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Fixed Capital Stock in the Swedish National Accounts

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Introduction

Calculations of the Gross Fixed Capital Stock (GFCS) have been undertaken at Statistics Sweden since the 1960-ies. Stock data have been published yearly except for a major break between 1984 and 1992. The methods used until 1984 are described in Tengblad and Westerlund (1976). From 1992 on Balance Sheets for institutional sectors also are compiled and published. The National Wealth calculations are described in Tengblad (1993). Until 1984 only the gross stock was published but calculations of net stock was used to estimate the Consumption of Fixed Capital (CoFC). With the introduction of Balance Sheets the net stock also was published.

Gross Fixed Capital Stock

The methods used at Statistics Sweden for the calculation of GFCS to a large extent rely on perpetual inventory of data in constant prices on gross fixed capital formation (GFCF), included in the national accounts. For a number of capital objects these figures have been projected backwards to account adequately for the full length of service lives. About 50 percent of the estimated stock values have been calculated using directly available information on the stock value of the assets.

The replacement costs of the GFCS has been calculated in accordance with the Perpetual Inventory Method by using the following formula:

$$K_t = \sum_{t-1} (I_t / P_t) * \varphi_{t-\tau} \qquad (1)$$

$\tau = t-\lambda$ (max.)

where K_t is the replacement cost of the stock of a specific asset type in an activity in the beginning of year t, I_t, the GFCF in current prices year τ, P_t is the price index relating year τ to the base year and $\varphi_{t-\tau}$ the proportion of assets of vintage τ still existing in year t. φ denotes a survival curve with a distribution of service lives around an average value and with a maximum value λ (max.) and $t-\tau$ denotes the number of service years for each vintage of assets. Summing over all asset types and all activities will give the total stock value. This implies an assumption of the efficiency being unchanged over the entire service life.

Service life assumptions

There is so far only scarce information directly available in Sweden on average service life of fixed assets. The service lives used depend on type of asset and kind of activity. It was possible however in the fixed capital stock estimates made in the 1960-ies to calculate service life data indirectly from a number of sources, sometimes by checking against stock data directly available from insurance or book values, sometimes referring to expert judgements. These earlier data have now been revised and given a test of reasonability through comparison with figures from other countries, notably Canada.

Price indices

For machinery and equipment there exists a price index system using producer price indices and import price indices to construct price indices for domestic use. For buildings and construction there are few output price indices. Two of them are indices for one and multifamily dwellings. In most other cases there only exists factor input price indices. Even though these in principle are adjusted for productivity changes, it is likely that the adjustments are conservative and therefore these indices have an upward bias.

Due to technical development in the capital goods producing industries, there is a continuos change in the quality of capital objects produced. A capital object with a given function produced in year t may often be different from an object with the same function produced in the base year. It may have better performance, a longer durability, higher precision, lower operating costs etc. It 's very likely that improvements are reflected in the observed market prices. The problem then arises how to evaluate these improvements and adjust the observed price change accordingly. The methods used at Statistic Sweden to deal with these problems are the following:

1) The producer is requested to decide how much of the observed price change is referring to quality changes.

2) The decision on adjustment is made by a central board of index experts and major users of price statistics.

3) In the case of major quality change the object is temporarily excluded from the index.

4) In some cases the impact of changes in a number of quality components have been estimated by regression analysis. This is the case for dwellings.

5) In the case of minor changes in quality, the effect is simply neglected.

It is obvious, however, that many cases of quality change are left unadjusted and consequently for this reason there is an upward bias in the price indices of capital goods.

The same price indices used in NA to deflate GFCF are used for GFCS, CoFC

and Balance Sheet calculations which means that a consistent system of price indices for deflating and reflating is used. Mid-year price indices from the input-output tables for each asset type and activity are transformed into quarterly indices out of which indices related to January 1:st every year are constructed as the average of last and first quarter of consecutive years. These indices are used in Balance Sheet compilation to reflate the net stock at constant prices.

Survival functions

The survival or mortality functions are of Winfrey type. The most used are of the types: S1, S2, S3, R2, R3, and R4. The symmetrical distributions are used for machinery and equipment reflecting an assumed procedure of scrapping with equal proportions around the average service life. The right skew distributions are used for buildings and construction reflecting the noted fact that more than 50 percent of such objects tend to be withdrawn later than the year of their average service life.

Direct calculations

Direct calculations using other sources than GFCF from NA has been done for residential buildings and transport equipment. For aeroplanes the number of planes in different weight classes is multiplied with relevant base year prices for each weight class. Fishing boats and vessels are estimated using information from the national surveys on fishing. The survey gives information on number of boats and vessels in different size groups. In the survey of 1979 values also was included these have been used in combination with the price index for fishing boats used in NA to estimate the stock value in the base year prices based on the numbers of boats only. The stock of the merchant fleet is calculated using insurance values per dead weight tonnes in the base year for different ship types in combination with statistics on number and sizes (in dead weight tonnes) for each type.

For cars and trucks a combination of methods is used. Using information on prices and quantities in the base year to estimate the level of the stock, the change in stock and distribution among activities are calculated by use of PIM. The PI-method gives a lower value indicating that the past GFCF have been underestimated. Improvements of the GFCF statistics have been made but no knew check against stock data is undertaken.

Problems with the PIM

The stock is made up by GFCF. So, it would in principle be possible to use information of GFCF to derive stock values. But in some cases information of GFCF and the associated service life is not enough. This is the case when GFCF systematically is over (under) estimated or the valuation of GFCF does not fit in with the valuation of the stock this is the case when used machinery is transferred. At the best there is a separate value of the used machinery corresponding to net stock principles and the mean age but usually there exists a mixed value of new and used machinery.

A special problem of this kind is the change in recording of GFCF under

financial leasing. Assets under financial leasing have been recorded on the activity of the user since 1985 only. This break in the GFCF series would have distorted the GFCS series so therefor financial leasing also was redistributed between 1970 and 1984 in the same way as for the later years.

Coverage

The stock is calculated for buildings (incl. construction) and for machinery and equipment divided into different vehicles and the rest called other machinery and equipment. Diary cattle, breeding stock, race horses and the like are omitted. This is done due to lack of good statistics of stock value. The value of stock change is also of disputed quality but included in GFCF. It would be possible to estimate the stock value but because it has little analytical importance this has not been done. The major part of the transfer costs are included. Besides machinery and equipment the costs of ownership transfer on transactions in residential buildings is included. The most frequent and valuable transfers are made with residential buildings and associated land which means that the largest part of the total transfer costs is covered.

National wealth

In the compilation of Balance Sheets the net stock value is needed. This is achieved by subtracting CoFC from equation (1) which leads to the following expression of the net stock, N_t at year t:

$$N_t = \sum_{t-1} (I_t / P_t) * \varphi_{t-\tau} * (1-(t-\tau)/\lambda_{t-\tau}) \qquad (2)$$

$\tau=t-\lambda$ (max.)

where the term $(t-\tau)/\lambda_{t-\tau}$ accounts for CoFC. The term $t-\tau$ is the age of the asset and $\lambda_{t-\tau}$ is the expected average service life of an asset with age $t-\tau$. An example might help in understanding. Let the service life lie between 0 and 10 years distributed around an average of 5 years. A new asset has an age of zero and an expected service life of 5 which means no CoFC. An asset of five years age have an expected service life longer than five years say 7 years which gives an accumulated CoFC of 5/7 of the replacement costs for that particular asset. We should remind us of the fact that only about 50 percent of all assets bought 5 years ago are in use which gives a higher share for the total CoFC. An asset of 8 years age might have an expected service life of 9 years so 8/9 of the replacement costs is used up and so on.

Balance sheets are made for institutional sectors. Separate calculations are made for each institutional sector except for the non-financial sector which is given residually.

References:

Tengblad, Åke (1993)	National Wealth and Stocks of Fixed Assets in Sweden, 1981-1990. The Review of Income and Wealth, Series 39, Number 2, June 1993 Capital Stock and Capital Consumption Estimates
Tengblad, Åke and Westerlund, Nana (1976)	Capital Stock and Capital Consumption Estimates by Industries in the Swedish National Accounts, The Review of Income and Wealth, Series 22, Number 4, December 1976

Annex A

The different assets and service lives used are the following:

Asset	Service life (average number of years)
Residential buildings	
One family dwellings	75
Multifamily dwellings	65
Non residential buildings	
Industrial buildings	30-45 depending on activity
Government buildings	45-60 dep. on use
Other buildings	40-60 dep. on activity
Construction	
Roads	40
Other constructions	25-65 dep. on activity
Transport equipment	
Cars	13
Trucks and buses	6-8
Fishing boats	35
Ships	25
Rolling stock	25
Aeroplanes	20
Machinery and equipment (except for transport)	
Industrial machinery	10-25 dep. on activity
Agricultural machinery	10
Main frame computers	10
Govemment machinery and equipment	10-12 dep. on use
Other machinery	8-25 dep. on activity