

Distr.
GENERAL

CES/AC.68/2000/21
17 February 2000

ENGLISH ONLY

STATISTICAL COMMISSION and
ECONOMIC COMMISSION FOR EUROPE

ORGANISATION FOR ECONOMIC
CO-OPERATION AND DEVELOPMENT (OECD)

CONFERENCE OF EUROPEAN STATISTICIANS

COMMISSION OF THE EUROPEAN
COMMUNITIES (EUROSTAT)

Joint ECE/Eurostat/OECD
Meeting on National Accounts
(Geneva, 26-28 April 2000)

CONSUMPTION OF FIXED CAPITAL ON ROADS AND OTHER PUBLIC INFRASTRUCTURE
IN THE FINNISH NATIONAL ACCOUNTS

Supporting paper submitted by Finland*

Introduction

One of the major changes for the Finnish National Accounts in implementing ESA95, was the calculation of consumption of fixed capital (CFC) on public infrastructure, especially as this has direct implications on GDP. This paper starts by briefly describing the perpetual inventory method used in Finland, and how consumption of fixed capital is calculated. Then the data sources for central and local government GFCF are described. A comparison of length of service lives (and degree of road utilization) with Finnish, Norwegian and Swedish data is done, as well as calculations with different service lives for CFC on Finnish public roads, and the potential impacts of these calculations on GDP.

* Prepared by Messrs. Jukka Jalava and Taru Sandström, National Accounts. Workshop on the Implementation of ESA95: Achieving Comparability in Practice, 7-9.6.1999, Copenhagen, Denmark. Expert Group on Capital Measurement, 8-10.11.1999, Washington DC, USA.

GE.00-

PIM

In Finland (as well as in all other OECD countries), the Perpetual Inventory Method (PIM) is used for the calculation of capital stock and consumption of fixed capital estimates. For its calculations, the PIM uses as inputs long series of gross fixed capital formation at constant prices (by industry and asset type), price indexes, and assumptions of service lives, survival functions and depreciation patterns¹.

Finnish capital stock calculations have been revised. Physically, the Dyalog APL-software was found to be optimal. While being compatible with the National Accounts new adp-environment, it still facilitates the specific demands made by capital stock calculations. Otherwise, the extension of the concept of capital formation (due to the implementation of ESA95), and the change of base year from 1990 to 1995, were the biggest changes.

Consumption of Fixed Capital

Consumption of fixed capital is the valuation of capital "used up in production". Thus it e.g. is, the difference between gross national income and net national income. As the SNA93 states (p. 147): "It may be defined as the decline, during the course of the accounting period, in the current value of the stock of fixed assets owned and used by a producer as a result of physical deterioration, normal obsolescence or normal accidental damage". Aging should also be added to the list (see Katz & Herman, 1997).

Consumption of fixed capital is calculated as the difference between GFCF and the change in Net Capital Stock. Equation 1 is valid at constant prices:

$$CFC_t = GFCF_t - (NCS_t - NCS_{t-1}) \quad (1)$$

CFC_t = Consumption of Fixed Capital in year t

$GFCF_t$ = Gross Fixed Capital Formation in year t

NCS_t = Net Capital Stock in year t

NCS_{t-1} = Net Capital Stock in year t-1.

The Finnish capital stock model produces the capital consumption estimates (by industry and asset type) using the assumption of linear depreciation. Both SNA93 (6.193-6.197) and ESA95 (6.04) refrain from stipulating whether the

¹ See Lehtoranta (1995) for a more detailed account of the PIM used in Finland.

"straight line" or geometric method should be used. ESA95 recommends using linear depreciation, unless we have such knowledge of a fixed assets pattern of efficiency-decline which would require using geometric depreciation. SNA93 is even more cautious. It states that, linear depreciation is possibly more realistic for structures, and geometric depreciation for machinery and equipment, but that it depends on knowledge (or assumptions) which is used.

GFCF² Data Sources: Central Government

The basic data for central government National Accounts is from the year 1998 onwards the State Business Bookkeeping data³, which is cross-classified by the administrative bookkeeping data (State Financial Statement and State Budget). The State Treasury receives from individual accounting offices information on receipts and expenditures monthly. Each year's State Financial Statement is completed by the State Treasury the following April. Statistics Finland's Government Finance-unit uses a bridge table to transform the Business Bookkeeping data to comply with the National Accounts definitions⁴. On these transformed figures Value Added Tax (VAT) is added⁵. What we get is the GFCF by industry and asset type for central government in current prices. The GFCF in current prices is deflated into constant prices using proper indexes (i.e. such that also take into account the addition of the VAT), so that the volumes aren't distorted. The constant prices figures thus calculated, are used, by applying the PIM, to construct estimates of Gross/Net Capital Stock, Retirements and Consumption of Fixed Capital by industry and asset type.

GFCF⁶ Data Sources: Local Government

The Local Government⁷ Finances, which is a total survey statistics, is processed by Statistics Finland's Government Finance-unit in accordance with the

² The central government public infrastructure GFCF contains the building of and improvement on civil engineering and other structures, e.g. roads, bridges, tunnels, waterways, airports, military civil engineering construction etc.

³ Before 1998 the so called Chart of Revenue and Outlays.

⁴ Especially concerning road maintenance the bookkeeping data must be adjusted. The problem lies in the difficulty of separating road maintenance from investment expenditure.

⁵ The total of VAT paid by central government as recorded by the accounting offices.

⁶ The local government public infrastructure GFCF contains the building of and improvement on civil engineering and other structures, e.g. roads, streets, sports fields, dumping grounds, parks etc.

⁷ Local government being municipalities and joint municipal authorities.

Classification of the Functions of Finnish Local Government (COFOFLG). A bridge table is used to transform this data to comply with the National Accounts definitions. On these transformed figures Value Added Tax (VAT) is added, and what we get is the GFCF by industry and asset type for local government in current prices. The GFCF in current prices is deflated into constant prices using proper indexes (i.e. such that also take into account the addition of the VAT), so that the volumes aren't distorted. The constant prices figures thus calculated, are used, by applying the PIM, to construct estimates of Gross/Net Capital Stock, Retirements and Consumption of Fixed Capital by industry and asset type.

Background

Even though consumption of fixed capital should in principle be calculated for all production capital defined as gross fixed capital formation, the calculation of CFC on public infrastructure like roads and dams was in the SNA68 omitted due to practical difficulties. Repair and maintenance of public roads and other infrastructure were considered sufficient to keep up their original condition.⁸ Similarly, according to the ESA79, CFC must be calculated for all reproducible fixed capital goods, with the exception of capital goods for collective use with an indeterminate life time (roads, bridges etc.).⁹ Accordingly, a great part of government produced fixed capital CFC was excluded from the CFC-total, due to these national accounts guidelines.

Both SNA93 as well as ESA95 require also in practice that CFC is calculated for all tangible and intangible fixed assets (except animals (ESA95, par. 6.03)) owned by producers. CFC should also be estimated for major improvements to non-produced assets, as well as costs of ownership transfer associated with non-produced assets.¹⁰

ESA95 Revision

In Finland the ESA95 revision concerning consumption of fixed capital on public sector infrastructure was easily implemented. In our capital stock model the calculations concerning public sector infrastructure were already incorporated. Previously, the CFC on public sector infrastructure that the model

⁸ See SNA68: par. 7.20.

⁹ ESA79: par. 403.

¹⁰ SNA93: par. 6.185 - 6.186, ESA95 par. 6.03.

produced was simply zeroed for the SNA68 based National Accounts. It was, however, separately published among the Capital Stock Data.

Impact on GDP

CFC on new capital assets (e.g. software) and the calculation of CFC on public infrastructure increases the level of the CFC-total, but the implications for national economy aggregates depend on the type of the producer. In the case of market producers, changes in CFC affect only the residual items operating surplus/mixed income, net, i.e. the distribution between gross and net concepts of operating surplus and mixed income, whereas an increase in CFC of non-market producers has a direct impact on value added/GDP and further on government consumption expenditure. The effects of CFC in the case of non-market producers is based on the fact, that non-market producers' value added¹¹ and output are calculated as sum of costs components. Table 1 shows the impact on GDP of CFC on public infrastructure.

Table 1: Impact on GDP of CFC on Public Infrastructure, in mill. FIM, CP

	1990	1991	1992	1993	1994	1995	1996	1997
GDP, at market prices	521021	498067	487194	493062	521443	561387	587550	630461
CFC on public infrastructure	2625	2811	2803	2861	3198	3504	3569	3711
% of GDP	0,5	0,6	0,6	0,6	0,6	0,6	0,6	0,6
of which CFC on public roads	2143	2291	2280	2328	2616	2868	2924	3041
% of GDP	0,4	0,5	0,5	0,5	0,5	0,5	0,5	0,5

Service life

The assumed service life for roads, bridges and other public infrastructure in Finnish capital stock calculations is 70 years. In comparison Sweden uses 40 years and Norway 75 years. Quite different assumptions for rather similar countries. In order to get evidence on road utilization in Finland, as well as Sweden & Norway, we looked into data from the Finnish National Road Administration. Table 2 summarizes some key indicators for the year 1996.

¹¹ Non-market producers' value added (net) equals the sum of: the compensation of employees, consumption of fixed capital and possible taxes on production and imports.

Table 2: Comparison of Country Information in 1996

	FINLAND	SWEDEN	NORWAY
Land area, 1000km ²	338	450	324
Country population, mill.	5,1	8,9	4,4
Length of public roads, km, 31.12.1996	77782	98015	91346
Automobile stock, 1000	2229	3981	2053
Traffic performance on public roads, bill.automobile-km	27,6	45,4	22,6
Inland passenger traffic, bill.passenger-km	63,5	112,2	57,1
of which road traffic	59,3	101,3	49,8
in percentages (%)	93,4	90,3	87,2
Inland goods transport, bill.ton-km	36,5	57,9	19,4
of which road traffic	24,1	31,2	10,7
in percentages (%)	66,0	53,9	55,2

Both the automobile stock and the traffic performance are by far the greatest in Sweden. Thus validating Sweden's shortest service life. When comparing the ratio of inland passenger traffic done as road traffic the differences aren't that big (Finland: 93,4%, Sweden: 90,3%, Norway: 87,2%). But concerning goods transport Finland seems to rely more on road traffic than either Sweden or Norway (Finland: 66,0%, Sweden: 53,9%, Norway: 55,2%). These factors, combined with the fact that the National Road Administration (NRA) uses in its own calculations a service life of approximately 50 years¹², indicate that the service life used in Finnish National Accounts is probably too long.

Calculations with different service lives

We made calculations with differing service lives for CFC on Finnish public roads, in order to ascertain their potential effects on GDP. The service lives chosen were: 60 years, 50 years and 40 years. As the capital stock data ESA95 revision is still being implemented, the following CFC figures aren't, however, definitive. Table 3 shows the effects in real terms on GDP, government consumption expenditure and government value added (gross), that a shortening of the assumed service life for public roads would have. In table 4, the impacts are shown in percentages.

¹² The service lives the NRA uses are: for subgrades 50 years, for surfacing 10 years, for bridges 85 years and for other road structures 10 years. Their weighted (the weights used are the asset types ratios of the NRA's balance sheet totals on 31.12.1998) average is approximately 50 years.

Table 3: The impact of different service lives for public roads, mill. FIM, CP

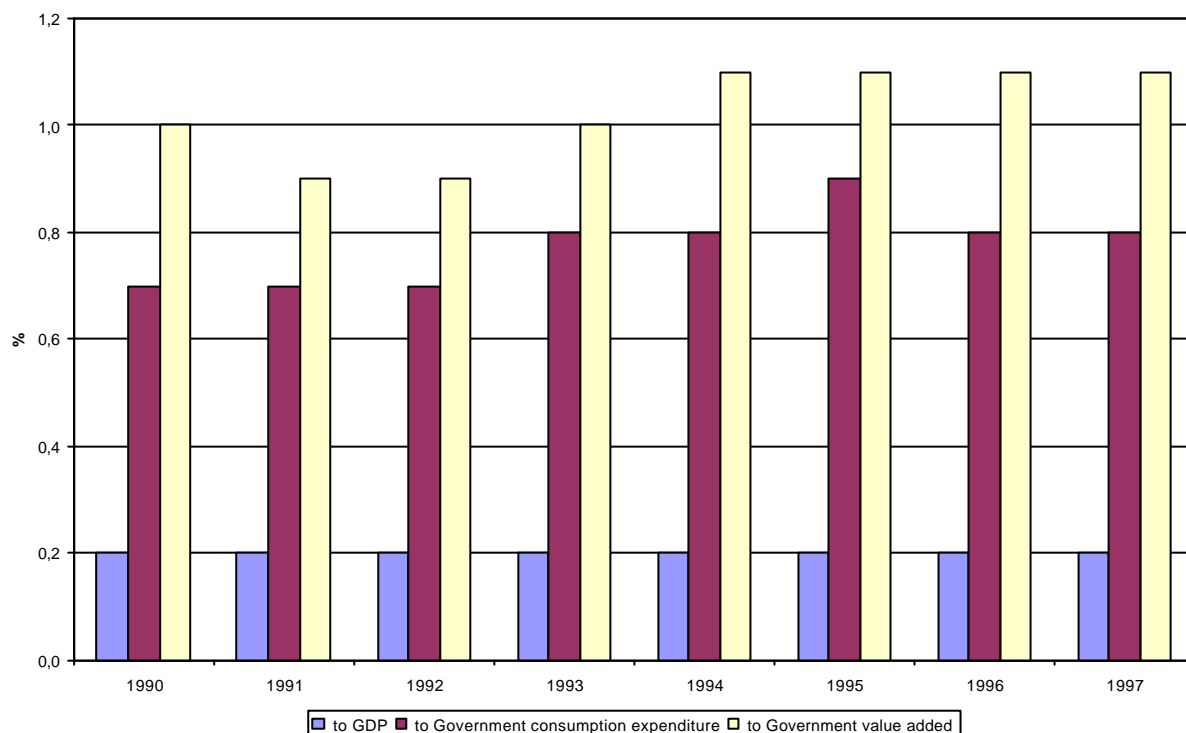
ESA95: Service life 70 years	1990	1991	1992	1993	1994	1995	1996	1997
GDP at market prices	521021	498067	487194	493062	521443	561387	587550	630461
Government consumption expenditure	112627	123369	123340	119129	121474	128178	134849	140459
Government value added, gross	86730	95784	95901	91269	92358	97398	102001	104421
CFC on public roads	2143	2291	2280	2328	2616	2868	2924	3041
Service life 60 years	1990	1991	1992	1993	1994	1995	1996	1997
GDP at market prices	521365	498436	487562	493440	521867	561855	588028	630962
Government consumption expenditure	112971	123738	123708	119507	121898	128646	135327	140960
Government value added, gross	87074	96153	96269	91647	92782	97866	102479	104922
CFC on public roads	2487	2660	2648	2706	3040	3336	3402	3542
additions to the present figures	344	369	368	378	424	468	478	501
Service life 50 years	1990	1991	1992	1993	1994	1995	1996	1997
GDP at market prices	521850	498956	488080	493968	522462	562504	588682	631635
Government consumption expenditure	113456	124258	124226	120035	122493	129295	135981	141633
Government value added, gross	87559	96673	96787	92175	93377	98515	103133	105595
CFC on public roads	2972	3180	3166	3234	3635	3985	4056	4215
additions to the present figures	829	889	886	906	1019	1117	1132	1174
Service life of 40 years	1990	1991	1992	1993	1994	1995	1996	1997
GDP at market prices	522508	499634	488724	494582	523093	563129	589245	632134
Government consumption expenditure	114114	124936	124870	120649	123124	129920	136544	142132
Government value added, gross	88217	97351	97431	92789	94008	99140	103696	106094
CFC on public roads	3630	3858	3810	3848	4266	4610	4619	4714
additions to the present figures	1487	1567	1530	1520	1650	1742	1695	1673

Table 4: The impact of different service lives for public roads, %, CP.

Service life 70 years (ESA95)	1990	1991	1992	1993	1994	1995	1996	1997
% of GDP	0,4	0,5	0,5	0,5	0,5	0,5	0,5	0,5
% of Government consumption expenditure	1,9	1,9	1,8	2,0	2,2	2,2	2,2	2,2
% of Government value added	2,5	2,4	2,4	2,6	2,8	2,9	2,9	2,9
Service life 60 years	1990	1991	1992	1993	1994	1995	1996	1997
% of GDP	0,5	0,5	0,5	0,5	0,6	0,6	0,6	0,6
% of Government consumption expenditure	2,2	2,1	2,1	2,3	2,5	2,6	2,5	2,5
% of Government value added	2,9	2,8	2,8	3,0	3,3	3,4	3,3	3,4
Service life of 50 years	1990	1991	1992	1993	1994	1995	1996	1997
% of GDP	0,6	0,6	0,6	0,7	0,7	0,7	0,7	0,7
% of Government consumption expenditure	2,6	2,6	2,5	2,7	3,0	3,1	3,0	3,0
% of Government value added	3,4	3,3	3,3	3,5	3,9	4,0	3,9	4,0
Service life of 40 years	1990	1991	1992	1993	1994	1995	1996	1997
% of GDP	0,7	0,8	0,8	0,8	0,8	0,8	0,8	0,7
% of Government consumption expenditure	3,2	3,1	3,1	3,2	3,5	3,5	3,4	3,3
% of Government value added	4,1	4,0	3,9	4,1	4,5	4,6	4,5	4,4

Graph 1 shows in percentages how much the change of service life for public roads from 70 years to 50 years would increase GDP, government consumption expenditure and government value added.

Graph 1: The additions to ESA95 figures resulting from a change of service life for public roads from 70 years to 50 years, %



Conclusion

It has been the objective of this paper to discuss the impacts of CFC on public infrastructure on GDP. Our results raise an important question: Do we need to reconsider and harmonize service lives between countries? Especially since increases/decreases in CFC has direct impacts on GDP, thus with important implications for the financing of the EU budget.

The on-going development work on capital measurement done by the Canberra-group¹³ is also relevant. The group is working on a manual on capital measurement, which is to be published by the OECD in the year 2000. Especially

¹³ The Expert Group on Capital Measurement.

of interest is, whether the manual will contain specific recommendations on the type of mortality and survival functions to be used.

References

Eurostat (1996): European System of Accounts (ESA95), Eurostat, Luxembourg.

Katz, A. J. & Herman, S. W. (1997): Improved Estimates of Fixed Reproducible Tangible Wealth, 1929-95, Survey of Current Business, May 1997.

Lehtoranta, O. (1995): Teollisuuden tuottavuuskehityksen mittaaminen toimialatasolla. Tilastokeskus, tutkimuksia 212. (a Statistics Finland publication only in Finnish)

United Nations, Eurostat, International Monetary Fund, Organisation for Economic Co-operation and Development, and World Bank (1993): System of National Accounts 1993, series F, No. 2, Rev. 4, United Nations, New York.