Producing Liquidity

Dennis Fixler and Kim Zieschang[1]

Introduction

An asset is liquid if its owner can trade it without incurring significant transaction cost. Thus, currency is liquid because it can be converted into goods or services, or other assets, due to its wide acceptance, at very low cost in time or value. By contrast, real estate is illiquid in most contexts because the transaction costs to convert it into other goods and services, or other assets, are relatively high. In modern economies, simply put, liquidity is the ability to meet financial obligations. On the supply side, banks provide financial instruments (deposit products) that allow agents to meet their obligations along with the additional services such as safekeeping and record keeping. Furthermore, there is a possibility of earning an interest income. On the demand side, Barnett (1978, 1980) showed by applying capital theory to financial assets that the liquidity of an asset to its holder—the monetary services it yields or its "moneyness"—is indicated by the margin between the holder's cost of capital—a "benchmark" rate of return on an asset yielding no monetary services—and the total return on the asset (the rate of property income and expected holding gains, if any). This paper focuses on how economic statistics such as Gross Domestic Product (GDP) account for liquidity services in recording economic performance. We first examine the liquidity services provided by banks (depository institutions), and then broaden our analysis to the liquidity services produced by other enterprises. The paper also considers an alternative view of liquidity services—as provided by the owners of financial assets for their own use—rather than the prevailing approach in the national accounts—as provided by financial institutions to other units in the economy.

Since at least the early 1950s economic statisticians have applied a method for measuring the nominal value of financial services resembling Barnett's principle for evaluating the service flow of a financial asset to its holder. The earliest official publication of national accounting standards—the United Nations' 1953 *A System of National Accounts and Supporting Tables* (hereafter, *1953 SNA*)—describes a method for measuring the financial intermediation services of banks that follows this principle, under the assumption that Barnett's benchmark rate or cost of capital is the rate of return on bank financial assets (mostly loans, some securities and deposits), and that the only non-equity funding source for banks is deposits.[2] Like Barnett, the early SNA saw households as

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[1] The views expressed in this paper are those of the authors and should not be attributed to the Bureau of Economic Analysis or to the IMF, its Executive Board, or IMF Management.
[2] See Fixler and Zieschang (1991). The *1953 SNA*'s treatment of indirectly measured financial services has earlier roots, reflecting Richard Stone's 1947 Appendix to *Measurement of National Income and the Construction of Social Accounts; Report of the Sub-Committee on National Income Statistics of the League of Nations Committee of Statistical Experts* (pp. 40-41). Barnett's (1978, 1980) contributions, derived independently of the national accounts tradition, went well beyond the 1953 national accounts financial intermediation services measure to show how it derives from the microeconomics of dynamic household

final consumers of these monetary services, at least regarding their holdings of deposits. The early national accounts also recognized the uses of these indirectly measured services by the government and nonresident owners of deposits as final uses of domestic production, and—importantly—by business owners of deposits as intermediate consumption. Modern measures of bank output in the national accounts, referred to by the acronym "FISIM"[3], refine this early principle to recognize banks' credit provision as well as liquidity services, and to include a wider array of financial instruments as sources of service output and a wider array of financial institutions besides banks that produce these services (*System of National Accounts 1993,* hereafter *1993 SNA*), although the most recent revision, the *2008 SNA*, has limited this calculation to the deposit and loan instruments on the balance sheets of financial corporations only.

Over the last six years, a strand of the economics literature has argued that current and historical statistical standards' association of liquidity and other financial instrument services with the produced service output of banks and other financial corporations is mistaken and overstates the importance of financial enterprises in value added and gross domestic product (GDP). Appealing to asset pricing theory, Wang, Basu, and Fernald (2009) (hereafter WBF) argue that compensation for financial risk should not be in financial output measures (or that the SNA treatment of banks be applied even handedly to nonbank enterprises[4]), while Basu, Inklaar and Wang (2011) (hereafter BIW) and Colangelo and Inklaar (2012) (hereafter CI) propose a specific measurement alternative to the currently standard approach that eliminates from the output, value added, and operating surplus of financial institutions the market risk premia on the monetary interest incomes and payments of their deposit and loan positions on both sides of the balance sheet.[5] The knock-on implication of removing these risk premia from nominal bank output is that a large part of the SNA's indirectly measured financial services in the intermediate consumption of *nonfinancial* enterprises disappears, and nonfinancial enterprises' value added and operating surplus (though not their total output) are thereby increased. For the US, this has a small negative impact on GDP in total as compared with the current standard presentation, but significantly reduces the measured value added of financial institutions in GDP and increases the measured value added of nonfinancial enterprises.

The national accounting community has viewed this critique cautiously, because it is not clear that all instrument specific risk premia should be removed from the returns on financial asset and liability positions of financial enterprises, which has significant

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behavior, and how it figures into the aggregation of the full array of financial instruments into liquidity—or monetary—aggregates.

[3] The term of art "Financial Intermediation Services Indirectly Measured" or FISIM was first coined in the *1993 SNA*. Compared with 1993, the most recent, 2008 version of the national accounting standards limits the scope of financial instruments for this measurement to deposits and loans; however, restoring the instrument scope of the FISIM calculation to its 1993 SNA state is an item on the Research Agenda of the *2008 SNA*.

[4] They note in footnote 40, however, that "We are not aware of any fully worked out models that explore the full implications of treating risk assumption as a service output."

[5] Like WBF, CI open the door to an SNA-type presentation on the condition that the risk bearing services of equity holders included in the SNA operating surplus of banks be treated as an intermediate consumption of the output of other banks as well as nonbanks.

impacts on the measured importance of financial services in major economies. Moreover, statisticians anticipate a practical difficulty with meeting its data requirements across the world in an internationally comparable way. The current indirect financial service measure in the national accounts—FISIM—is simple and generally practical provided the compiler has a key datum—the "reference rate of interest." The calculation is essentially

$$\text{Output} = (\text{Reference rate of interest} - \text{Deposit rate}) \cdot \text{Deposit liabilities}$$

$$+ (\text{Loan rate} - \text{Reference rate of interest}) \cdot \text{Loan assets}$$

As the deposit and loan financial instrument coverage of this formula implies, the current 2008 national accounting standards apply it only to banks—deposit takers—as well as non-deposit-taking loan-making financial institutions such as finance companies and money lenders. Simplicity notwithstanding, since 1993 here has been lack of consensus on how the reference rate in this formula should be determined, which is reflected in the non-specific language of the accounting standards concerning this rate. Consequently, the approach to setting the reference rate countries actually use is not uniform internationally. BIW and CI replace the single reference rate per economy of the 1993 and 2008 SNA with a constellation of instrument-specific reference rates, on the principle that no systemic, instrument specific compensation for risk bearing should be present in nominal output; that is, all financial instrument returns should be specific risk-adjusted. However, their alternative output measure has significantly higher requirements for detailed data on instrument returns that could be difficult to implement internationally.[6]

A second long running issue in the national accounts dialogue on financial services is the scope of financial instruments that should be associated with the SNA's indirect financial services measure. There has been a fluctuation in the instrument scope of FISIM that appears inspired by what appeared practical at the time successive versions of the standards were issued rather than with making conceptual progress over the years. The *1953 SNA* included only deposit liabilities in indirectly measured financial services. The *1993 SNA* included essentially all financial instruments in the calculation, but the *2008 SNA* proscribed the calculation of such services to deposit and loan instruments. Return to the 1993 instrument scope is nevertheless a research agenda item for the next version of the SNA, and appears essential to align the SNA with the scope of liquidity measured by the money and banking literature and the associated standards for compiling financial statistics.

Throughout the SNA's history it has implicitly treated liquidity as a service *produced* by financial institutions. However, liquidity could be treated as a *primary* service, what national accountants might call production of capital services for own use. By primary service, we mean that the agents, such as households, that own financial instruments and for whom they are assets directly receive liquidity services from certain of these instruments (to be elaborated below) rather than obtaining these services from the issuers of those instruments, for whom they are liabilities. Examining the primary-versus-produced distinction is, in our view, best undertaken in the context of resolving the two

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[6] Whether to use market or book interest rates has also been an issue. For national accounts purposes, the interest rates are computed as unit values using income and balance sheet data.

long-running national accounts issues. We use a straightforward derivation of the "production ≡ cost" identity from the "revenue ≡ expense" identity as our analytical framework.

We resolve the SNA reference rate problem by arguing that the reference rate is the bank's cost of capital: the overall rate of return paid to all sources of funding on the liability side of the balance sheet. If the bank is only equity financed, the cost of capital is the return on equity. If it is financed not only with equity but also with deposits and other debt securities (bonds and notes), then the cost of capital is the liability portfolio weighted average of the rate of return on equity and the average interest rate paid on debt securities. The return on deposits must be calculated on a *(debt) security-equivalent* basis, taking account of the expected maturity and presumed safety of deposit instruments (more on this below). Our cost of capital or cost of funds approach to the reference rate is conceptually straightforward and definitive compared with the language in the *2008 SNA*, as well as practical, requiring data from income statements and balance sheets (though requiring an imputation for the security equivalent return on deposits), and coherent in the accounting sense above, that the value of what is sold by the provider is identically equal to that purchased by the user.

Regarding national accountants' long struggle with the scope issue, we broaden the financial instruments associated with indirectly measured financial services from the *2008 SNA*'s deposits-and-loans-only back to the comprehensive financial instrument scope of the *1993 SNA*. Our motivation for rolling this proscription back is that constraining the scope of indirectly measured financial production to deposits and loans, among other things, is inconsistent with the wide instrument scope of the liquidity measures—and the liquidity services—inherent in bank operations. In addition, narrowing the scope of instruments to deposits and loans obfuscates to some extent some of the key findings otherwise readily apparent from the straightforward algebra with which we frame financial production.

Having set the broad financial instrument scope, our "reference rate of interest" is individual to each bank and given by the average service free rate of return paid across *all* sources of funding present on the liability side of the balance sheet, including equity.

Armed with the cost of capital reference rate and full financial balance sheet instrument scope, we proceed simply to derive the *production identity* (value of output ≡ cost of production) from the income ≡ expense identity under the general principle applied in the current national accounts methodology, but assuming a single, cost of capital reference rate for each enterprise rather than for the whole economy. On examining the SNA-type production identity we find the cost side contains a term within operating surplus—the equity leverage premium—that depends, as its moniker implies, on the bank's financing—the debt and equity composition of the liability side of its balance sheet. Further, it is inherent in the definition of the cost of capital reference rate that the equity leverage premium is identically equal to what we will term *produced liquidity* within the part of SNA financial services output of the bank coming from the debt instruments on the liability side of the its balance sheet, prominent among which being deposits. This financing-related component of the gross output, value added, and operating surplus of

banks computed under the SNA methodology is not present in the comprehensive income statements of banks.

We observe that consistency with the primary services treatment of liquidity and approximate consistency with commercial income statements requires eliminating the equity leverage premium from the cost side and, by implication, produced liquidity from the output side of the SNA-type production identity for banks. This produces a treatment of services from bank debt funding (including deposits) similar to BIW and CI. Hence the produced liquidity approach will generate consistently higher output, value added, and operating surplus for *banks* than the primary services approach. *However,* our analysis of this issue differs from previous authors in characterizing the source of this difference. The difference arises from the SNA's inclusion of the equity leverage premium in operating surplus, which in turn depends on the debt-equity composition of the bank's funding, rather than the inclusion of specific risk premia in the returns of individual financing instruments, as WBF, BIW, and CI suggest. A key implication of this is that we do *not* find issues with the SNA's indirect financial services (FISIM) calculation associated with banks' financial *assets*, assuming adoption of the cost of the cost of capital reference rate, *even* when liquidity is characterized as a primary service.[7,8]

Under the primary services treatment, liquidity services produced for own use by household and general government holders of financial assets would have to be included in output. On the other hand, the capital services produced for own use by nonresidents holding financial claims against resident financial institutions would be shown as outputs of the economy in which they are resident, not of the economy of the issuing institutions.[9]

The SNA assigns production of these liquidity services to banks. If instead liquidity is viewed as a primary service, then produced liquidity services as well as the equity leverage premium currently included in bank operating surplus and value added vanish. However, the changes would not stop there. We would also need add a nonmarket productive activity for households and general government that generates liquidity services for own final use from the financial assets these sectors own that have positive user costs. Non-market uses are in activities whose output is not sold at what the SNA calls "economically significant" prices (i.e., consistently too low to cover the cost of production). In market activities, liquidity (primary) services would be imbedded in operating surplus, calculated residually as the value of output less intermediate consumption, compensation of employees, and taxes on production. Including them in market activities thus would require no special calculation. However, in non-market (here, specifically, "production for own final use") activities, operating surplus must be

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[7] On loans, we accept the correction, already made by BEA, to eliminate loan loss rates from loan interest as an actuarily anticipated leakage of contract interest that the bank knows it will never receive. For the US this has a quantitatively small effect.

[8] We think that the *asset* side (credit provision) analysis of financial services of Basu, Inklaar, and Wang (2012), and Colangelo and Inklaar (2013) omits a key output component—asset management services—that is characteristic of investment funds but also inherent in the output of most enterprises considered to be "financial," including banks.

[9] The current, FISIM treatment shows the produced liquidity of resident financial institutions provided to nonresident holders of claims on (liabilities of) those institutions as an export of services.

calculated directly, as nonmarket output and value added are calculated at sum of costs.[10] Primary services from the debt assets of households, nonprofits, and government thus would have to be estimated and added to GDP. Outflows of the primary services of the debt assets issued domestically but owned by the rest of the world would be shown as payment for primary services provided by the rest of the world (not as exports).

If, as in the current SNA FISIM treatment, liquidity services are deemed produced by banks as the issuers of debt instruments and used according to each sector's asset holdings of those debt instruments, it nevertheless may be useful to quantitatively distinguish the banks' credit provision (e.g., loan servicing and asset management) activities from their transformation of leverage risk bearing provided by their equity holders into the produced liquidity provided by the bank to its debt holders (notably, depositors). This effectively splits an insurance activity from the output of the SNA's current "deposit taking corporations" sector in the sense that, while bank total output is unaffected, some of banks' operating surplus—the equity leverage premium—is reclassified as intermediate consumption purchased from equity holders' (possibly secondary) insurance (debt guarantee) operations.[11] In this presentation, equity holders' debt guarantee service output is generated from a primary service—their willingness to bear the risk of losing part or all of their equity stake in the event of a sufficiently large decline in the value of enterprise assets. Thus, produced liquidity is shown to be a direct function of equity holders' debt guarantee services, whose insurance reserves are given by the difference between bank total assets and debt liabilities (assuming the usual limited liability, corporate legal organization). [12]

This approach produces similar nominal GDP to that presently calculated, but reattributes the equity leverage premium currently in the operating surplus and value added of banks to the sectors holding equity in banks. The advantages of this approach are that it is

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[10] We caution that our use of "sum of costs" here differs from the national accounting standards' use of this term. The SNA defines "sum of costs" as intermediate consumption, compensation of employees, taxes on production, and consumption of fixed capital. The latter does not fully cover the cost of capital, which also should include the opportunity cost of invested finance less any monetary rent or other property income earned on productive assets. The SNA recommends imputation of market equivalent valuations for nonmarket output when available. The latter would be difficult to implement for what are already indirectly measured financial services, an advantage of the "sum of costs" approach to output in the liquidity services case.

[11] Paragraph 4.115 of the 2008 SNA recognizes the insurance service output of the issuers of debt guarantees:

> Deposit insurers, issuers of deposit guarantees and other issuers of standardized guarantees that are separate entities and act like insurers by charging premiums and have reserves, are classified as insurance corporations.

The catch to this is the terminology "standardized" guarantees. The reserves of the debt guarantees issued by the equity holders of leveraged enterprises are, as noted, limited either to equity holders' total wealth or, if the legal organization is corporate, to their equity positions based on the liquidation value of the enterprise. There is an implicit premium charged for this guarantee, the equity leverage premium, but it varies depending on the profitability of the enterprise relative to the interest cost of any debt financing. For banks, the SNA currently includes this in the value of production, because it includes the equity leverage premium in the cost of bank output.

[12] CI sketch an approach in the spirit of this variant of the produced liquidity approach.

incremental to the current SNA FISIM methodology, exposes the direct connection between liquidity provision and the assets of debt-issuing enterprises, bank or nonbank, and highlights the sectoral flows of risk bearing services that underpin provision of the liquidity services provided through the debt instruments issued by financial (and other) enterprises to the owners of these instruments.

The produced liquidity and primary services approaches to booking financial services should generate broadly similar results for aggregate GDP and the contribution of banks to GDP, but they will differ in attribution of which sectors generate liquidity and in the primary versus produced nature of liquidity services.[13] The second produced liquidity presentation—an outgrowth of the current SNA—effectively peels back a layer of the liquidity generation process depicted in the first presentation, showing that it depends ultimately on sectors' willingness to bear leverage risk. Thus, liquidity is not a primary but a produced service, the result of a supply of risk-bearing primary services used to produce debt guarantee (insurance) service output that is transformed by banks into liquidity services.

This paper aims to resolve the scope and methodology issues in the existing national accounts conversation on financial services, and to shed additional light on the consistency issues with the current national accounts FISIM procedure raised in the recent economics literature. Of the two alternative accounting procedures to the present SNA, we think the second approach illuminates the liquidity generation process in a way that best exposes the links between financial service production and use and production and use of goods and nonfinancial services—the "linkage between the real and financial sectors."

Basic accounting identities

The income ≡ expense identity
The income ≡ expense identity is

$$p'y + r_K'K + r_F'F \equiv v'x + w'L + T + \delta'K + r_D'D + r_E E \tag{1}$$

where

> $p'y$ is the revenue from goods and services at directly measured prices p and output quantities y
>
> $r_K'K$ is the monetary income (rent) at rates r_K earned on the market values of nonfinancial assets K
>
> $r_F'F$ is the property income (interest and dividends) at rates r_K earned on the market values of financial assets F

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[13] The two approaches also will show different *gross* outputs across sectors.

$v'x$ is the cost of goods and services inputs purchased from other enterprises (intermediate consumption) at directly measured prices v and quantities x

$w'L$ is the cost of labor services inputs purchased from households at directly measured prices w and quantities L

T is taxes less subsidies on production (excluding taxes less subsidies on products)

$\delta'K$ is capital depreciation[14] at rates δ on the market values of nonfinancial assets K

$r_D'D$ is the interest cost at rates r_D of debt liabilities D (deposits, debt securities, loans, etc) at market values

$r_E'E$ is the net income paid to owners before taxes on production at rate r_E on equity liabilities E, where $r_E E$ is defined as the residual of income over expense and thus completes the identity.[15]

The bank balance sheet identity
In addition, we have the **balance sheet identity**

$$\iota'K + \iota'F \equiv \iota'D + E \tag{2}$$

where E is defined as the residual of the value of total assets over debt and thus completes the identity, and ι is the vector of ones so that multiplication of any vector by ι' is a compact way of writing the summation of a vector's elements.

The bank cost of capital
We use a standard characterization of the enterprise cost of capital: the average rate of return paid to all of its funders taken together, whether they hold debt or equity, as in

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[14] The term of art for depreciation in national accounting standards is "consumption of fixed capital," or CFC, with the understanding that, in principle, CFC excludes the holding gains and losses on nonfinancial assets that may be included in depreciation as usually understood. Holding gains and losses are booked elsewhere in the national accounts, in the "revaluation" account explaining overall change in market value between the opening and closing entries on the balance sheet for each asset and liability. Depreciation often is understood as the overall change between the opening and closing market value, rather than this change exclusive of the holding gain or loss. However, the economics of capital accounting calculates the user cost of capital assets including holding gains as a negative depreciation component and holding losses as a positive depreciation component (adding to nominal capital consumption). As the national accounts continue moving toward the economic treatment of capital services, this treatment of holding gains, moving them out of the revaluation account to be treated as an implicit transaction in the production and capital accounts, would seem a logical step in the progression.

[15] The cost of equity capital is generally characterized as the return investors expect *ex ante* in a given period rather than the return they realize *ex post*; nevertheless, the realized rate of return is the basis for the expected cost of equity and suits our measurement purpose here.

$$\bar{r} = \frac{\hat{r}_D' D + r_E E}{\iota' D + E} \tag{3}$$

Note the notational innovation in equation (3): the caret over the interest cost of debt. The reason for this is that, among the debt instruments funding the bank,[16] the actual cost of a given deposit product to the bank is not just the monetary interest it pays to the holder of that account, but also the value of the statement, transaction processing, and safekeeping services—say, the *account servicing*—it supplies to each deposit account holder, that it would not have had to provide had it used another otherwise equivalent (in maturity and risk) debt security such as a bond issue. Thus the actual interest cost of a deposit is the return on a security of similar contract risk and maturity to the deposit, with the maintained assumption that the value of account servicing on securities is negligible. In the remainder of the paper, we will call this the *security equivalent return* on the individual deposit product.

Before leaving the cost of capital, it is important to note that the definition of the cost of capital (3) is equivalent to the following identity, which will play a key role later:

$$\left(\bar{r} \iota - \hat{r}_D \right)' D \equiv \left(r_E - \bar{r} \right) E. \tag{4}$$

In looking at the relationships among the of rates of return in (4), as a rule, $\left(\bar{r} \iota - \hat{r}_D \right)' D > 0$, or in words, debt holders accept a security equivalent interest rate $\hat{r}_D$ (recalling that this includes the value of deposit account servicing, if any) below the cost of capital $\bar{r}$ in return for ensuring a callable or fixed duration participation in funding the enterprise, with return of their original principal, at a contract rate of return. Equation (4) says that this discount times the value of debt holders' investment D, is identically equal to the premium over the cost of capital that equity holders require to fund the enterprise partly with debt, times the value of equity. Identity (4), in words, states that *produced liquidity* on the left hand side, is identically equal to the *equity leverage premium* on the right hand side when the cost of capital is defined as in identity (3).

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[16] Current international standards for economic statistics (see, e.g., *System of National Accounts 2008* and the associated standards for balance of payments, government finance, and monetary and financial statistics) recognize 8 types of financial instrument: Monetary gold and Special Drawing Rights (SDRs) (AF1, of which Monetary gold AF11 and SDRs AF12), Currency and deposits (AF2, of which Currency AF21, Transferrable deposits AF22, and Other deposits AF29), Debt securities (AF3), Loans (AF4), Equity and investment fund shares (AF5), Insurance and pension reserves (AF6), Financial derivatives and employee stock options (AF7), and Other accounts receivable/payable (AF8). Our category "equity" E corresponds to AF5 liabilities. Our category "debt" D comprises SDR (AF12) liabilities in AF1 (Monetary gold AF11 is unique among financial assets, and similar to nonfinancial assets, in not having a counterparty for whom it is a liability), and all other non-equity liability instruments (AF2, AF3, AF4, AF6, AF7, and AF8). Our category "deposits" comprises AF22 + AF29.

Liquidity and other bank services

To describe the production of liquidity, we begin with a bank balance sheet that includes the usual goods and services output and input, as well as primary services from labor and capital.

The production identity

We now use (1) to begin rearrange the income ≡ expense identity as an output ≡ input— or production—identity by first subtracting the cost of invested finance incurred by the enterprise on assets K and F from the left hand side and the cost of invested finance paid to holders of debt D and equity E funders from the right hand side. This maintains the original income ≡ expense identity because, by the balance sheet identity (2), $\iota'K + \iota'F \equiv \iota'D + E$ and thus $\bar{r}(\iota'K + \iota'F) \equiv \bar{r}(\iota'D + E)$. We now have

$$p'y + \left(r_K - \bar{r}\iota\right)' K + \left(r_F - \bar{r}\iota\right)' F \equiv v'x + w'L + T + \delta'K + \left(r_D - \bar{r}\iota\right)' D + \left(r_E - \bar{r}\right)E \quad (5)$$

We first collect the depreciation rates δ with the other rates applying to nonfinancial assets by subtracting them from both sides of (5), and subtract from both sides of the resulting expression any of the margin terms on either side that are negative, to derive the **production identity**:

$$
\begin{aligned}
&p'y + \left(r_K - \bar{r}\iota - \delta\right)'_+ K + \left(r_F - \bar{r}\iota\right)'_+ F - \left(r_D - \bar{r}\iota\right)'_- D \\
&\equiv v'x + w'L + T - \left(r_K - \bar{r}\iota - \delta\right)'_- K - \left(r_F - \bar{r}\iota\right)'_- F + \left(r_D - \bar{r}\iota\right)'_+ D + \left(r_E - \bar{r}\right)E
\end{aligned}
\quad (6)
$$

where the "+" subscript means that the elements of the resultant vector are the positive elements of the vector being subscripted, with its negative elements censored at zero, and the "–" subscript means that the elements of the resultant vector are the negative elements of the vector being subscripted, with its positive elements censored at zero. Thus, other than the margin item for equity $\left(r_E - \bar{r}\right)E$ on the cost side, which we suppose is usually positive but may be negative on occasion, (6) contains only positive terms on either side of the identity sign.

Interpreting the production identity

This section interprets the production identity (6) term by term, highlighting each with a box as we go.

Outputs – Directly priced goods and services

$$
\begin{aligned}
&\boxed{p'y} + \left(r_K - \bar{r}\iota - \delta\right)'_+ K + \left(r_F - \bar{r}\iota\right)'_+ F - \left(r_D - \bar{r}\iota\right)'_- D \\
&\equiv v'x + w'L + T - \left(r_K - \bar{r}\iota - \delta\right)'_- K - \left(r_F - \bar{r}\iota\right)'_- F + \left(r_D - \bar{r}\iota\right)'_+ D + \left(r_E - \bar{r}\right)E
\end{aligned}
$$

These outputs, shown in a box, have well specified prices and volumes. They are familiar from traditional microeconomics and do not need much additional explanation here. For banks, this term includes any direct service charges.

Outputs – Capital (nonfinancial asset) leasing and portfolio management services

$$p'y + \boxed{\left(r_K - \bar{r}\iota - \delta\right)'_+ K} + \left(r_F - \bar{r}\iota\right)'_+ F - \left(r_D - \bar{r}\iota\right)'_- D$$

$$\equiv v'x + w'L + T - \left(r_K - \bar{r}\iota - \delta\right)'_- K - \left(r_F - \bar{r}\iota\right)'_- F + \left(r_D - \bar{r}\iota\right)'_+ D + \left(r_E - \bar{r}\right)E$$

These services are characteristic of equipment and real estate leasing activities. The effective yield from these activities is the gross rent charged r_K less the financing and depreciation costs $\bar{r}\iota + \delta$. Note that these nonfinancial assets (equipment and structures; intellectual capital, land and other natural resources; contracts, leases, and licenses, valuables, etc) may be purchased simply to hold in anticipation of future price increases rather than, or in addition to, their use as leasing inventory. This portfolio management motivation is typical of "valuables," which national accounting standards have recognized in nonfinancial assets since 1993. For these assets δ may be negative (and thus represent appreciation rather than depreciation) and large enough that $-\delta$ in combination with gross rent r_K (if any) more than offsets the cost of invested financial capital $\bar{r}$.

Outputs – Credit (loan) and financial portfolio management services

$$p'y + \left(r_K - \bar{r}\iota - \delta\right)'_+ K + \boxed{\left(r_F - \bar{r}\iota\right)'_+ F} - \left(r_D - \bar{r}\iota\right)'_- D$$

$$\equiv v'x + w'L + T - \left(r_K - \bar{r}\iota - \delta\right)'_- K - \left(r_F - \bar{r}\iota\right)'_- F + \left(r_D - \bar{r}\iota\right)'_+ D + \left(r_E - \bar{r}\right)E$$

These services include the credit assessment, monitoring, and account management services associated with making loans. They also comprise the portfolio management services are associated with the service charges levied by investment funds, for which (because investment funds as a rule do not originate and service loan assets) they are explicit in the form of the "expense ratio" reported in fund prospectuses and financial statements. These portfolio management services are the hallmarks of all financial enterprises—investment funds, banks, finance companies, and insurance—and are inherent in the, perhaps secondary, output of any enterprise having a financial asset portfolio yielding property income at a higher rate than that enterprise's cost of capital.[17]

Outputs – Produced liquidity and liability account management services

$$p'y + \left(r_K - \bar{r}\iota - \delta\right)'_+ K + \left(r_F - \bar{r}\iota\right)'_+ F \boxed{- \left(r_D - \bar{r}\iota\right)'_- D}$$

$$\equiv v'x + w'L + T - \left(r_K - \bar{r}\iota - \delta\right)'_- K - \left(r_F - \bar{r}\iota\right)'_- F + \left(r_D - \bar{r}\iota\right)'_+ D + \left(r_E - \bar{r}\right)E$$

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[17] An interesting example of this is Apple Corporation (United States), a media distribution, IT design, engineering, and marketing enterprise, a substantial fraction of whose balance sheet is financial assets. Although Apple has some US manufacturing operations, the bulk of its hardware products come from a global contract manufacturing network.

We can rewrite the highlighted term above as $-\left(r_D - \overline{r}\iota\right)'_{-} D \equiv \left(\overline{r}\iota - r_D\right)'_{-} D$. Because the debt vector D includes deposits along with other debt liabilities, this term includes the national accounts' "deposit FISIM," the nominal, indirectly measured financial service output from the deposit funding liabilities of the bank. Referencing the earlier discussion concerning the role of deposits in the definition of the cost of capital (3) (and suppressing for simplicity the "–" subscript notation), we can decompose this further as

$$\left(\overline{r}\iota - r_D\right)' D = \left(\overline{r}\iota - \hat{r}_D\right)' D + \left(\hat{r}_D - r_D\right)' D \tag{7}$$

where the second term on the right hand side of (7), $\left(\hat{r}_D - r_D\right)' D$, reflects the deposit "account servicing" mentioned earlier as being included in the cost of deposits in the definition of the cost of capital $\overline{r}$, covering the cost of statement preparation, transaction processing, safekeeping services, etc. that may be associated with each individual account. The first term, $\left(\overline{r}\iota - \hat{r}_D\right)' D$, includes the deposit component of what we called *produced liquidity services* in the Introduction. Note that this liquidity services output term applies to *all* debt instruments whose *security equivalent* interest rate is less than the cost of capital, not just deposits. Current statistical standards include *produced liquidity* in bank total output (along with account servicing on liabilities) and intermediate consumption in calculating value added, and thus bank contribution to national output, but only for the *deposits* item within our debt vector D, and, by implication, only such services originating with deposit taking enterprises (banks).[18]

Inputs – Directly priced goods and services

$$p'y + \left(r_K - \overline{r}\iota - \delta\right)'_{+} K + \left(r_F - \overline{r}\iota\right)'_{+} F - \left(r_D - \overline{r}\iota\right)'_{-} D$$

$$\equiv \boxed{v'x + w'L} + T - \left(r_K - \overline{r}\iota - \delta\right)'_{-} K - \left(r_F - \overline{r}\iota\right)'_{-} F + \left(r_D - \overline{r}\iota\right)'_{+} D + \left(r_E - \overline{r}\right) E$$

These inputs are familiar from traditional microeconomics and have well specified prices and volumes. They comprise the directly measured intermediate consumption of goods and services $v'x$ purchased from other enterprises in the economy, as well as labor service primary inputs $w'L$, and do not need much additional explanation here. In connection with the overall cost of production, they include the staff and other resources

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[18] Because our treatment here does not proscribe the type of debt instrument, the concept of purchased liquidity here has significantly broader coverage of financial instruments than envisaged in the current national accounting standards. This said, the scope we use here is, we believe, similar in scope to the liquidity concept used in money and baking, at least at it has developed since the 1980s, as well as the current IMF standards for liquidity in money and banking statistics. See the *Monetary and Financial Statistics Manual and Compilation Guide (MFSMCG)*, International Monetary Fund, at http://www.imf.org/external/data.htm#guide, Chapter 6 (http://www.imf.org/external/pubs/ft/mfsmcg/c6.pdf) and particularly Annex 6 of that Chapter. Recall our earlier point that the highlighted liquidity services term of equation (6) has been present, albeit with a different implied reference rate than the cost of capital rate we use here, in the national accounting standards for measuring the output of financial institutions since 1953.

used in the risk management—including asset-liability risk management—functions of the bank.

Inputs – Capital services (nonfinancial asset implicit rentals)

$$p'y + \left(r_K - \bar{r}\iota - \delta\right)'_+ K + \left(r_F - \bar{r}\iota\right)'_+ F - \left(r_D - \bar{r}\iota\right)'_- D$$

$$\equiv v'x + w'L + T \boxed{-\left(r_K - \bar{r}\iota - \delta\right)'_- K} - \left(r_F - \bar{r}\iota\right)'_- F + \left(r_D - \bar{r}\iota\right)'_+ D + \left(r_E - \bar{r}\right)E$$

The implicit capital rentals on (or *user costs* of) nonfinancial assets (equipment, structures, intellectual capital, land and other natural resources, contracts, leases, and licenses, valuables, etc) held by the enterprise and used for the production of other goods and services, where for the ith such asset $-\left(r_{Ki} - \bar{r} - \delta_i\right) = \left(\bar{r} + \delta_i - r_{Ki}\right) > 0$, will show up on the cost side as a component of what national accountants call *operating surplus*. Often as not, the rate of monetary rent is not only small but nil in this case—$r_{Ki} = 0$—and the user cost becomes the familiar $\left(\bar{r} + \delta_i\right)K_i$.

Inputs – Owned liquidity services

$$p'y + \left(r_K - \bar{r}\iota - \delta\right)'_+ K + \left(r_F - \bar{r}\iota\right)'_+ F - \left(r_D - \bar{r}\iota\right)'_- D$$

$$\equiv v'x + w'L + T - \left(r_K - \bar{r}\iota - \delta\right)'_- K \boxed{-\left(r_F - \bar{r}\iota\right)'_- F} + \left(r_D - \bar{r}\iota\right)'_+ D + \left(r_E - \bar{r}\right)E$$

Financial assets with negative net rental rates and thus positive user costs— $-\left(r_F - \bar{r}\iota\right)'_- F > 0$—will show up on the cost side of the production identity. Examples of this are deposit account balances that have low yields and short-term securities held to pay for inputs, and in the event of investment opportunities.

Inputs – Borrowed liquidity services

$$p'y + \left(r_K - \bar{r}\iota - \delta\right)'_+ K + \left(r_F - \bar{r}\iota\right)'_+ F - \left(r_D - \bar{r}\iota\right)'_- D$$

$$\equiv v'x + w'L + T - \left(r_K - \bar{r}\iota - \delta\right)'_- K - \left(r_F - \bar{r}\iota\right)'_- F + \boxed{\left(r_D - \bar{r}\iota\right)'_+ D} + \left(r_E - \bar{r}\right)E$$

This term refers to the liquidity provided by high cost financing, whose interest rate exceeds the enterprise cost of capital. Barnett and Su (2014) argue that high cost revolving debt (e.g., credit card loans) can play a liquidity role for households and on that basis have a role in liquidity aggregates. Its appearance here for enterprises is analogous to Barnett's inclusion of it in household liquidity. This term also could appear anecdotally when profitability r_E is low or funding interest rates r_D unusually high, as in financial distress situations, but can persist in the presence of cheaper sources of debt finance also on the balance sheet that bring the average debt service rate below the cost of capital. We might expect that "normally" this term will be a small component of the cost of production. We note borrowed liquidity for context, to provide a connection between our

analytical framework and very recent developments in liquidity measurement theory, but will not discuss it further here.

Inputs – The equity leverage premium

$$p'y + \left(r_K - \bar{r}\iota - \delta\right)'_+ K + \left(r_F - \bar{r}\iota\right)'_+ F - \left(r_D - \bar{r}\iota\right)'_- D$$
$$\equiv v'x + w'L + T - \left(r_K - \bar{r}\iota - \delta\right)'_- K - \left(r_F - \bar{r}\iota\right)'_- F + \left(r_D - \bar{r}\iota\right)'_+ D + \boxed{\left(r_E - \bar{r}\right)E}$$

The equity leverage premium, as discussed above (equation (4)) in connection with our definition of the cost of capital (equation (3)), is the return in excess of the enterprise cost of capital that equity holders require in compensation for the additional risk they assume by taking on debt. If $D = 0$ and the enterprise is entirely equity financed, $\bar{r} = r_E$ and the equity leverage premium vanishes.

Produced liquidity: the SNA's approach to indirectly measured financial services

As noted in the Introduction, the SNA has since its inception included *produced liquidity* in output, which we can show by rewriting the debt term identified on the left hand—output—side of the production identity (6) using equation (7):

$$p'y + \left(r_K - \bar{r}\iota - \delta\right)'_+ K + \left(r_F - \bar{r}\iota\right)'_+ F - \left(r_D - \hat{r}_D\right)'_- D \boxed{- \left(\hat{r}_D - \bar{r}\iota\right)'_- D}$$
$$\equiv v'x + w'L + T - \left(r_K - \bar{r}\iota - \delta\right)'_- K - \left(r_F - \bar{r}\iota\right)'_- F + \left(r_D - \bar{r}\iota\right)'_+ D + \boxed{\left(r_E - \bar{r}\right)E}$$

(8)

The presence of produced liquidity (highlighted on the left hand side of (8) with a box) in output in conjunction with defining the cost of capital as in (3), implies via identity (4) that anything affecting produced liquidity on the output side will have an identical impact on the equity leverage premium (highlighted on the right hand side of (8) with a box) on the cost side. This implies that compensation for assuming financing (leverage) risk is treated as a primary (service) cost of production (a capital service) and not just a financial entry. A regrouping of terms on the right hand side of equation (8) shows how the produced liquidity approach views intermediate consumption and operating surplus

$$p'y + \left(r_K - \bar{r}\iota - \delta\right)'_+ K + \left(r_F - \bar{r}\iota\right)'_+ F - \left(r_D - \hat{r}_D\right)'_- D - \left(\hat{r}_D - \bar{r}\iota\right)'_- D$$
$$\equiv \left[v'x - \left(r_F - \bar{r}\iota\right)'_- F + \left(r_D - \bar{r}\iota\right)'_+ D \right]$$
$$+ w'L + T$$
$$- \left(r_K - \bar{r}\iota - \delta\right)'_- K + \left(r_E - \bar{r}\right)E.$$

(8)

A key implication of the produced liquidity approach is not only the inclusion of produced liquidity in the output of banks, but also assigning intermediate uses of that

produced liquidity by other enterprises in the economy. Thus the inputs associated with financial assets F—given by the term $-\left(r_F - \bar{r}\iota\right)'_- F$—are split into two components: intermediate consumption of produced liquidity purchased from banks, and a residual component appearing in operating surplus that depends on the difference between the cost of capital of the bank supplying produced liquidity and the enterprises using that produced liquidity. The SNA's produced liquidity approach thus imputes a larger share of total GDP by production—a larger value added—to banks, and a smaller share—a smaller value added—to other enterprises than would be indicated by their respective reported financial statements, unless the debt guarantee service of bank equity holders is separately recognized and assigned to the sectors according to their holdings of bank equity. We discuss this further below in the section titled Liquidity in value added and GDP.

Primary service liquidity: an alternative approach to indirectly measured financial services

An alternative to the long running national accounts treatment of liquidity services as produced by banks is to recognize the benefits of financial instruments *only* as *primary services*, produced for own use by their owners, for whom they are assets. By implication, this eliminates *produced liquidity* from both sides of equation (8). If the reference rate is the cost of capital, this implies that the equity leverage premium on the cost side is cancelled out via equation (4) and vanishes along with produced liquidity on the output side, yielding the following, "liquidity as primary services" version of the production identity of banks:

$$
\begin{aligned}
&p'y + \left(r_K - \bar{r}\iota - \delta\right)'_+ K + \left(r_F - \bar{r}\iota\right)'_+ F - \left(r_D - \hat{r}_D\right)'_- D \\
&\equiv v'x + w'L + T - \left(r_K - \bar{r}\iota - \delta\right)'_- K - \left(r_F - \bar{r}\iota\right)'_- F + \left(r_D - \bar{r}\iota\right)'_+ D
\end{aligned}
\tag{9}
$$

Thus, the only kind of output that primary service liquidity associates with debt instruments (including deposits) is what we have termed *account servicing*, the term $-\left(r_D - \hat{r}_D\right)'_- D$ on the left side of equations (7) and (9), recalling that this only includes the margin between the security equivalent return and the monetary return on debt instruments, rather than the larger margin between the enterprise cost of capital and the monetary return.

However, as foreshadowed in the Introduction, taking produced liquidity out of bank output and treating it only as a primary service requires us to recognize the currently unrecognized (nonmarket) production of liquidity for own use by households and general government from their holdings of bank debt. Thus, what is taken away from bank produced liquidity output reappears as the output of liquidity services for own use by households and general government. By implication, the primary service approach to liquidity services would require changes to national accounting standards not only in removing produced liquidity from bank output, but also in adding imputations for

nonmarket production for own consumption of liquidity services by households and general government that flow from these sectors' asset holdings of bank deposit and (possibly) loan liabilities. We discuss this further below in the section titled Liquidity in value added and GDP.

Discussion

A key implication of the primary services treatment of liquidity is that the value of total output does not depend on the way the enterprise is financed—the proportion of equity and debt funding—in contrast to the produced liquidity treatment, which includes the equity leverage premium in nominal output, at least for banks.[19]

The production of liquidity services by banks is a by-product of the intermediation process. Agents do not want to hold all of their currency; this is a fundamental presumption of the Baumol-Tobin model (the trips to the bank model) of the demand for money as well as the founding idea of banks as depositories. The demand deposit instrument (check) as a means of payment is a main source of liquidity.[20]

Liquidity in value added and GDP

Notwithstanding the difference in total output calculation between the primary and produced approaches to liquidity services, the key indicator of economic performance in the national accounts is GDP, which is the economy wide sum of the values added of enterprises resident in the economy. How does the treatment of liquidity generation affect value added in total? How does the treatment of liquidity affect the importance of sectors as origins of value added?

In the primary services treatment of liquidity, only "account servicing" output is associated with debt liabilities, of which principally deposit liabilities, as shown in equation (9). In the produced liquidity case, total output is significantly higher for banks because of their high leverage, as shown in equation (8). Corresponding to this, there also will be relatively smaller intermediate flows in the primary service treatment of liquidity as compared with the produced service treatment.

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[19] This suggests one inconsistency of the SNA treatment of indirectly measured financial services: if the equity leverage premium is included in the value of banks' total output, then should it not be included in the value of output of all other leveraged enterprises in the economy? Fixler and Zieschang (2013) estimated that if produced liquidity were included in the output of all enterprises in the US, economy wide total output of indirectly measured financial services would roughly double and become more pro-cyclical. Fixler and Zieschang (2013) refer to produced liquidity as "risk intermediation," a terminology highlighting the fact that the cost side equity leverage premium inherent in providing the debt instruments generating liquidity compensates equity funders for the additional risk they bear as a result of taking on leverage. As shown in identity (4), this is equal to the return debt funders forego in order to have a lower risk participation in funding the enterprise, termed produced liquidity in this paper. Although nonbanks' estimated produced liquidity is small relative to directly measured output owing to their relatively low leverage and relatively long-maturity, high monetary return debt funding, nonbanks' total output is a much larger fraction of national total output than banks' output. Their produced liquidity is thus a small fraction of a relatively large total output number, compared with banks, whose produced liquidity is a large fraction of a relatively small total output number.

[20] Quinn and Roberds (2008).

By implication, because of banks' high leverage, the contribution to GDP of banks relative to other enterprises can be significantly larger in the produced rather than primary service liquidity treatment. As already noted, leverage differentially increases output in the produced liquidity case compared with the primary services liquidity treatment.

WBF, BIW, and CI have made a similar point about the upward impact of the SNA's produced liquidity approach on the share of aggregate value added attributed to banks. CI briefly sketch an extension of the SNA that would address the value added share issue. They posit that an additional household risk bearing productive activity might be recognized as production that would then be sold to banks as intermediate consumption. This would pull bank value added down relative to nonbank (including household) value added. We will visit a proposal below that achieves what Colangelo and Inklaar intend, noting, however, that the new financial activity might best be characterized as a debt guarantee insurance service production activity undertaken by bank equity holding sectors that sells its output to banks. This insurance activity, in turn, relies heavily on risk bearing primary services provided by the equity holding sectors.

Value added when liquidity is a primary service

In looking at the effect of liquidity primary services on total economy and sector value added, we need to broaden the scope of the national accounts treatment of liquidity to that of the money and banking standards, recognizing all sectors' generation of liquidity primary services from their low-interest (below cost of capital) bank debt assets. There are two scope restrictions in current national accounting standards that we would therefore need to adjust.

First, the current set of national accounting standards explicitly excludes household production of services for own use, including capital services from low yielding financial assets, with the exception of the shelter services produced from owner occupied housing. We would broaden this to include in addition households' production of liquidity from their low-yielding debt instrument assets.

Second, the current accounting standards do not include the full cost of capital in computing the value of output as sum of costs for non-market activities in which output is provided at a price far enough and consistently enough below the cost of production as *not* to be "economically significant."[21] Sum of costs is routine for calculating the value of non-market production for which there is no close market equivalent whose price could be imputed. This would include household production of liquidity (an indirect calculation depending on the household cost of capital), and production of most general government enterprises and many (though not all) nonprofit institutions serving households. The key quantity that must be estimated in a sum of costs calculation is operating surplus, ordinarily residually calculated as the difference between (the value of) output, and the sum of intermediate consumption, compensation of employees, and taxes on production. The SNA's "sum of costs" estimator for operating surplus includes only consumption of fixed capital, excluding the interest foregone on invested finance. We would relax this restriction to include the return foregone on invested finance in computing output as sum

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[21] On economically significant prices see *System of National Accounts 2008*, paragraph 4.18.

of costs for nonmarket household, government, and nonprofit enterprises. This would allow more credible estimates of the value of liquidity primary services from the low yielding financial assets owned by these sectors.

Armed with these two adjustments, in addition to recognizing liquidity services from all types of low yielding assets rather than only deposit and loan instruments, we have a conventional economic breakdown of aggregate liquidity into the sectors that provide that liquidity *for themselves* on the basis of sector *asset* positions in low-yielding debt instruments. In maintaining that liquidity is a primary service, we are saying that economic units never buy liquidity services from other units, but always produce it for themselves from the financial assets they own.

Value added in this framework is compiled *as measured* by the difference between output and intermediate consumption for all *market* enterprises providing output at "economically significant" prices. This is because the implicit rental of low yielding financial assets—liquidity primary services—is already covered within operating surplus calculated as the residual of the value of output and non-capital production costs. Value added for nonmarket activities, on the other hand, requires an explicit user cost calculation of operating surplus for each such activity.

To show the calculation of value added the nonmarket case, we can sort the cost side terms of the "liquidity as primary service" version of the production identity (9) into intermediate consumption and primary service (operating surplus) components as follows:

$$
\begin{aligned}
& p'y + \left(r_K - \overline{r}\iota - \delta \right)'_+ K + \left(r_F - \overline{r}\iota \right)'_+ F - \left(r_D - \hat{r}_D \right)'_- D \\
& \equiv \left[v'x - \left(\hat{r}_F - r_F \right)'_- F + \left(r_D - \hat{r}_D \right)'_+ D \right] \\
& + w'L + T \\
& - \left(r_K - \overline{r}\iota - \delta \right)'_- K + \left[-\left(\overline{r}\iota - \hat{r}_F \right)'_- F + \left(\hat{r}_D - \overline{r}\iota \right)'_+ D \right]
\end{aligned}
\tag{10}
$$

In (10) output includes the financial asset account servicing and asset management covered in the term $\left(r_F - \overline{r}\iota \right)'_+ F$ as well as debt account servicing $-\left(r_D - \hat{r}_D \right)'_- D$ on the left hand side. Intermediate consumption includes asset account servicing $-\left(\hat{r}_F - r_F \right)'_- F$ (as for a deposit asset) and debt account servicing $\left(r_D - \hat{r}_D \right)'_+ D$ (as for a loan liability) on

the right hand side.[22,23] Operating surplus, comprising the last line of (10), includes not only the user cost of nonfinancial assets $-\left(r_K - \overline{r}\iota - \delta\right)'_- K$ but also the liquidity services from low yielding financial assets $-\left(\overline{r}\iota - \hat{r}_F\right)'_- F$ and liquidity services from high cost (e.g., revolving) debt $\left(\hat{r}_D - \overline{r}\iota\right)'_+ D$.

Comparing equations (8) and (10), it is evident that the produced liquidity approach will yield larger or smaller value added for banks depending on whether the equity leverage premium $\left(r_E - \overline{r}\right)E$ is larger or smaller than the value of primary services from financial assets and borrowed liquidity $\left[-\left(\overline{r}\iota - \hat{r}_F\right)'_- F + \left(\hat{r}_D - \overline{r}\iota\right)'_+ D\right]$. Results from BIW and CI suggest that the bank equity leverage premium is higher than the value of primary services from low yielding bank financial assets and high cost borrowed liquidity.

In what follows, we will consider the "produced liquidity" calculation of aggregate GDP and attribution of GDP to sectors as a baseline against which to consider the following alternative presentation of the sector accounts that exposes how sector risk bearing primary service flows are the underlying sources of liquidity, which is *produced* by banks using these primary services. This presentation turns out to be an extension of the SNA's "produced liquidity" that peels back a layer of the SNA presentation to expose the role of banks as intermediaries between the leverage risk bearing primary services generated by sectors holding equity in leveraged enterprises and the users of the liquidity the intermediaries generate by issuing debt whose return is less than their cost of capital.

Value added when liquidity is a produced service

As noted in the introduction, the national accounts have since 1953 viewed liquidity as produced by financial institutions rather than as the own production of the units owning these instruments, based on thinking that was well established at the time of Stone's 1947 report to the League of Nations. The argument for this view might go along the following lines: liquidity services from debt instruments would not be possible without financial (and other leveraged) enterprises creating, issuing, and servicing these instruments, which

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[22] As an aside, we treat this account servicing item on loans just as the SNA treats FISIM on loans. However, the treatment of the asset management fee, when implicit as in the case of banks, is inconsistent in the SNA because the SNA does not distinguish between the two types of financial service—account servicing and asset management—in the implicit case. When asset management is the only indirectly measured financial service output, as for investment funds, it at the same time becomes explicit, and the SNA prescribes that the equity holders (the funders) of the investment fund pay the now explicit fee, termed the expense ratio in fund financial statements. The same asset management fee is imbedded in the asset side FISIM of banks, along with account servicing on loans, but in this case the SNA prescribes that it be assigned as paid by the borrowers rather than the bank's debt and equity funders, along with account servicing on loans.

[23] It could be argued that the implicit service charge for loan account servicing is seen by borrowers merely as interest, and that the payers of this service charge are not the borrowers but are the debt and equity funders of the enterprise, who would pay this account servicing fee as part of the monitoring cost of loan contracts along with the asset management fee. This treatment, while conflicting with the current SNA, is arguably not only better rationalized but simpler to implement.

are secured by the assets of those enterprises. It thus appears meaningful to construct a presentation of the accounts associating liquidity services with the debt issuing enterprises.

However, at the same time these produced liquidity services are recognized on the output side of the issuing enterprises, increasing their nominal total output, it is important to consider the source of the debt guarantee insurance service compensated by the equity leverage premium that concomitantly appears on the cost side.[24] Equity holders effectively pledge their wealth as an insurance reserve insulating debt holders' principal should enterprise assets decline in value (unlimited liability), unless the enterprise legal structure is corporate, in which case equity holders pledge an insurance reserve equal to their equity stakes (limited liability). This requires in turn that a productive activity generating this insurance be recognized whose output originates with equity holders' willingness to bear leverage risk. As such, in addition to banks' role in providing credit and managing assets, as leveraged enterprises banks are an intermediary between economic units (equity holders) providing financial risk bearing services and economic units (debt holders) receiving liquidity services.

Thus, for a bank (or other leveraged enterprise), we would write the following version of the production identity (6) for the produced liquidity case where risk bearing by equity holders is accounted for separately from the bank itself:

$$p'y + (r_K - \bar{r}\iota - \delta)'_+ K + (r_F - \bar{r}\iota)'_+ F - (r_D - \bar{r}\iota)'_- D$$

$$\equiv v'x + w'L + T - (r_K - \bar{r}\iota - \delta)'_- K - (r_F - \bar{r}\iota)'_- F + (r_D - \bar{r}\iota)'_+ D + (r_E - \bar{r})E$$

$$\equiv v'x + \left[-(r_F - \bar{r}^{SF}\iota)'_- F + (r_D - \bar{r}^{SD}\iota)'_+ D + (r_E - \bar{r}^{SE})E \right] \tag{11}$$

$$+ w'L + T$$

$$- (r_K - \bar{r}\iota - \delta)'_- K + \left[(\bar{r} - \bar{r}^{SF})\iota'_{F_-} F - (\bar{r} - \bar{r}^{SD})\iota'_{D_+} D - (\bar{r} - \bar{r}^{SE})E \right]$$

where the superscripts refer to the average costs of capital of the *suppliers* to this enterprise of services on its financial assets $\bar{r}^{SF}$, on its debt liabilities $\bar{r}^{SD}$, and on its equity liabilities $\bar{r}^{SE}$.

The left hand side of (11) is the same as (6), so this equation simply regroups the FISIM components of the right hand, cost side of (6) into intermediate consumption of produced liquidity (the bracketed term after directly measured intermediate consumption $v'x$ in the

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[24] Our characterization of this service as insurance is potentially controversial. Equity holders provide debt holders a guarantee of their principal that could be characterized in terms of a derivative contract, but because this type of guarantee is not "standardized," the SNA does not associate it with insurance. The current national accounting standards recognize insurance services only if associated with pooling schemes and standardized guarantees. See 2008 SNA paragraphs 17.210-17.214. However, recognizing the services associated with the fees of derivative contracts is not precluded if those fees can be properly measured. Thus, "portfolio insurance" is not in principle outside the SNA production boundary, but when the fee cannot be distinguished from other payments, the standards permit compilers to ignore the fee component of settlement flows on these contracts and treat them as distributive flows. See *2008 SNA* paragraph 11.114.

third to last line of identity (11)), with any residual included in operating surplus (the bracketed term in the last line of identity (11)). The term $-\left(r_F - \bar{r}^{SF} \iota\right)'_{-} F \geq 0$ is for intermediate consumption of what are principally asset management services (but also inclusive of account servicing if any) associated with the financial assets F of the enterprise that are supplied by other units.[25]

The value of these services is based on the supplier's cost of capital, denoted by the S superscript in $\bar{r}^{SF}$, since the enterprise can pay no less and need pay no more than the supplier's valuation to obtain these services. We have defined F to be any type of financial asset, so these indirectly measured service payments range from asset management fees imbedded in mutual fund shares to account servicing and liquidity services on low-yielding deposits and debt securities yielding less than the supplier's cost of capital. Note further that these services would be seen from the supplier's side as associated with the supplier's *liabilities*, the flip side of the enterprise's assets.

The term $\left(r_D - \bar{r}^{SD} \iota\right)'_{+} D \geq 0$ is for intermediate consumption of services associated with the enterprise's high-cost debt *liabilities* D (e.g., revolving credit lines) that are issued by other units, what we have called borrowed liquidity. Again, the value of these services is based on the supplier's cost of capital, denoted by the S superscript in $\bar{r}^{SD}$, since the enterprise can pay no less and need pay no more than the supplier's valuation to obtain these services.

The first and second of the aforementioned terms are included, in principle, in current national accounts calculations, which are based on treating liquidity as a produced service. However, intermediate consumption in the current case differs from present calculations because it also includes the debt guarantee premium implicitly charged by equity holders $\left(r_E - \bar{r}^{SE}\right) E$, whose ownership positions in the enterprise comprise E. It is the insurance (guarantee) input from equity holders allows the enterprise to issue produced liquidity $-\left(r_D - \bar{r} \iota\right)'_{-} D$ on the far left hand side.

Operating surplus is the last line of (11), whose first term is the user cost of nonfinancial assets and whose second, bracketed term is an adjustment for the differences in cost of capital between the enterprise in question and the various units supplying it with financial services. This term is at first difficult to compare with the expression for operating surplus under the primary service treatment of liquidity in equation (10). However, under the assumption that all institutional sectors have the same cost of capital, the adjustment term in brackets vanishes, in which case operating surplus for the leveraged enterprise in the produced liquidity service case is less than it is in the primary liquidity service case.

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[25] F also includes any equity assets held by the bank. We suppose that the FISIM margins associated with these terms are usually nonnegative and thus in the left hand side, output term $\left(r_F - \bar{r} \iota\right)'_{+} F$, rather than the right hand side, input term $-\left(r_F - \bar{r} \iota\right)'_{-} F$.

In this canonical case, treating liquidity as a produced service is shown, not surprisingly, to eliminate financial instruments from the enterprise capital stock (thus no *primary* liquidity services), leaving only nonfinancial assets. Otherwise, if the uniform cost of capital assumption does not hold, operating surplus also reflects the difference between the bank's cost of funds and that of the suppliers of liquidity to the bank—$\left(\bar{r} - \bar{r}^{SF} \right) \iota'_{F_-} F$, likely nonnegative—the cost of funds advantage the bank has over its debt holders (including depositors)—$-\left(\bar{r} - \bar{r}^{SD} \right) \iota'_{D_+} D$, likely nonnegative—and the cost of funds advantage the bank has as compared with its investors (equity holders)—$-\left(\bar{r} - \bar{r}^{SE} \right) E$, also likely nonnegative.

In the produced liquidity case, then, financial instruments ultimately have no role in productive capital other than to enable funders to benefit from a lower cost of capital than they otherwise could obtain. If there are no intersectoral differences in the cost of capital to exploit, this role of financial instruments in productive capital vanishes.

Discussion

In the (enhanced) produced service treatment of liquidity, each institutional sector's importance in the generation of liquidity is in proportion to the low yielding (below cost of capital) debt it *issues*, but each institutional sector also generates leverage risk insurance (guarantees) in proportion to its ownership of the equity in (leveraged) banks. In this treatment, the major contributors of liquidity services in the economy will be the *issuers* of low yielding debt, prominently banks, while households and general government will be much less prominent. On the other hand, leveraged enterprises will contribute little to the risk bearing allowing bank debt guarantees, but households and government will be prominent and thus bear much of this leverage risk. Indeed, to the extent that enterprises have equity interests in one another, any leverage premia they earn and the associated financing risks they bear ultimately lead to resident household and government units or to nonresidents.

In the primary service treatment of liquidity, each institutional sector's importance in generation of liquidity is in proportion to the low yielding (below cost of capital) financial assets it *owns*. Thus, for example, sectors having large *holdings* of deposits, such as households and general government, will be major contributors to aggregate liquidity services generated in the economy. It is notable that, because only low yielding financial assets appear as capital assets, commanding rents within operating surplus, equity, as a rule, has no role as a capital asset in the primary services approach to liquidity.[26] Thus, as noted in the previous section, in the produced service treatment of liquidity, equity has the principal role among financial assets in productive capital (it is the source of risk bearing giving rise to the debt guarantee services banks implicitly purchase from their equity holders), in contrast with the primary service treatment of liquidity, where debt assumes a productive capital role for all sectors.

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[26] The user cost of high cost (e.g., revolving) debt (borrowed liquidity) is an intermediate consumption in both the produced and primary service treatment of liquidity.

Empirical application

Data

We will use three datasets to examine the implications of the foregoing sections. We will adopt standard international terminology in referring to the institutional sectors of the economy, shown in Table 1.

- To shed light on the impact of the cost of funds reference rate in calculating the nominal output of the SNA's "Other deposit taking corporations" sector (S122), we will use information from the Federal Deposit Insurance Corporation's (FDIC's) "Call Reports," which provide detailed quarterly financials and (very) limited production indicators on every FDIC insured depository institution in the US.

- To show the evolution of the interaction between the SNA's "Central bank" (Federal Reserve System) sector (S121) and the "Other deposit taking corporations, except the central bank" sector (S122, hereafter referenced compactly as "Other deposit taking corporations"), we also look at data from the audited Annual Financial Reports of the Federal Reserve System.[27]

- To examine the risk intermediation/liquidity services of not only the Financial corporations sector, but also the SNA Nonfinancial corporations sector, we examine the annual Integrated Macroeconomic Accounts (IMA) from the Bureau of Economic Analysis.

Table 1. 2008 SNA Institutional Sectors

Sector	Code
Nonfinancial corporations	S11
Financial corporations	S12
Central bank	S121
Other deposit taking corporations, except the central bank	S122
Money market funds (MMFs)	S123
Non-MMF investment funds	S124
Other financial intermediaries, except insurance corporations and pension funds	S125
Financial auxiliaries	S126
Captive financial institutions and money lenders	S127
Insurance corporations	S128
Pension funds	S129
General government	S13
Households	S14

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[27] Quarterly unaudited financial reports are available beginning in 2012.

Results

The US financial corporations sector

The SNA "Financial corporations" institutional sector (S12) is shown in the IMA as the "Financial business" sector. Data are provided annually from 1960 on the components of the cost of funds as well as balance sheet items needed to determine the cost of funds reference rate prevailing for this sector. [28] We calculate the cost of funds by summing the interest paid by the Financial corporations sector, plus its account servicing on deposits, plus interest paid on debt securities, plus loan interest, [29] plus operating surplus.

We include account servicing on deposits because equation (3) is written in terms of the security equivalent returns on liability instruments. Monetary interest paid is lower than the security equivalent value and thus $r_D \leq \hat{r}_D$. Hence, to get the security equivalent rate on deposits, we have to impute it. By implication, we add the difference between the imputed security equivalent interest and interest paid on deposits (which is deposit account servicing) to interest paid on deposits. Our security equivalent imputation for deposits here is the rate the financial institution pays on its debt security liabilities.

Because Deposit taking corporations are quantitatively important generators of produced liquidity FISIM, we provide, in addition to financial corporations sector, estimates for the

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[28] The Integrated Macroeconomic accounts also are available at quarterly frequency, but at this frequency do not include a breakdown of property income into interest and other property income, which we will find useful.

[29] To determine the cost of funds reference rate, the empirical results of this paper use a "funder pays the spread" principle for loans, for which the interest rate is generally higher than the security equivalent rate. Under this principle, the security equivalent interest cost of the loan *liabilities* of sectors is simply the measured loan interest. That is, it is not necessary to determine a security equivalent rate of interest for loans from the borrower perspective to calculate the cost of funds, because *borrowers* do not see the charge for loan account servicing. Instead, *funders* see this charge, as part of the overall cost of asset management. Allocation of FISIM to sectors under "funder pays the spread" requires us to know sectors' participation in the liability portfolios of leveraged enterprise sectors by instrument (including their participation in equity funding). Some data of this type are available in the US flow of funds accounts, but they are not comprehensive. The US, as a member of the G-20, will be developing counterparty sector breakdowns, by instrument, of the IMA financial transactions and balance sheet accounts as part of the G-20 Data Gaps Initiative. See Recommendation 15 of the Financial Stability Board and IMF to the G-20 Central Bank Governors and Finance Ministers at http://www.financialstabilityboard.org/publications/r_131014.htm. The *1993* and *2008 SNA* allocate all loan FISIM output according to the borrowing rather than the funding sector, so "funder pays the spread" will generate a slightly higher reference rate for banks than had we followed the last two SNA versions to the letter. Our use of "funder pays" is convenient and empirically not consequential for banks, because their loan funding is relatively small. Even so, "funder pays" is perhaps logically easier to justify than the prevailing accounting standards' "borrower pays" allocation of loan FISIM to using sectors. In an earlier note, we drew attention to the fact that the SNA inconsistently takes a "funder pays" approach to the asset management service charge (the "expense ratio") levied by investment funds, but a "borrower pays" approach to the same asset management service fee within loan FISIM that is implicitly charged by banks on their loan portfolios.

Central bank (SNA subsector S121)—the Federal Reserve System—and the Other deposit taking corporations sector (SNA subsector S122). Data for S121 subsector are available annually (and since 2012, quarterly, but on an unaudited basis) in various issues of the Annual Financial Report of the Federal Reserve System. Data for the S122 sector are available quarterly from the Federal Deposit Insurance Corporation (FDIC) website. Although FDIC data are available over a reasonably long history, we consider the data from 2001.

First we consider the "Other deposit taking corporations" sector (S122) for the US using quarterly data from the FDIC for 2001Q1-2011Q2. Figure 1 shows the cost of funds reference rate (equation (3)) computed using the FDIC information essentially as it is used in the US national accounts, a calculation of the cost of funds reference rate adjusting the historical costing of, particularly nonfinancial, assets in the FDIC data to market value (using market valuation of equity), and an estimate of the cost of funds reference rate taking account of holding gains and losses on financial assets reported to the FDIC. In principle, the SNA prescribes market valuation for all financial instruments except deposits, loans, and other accounts receivable/payable, as well as for nonfinancial assets. So the market valuation of equity in principle takes all of these into account. We market value bank equity using Thomson Reuters DataStream information on the price to book ratio for US financial corporations. In general, the market valuation adjustments have a small negative impact on the cost of funds reference rate, mainly because of the understatement of the value of nonfinancial assets in the FDIC and IMA Financial business data.
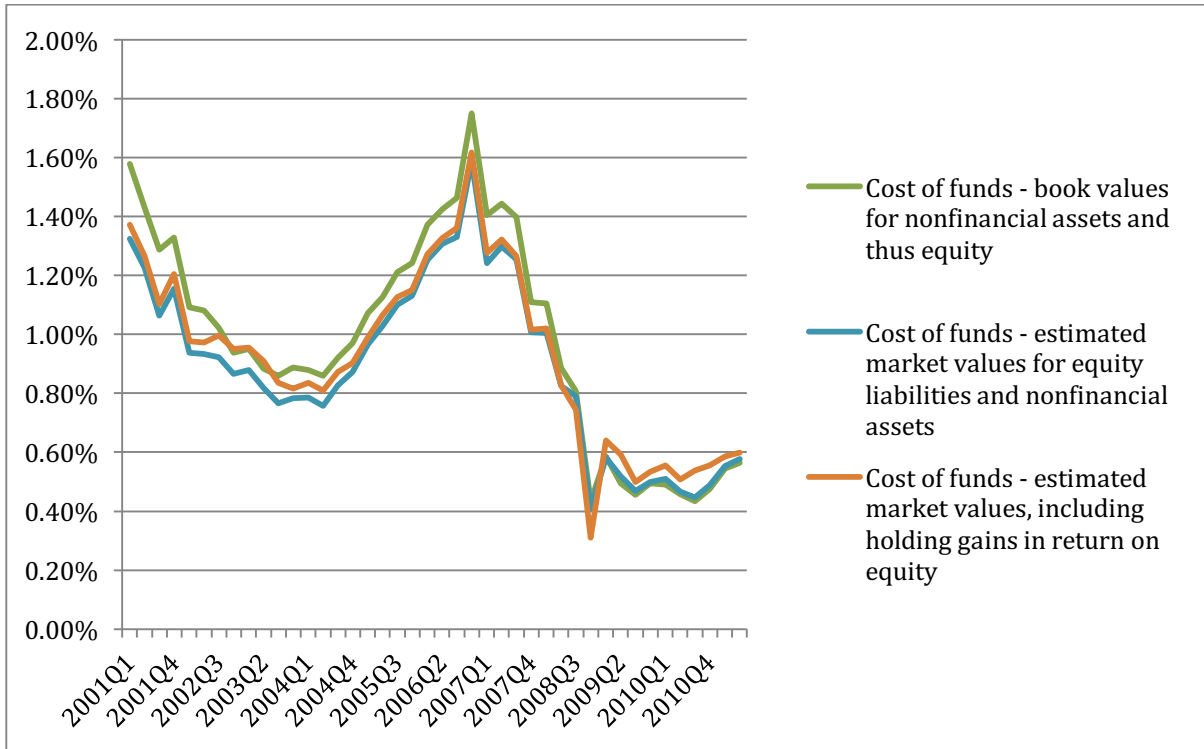
Figure 2 shows the risk intermediation component of FISIM. Regardless of market valuation adjustments, risk intermediation is a substantial fraction of SNA-type FISIM in US data ranging from a historical high of 50 percent (40 percent for market value adjusted data) to a low of 10 percent (post crisis), not surprisingly exhibiting substantial volatility during the 2007-2009 financial crisis period.

Figure 2. The share of liquidity services (risk intermediation) in FISIM for US Other deposit taking corporations (S122)
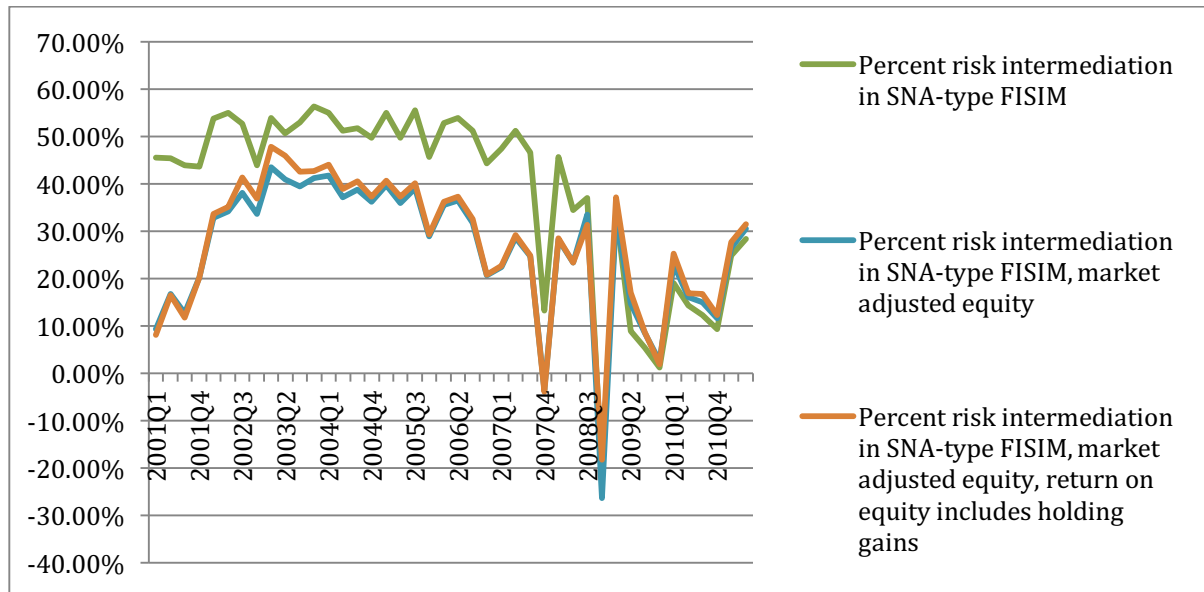
Figure 3 shows the nominal level of FISIM for the Other deposit taking corporations sector (S122) during 2001Q1-2011Q2, including total FISIM, its risk intermediation component, and the sum of its asset management and asset and liability account servicing components. Figure 3 shows that asset FISIM is on an upward trend (if sometimes choppy) with a small dip through the financial crisis, while including liquidity services (risk intermediation), as in the present national accounting treatment, produces substantial business cycle sensitivity, cratering in 2008 and then recovering to the previous trend. Were liquidity services treated as primary services only, only asset FISIM would have been included in US banking output.

Figure 4 shows the evolution of the cost of funds reference rate of the Federal Reserve System (S121) at annual frequency, compared with the FISIM of the Other deposit taking corporations (S122) sector aggregated to comparable annual frequency. Of interest in Figure 4 is how the central bank (S121) cost of funds moved upward during 2008-2010, countering the plunge in the cost of funds of Other deposit taking corporations (S122). The reason for the increase in the central bank cost of funds was the significant policy increase in the size of the central bank balance sheet, fueled by the accumulation of riskier and higher yielding assets, including eventually mortgage backed securities, which raised profitability, operating surplus, and thus the cost of funds for the central bank. Since interest costs on the debt components of the central bank's liability side did not rise, the rise in the cost of funds would have lifted the risk intermediation component of FISIM on the liability side of the central bank balance sheet as the gap

Figure 3. Impact of liquidity services (risk intermediation) on FISIM for US Other deposit taking corporations (S122)
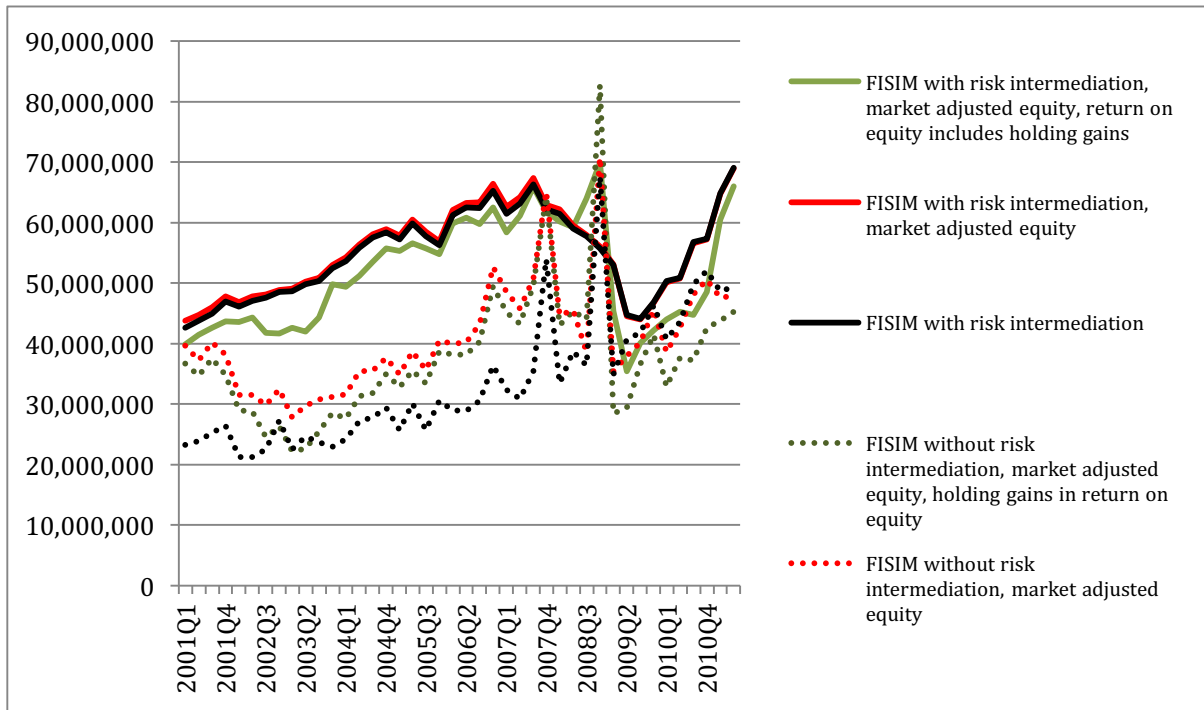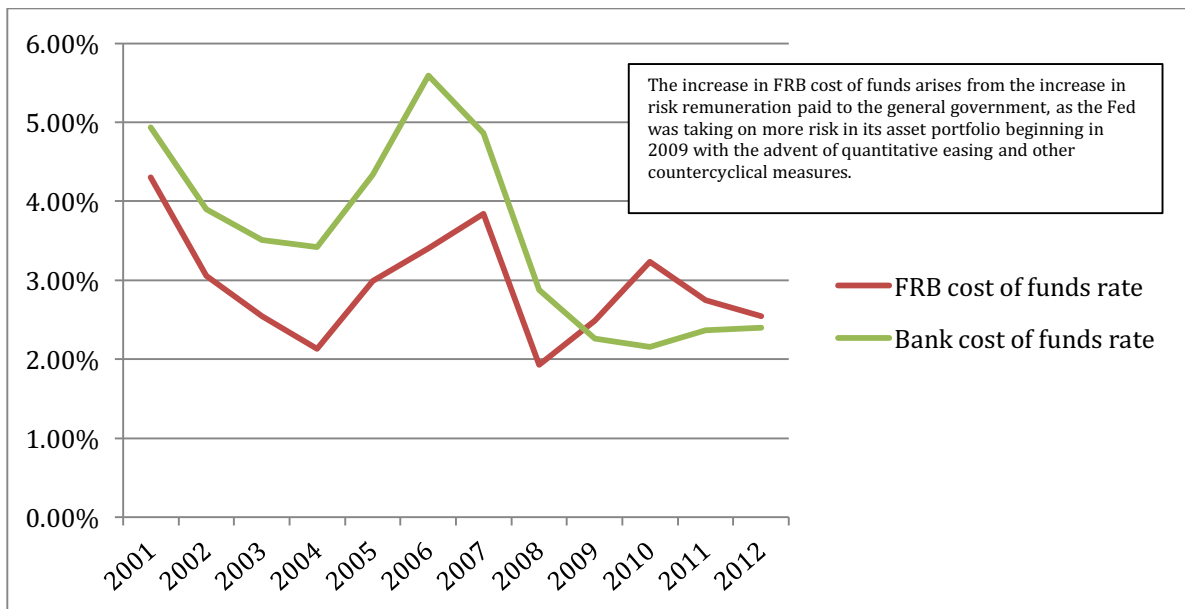

Figure 4. Cost of funds of US Central bank (S121) versus Other deposit taking corporations (S122)

between the central bank's cost of funds and the low interest rates paid on its liabilities widened, reflecting the increase in leverage risk the central bank was taking on.[30]

Liquidity services from the US nonfinancial corporations sector

Figure 5 shows how FISIM for the US nonfinancial corporations sector (S11) and financial corporations sector (S122) has evolved during 2001-2011 based on the annual IMA data. The cost of funds in this case is calculated by considering the liability sides of the balance sheets, first, of the US Nonfinancial corporate business sector within the SNA Nonfinancial corporations (S11) sector, and second, of the US Financial business sector, equivalent to the SNA Financial corporations (S12) sector. As with the high frequency detail from the Deposit taking corporations (S121 and S122) subsectors of Financial corporations (S12),[31] we impute the security equivalent cost of funds of deposit liabilities for the Financial corporations sector as the measured liability debt security rate of return from the IMA. Since only financial corporations have deposit liabilities, we need no imputations to compute the average cost of funds for the US Nonfinancial corporate business sector from the IMA data. Figure 5 also shows the FISIM calculated for the central bank (FRB). The central bank results in Figure 5 are predicated on the Federal Reserve Notes component of the Fed's liabilities paying no interest to the holders of these instruments as assets. [32]

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[30] The central bank's accumulation of higher yielding (and riskier) assets effectively raised its cost of funds by increasing its profits and operating surplus, while the interest cost of its liabilities remained minimal.
[31] Financial corporations includes a number of other types of financial corporations besides the deposit taking corporations considered earlier, including in addition Money market funds (S123), Non-money market investment funds (S124), Other financial intermediaries, except insurance corporations and pension funds (S125), Financial auxiliaries (S126), Captive financial institutions and money lenders (S127), Insurance corporations (S128), and Pension funds (S129).
[32] The accounts of the Federal Reserve Banks refer to payment of their profits to the central government, over and above a limited distribution to the commercial banks (S122) that are presumed to own them, as "Interest on Federal Reserve Notes." If, alternatively, this payment is treated as interest on assets of the central government in the form of "Federal Reserve Notes" issued by the central bank and owned by the central government, the risk intermediation FISIM of the central bank would be significantly smaller than shown in Figure 4. Treated as in Figure 4, these profits are part of central bank operating surplus and thus are part of its risk intermediation FISIM. While the two treatments imply the same cost of funds, the Figure 4 treatment of currency implies a much larger differential in returns paid to liability holders between currency (zero) and central bank net worth (all residuals earned by the central bank in excess of the amount paid to commercial banks), where central bank net worth is presumed owned by the government. The alternative treatment to the one shown in Figure 5 would assign a large fraction of central bank profits as interest returns on currency (Federal Reserve Notes), leaving a smaller operating surplus residual earned by net worth.

Figure 5. FISIM of Nonfinancial (S11) and Financial (S12) Corporations
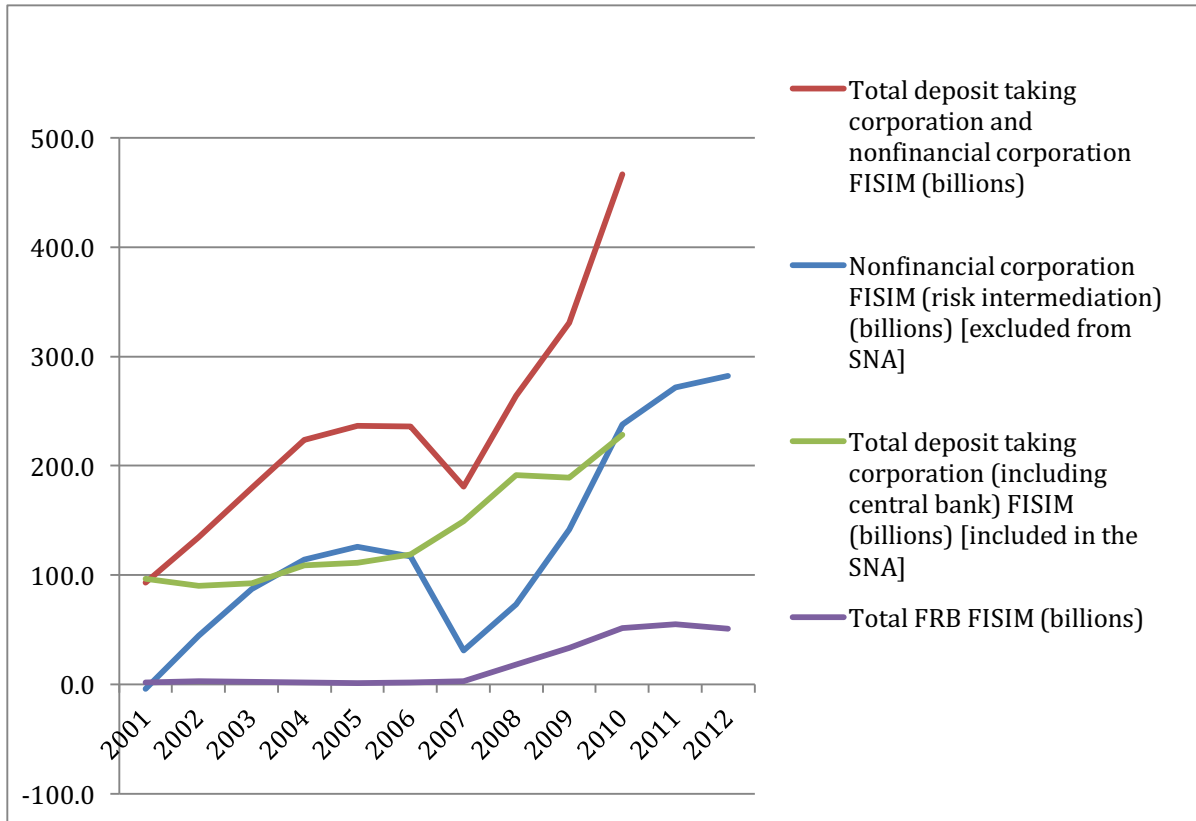
The takeaway from Figure 5 is that, although FISIM for the nonfinancial institutional sectors is not in scope for the SNA, they can produce substantial liquidity (risk intermediation) services when calculated using a cost of funds reference rate, on the same scale as that of Financial corporations, when measured the same way SNA-type FISIM measures it for Financial corporations. These sectors' leverage (share of debt in total liabilities) is significantly lower than that of financial corporations, implying lower risk intermediation FISIM for the nonfinancial sectors as a percentage of output, and they produce little financial asset FISIM. However, they together generate about 15 times the value added of financial corporations. Thus, even though their level of risk intermediation is comparable to that of financial corporations, it is much less important in their overall output than for financial corporations.

Again, the SNA does not consider FISIM to apply to sectors other than Financial corporations or to financial instruments other than deposits and loans, so the comparison shown here would constitute a "satellite" or "memorandum" to the core set of national accounts.

Concluding remarks

Coverage of banking services at current prices has been a subject of discussion since national accounts standards were initiated in the 1940s. In this paper we have viewed this long running conversation through the lens of measuring liquidity, with an emphasis on how the well established national accounting standards measure liquidity and attribute it to deposit taking institutions. We have addressed two long running issues among national accountants by arguing first that the "reference rate" for the SNA's "FISIM" output measure is the enterprise cost of capital, for each deposit taking and loan making enterprise in the economy, and second that the SNA output measurement principle for banks applies not only to deposits, but to all debt funding whose full interest cost lies below banks' cost of capital. Further, once applied to banks, the same liquidity measurement principle applies to the debt funding of nonbank enterprises whose full interest cost lies below their costs of capital. The result of this would be to significantly increase the role of liquidity services in measures of national output from their current level. Such broad measures of financial services would align the SNA's output of liquidity services with the already standard broad liquidity measure in money and banking statistics.

We explain that the SNA's "produced liquidity" can be seen as the result of a "risk intermediation" process operating through banks (and other debt financed enterprises), whereby the debt guarantee service equity holders inherently provide to depositors and other debt holders enables "safe" assets such as deposits as well as the produced liquidity services provided to the holders of those assets. The cost of funds reference rate implies that the value of the guarantee provided by equity funders, which we term the equity leverage premium, is identically equal to the produced liquidity the SNA would assign to banks with such a reference rate.

We also take note that the SNA's traditional approach to liquidity measurement, by assigning its production to banks, is not the only way of presenting the accounts. Liquidity could be seen, not as a service produced by financial institutions and sold to other units in the economy, but solely as a primary (capital) service, produced by the owners of, for example, deposits, for their own use, as would be the case with the services from nonfinancial capital assets. Although this would reduce the importance of banks (as well as other debt funded—and thus liquidity producing—institutional units in the economy) in national output, the total contribution of liquidity services would not diminish, because nonmarket production of liquidity for own use by household and government units would offset the declines from banks (and other debt-funded *market* institutional units whose output is sold at what the SNA calls economically significant prices). This alternative, primary services approach to liquidity services is consistent with the way recent critics of the SNA would measure bank financial services from deposit (but not loan) instruments.

Users of the accounts ultimately would need to weigh in on which presentation meets their analytical needs. We think the traditional "produced liquidity" approach of the SNA is consistent with the way people normally think of the services provided by financial institutions, and that it provides a well defined linkage between the financial and nonfinancial sectors of the economy. And "produced liquidity" is not inconsistent with

the dynamic microeconomic analysis leading to, for example, Divisia monetary aggregates, and whose direct application generates "primary services liquidity." "Produced liquidity" is the supply value of liquidity services for which dynamic microeconomic modeling provides the demand value.

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