Measuring Productivity in the System of National Accounts

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Abstract

The paper reviews some of the measurement problems that are associated with measuring sectoral Total Factor Productivity growth rates. The paper notes that the production accounts in the present System of National Accounts (SNA) need to be extended somewhat in order to be suitable as a data base for measuring sectoral productivity growth rates. In particular, the treatment of exports, imports and indirect taxes is not completely adequate for productivity measurement purposes in the present SNA. Finally, the paper considers some of the problems that are associated with the measurement of banking sector outputs and the System of National Accounts FISIM (Financial Intermediation Services Indirectly Measured) imputations.

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Total factor productivity growth, production accounts, System of National Accounts, exports and imports in the input output accounts, the measurement of banking sector output, FISIM, Financial Intermediation Services Indirectly Measured.

1. Introduction

In section 2 of this paper, we will provide a bit of an overview of some of the measurement problems that arise whenever we want to measure the productivity growth of an establishment, firm, industry or economy. This overview will show that the KLEMS framework is not the end of the story but it is a good beginning.

In section 3, we will consider some of the problems with the production accounts in the *System of National Accounts 1993* (*SNA 1993*) that make one cautious about the validity of industry Total Factor Productivity (TFP) growth estimates that use national statistical agency real input output tables as inputs into their productivity estimates.

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In section 4, we will consider some of the problems that are associated with the measurement of banking sector outputs and the System of National Accounts FISIM (Financial Intermediation Services Indirectly Measured) imputations.

Section 5 offers a brief conclusion.

2. General Problems for the Measurement of Total Factor Productivity

In this section,[2] we will look at some of the general problems that arise when we attempt to measure the Total Factor Productivity of an enterprise, industry or economy. The methodology for measuring the TFP of a production unit is due to Jorgenson and Griliches (1967) (1972) and will not be repeated here. Basically, TFP growth between two time periods for a production unit is equal to a quantity index of output growth (or net output growth) divided by a quantity index of input growth.[3]

2.1 Gross Outputs

In order to measure the productivity of a firm, industry or economy, we need information on the outputs produced by the production unit for each time period in the sample along with the average price received by the production unit in each period for each of the outputs. In practice, period by period information on revenues received by the industry for a list of output categories is required along with either an output index or a price index for each output. In principle, the revenues received should not include any commodity taxes imposed on the industry's outputs, since producers in the industry do not receive these tax revenues. The above sentences sound very straightforward but many firms produce thousands of commodities so the aggregation difficulties are formidable. Moreover, many outputs in service sector industries are difficult to measure conceptually: think of the proliferation of telephone service plans and the difficulties involved in measuring insurance, gambling, banking and options trading.

2.2 Intermediate Inputs

Again, in principle, we require information on all the intermediate inputs utilised by the production unit for each time period in the sample along with the average price paid for each of the inputs. In practice, period by period information on costs paid by the industry for a list of intermediate input categories is required along with either an intermediate input quantity index or a price index for each category. In principle, the intermediate input costs paid should include any commodity taxes imposed on the intermediate inputs, since these tax costs are actually paid by producers in the industry. On the other hand, taxes that fall on the outputs produced by the production unit should be excluded for productivity measurement purposes.[4]

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[2] This section draws heavily on Diewert (2001).

[3] Diewert and Morrison (1986) and Kohli (1990) provide an exact index number justification for this methodology based on flexible functional form production theory. Note that no separability assumptions about outputs and inputs are required using this methodology.

[4] These conventions for the treatment of indirect taxes on outputs and intermediate inputs when measuring productivity date back to Jorgenson and Griliches (1972; 85).

The major classes of intermediate inputs at the industry level are:

- materials
- business services
- leased capital.

The current input–output framework deals reasonably well in theory with the flows of materials but not with intersectoral flows of contracted labour services or rented capital equipment. The input-output system was designed long ago when the leasing of capital was not common and when firms had their own in house business services providers. Thus there is little provision for business services and leased capital intermediate inputs in the present system of accounts. With the exception of the manufacturing sector, even the intersectoral value flows of materials are often incomplete in the industry statistics (due to the lack of surveys).

This lack of information means the current input–output accounts will have to be greatly expanded to construct reliable estimates of real value added by industry. At present, there are no surveys (to our knowledge) on the interindustry flows of business services or for the interindustry flows of leased capital. Another problem is that using present national accounts conventions, leased capital resides in the sector of ownership, which is generally the Finance sector. This could lead to a large overstatement of the capital input into Finance and a corresponding underestimate of capital services into the sectors actually using the leased capital unless some care is taken in reconciling the primary and intermediate input accounts for owned and leased capital services. We will look at this problem in more detail in section 4 below.

It should be noted that at the level of the entire market economy, intermediate inputs collapse down to just imports plus purchases of government and other nonmarket inputs. This simplification of the hugely complex web of interindustry transactions of goods and services explains why it may be easier to measure productivity at the national level than at the industry level. We will pursue this point in more detail in section 3 below.

2.3 Labor Inputs

Using the number of employees as a measure of labour input into an industry will not usually be a very accurate measure of labour input due to the long term decline in average hours worked per full time worker and the recent increase in the use of part time workers. However, even total hours worked in an industry is not a satisfactory measure of labour input if the industry employs a mix of skilled and unskilled workers. Hours of work contributed by highly skilled workers generally contribute more to production than hours contributed by very unskilled workers. Hence, it is best to decompose aggregate labour compensation into its aggregate price and quantity components using index number theory. The practical problem faced by statistical agencies is: how should the various categories of labour be defined? Alternative approaches to this problem are outlined in Jorgenson and Griliches (1967), the Bureau of Labor Statistics (1983), Denison (1985),

Jorgenson, Gollop and Fraumeni (1987) and Jorgenson and Fraumeni (1989) (1992). Dean and Harper (1999) provide an accessible summary of the literature in this area.

Another important problem associated with measuring real labour input is finding an appropriate allocation of the operating surplus of proprietors and the self employed into labour and capital components. There are two broad approaches to this problem:

- If demographic information on the self employed is available along with hours worked, then an imputed wage can be assigned to those hours worked based on the average wage earned by employees of similar skills and training. Then an imputed wage bill can be constructed and subtracted from the operating surplus of the self employed. The reduced amount of operating surplus can then be assigned to capital.
- If information on the capital stocks utilised by the self employed is available, then these capital stocks can be assigned user costs and then an aggregate imputed rental can be subtracted from operating surplus. The reduced amount of operating surplus can then be assigned to labour. These imputed labour earnings can then be divided by hours worked by proprietors to obtain an imputed wage rate.

The problems posed by allocating the operating surplus of the self employed are becoming increasingly more important as this type of employment grows in many countries. Fundamentally, the problem appears to be that the current SNA does not address this problem adequately.

2.4 Reproducible Capital Inputs

When a firm purchases a durable capital input, it is not appropriate to allocate the entire purchase price as a cost to the initial period when the asset was purchased. It is necessary to distribute this initial purchase cost across the useful life of the asset. National income accountants recognize this and use depreciation accounts to do this distribution of the initial cost over the life of the asset. However, national income accountants are reluctant to recognize the interest tied up in the purchase of the asset as a true economic cost. Rather, they tend to regard interest as a transfer payment. Thus the user cost of an asset (which recognizes the opportunity cost of capital as a valid economic cost) was not regarded as a valid approach to valuing the services provided by a durable capital input by many national income accountants and in SNA 1993 in particular. However, if a firm buys a durable capital input and leases or rents it to another sector, national income accountants regard the induced rental as a legitimate cost for the using industry. It seems very likely that the leasing price includes an allowance for the capital tied up by the initial purchase of the asset; i.e., market rental prices include interest. Hence, it seems reasonable to include an imputed interest cost in the user cost of capital even when the asset is not leased. Put another way, interest is still not accepted as a cost of production in the SNA, since it is regarded as an unproductive transfer payment. But interest is productive; it is the cost of inducing savers to forego immediate consumption. This difficulty with SNA 1993 has been recognized in the current revision process for the internationally approved System of National Accounts and the next version of these accounts will probably allow for a decomposition of gross operating surplus in the

accounts into price and quantity components where the price of capital services will be a user cost concept; see Schreyer (2007a) for the latest proposal.

The treatment of capital gains on assets is even more controversial than the national accounts treatment of interest. In the national accounts, capital gains are not accepted as an intertemporal benefit of production but if resources are transferred from a period where they are less valuable to a period where they are *anticipated* to be more highly valued, then to user cost proponents, a gain has occurred; i.e., capital gains are productive according to this view.

However, the treatment of interest and capital gains pose practical problems for statistical agencies. For example, which interest rate should be used?

- An ex post economy wide rate of return which is the alternative used by Christensen and Jorgenson (1969) (1970)?
- An ex post firm or sectoral rate of return? This method seems appropriate from the viewpoint of measuring ex post performance.
- An ex ante safe rate of return like a Federal Government one year bond rate? This method seems appropriate from the viewpoint of constructing ex ante user costs that could be used in econometric models.
- Or should the ex ante safe rate be adjusted for the risk of the firm or industry?

Since the ex ante user cost concept is not observable, the statistical agency will have to make somewhat arbitrary decisions in order to construct expected capital gains. This is a strong disadvantage of the ex ante concept. On the other hand, the use of the ex post concept will lead to rather large fluctuations in user costs, which in some cases will lead to negative user costs, which in turn may be hard to explain to users. However, a negative user cost simply indicates that instead of the asset declining in value over the period of use, it rose in value to a sufficient extent to offset deterioration. Hence, instead of the asset being an input cost to the economy during the period, it becomes an intertemporal output. For further discussion on the problems involved in constructing user costs, see Diewert (1980; 470-486) (2005a) (2006) and Schreyer (2001) (2007a). For evidence that the choice of user cost formula matters, see Harper, Berndt and Wood (1989).

A further complication is that our empirical information on depreciation rates for reproducible assets is often weak. In general, we do not have good information on the useful lives of assets. In past years, the UK statistician assumed that machinery and equipment in manufacturing lasted on average 26 years while the Japanese statistician assumed that machinery and equipment in manufacturing lasted on average 11 years; see the OECD (1993; 13).[5]

[5] The Economic and Social Research Institute (ESRI), Cabinet Office of Japan, under the direction of Koji Nomura, has implemented a new survey on retirements and sales of assets which should lead to better estimates of depreciation rates for capital stocks in Japan. Canada, the Netherlands and New Zealand have similar surveys.

A final set of problems associated with the construction of user costs is the treatment of business income taxes: should we assume firms are as clever as Hall and Jorgenson (1967) and can work out their rather complex tax–adjusted user costs of capital or should we go to the accounting literature and allocate capital taxes in the rather unsophisticated ways that are suggested there?

2.5 Inventories

Because interest is not a cost of production in the national accounts and the depreciation rate for inventories is close to zero, many productivity frameworks neglect the user cost of inventories. This leads to misleading productivity statistics for industries where inventories are large relative to output, such as retailing and wholesaling. In particular, rates of return that are computed neglecting inventories will be too high since the opportunity cost of capital that is tied up in holding the beginning of the period stocks of inventories is neglected.

The problems involved in accounting for inventories are complicated by the way accountants and the tax authorities treat inventories. These accounting treatments of inventories are problematic in periods of high or moderate inflation. A treatment of inventories that is suitable for productivity measurement can be found in Diewert and Smith (1994). These inventory accounting problems seem to carry over to the national accounts in that for virtually all OECD countries, there are time periods where the real change in inventories has the opposite sign to the corresponding nominal change in inventories. This is difficult for users to interpret.[6]

2.6 Land

The current SNA has no role for land as a factor of production, perhaps because it is thought that the quantity of land in use remains roughly constant across time and hence it can be treated as a fixed, unchanging factor in the analysis of production. However, the quantity of land in use by any particular firm or industry does change over time. Moreover, *the price of land can change dramatically over time and thus the user cost of land will also change over time and this changing user cost will, in general, affect correctly measured productivity*.[7]

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[6] See Diewert (2005b) for a more coherent framework for measuring inventory change and the user cost of inventories.

[7] Diewert and Lawrence (2000; 285) in their Canadian TFP study showed that neglecting land and inventories decreased the TFP growth rate by about 20%; i.e., when land and inventories were omitted as factors of production with their own user costs, the Canadian TFP growth rate fell from 0.68 percent per year over the period 1962-1996 to 0.55 per cent. In a similar study for Japan, Nomura (2000; 347) showed that the Japanese TFP growth rate fell from 1.54 percent per year over the period 1960-2000 to 0.80 percent per year when land and inventories were omitted. These studies indicate the importance of including land and inventories as productive factors in productivity studies. Due to lack of data, EUKLEMS does not have land or inventory services as primary inputs in its data base; see Timmer, O'Mahony, and van Ark (2007).

Land ties up capital just like inventories (both are zero depreciation assets). Hence, when computing ex post rates of return earned by a production unit, it is important to account for the opportunity cost of capital tied up in land. Neglect of this factor can lead to biased rates of return on financial capital employed. Thus, industry rates of return and TFP estimates may not be accurate for sectors like agriculture which are land intensive.

In many countries, the long run trend in the price of land can be higher than the opportunity cost of capital for the sector that is using the land as an input into its production function. This means that even the ex ante user cost of land can be negative which can lead users to question the user cost methodology. The problem of negative user costs can also arise in the context of finding a price for the use of an owner occupied dwelling unit. In this CPI context, Diewert (2007a; 27) suggested the following solution to the negative user cost problem:

> We conclude this section with the following (controversial) observation: perhaps the "correct" opportunity cost of housing for an owner occupier is not his or her internal user cost but the *maximum* of the internal user cost and what the property could rent for on the rental market. After all, the concept of opportunity cost is supposed to represent the *maximum sacrifice* that one makes in order to consume or use some object and so the above point would seem to follow. If this point of view is accepted, then at certain points in the property cycle, user costs would replace market rents as the "correct" pricing concept for owner occupied housing, which would dramatically affect Consumer Price Indexes and the conduct of monetary policy.

The same logic could be applied to the problem of finding prices for the use of commercial and industrial land in productivity accounts: the "correct" *opportunity cost price* is the *maximum* of the financial opportunity cost for using the land during the accounting period (its ex ante user cost) and the market rent for the use of the land during the period. If this point of view were adopted, the problem of negative user costs would vanish.

As a final complication, property taxes that fall on land must be included as part of the user cost of land. However, it may not be easy to separate the land part of property taxes from the structures part.

2.7 Resources

The costs of using up nonrenewable natural resources should also be included in a productivity framework as should environmental degradation and pollution costs. However, since the current SNA 1993 makes no provision for these costs and most countries have not developed data on these costs, we will just mention this topic as one that deserves attention in the next revision of the System of National Accounts. When data on natural resource stocks and environmental "bads" are made available in the SNA, then we will be able to measure TFP growth in a more satisfactory manner.

2.8 Other Stocks and the Capitalization of R&D Problem

There are also additional types of capital that should be distinguished in a more complete classification of commodity flows and stocks such as knowledge or intellectual capital, patents, trademarks, working capital or financial capital, infrastructure capital and

entertainment or artistic capital.[8] Knowledge capital, in particular, is important for understanding precisely how process and product innovations (which drive TFP growth) are generated and diffused. Basically, knowledge capital is society's set of recipes or blueprints for production functions.

R&D expenditures generally add to society's stock of knowledge. The immediate importance of R&D expenditures is that the current revision process for the international System of National Accounts will recommend capitalizing R&D expenditures. There are many unresolved issues surrounding exactly how to measure the benefits of R&D expenditures and exactly how to depreciate the costs of R&D investments over time.[9] A major problem is that there is a tendency in the R&D literature to treat R&D stocks as just another form of reproducible capital which depreciates just like structures or machines. However, R&D depreciation is not at all like wear and tear depreciation: knowledge capital depreciates due to obsolescence (new and better goods and processes replace existing new goods and new processes) or to shifts in household tastes. Moreover, the *competitive model of producer behavior* serves as the backbone of the existing SNA production accounts but the development of new goods and processes is all about obtaining a competitive advantage and producers must recover their R&D expenditures by setting prices above the marginal costs of production; i.e., *innovation almost always involves noncompetitive pricing and monopolistic markups*. Thus the capitalization of R&D expenditures in the revised SNA is far from straightforward and doing this job properly will lead to big changes throughout the national accounts. The present Jorgenson and Griliches (1967) (1972) growth accounting methodology will also have to be extensively revised in order to account for knowledge expenditures in a realistic manner.

3. The Treatment of Exports, Imports and Indirect Taxes in the SNA

The measurement problems that were discussed in the previous section are general problems that arise when we attempt to measure the productivity of any establishment, industry or economy. However, there are additional measurement problems that arise when the gross output and intermediate input accounts in the *System of National Accounts 1993* are used to measure the productivity growth of industrial sectors. In particular, in this age of globalization, we would like to see how exports and imports contribute to the productivity growth of particular industries in the economy. The production accounts in *SNA 1993* does not allow us to do this.

The main problem areas with the production accounts in SNA 1993 are as follows:

- The main supply and use tables in the production accounts[10] do not show exports produced by industry and imports used by industry;

[8] See Corrado, Haltiwanger and Sichel (2005) for papers on these topics.
[9] See Diewert (2005a; 533-537) for a discussion of these accounting problems.
[10] See Table 15.1 in Eurostat, IMF, OECD, UN and the World Bank (1993)

- The supply and use tables concentrate on the allocation of *values* of outputs produced and *values* of inputs used but do not give any guidance on how to construct *real* supply and use tables and
- The role of indirect taxes on outputs and intermediate inputs is not completely spelled out nor is the reconciliation of estimates of real GDP at final demand prices built up from final demand components versus estimates of real GDP built up using information on industry outputs and intermediate inputs.

We will briefly discuss each problem in turn.

The first problem is easy to remedy, at least conceptually: all that is needed is a refinement of the commodity classification that is used in the present supply and use tables: a gross output that is being produced by a particular industry in a particular commodity category would be further distinguished as being supplied to the domestic market or as an export while an intermediate input that is being used by a particular industry in a particular commodity category would be further distinguished as being purchased from a domestic supplier or from a foreign supplier and hence in the latter case, would be classified as an import into the sector. Making the above changes to the main production accounts in SNA 1993 would not be a dramatic methodological leap since the present SNA already suggests the above treatment of intermediate inputs as a supplementary table; see Table 15.5 in Eurostat, IMF, OECD, UN and the World Bank (1993). However, implementing the above extension of the commodity classification in the main production accounts would entail a considerable increase in the costs of producing the national accounts.[11] However, if we want to trace through the implications of globalization and outsourcing to its effects on particular industries (and in particular, its effects on productivity by industry), the above suggestion would seem to be the only way forward.[12]

The second problem is methodologically much more difficult. Since the *SNA 1993* does not give much advice on how to construct real supply and use matrices, countries that produce constant dollar input output matrices tend to use the following methodology that has evolved over the years:

- Construct gross output price indexes using a PPI methodology for the 200 to 1000 commodities that are distinguished by the statistical agency in its supply and use tables;
- Use these output based PPI indexes to deflate the cells in the corresponding commodity row along all of the industry columns of the matrix of gross output values produced during the accounting period in order to obtain a matrix of real gross outputs by commodity and industry (which is a real make matrix) and

[11] In particular, the country's Producer Price Index program would require extra funding along with increased expenditures on import and export surveys. The proposed IMF *Export Import Price Index Manual* will be methodologically consistent with the existing PPI Manual; see the IMF, Eurostat, ILO, OECD, World Bank and the UN (2004) for the PPI methodology.

[12] For a more detailed discussion of how exports and imports could be introduced into the production accounts, see Diewert (2007b) (2007c).

- Again use the output based PPI indexes to deflate the cells in the corresponding commodity row along all of the industry columns of the matrix of intermediate input values purchased during the accounting period in order to obtain a matrix of real intermediate inputs by commodity and industry (which is a real use matrix).

The statistical agency then may note that total real supply by commodity does not equal the corresponding total real demand by commodity and various balancing exercises are made in order to achieve balance between supply and demand.

Unfortunately, the above procedures used to construct real supply and use matrices are not conceptually sound. The main problem is this: *not all of the transactions in a single homogeneous commodity take place at the same price*. A seller of a commodity will often change the selling price during the reference period and since purchases of the commodity will be somewhat sporadic over the period, different purchasers will face different average prices for the same time period. This problem could be handled in one of two ways:

- Across the commodity row of the make and use matrices, we could have industry specific prices or
- We could expand the make and use tables so that we distinguish the delivery of goods and services by the purchaser and the seller.

In the second method, the average price for the buyer and seller, arranged in bilateral pairs, would always be the same but of course, the dimensionality of the supply and use tables would be expanded enormously.[13]

The above problem is not the only one with existing statistical agency methods for constructing real use and make matrices. Another important problem is *aggregation bias*; i.e., the commodity classification used in real use and supply matrices is not "pure"; each commodity category will consist of hundreds if not thousands of specific products or items. Since producers will generally not make each of the products in each of the commodity classes and purchasers will not purchase each item in fixed proportions, again we see that the assumption that a *single* price index can be used to deflate *every* entry along a commodity row in a supply or use matrix is very dubious indeed.

The tentative conclusion that we can draw from the above considerations is that real use and supply matrices as presently constructed will generally have substantial aggregation errors imbedded in them. *Hence industry productivity estimates must be viewed with some caution*. Economy wide productivity estimates are likely to be much more accurate because statistical agencies have generally devoted considerable amounts of resources in order to obtain good deflators for the components of final demand whereas the problem

[13] This second method of arranging the make and use matrices was followed in Chapter 19 of the PPI Manual and in Diewert (2005c) (2007b) (2007c). This second method seems to be the most conceptually sound but of course, it would be impossible for statistical agencies to implement it in practice. However, it could be partially implemented and the method serves as a useful benchmark for evaluating possible biases in existing methods.

of finding PPI deflators has not had a high priority until recently when more accurate productivity estimates by industry have been requested by users.

The third problem with the SNA production accounts that we mentioned at the beginning of this section had to do with the role of indirect taxes on outputs and intermediate inputs and the reconciliation of estimates of real final demand GDP with estimates of real GDP built up from the production accounts. We will not explain these problems in detail except to say that they can be solved with the addition of a bit more information on indirect taxes by commodity and industry in some expanded supply and use tables.[14]

4. Price and Output Measurement for Financial Services

One of the most difficult to measure parts of the System of National Accounts and the Consumer and Producer Price Indexes is the measurement of the outputs (and the inputs) of the financial sector. The pricing of financial services is so controversial that there has not been general agreement on how to measure the *value* of various types of financial services like banking and insurance outputs and there is even less agreement on how to measure the *quantity* (or *price*) of financial services.[15] Most Consumer Price Indexes, including the U.S. CPI, exclude many financial services because CPI methodology regards these services as costs of moving consumption from one period to another period and hence regards these costs as being out of scope. However, Fixler (2007) makes a case for including these transactions costs in a CPI:

"Similarly, professional fees that are associated with financial management, such as accounting, are included in CPIs while fees for services such as financial advice, or portfolio management are generally excluded. However, this notion is inconsistent with the fact that the purchase of financial services by a consumer is consumption in the current period even though the purpose of the services is to increase income in subsequent periods. Therefore, these services should be included in the domain of a CPI. In principle, all financial services should be candidates for inclusion in a CPI."

The point that Fixler makes is that since households are spending their resources on these financial services, they must be getting some benefit or utility from the purchase of these products and hence these products belong in the CPI. However, proponents of excluding these products from the CPI might argue in return that these products seem to be unconnected to this period's consumption so perhaps they should be regarded as part of the household's home production sector and hence be excluded from the current period CPI, which is supposed to measure the price of current consumption. This point of view could be accepted except that we need to ensure that these costs are captured somewhere in the household accounts. On the other hand, advocates of Fixler's position could respond by saying that it is well established that the inputs purchased by households for home production, which in turn produces final consumption services, are generally in scope for a CPI and so we are back to Fixler's position.

Fixler (2007) constructs a financial services price index for households in the U.S. by using the BEA's data base on Personal Consumption Expenditures. The two

[14] See Diewert (2005c) for a treatment of these problems in a closed economy context and Diewert (2007b) (2007c) for an open economy treatment.

[15] The best reference on measurement problems in the services sector in general, including financial services, is probably Triplett and Bosworth (2004). For a (positive) review of their work, see Diewert (2005d). See also Schreyer and Stauffer (2003) on financial services measurement problems.

controversial components in Fixler's experimental household financial services index are imputed household bank deposit services and imputed household loan services. We will explain Fixler's theoretical user cost framework for modeling these two components of household financial services in a bit of detail (using somewhat different notation than he used) because this will help introduce the reader to some of the difficult issues that arise in this banking literature.

Following Fixler (2007), suppose that the *household reference rate of return on safe assets* is r_R for the period under consideration and the banking sector pays on average an interest rate of r_D on bank deposits. Then the *beginning of the period user cost* u_D of holding a dollar of deposits (on average) throughout the period will be:[16]

(1) $u_D \equiv 1 - (1 + r_D)/(1 + r_R) = (r_R - r_D)/(1 + r_R)$.

Thus the depositor gives up one unit of purchasing power at the beginning of the period in exchange for deposit services but gets back his or her deposit at the end of the period plus the amount of interest that the bank pays for deposits held during the period, r_D. However, money received at the end of the period is worth less than money received at the beginning of the period and so the end of period money received, $1 + r_D$, must be divided by 1 plus the depositor's opportunity cost of financial capital, r_R. Thus the net cost of holding one dollar of deposits over the period is 1 less $(1 + r_D)/(1 + r_R)$,which is the nominal user cost of money. Usually, the household reference rate r_R will be greater than the bank deposit rate r_D. Note that the costs and benefits of holding the bank deposit are discounted to the beginning of the period. However, it is possible to reverse discount the costs and benefits to the end of the period and this leads to the following *end of the period user cost* U_D of holding a deposit:[17]

(2) $U_D \equiv (1 + r_R)\, u_D = r_R - r_D$.

End of period user costs are more consistent with accounting conventions and they are simpler to interpret so we will work with them in what follows.

Given the end of period user cost for a bank deposit, U_D, and the (asset) value of household bank deposits V_D, the *imputed (nominal) value of bank deposit services*, S_D, is defined as the product of U_D and V_D:

(3) $S_D \equiv U_D V_D = (r_R - r_D)V_D$.

However, the above model is not quite a complete one; i.e., we have not specified what the real quantity of deposit services is; (3) just defines the nominal value of deposit services. In order to determine what the real quantity of monetary services is, it is necessary to ask exactly what the purpose of these household deposits are. If the purpose is to buy consumer goods and services, then it seems reasonable to deflate V_D by the

[16] For additional material on the user cost of money and bank deposits, see Diewert (1974), Barnett (1978), Donovan (1978) and Fixler and Zieschang (1991) (1992) (1999).
[17] See Diewert (2005a; 485-486) for a discussion of beginning and end of period user costs.

corresponding consumer price index (excluding financial services), P_C say, and define the *real quantity of bank deposit services*, Q_D, as follows:[18]

(4) $Q_D \equiv V_D/P_C$.

Using (3) and (4), we see that the final price for bank deposit services must be P_D defined as follows:

(5) $P_D \equiv (r_R - r_D)P_C = S_D/Q_D$.

It should be noted that Fixler did not use a consumer price index P_C in order to form real balances Q_D; instead he used the U.S. gross domestic purchases chain price index as his deflator.[19]

Fixler goes on to derive the net benefit to a bank of a consumer loan. Fixler assumes that the bank has the same opportunity cost for financial capital as households so that the bank's reference rate is also r_R and it makes loans to households at the rate of interest r_L which is greater that r_R. Then the *beginning of the period user benefit* u_L to the bank of making a household loan is:

(6) $u_L \equiv -1 + (1 + r_L)/(1 + r_R) = (r_L - r_R)/(1 + r_R)$.

Fixler assumes that households face the same price u_L as the user cost of their loans from the bank. Now we can follow through the same logic that was used in equations (2)-(5) and define the household *end of the period user cost* U_L of taking a bank loan by (7):

(7) $U_L \equiv (1 + r_R)\, u_L = r_L - r_R$.

Given the end of period household user cost for a bank loan, U_L, and the (asset) value of household bank loans V_L, the *imputed (nominal) value of household bank loan services*, S_L, is defined as the product of U_L and V_L:

(8) $S_L \equiv U_L V_L = (r_L - r_R)V_L$.

Note that S_L just defines the nominal value of household loan services. In order to determine what the real quantity of monetary services is, it is necessary to ask exactly what the purpose of these household loans are. If the purpose is to make home renovations or purchase a car, then the corresponding loan values should probably be

[18] Since prices are discounted to the end of the period, P_C should be the consumer price index value that corresponds to the end of the period in order to reflect opportunity costs at that time. Feenstra (1986) provides a formal model of a cash in advance economy that justifies the deflation of nominal household bank balances by a consumer price index.

[19] Here is perhaps our first point of controversy in this literature: what exactly is the "right" deflator to be used in (4) in order to form real balances? Basu in his commentary on Fixler notes that we need an appropriate theoretical framework in order to decide this question and other questions which will follow. The problem is that "practical" price statisticians and national income accountants need answers which are at least approximately consistent with economic theory (and relatively simple so that they can be explained to the public) right now but there is little professional consensus on what the "right" model is.

deflated by these prices. Although Fixler does not deflate V_L by a different deflator than the one he used to deflate household bank deposits, it is simple enough conceptually to deflate V_L by a more appropriate deflator, P_A say, and define the *real quantity of bank household loan services*, Q_L, as follows:

(9) $Q_L \equiv V_L/P_A$.

Using (8) and (9), we see that the final price for household bank loan services must be P_L defined as follows:

(10) $P_L \equiv (r_L - r_R)P_A = S_L/Q_L$.

In his paper, Fixler (2007) uses the above theory in order to construct various alternative financial services price indexes using BEA quarterly data over the period 1987-2003 and finds (not surprisingly) that the various alternative treatments do make a difference.

Basu (2007), in his commentary on Fixler's paper, notes the ambiguity in choosing the deflator for converting nominal financial values into real ones:

"But what is the right price index? One might divide by the GDP deflator, on the grounds that it is the most comprehensive, or by the CPI, on the grounds that consumers use bank deposits to buy consumption goods. When issues of this importance are left ambiguous, it is usually a sign that more detailed theorizing is necessary."

Basu is surely on target in his criticism of the *details* of the user cost approach to defining nominal and real bank outputs. Two questions arise from the brief exposition of the user cost approach outlined above:

- Should the *same* reference rate be used for defining the user costs for household bank deposits and for household bank loans?
- What are the appropriate price deflators to convert nominal financial service flows into real flows? In particular, should these deflators be the *same* across the suppliers and users of financial capital?[20]

We agree with Basu that more detailed theories are required in order to answer the above questions.

Basu goes on to criticize another aspect of the above user cost approach to modeling the price and quantity of financial services in that he is critical of equations (4) and (9) above, which define the real quantity of financial services as being proportional to stocks of financial assets held by banks or households. Basu suggests that *direct measures* of the services rendered by consuming financial services be constructed and then the nominal service flows would be deflated by these direct measures, yielding an implicit price index for the services, as an alternative to deflating nominal asset holdings by a price index. Basu then completes his commentary by outlining his alternative approach which has been jointly developed by himself and Christina Wang and John Fernald; see

[20] The answer to this last question is: probably not. The deflator for the supplier of the funds should be the price of the foregone alternative while the price to the user of the funds should be related to the intended use of the funds.

Wang, Basu and Fernald (2007). In principle, there can be no objection to Basu's suggested approach: a value aggregate is equal to the product of price times quantity so if we know the value and either price or quantity, that is all that is required. The devil is in the details; i.e., a detailed model developed by user cost advocates such as Fixler can be compared to the detailed model developed by Basu and his coworkers and users can decide which framework seems more reasonable.

The above material provides an introduction to Wang, Basu and Fernald (2007) (hereafter referred to as WBF), who also present a framework for defining bank output, both nominal and real. WBF are critical of the SNA 1993 method for defining the value of banking output services and so it will be useful to first discuss the measurement of banking services in the context of the System of National Accounts (SNA).

With the exception of banking services (or financial intermediation services more generally), SNA 1993 treats interest payments as transfer payments in the primary distribution of income accounts; i.e., interest flows are generally treated as primary input flows between sectors. In order to understand the treatment of banking services advocated by WBF, it will be useful to construct a very simple model of the value flows in a three sector model of a closed economy. The three sectors are H, the household sector, B, the banking sector and N, the nonfinancial production sector. The price and quantity of explicitly priced banking services are P_B and Y_B and the price and quantity of nonfinancial consumption are P_N and Y_N respectively. The price and quantity of nonfinancial, nondurable primary inputs (labour) for the banking sector are W_B and X_B and for the nonfinancial sector are W_N and X_N respectively. Only consumers hold deposit balances of V_D in beginning of the period dollars and the bank interest rate on deposits is r_D. Only the production sector secures financial capital from the banking sector and the value of these loans at the beginning of the period is V_L and the associated one period interest rate is r_L. Finally, the beginning of the period value of household loans and equity capital to the banking sector is V_{EB} and to the nonfinancial production sector is V_{EN} and the rates of return on these investments (including imputed rates of return on equity capital) are r_{EB} and r_{EN} respectively.[21] With the above definitions, we can now put together a picture of the intersectoral flows in the economy in Table 1.[22]

Table 1: Modified SNA Intersectoral Value Flows with no Imputations

Row	**H**	**B**	**N**
	Net	**Output**	**Flows**

[21] All of these prices can be interpreted as ex ante expected prices or ex post actual realized prices depending on the purpose of the accounts at hand.

[22] *SNA 1993* does not correspond precisely to the flows laid out in Table 1; i.e., neglecting the FISIM imputations, rows 3-5 in Table 1 would be consolidated in *SNA 1993* as *net operating surplus*, which in turn is equal to the row 1 entries less the row 2 entries. We will follow Rymes (1968) (1983) and regard net operating surplus as a repository for *interest waiting services*, which we regard as a primary input. Thus we have changed net operating surplus from a balancing item in the SNA to a reward for postponing consumption, a service whose price is the interest rate.

1	$P_BY_B + P_NY_N$	P_BY_B	P_NY_N
	Primary	**Input**	**Flows**
2	$W_BX_B + W_NX_N$	W_BX_B	W_NX_N
3	$r_{EB}V_{EB} + r_{EN}V_{EN}$	$r_{EB}V_{EB}$	$r_{EN}V_{EN}$
4	r_DV_D	r_DV_D	0
5	0	$- r_LV_L$	r_LV_L

The value flows in each row of column H in Table 1 are equal to the sum of the corresponding value flows in columns B and N so that each row reflects the fact that the value of household demand (or supply) for each commodity equals the corresponding aggregate production sector supply (or demand) for the same commodity.[23] We also assume for simplicity that the value flows in row 1 of the table are equal to the sum of the value flows in rows 2-5 of the table for each column so that there are no net savings in the economy. These two sets of adding up assumptions mean that we can estimate Net National Product (NNP)[24] in nominal terms in any one of four ways:

- As the value in row 1 and column H (final demand NNP);
- As the sum of the values in row 1 and columns B and N (production accounts sum of value added across industries);
- As the sum of the values in rows 2-5 and column H (household net income), or
- As the sum of the values in rows 2-5 and columns B and N (production accounts distribution of primary factor income generated by production).

There is nothing problematic about the entries in rows 1-3 of Table 1. However, problems arise when we *consolidate* the interest flows listed in rows 3-5. The total interest income received by households is the sum of equity and direct loan interest income received from the banking sector and the nonfinancial production sector, $r_{EB}V_{EB} + r_{EN}V_{EN}$, plus bank interest paid on household bank deposits, r_DV_D. This is not a problem nor is the fact that the nonfinancial sector pays out interest payments of $r_{EN}V_{EN}$ to households and r_LV_L to the banking sector. The problem is that the consolidated net interest payments made by the banking sector to other sectors, $r_{EB}V_{EB}$ (equity and loan interest payments to households) plus r_DV_D (interest payments to households for the use of their bank deposits) less r_LV_L (loan interest received from the nonfinancial production sector), will be a negative number in all real life economies.[25] This negative number will decrease the value added generated by the banking sector and if explicit fee revenue is

[23] Since the value flows in rows 1, 2 and 3 of Table 1 are not controversial, we have aggregated the various value flows across commodities to make the table smaller.

[24] We have not introduced a separate investment sector so it can be thought of as being part of the general nonfinancial production sector N. We are implicitly assuming that depreciation is treated as an intermediate input and acts as an offset to gross investment.

[25] Formally, this will be true in our simplified model if explicit fee bank revenue, P_BY_B, is less than bank nonfinancial primary input payments, W_BX_B.

zero, the value added of the banking sector will turn out to be zero as well. Thus the contribution of the banking sector to NNP seems to be understated.

The 1993 version of the System of National Accounts (SNA) recognized the above problem that banking sector output seemed to be understated in the SNA production accounts as they were originally designed.[26] It is worth quoting in some detail the solution that SNA 1993 suggested for this problem:

"Some financial intermediaries are able to provide services for which they do not charge explicitly by paying or charging different rates of interest to borrowers or lenders (and to different categories of borrowers and lenders). They pay lower rates of interest than would otherwise be the case to those who lend them money and charge higher rates of interest to those who borrow from them. The resulting net receipts of interest are used to defray their expenses and provide an operating surplus. This scheme of interest rates avoids the need to charge their customers individually for services provided and leads to the pattern of interest rates observed in practice. However, in this situation, the System must use an indirect measure, financial intermediation services indirectly measured (FISIM), of the value of services for which the intermediaries do not charge explicitly.

"The total value of FISIM is measured in the System as the total property income receivable by financial intermediaries minus their total interest payable, excluding the value of any property income receivable from the investment of their own funds, as such income does not arise from financial intermediation. Whenever the production of output is recorded in the System, the use of that output must be explicitly accounted for elsewhere in the System. Hence FISIM must be recorded as being disposed of in one or more of the following ways—as intermediate consumption by enterprises, as final consumption by households, or as exports to non-residents. ...

"For the System as a whole, the allocation of FISIM among different categories of users is equivalent to reclassifying certain parts of interest payments as payments for services. This reclassification has important consequences for the values of certain aggregate flows of goods and services—output, intermediate and final consumption, imports and exports—which affect the values added of particular industries and sectors and also total gross domestic product (GDP). There are also implications for the flows of interest recorded in the primary distribution of income accounts." Eurostat, IMF, OECD, UN and the World Bank (1993, pp.139-140).

As can be seen from the above, it is not a trivial matter to make an imputation in the SNA. Unfortunately, the banking imputation solution suggested by SNA 1993 was soon attacked on the details of its implementation; it proved to be difficult to figure out how to do the imputations for banking services, taking into account the exclusion of the property income generated by the banking sector's own funds.[27] Thus we will not examine the details of the FISIM imputation; instead, we will provide our own solution to the understatement of banking sector output in the SNA.

As a first step towards a resolution of the banking problem, we could take the loan and deposit interest flows of the banking sector out of the primary input flows and instead, treat them as output or intermediate input flows. Thus in Table 2, we have taken lines 4 and 5 out of Table 1, changed the signs of these entries and inserted the resulting lines into the Net Output flows of the accounts. Note that this reclassification of primary input flows into net intermediate input flows does not change the profitability of each sector

[26] Earlier versions of the SNA also recognized that there was a problem measuring banking output.
[27] See Hill (1996) for an early influential criticism of the SNA's FISIM imputation and Sakuma (2006) for a comprehensive review of the criticisms of the FISIM imputation.

and the demand equals supply restrictions on the production and use of commodities are still maintained.[28]

Table 2: Reclassified SNA Intersectoral Value Flows with no Imputations

Row	**H**	**B**	**N**
	Net	**Output**	**Flows**
1	$P_BY_B + P_NY_N$	P_BY_B	P_NY_N
2	$- r_DV_D$	$- r_DV_D$	0
3	0	r_LV_L	$- r_LV_L$
	Primary	**Input**	**Flows**
4	$W_BX_B + W_NX_N$	W_BX_B	W_NX_N
5	$r_{EB}V_{EB} + r_{EN}V_{EN}$	$r_{EB}V_{EB}$	$r_{EN}V_{EN}$

Note that our reclassification of some of the primary input income flows into net intermediate input flows has the effect of decreasing NNP; i.e., the new NNP is equal to the sum of rows 1 and 2 down column H (and of course, there are three other ways of calculating NNP) which is $P_BY_B + P_NY_N - r_DV_D$, which is less than the Table 5 NNP of $P_BY_B + P_NY_N$. The net output of the banking sector is now the sum of explicit fee income, P_BY_B, plus its loan interest revenue, r_LV_L, less its deposit interest payments to households, $- r_LV_L$. Thus the banking sector's net interest income is the difference $r_LV_L - r_DV_D$, and thus the industry is treated as a kind of financial margin industry, similar to wholesaling or retailing, except that the product being bought and sold is the use of financial capital for one period instead of specific goods. The net output of the nonfinancial production sector is now the value of nonfinancial goods and services produced less loan interest payments, $P_NY_N - r_LV_L$, which is (much) less than the corresponding contribution to NNP in Table 5, which was P_NY_N. Thus the net effect of the above reclassifications is to:

- Decrease NNP;
- Decrease the contribution of the nonfinancial production sector to NNP and
- Increase the contribution of the banking sector to NNP so that even if explicitly priced bank services are zero, the banking sector will make a positive contribution to production.

The accounting framework defined by Table 2 seems at first sight to be satisfactory but there are some residual problems remaining:

[28] The Table 2 accounting setup seems to be consistent with the Ruggles and Ruggles (1970) and Triplett and Bosworth (2004; 201) measure of bank output, which regarded banking as a margin industry similar to wholesaling or retailing.

- Household banking deposit services do not contribute anything to NNP; in fact, they are regarded as a *drain* on NNP;
- The output of the banking sector now seems to be too large compared to the output of the nonfinancial production sector, whereas before, it appeared to be too small and
- Explicit financial services of the banking sector to both households and to the nonfinancial sector (of the type discussed by Fixler (2007)) are not recognized in the above accounting framework.

We can now relate the above material to the contributions to the banking literature in Fixler (2007) and Wang, Basu and Fernald (2007). Fixler suggests that the contribution of deposit services to NNP should be $(r_R - r_D)V_D$ where r_R is a reference safe interest rate instead of the present negative contribution of $-r_DV_D$. Using Fixler's user cost of loans analysis, he would also suggest that the banking sector's service in providing loan services to the nonfinancial sector should be $(r_L - r_R)V_L$ instead of r_LV_L. WBF would go further and say that Fixler's suggested measure of banking loan services is still too large; they would replace $(r_L - r_R)V_L$ by $(r_L - r_{RB})V_L$ where r_{RB} is a reference rate which is higher than the safe interest rate r_R (but still lower than the bank lending rate of r_L) due to the inclusion of risk premium in r_{RB}. Basically, what WBF assume is that households take all the risks in the economy; banks have only a screening and monitoring of loans function, and the price for this service is collected via the (smaller) interest rate margin, $r_L - r_{RB}$.

Our task now is to show how the accounts in Table 2 can be modified to deal with the three difficulties noted above. We will be more general than Fixler at this stage and assume that the household opportunity cost reference rate for holding bank deposits is r_{RH} and we assume that the banks opportunity cost reference rate for raising capital for loan purposes is r_{RB}.[29] Thus the appropriate household value of deposit services is $(r_{RH} - r_D)V_D$ and the appropriate value of banking loan services is $(r_L - r_{RB})V_L$. We can obtain the entry $(r_{RH} - r_D)V_D$ in row 2 and column H of Table 3 by adding $r_{RH}V_D$ to the corresponding entry in Table 2. In order to offset this imputation and to ensure that the value of output is equal to the value of input by sector, we need to also add $r_{RH}V_D$ as an extra imputed income for the household sector; we do this in Table 3 by adding $r_{RH}V_D$ to household income in a new row 6, which accounts for our income imputations. But these two imputations to the household column of the accounts have upset the net demand equals net supply restrictions that our system of production accounts should possess. Hence we also need to add $r_{RH}V_D$ to rows 2 and 6 of the banking column of our accounts. A similar set of imputations will work for bank loans. Thus subtract $r_{RB}V_L$ from row 3 of column B in Table 2 and we obtain the WBF suggested measure of nominal banking loan services (provided that the banking reference rate r_{RB} contains the risk premium), $(r_L - r_{RB})V_L$. In order to ensure that the value of banking outputs equals the value of banking inputs, we need to subtract $r_{RB}V_L$ from the income components of the banking column and so we do this in row 6 of Table 3. Again, these two imputations to the banking

[29] Of course, if one feels that the reference interest rate (used to discount future cash flows) should be the same for households and banks, then we simply set the two reference rates to a common reference rate.

column of the accounts have upset the net demand equals net supply restrictions that our system of production accounts should possess. Hence we also need to add $r_{RB}V_L$ to rows 3 and 6 of the N column of our accounts. After making these eight imputations, the resulting system of accounts is given in Table 3.[30]

[30] The two zeros in Table 3 reflect our simplifying assumptions that (i) banks do not make loans to households and (ii) the nonfinancial sector does not hold any bank deposits. However, following our earlier logic, the reader can see how to relax these assumptions. The cost of relaxing these assumptions will be an additional eight imputations.

Table 3: Reclassified SNA Intersectoral Value Flows with Imputations

Row	**H**	**B**	**N**
	Net	**Output**	**Flows**
1	$P_B Y_B + P_N Y_N$	$P_B Y_B$	$P_N Y_N$
2	$(r_{RH} - r_D)V_D$	$(r_{RH} - r_D)V_D$	0
3	0	$(r_L - r_{RB})V_L$	$-(r_L - r_{RB})V_L$
	Primary	**Input**	**Flows**
4	$W_B X_B + W_N X_N$	$W_B X_B$	$W_N X_N$
5	$r_{EB} V_{EB} + r_{EN} V_{EN}$	$r_{EB} V_{EB}$	$r_{EN} V_{EN}$
6	$r_{RH} V_D$	$r_{RH} V_D - r_{RB} V_L$	$r_{RB} V_L$

The value of banking sector outputs in Table 3 now consists of three output terms instead of the previous two output terms (and one intermediate input term) in Table 3: the sum of explicitly priced services, $P_B Y_B$, bank deposit service margins, $(r_{RH} - r_D)V_D$, and bank loan margin services, $(r_L - r_{RB})V_L$. Assuming that these service margins are positive, it can be seen that the Table 3 NNP is larger than the Table 1 NNP which in turn is larger than the Table 2 NNP. Assuming that gross banking service margins, $r_L V_L - r_D V_D$ are greater than net banking service margins, $(r_L - r_{RB})V_L + (r_{RH} - r_D)V_D$, which in turn are positive, it can be seen that the banking sector makes the smallest contribution to NNP using the Table 1 accounting framework and the largest contribution using the Table 2 framework so that our final framework gives an intermediate sized contribution. The disadvantage of the Table 1 setup is that the banking sector makes no contribution to NNP. One advantage of the Table 3 setup over the Table 2 setup is that the separate contributions of the banking sector to the provision of deposit services and loan services is now explicit whereas in Table 2, we can see only an aggregate services contribution. Of course, a disadvantage of the Table 3 framework is that we now have to specify reference rates for deposits and loans and this may prove to be contentious.

Comparing the income sides of Tables 2 and 3, it can be seen that household nominal income (which is equal to nominal NNP) increases going from Table 2 to 3 by $r_{RH} V_D$, the product of the household reference interest rate r_{RH} times the value of household bank deposits, V_D. Turning to the production side of the income accounts, as we go from Table 2 to 3, it can be seen that the net income generated by the banking sector will decrease while the net income attributed to the nonfinancial production sector will greatly increase by the amount $r_{RB} V_L$, which is the reference interest rate for the banking sector, r_{RB}, times the value of bank loans to the nonfinancial production sector, V_L. Thus it appears that the series of imputations made going from Table 2 to 3 is one way of implementing the WBF view of the world where the banking sector simply acts as a

mechanism for transferring income generated by the nonfinancial production sector to the household sector.

Perhaps the biggest advantage of the Table 3 imputations framework is that *it can be readily integrated with a coherent system of sectoral productivity accounts*. The next revision of the SNA will make provision for capital services to appear in the production accounts. If we attempt to model the provision of capital services using the Table 2 accounting framework, we will have to convert the financial flows in rows 3 and 5 (which are the intermediate and primary input interest flows – $r_L V_L$ and $r_{EN} V_{EN}$ respectively) into the waiting services part of the user cost of capital,[31] so that capital services will appear in *both* the intermediate and primary input parts of the accounts. On the other hand, if we use the Table 3 framework, the flow of waiting services of capital will be collected together in rows 5 and 6 of the nonfinancial production sector accounts, $r_{EN} V_{EN}$ plus $r_{RB} V_L$, so that all of these capital services will appear *only* in the primary input accounts of the industries that use the capital services.[32] However, note that if the Table 3 accounting framework is used in constructing productivity accounts, then bank deposits should be treated as a capital asset in these accounts.

There are many other issues which are raised by the measurement of bank output and input and the FISIM imputations raised by the discussant of WBF, Schreyer (2007b). Schreyer noted that WBF focus on the *flow of financial services* whereas earlier strands of research focused on banks as *providers of financial capital* to borrowers. Roughly speaking, the WBF view of the world is the Table 3 view whereas the earlier view corresponds to Table 2. Schreyer raises a number of issues that arise out of the WBF paper:

- Do financial institutions take on any risk themselves or do the risks simply flow through to householders (or more generally, the sectors that make up final demand)?[33]
- What is the scope of financial services? In the European Union, Schreyer notes that the SNA measure of financial services is based solely on bank deposits and loans whereas the U.S. national accounts takes a wider perspective and considers all assets and liabilities that earn interest or imputed interest. We favour the wider perspective.

[31] Recall that we are assuming that the depreciation part of the user cost of capital appears as an intermediate input rather than as a primary input.

[32] Thus the financial service flows, $r_{EN} V_{EN}$ plus $r_{RB} V_L$, will be set equal to $r_A P_K K$ where r_A is an average of the interest rates r_{EN} and r_{RB}, P_K is the stock price of a unit of capital and K is the number of units of capital available for use by the nonfinancial firm at the beginning of the period. Thus the "right" price to deflate the nominal asset values V_L and V_{EN} into quantities would appear to be the asset price of capital, P_K. For an explicit intertemporal model for a financial intermediary sector which takes loans from households and uses these loans to purchase capital stocks and then to lease them out to producers, see Diewert (1977; 84).

[33] If there is only one household in the economy, then the WBF point of view seems to be justified; i.e., that all risk in the economy must be taken on by the single household. This justifies the Fixler point of view that the reference rate should be the same across sectors as well; however, WBF would argue that the single rate should be the risky rate and not the risk free rate. But when we turn to a world with many households, there is scope for different reference rates, reflecting the risk characteristics of households who hold bank deposits versus households who own shares in banks.

- The issues of imputed interest flows on equity capital and capital gains on assets arise. We agree with WBF and Schreyer that expected holding gains are an important part of the return to capital on many financial instruments and these expected holding gains should be included in income measures.
- There are some subtle issues involving the accounting treatment of loan services. According to WBF, the loan services provided by a bank are monitoring and screening services. However, the screening service occurs just before the loan occurs. If banks were able to charge a specific fee for this screening service, then there would be no accounting problems for the bank (but there would be accounting problems for the borrower since this transactions cost should probably be spread over the life of the loan, leading to an accounting problem). However, since banks are usually not able to charge a specific fee for their screening services, in this case, the imputed fee is equal to the discounted present value of the excess interest margins that they earn on the loan times the declining value of the loan. It will not be straightforward to calculate this expected present value in the period when the loan will be made and thus again, there is an accounting problem.
- The final problem that Schreyer raises is how to estimate the size of the risk premium. Empirical estimates of the risk premium seem to be too small but these estimates are based on expected utility maximization problems. Research has shown that we need to move to non-expected utility maximization frameworks in order to obtain more realistic estimates of the equity risk premium.

It can be seen that the measurement of banking sector outputs and inputs raises many significant methodological problems, not only for price measurement, but also for the System of National Accounts. There is also the possibility that the FISIM banking imputations lead to some problems in reconciling capital services input from productivity accounts with intermediate input capital services. More research on the role of financial intermediaries and their integration into the SNA is urgently needed.

5. Conclusion

From the list of problems that were discussed above, it can be seen that we are some distance away from being able to accurately measure the productivity performance of individual sectors of the economy due to difficulties in constructing real input output tables. The imputation problems caused by the SNA FISIM imputations may also make it difficult to measure industry productivity growth. Finally, if we want to trace out the effects of globalization by industry, changes to the SNA will be required.

My paper seems to be a bit negative. However, I do not mean to imply that it is not worthwhile undertaking productivity studies by industry; it is just that we have to realize that better data in the future may make the currently available estimates obsolete.

Another point that I wish to make in conclusion is that we must ask that governments provide more resources to statistical agencies so that we can better measure economic

growth, welfare and the productivity contributions of industry to improving welfare. It is not the fault of statistical agencies that the pace of technical progress has greatly increased in recent years, leading to a proliferation of new products and leading to difficulties with traditional matched model methods for constructing price indexes. On the other hand, it seems necessary that statistical agencies and international organizations concerned with economic measurement provide governments and the public a well thought out plan for improving economic measurement in coming years.

Academics can also play a role in improving economic measurement by providing practical methodologies for measuring the prices of goods and services in difficult to measure areas such as banking.

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