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INTRODUCING CAPITAL SERVICES INTO THE PRODUCTION ACCOUNT

(DRAFT) DRAFT ISSUES PAPER

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WORKING PARTY ON NATIONAL ACCOUNTS

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Executive Summary

1. In a production process, labour, capital and intermediate inputs are combined to produce one or several outputs. Capital goods that are purchased or rented by a firm are seen as carriers of capital services that constitute the actual input in the production process. In a similar way, employees can be seen as carriers of stocks of human capital and therefore repositories of labour services. However, whereas the value of labour services are fully articulated in the SNA production accounts the value of capital services are not. Consumption of fixed capital (CFC) is shown in the accounts but the full benefits of using fixed capital (the user costs or value of capital services) is comprised of other components too, including the return on fixed capital. The Canberra II group has been investigating the changes needed to the accounts to address this issue and, in conjunction with this, the methodological issues concerning the measurement of CFC and capital services.

Recommendation

2. Although the Group has not yet resolved some methodological issues, including the appropriate measure of CFC that should be used in the accounts, these outstanding issues do not impact on the estimation of the value of capital services, since, although related concepts, they are not dependent on each other. A complete methodological description of how the costs of capital services can be estimated is included in OECD (2001a) and (2001b), and is not included in this paper.

3. The Group has investigated most asset groups and has concluded that, for land, fixed assets, natural and sub-soils assets and inventories, *the SNA should recognise the principle that the value of capital services, in current and constant prices, is recorded in the accounts.*

4. In recognition of the relationship between estimates of CFC and capital services, the Group's second recommendation is that these estimates should be consistent. In other words the implicit or explicit *age-efficiency profiles, age-price profiles and rates of return used in estimating CFC should be consistent with those used in estimating the value of capital services.*

5. The third recommendation relates to the presentation of this information in the accounts. In this regard *the Group recommends that the value of capital services from fixed assets, inventories, land and natural assets, (in current and constant prices) should be shown as 'of which' items under value-added in the production account, for each institutional sector.*

6. *For constant price estimates, the Group recommends that an 'of which' item is also shown for the contribution of labour.* (For simplicity the Table below describes the recommendation for all sectors in constant prices). At present the recommendation refers to compensation of employees only but this will be extended if the Group can agree on how to decompose labour costs within mixed-income.

7. The Group did consider extending this presentation into the generation of income accounts but thought this unnecessary. It's important to note that the Group's recommendations in this regard, imply no radical changes to the presentation of the accounts or to the general meaning given to any of its aggregates; such as net operating surplus. However the Group did recommend *that the SNA encourage countries to record the full value of capital services in supply-use tables*

Table. Account I: Production account (in Constant Prices)

Current SNA		Proposal	
Uses	Resources	Uses	Resources
P.2 Intermediate consumption	P.1 Output	P.2 Intermediate consumption	P.1
B.1g <i>Value added, gross</i>		B.1g <i>Value added, gross</i>	
K.1 consumption of fixed		<i>Of which:</i>	
B.1n <i>Value added, net</i>		<i>Capital services from fixed capital.</i>	
		<i>Capital services from natural assets, including depletion.</i>	
		<i>Capital services from inventories.</i>	
		<i>Capital services from land used in production.</i>	
		<i>Compensation of Employees</i>	
		K.1 consumption of fixed capital	
		B.1n <i>Value added, net</i>	

Outstanding and Related Issues

8. Other issues related to the measurement of capital services but not affecting the recommendations made here have been considered by the Group, see Diewert, Harrison and Schreyer, (2004). The issues are:

- Determining the correct rate of return to use (endogenous or exogenous rates). The Group's view is that both endogenous and exogenous rates are acceptable but further work on this issue is planned.
- Defining consumption of fixed capital and obsolescence. The group has concluded that SNA depreciation, which corresponds to cross-section depreciation in most cases, is the appropriate measure of consumption of fixed capital for the national accounts, see also Ahmad, Aspden and Schreyer, (2004).
- Investigating whether gross mixed income can be decomposed into its labour and capital components; although, if this occurs, the components will only be shown as memorandum items.
- R&D capitalisation. The group is still considering whether R&D should be included as investment. If so estimates of the costs of R&D capital services will also be needed.

Impact on GDP

9. For market operations no change to GDP will occur. However, for non-market operations, where output is commonly calculated as the sum-of-inputs, the inclusion of all capital services received by government will raise GDP by the difference between total capital services and consumption of fixed capital.

Consistency with Other Manuals and Business Accounting Standards

10. Because the recommendation is to include capital services as an '*of which*' item only, the recommendation is not expected to affect the current consistency between the SNA and other manuals and business accounting standards.

Practical Feasibility

11. The feasibility of the recommendations are partly determined by the methods currently used to estimate CFC used. For example, a number of countries currently estimate CFC using a depreciation function with no explicit reference to age-efficiency functions or rates of return, and, so, in this sense, extra information would be required. However, the estimation of these components is unlikely to be onerous.

Background

12. In 2001 the OECD published a manual on measuring capital (OECD 2001a) describing best practice for measuring capital stocks, consumption of fixed capital and capital services and the relationships between these concepts. The manual took the measurement of capital a long way forward but acknowledged that further research areas remained (Annex 4 of the manual). This issues paper concerns one of those areas: capital inputs in the production account, and describes the recommendations made by the Canberra II Group in this context, see also Ahmad (2001). The Group did consider the consequential impact/s on the distribution and use of income account but concluded that changes here were not necessary.

13. The proposals made by the Group to date are deliberately prudent. They imply no radical changes to the presentation of the accounts or to the general meaning given to any of its aggregates; such as net operating surplus. This prudence reflects the fact that the development and understanding of statistics in this area is still relatively new; and the fact that the valuation of concepts, such as capital services, are, to some extent, dependent on assumptions about the way the economy works. Generally the introduction of capital services into the accounts does not change the value of the aggregates as they enter as 'of which' items. One specific item may change GDP estimates however; the introduction of the costs of capital services for public assets (see Harrison 2004).

Why Record Capital Inputs?

14. The present SNA production account contains a presentational anomaly in its treatment of fixed assets. Consumption of fixed capital (CFC) is sometimes thought of as reflecting the full benefits of using fixed assets but the full benefits of using fixed capital (the user costs or value of capital services) is comprised of other components too, including the return on fixed capital. At present the accounts do not explicitly identify these components as they are subsumed within operating surplus.

15. If all fixed assets were leased on the market, rental values would be directly observable and this data could be used to estimate the cost of capital services. In practice, of course, many fixed assets are owned by their users and so imputations are needed to estimate the costs of capital services.

16. The idea that the production account does not explicitly identify the total values of capital services from fixed assets but instead records them within value-added or operating surplus is not new. The impetus to separately identify these capital services now, largely reflects the increased interest in growth accounting and productivity analysis (OECD (2001b), Harper et al (2003)). The recommendation made by the Canberra Group is to correct this presentational anomaly for fixed assets and to extend the rationale to other assets, namely inventories, land, and natural and sub-soil assets.

17. The expected (pure) gross operating surplus (net of mixed income associated with labour) of an enterprise is commonly understood to represent the benefit of using all of its owned fixed assets and rent,

or own-use, of non-produced assets¹, and can be described as the value of capital services rendered by these assets, or the economic rent of the assets. The actual observed gross operating surplus reflects the value of these capital services plus an additional item that represents the (*ex post*) unexpected profit/loss actually recorded by an enterprise.

18. Capital, in its broadest sense covers any expenditure that requires foregoing something in the present to earn something in the future. Therefore, capital services are in theory rendered by all types of capital; produced (including inventories) and non-produced (including, subsoil assets, land, patents) as well as services from R&D, knowledge etc and, so, if the full value of capital services from fixed capital is to be explicitly recorded, one might consider, by extension, whether other capital services from other assets should be explicitly identified too.

19. The role of financial capital within the production account is not clear. It is generally accepted that financial capital plays no (productive) role although some of the literature on this subject (Keuning 1998) make a case for its inclusion. Financial assets are quite often essential for companies to function (e.g. Insurance companies) but it is difficult to identify the links within a production framework between financial decisions and production decisions, (Miller and Modigliani 1966). This subject is beyond the scope of the Canberra Group's current remit, and, as such, financial capital is not considered here but is recognised as a separate research area in the OECD Capital Manual. In addition, because the SNA does not currently treat them as assets, R&D, which is currently being considered by the Canberra Group, and knowledge are also not considered in this paper. The paper continues by reviewing the recommendations made by the Canberra Group for each asset type in turn.

Fixed Assets

It can be shown that consumption of fixed capital is but one component of the value of capital services. The value-of capital services of an asset aged k at time t can be shown to be equal to:

$P_t^k - P_{t+1}^{k+1} + r_t P_t^k$; where P_t^k is the price of an asset aged k at time t and r_t is the nominal rate of interest at time t , see Diewert (2001).

$P_t^k - P_{t+1}^{k+1}$ is the change in the value of an asset between two periods. It reflects two effects: the change in value due to ageing and the change in the market price of the asset for a given age. Whether the entire expression or only the part that relates to ageing is consumption of fixed capital is of secondary importance but is discussed further in Ahmad, Aspden, Schreyer (2004).

In order to record the full costs of capital in the production accounts therefore, the Canberra Group, had recommended that an addition is made to the production accounts to show the costs of capital services, in current and constant prices, as an '*of which*' item under value-added, as shown in Table 1 below.

¹ Gross operating surplus is often, mistakenly, considered as being equal to the benefits to the owner of assets. However this view is not entirely correct. If a fixed asset is leased or used by its owner, economic rent, (capital services), is included in the gross operating surplus of the owner. In the case of non-produced assets however such as land and subsoil assets, the economic rent appears in the operating surplus of the user of the resource and the transfer of this element to the owner takes place as the rent element of property income. For financial assets, there is no explicit element of operating surplus that can be identified as capital services of these assets (because in the accounts we do not regard them as being "used" in production) but operating surplus still has to be large enough to cover the cost of borrowing financial capital and this charge against the gross operating surplus is shown as property income.

Non-Produced Non-Financial Assets

Land

20. The economic case for treating land used in production symmetrically with fixed assets is sound, as land provides also provides capital services.

21. The treatment of land in the 1993 SNA is however different to that for fixed assets. As it is (normally, see below) a non-produced asset, rent from land is not recorded as intermediate consumption but as property income; which is not recorded within the operating surplus of the recipient of the income. As such the 1993 SNA introduces asymmetries with regards to the recording of the capital services associated with land; it is the user who receives the capital services from land, not the owner, because there is no such thing as output, or production, of rent.

22. For non-produced land, when the user of the land is also the owner (owner-user) for a given value of output in competitive markets, the operating surplus would implicitly include a component that reflected the capital services from the land. Where the user is not the owner the capital services provided are equal to the resource rent. This will not necessarily be equal to property income (rent, excluding administration costs) paid to use the land since rent is often agreed in advance of unknown conditions, such as the weather, that determine resource rent.

23. The gross operating surpluses of the owner-user and user are therefore (all other things being equal) identical, which is illogical from an economics perspective; since one has ownership of a productive agent (land) and the other does not. This does not of course mean that the balance of primary incomes should be preferred to gross operating surplus, since property income includes other types of assets (and not just land); irrespective of whether these assets play a recognised role in production or not.

24. In theory, therefore, if it is possible to separately identify property income from land, it should be possible to record the capital services from land used in production for users paying rent (and owner-users). In these cases capital services could be estimated as the actual rent payments (net of administrative costs). Therefore the Group has recommended that the SNA shows the value of capital services from land used in production in the production accounts; see Table 1.

25. In a previous Canberra Group meeting the Group recognised that land could also be produced. This has consequences for the measurement of capital services as, when produced land is rented, payments will be recorded as rentals (and not rent), so the value of capital services will be recorded in the production account of the owner (as opposed to the user in the case of non-produced land).

Subsoil and other natural assets

26. The SNA (paragraphs 13.59 and 13.61 and paragraphs 7.203-205 of Integrated Environmental and Economic Accounting (IEEA) 2003) recommend that the value of subsoil and other natural assets are valued by their net present value. Paragraph 7.168 (and Figure 7.1) of the IEEA further states that depletion is the counterpart for non-produced natural assets to CFC for produced assets, and so, in principle, the conclusions that were drawn for capital services for fixed assets apply to subsoil and other natural assets. The only difference between fixed assets and natural/subsoil assets, in this context, is that whereas CFC is already identified in the production accounts, depletion is not.

27. Therefore the Group has recommended that the value of capital services from natural and sub-soil assets be shown in the accounts (see Table 1).

Valuables

28. The arguments for valuables follow those of land not used in production and financial assets, and the Group has recommended that no capital services from valuables are shown in the accounts.

Inventories

29. The rationale for recognising capital services from inventories is based on the idea that the inventory holder provides security of supply or the ability to provide goods at a later date. In this way one can visualise the service provided as being analogous to transport services, except that, where transport services move a product from one location to another, inventories provide a service that moves a product from one point in time to another. On this basis the Group's recommendation is that the capital services from all inventories should be identified separately in the accounts.

30. The Group considered whether inventories of goods for sale should be treated differently to inventories of inputs, but concluded that the recommendations should apply to all inventories on the grounds that both types were necessary for businesses to function efficiently. However some practical issues remain to be resolved such as how to choose the life length of the stock.

Public Assets

31. The Group has agreed that the introduction of the costs of capital services should be treated consistently for all sectors, market and non-market. In this sense it follows that the recommendations made concerning fixed assets, land and inventories apply equally to government and non-market output. This includes public monuments. Where value-added is estimated using input-costs the inclusion of the cost of capital services in the production accounts will increase (non-market) gross value-added and GDP.

Outstanding and Related Issues

32. Other issues related to the measurement of capital services but not affecting the recommendations made below have also been considered by the Group, see Diewert, Harrison and Schreyer, (2004). The issues are:

- Determining the correct rate of return to use (endogenous or exogenous rates). The Group's view is that both endogenous and exogenous rates are acceptable but further work on this issue is planned.
- Defining consumption of fixed capital and obsolescence. The group has concluded that SNA depreciation, which corresponds to cross-section depreciation in most cases, is the appropriate measure of consumption of fixed capital for the national accounts, see also Ahmad, Aspden and Schreyer, (2004).
- Investigating whether gross mixed income can be decomposed into its labour and capital components; although, if this occurs, the components will only be shown as memorandum items.
- R&D capitalisation. The group is still considering whether R&D should be included as investment. If so estimates of the costs of R&D capital services will also be needed.

Summary of Recommendations

33. The Canberra II Group has recommended that the capital services from land, fixed assets, natural and sub-soil assets and inventories are explicitly included as '*of which*' items under the value-added of each institutional sector in the production account, in both constant and current prices. In conjunction with

this the Group has also recommended that constant price estimates of compensation of employees should also be recorded as an *'of which'* item.

34. Table 1, below, illustrates this recommendation. For simplicity, the table is not broken down by institutional sector. Equally, only the constant price presentation is shown below (the current price presentation is identical except compensation of employees are not shown as an *'of which'* item).

35. In recognition of the relationship between CFC and capital services, the Group has further recommended that, these estimates (CFC and the value of capital services) should not be introduced in an isolated manner. In other words, the explicit or implicit age-efficiency profiles, age-price profiles and rates of return used to estimate CFC and any other capital related data that services both the analysis of income and wealth (via NDP on the balance sheets) and the analysis of production and productivity (via prices and quantity of capital services) should be consistent with those used to estimate the value of capital services

Table 1. **Account I: Production account in constant prices**

Current SNA		Proposal	
Uses	Resources	Uses	Resources
P.2 Intermediate consumption	P.1 Output	P.2 Intermediate consumption	P.1
B.1g <i>Value added, gross</i>		B.1g <i>Value added, gross</i>	
K.1 consumption of fixed		<i>Of which:</i>	
B.1n <i>Value added, net</i>		<i>Capital services from fixed capital.</i>	
		<i>Capital services from natural assets, including depletion.</i>	
		<i>Capital services from inventories.</i>	
		<i>Capital services from land used in production.</i>	
		<i>Compensation of Employees</i>	
		K.1 consumption of fixed capital	
		B.1n <i>Value added, net</i>	

REFERENCES

AHMAD, N (2004): “Introducing Capital Services into the Production Account - Update”. Paper presented to the meeting of the Canberra Group in Washington, March 2004.

AHMAD, N. ASPDEN, C. SCHREYER, P. (2004). “Depreciation and Obsolescence”. Paper presented to the meeting of the Canberra Group in London, September 2004.

DIEWERT, E.W. (2001). “Measuring the Price and Quantity of Capital Services under Alternative Assumptions”; *Department of Economics Working Paper No 01-24*, University of British Columbia.

DIEWERT, E.W., HARRISON, A. SCHREYER, P. (2004). “Cost of Capital Services in the Production account”. Paper presented to the meeting of the Canberra Group in London, September 2004

HARRISON, A. (2004). “Government Owned Assets – Continued”. Paper presented to the meeting of the Canberra Group in Washington, March 2004.

KEUNING S. (1996). “The Role of Financial Capital in Production”.

MILLER, M.H. and MODIGLIANI, F. (1996). “Some Estimates of the Cost of Capital to the Electric Utility Industry, 1954-1957.” *American Economic Review* 56”pp. 333-391.

MULLER, D.C. (1986) “Profits in the Long Run.”. Cambridge University Press.

OECD (2001a); *Measuring Capital – OECD Manual. Measurement of Capital Stocks, Consumption of Fixed Capital and Capital Services*, Paris.

OECD (2001b); *Measuring Productivity - OECD Manual. Measurement of Aggregate and Industry-Level Productivity Growth*, Paris.