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ADJUSTING DEPRECIATION FOR  
PRICE CHANGES IN THE NATIONAL  
INCOME ACCOUNTS IN TURKEY

by

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# ADJUSTING DEPRECIATION FOR PRICE CHANGES IN THE NATIONAL INCOME ACCOUNTS IN TURKEY

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Any attempt to adjust depreciation for price changes in the Turkish National accounts will have to beg the following questions:

1) Will lack of data required for a correct adjustment of depreciation for price changes bar any such attempt; or is there a method that can approximate such an adjustment, making use of the scarce data already available.

It is the contention of this paper that a method that can approximate depreciation adjustments for price changes is available. It may, however, be difficult to organize the collection of data for a more refined method of adjustment of depreciation for price changes. On the other hand, since access to direct data required for a correct adjustment is not available, even in Western countries, it should become very understandable why such a rough method as will be explained later has ever come to be adopted.

Indeed, such an effort to apply an approximate method of depreciation adjustment in the Turkish national income figures has already been made by the author of this paper. To the best of his knowledge, it is the first attempt of its kind in Turkey. However, as it will become apparent in the later parts of this paper, it would be advisable to adjust depreciation, using the same method in principle but in a more detailed way than was attempted.

2) Will the adjustment of depreciation for price changes be of reasonable quantitative importance to justify the efforts than will be spent on the calculations? This question should inevitably weigh the complexity of the method of depreciation adjustment for price changes with the quantitative importance of the results of adjustments.

It should be mentioned here that the method of adjustment adopted works with minimum of data, and these are already available. As more data become available after recent studies concerning the correction and compilation of investment figures are completed, it could be possible to apply the method in a more detailed manner.

In short, the method of price adjustment proposed and applied is simple enough to justify its utilization even for moderate divergences between the nominal and the adjusted depreciation figures.

In addition, however, rapid rises in the general price level already suggests that the quantitative importance of depreciation adjustment should be great enough to justify the effort of adjustment. To cite, from 1948 to 1960 the price index has increased by more than one and a half times, price increases being most pronounced in the latter half on the period; to witness from 1955 till 1960 it has gone up about 100%. The results of this first attempt to adjust depreciation also serves to indicate the quantitative importance of the adjustment and hence the need to work it out in a more detailed manner.

3) Will the using of a correct but complex method of depreciation adjustment be justified, not in view of the quantitative significance of the adjustment but in view of the presence of more fundamental errors in the estimation of national income, including the estimation of total nominal depreciation charge and total gross investment figures is a question that remains open still. Attempts to adjust depreciation for price changes in a more refined manner than is adopted in this paper without first devising methods and procedures for a more correct national income, depreciation and investment figures will be but building upon the fundamental errors already present. This will limit the usefulness of the adjustment of depreciation for price changes. It is, therefore, contended in this paper that the application of a correct method of depreciation adjustment and the efforts for collecting data required for such an adjustment method should either be ruled out as impractical or should await the accomplishment of narrowing the margin of error in the estimation of national income, depreciation and investment within reasonable limits by revising and correcting the fundamental methods and procedures of estimation first.

The author of this paper thinks it more reasonable to adhere for some time to come to the rough method adopted in this paper but work it out in a more detailed manner after the abovementioned correction of fundamental errors are completed.

4) The suggestion made above with regard to the immediate application of the approximate method of depreciation adjustment is enhanced by the quantitative significance of the result of the adjustment. The following comparisons were made to arrive at the relative quantitative importance of depreciation adjustment for price changes:

Results of the preliminary efforts by other writers and organizations to correct total investment figures by revising the fundamental methods and procedures were compared with the results of depreciation adjustment. Even after making allowances for the upward bias inherent in the method adopted, depreciation adjustment was quantitatively more significant for all the years studied. It has thus become very apparent that such an adjustment deserves to be taken into account.

Same can be said about the comparisons of the results of depreciation adjustment with the results of preliminary correction of gross national product and national income figures attempted by other authors and organizations. Depreciation adjustment is relatively of enough quantitative weight to be taken into account in arriving at a correct net national product or national income figure, although in this instance the quantitative significance of correcting the gross national product figures by revising the fundamental procedures of estimation are much greater than the quantitative effect of depreciation adjustment on net national product.

To the knowledge of the author, no attempt has been made to this data to revise and correct the nominal depreciation charge. This is especially awkward for this attempt to adjust depreciation for price changes, since the approximate adjustment method adopted had to be based on nominal depreciation figures. The neglect of the correction of the nominal depreciation figures is understandable, however, both because of the difficulty of such a correction and because of the fact that gross national product and gross investment figures are used more often than net national product and net investments and hence deserve prior attention.

This paper will consist of two sections. In the first section the methods of estimation of total gross investments and of total



nominal depreciation will be explained briefly. Preliminary attempts to correct the available investment estimates will also be mentioned.

The definition of and the method of estimation of the gross national product and national income used by the Central Statistical Office and the preliminary attempts by other writers and institutions to correct national income figures is purposely left out of discussion in this paper. The reasons for it are twofold. Firstly, the scope of the topic of national income estimation is too large to be adequately dealt with as a section of this paper. Secondly, it seems less important for the purpose of this paper which is more specifically interested in the estimation of capital formation. In the second section of this paper, the method applied to adjust depreciation for price changes will be dealt with at some length and the quantitative importance of the depreciation adjustment will be shown.

SECTION: I

BRIEF SURVEY OF INVESTMENT AND DEPRECIATION ESTIMATES

A- Estimation of Gross Investment Figures

The gross investment figures are prepared initially by the Central Statistical Office breaks the gross investments into two major groups:

1- Investment in buildings and construction

2- Investment in machinery and equipment

These major groups are further broken down into various subgroups such as private houses and buildings, public buildings and commercial and Industrial construction for the former major group and imported machinery and home-produced machinery for the latter. The subgroups are further divided into various sections. Whenever direct data to arrive at the investment figure of a section of a subgroup is not available an index that approximates the actual total investment in that section is utilized. Even as brief an information on the method of compilation of total gross investment figures as that above will at once reveal the following deficiencies and possible search for corrections:

1- Changes in the investment in stocks is completely left out of account. Data on stock movements are not collected and hence reflected in the national product and investment figures.

It is particularly important to note here that exclusion of investment in stocks, and mere contention with investment in fixed capital will, amongst many other consequences, make any calculation of the capital-output ratio very unrealistic. While it is impossible to collect figures for stock movements in the major sections of the economy such as the agricultural sector and the income of unincorporated firms, there should be access to stock movement figures in the public sector and private corporate firms and hence, if desired, these could be used both for a partial correction of the national income figures and certainly as a basis for a more realistic estimation of the overall or sectional capital-output ratios.

2- The Central Statistical Office does not break down the investment figures by sectors. Not to mention any subgroups that we may devise, data on the breakdown of investment into such major sections as agriculture, industry, services etc.



are not made available. This seriously limits the usefulness of the investment figures of the Central Statistical Office for economic analysis.

A breakdown, is made, however, into public and private investments. This breakdown shows that the proportion was roughly 60% private, 40% public during the years 1948-1955, with the share of public investments increasing to approximately 50% in the preceding years.

3- The indexes and methods of approximation used by the Central Statistical Office to arrive at the investment figures in some sections of the subgroups can always be subjected to improvement. More important than this, however, for these more important groups on which direct data is available, a lot of modifications need be made. This comment is particularly relevant for the imported machinery and imported building materials. It appears that the Central Statistical Office has taken account only of the August 1958 devaluation of the lira from  $\text{₺ } 1 = 2.80$  to  $\text{₺ } 1 = 9.00$ . In addition to this, however, other changes that had occurred in the period under study should also have been taken into account. One important change not accounted for in the investment figures of the Central Statistical Office was the change in the importation and tax systems.

The points mentioned above were the immediate concern of the preliminary attempts made by a number of authors to correct the available total gross investment figures.

Kenan Gurtan's study is comprehensive but unfortunately covers only the period 1948-1955 and still needs some months to be up-dated.

His study is particularly important since it includes an estimate of the breakdown of investments into major sectors such as agriculture industry, construction, mining, commerce, transportation, buildings and services and is more elaborate than the breakdown made by H.B. Chenery. When this study is up-dated, it will fill a great gap in the available investment statistics.

Kenan Bulutoglu's study made for the State Planning Organization covers the period 1948-1955. It is mainly concerned with the

correction of the total gross investment figures prepared by the Central Statistical Office. Later in this paper, the results of this latter study will be compared with the results of depreciation adjustment with the sole purpose of stressing the relative quantitative importance of the price adjustment.

B- Estimation of Nominal Depreciation Figures

Estimates of total nominal depreciation made by the Central Statistical Office can be critisized in two veins:

1- The first reason for critisizm, that has not been stressed with vigour if stressed at all, lie in the deficiencies of the depreciation methods allowed by depreciation accounting regulations and hence the inability of the depreciation allowance to reflect true capital consumption. Two important deficiencies in the depreciation accounting regulations can be cited here:

a) In fixing the life of fixed assets the accounting regulations were influenced by the estimates made in Western countries. Obsolescence plays a major role in the life expectancy of fixed assets and though detailed comparisons and calculations has not yet been made on the subject of obsolescence, it is contended here that the conditions of obsolescence are radically different between this country and Western countries, obsolescence rate being much slower in the former, as can be witnessed by virtually all machinery that have diminished to 0 accounting value being still utilized for a lot of years. To what extent this may be caused by the unavailability of foreign exchange is dubious. This error in the correct estimation of the life of assets should give somewhat a strong upward bias in the estimation of the total capital consumption figure.

b) Another deficiency that is important in the allocation of the capital consumption expense between years is the deficiency of the method of straight-line depreciation that is allowed exclusively by the tax authorities here. Application of use-depreciation, the declining balance or a combination of straight-line plus use-depreciation that may reflect true capital consumption cost for the years much better than mere straight-line depreciation is left entirely out of account for tax purposes. The national income estimates are thereby also based on the straight-line depreciation method. It

should be mentioned here that new tax reform proposals permit a variant of the declining-balance method for some fixed assets and if these proposals are put into effect, account should be taken of differences in the depreciation method in order to make the national income and other estimates comparable between the years.

2- The second vein of criticism lies in the method of estimating the depreciation in those sectors in which direct recourse to financial reports is not possible. Mere suggestions for the collection of data need not concern us here. The concept of depreciation explicitly or implicitly followed is, however, directly relevant for the purpose of this paper.

It was already mentioned that depreciation in the public sector which accounts for approximately 50% of total depreciation, and depreciation of private corporate firms which cuts across the various income sectors of the economy and should account for approximately an additional 15% are, per force, based on the nominal concept with straight-line method.

Estimates for the depreciation in the agricultural sector which amounts to about 10% of total depreciation is also based on the nominal concept. Because, for this sector the procedure is as follows: First the nominal values of total fixed assets are estimated and then a certain percentage representing a weighted depreciation allowance is applied to arrive at total depreciation for the sector. Nominal depreciation concept is also implicit in the method of estimation applied to the construction sector.

The unincorporated sections of the rest of the sectors which should represent approximately about 20% of total depreciation (notice here that this figure depends on the capital intensity of the sector and is not necessarily proportional to the share of the unincorporated sections in the total income) is estimated as a certain low percentage on the current income produced by these sections. This suggests that the replacement concept of depreciation may implicitly creep into the estimates. The author of this paper is of the opinion that, this tendency is not quantitatively important in the total depreciation figure and may be entirely omitted in the calculations of price adjustment.



Those who are not satisfied with the above contention and wish to make the most conservative calculation of price adjustment may take an initial discount of about 20% in the quantitative results obtained through the method of calculation adopted in this paper.

It should be mentioned here that a more refined calculation separating that depreciation figure to which price changes have crept can be made after refined breakdowns of gross investments by sectors are up-dated.

## SECTION II

### A METHOD OF MAKING APPROXIMATE ADJUSTEMENTS FOR PRICE CHANGES IN DEPRECIATION AND THE QUANTITATIVE RESULTS OF ITS APPLICATION.

#### A- The Method of Making Approximate Adjustments for Price Changes in Depreciation

The following assumption will help explain the method of depreciation.

1- The assumption about the net increase of nominal depreciation.

To adjust nominal depreciation for price changes, one would need a detailed breakdown as to the years over which a component of the total nominal depreciation has been based. This being unavailable, one has to choose between methods that accomplish depreciation adjustment in an approximate way. The method used in this paper is probably the roughest. It consists of finding the difference of the total nominal depreciation between two consecutive years, say between 1950-1951, and of assuming that component of total depreciation for any year, say 1954 is charged and is continued to be charged till 1954 at the prices of the later of the consecutive years, that is, of 1951. Such an assumption is bound to give an upward bias in the adjustment difference computed because it omits capital exhaustion by 1951. Due to capital exhaustion or complete write-off of the accounting value by the end of the first of the consecutive years, that is, by 1950, actually more than depreciation difference between 1950-1951 should have been made with the then current, i.e. 1951 prices.

To emphasize this deficiency of the method price adjustment employed, we need only stress that it virtually means continuous life for assets during the period under study and downwards, which is obviously untenable. This upward bias, however, may be compensated partly or wholly in a number of ways. One rough way is to make a reasonable deduction in the results of the depreciation adjustment differences obtained. Another way is explained in the following paragraph.

#### 2- The Handling of the 1938 Depreciation and of the Depreciation between 1939 and 1947

Complete series of capital consumption and national income figures are not available. Indeed, there is an estimate of national

income and capital consumption for the year 1938. Figures for the years 1939-1947 are not available. The series, therefore, actually start with year 1948.

Since the above method assumes continuous life, total depreciation for 1938 should, by assumption, be included as a component in the total depreciation charge for any year under study and that part of the total depreciation which is being carried at 1938 prices. This assumption would be unrealistic especially with regard to machinery. Therefore no adjustment for price changes were made for the 1938 component of the total nominal value. This procedure followed for the 1938 depreciation component would offset to some extent the inherent upward bias of the method.

The increase in the total depreciation charge between 1939-1947, on the other hand, was adjusted by using an unweighted average of price indexes for these years. This procedure implicitly assumes an equal increase in total depreciation figures during the years in question.

The upward bias inherent in the method adopted may still be questioned in spite of the treatment of the 1938 depreciation figure. Unfortunately, it is not even possible to approximate the probable margin of error present because this would depend entirely upon the actual distribution of capital exhaustion throughout the period. Probable check could have been to work with yearly gross investment figures broken down into buildings and machinery and with a weighted average of depreciation percentage for each of these two categories. Another could be to compare the results of this method of depreciation adjustment with the results of a more refined method both applied in another country.

No attempt at a rough verification, however, was made here. It is suggested that the depreciation adjustment figures be discounted by about 20% to offset the upward bias inherent in the method adopted. Those who may feel ill at ease with such a rough method of depreciation adjustment, should only have to remember that by leaving the nominal depreciation figure unadjusted they would actually have to be content with a greater percentage of error in their figures of capital consumption and national income than those who do the adjustment in the rough way.



### 3- The index used for price adjustments

The index used in this paper was the general wholesale price index prepared by the Istanbul Chamber of Commerce. While a lot can be said in favor of such an index which measures the change in the purchasing power of money, some authors prefer the specific indexes on the belief that these latter are more relevant to the concept of replacement.

Any search for a specific index would come up with the following result: Construction materials price index for adjusting depreciation on buildings and price index of imported materials, which also includes prices of imported consumption goods as an approximation for adjusting depreciation on machinery. The deviation between these two indexes are not great enough to justify a separate treatment of the two investment groups. But they have risen about 20% less slowly than the wholesale price index used in this paper. Strict adherents to the specific indexes should, therefore, make a further discount of about 20% in the comparisons of the quantitative significance of the adjustment difference calculated on the basis of general wholesale index.

### B- Quantitative Significance of Depreciation Adjustment

In view of the above, it appears that the following allowances can be made in the interpretation of the quantitative significance of depreciation adjustment calculated in this paper:

I- Entire exclusion of 20% of depreciation from the adjustment process.

2- A discount of about 20% to offset the upward bias of the method of price adjustment itself.

3- A discount of about 20% for switching to the use of specific indexes.

Those who allow for any two of the above should make a total discount of about 35% and those who allow for the three, a total discount of about 50% in the depreciation adjustment figures given below.

The results of the method employed in this paper shows a constant increase of the relative weight of the depreciation adjustment difference over nominal total depreciation, total gross national product and total gross investment figures over the years between

1952-1960. This is as is expected and not the in least explainable by the bias of the method for the later years. The explanation lies mainly in the relative rapidity with which prices rose in the latter part of the period under study.

The rise of adjustment difference over total nominal depreciation was from 22% in 1952 to 74% 1960. Over gross national product it was from 0,8% in 1952 to 32% in 1960 and over gross investment it was from 7% in 1952 to 19% in 1960, using the capital consumption, gross national product and gross investment figures prepared originally by the Central Statistical Office. Detailed results are shown in Table I.

TABLE I

RESULTS OF DEPRECIATION ADJUSTMENT FOR PRICE CHANGES (+)  
(All money figures to the nearest million liras)

<u>Years</u>	<u>Total Nominal Deprecia- tion</u>	<u>Total Adjusted Deprecia- tion</u>	<u>Adjustment Difference</u>	<u>Difference Over Nominal Depreciation</u>	<u>Difference Over Total Gross Investment</u>	<u>Differ- ence over GNP</u>
1952	541	657	116	22%	7	0,8
1953	602	737	135	22	7	0,8
1954	699	900	201	29	8	1,2
1955	906	1.169	263	29	9	1,2
1956	1.097	1.538	441	40	138	1,8
1957	1.229	1.937	708	58	18	2,3
1958	1.548	1.538	.990	64	19	2,6
1959	1.911	1.384	1.473	77	19	3,1
1960	1.238	1.890	1.652	74	19	3,2

(+) It has been obtained from presenting the work sheet. Assumptions in the calculations and the procedure was as follows

1- Assumption of 100% nominal basis of the original Central Statistical Office depreciation figures.

2- Assumption of the net increase in depreciation between consecutive years as at current prices. Exception was for 1938 depreciation component which was not adjusted in order to decrease the upward bias of the method used. Yearly differences between total depreciation not being available for the period 1939-1947, a

weighted average of price indexes was used.

3- To adjust depreciation differences to current prices, Istanbul Chamber of Commerce general wholesale prices index was used.

4- Comparisons of adjustment difference are made with the Capital Consumption, total Gross investment and GNP figures prepared originally by the Central Statistical Office.

Notice that depreciation adjustment figure is by essence expressed in a current prices. All depreciation, net investment, national income figures can be expressed in any base price, say 1948 prices only after proper adjustment in depreciation to current prices is made.

The quantitative significance of depreciation adjustment for price may be compared with the results of fundamental methodological corrections made on the gross investment figures by Kenan Bulutoglu for the State Planning Organization. In the above mentioned study, major discrepancies are seen in the gross investment figures for the years 1958 and 1959: correct figure for 1960 has not yet been prepared. It appears that correction for the fundamental defect of estimation necessitates the following discounts expressed as percentage of total gross investment figures prepared by the Central Statistical Office: About 2% down for the 1958 investment figure, about 7% down for the 1959 figure.

Depreciation adjustment difference for both years in order to arrive at the net investment figures.

It is also worth noting that Kenan Bulutoglu's corrections result in either very slight additions to or subtractions from the total investment figures for the years 1952-1957.

The first set of corrections made by the State Planning Organization showed a wider minus divergence from the original Central Statistical office gross investment figures for the years 1959 and 1960 with all other years under study including 1957 upped. Percentage of minus error for 1959 was shown to be around 10% and that for 1960, around 4%.

All the above lead to the conclusion that where as the adjustment of depreciation for price changes is quantitatively much less significant for the net national product figures. It is much more significant in arriving at the net investment figures when compared



with the other set of corrections. Therefore, after the correction of the original national income, investment and depreciation adjustment for price changes should be calculated in a more detailed manner than the one already attempted in this paper.

S.Z.







