702	394.693	384.750	8830.766
2005-Q2	399.287	2187.072	5582.969	410.847	393.759	8973.933
2005-Q3	390.617	2196.511	5723.638	410.849	392.446	9114.062
2005-Q4	394.672	2190.186	5895.456	417.052	399.023	9296.388
2006-Q1	410.118	2161.348	6030.897	420.941	411.748	9435.053
2006-Q2	379.560	2264.419	6199.734	442.399	448.339	9734.452
2006-Q3	407.147	2329.237	6365.223	452.176	458.914	10012.700
2006-Q4	401.848	2301.045	6477.223	503.668	456.277	10140.060
2007-Q1	443.042	2365.620	6703.105	482.172	472.359	10466.300
2007-Q2	410.377	2400.114	6743.722	472.362	483.914	10510.490
2007-Q3	469.034	2433.650	6909.017	483.067	498.800	10793.570
2007-Q4	453.743	2502.795	7151.749	536.497	526.318	11171.100
2008-Q1	492.105	2532.325	7466.554	526.091	550.338	11567.410
2008-Q2	518.917	2673.519	7571.396	574.784	558.850	11897.470
2008-Q3	529.525	2618.965	7566.072	553.695	572.650	11840.910
2008-Q4	703.572	2700.789	7847.288	637.705	590.444	12479.800
2009-Q1	1055.287	2778.886	7699.952	675.006	537.000	12746.130
2009-Q2	995.820	2787.730	7495.103	652.054	535.828	12466.540
2009-Q3	888.316	2823.134	7405.106	693.846	559.229	12369.630
2009-Q4	989.463	2933.747	7166.842	703.017	556.539	12349.610
2010-Q1	1008.559	2977.588	7053.231	738.860	579.937	12358.180
2010-Q2	1053.034	2984.087	7287.576	731.556	580.211	12636.460
2010-Q3	1033.484	2969.918	7201.964	737.169	549.128	12491.660
2010-Q4	981.715	3171.260	7226.136	739.414	547.191	12665.720
2011-Q1	953.668	3144.256	7219.472	723.733	557.013	12598.140
2011-Q2	1100.514	3211.904	7084.780	735.473	557.497	12690.170

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%.

In Table A2, we list the quarterly interest income received for each of the first four asset classes, V_{AR1}-V_{AR4}, 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, $\delta_{LL} \equiv V_{LL}/V_{A3}$, are also listed in Table A2.

Table A2: Quarterly Interest Earned by Asset Class V_{AR1}-V_{AR4}, Total Interest Earned V_{AR}, Loan Losses V_{LL} and the Loan Loss Rate δ_{LL}

Quarter	V_{AR1}	V_{AR2}	V_{AR3}	V_{AR4}	V_{AR}	V_{LL}	δ_{LL}

2001-Q2	1.695	19.802	79.786	0.642	101.924	7.994	0.00184
2001-Q3	1.618	19.508	77.069	0.644	98.838	9.976	0.00228
2001-Q4	0.635	21.787	70.439	0.627	93.488	13.213	0.00300
2002-Q1	0.960	18.019	62.871	0.610	82.459	11.126	0.00253
2002-Q2	0.935	18.975	64.004	0.700	84.614	10.972	0.00250
2002-Q3	0.914	19.156	63.921	0.718	84.707	11.564	0.00258
2002-Q4	0.852	18.181	62.874	0.678	82.586	11.589	0.00252
2003-Q1	0.778	17.346	61.318	0.644	80.086	9.709	0.00208
2003-Q2	0.817	17.058	61.567	0.737	80.179	9.631	0.00203
2003-Q3	0.609	15.771	61.520	0.675	78.575	8.962	0.00183
2003-Q4	0.612	17.282	61.604	0.740	80.238	10.399	0.00211
2004-Q1	0.760	17.814	62.621	0.634	81.830	8.076	0.00162
2004-Q2	0.779	18.671	63.580	0.918	83.948	7.547	0.00149
2004-Q3	0.872	18.559	68.799	0.892	89.122	6.817	0.00130
2004-Q4	1.083	19.212	73.166	0.033	93.495	8.799	0.00162
2005-Q1	1.243	20.398	74.353	0.995	96.989	6.502	0.00118
2005-Q2	1.213	21.511	81.820	1.055	105.598	6.082	0.00109
2005-Q3	1.276	21.293	85.446	1.066	109.081	7.754	0.00135
2005-Q4	1.574	22.209	89.817	−0.102	113.498	8.946	0.00152
2006-Q1	1.643	23.694	98.751	1.130	125.217	4.884	0.00081
2006-Q2	1.997	25.892	104.920	1.176	133.985	5.401	0.00087
2006-Q3	2.136	26.206	113.027	1.233	142.602	6.323	0.00099
2006-Q4	2.214	26.583	128.085	−0.083	156.799	10.167	0.00157
2007-Q1	2.010	27.586	114.119	0.935	144.650	7.158	0.00107
2007-Q2	2.256	28.028	118.605	0.978	149.867	7.779	0.00115
2007-Q3	2.997	30.029	125.948	1.156	160.130	9.666	0.00140
2007-Q4	2.856	29.020	118.040	1.616	151.532	14.184	0.00198
2008-Q1	2.542	28.512	107.399	1.103	139.555	15.898	0.00213
2008-Q2	2.569	27.836	91.471	0.968	122.844	21.007	0.00277
2008-Q3	2.282	27.643	87.007	0.806	117.738	24.862	0.00329
2008-Q4	3.266	27.555	73.754	0.821	105.395	33.955	0.00433
2009-Q1	1.680	26.589	63.365	0.740	92.374	34.269	0.00445
2009-Q2	1.333	26.820	52.288	0.613	81.054	45.584	0.00608
2009-Q3	1.111	26.598	47.740	0.737	76.186	47.598	0.00643
2009-Q4	1.156	26.357	49.416	0.682	77.612	51.852	0.00724
2010-Q1	0.988	24.317	51.928	0.581	77.813	49.790	0.00706
2010-Q2	1.121	23.158	51.795	0.576	76.650	48.274	0.00662
2010-Q3	1.089	22.350	57.438	0.642	81.519	41.428	0.00575
2010-Q4	1.110	22.326	57.887	0.593	81.916	40.104	0.00555
2011-Q1	1.218	22.071	63.854	0.708	87.851	31.413	0.00435
2011-Q2	1.369	22.412	67.069	0.696	91.546	27.010	0.00381

The sample average quarterly loan loss rate, δ_{LL}, 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:

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

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}

Quarter	V_{L1}	V_{L2}	V_{L3}	V_L	V_{LR1}	V_{LR2}	V_{LR3}
2001-Q2	4392.038	1640.516	646.288	6678.842	37.942	16.249	31.486
2001-Q3	4455.208	1619.004	656.390	6730.602	35.122	14.886	30.992
2001-Q4	4509.300	1733.272	687.121	6929.692	28.683	14.687	32.935
2002-Q1	4609.862	1638.202	700.002	6948.066	22.477	9.938	34.896
2002-Q2	4572.785	1601.758	712.845	6887.389	23.056	10.504	36.339
2002-Q3	4672.705	1730.580	732.998	7136.283	22.671	10.485	38.111
2002-Q4	4785.183	1811.063	752.945	7349.191	20.425	10.109	34.586
2003-Q1	4936.097	1794.277	765.489	7495.863	18.321	9.221	39.030
2003-Q2	5029.813	1813.391	780.542	7623.746	17.659	9.127	39.397
2003-Q3	5188.042	1939.994	798.676	7926.712	16.334	8.362	39.031
2003-Q4	5183.188	1928.294	805.136	7916.618	15.660	8.466	39.125
2004-Q1	5297.372	1933.620	816.991	8047.983	15.650	8.642	40.794
2004-Q2	5439.103	1980.298	838.890	8258.291	15.710	9.019	40.328
2004-Q3	5593.152	2038.023	867.864	8499.039	17.461	10.199	42.074
2004-Q4	5661.709	2078.122	947.619	8687.450	19.694	11.028	40.750
2005-Q1	5825.147	2030.823	974.795	8830.766	22.289	12.657	43.678
2005-Q2	5922.534	2065.691	985.708	8973.933	26.113	14.402	44.086
2005-Q3	6018.591	2084.976	1010.495	9114.062	29.774	16.027	46.137
2005-Q4	6145.153	2132.698	1018.537	9296.388	33.969	17.898	39.622
2006-Q1	6303.701	2103.001	1028.351	9435.053	37.690	19.833	48.280
2006-Q2	6450.274	2208.645	1075.533	9734.45	42.970	21.782	50.622
2006-Q3	6619.433	2298.577	1094.688	10012.70	48.975	23.780	50.809
2006-Q4	6641.924	2373.500	1124.637	10140.06	53.277	30.655	51.620
2007-Q1	6946.622	2374.626	1145.050	10466.30	52.331	23.822	48.607
2007-Q2	6939.157	2410.447	1160.885	10510.49	54.501	25.443	51.188
2007-Q3	7085.892	2534.036	1173.640	10793.57	59.127	26.901	48.358
2007-Q4	7224.290	2722.424	1224.387	11171.10	57.473	26.030	22.545
2008-Q1	7522.750	2770.046	1274.617	11567.41	49.102	22.631	43.249
2008-Q2	7644.428	2951.626	1301.412	11897.47	39.811	18.500	31.327
2008-Q3	7632.260	2900.603	1308.044	11840.91	38.097	17.863	25.442
2008-Q4	7987.338	3160.586	1331.875	12479.80	33.118	15.452	–2.437
2009-Q1	8290.713	3122.628	1332.790	12746.13	25.606	11.016	32.773
2009-Q2	8201.205	2847.831	1417.500	12466.54	23.695	10.748	18.975
2009-Q3	8298.443	2607.623	1463.565	12369.63	21.388	9.460	12.081

2009-Q4	8401.498	2436.658	1511.451	12349.61	19.934	9.756	11.516
2010-Q1	8566.930	2248.080	1543.165	12358.18	16.452	9.189	22.124
2010-Q2	8530.679	2515.144	1590.640	12636.46	15.370	8.513	18.667
2010-Q3	8479.241	2425.770	1586.651	12491.66	14.605	8.040	24.015
2010-Q4	8611.235	2444.589	1609.891	12665.72	14.007	8.482	20.036
2011-Q1	8751.324	2250.295	1596.523	12598.14	12.879	7.543	27.780
2011-Q2	8916.799	2161.590	1611.777	12690.17	12.698	7.287	30.520

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}

Quarter	r_{A1}	r_{A2}	r_{A3}	r_{A4}	r_{L1}	r_{L2}	r_{L3}
2001-Q2	0.00457	0.01365	0.01832	0.00204	0.00864	0.00990	0.04872
2001-Q3	0.00410	0.01343	0.01760	0.00205	0.00788	0.00919	0.04722
2001-Q4	0.00157	0.01413	0.01599	0.00166	0.00636	0.00847	0.04793
2002-Q1	0.00239	0.01149	0.01427	0.00168	0.00488	0.00607	0.04985
2002-Q2	0.00269	0.01193	0.01456	0.00210	0.00504	0.00656	0.05098
2002-Q3	0.00246	0.01119	0.01425	0.00206	0.00485	0.00606	0.05199
2002-Q4	0.00218	0.01020	0.01367	0.00188	0.00427	0.00558	0.04593
2003-Q1	0.00197	0.00942	0.01313	0.00175	0.00371	0.00514	0.05099
2003-Q2	0.00209	0.00903	0.01296	0.00200	0.00351	0.00503	0.05047
2003-Q3	0.00141	0.00801	0.01259	0.00164	0.00315	0.00431	0.04887
2003-Q4	0.00156	0.00902	0.01249	0.00170	0.00302	0.00439	0.04859
2004-Q1	0.00191	0.00882	0.01256	0.00164	0.00295	0.00447	0.04993
2004-Q2	0.00189	0.00874	0.01256	0.00237	0.00289	0.00455	0.04807
2004-Q3	0.00195	0.00886	0.01308	0.00229	0.00312	0.00500	0.04848
2004-Q4	0.00254	0.00932	0.01347	0.00008	0.00348	0.00531	0.04300
2005-Q1	0.00314	0.00947	0.01352	0.00252	0.00383	0.00623	0.04481
2005-Q2	0.00304	0.00984	0.01466	0.00257	0.00441	0.00697	0.04473
2005-Q3	0.00327	0.00969	0.01493	0.00260	0.00495	0.00769	0.04566
2005-Q4	0.00399	0.01014	0.01523	−0.00024	0.00553	0.00839	0.03890
2006-Q1	0.00401	0.01096	0.01637	0.00268	0.00598	0.00943	0.04695
2006-Q2	0.00526	0.01143	0.01692	0.00266	0.00666	0.00986	0.04707
2006-Q3	0.00525	0.01125	0.01776	0.00273	0.00740	0.01035	0.04641
2006-Q4	0.00551	0.01155	0.01977	−0.00017	0.00802	0.01292	0.04590
2007-Q1	0.00454	0.01166	0.01702	0.00194	0.00753	0.01003	0.04245
2007-Q2	0.00550	0.01168	0.01759	0.00207	0.00785	0.01056	0.04409
2007-Q3	0.00639	0.01234	0.01823	0.00239	0.00834	0.01062	0.04120
2007-Q4	0.00629	0.01160	0.01651	0.00301	0.00796	0.00956	0.01841

2008-Q1	0.00517	0.01126	0.01438	0.00210	0.00653	0.00817	0.03393
2008-Q2	0.00495	0.01041	0.01208	0.00168	0.00521	0.00627	0.02407
2008-Q3	0.00431	0.01055	0.01150	0.00146	0.00499	0.00616	0.01945
2008-Q4	0.00464	0.01020	0.00940	0.00129	0.00415	0.00489	−0.00183
2009-Q1	0.00159	0.00957	0.00823	0.00110	0.00309	0.00353	0.02459
2009-Q2	0.00134	0.00962	0.00698	0.00094	0.00289	0.00377	0.01339
2009-Q3	0.00125	0.00942	0.00645	0.00106	0.00258	0.00363	0.00825
2009-Q4	0.00117	0.00898	0.00690	0.00097	0.00237	0.00400	0.00762
2010-Q1	0.00098	0.00817	0.00736	0.00079	0.00192	0.00409	0.01434
2010-Q2	0.00106	0.00776	0.00711	0.00079	0.00180	0.00338	0.01174
2010-Q3	0.00105	0.00753	0.00798	0.00087	0.00172	0.00331	0.01514
2010-Q4	0.00113	0.00704	0.00801	0.00080	0.00163	0.00347	0.01245
2011-Q1	0.00128	0.00702	0.00884	0.00098	0.00147	0.00335	0.01740
2011-Q2	0.00124	0.00698	0.00947	0.00095	0.00142	0.00337	0.01894
Mean	0.00299	0.01008	0.01304	0.00165	0.00458	0.00644	0.03554

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%)[87] 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.[88] The numbers in brackets following the sample average rates of return are the corresponding rates of return for the pre crisis observations (Q2 of 2001 through Q1 of 2008) and the post crisis observations (Q2 of 2008 through Q2 of 2011). It can be seen that most rates fell by about 50% but the drop in the rate of return to equity was particularly steep: from an average pre crisis annual rate of return of 18.16% to a post crisis annual average of 5.71%.

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) $V_{EVA} = V_Y - V_N$

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*

[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 is equal to explicitly measured value added plus *net interest earned* by the banking sector]; i.e., we have the following identities:

$$\text{(A3) } V_{AVA} = V_{EVA} + V_{AR1} + V_{AR2} + V_{AR3} + V_{AR4} - V_{LR1} - V_{LR2}$$
$$= V_E + V_{D\&A} + V_{AI}$$

where V_E is the *value of salaries and employee benefits* (employment income), $V_{D\&A}$ is the *value of depreciation and amortization*[91] 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 $V_{D\&A}/V_{A5}$. 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}

Quarter	V_Y	V_N	V_E	$V_{D\&A}$	$\delta_{D\&A}$	V_{AI}	V_{EVA}	V_{AVA}
2001-Q2	41.371	24.004	24.442	9.173	0.04890	31.486	17.368	65.101
2001-Q3	42.602	25.971	25.046	9.423	0.04935	30.992	16.631	65.462
2001-Q4	48.511	28.558	26.983	10.153	0.05060	32.935	19.953	70.071
2002-Q1	43.405	23.935	26.068	8.550	0.04060	34.896	19.470	69.514
2002-Q2	45.188	24.762	26.169	8.971	0.04072	36.339	20.425	71.480
2002-Q3	47.945	25.395	26.481	9.509	0.04339	38.111	22.505	74.101
2002-Q4	48.310	28.762	27.705	9.309	0.04341	34.586	19.549	71.600
2003-Q1	48.078	23.843	28.336	9.413	0.04305	39.030	24.235	76.779
2003-Q2	50.396	26.004	28.791	9.597	0.04265	39.397	24.392	77.785
2003-Q3	49.251	26.586	28.252	9.260	0.04062	39.031	22.665	76.543
2003-Q4	52.055	29.384	29.546	10.112	0.04228	39.125	22.671	78.783
2004-Q1	50.735	27.731	30.001	9.746	0.03763	40.794	23.004	80.541
2004-Q2	51.031	30.076	30.078	9.768	0.03748	40.328	20.956	80.174
2004-Q3	48.987	27.957	29.894	10.524	0.03405	42.074	21.030	82.492
2004-Q4	54.024	32.182	31.979	11.886	0.03284	40.750	21.842	84.615
2005-Q1	51.672	27.069	32.161	10.807	0.02809	43.678	24.603	86.646
2005-Q2	52.659	30.468	32.015	11.173	0.02838	44.086	22.191	87.275

[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.

2005-Q3	55.362	28.906	32.686	10.914	0.02781	46.137	26.457	89.736
2005-Q4	51.669	29.848	32.721	11.109	0.02784	39.622	21.821	83.452
2006-Q1	56.450	28.855	35.526	11.482	0.02789	48.280	27.594	95.289
2006-Q2	57.188	30.233	34.496	11.070	0.02469	50.622	26.955	96.188
2006-Q3	58.636	30.875	35.485	11.316	0.02466	50.809	27.761	97.610
2006-Q4	58.595	32.018	36.110	11.714	0.02567	51.620	26.577	99.444
2007-Q1	59.332	29.970	37.712	11.540	0.02443	48.607	29.362	97.859
2007-Q2	62.951	31.986	38.060	11.641	0.02406	51.188	30.965	100.889
2007-Q3	57.335	33.128	37.358	12.592	0.02524	48.358	24.207	98.308
2007-Q4	42.515	36.899	36.793	14.305	0.02718	22.545	5.616	73.644
2008-Q1	56.515	29.873	38.291	12.925	0.02348	43.249	26.642	94.465
2008-Q2	55.005	33.490	39.986	14.734	0.02636	31.327	21.514	86.047
2008-Q3	49.791	33.941	37.323	14.863	0.02596	25.442	15.850	77.628
2008-Q4	30.646	38.663	34.903	16.342	0.02768	−2.437	−8.017	48.809
2009-Q1	67.321	32.434	40.135	17.732	0.03302	32.773	34.887	90.640
2009-Q2	65.756	40.124	38.906	14.363	0.02681	18.975	25.633	72.244
2009-Q3	56.400	34.869	39.916	14.871	0.02659	12.081	21.530	66.868
2009-Q4	60.953	40.719	39.644	16.996	0.03054	11.516	20.233	68.156
2010-Q1	59.785	37.352	39.687	12.793	0.02206	22.124	22.433	74.604
2010-Q2	57.790	38.084	41.094	12.713	0.02191	18.667	19.706	72.474
2010-Q3	56.230	38.131	40.185	12.773	0.02326	24.015	18.099	76.973
2010-Q4	58.714	42.273	41.474	14.358	0.02624	20.036	16.441	75.868
2011-Q1	55.378	39.206	43.196	12.625	0.02267	27.780	16.172	83.602
2011-Q2	56.997	43.067	42.364	12.607	0.02261	30.520	13.930	85.491
Mean	53.013	31.650	34.097	11.848	0.03177	34.671	21.363	80.616

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.[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

Alon, T., J. Fernald, R. Inklaar and J.C. Wang (2011), "What is the Value of Bank Output?", *Federal Reserve Bank of San Francisco Economic Letter*, May 16, 1-5.

Basu, S. (2009), "Incorporating Financial Services in a Consumer Price Index: Comment", pp. 266-271 in *Price Index Concepts and Measurement*, W.E. Diewert, J. Greenlees and C. Hulten (eds.), Studies in Income and Wealth, Volume 70, Chicago: University of Chicago Press.

Basu, S., R. Inklaar and J.C. Wang (2011), "The Value of Risk: Measuring the Services of U.S. Commercial Banks", *Economic Inquiry* 49, 226-245.

[92] See the discussion on alternative bank output concepts in Diewert, Fixler and Zieschang (2012).

Berger, A.N. and D.B. Humphrey (1997), "Efficiency of Financial Institutions: International Survey and Directions for Future Research", *European Journal of Operational Research* 98:2, 175-212.

Berger, A.N. and L.J. Mester (1997), "Inside the Black Box: What Explains Differences in the Efficiencies of Financial Institutions?", *Journal of Banking and Finance* 21, 895-947.

Böhm-Bawerk, E. V. (1891), *The Positive Theory of Capital*, W. Smart (translator of the original German book published in 1888), New York: G.E. Stechert.

Christensen, L.R. and D.W. Jorgenson (1969), "The Measurement of U.S. Real Capital Input, 1929-1967", *Review of Income and Wealth* 15, 293-320.

Christensen, L.R. and D.W. Jorgenson (1973), "Measuring the Performance of the Private Sector of the U.S. Economy, 1929-1969", pp. 233-351 in *Measuring Economic and Social Performance*, M. Moss (ed.), New York: Columbia University Press.

Colangelo, A. and R. Inklaar (2012), Bank Output Measurement in the Euro Area—a Modified Approach", *The Review of Income and Wealth*, forthcoming.

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

Diewert, W.E. (1976), "Exact and Superlative Index Numbers", *Journal of Econometrics* 4, 114-145.

Diewert, W.E. (1977), "Walras' Theory of Capital Formation and the Existence of a Temporary Equilibrium", pp. 73-126 in *Equilibrium and Disequilibrium in Economic Theory*, G. Schwödiauer (ed.), Dordrecht: Reidel Publishing.

Diewert, W.E. (1980), "Aggregation Problems in the Measurement of Capital", pp. 433-528 in *The Measurement of Capital*, D. Usher (ed.), Chicago: The University of Chicago Press.

Diewert, W.E. (2005a), "Issues in the Measurement of Capital Services, Depreciation, Asset Price Changes and Interest Rates", pp. 479-542 in *Measuring Capital in the New Economy*, C. Corrado, J. Haltiwanger and D. Sichel (eds.), NBER Studies in Income and Wealth Volume 65, Chicago: University of Chicago Press.
http://www.econ.ubc.ca/discpapers/dp0411.pdf

Diewert, W.E. (2005b), "On Measuring Inventory Change in Current and Constant Dollars", Discussion Paper 05-12, Department of Economics, University of British Columbia, Vancouver, B.C., Canada, V6T 1Z1.

Diewert, W.E. (2009a), "The Paris OECD-IMF Workshop on Real Estate Price Indexes: Conclusions and Future Directions," pp. 87-116 in W.E. Diewert, B.M. Balk, D. Fixler, K.J. Fox and A.O. Nakamura (eds.), *Price and Productivity Measurement: Volume 1—Housing*, Victoria, Canada: Trafford Press and also freely downloadable from http://www.indexmeasures.com/.

Diewert, W.E. (2009b), "Durables and Owner Occupied Housing in a Consumer Price Index", pp. 445-506 in *Price Index Concepts and Measurement*, NBER, Studies in Income and Wealth, 70, W.E. Diewert, J. Greenlees and C.R. Hulten (eds.), Chicago: University of Chicago Press.

Diewert, W.E. (2010), "User Costs versus Waiting Services and Depreciation in a Model of Production", *Journal of Economics and Statistics* 230/6, 759-771.

Diewert, W.E. and A.O. Nakamura (2009), "Accounting for Housing in a CPI", pp.7-32 in *Price and Productivity Measurement: Volume 1—Housing*, W.E. Diewert, B.M. Balk, D. Fixler, K.J. Fox and A.O. Nakamura (eds.), Trafford Press and also freely downloadable from http://www.indexmeasures.com/.

Diewert, W.E., A.O. Nakamura and L.I. Nakamura (2009), "The Housing Bubble and a New Approach to Accounting for Housing in a CPI", *Journal of Housing Economics* 18:3, 156-171.

Diewert, W.E., D. Fixler and K. Zieschang (2012), "The Measurement of Banking Services and the System of National Accounts", forthcoming in *Price and Productivity Measurement: Volume 3—Services*, W. Erwin Diewert, Dennis Fixler, Kevin J. Fox and Alice O. Nakamura (eds.), Trafford Press and also freely downloadable from http://www.indexmeasures.com/.

Edwards, E.O. and P.W. Bell (1961), *The Theory and Measurement of Business Income*, Berkeley, California: University of California Press.

Eurostat, IMF, OECD, UN and the World Bank (1993), *System of National Accounts 1993*, New York: The United Nations.
http://unstats.un.org/unsd/nationalaccount/hsna.asp

Eurostat, IMF, OECD, UN and the World Bank (2008), *System of National Accounts 2008*, New York: The United Nations.
http://unstats.un.org/unsd/nationalaccount/hsna.asp

Fama, E.F. (1985), "What's Different About Banks?", *Journal of Monetary Economics* 15(1), 29-39.

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

Feenstra, Robert C. (1986), "Functional Equivalence between Liquidity Costs and the Utility of Money", *Journal of Monetary Economics* 17:2, 271-291.

Fischer, S. (1974), "Money and the Production Function", *Economic Inquiry* 12, 517-533.

Fixler, D. (2009), "Incorporating Financial Services in a Consumer Price Index", pp. 239-266 in *Price Index Concepts and Measurement*, W.E. Diewert, J. Greenlees and C. Hulten (eds.), Studies in Income and Wealth, Volume 70, Chicago: University of Chicago Press.

Fixler, D. (2012), "Valuing Implicit Financial Services and the Impact on Commercial Bank Activity", forthcoming in *Price and Productivity Measurement: Volume 3; Services*, W.E. Diewert, D. Fixler, K.J. Fox and A.O. Nakamura (eds.), Trafford Press and also freely downloadable from http://www.indexmeasures.com/.

Fixler, D. and K.D. Zieschang (1991), "Measuring the Nominal Value of Financial Services in the National Income Accounts", *Economic Inquiry*, 29, 53-68.

Fixler, D. and K.D. Zieschang (1992a), "User Costs, Shadow Prices, and the Real Output of Banks," pp. 219-243 in Z. Griliches (ed.), *Output Measurement in the Service Sector*, Chicago: University of Chicago Press.

Fixler, D. and K.D. Zieschang (1992b), "Incorporating Ancillary Measures of Process and Quality Change into a Superlative Productivity Index," *The Journal of Productivity Analysis*, 2, 245-267.

Fixler, D.J., M.B. Reinsdorf and G.M. Smith (2003), "Measuring the Services of Commercial Banks in the NIPAs: Changes in Concepts and Methods", *Survey of Current Business* 83:9, 33-44.

Haan, J. de and W.E. Diewert (eds.) (2011), *Residential Property Price Indices Handbook*, Luxembourg: Eurostat, May draft.

Hancock, D. (1985), "The Financial Firm: Production with Monetary and Non-Monetary Goods", *Journal of Political Economy* 93, 859-880.

Hancock, D. (1991), *A Theory of Production for the Financial Firm*, Boston: Kluwer Academic Press.

Hayek, F.A. von (1941), "Maintaining Capital Intact: A Reply", *Economica* 8, 276-280.

Hicks, J.R. (1939), *Value and Capital*, Oxford: Clarendon Press.

Hicks, J.R. (1961), "The Measurement of Capital in Relation to the Measurement of Other Economic Aggregates", pp. 18-31 in *The Theory of Capital*, F.A. Lutz and D.C. Hague (eds.), London: Macmillan.

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.

Hill, R.J. and T.P. Hill (2003), "Expectations, Capital Gains and Income", *Economic Inquiry* 41, 607-619.

Inklaar, R. and J.C. Wang (2012), "Real Output of Bank Services: What Counts is What Banks Do, Not What They Own", *Economica*, forthcoming.

Jorgenson, D.W. (1989), "Capital as a Factor of Production", pp. 1-35 *in Technology and Capital Formation*, D.W. Jorgenson and R. Landau (eds.), Cambridge MA: The MIT Press.

Jorgenson, D.W. and Z. Griliches (1967), The Explanation of Productivity Change", *The Review of Economic Studies* 34, 249-283.

Keuning, S. (1999), "The Role of Financial Capital in Production", *Review of Income and Wealth* 45:4, 419-434.

Malinvaud, E. (1953), "Capital Accumulation and the Efficient Allocation of Resources", *Econometrica* 21, 233-268.

Peasnell, K.V. (1981), "On Capital Budgeting and Income Measurement", *Abacus* 17:1, 52-67.

Pigou, A.C. (1941), "Maintaining Capital Intact", *Economica* 8, 271-275.

Rymes, T.K. (1968), "Professor Read and the Measurement of Total Factor Productivity", *The Canadian Journal of Economics* 1, 359-367.

Rymes, T.K. (1983), "More on the Measurement of Total Factor Productivity", *The Review of Income and Wealth* 29 (September), 297-316.

Schreyer, P. and P. Stauffer (2012), "Measuring the Production of Financial Corporations", forthcoming in *Price and Productivity Measurement: Volume 3; Services*, W.E. Diewert, D. Fixler, K.J. Fox and A.O. Nakamura (eds.). Trafford Press and also freely downloadable from http://www.indexmeasures.com/.

Verbrugge, R. (2008), "The Puzzling Divergence of Rents and User Costs", *The Review of Income and Wealth* 54:4. 671-699.

Walras, L. (1954), *Elements of Pure Economics*, a translation by W. Jaffé of the Edition Définitive (1926) of the *Eléments d'économie pure*, first edition published in 1874, Homewood, Illinois: Richard D. Irwin.

Wang, J.C. (2003), "Loanable Funds, Risk and Bank Service Output", Federal Reserve Bank of Boston, Working Paper Series No. 03-4. http://www.bos.frb.org/economic/wp/wp2003/wp034.htm

Wang, J.C. and S. Basu (2012), "Risk Bearing, Implicit Financial Services and Specialization in the Financial Industry", forthcoming in *Price and Productivity Measurement: Volume 3; Services*, W.E. Diewert, B.M. Balk, D. Fixler, K.J. Fox and A.O. Nakamura (eds.).

Wang, J.C. and S. Basu (2012), "Risk Bearing, Implicit Financial Services and Specialization in the Financial Industry", forthcoming in *Price and Productivity Measurement: Volume 3; Services*, W.E. Diewert, D. Fixler, K.J. Fox and A.O. Nakamura (eds.), Trafford Press and also freely downloadable from http://www.indexmeasures.com/.

Zieschang, K. (2011), "Risk in FISIM", paper presented at the ISWGNA FISIM Working Group, July 5-6, United Nations, New York.