Summary of the Roundtable on the Upcoming Revision to the UN System of National Accounts held at the National Bureau of Economic Research Summer Institute 2005, Conference on Research on Income and Wealth Workshop, July 25, 2005 held at the Royal Sonesta Hotel, Cambridge, Massachusetts. The 30 people who attended the workshop included a mixture of productivity research and national accounting specialists.

August 31, 2005

Roundtable Speakers:

Charles Hulten, University of Maryland and NBER
Barbara Fraumeni, Bureau of Economic Analysis
Tarek Harchaoui, Statistics Canada
Jacques Mairesse, CREST-INSEE and NBER

Summary Editors:

W. Erwin Diewert, University of British Columbia and NBER
Charles Hulten, University of Maryland and NBER

1. Summary of Charles Hulten's Discussion

Hulten noted that the current international System of National Accounts was put in place in 1993 and is in the process of being revised. He noted that the Canberra II Group on Capital Measurement has played a key role in providing technical advice on what revisions should be considered.

Hulten identified *three key issues* that were discussed in the Canberra Group that are of great interest to the larger economics community:

> Should capital services be introduced into the production accounts of the SNA?
> Should Research and Development expenditures be capitalized and introduced into the accounts as an asset?
> Should a rate of return be imputed to capital that is being utilized by the general government sector?[1]

At the conclusion of the Roundtable, Hulten canvassed the audience and the answer to the above three questions was *yes* in all cases.

Hulten then provided a bit of background information on how capital would fit into the usual circular flow diagrams of an economy that are illustrated in introductory textbooks on economics. The details of his exposition may be found in Hulten (2005).

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[1] If a user cost approach is adopted for the market sector of the economy, then in order for the government sector to be treated in a symmetric manner, a real rate of return should be imputed to government capital. In the present SNA, only depreciation is recognized as a cost of production associated with the use of capital in the general government sector.

Hulten noted that at first glance, it seems straightforward to introduce user costs and capital services[2] into the production accounts since the proposal amounts to a decomposition of gross operating surplus into depreciation, return to capital employed, capital taxes and revaluation terms.[3] However, the details involved in implementing this seemingly straightforward proposal are formidable. However, Hulten noted that the forthcoming volume edited by Jorgenson, Landefeld and Nordhaus (2005) actually provides these details for the U.S. economy; see in particular Jorgenson and Landefeld (2005). He also noted that effects of the imputation of a real rate of return for general government capital used in the U.S. to GDP would be substantial since the value of government capital in the U.S. in 2000 amounted to approximately $5 trillion.[4]

Hulten went on to note that although he favored capitalizing R&D expenditures and including them in the production accounts, he also favored capitalizing a wider class of expenditures. In fact, he suggested capitalizing any expenditure that will at least partially increase future consumption; the details of his position may be found in Corrado, Hulten and Sichel (2005).[5]

Hulten concluded his presentation by asking why capital services had not been included in the SNA previously. He thought that there might be two reasons:

> One side of the Cambridge Controversy on Capital maintained that it was not possible to measure capital services and so naturally, adherents of this position would not favor including capital services in the production accounts.
> There are many difficult practical measurement issues that stand in the way of actually implementing capital services in the production accounts in a reproducible way.[6]

2. Summary of Barbara Fraumeni's Discussion

Fraumeni began her presentation by noting a *fifth* major issue that was discussed in the SNA revision process:

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[2] Early papers which explain and implement these concepts for the U.S. are Jorgenson and Griliches (1967) (1972) and Christensen and Jorgenson (1969) (1970). These papers led to the first official statistical agency productivity program; see the Bureau of Labor Statistics (1983).

[3] Thus the basic structure of the current system of accounts is preserved (with the exception of the possible imputation of a real rate of return for general government capital).

[4] Thus the imputation of a 4% real rate of return would add approximately $200 billion in 2000 or an approximate 20% increase in GDP.

[5] Table 3 in Corrado, Hulten and Sichel (2005) provided rough estimates for the value of 9 types of intangible capital for the U.S. over the period 1990-2000. The 9 categories were: (1) computer software; (2) computerized data bases; (3) science and engineering research and development; (4) mineral exploration; (5) spending for the development of entertainment and artistic originals usually leading to a copyright or license; (6) other product design, development and research expenses not necessarily leading to a patent or copyright; (7) advertising expenditures and market research for the development of brands and trademarks; (8) firm specific human capital and (9) organizational structure: costs of organizational change and development and company formation expenses.

[6] We will return to this topic later in this summary.

Should the services of consumer durables be included in the capital accounts?

Fraumeni went on to list criteria that had been suggested at the beginning of the revision process for considering changes to the SNA. The criteria are the following ones:

There should be no *fundamental* changes to the SNA.

Revisions could be considered if there are new issues in the economy that demand a new treatment.

Old issues can be reconsidered only if there are new developments that warrant a reconsideration of the issues.

Users should be demanding the suggested changes.

Any revisions should be consistent with the Balance of Payments Manual and the Government Finance Statistics Manual.

It should be feasible for statistical agencies to carry out the suggested changes at reasonable cost.

Applying the above criteria, the last meeting of the AEG made the following decisions:

Accepted for Further Consideration

Capital services
Capitalization of R&D
Imputing a net return to government capital
Capitalization of military durables

Not Accepted for Consideration

Consumer durables

Fraumeni then explained the above decisions of the AEG in more detail.

Capital services would appear in supplementary tables.

All R&D (for profit R&D and public R&D) is to be capitalized with one possible exception.[7]

The decision on imputing a net return to government capital was deferred.

Developing countries were concerned about the poor quality of their capital stock estimates.

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[7] Countries can choose to capitalize or not capitalize freely available R&D based on practical considerations. The inclusion of public R&D was somewhat controversial since typically, an asset is considered to be an SNA asset only if ownership rights can be asserted. From this point of view, freely available R&D would not be an asset; see de Haan (2004) for an elaboration of this argument. However, it was pointed out that public roads have the same character and yet they appear in the present SNA as a general government asset.

> Some European countries were concerned about the large potential impact of a rate of return opportunity cost imputation on government capital on the relative size of their GDP.

Fraumeni went on to discuss the problems involved in capitalizing R&D in more detail. She noted that R&D was seriously considered for inclusion as an asset in SNA 1993 but was ultimately rejected. She also noted that a significant number of countries now have R&D satellite accounts, including the U.S.,[8] France, [9] Israel, [10] the Netherlands [11] and Canada.[12] Fraumeni noted that satellite accounts are a natural way to test a new methodology before it is introduced into the core accounts.

Fraumeni spent some time discussing the problems involved in defining R&D and determining its scope. These problems are discussed in Aspden (2005) and Robbins (2005). She concluded this part of her discussion by noting that the Canberra II Group had recommended using the definition of R&D expenditures that can be found in the Frascati Manual; see the OECD (2002). The reason for this recommendation is the fact that many OECD countries have been collecting information on R&D expenditures for some years using the Frascati definition.

Fraumeni also touched on another difficult issue associated with measuring R&D: the issue of how exactly to treat expenditures on own (or in house) software development. The discussion in Aspden (2005), Mandler and Peleg (2003) and Robbins (2005) suggests that several alternative treatments are possible:

> To exclude R&D software investment from software gross private fixed investment;
> To include R&D software in R&D investment and
> To include services from R&D software in software gross private fixed investment.

Fraumeni concluded this part of her presentation with the observation that these issues are open to further debate.

Fraumeni described some of the measurement problems that the joint Bureau of Economic Analysis and National Science Foundation project has encountered in constructing the U.S. R&D Satellite Account:[13]

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[8] See the BEA (1994) and Fraumeni and Okuba (2002) (2005).
[9] See Mairesse and Mohnen (2004).
[10] See Mandler and Peleg (2004).
[11] See de Haan and van Rooijen-Horsten (2004).
[12] See Siddiqi and Salem (2005) and Baldwin, Beckstead and Gellatly (2005).
[13] See Fraumeni and Okuba (2002) (2005) for a more detailed discussion of these issues in the U.S. context. Fraumeni also noted that the document on capitalizing R&D expenditures that went forward from the Canberra Group to the AEG, Aspden (2005), did not consider all of the methodological problem areas in great depth.

What are the appropriate *prices* that should be used to deflate R&D expenditures into real expenditures?

What are appropriate *depreciation rates* for the R&D real expenditures?[14]

What *rate of return* should be attributed to R&D investments?

R&D expenditures typically do not yield an immediate benefit; often, there are long *gestation lags* before an R&D investment yields a return. How long are these lags?

Often R&D expenditures in foreign countries spill over into the domestic economy? Should these *spillovers* be taken into account and if so, how can their quantitative importance be determined?[15]

The above questions are not easy to answer!

Before concluding, Fraumeni digressed briefly and listed the 20 countries that have representation on the AEG, which will forward recommendations for change to the SNA to the next level. The twenty member countries are: Australia, Brazil, Canada, Costa Rica, Czech Republic, Denmark, Ethiopia, France, Germany, India, Jordan, Lithuania, Malaysia, Netherlands, Philippines, Russian Federation, South Africa, South Africa, Trinidad and Tobago, United Kingdom and the USA. The major international organizations that are involved with economic statistics are also represented in this Group: Eurostat, the IMF, the OECD, the UN and the World Bank. Fraumeni then listed the timetable and the structure of the higher level committees who would eventually decide on which revisions would be implemented:

Last meetings of the expert groups, like the Canberra II Group, to forward recommendations to AEG in 2005

AEG (Expert Advisory Group)

Proposal consideration: July 2005, with deliberations lasting until late 2005 or early 2006

Consistency review & circulation to countries in May 2006

Sent to United Nations Statistical Committee for approval October 2006

UNSC meeting to consider recommendations March 2007

Complete draft sent to countries for comments on consistency & readability May 2007

ISWGNA review May-Oct. 2007

AEG & ISWGNA approval Oct. 2007

UNSC final approval March 2008.

Fraumeni concluded that the proposed SNA revisions could have a significant impact on how we measure economic activity and she noted that revisions to the UN System of National Accounts are not done very often. The 1968 SNA was not revised until 1993

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[14] See Lev and T. Sougiannis (1996) (1999), Nadiri and Prucha (1996), Peleg (2003), Rosa and Rose(2004) and Bernstein and Mamuneas (2005) on this topic and Diewert (2005a) for a somewhat critical review of this literature.

[15] See Bernstein and Nadiri (1988) (1991), Bernstein (1996) and McNeil and Fraumeni (2005) on this topic.

and the current round of revisions is due to be released in 2008. Thus she suggested that we take this opportunity to make our views known to the decision making bodies.

3. Summary of Tarek Harchaoui's Discussion

Harchaoui opened his presentation by providing the following overview of the issues:

- What is the nature of the proposed list of changes to the SNA?
- What is the current situation in Canada?
- Canada's position on the proposed changes.[16]
- What are the problem areas remaining?

What is the nature of the proposed list of changes to the SNA?

The conceptual target for the changes is the construction of an extended set of production accounts so that Total Factor Productivity Growth or Multifactor Productivity Growth could be measured for the business sector of the economy.[17] Thus the extended production accounts should have the following features:

> Broader domain of definition for capital (e.g. R&D capital; 'natural' capital and government assets) and
> Introduction of the notion of capital services.

However Harchaoui noted that the current suggested revisions to the SNA ignore an important point:

> A similar discussion on the need to build adequate measures of labour services has been ignored![18]

What is the present situation in Canada?

To a certain extent, a version of the desired production accounts for productivity measurement purposes is currently available in the Canadian core accounts for the annual input-output tables. In *current prices*, most of the elements of the production account are currently being produced:

> Value added and gross output;

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[16] The position of Statistics Canada on these last two issues is developed more fully in Baldwin and Harchaoui (2005).

[17] The conceptual target is explained in more detail in the recent OECD Productivity Manual; see Schreyer (2001). This Manual builds on the earlier work of Jorgenson and Griliches (1967) (1972), Christensen and Jorgenson (1969) (1970) and the BLS (1983).

[18] Chapter 17 of the SNA 1993 suggests measuring employee labour input at constant compensation; i.e., it suggests a wage index for employees. However, gross operating surplus in the SNA 1993 includes the remuneration of the self employed as a single aggregate but for productivity measurement purposes, it is necessary to break this value aggregate into capital and labour value contributions and then it is necessary to further decompose these two value subaggregates into price and quantity components.

> Cost of intermediate inputs;
> Wages and salaries and supplementary labour income;
> Other operating surplus and mixed income.

But in *constant prices*, only some elements are available for all sectors:

> Real value added and real gross output;
> Real intermediate inputs.

However, using the information available from the core accounts, the Canadian productivity accounts have developed a production account for the *business sector* in accordance with the current best practice.[19] In current prices, we have:

> Constructed estimates of labour income and capital income (once the split of mixed income is accomplished).

In constant prices, we have:

> Estimates of capital services using the concept of user cost of capital;
> Estimates of employment and hours that are consistent with the SNA and hence we have estimates of the price and quantity of labour services.

However, there are some significant gaps in our business sector productivity accounts; in particular, we have no estimates for the following inputs:

> Natural capital (mineral and other sub-soil assets, etc.);
> Government capital;[20]
> R&D capital.

However, Statistics Canada is undertaking some exploratory work in these areas:

> We are attempting to provide an integration between the productivity accounts and the environment accounts to reflect natural capital in the production function of the mining sector;
> We are attempting to derive an implicit rate of return of government assets and we are attempting to measure the contribution of public infrastructure capital to productivity growth.

Canada's position on the suggested revisions to the SNA

In principle, Statistics Canada supports the revisions to the SNA suggested by the work of the Canberra II group. The position of Statistics Canada on revising the production

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[19] See Schreyer (2001).
[20] Government infrastructure investments (such as roads) provide valuable inputs into the business sector of the economy but it is difficult to determine an exact value for the contribution of these infrastructure services.

accounts so that they would be more useful for productivity measurement purposes can be summarized by the following material taken from a recent paper by Baldwin and Harchaoui (2005; 2):

"The paper notes that integration provides not only benefits when it comes to the construction of productivity estimates, but also a means of quality control for the National Accounts. Productivity Accounts are at the top of the statistical pyramid. Productivity accounts bring together data on outputs, materials inputs, labor and capital. By confronting one series with another, the process of constructing productivity accounts provides a valuable means of quality assessment. It also helps to identify and fill data gaps. An integrated set of productivity accounts enhances the quality of the SNA through improvements in accuracy, coherence, relevance, and interpretability."

"Finally, the paper focuses on the need to consider whether the SNA manual should be extended into the area of productivity measurement. International comparisons of GDP have benefited immensely by the development of international standards over the last half-century. But productivity is not a central focus of the 1993 SNA. The paper argues that the advantage of integrating productivity accounts into the general accounts is sufficiently great that it is time to include more detail on the nature of productivity accounts in the general SNA framework."

What are the problem areas remaining?

Harchaoui concluded his presentation with some challenges for the expert groups involved in evaluating the suggested changes for the SNA. In particular, he suggested that the expert groups had not provided specific enough advice on precisely how the new suggestions should be implemented. Two examples where he urged the experts to provide more explicit guidelines on implementation were:

> How exactly should mixed income be split between capital and labour?
> How exactly should the external reference rate of return in the user cost of capital be chosen?

In fact, Harchaoui suggested that Canada's position on the last point was that for most purposes, an external reference rate of return should *not* be chosen: instead, a balancing rate of return should be chosen for each industry that would make the annual value of outputs equal to the corresponding annual value of inputs.[21] In any case, Harchaoui suggested that the current expert advice was not specific enough on this issue and hence, international comparability could be at risk if the advice was not made more specific.

4. Summary of Jacques Mairesse's Discussion

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[21] This is the methodological approach taken by Jorgenson and Griliches (1967) (1972) and Christensen and Jorgenson (1969) (1970). The problem with this approach is that sometimes the resulting balancing rates of return can be rather nonsensical (this could be an indication of severe measurement error). Another issue to be resolved is whether the balancing rate of return should be calculated using an ex post user cost methodology (which includes the ex post capital gains or losses on the assets in the user cost formula) or using an ex ante user cost methodology, where only anticipated capital gains or losses are included in the user cost formula.

Mairesse mainly presented the outline of a very interesting paper, Mairesse (2005), which compared the contributions of R&D and ICT in a growth accounting framework for the U.S. and France in recent years. However, he also made the following observations about the SNA revisions:

> In the case of R&D, it is particularly appropriate to take into account the positive research spillovers, and thus to consider a social rate of return of R&D, higher than the private rate of return.
>
> In the case of R&D, it is appropriate to allow for the fact that the social returns are spread out on a longer period than the private returns, and thus to adopt a social rate of depreciation of R&D smaller than the private rate.
>
> For R&D, for lack of an official price index, the GDP price index is often simply adopted. However, the issue of quality adjustment is also relevant for R&D.
>
> The estimated contributions of R&D and ICT in the standard growth accounting framework both crucially depend on the estimated rate of price changes, and particularly on the size of quality adjustment.
>
> The estimated contribution of R&D also crucially depends on taking research externalities into account, by using social rates of return and depreciation, not private rates.
>
> "Correctly" estimated (and "rightly" interpreted), the contribution of R&D, in the United States, even in the recent years since the mid 90s, *is not small relative to that of ICT*, contrary to the message that some (of the many) growth accounting studies tend to convey. Both are likely to be of a comparable order of magnitude.
>
> In the recent years, since the mid 90s, the contribution of R&D to growth, in the business economy (also the overall economy at large), has been stagnating in France, while increasing in the United States. The contribution of ICT to growth in France has been increasing very significantly in France as in the United States, but less rapidly.
>
> The new System of National Accounts (SNA), currently under discussion, should, at last, consider and treat R&D as an investment.
>
> The compromise which will consist of treating R&D as an investment only in a satellite R&D account is not satisfactory in principle nor will it be in practice for a number of reasons.

5. Discussion from the Floor

Erwin Diewert tried to summarize some of the key issues raised by the presentations and added some additional problem areas associated with moving the SNA towards a system of productivity accounts:

> Should the services of land, natural resources, environmental resources and inventories be included in the production accounts in addition to the services of reproducible capital?
>
> How exactly should mixed income or the income of the self employed be decomposed into capital and labour components?

Should an exogenous or endogenous opportunity cost of capital be used in the user cost formula?

Should ex post or ex ante capital gains or losses be used for the revaluation term in the user cost formula?

Should government capital have a user cost treatment with an imputation for the opportunity cost of capital?

What is the appropriate scope of R&D capital?

What is the right opportunity cost of capital to use in the user cost formula for R&D capital?

What is the right depreciation rate to use in the user cost formula for R&D capital?

How exactly should we deal with the spillovers problem for R&D capital?

Is the reproducible capital model the "right" model for R&D investments?[22]

The treatment of inventory change in the current SNA is not satisfactory. Index number theory fails if a value aggregate can change sign from period to period. A more suitable treatment would involve disaggregating inventory change into the difference between two aggregates: a beginning and an end of period stock of inventories.[23]

Diewert concluded his list of problem areas by suggesting that the NBER convene an "expert group" to develop a consensus on the above issues.

Dale Jorgenson from Harvard University noted that all participants at this roundtable session agreed that it was time to get the user cost of capital into the SNA.

Barbara Fraumeni agreed with the observation of Jacques Mairesse that getting SNA changes into satellite accounts would "buy us nothing".

Michael Harper, who is in charge of the BLS productivity program, made some observations:

He noted that the Canberra I Group of experts on capital measurement were generally not very enthusiastic about introducing capital services into the SNA. However, the tide had turned by the time the Canberra II Group met where most participants favored the introduction of capital services into the accounts.

The BLS and BEA are working together on creating production accounts that include capital services.

Jack Triplett of the Brookings Institution made a number of observations:

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[22] Diewert (2005b; section 12) argued that an R&D asset has a quite different character than an ordinary "physical" reproducible capital asset.

[23] This suggested treatment of inventory change would be analogous to the current treatment of the trade balance; i.e., the trade balance is not deflated directly; rather exports and imports are separately deflated. See Diewert (2005c) for the details.

Why has the introduction of capital services into the SNA been controversial? Triplett pointed out that only one European country has a set of productivity accounts: the UK.[24] Most countries, therefore, regard the introduction of capital services as not relevant to their statistical programs, and accordingly do not wish to discuss it. Contributing to this is the idea, still prevalent in national accounting circles, that the services of capital are measured by "capital used up," which some national accountants still identify with depreciation. Triplett (1996) addressed this issue.

With respect to valuing R&D, Triplett felt that this was important but that it was an issue of the 1980s. The compelling issue for the 21st century is the valuation of other intangibles. Past practice on revisions suggests that unless there is serious discussion of other intangibles in this round, we may have to wait for two more revisions to get them incorporated into the SNA.

Triplett contended that the debate over imputing a rate of return to government capital (in calculating a proxy for government output) was the wrong issue, from the economics of it, and bad strategy on top of that. There are two forms of the user cost equation, which have different terms on the left hand side and different unknowns to be solved for on the right hand side:

(a) Rent = $(\delta + r)$ P ;

(b) Cost = $(\delta + i)$ P

where δ is the depreciation rate, r is the internal rate of return and i is the opportunity cost of capital.

In the first equation (a), the rent is known and the equation is solved for the internal rate of return, r. In the second equation (b), the left-hand side is not known, and the opportunity cost of capital i appears on the right-hand side. In the SNA, the services of government are counted as their cost, so it is the (b) form that is relevant, not the (a) form—if we knew the rent, we would use that, and no imputation of this form would be necessary. To implement the appropriate form, equation (b), the government borrowing rate could be used, which is simple, not controversial, and readily available.

Triplett could understand, he said, why statistical agencies were reluctant to impute a return to government capital. For one thing, it would likely put them into conflict with policy decisions on returns made by their own governments. But the two equations and the other parts of the SNA make it clear that the relevant issue is whether the *opportunity cost* to the government of capital is zero, not whether the rate of return is zero. Triplett thought that few statistical agencies were likely to argue that the opportunity cost of capital is zero, whatever they might believe about the rate of return. Whatever might be the difference between the appropriate rental rate for government capital, if it were rented, and the government's cost of providing capital services (which is equivalent to whether or not the government is making profits or losses on its capital investments, since rent $\geq$ cost implies r $\geq$ i), the objective of getting a better accounting for capital in estimating government output is met by implementing the equation (b) form. If one wants to think of it that way, it could be a by-station on the road to getting

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[24] In addition to the UK, the other countries that have productivity accounts are the U.S., Canada and Australia. New Zealand is just introducing their productivity accounts.

true measures of government output (in which case no imputations are necessary, for the SNA purpose of measuring government output).

There are two other items that should be on the revision menu: (a) There should be a thorough discussion on how to measure the output of service sectors[25] and (b) it is incorrect to lump together the nonprofit sector serving households with the household sector.

Kevin Fox from the University of New South Wales raised a number of interesting points:

He pointed out that Diewert and Lawrence (2004) had great difficulties working with endogenous balancing sectoral rates of return while using Australian industry data; i.e., the resulting internal rates of return were not believable for many industries.

Fox noted that the New Zealand official multifactor productivity estimates will be released shortly and the asset base will include land and inventories, including livestock inventories (which can grow!).

The New Zealand user cost methodology is based on using ex post user costs (which use the actual annual change in an asset price as the revaluation term) and on using sectoral internal rates of return that force the value of inputs to equal the value of outputs. Negative user costs were encountered along with negative internal rates of return and Fox discussed various possible solutions to these problems.[26]

Fox pointed out that the New Zealand productivity program is following the example set by the BLS and using a hyperbolic depreciation model.[27] Although this depreciation model is more flexible than the geometric or one hoss shay models of depreciation, it is more difficult to implement this model in a manner that preserves consistency between stock and flow estimates.[28]

6. Conclusion

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[25] In particular, Triplett note that more discussion is required on difficult to measure outputs like insurance and financial activities. For some recent work on difficult to measure service sector outputs, see Diewert (2003), Triplett and Bosworth (2004) and Lipsey and Nakamura (2005).

[26] Negative user costs could be replaced by a tiny positive number and negative interest rates could be replaced by a standard 4 % real rate. The New Zealand position on these problems has not been finalized. It should be noted that the BLS productivity program also encountered the problem of negative user costs and erratic internal rates of return. The former problem was solved by smoothing the revaluation term by using three year moving averages; see Dean and Harper (2001; 67-68) for a discussion of these problems.

[27] See the Bureau of Labor Statistics (1983) and Dean and Harper (2001; 66) for descriptions of this model.

[28] Diewert and Lawrence (2000; 275-277), following the example of Jorgenson (1989) and Hulten (1990; 127-129) (1996; 152-160) showed how an internally consistent treatment of capital services and capital stocks can be obtained in a set of vintage capital accounts. However, Diewert and Lawrence relaxed the Jorgenson-Hulten assumption that vintage capital flows could be aggregated by a constant relative efficiency function; instead, Diewert and Lawrence suggested the use of a superlative index number formula to aggregate capital services over vintages. It turns out that this more general treatment of the aggregation over vintages problem does not make a material difference for the geometric and one hoss shay depreciation models but it does make a difference for the straight line and hyperbolic depreciation models; see Diewert and Lawrence (2000; 277-283). Thus viewed from this more general perspective, the BLS hyperbolic depreciation model is not quite internally consistent.

The sense of the workshop was a strong endorsement of many of the positions of advocated by the Canberra Group. Clearly, the Group has made great progress toward improving the structure of the SNA. There was also great support for going further than the AEG currently proposes in the areas of the capital services account (the consensus was that it should be a part of the a regular accounts rather than a supplementary account), and that the return to government capital (it should be recognized as part of GDP).

It is also important to separate the issue of design from that of implementation. The endorsement of the capital services account was based on the principle that a complete set of accounts should have this component. This issue is separate from the question of how exactly to implement the principle. There are many tough issues to be resolved, about the appropriate treatment of depreciation, obsolescence, and the rate of return. However, difficulties of implementation should not cloud the basic need for a capital services account within the SNA. A similar remark applies to the capitalization of R&D expenditures and to imputing a return to government capital.

Moreover, while implementation issues pose difficult problems, they are not insurmountable. Other countries have successfully built productivity accounts that are linked to their national accounts, or are in the process of so this. Much the same is true of R&D accounts.

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