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CHAPTER FIVE

THE ESTIMATION TECHNIQUES OF THE STUDY AND THEIR VALIDATION

5.1 Introduction

As mentioned in Section 1.2, the main purpose of the study is to approximate, ex ante, the impact of applying GPPA on Greek accounts and especially on Greek earnings and thereby draw implications for micro- and macro-decision making in Greece. In accomplishing the purpose a combination of detailed GPPA restatement procedures and estimation models was employed on a sample of 30 quoted Greek manufacturing companies.

The nature and operation of the estimation techniques used in the study and their validation are discussed in this chapter. The detailed mechanical procedures employed to restate each basic category of Greek accounts is deferred to the next chapter. Hence, the purposes of this chapter are the following:

> *1. To discuss the estimation techniques used in the study, to validate their accuracy, and concurrently test their generalisability.*
>
> *2. To discuss the general, as well as the specific problems associated with the GPPA restatement of the sample and describe the mechanical procedures finally employed to restate each basic category of accounts.*:

The sub-purposes of the study are two: **(a)** To

compare the performance of the untested Dichotomous Year Technique and its variation developed for the needs of this study (i.e. for the restatement of fixed assets) with that of the Composite Age Technique used in previous studies for GPP adjustments of fixed assets. (b) To compare a detailed annual restatement of fixed assets with a monthly one in order to see whether costs of operation of GPPA can be saved, on the one hand, as well as to determine the error involved in restating the fixed assets of the second sub-sample of the study by use of detailed annual information gathered by the researcher, on the other.

Toward these ends, Section 5.2 briefly states the reasons for which the Petersen, the Davidson-Weil, and the Parker models serve as candidates for choosing the estimating techniques of the study. Following this, the reason for choosing the Davidson-Weil model are given. Then the nature and operation of the chosen model are outlined, and the modifications made by the researcher to it and their underlying reasoning are explained. An illustration of the operation of the D-W model is deferred to the next chapter.

In Section 5.3 the reasons for developing the Dichotomous Year Technique (DYT) for the restatement of fixed assets and depreciation are explained, the nature and operation of the new technique and of its variation, which is called Equal Additions Technique (EAT), are discussed. Following this, an illustration of their operation is presented, and a comparison between the new

technique and its variation with the Composite Age Technique is made.

Section 5.4 validates the estimation techniques used in the study and concurrently tests their inherent generalisability. Specifically, errors of estimates are established in restating fixed assets by use of DYT, EAT, and CAT instead of analytical monthly fixed assets data, and in computing monetary gains/losses by use of the Average Balance Technique rather than by use of monthly data. Following this, the statistical significance of these errors is determined by use of statistical tools and conclusions are drawn regarding accuracy and generalisability of the techniques.

In Section 5.5 errors of estimate are established in restating the first sub-sample of the study on an annual rather than monthly basis. Following this, the significance of these errors is determined and conclusions are drawn on the error involved in restating the second sub-sample of the study by use of annual data gathered, as well as on whether operation costs of GPPA can be saved by restating fixed assets in general by use of annual data rather than monthly data.

5.2. The Estimating Techniques Used in the Study and Their Origin

From the estimating techniques which are available for GPP restatement of financial statements, the models of Petersen (1973, or 1971), of Davidson and Weil (Davidson et al. 1976), and of Parker (1977), are considered to be the most sophisticated models. These three models have been used a lot by estimation studies on GPPA. For example, the Peterson model has been used by Norton and Smith (1979), the Davidson-Weil model (hereafter D-W) by Flink et al. (1978), Devon and Colodny (1978) and by Hillison (1979), whilst the Parker model has been used by Ketz (1977) and by Baran et al. (1980a). Other researchers such as Short (1978) have also used similar procedures.

The above mentioned estimating models have been tested for their accuracy by other researchers and generally they have been found to perform well[1]. Thus, Ketz tested all three models using McKenzie's data, i.e. financial statements of 8 air line companies for a ten year period (1958-1967). His conclusion was that "...except for owner's equity the models estimate(d) the general price level items very well" (Ketz, 1978, p.956). Baran et al. tested the Parker model against detailed

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1. Of cource these models have never been rigorously tested, as discussed in Section 4.3. However, perhaps with the exception of the Basu and Hanna model (1975 & 1976) the tests which these models have passed are more rigorous than the tests passed by other estimation models.

restated figures provided by companies[2] which had participated in the AICPA research study (Rosenfield, 1969). They concluded that "...the level of inaccuracy introduced by the estimation procedure (was) not sufficiently large to alter the major effect of a general price-level (GPL) restatement" (Baran et all. 1980b, p.139). Finally, Walther tested the Davidson-Weil model against data which 459 companies had reported persuant to SFAS 33. The author found that the estimates of the D-W model exceeded the reported depreciation expense by an average of 13.73 per cent, the reported cost of goods sold by an average of 0.54 per cent and the reported monetary gains/losses by an average of 68.3 per cent (Walther, 1982, p.376).

The use of these techniques in field studies as well as the test of accuracy passed by them constitute two good reasons for the researcher to concentrate on them and choose from them the particular estimation procedure to be employed in the study. However, these reasons are not enough to justify the particular choice. The fact that a model has been found to perform well in one country does not necessarily mean that it will perform well too when applied in another country, which might have different inflation-sensitive characteristics and rates of inflation (See Section 4.3). Validation of these models is required if the models are to be accepted for use within a specific country.

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2. Ten companies provided the authors with actual restated data for one or two year period.

For the validation of these techniques the researcher was able to get detailed information for several Greek firms regarding fixed assets and depreciation (the first sub-sample of the study), as well as monetary items (the third sub-sample of the study). However, it was not possible to gather detailed information for inventory and cost of goods sold. The latter information is of particular importance with respect to the choice of the estimation model to be used in the study since the three models differ basically only as regards the restatement of inventory and cost of goods sold.

Indeed, for revenues and expenses other than cost of goods sold and depreciation, the three models apply basically the same procedure for their restatement (assuming that revenues and expenses occur evenly throughout the year). The same applies to the restatement of fixed assets and depreciation when the straight line of depreciation is applied (see Ketz, 1978), as it is the case with Greece, as well as to the restatement of owner's equity. As for the computation of monetary gains/losses the D-W model as well an the Parker model apply exactly the same estimation procedure. Petersen does not use a specific technique but he derives the gain/loss indirectly as a residual by use of the Equity

Change Technique[3]. Hence, what differentiates the three models is the restatement of inventory and cost of goods sold.

Due to the lack of data availability as regards inventory and cost of goods sold, the choice of the particular model will not be based on validation of these models with Greek data. Rather the particular choice will necessarily rely on such criteria as past use and degree of accuracy of the models found in the USA where the models have been applied mainly.

The D-W model seems to fulfill these criteria better than the other two models. This is because this model has been more rigorously[4] tested than the other two models and as regards the cost of goods sold it has been found to be very accurate. Additionally, this model has been used more widely than the other two models. Hence, the D-W model is employed in the study.

The estimating procedure used by D-W for restating each basic category of items is outlined in the following paragraphs. In these paragraphs the modifications made to the model by the researcher and the reasons underlying them are also described.

1. Income statement items

Sales, other revenues, and expenses other than cost

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3. According to this technique monetary gain/loss is the amount required for the restated beginning equity (expressed in end of the year purchasing power terms) plus any restated additions during the year minus any restated reductions to it (i.e. cash dividends) to equal the restated ending owner's equity.

4. Rigorously in the sense that the sample used by Waitner (1982) for the validation of the model included a great number of firms (i.e. 459), and therefore the findings of that test are more generalisable than the findings of the tests passed by the other two models.

of goods sold and depreciation are included here. For the restatement of these items the assumption made by the D-W model (as well as by the other two models) is that these items occur evenly within the accounting period (year). Hence, the conversion factor applied for their restatement is given by CF in the following expression:

CF = index at the end of the year / index at midyear (5.1)

Since the GNP index is used by D-W (as well as by the other two models) for GPP adjustments, the GNP Deflator of the fourth quarter of the year is used for the computation of the nominator of the conversion factor. For computing the mid-year index or one-half year of price changes D-W use the geometric mean of the annual indices[5].

The researcher makes some modifications as regards the computation of the conversion factor used for the restatement of income statement items. A general modification is the use of the consumer price index (CPI) for the restatement of accounts generally instead of the GNP index (the reasons for this are explained in the next chapter). Also, the "year-end" index number is taken as the arithmetic mean of the index numbers of December and January and not as the index number of December of the year under consideration. This calculation is made because the Greek CPI numbers applied to each month are average numbers, and therefore they are more representative of mid-month prices than end of month

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5, Parker as well as Basu and Hanna (1975 & 1976) also use the geometric mean. Petersen uses the arithmetic mean.

prices. Finally, for computing half year of price changes the researcher uses the geometric mean as D-W, that is the formula:

$$G = \text{Square Root} (X_1, X_2, \ldots, X_n) \qquad (5.2)$$

where $X_1, X_2, \ldots, X_n$ stand for the CPI of January to December.

The choice of the geometric mean is based on the plausible assumption that it is unit of sales and other expenses which occur evenly thoughout the year (Davidson et al, 1976, pp. 95-99), as well as that the changes in the inflation rate occur uniformly through the years. In practice, basically it does not make any difference if one uses the arithmetic mean instead of the geometric mean (i.e. even in the period with the highest changes in the inflation rate in Greece their differences are less than 0.5%).

2. Owners' equity

All three models use the same procedure for the restatement of owners' equity; that is, the restated owners' equity is taken as the difference between restated total assets and restated total liabilities. This procedure is also employed by the researcher.

3. Monetary items

For the calculation of general purchasing power gains/losses D-W (as well as Parker)[6] use the so called Average Balance Technique. That is, the net monetary position of the firm at the beginning and at the end of the year is averaged. This average number is multiplied

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6. As mentioned in this section, Petersen computes monetary gains/losses indirectly by use of the Equity Change Technique.

by the average annual change in the inflation rate to yield the monetary gain or loss of the year, the assumption being that the monetary items occur evenly through the year.

In this study instead of the average net monetary position being multiplied by the average annual change in the inflation rate, it is multiplied by the CPI prevailing at the end of the year and then it is devided by the CPI prevailing at the beginning of the year. From the figure obtained the historical average net monetary position is substracted to get the monetary gain/loss expressed in end-of-year general purchasing power terms. The results obtained are basically the same with those obtained under the Average Balance Technique as used by D-W.

4. Stocks and cost of goods Sold

The particular technique used by Davidson and Weil (as well as by the other two models) for restating stocks and cost of goods sold depends on the method of inventory valuation.

In restating FIFO stocks D-W concentrate on the adjustment of cost of goods sold (COGS). COGS equals beginning inventory (BI) plus purchases (P) minus ending inventory (EI), that is:

$$COGS = BI + [P-EI] \qquad (5.3)$$

where [P-EI] is the average purchase (AP) which entered the cost of goods sold and equals as well cost of goods sold minus beginning inventory. Hence, the adjusted COGS is given by the following equation:

$$COGS(adj) = BI(adj) + [P-EI](adj) \qquad (5.4)$$

or

$$COGS(adj) = BI(adj) + [COGS-BI](adj)$$

The beginning inventory which entered the COGS under FIFO is adjusted for this year's price change plus a fraction (t_2) of last year's price change, where:

$$t_2 = \frac{1}{2} \times \left(1 - \frac{COGS_{last\ year} - BI_{this\ year}}{P_{last\ year}} \right) \qquad (5.5)$$

(see Davidson et al., 1976, p. 119). In other words, the age (in months) of the beginning inventory at the end of the year under examination is the following:

$$\text{Age of BI} = 12 \text{ months} + \frac{1}{2} \times \left(1 - \frac{COGS_{last\ year} - BI_{this\ year}}{P_{last\ year}} \right) \times 12 \qquad (5.6)$$

In practice, D-W adjust beginning inventory for price change occuring during one year plus

$$\frac{1}{2} \times \frac{COGS_{this\ year} - BI_{this\ year}}{P_{this\ year}}$$

Hence, the equation (5.6) becomes:

$$\text{Age of BI} = 12 \text{ months} + \frac{1}{2} \times \left(1 - \frac{COGS_{this\ year} - BI_{this\ year}}{P_{this\ year}} \right) \times 12 \qquad (5.7)$$

The average purchase (AP) which entered the cost of goods sold was defined as

$$\frac{1}{2} \times [(COGS-BI) / P] \times 12$$

months after January 1 of the year under examination (see Davidson et al., 1976, pp. 118-19). Hence, at the end of the year under examination the average age of the average purchase entered the cost of goods sold is the following:

$$\text{Age of AP} = 12 \text{ months} - \left(\frac{1}{2} \frac{COGS - BI}{P} \times 12 \right) \qquad (5.8)$$

The indices corresponding to the age of the beginning inventory and average purchase entered the cost of goods sold in relation to the index at the end of the year constitute the conversion factors for the restatement of BI and AP. The restated COGS is given by the equation:

$$COGS(adj) = BI(adj) + AP(adj) \qquad (5,9)$$

As for the restated ending inventory (EI), this is given by the equation:

$$EI(adj) = BI(adj) + P(adj) - COGS(adj) \qquad (5,10)$$

where the purchases of the year are adjusted for one-half year of price change, the assumption being that the purchases are spread fairly evenly throughout the year[7].

For restating **weighted average cost** of inventory, D-W concentrate on the adjustment of cost of. goods available for sale (COGAS). COGAS equals beginning inventory plus all purchases of the year. The purchases of the year are adjusted for one-half year of price

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7, For adjusting FIFO inventories Petersen concentrates on inventory turnover on the basis of which he determines age of inventory, and hence index to be used for restatement. Thus, if the inventory turnover is greater than 4,0 the age of inventory under restatement is zero (and hence no restatement is needed). If the inventory turnover is 4,0 to 2,1 or 2,0 to 1,34 the age of inventory is 3 months or 6 months and so on, (See Petersen, 1971, p,18)

For adjusting FIFO inventories Parker concentrates on the restatement of ending inventory. Specifically, he determines the average daily purchases by dividing purchases of the year by 365. Following this, he determines the number of days purchases contained in ending inventory by dividing it by the average daily purchases figure. Then ending inventory layers by date of acquisition are determined. That is, the average daily purchases are multiplied by the number of days contained in the last quarter of the year (i,e, 92 days) to get the historical inventory figure which is a quarter old. In the same way the part of ending inventory which is two quarters old is determined and so on. Then the purchases of the year are adjusted for one-half year of price change. Given that the ending inventory of this year is the beginning inventory of the next year the restated COGS is obtained by the equation

$$COGS(adj) = BI(adj) + P(adj) - EI(adj)$$

(For more about this see Parker, 1977, p,77).

changes the assumption being that they occur evenly throughout the year. As for the adjustment of the beginning inventory the concentration is on the adjustment of ending inventory which is equal to the beginning inventory of the next year.

The exact age of a weighted average ending inventory depends on the rate of growth in purchases and the inventory turnover. However, under most normal circumstances, ending inventory is three quarters of a year old (see Davidson et al., 1976, p. 122). Hence, the COGAS expressed in end-of-year general purchasing power is given by the equation:

COGAS = Beginning inventory adjusted for 1,75 years[8]

plus

Purchases adjusted for one-half year (5,11)

As for the restated COGS, this is given by the equation:

COGS = (COGS / COGAS) x adjusted COGAS (5,12)

the assumption being that a firm uses equal portions of

8, Since the ending inventory of last year is 0,75 years old, the beginning inventory of this year at the end of the year is 1,75 years old,

all goods available for sale[9].

The researcher uses the same procedure, for restating FIFO and weighted average cost of stocks. The only difference is that he uses the CPI instead of the GNP index, as already mentioned.

With respect to the LIFO inventory, the Greek companies included in the study do not use this method of valuation. Hence, it serves no purpose to dwell on the way the D-W model restates LIFO inventories. If more than one methods of inventory valuation are used by the Greek firms in this study, the restatement of the entire inventory is made on the basis of that method identified as "primary".

6. Miscellaneous items

This category includes all these items which are not included in the previous categories. For example, prepaid expences, advances to suppliers, foreign currency, investment etc are included here. For the restatement of these items specific weighting is applied by D-W (and

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9, Parker uses the same procedure basically, However, instead of adjusting COGS he adjust EI by aid of COGAS, Another difference concerns the restatement of BI, That is, Parker restates beginning inventory assuming that it is one year old and chooses arbitrarily 1965 as the starting point whereas the period examined was 1972 to 1974,

Petersen adjusts weighted average cost of stocks in the way he adjusts LIFO inventory, That is, in order to determine the LIFO base of inventory he solves the linear regression equation;

$$y=a+bx$$

where y=historical dollar value of inventory, and x=year

If b is positive the stock level is assumed to be increasing and the x-value which yields a zero y-value is the estimated age of the LIFO base of inventory, If this age is less than 1947 then the first quarter, 1947 index is utilized, If b is negative this indicates a decreasing trend of LIFO inventories, Accordingly, it is assumed that quantities are being utilized from the LIFO base and the first quarter, 1947 index is used for adjustment,

Petersen).

Because of the Greek peculiarities specific weighting is also applied by the researcher for the restatement of these items. That is, in the light of the relevant information at hand a specific age is attached to them. The specific age assigned to these items as well as the reasons for assigning it are given in the next chapter.

7. Fixed assets and depreciation

When the straight line method of depreciation is applied, D-W (as well as Parker)[10] use the so called Composite Age Technique for the restatement of fixed assets and depreciation, assuming a zero salvage value of fixed assets. This technique is very simple. The age of fixed assets is taken by dividing accumulated depreciation by depreciation of the year, where depreciation of the year is the difference between accumulated depreciation of two consecutive years. Then by substracting this age from the year under examination

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10. Petersen's model computes the average age of fixed assets indirectly. That is, assuming a 10% salvage value of fixed assets, he estimates the useful life of the assets (which is a necassary information for restating fixed assets when the accelarated method of depreciation is applied) by the formula; Life = ,9 x Total Cost / Depreciation. Then he divides the depreciable amount of fixed assets by useful life to get the composite depreciation. Following this, the accumulated depreciation is divided by the composite depreciation to get the average age of fixed assets. Since composite depreciation always equals depreciation under the straight line method of depreciation, Petersen's model always gives the same results as the other two models. The basic difference between Petersen's model and the other two models is that while Petersen adjusts accumulated depreciation using this age he restates the total fixed assets account by using an age which is one year less than the average age of fixed assets. The rationale offered for this is that this construction fitted better the data used to pretest the model.

When other than straight line method of depreciation is applied, Petersen's and D-W's models (the Parker model always assumes straight line method of depreciation) differ significantly (See Ketz, PH.D Dissertation 1977, Ch. 4). However, since in Greece by law only straight line method of Depreciation is applied for external reporting, it serves no purpose to dwell on the different way the two models restate fixed assets when other than straight line method of depreciation is applied.

the average acquisition date of the asset is estimated. The index of the acquisition date in relation to the "year-end" index constitutes the conversion factor for restating fixed assets and depreciation.

Instead of the Composite Age Technique a new technique, developed by the researcher and called Dichotomous Year Technique (DYT), is used in this study for the restatement of fixed assets and depreciation because it gives better results (see Section 5.4). The nature and operation of DYT is discussed in the next section.

5.3. The problem of Indexing Fixed Assets with Incomplete Information

5.3.1. Introduction

In the case of manufacturing firms depreciation is one of the most important items of the Profit and Loss statement. Because of it, great care must be exercised so that for the restated depreciation to be as precise as possible, if the so important figure of net (restated) earnings is going to be reliable.

In order for the restated depreciation to be precise two things must be known: (a) The exact value of the depreciation charged to each one of the individual fixed assets held by a firm at a given time. (b) The age of the individual fixed asset items held (i.e. month and year or at least only year).

In the published financial statements, however, neither the value of depreciation which corresponds to each item nor the age of it are given. Instead, the total fixed assets (F_t) and related accumulated depreciation (D_t) are given. In some cases the total depreciation of the year (Δ_t) is given as well. Because of it, the researchers who have no access to detailed accounting data have developed estimation models to restate (fixed assets and) depreciation.

The most well known of these models is the so called Composite Age Technique (CAT), as mentioned. This technique, based on the Mean Value Theorem attempts to

approximate the average age of fixed assets (F_t), and hence the index (average index or conversion factor) of restatement of total (fixed assets and) depreciation by use of the equation $t^* = D_t/\Delta_t$, where Δ_t is taken as the difference between D_t and D_{t-1}.

One of the implicit assumptions made under CAT is that all fixed assets are undepreciated. This is because the technique does not make any distinction between fully depreciated components of fixed assets, (to which no depreciation of the year is assigned and) which need no restatement, and undepreciated fixed assets, (to which the depreciation of the year is applied and) which are going to be restated, and hence their average age is needed. Instead, CAT computes an average age for all fixed assets (F_t) and on the basis of that age the conversion factor or average index of restatement is determined. In turn, the index is necessarily applied not to all fixed assets but only to the undepreciated ones (i.e. net fixed assets), to which of course another smaller index is applied actually. As a result of it, ceteris paribus, where there are fully depreciated fixed assets still in operation restated depreciation and net fixed assets are overstated under CAT.

In Greece a considerable amount of fully depreciated fixed assets are still in operation, as the researcher noticed during the data gathering phase of the study. Because of it, he formed the opinion that CAT was not going to work in the Greek case.

Of course, the accuracy of the CAT was tested in the

USA by Walther and a 13.73 per cent overstatement was observed, as mentioned. However, the USA is a developed country. As such its economy should be much healthier than the Greek economy; the profitability of the USA companies should be much greater than that of the Greek companies; the USA management should be more sophisticated than the Greek management. Because of these factors the fixed assets used by the USA companies should be much younger than that employed by the Greek companies. Consequently, the inaccuracy of the CAT should be greater in the Greek case than that found in the USA case.

Hence, the researcher decided to examine closely the conditions under which this so simple technique gives good results, on the one hand, and to see whether or not these conditions hold true in the Greek case, on the other. Which are these conditions and how they influence the accuracy of the CAT is examined in the next sub-section.

5.3.2. Weaknesses of the Composite Age Technique

The close examination of the CAT showed that there are five conditions which should be fullfiled in order for the CAT to generate figures which approximate reality well. These conditions (or assumptions) are the following:

1. The rate of depreciation applied is constant through the years.

2. The annual additions of fixed assets are constant through the years.

3. The change in the rate of inflation from year to year is constant.

4. The fixed assets to be restated have no fully depreciated componets.

5. There are no retirements during the period of restatement.

The first condition is necessary because the average age of fixed assets and depreciation, and hence the average conversion factor, depends on the accumulated depreciation as well as on the depreciation of the year. Ceteris paribus, only if the rate of depreciation applied in the years which proceed the year under examination is equal to the rate of depreciation applied in the year under examination, and supposing that the purchases of assets occur at the beginning of the year, the average age of fixed assets and depreciation is equal to the actual one. Otherwise, the lower the average rate of depreciation applied in the years which procced the year under examination in comparison to the rate applied in the year under examination, the less the estimated average conversion factor than it should be, and hence the bigger the understatement of depreciation under CAT and vice versa. This is because the increase in the denominator (depreciation expense) due to the higher rate of depreciation applied in the year under examination, expressed as a percentage, is bigger than the increase in the nominator (accumulated depreciation). Basically the same results are yielded when the annual additions of fixed assets are increasing/decreasing materially from

year to year.

The third condition is needed because even if the estimated average age is very close to the actual one, the conversion factor which corresponds to it is not representative of the individual conversion factors actually applied unless the changes in the inflation rate from year to year are constant. Other things being equal, the smaller the change in the rate of inflation in the years which proceed the average year of acquisition of fixed assets in comparison to the changes in the inflation rate in the years which follow the average year of acquisition of fixed assets the bigger the overstatement of depreciation under CAT and vice versa.

The fourth assumption should hold true because, as the fully depreciated fixed assets needs no restatement the average age to be determined for restatement purposes concerns actually the undepreciated portion of the fixed assets account and the depreciation expense which correspond to it, not all fixed assets. Hence, in order for the estimated average age to be close[11] to the actual one the accumulated depreciation account should not include fully depreciated fixed assets. Otherwise, the more the accumulated depreciation of fully depreciated fixed assets which is included in the accumulated depreciation account the bigger the estimated average age than the actual one, and consequently the bigger the

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11. Under CAT, and supposing that the additions of fixed assets occur in the middle of the year, the estimated average age is always a little bigger than the actual average age of fixed assets.

overstatement of depreciation.

With respect to the fifth condition, when the retirement occurs during the period of restatement it reduces the historical accumulated depreciation account of the year of restatement by an amount which is equal to the accumulated depreciation of the retired item. As a consequence, the historical depreciation of the year to be restated, which is computed under CAT as the difference between accumulated depreciation of two consecutive years, is always less than the actual historical depreciation of the year no matter whether the retired item is fully depreciated or not at the time of retirement. Ceteris paribus, the older the retired item, and hence the bigger the accumulated depreciation of retirement, the less the estimated historical depreciation under restatement, and consequently the bigger the understatements of restated depreciation under CAT.

However, on a per cent basis the reduction in the accumulated depreciation account (i.e. numerator) due to the retirement is always less than the reduction in the depreciation of the year account (i.e. denominator). Because of it the estimated average age of fixed assets, and hence the estimated conversion factor, is bigger than it should be. Ceteris paribus, the more the accumulated depreciation of the retired item and the more the presence of fully depreciated fixed assets the more the overstatement of restated depreciation.

Therefore, in the case of retirement two opposing

forces interact as regards restatement of depreciation. The first of them tends to understate depreciation and the second tends to overstate it. What force is the stronger depends on the situation at hand.

With respect to the restatement of net fixed assets under each one of the first four conditions mentioned, the conclusions drawn regarding accuracy of restated depreciation hold true as well. The only difference is that for the reason to be mentioned subsequently there is a general tendency for an overstatement of fixed assets under CAT. Because of this tendency the overstatement of fixed assets (when applicable) is always bigger than the corresponding overstatement of depreciation. For the same reason the understatement of net fixed assets (when applicable) is always less than the understatement of depreciation and may be offset completly by the mentioned tendency.

As for the effect on restated net fixed assets when the fifth assumption does not hold true, it should be mentioned that net fixed assets is always overstated. This is because the retirements do not affect the historical figure of **net** fixed assets to be restated, as is the case with the estimated historical depreciation to be restated.

The tendency for overstatement of fixed assets generally under CAT is due to the fact that under CAT **total** net fixed assets are multiplied by the estimated **average** conversion factor in order to be restated, the implicit assumption being that each one of the actual net

fixed asset items under restatement is of equal value. This assumption, however, does not hold true actually since the older the fixed assets the more their accumulated depreciation, and hence the less their net value under restatement. Hence, in money amounts, the younger fixed assets items to which a greater (than it should be) conversion factor is applied are bigger than the older fixed assets items to which a less (than it should be) conversion factor is applied for restatement. As a result, there is a tendency for overstatement of net fixed assets under CAT unless the new additions of fixed assets are decreasing materially from year to year.

In order for the reader to get a concrete idea on how exactly and how much the factors (conditions) mentioned affect the accuracy of CAT, the following illustration is presented.

5.1. ILLUSTRATION

a. Fixed Assets and Related Depreciation (in thousand drachmas)

D a t e	\Depreciation Gross\ rate value \ and year of FA \	10% 65	16% 66	12% 67	8% 68	10% 69	16% 70	10% 71	12% 72	6% 73	12% 74	8% 75	12% 76	8% 77	16% 78
13/65	* 100,000	5	16	12	8	10	16	10	12	6	5	-	-	-	-
13/66	200,000	5	16	24	16	20	32	20	24	12	24	12	-	-	-
13/67	150,000		32	9	12	15	24	15	18	9	18	12	18	-	-
13/68	200,000			45	8	20	32	20	24	12	24	16	24	16	4
13/69	100,000				44	5	16	10	12	6	12	8	12	8	11
13/70	150,000					70	12	15	18	9	18	12	18	12	24
13/71	200,000						132	10	24	12	24	16	24	16	32
13/72	150,000							100	9	9	18	12	18	12	24
13/73	100,000								141	3	12	8	12	8	16
13/74	200,000									78	12	16	24	16	32
13/75	200,000										167	8	24	16	32
13/76	150,000											120	9	12	24
13/77	100,000												183	4	16
13/78	200,000													120	16
13/79	300,000														231

D a t e	\Depreciation Gross\ rate value \ and year of FA \	10% 79	10% 80	6% 81	8% 82	12% 83	12% 84	16% 85	8% 86	8% 87	10% 88	16% 89	12% 90	10% 91	16% 92
13/69	100,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13/70	150,000	12	-	-	-	-	-	-	-	-	-	-	-	-	-
13/71	200,000	20	20	2	-	-	-	-	-	-	-	-	-	-	-
13/72	150,000	15	15	9	9	-	-	-	-	-	-	-	-	-	-
13/73	100,000	10	10	6	8	7	-	-	-	-	-	-	-	-	-
13/74	200,000	20	20	12	16	24	8	-	-	-	-	-	-	-	-
13/75	200,000	20	20	12	16	24	24	4	-	-	-	-	-	-	-
13/76	150,000	15	15	9	12	18	18	18	-	-	-	-	-	-	-
13/77	100,000	10	10	6	8	12	12	16	6	-	-	-	-	-	-
13/78	200,000	20	20	12	16	24	24	32	16	16	4	-	-	-	-
13/79	300,000	15	30	18	24	36	36	48	24	24	30	15	-	-	-
13/80	200,000	157	10	12	16	24	24	32	16	16	20	30	-	-	-
13/81	100,000		170	3	8	12	12	16	8	8	10	16	7	-	-
13/82	200,000			101	8	24	24	32	16	16	20	32	24	4	-
13/83	200,000				141	12	24	32	16	16	20	32	24	20	4
13/84	100,000					217	6	16	8	8	10	16	12	10	14
13/85	200,000						212	16	16	16	20	32	24	20	32
13/86	300,000							262	12	24	30	48	36	30	48
13/87	300,000								138	12	30	48	36	30	48
13/88	100,000									156	5	16	12	10	16
	4,200,000				Acc. Depreciation					3,022					
13/89	200,000										199	16	24	20	32
13/90	300,000				Acc. Depreciation					3,221	301	18	30	48	
13/91	400,000											217	20	54	
13/92	500,000												194	40	
														345	

* 13 stands for midyear.

5,1, ILLUSTRATION
b, Inflation of the period

Date[12]	CPI	in CPI % Change	Date	CPI
			14/90	755,00
13/77	144,00		14/89	730,00
13/78	162,10	12,5%	14/88	700,00
13/79	192,70	18,9%	8/85	564,98
13/80	240,60	24,9%	7/85	561,55
13/81	299,70	24,6%	12/82	403,00
13/82	370,00	23,5%	11/82	397,20
13/83	440,00	18,9%	3/80	227,30
13/84	500,00	13,6%	2/80	220,40
13/85	560,00	12,0%	5/78	162,50
13/86	600,00	7,1%	4/78	161,10
13/87	640,00	6,7%	2/77	135,80
13/88	670,00	4,7%	1/77	136,50
13/89	720,00	7,5%	11/72	69,80
13/90	745,00	3,5%	10/72	69,20
			1/64	54,20
			12/63	54,20

In the 5.1 illustration, which concerns, say, "machinery", the additions of the year occur in midyear and they are not constant. There are no retirements. The rate of depreciation (r) required by law is 12% but the (r) actually applied differs from year to year. The per cent change in the inflation rate from year to year is not constant too. The period under examination is 1988-1992. Finally, the salvage value of fixed assets is zero.

According to CAT the restated depreciation and fixed assets for 1988 are determined as follows:

Aver, age of FA = Accum, depreciation 1988 / Depreciation 1988

= 3,221,000 / 199,000 = 16,18593 years

12, The date indicates month and year respectively, 13 stands for midyear while 14 stands for year-end,

Hence, the average date of acquisition of fixed assets is 23/10/1972 (0.18539 × 360 days = 66.93 = 67 days).

The consumer price index (CPI) which corresponds to October 23 is found by linear extrapolation:

CPI of October + (CPI of November - CPI of October) x 8[1]/30
= 69,20 + (69,80 - 69,20) x 8/30 = 69,20 + 0,16 = 69,36

The conversion factor is

(index at 31/12/88) / (index at 23/10/72) = 700,00 / 69,36

The restated depreciation of the year 1988 is

199,000 x 700,00/69,36 = 2,008,362

and the restated net fixed assets of 1988 is

(4,200,000 - 3,221,000) x 700,00/69,36 = 9,880,335

The actual restatement of fixed assets and depreciation is as determined below:

Depreciation 1988			Net Fixed assets 1988		
	Historical	Restated		Historical	Restated
13/78	4,000 x 700,00/162,10 =	17,273		----	----
13/79	30,000 x 700,00/192,70 =	108,978		15,000 x 700,00/192,70 =	54,489
13/80	20,000 x 700,00/240,50 =	58,188		30,000 x 700,00/240,50 =	87,282
13/81	10,000 x 700,00/299,70 =	23,357		23,000 x 700,00/299,60 =	53,720
13/82	20,000 x 700,00/370,00 =	37,838		60,000 x 700,00/370,00 =	113,514
13/83	20,000 x 700,00/440,00 =	31,818		80,000 x 700,00/440,00 =	127,273
13/84	10,000 x 700,00/500,00 =	14,000		52,000 x 700,00/500,00 =	72,800
13/85	20,000 x 700,00/560,00 =	25,000		132,000 x 700,00/560,00 =	165,000
13/86	30,000 x 700,00/600,00 =	35,000		234,000 x 700,00/600,00 =	273,000
13/87	30,000 x 700,00/640,00 =	32,813		258,000 x 700,00/640,00 =	282,188
13/88	5,000 x 700,00/670,00 =	5,223		95,000 x 700,00/670,00 =	99,254
	-------	-------		-------	-------
	199,000	*389,488*		*979,000*	*1,328,520*

13, 23/10 - 15/10 = 8 days

The "error of estimate" for restated depreciation is

$$(E - R) / R \simeq (2,008,362 - 389,488) / 389,488 \simeq + 415.64\ \%$$

The "error of estimate" for restated net fixed assets is

$$(E - R) / R \simeq (9,800,335 - 1,328,520) / 1,328,520 \simeq + 643.71\ \%$$

That is, the errors of estimate are very serious. The CAT does not work well at all in this illustration. This is mainly due to the presence of fully depreciated fixed assets.

Supposing that CAT takes into account only the undepreciated portion of fixed assets for determining average age, then the average age of fixed assets is

Accum. depreciation 1988 / Depreciation 1988 ≃ 1,221,000 / 199,000 ≃ 6.1356784 years

or November 19, 1982. The conversion factor which corresponds to that age is 700.00 ÷ 397.97[14], the restated depreciation and fixed assets are 350,026 and 1,721,989 respectively, and the errors of estimates are -10.13% and +29.67%. That is, the performance of CAT has been improved remarkably now since the fully depreciated fixed assets factor, which leads to overstatement of restated depreciation and fixed assets, have been eliminated.

It should be moted, however, that though the fully depreciated fixed assets factor has been eliminated, there are no retirements, and the average rate of depreciation of the period 1978-1987 is almost the same with the rate of depreciation for 1988 (i.e. 10.6% vs 10%), still the restated depreciation is understated by

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14, 397.20 + (403.00 - 397.97) x 4/30 = 397.97

10.13%. This is due to the fact that the change of the inflation rate in the years which proceed the average year of acquisition of fixed assets is bigger than the change of the inflation rate in the years which follow the average age of fixed assets. As for the overstatement of the restated fixed assets by 29.67% instead of understatement this is due to the tendency for overstatement of restated fixed assets under CAT already mentioned.

When the rate of depreciation of the year under examination is bigger than the average rate of depreciation of the years which proceed it, then, other things being equal, the restated depreciation and fixed assets are understated, as mentioned. Mainly because of it in 1989 the overstatement of depreciation was reduced from 415.64% in 1988 to 164.73% (i.e. 1,363,174 vs 514,923), while the overstatement of fixed assets was also reduced from 643.71% in 1988 to 99.62% (i.e. 3,976,301 vs 1,073,308). For the same reason and supposing that CAT takes into account only the undepreciated fixed assets for computing average age of fixed assets, the understatement of restated depreciation of 1989 would increase from 10.13% (in 1988) to 24,38%, while the overstatement of fixed assets would be reduced from 29.67% (in 1988) to 5.82%.

Supposing now that the 1982 addition of machinery was retired in the middle of 1989. In such a case the actual historical depreciation under restatement would be 285,000 drs. The actually restated depreciation would be

483,355 drs, and the actually restated net fixed assets 1,018,065 drs. Under CAT the estimated historical depreciation of 1989 would be 129,000 (instead of 285,000) and the average age of fixed assets would be

Accum. depreciation 1989 / Depreciation 1989 = 3,350,000 / 129,000 = 25,969 years

(instead of 6 years), or January 11, 1964. The restated depreciation would be 129,000 × 730.00/54.20 = 1,737,454, and the restated fixed assets would be

(4,200,000 - 3,350,000) x 730,00/54,20 = 11,448,339

In other words, because of the retirement the overstatement of depreciation was increased from 164.73% (before the retirement) to 259.46%, while the overstatement of net fixed assets was increased from 99.62% (before the retirement) to 1,024.52%. This so remarkable overstatement of net fixed assets after the retirement has been already explained.

From the five assumptions mentioned the most serious seem to be the assumptions No (1), (3), (4) & (5). Especially in the Greek case, the assumption No (4) seems to be the most unrealistic and to have the most serious consequences regarding accuracy of CAT since, as mentioned, many Greek companies have a considerable number of fully depreciated fixed assets still in operation. Because of it, the researcher developed, as mentioned, a new technique for restating fixed assets and depreciation with the aim to eliminate not only the fourth assumption but also as many from the other assumptions as possible. This technique is called

Dichotomous Year Technique, and its nature and operation are described in the next sub-section.

5.3.3. Operation of the Dichotomous Year Technique When There Are No Retirements

The underlying philosophy of Dichotomus Year Technique (DYT) is that an annual restatement of fixed assets and depreciation does not differ significantly from a monthly restatement. Accordingly, DYT builds up (estimated) annual data as regards additions, accumulated depreciation and depreciation expense for those fixed asset items which are undepreciated in the first year of the period under examination.

To separate undepreciated from depreciated fixed assets the so called Dichotomus Year (DY) is determined. DY is the year in which all fixed assets appearing in the corresponding balance sheet statement will have been fully depreciated at the beginning of the first year of the period under examination. These assets are called "old" fixed assets (OFA). In contrast, the fixed assets acquired after the DY are called "new" fixed assets and they are the only assets which concern the researcher for restatement purposes.

According to the definition given to it, the DY can be determined by the equation:

$$DY = Y - [(100\% : r)^{15} + 1] \qquad (5.13)$$

where Y = the first year of the period under examination
r = the constant rate of depreciation of the year applied

As can be seen from the above formula the DY depends on the rate of depreciation (r) applied to each basic category of fixed assets appearing in the balance sheet statement. This rate must be constant each year. Since in Greece by law different (r) is applied to different basic categories of fixed assets, it follows that the DY is different for different fixed asset categories.

An "outsider" can approximate well the rate of depreciation (r) actually applied by the companies to each basic category of fixed assets. This is because the Greek law determines which types of fixed assets must be included in a basic fixed assets category appearing in the balance sheet statement; also the law (Presidential Decrèe 88\1973) determines the rate of depreciation which must be applied to each type of fixed assets constantly through the years. For example, in the basic category "means of transportation" three types of fixed assets may be included for which different rates of depreciation must be applied, that is, 12% for cars, 15% for coaches and 20% for trucks. In such a case the simple average rate of depreciation is taken into account for determining DY.

It is supposed that the rates of depreciation

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15. When 100% : r is a decimal number, it is rounded to the next integral number.

required by law are actually applied by the Greek companies. However, some times for income smoothing purposes the rate of depreciation actually applied by some Greek companies is lower than that required by law. In extreme cases, in a given year no depreciation at all may be applied to some or even all fixed assets[16]. On the other hand, usually the Greek companies take advantage of the incentives provided by law and they apply, at least in some years, additional depreciation to their fixed assets. This additional depreciation may be even more than twice the (r) required by law.

Under the above conditions the (r) required by law and used in the DYT to determine DY seems to be on average approximately equal to (if not less than) that actually applied by companies in the years which proceed the period under examination. Any way, the (r) actually applied by companies should be far less than that used in the DYT in order to have (through a DY which is younger than the actual DY) a serious effect on the precicion of the technique, as simulation examples have shown.

To bring a concrete example with respect to determination of DY, supposing that the rate of depreciation for "machinery" is 15% per year, and the first year of restatement is 1976. The useful life of machinery is then n = 100% : 15% = 6.66 years ≈ 7 years. The DY is then 1976 - (7+1) = 1968.

Since 1968 is the DY, that means, ceteris paribus,

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16. This happened in 1977 when some of the companies in the textile industry did not apply depreciation.

all fixed assets appearing in the balance sheet statement as of 31/12/68 will have been fully depreciated by the beginning of 1976. Hence, these fixed assets are the "old" fixed assets (OFA). The additions to fixed assets which will occur each year after 31/12/1968 will constitute the "new" fixed assets (NFA). That is, the assets which will not have been depreciated by the beginning of 1976. The latter assets concern the researcher for restatement purposes, as mentioned.

The annual additions (f_t) to NFA as well as the depreciation of the year (Δ_t) are computed as the difference between total fixed assets, on the one hand, and total accumulated depreciation, on the other, of two consecutive balance sheet statements, the assumption being that there are no retirements of fixed assets after the DY. That is,

$$f_t = F_t - F_{t-1} \qquad (5.14)$$

$$\Delta_t = D_t - D_{t-1} \qquad (5.15)$$

Having determined both additions of the year and depreciation of the year, the latter is assigned to undepreciated OFA as well as to NFA in proportion to their gross value, the assumption being that the additions of fixed assets occur evenly through the year and hence midyear is assigned as their date of acquisition. In other words, the rate of depreciation is determined by the equation:

$$r = \frac{\Delta_t}{\text{Undeprec. } F_{t-1} + \frac{f_t}{2}} \qquad (5.16)$$

Since the depreciation of the year, for each one of the years which follow the DY, is assigned proportionately to the **undepreciated** OFA as well as to NFA, it is necessary to know the annual additions of OFA as well as their accumulated depreciation. To build up the annual additions of OFA and their accumulated depreciation one must go back to the year of establishment of the quoted company under examination. This is not only practically impossible in many cases, due to the lack of available balance sheet data[17], but also it involves so much work, especially as regards accumulated depreciation of each annual addition, as to render DYT impractical.

To overcome this problem DYT divides OFA into equal parts (additions) assuming that the additions occur in midyear. To each one of these additions the corresponding accumulated depreciation at the DY is determined. How this is accomplished is explained in the following paragraphs.

Let F_t the gross value of fixed assets in the balance sheet of the year (t)

D_t the cummulative depreciation in the balance sheet of the year (t)

Δ_t the annual depreciation charge in the P/L account of the year (t).

Assuming that the annual additions of fixed assets are

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17. The reader should know that in Greece some times twenty years old fixed assets is still in operation.

constant through the years and they occur at the beginning of the year, then the average life $\langle t^* \rangle$ of the fixed assets appearing in the balance sheet of the year t is given by the equation:

$$t^* = \frac{D_t}{\Delta_t} \qquad (5.17)$$

If $\delta_j = \delta$ the constant annual depreciation charge on fixed assets purchased in year t (i.e. straight line method of depreciation), and $d_t = d_{t-1} + \delta_t$ the cummulative depreciation of fixed assets purchased in year t, then:

$$\Delta_t = \sum_{j=0}^{t} \delta_j = t \cdot \delta$$

$$D_t = \sum_{j=0}^{t} d_j = \sum_{j=0}^{t} (d_{j-1} + \delta_j)$$

$$D_t = \frac{t\ (t+1)}{2}\ \delta \qquad (5.18)$$

So $$t^* = \frac{D_t}{\Delta_t} = \frac{1}{2}\ t\ \frac{(t+1)}{t \cdot \delta}\ \delta$$

ie. $$t^* = \frac{1}{2}\ (t+1) \qquad (5.19)$$

and $$t = 2t^* - 1 \qquad (5.20)$$

where t is the time since the foundation of the company to the present day.

Since D_t as well as Δ_t are given in the published Greek financial statements, t^* and consequently t can be determined from the published accounting data. Under the assumptions made t^* and t are equal to the actual ones, provided that at the end of the year (t) all fixed assets are undepreciated. In order for t to be equal to the actual one as well even when the assumption is employed, as it is the case with DYT, that the additions occur in

midyear, when t is a decimal number it is rounded to the next integral number.

Having determined <t> at the end of the $DY_{(t)}$, then the equal annual additions of fixed assets (i.e. OFA) at the $DY_{(t)}$ as well the cummulative depreciation of each one of these additions can be determined. Thus, the average annual addition of OFA is given by the equation:

$$f_t^* = \frac{F_t}{t} \qquad (5.21)$$

The accumulated depreciation of each one of the t equal addition at the end of the $DY_{(t)}$ is given by:

$$\begin{aligned} d_1 &= t \cdot \delta \\ d_2 &= (t-1)\delta \\ &\cdots\cdots\cdots \\ d_t &= \delta \end{aligned}$$

$$\begin{aligned} D_t &= \frac{t(t+1)}{2}\,\delta \\ &\text{or} \\ d_1 &= \frac{D_t}{\frac{t(t+1)}{2}}\,t \\ d_2 &= \frac{D_t}{\frac{t(t+1)}{2}}\,(t-1) \\ &\cdots\cdots\cdots\cdots\cdots\cdots \\ d_t &= \frac{D_t}{\frac{t(t+1)}{2}}\,1 \end{aligned} \qquad (5.22)$$

where d_1 is the oldest addition of OFA and d_t the youngest one.

Provided that all fixed assets (i.e. OFA) at the $DY_{(t)}$ are undepreciated, the cummulative depreciation of each one of the annual additions of OFA equals the actual

one under the mentioned assumptions[18]. However, when there are fully depreciated componets (additions) of OFA at the DY (t), then t>n, where n is the useful life of the assets. That is, in such a case, equations No (17) to (22) do not reflect reality. Actually, the cummulative depreciation of, say, the oldest addition d, is $n \cdot \delta$ rather than $t \cdot \delta$ since no depreciation is assigned to fully depreciated assets.

As a consequence of applying equation (5.22) to determine cummulative depreciation of each addition of OFA even when there are fully depreciated componets of OFA at year (t), the cummulative depreciation of the oldest addition(s) of OFA is (are) bigger than its (their) gross value. The more the fully depreciated componets (additions) of OFA at the DY(t), the more the additions whose cummulative depreciation, as computed under DYT, is bigger than their gross value.

Since no addition can have cummulative depreciation which is bigger than its gross value, any excess accumulated depreciation is reallocated to the undepreciated additions of OFA but not equally to each one of them. Rather the excess cummulative depreciation is added to the accumulated depreciation of the first undepreciated addition of OFA. If still there is excess cummulative depreciation, it is added to the second, third and so on undepreciated additions of OFA until all

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18, If the additions occur in midyear, as is the case under DYT, then the accumulated depreciation of the first half of the additions are rather understated while that of the second half of the additions of OFA are rather overstated.

excess cummulative depreciation has been exhausted.

The reallocation of the excess accumulated depreciation in the mentioned way was preferred not only because this is the easier way to do it but also, and mainly, because, generally speaking, such a reallocation makes the fully depreciated componet (additions) of OFA as a whole to approximate the actually fully depreciated componet of OFA better than otherwise. Such a good approximation is of significance as regards accuracy of DYT since it affects depreciation of the year to be assigned to NFA which is subject to restatement (i.e. the reader should recall that under DYT the depreciation of the year is assigned **proportionately** to the **undepreciated** OFA as well as to the NFA).

The rationale of the mentioned reallocation is the following:

Supposing equal annual additions, when there are actually fully depreciated fixed assets still in operation the estimated t is bigger than the actual one, as mentioned. Hence, the estimated equal annual additions of OFA are older than they are actually. The only way to exclude these very old additions from the restatement process (and hence to prevent overstatement of restated net fixed assets and depreciation) is to add all of the excess accumulated depreciation to the oldest additions so that for them to become fully depreciated. In this way the depreciation of the year (which is a certain amount) will be assigned to younger rather than to older additions of fixed assets, which is actually the case.

For the reasons to be mentioned in Section 5.3.5 a bad approximation of the fully depreciated component of OFA at the DY affects more seriously the variation of DYT, which is called Equal Additions Technique, than the DYT per se. In order for the DYT to be seriously affected the bad approximation should be a very bad one, as simulation examples have shown. In any way, the way in which the extra accumulated depreciation is reallocated seems to prevent or at least to moderate any bad consequences resulted from a bad approximation of the fully depreciated componets of OFA at the end of DY.

In summarizing, the steps which are followed in applying DYT are divided into two categories: (a) Preliminary Steps. (b) Ordinary Steps. The Preliminary Steps are applied **once** in the first year of application of DYT and they concern the computation of the DY, the equal annual additions of fixed assets at the end of DY (i.e. OFA) and their related accumulated depreciation. The Ordinary Steps are applied every year after the DY and they concern the computation of the additions of the year, the total depreciation of the year, and the depreciation which corresponds to each annual addition of fixed assets (i.e. OFA and NFA). These steps are given below.

D Y T

A. Preliminary Steps

1. Determine the DY:

$$DY = Y - [(100\% / r) + 1]$$

2. Determine the average age (t^*) of OFA at the $DY_{(t)}$:

$$t^* = \frac{D_t}{\Delta_t}$$

3. Determine the years (t) passed from the first acquisition of fixed assets up to DY:

$$t^{19} = 2t^* - 1$$

4. Determine the average annual additions (f_t^*) of OFA:

$$f_t^* = \frac{F_t}{t}$$

5. Determine the accumulated depreciation d_i of each one of the additions of OFA at the end of DY (t):

$$d_1 = \frac{D_t}{\frac{t(t+1)}{2}}\ t$$

$$d_2 = \frac{D_t}{\frac{t(t+1)}{2}}\ (t-1)$$

and so on

If there is excess accumulated depreciation add it to the accumulated depreciation of the next undepreciated addition(s) until all excess accumulated depreciation has been exhausted.

B. Ordinary Steps

1. Determine the annual additions (f_t) of NFA:

$$f_t = F_t - F_{t-1}$$

2. Determine the total depreciation (Δ_t) of the year:

$$\Delta_t = D_t - D_{t-1}$$

3. Determine the rate of depreciation of the year to be assigned to each udepreciated addition of fixed assets:

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19. When t is a decimal number it is rounded to the next integral number.

$$r = \frac{\Delta_t}{\text{Undeprec. } F_{t-1} + \frac{f_t}{2}}$$

If the first undepreciated addition (f_n) needs less (say δ') depreciation than its share in order to become fully depreciated, then a new rate (r) is applied to the remaining undepreciated additions.

$$r = \frac{\Delta_t - \delta'}{\text{Undeprec. } F_{t-1} + \frac{f_t}{2} - f_n}$$

4. To calculate the depreciation of the year which corresponds to each undepreciated addition of fixed assets multiply the gross value of each one of them by (r).

When in the balance sheet statements there are advances for buildings (and building installations) or/and for machinery, these advances are transferred to their proper account in the next year or even after two or three years (i.e. the advances for buildings), when the completion of the transaction takes place. Since the restatement of fixed assets must be based on (the earlier) date of capital expenditure rather than on date of completion of the transaction (see Section 6.5) these advances must be incorporated in the additions of the year in which the capital expenditure was made.

To incorporate the advances of the year in the additions of the year, the additions of the year are taken in the mention way. Then to these additions the advances of the year are added and the advances of the previous year are substracted. The figure so obtained constitutes the actual additions of the year no matter

how often (i.e. in the next year or after two years) the advances of fixed assets are transferred to their proper account[20].

The incorporation of the advanced of the year in the additions of the year starts after the DY. The advances of the DY are considered as additions of the DY and hence they are added to the last addition of OFA.

From a strictly theoretical point of view this treatment may not be correct since it may happen that part (or even all) of the advances of DY are actually advances of a previous year, and hence they should be assigned that previous year as their age (date of acquisition) for restatement purposes. However, this does not matter actually since all OFA will be fully depreciated in the beginning of the period under examination, and hence they will need no restatement.

Assuming that there are no retirements during the years which follow the DY, the additions of NFA and the depreciation of the year as computed under DYT are always equal to the actual ones. As for the depreciation of the year assigned to the undepreciated OFA as a whole as well as to each annual addition of NFA, they are equal to the actual ones only when all OFA are undepreciated in the year under consideration.

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20. This is so because either the advances of the previous year have been transferred to their proper account in this year, and hence they constitute part of the additions of this year, or they have not been transferred this year, and hence they constitute part of the advances of this year. In either case the advances of the previous year must be substracted from the summation: additions of the year plus advances of the year, since they actually occured one year earlier.

When the actual additions of OFA start to become fully depreciated year after year, equation (5.17) and consequently, equation (5.20) do not reflect reality any more. The estimated t is bigger or less than the actual one depending on the pattern of the actual rate of depreciation as well as on the pattern of the annual additions[21].

If the estimated t is less than the actual one then the estimated fully depreciated component of fixed assets is less than the actual one. As a consequence there is an understatement of the historical depreciation actually applied to NFA. Such an understatement results in an overstatement of restated depreciation (and net fixed assets). The opposite holds true when the estimated t is bigger than the actual one.

Thanks to the mentioned way in which the excess accumulated depreciation is allocated to the undepreciated additions of fixed assets under DYT, it seems that the fully depreciated component of fixed assets as estimated under DYT approximates well the actual one each year. Hence, the final over- or understatement of restated depreciation of NFA does not seem to be material enough to affect the precision of the technique.

In order for the reader to get a concrete idea on

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21. Supposing equal annual additions, then, ceteris paribus, the estimated t is always bigger than the actual t when there are fully depreciated fixed assets still in operation. The more the fully depreciated fixed assets still in operation the more the difference between estimated and actual t.

how exactly the new technique works and how accurate are the figures generated when there are no retirements the 5.1 illustration is offered.

As the reader may recall the mentioned illustration concerns one fixed assets category, the period under examination (restatement) is 1988-1992, the year of foundation of the firm is 1965, there are no retirements, the rate of depreciation required by law is 12%, but the rate actually applied differs from year to year. The operation of DYT for the first year 1979 is the following:

D Y T

A. Preliminary Steps

1. Determine the DY:

$$DY = Y - [(100\% / r) + 1] = 1988-(8.33+1) = 1978$$

Since 1978 is younger than the year of foundation of the company, continue your preliminary steps.

2. Determine the average age (t^*) of OFA at the DY:

$$t^* = \frac{D_t}{\Delta_t} = \frac{1468000}{231000} = 6.35 \text{ years}$$

3. Determine the years passed from the foundation of the company to the DY:

$$t = 2t^*-1 = 2\cdot 6.35-1 = 12.70-1 = 12 \text{ years}$$

4. Determine the average annual additions of OFA:

$$f_t^* = \frac{F_t}{t} = \frac{2200000}{12} = 183,333.33$$

Since $183,333\cdot 12 = 2,199,996$ each one of the four last additions of OFA equals 183,334 instead of 183;333 drs.

5. Determine the accumulated depreciation of each one of the additions of OFA:

$$d_1 = \frac{D_t}{\frac{t(t+1)}{2}}\, t = (1468000/78)\cdot 12 = 225,846$$

$$d_2 = \frac{D_t}{\frac{t(t+1)}{2}}\, (t-1) = (1468000/78)\cdot 11 = 207,026$$

and so on (see table 5.1)

Table 5,1

DYT - Fixed Assets as of 31/12/1978

Year	Additions of OFA	Accum, Depreciation 1978	New Assignment of Accum, Depreciation 1978
1st 1967	183,333	225,846	183,333
2nd 1968	183,333	207,026	183,333
3nd 1969	183,333	188,205	183,333
4th 1970	183,333	169,385	183,333
5th 1971	183,333	150,564	183,333
6th 1972	183,333	131,733	156,104
7th 1973	183,333	112,923	112,923
8th 1974	183,333	94,103	94,103
9th 1975	183,334	75,282	75,282
10th 1976	183,334	56,462	56,462
11th 1977	183,334	37,641	37,641
12th 1978	183,334	18,820	18,820
	2,200,000	1,468,000	1,468,000

As can be seen from table 5.1 the accumulated depreciation of the first three additions of OFA, as computed by DYT, was bigger than their gross value. This, however, is unacceptable. Hence, the extra accumulated depreciation was assigned to the accumulated depreciation of the next additions.

B. Ordinary Steps - Year 1978

1. Determine the additions of the year (f_t):

$$f_t = F_t - F_{t-1} = 2500000 - 2200000 = 300,000$$

2. Determine the depreciation of the year (Δ_t):

$$\Delta_t = D_t - D_{t-1} = 1625000 - 1468000 = 157,000$$

3. Determine the rate of depreciation (r) to be applied to each annual addition:

$$r = \frac{\Delta_t}{\text{Undeprec. } F_{t-1} + \frac{f_t}{2}} = \frac{157000}{1283335 + 150000} = \frac{157000}{1433335}$$

4. Apply the depreciation rate found in (3) to each annual addition to find the depreciation which corresponds to each one of them.

Thus the depreciation of each annual addition (f_t^*) of OFA is:

$$f_t^* \cdot r = 1833333 \frac{157000}{1433335} = 20,081.33$$

The depreciation of the last addition (f_t) is:

$$\frac{f_t}{2} r = \frac{300000}{2} \cdot \frac{157000}{1433335} = 16,430$$

Since each of the seven additions of OFA was assigned 20,081.33 drs three extra units were assigned to the last addition f_t (see table 5.2).

Table 5.2 presents estimated annual data of fixed assets and depreciation. In particular, table 5.2 presents the addition of OFA and their corresponding accumulated depreciation at the end of 1978, the additions of NFA, as well as the depreciation of the year for each one of the years 1979-1992 which corresponds to each addition of fixed assets.

A comparison between table 5.2 and illustration 5.1 which presents actual annual data of fixed assets and depreciation, reveals that the actually fully depreciated component of total fixed assets at the end of 1978 is

T a b l e 5,2

DYT, Fixed Assets and Depreciation - Years 1978-1982

Year	Additions of FA	Acc, Deprec, 1978	Deprec, 1979	Deprec, 1980	Deprec, 1981	Deprec, 1982	Deprec, 1983	Deprec, 1984	Deprec, 1985
1967	183,333	183,333	--	--	--	--	--	--	--
1968	183,333	183,333	--	--	--	--	--	--	--
1969	183,333	183,333	--	--	--	--	--	--	--
1970	183,333	183,333	--	--	--	--	--	--	--
1971	183,333	183,333	--	--	--	--	--	--	--
1972	183,333	156,104	20,081	7,148	--	--	--	--	--
1973	183,333	112,923	20,081	19,904	11,222	14,361	4,842	--	--
1974	183,333	94,103	20,081	19,904	11,222	14,361	21,411	2,251	--
1975	183,334	75,282	20,081	19,904	11,222	14,361	21,411	21,073	--
1976	183,334	56,462	20,081	19,904	11,222	14,361	21,411	21,619	18,274
1977	183,334	37,641	20,081	19,904	11,222	14,361	21,411	21,619	28,521
1978	183,334	18,820	20,081	19,904	11,222	14,362	21,411	21,621	28,521
1979	300,000	1,468,000	16,433	32,571	18,364	23,500	35,035	35,377	46,670
1980	200,000		157,000	10,857	12,243	15,667	23,353	23,584	31,113
1981	100,000			170,000	3,061	7,833	11,679	11,793	15,557
1982	200,000				101,000	7,833	23,357	23,584	31,114
1983	200,000					141,000	11,679	23,584	31,115
1984	100,000						217,000	5,895	15,557
1985	200,000							212,000	15,558
									262,000

... continued ...

Year	Additions of FA	Acc, Deprec, 1978	Deprec, 1986	Deprec, 1987	Deprec, 1988	Deprec, 1989	Deprec, 1990	Deprec, 1991	Deprec, 1992
1976	183,334	56,462	--	--	--	--	--	--	--
1977	183,334	37,641	8,574	--	--	--	--	--	--
1978	183,334	18,820	14,527	12,865	--	--	--	--	--
1979	300,000		23,772	24,538	30,615	13,125	--	--	--
1980	200,000		15,849	16,358	20,410	30,566	--	--	--
1981	100,000		7,924	8,179	10,205	16,082	7,687	--	--
1982	200,000		15,848	16,358	20,410	32,163	23,921	5,412	--
1983	200,000		15,848	16,358	20,410	32,163	23,921	19,851	5,071
1984	100,000		7,924	8,179	10,205	16,082	11,961	9,926	14,389
1985	200,000		15,848	16,357	20,410	32,163	23,921	19,851	31,858
1986	300,000		11,886	24,539	30,616	48,245	35,882	29,777	47,786
1987	300,000		138,000	12,269	30,616	48,245	35,882	29,777	47,786
1988	100,000			156,000	5,103	16,083	11,961	9,926	15,929
	4,200,000								
1989	200,000				199,000	16,083	23,921	19,851	31,858
1990	300,000					301,000	17,943	29,777	47,786
1991	400,000						217,000	19,852	53,715
1992	500,000							194,000	39,522
									346,000

different from the estimated one. This is due to the fact that the equal annual additions in which DYT divides the OFA are not equal actually, as well as to the fact that t, as estimated under DYT, is less than the actual t by 2 years.

Since estimated and actually fully depreciated component of fixed assets are different, and since the depreciation of the year is assigned proportionately to undepreciated OFA and NFA, the depreciation of the year which corresponds to each estimated addition of NFA is different from that actually assigned to each addition of NFA. For the same reason the same holds true as regards depreciation of the years 1980-1992 assigned to each addition of NFA.

With the passing of the years, however, more and more additions of OFA are becoming fully depreciated. Because of it, depreciation assigned to NFA as a whole under DYT is becoming less and less significantly different from the actual one. (The reader sould keep in mind that both estimated and actual annual additions of NFA are the same when there are no retirements). Thus, in the first three years of the period under examination (i.e. 1988-1992) the estimated annual data of net fixed assets (i.e. NFA) and depreciation under restatement approximate well the actual ones as regards date of acquisition and value as can be seen from tables 5.3, 5.4 and 5.5. Hence, the differences between estimated and actually restated depreciation and net fixed assets are not material.

T a b l e 5.3

1988 Restated Depreciation and Net Fixed Assets

	Depreciation					
	Actual Restatement			DYT Restatement		
1978	4,000 x 700.0/162.1	≈	17,273	---		
1979	30,000 x 700.0/192.7	≈	108,978	30,616 x 700.0/192.7	≈	111,215
1980	20,000 x 700.0/240.6	≈	58,188	20,410 x 700.0/240.6	≈	59,381
1981	10,000 x 700.0/299.7	≈	23,357	10,205 x 700.0/299.7	≈	23,836
1982	20,000 x 700.0/370.0	≈	37,838	20,410 x 700.0/370.0	≈	38,614
1983	20,000 x 700.0/440.0	≈	31,818	20,410 x 700.0/440.0	≈	32,470
1984	10,000 x 700.0/500.0	≈	14,000	10,205 x 700.0/500.0	≈	14,287
1985	20,000 x 700.0/560.0	≈	25,000	20,410 x 700.0/560.0	≈	25,513
1986	30,000 x 700.0/600.0	≈	35,000	30,616 x 700.0/600.0	≈	35,719
1987	30,000 x 700.0/640.0	≈	32,813	30,615 x 700.0/640.0	≈	33,485
1988	5,000 x 700.0/670.0	≈	5,223	5,103 x 700.0/670.0	≈	5,331
	199,000		*389,488*	*199,000*		*379,851*
	Net Fixed Assets					
1979	15,000 x 700.0/192.7	≈	54,489	13,125 x 700.0/192.7	≈	47,852
1980	30,000 x 700.0/240.6	≈	87,282	30,566 x 700.0/240.6	≈	88,929
1981	23,000 x 700.0/299.7	≈	53,720	23,769 x 700.0/299.7	≈	55,516
1982	60,000 x 700.0/370.0	≈	113,514	61,496 x 700.0/370.0	≈	116,344
1983	80,000 x 700.0/440.0	≈	127,273	81,006 x 700.0/440.0	≈	128,873
1984	52,000 x 700.0/500.0	≈	72,800	52,240 x 700.0/500.0	≈	73,136
1985	132,000 x 700.0/560.0	≈	165,000	131,827 x 700.0/560.0	≈	164,784
1986	234,000 x 700.0/600.0	≈	273,000	232,959 x 700.0/600.0	≈	271,785
1987	258,000 x 700.0/640.0	≈	282,000	257,115 x 700.0/640.0	≈	281,220
1988	95,000 x 700.0/670.0	≈	99,254	94,897 x 700.0/670.0	≈	99,146
	979,000		*1,328,520*	*979,000*		*1,327,585*

Table 5.4

1989 Restated Depreciation and Net Fixed Assets

	Depreciation			
	Actual Restatement		DYT Restatement	
1979	15,000 x 730,0/192,7 ≃	56,824	13,368 x 730,0/192,7 ≃	50,642
1980	30,000 x 730,0/240,6 ≃	91,022	30,726 x 730,0/240,6 ≃	93,225
1981	16,000 x 730,0/299,7 ≃	38,972	16,057 x 730,0/299,7 ≃	39,111
1982	32,000 x 730,0/370,0 ≃	63,135	32,113 x 730,0/370,0 ≃	63,358
1983	32,000 x 730,0/440,0 ≃	53,091	32,113 x 730,0/440,0 ≃	53,278
1984	16,000 x 730,0/500,0 ≃	23,360	16,057 x 730,0/500,0 ≃	23,360
1985	32,000 x 730,0/560,0 ≃	41,714	32,113 x 730,0/560,0 ≃	41,862
1986	48,000 x 730,0/600,0 ≃	58,400	48,170 x 730,0/600,0 ≃	58,607
1987	48,000 x 730,0/640,0 ≃	54,750	48,170 x 730,0/640,0 ≃	54,944
1988	16,000 x 730,0/670,0 ≃	17,433	16,056 x 730,0/670,0 ≃	17,494
1989	16,000 x 730,0/720,0 ≃	16,222	16,056 x 730,0/720,0 ≃	16,279
	301,000	*514,923*	*301,000*	*512,160*
	Net Fixed Assets			
1981	7,000 x 730,0/299,7 ≃	17,050	7,687 x 730,0/299,7 ≃	18,724
1982	28,000 x 730,0/370,0 ≃	55,243	29,333 x 730,0/370,0 ≃	57,873
1983	48,000 x 730,0/440,0 ≃	79,636	48,843 x 730,0/440,0 ≃	81,035
1984	36,000 x 730,0/500,0 ≃	52,560	36,158 x 730,0/500,0 ≃	52,791
1985	100,000 x 730,0/560,0 ≃	130,357	99,664 x 730,0/560,0 ≃	129,919
1986	186,000 x 730,0/600,0 ≃	226,300	184,714 x 730,0/600,0 ≃	224,735
1987	210,000 x 730,0/640,0 ≃	239,531	208,870 x 730,0/640,0 ≃	238,242
1988	79,000 x 730,0/670,0 ≃	86,075	78,814 x 730,0/670,0 ≃	85,872
1989	184,000 x 730,0/720,0 ≃	186,556	183,917 x 730,0/720,0 ≃	186,471
	878,000	*1,073,308*	*878,000*	*1,075,662*

T a b l e 5.5

1990 Restated Depreciation and Net Fixed Assets

	Depreciation					
	Actual Restatement			OYT Depreciation		
1981	7,000	x 755.0/299.7	= 17,634	7,793	x 755.0/299.7	= 19,632
1982	24,000	x 755.0/370.0	= 48,973	23,909	x 755.0/370.0	= 48,787
1983	24,000	x 755.0/440.0	= 41,182	23,909	x 755.0/440.0	= 41,026
1984	12,000	x 755.0/500.0	= 18,120	11,955	x 755.0/500.0	= 18,052
1985	24,000	x 755.0/560.0	= 32,357	23,909	x 755.0/560.0	= 32,234
1986	36,000	x 755.0/600.0	= 45,300	35,864	x 755.0/600.0	= 45,129
1987	36,000	x 755.0/640.0	= 42,469	35,864	x 755.0/640.0	= 42,308
1988	12,000	x 755.0/670.0	= 13,522	11,965	x 755.0/670.0	= 13,483
1989	24,000	x 755.0/720.0	= 25,167	23,909	x 755.0/720.0	= 18,174
	217,000		*302,966*	*217,000*		*303,896*
	Net Fixed Assets					
1982	4,000	x 755.0/370.0	= 8,162	5,412	x 755.0/370.0	= 11,494
1983	24,000	x 755.0/440.0	= 41,182	24,922	x 755.0/440.0	= 42,859
1984	24,000	x 755.0/500.0	= 36,240	24,197	x 755.0/500.0	= 36,682
1985	76,000	x 755.0/560.0	= 102,464	75,743	x 755.0/560.0	= 102,289
1986	150,000	x 755.0/600.0	= 188,750	148,832	x 755.0/600.0	= 187,441
1987	174,000	x 755.0/640.0	= 205,266	172,988	x 755.0/640.0	= 204,197
1988	67,000	x 755.0/670.0	= 75,500	66,853	x 755.0/670.0	= 75,372
1989	160,000	x 755.0/720.0	= 167,778	159,996	x 755.0/720.0	= 167,814
1990	282,000	x 755.0/745.0	= 285,785	282,057	x 755.0/745.0	= 288,853
	961,000		*1,111,127*	*961,000*		*1,112,765*

Specifically, the "errors of estimate" defined as the difference between estimated and actual values as a percentage of the latter, that is (E-A):A, for restated depreciation and net fixed assets for the years 1988 to 1990 are 2.5%, 0.53% and 0.31% respectively for restated depreciation and 0.7%, 0.2% and 1.5% respectively for restated net fixed assets. The corresponding errors of

estimate for CAT for the years 1988 and 1989 were found to be 415.64% and 164.73% for restated depreciation, and 643.71% and 99.62% for restated net fixed assets.

Therefore, DYT seems to generate more accurate results than CAT when there are no retirements of fixed assets, especially when there are fully depreciated assets still in operation. How does DYT work when there are retirements of fixed assets and how accurate are its results is examined in the next sub-section.

5.3.4. Operation of DYT When There Are Retirements.

Whether or not the retirements have a bad effect on the precision of DYT depends on when the retirements take place. If the retirements take place before or in the dichotomous year (DY) they have no effect on DYT. If, however, the retirements occur after DY and especially during the period under examination they may have a serious effect on the precision of DYT.

Retirements which occur before the DY seem to have no effect on DYT basically because these retirements affect (through the reduced accumulated depreciation of OFA at the DY) only the average age (t^*) and hence the years (t) passed from the first acquisition of fixed assets up to DY. However, simulation examples have showed that it does not matter basically if the estimated (t) is somehow different from the actual one. The results obtained as regards additions of NFA and their corresponding depreciation of the year (which will be

restated) are basically the same under different t's.

Only when there is a massive reduction (retirements) of fixed assets the precision of DYT may be affected. However, for obvious reasons massive reductions of fixed assets are rather very rare when a firm is young. When a firm is old enough and hence fully depreciated fixed assets are still in operation, then the retirements have rather a favourable effect. This is because with the retirements part of the accumulated depreciation of the old fixed assets is removed and hence the estimated t* approaches the actual one.

Basically it does not seem to matter as well if retirements occur in the DY, unless they affect drastically the depreciation of the year by aid of which t^* and t are computed . Anyway, if due to retirements the depreciation charge of the DY differs significantly from the depreciation charge of the year which proceeds (or follows) the DY, then the year which proceeds (or even follows)[22] the DY is taken as DY, and the additions of OFA and their accumulated depreciation at the end of the DY are computed in the way mentioned in the previous sub-section.

Retirements which occur after the DY, and especially during the period under examination, may have a serious effect on the precision of DYT, as mentioned. This is because they affect both total gross value and total

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22. As simulation examples have shown the accuracy of DYT is not affected materially if the first or even the second year after the (actual) DY is taken as DY.

accumulated depreciation of fixed assets of the year of retirements on the basis of which the additions of the year f_j as well as the depreciation of the year Δ_j are determined under DYT.

Specifically, the additions of the year of retirements, as determined under DYT, are less than the actual ones by the gross value of retirements. By the same token the depreciation of the year (of retirements) is less than the actual one by the amount of accumulated depreciation of retirements. Hence, NFA and depreciation of the year are less than the actual ones.

If the actual gross value and the accumulated depreciation of retirements were known, then the additions of the year (of retirements) as well as the depreciation of the year (of retirements) could be determined precisely under DYT, and the retirements could have no effect on the precision of DYT. Therefore, DYT aims at determining the gross value (Rv) and the accumulated depreciation (Rad) of the retirements (which occur after the DY) as precisely as possible.

In determining Rv and Rad the following procedure is applied:

Supposing that there is only one category of fixed assets and denoting by $d^*_{(t-1)}$ and $d^*_{(t)}$ respectively the difference in gross value and accumulated depreciation of fixed assets of two consecutive balance sheet statements, then the following equations hold true when there are no retirements:

$$d_t^{*} = F_t - F_{t-1} = f_t \qquad (5.23)$$
$$d_t^{*\prime} = D_t - D_{t-1} = \Delta_t \qquad (5.24)$$

However, when there are retirements the two equations above do not hold true. d_t^{*} is actually the difference between additions and retirements of the year (t), rather than additions of the year, while $d_t^{*\prime}$ is the difference between depreciation of the year and accumulated depreciation of retirements, rather than depreciation of the year. Hence, the equations (5.23) and (5.24) become:

$$d_t^{**} = F_t - F_{t-1} = f_t - Rv \qquad (5.25)$$
$$d_t^{**\prime} = D_t - D_{t-1} = \Delta_t - Rad \qquad (5.26)$$

From these equations the following equations can also be derived:

$$f_t = Rv + d_t^{**} \qquad (5.27)$$
$$Rv = f_t - d_t^{**} \qquad (5.28)$$
$$Rad = \Delta_t - d_t^{**\prime} \qquad (5.29)$$

By donoting with $d_t^{**\prime\prime}$ the difference between total depreciation of the year Δ_t (given in the Profit and Loss statement) and depreciation of the year as computed (in the first place) under DYT (i.e. as the difference in accumulated depreciation of two concecutive balance sheets) then,

$$d_t^{**\prime\prime} = \Delta_t - d_t^{**\prime} \qquad (5.30)$$

and

$$d_t^{**\prime\prime} = Rad \qquad (5.31)$$

$d_t^{**\prime\prime}$ is the key factor to recognize that there are retirements (and hence Rv and Rad should be determined). That is, if $d_t^{**\prime\prime}$ is zero (i.e. $\Delta_t = d_t^{**\prime}$) then there are retirements. If $d_t^{**\prime\prime}$ is a positive number then there are retirements.

Of course, there might be an extreme case in which

d_t*" is zero and still there are retirements actually. This might happen when the retirements come from wholly undepreciated fixed assets. In such a case DYT is not in a position to recognize the retirements unless d_t* is a negative number (i.e. Rv > f_t).

Since in the Greek Profit and Loss statement the actual total depreciation of the year is given, as mentioned, it follows that under DYT always Δ_t and Rad can be determined precisely if there is only one category of fixed assets. f_t and Rv, however, cannot be determined since the determination of the one pressuposes the determination of the other.

To solve this problem the FIFO flow of retirements assumption is employed. That is, it is supposed that the whole first addition(s) (f_1) of fixed assets is retired in midyear. Then, by multiplying the gross value of the first addition (f_1) by r/2 (where r is the rate of depreciation applied) the depreciation of the year of this addition is determined. To the figure found the accumulated depreciation of the first addition at the end of the previous year is added in order to get the accumulated depreciation of the mentioned addition at the end of the year of retirements (t).

If the assumption that the whole addition (f_1) was retired in midyear holds true, then the accumulated depreciation of f_1 at (t) is equal to Rad. If it is bigger than Rad, it is meant that not the whole addition but only part of it was retired in midyear. In either case the gross value of retirements (Rv) is given by the

equation:

$$Rv = f_1 \times \frac{Rad}{\text{Accum. depreciat. } f_1 \text{ at } (t)} \qquad (5.32)$$

Having determined Rv the additions of the year f_t can be determined as well by applying the equation:

$$f_t = d_t^* + Rv$$

In order to determine the rate of depreciation (r) applied in the year of retirements to each undepreciated addition of fixed assets, the following formula is applied:

$$r = \frac{\Delta_t}{\text{Undepreciated } F_{(t-1)} + \frac{\text{Additions}(t)}{2} - \frac{\text{Retirements}(t)}{2}}$$

$$= \frac{\Delta_t}{\text{Undepreciated } F_{(t-1)} + \frac{d_t^{*}}{2}[23] + \frac{\text{Retirements}(t)}{2} - \frac{\text{Retirements}(t)}{2}}$$

$$r = \frac{\Delta_t}{\text{Undepreciated } F_{(t-1)} + \frac{d_t^*}{2}} \qquad (5.33)$$

In summarizing, the following are the steps in determining Rv and f_t when there are retirements:

1. Determine the rate of depreciation (r) of the year of retirements (t) which must be applied to each undepreciated addition of fixed assets in proportion to the gross value of each addition.

$$r = \frac{\Delta_t}{\text{Undepreciated } F_{(t-1)} + \frac{d_t^*}{2}}$$

2. Find the depreciation of the year (t) for the first addition f_1, supposing that the whole addition was retired in midyear:

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23. The reader should recall that $f_t = d_t^* + Rv$.

$$\text{Depreciation } f_1 = \frac{f_1}{2} \times r$$

3. Find the accumulated depreciation of f_1 at the end of the year (t) by adding the depreciation of the year for f_1 found in (2) to the accumulated depreciation of f_1 at the end of the year (t-1).

4. Find the gross value of retirements (Rv) by applying the formula:

$$Rv = f_1 \times \frac{\text{Rad}}{\text{Accum. depreciation of } f_1 \text{ at (t)}}$$

5. Find the gross value of the additions of the year (t):

$$f = Rv + d_t$$

Having determined Rv and, hence, f_t the depreciation of the year (Δ_t) is assigned to each addition of fixed assets in the way mentioned in the previous sub-section. The only difference is that since the retirements occur in midyear under DYT, half of the retirements (Rv) participates in the assignment of depreciation of the year of retirements. The depreciation assigned to Rv/2 along with the depreciation assigned to f_1-Rv constitute the depreciation of the first addition (f_1) for restatement purposes.

In the case in which the accumulated depreciation of f_1 at the year of retirements (t) is less than Rad that means the retirements come from more than one additions of fixed assets (say, from n additions). In such a case for each one of these additions, except for the last addition (f_n), and on a FIFO flow order, the steps (2) and (3) are repeated in order to determine Rad, to

Rad_{n-1}. The step (4) is not repeated since necessarily Rv_1 to Rv_{n-1} are equal to the gross value of the additions f_1 to f_{n-1}. To find the last Rv_n the steps (2) to (4) are repeated, where in the formula applied in step (4) Rad_n stands for Rad and it is equal to $Rad - \sum_{i=1}^{n-1} Rad_i$. Then the individual Rv_i are added in order to get Rv which is needed for the determination of f_t.

If the first addition (or additions) of fixed assets is already fully depreciated at the beginning of the year of retirements (t) and the gross value of the depreciated additions are equal or bigger than Rad, then there is no need for the steps (1) to (4) to be followed in determining Rv. Rv is necessarily equal to Rad since the FIFO flow of retirements is employed. The rate of depreciation (r) is equal to $\frac{\Delta_t}{\text{Undeprec. } F_{t-1} + I_t/2}$. Therefore, much time is saved if DYT is applied to fixed assets which have fully depreciated components (additions).

When d_t^* is negative while $d_t^{*''}$ is zero, and hence Rad is zero, that means the retirements (Rv) come from wholly undepreciated addition(s) obviously acquired at the end of the previous year (t-1) and retired at the beginning of the year of retirements. In such a case the equation used for determining Rv cannot be applied. Hence, it serves no purpose to follow steps (1) to (4). f_t is supposed to be zero, and thus Rv equals d_t^*. Since Rad is zero, that means the retirements (Rv) did not participate in the assignment of depreciation of the year of retirements (t). Because of it the rate of depreciation of the year to be applied to each undepreciated addition of fixed assets becomes:

$$r = \frac{\Delta_t}{\text{Undepreciated } F_{t-1} - Rv} \qquad (5.34)$$

In the rather unusual case in which there are fully depreciated additions of fixed assets, the retirements come actually from young fixed assets, and their gross value is much bigger than the gross value of the additions of the year, then d_t^* becomes negative and $|d_t^*|$ is bigger than Rad. Since in this case Rv=Rad (due to the FIFO flow of retirements assumption employed under DYT) and since f_t is always equal to d_t^*+Rv, f_t takes a negative value. This, however, is unacceptable and indicates that the FIFO flow of retirements assumption does not hold true; actually the retirements come from undepreciated additions of fixed assets and hence Rv>Rad.

When the fallacy of the FIFO assumption is recognized, DYT should concentrate on identifying the addition(s) from which the retirements actually come, before determining Rv and hence f_t. This, however, does not worth the effort. That is, as simulation examples indicate, the better precision of DYT obtained by identifying the addition (or additions) from which the retirement comes does not seem to compensate for the substantial additional work involved in accomplishing it. This is especially true if someone takes into account that when the retirements come actually from more than one additions DYT is unable to recognize it.

Therefore, when f_t takes a negative value, which is unacceptable, it is necessarily supposed that there are

no additions of the year. Thus Rv = $|d_t^*|$ (i.e. Rv = f_t - d_t^* = 0 - $(-d_t^*)$ = $|d_t^*|$). Also out of necessity Rad = Rv rather than Rad = Δ_t - $d_t^{*\prime}$, as it is actually the case.

From the way in which Rv and f_t are determined it becomes clear that if the FIFO flow of retirements assumption holds true in reality then the estimated Rv and f_t are equal to the actual ones provided that in the year of retirements there are fully depreciated additions equal to or bigger than Rad. In such a case the retirements have no consequences on the precision of DYT.

If, however, the FIFO assumption does not hold true or if it does hold true but all fixed assets are undepreciated and the first addition f_1, as estimated under DYT, is different from the actual f_1[24] then DYT determines precisely Δ_t and Rad again but not Rv and f_t. Because of it the retirements may have serious consequences on the precision of the technique, especially if the FIFO assumptions does not hold true.

Any serious consequences of retirements do not restrict themselves to the year of retirements only, but they are extended up to some extend to the years which follow the year of retirements. This is because the retirements affect three of the (annual) additions of fixed assets: (a) the first addition from which, wrongly, the retirements of the year are subtracted under DYT, due to the FIFO flow of retirements assumption adopted;

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24. The estimated f_1 is different from the actual one when retirements occured in the years which proceed the year of retirements or when the annual additions and/or the rate of depreciation of the years which proceeded the DY were not constant.

(b) that addition from which the retirements should have been subtracted actually; (c) the last addition which actually is as different from the estimated one as different from the actual one is the estimated Rv.

In the years which follow the year of retirements the consequences of retirements as regards restated depreciation become more serious than they are in the year of retirements per se. This is due to the fact that in the year of retirements only half of the estimated and actual Rv and f_t participate in the assignment of depreciation of the year. Hence, in the year of retirements only half of any striking differences existed between actual and estimated values of Rv and f_t, as well as between actual and estimated age of Rv (i.e. always under DYT the retirements come from the first addition(s)), are reflected in the historical depreciation of the year assigned to Rv and f_t and ultimately to the restated depreciation.

How serious the consequences of retirements can be depends on four conditions: (a) how big in value the retirements of the year are; (b) how much the age of the addition actually retired differ from the age of the first addition(s) of fixed assets from which the retirements are, wrongly, subtracted under DYT; (c) how sharp is the change in the inflation rate from year to year; (d) whether or not the first addition(s) of fixed assets is fully depreciated at the beginning of the year of retirements.

With the exception, perhaps, of the condition (a)

the reasons why the already mentioned conditions affect the precision of DYT are obvious. Condition (d) affects the degree of seriousness of retirements because in the case in which there are fully depreciated additions of fixed assets it is as if DYT ignores that retirements have occured, and hence an addition (or additions) should be eliminated by the value of Rv. This is because in the place of the actually retired addition the technique eliminates the first addition which is **de facto** already eliminated (i.e. being fully depreciated, the first addition does not participate in the assignment of depreciation of the year; also it is not included in the next fixed asset to be restated).

In order for the reader to get a concrete idea with respect to the calculation of Rad, Rv, and f_t under DYT when all fixed assets are undepreciated in the year of retirements as well as when there are fully depreciated additions of fixed assets in the same year the illustrations 5.2 is offered. By aid of that illustration the reader will get an idea as well regarding the consequences on the precision of DYT when the FIFO flow of retirements assumption does not hold true.

The illustration 5.2 concerns a firm which commenced business on 1/1/1969. The firm has only one fixed asset category; that is, furniture and fixtures. The annual rate of depreciation is 20%. The additions of 1969 are 100,000 drs. From 1969 and henceforth they are increasing by 20% and they occur in midyear. There are no retirements. The inflation rate from 1/1/1969 and

5.2. ILLUSTRATION

Fixed Assets and Related Depreciation, Years 1969-1980

Year	Additions	Depr.69	Depr.70	Depr.71	Depr.72	A.Depr.72	Depr.73	Depr.74
1969	100,000	10,000	20,000	20,000	20,000	70,000	20,000	10,000
1970	120,000	---	12,000	24,000	24,000	60,000	24,000	24,000
1971	144,000	---	32,000	14,400	28,800	43,200	28,800	28,800
1972	172,800	---		58,400	17,280	17,280	34,560	34,560
1973	207,360	---			90,080	190,480	20,736	41,472
							128,096	24,883
								163,715

Year	Additions	Depr.75	Depr.76	Depr.77	A.Depr.77	Depr.78	Depr.79	Depr.80
1969	100,000	---	---	---	100,000	---	---	---
1970	120,000	12,000	---	---	120,000	---	---	---
1971	144,000	28,800	14,400	---	144,000	---	---	---
1972	172,800	34,560	34,560	17,280	172,800	---	---	---
1973	207,360	41,472	41,472	41,472	186,624	20,736	---	---
1974	248,832	49,766	49,766	49,766	174,181	49,767	24,884	---
1975	298,598	29,860	59,720	59,720	149,300	59,720	59,719	29,859
1976	358,318	136,458	35,832	71,664	107,496	71,664	71,664	71,663
1977	429,982		235,750	42,998	42,998	85,996	85,996	85,997
1978	515,978			282,900	1,197,399	51,598	103,196	103,196
1979	619,174					339,481	61,917	123,834
1980	743,009						407,376	74,301
								488,850

henceforth is that actually prevailed in Greece in that period (see table 5.6).

Supposing now that the first year of the period under examination (restatement) is 1973 and that in the middle of 1973 the 1969 addition was retired. That is, the FIFO flow of retirements assumption holds true. In such a case actually Rv=100,000 drs and Rad=80,000 drs.

In order to restate depreciation and net fixed assets as of 31/12/1973 the first thing DYT does is to determine the DY. The DY is given by the equation:

$$DY = Y - [(100\%/r)+1] = 1973 - [(100\%/20\%)+1] = 1967$$

T a b l e 5,6

Consumer price Index of Greece, 1959-1981

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
01	50,3	51,1	52,9	52,2	54,0	54,2	55,0	57,9	60,5	59,7	61,2	62,6
02	50,3	50,8	52,8	51,7	53,8	54,2	54,8	57,6	60,1	59,3	60,5	61,7
03	50,5	51,0	53,1	52,1	54,4	54,6	55,3	58,3	60,8	60,1	61,3	63,0
04	50,9	51,5	53,3	52,5	54,5	54,7	55,8	59,1	61,8	60,3	62,1	63,9
05	50,8	51,4	53,1	52,4	54,2	54,7	56,6	59,1	60,5	60,3	61,8	64,1
06	50,5	51,7	52,5	52,4	53,9	54,5	56,2	58,8	59,8	60,1	61,8	64,1
07	51,0	51,7	52,2	52,2	53,9	54,4	56,2	58,7	59,7	60,0	61,8	63,3
08	51,1	51,7	52,0	52,2	53,6	54,0	56,2	58,5	59,1	59,8	60,9	62,3
09	52,2	52,0	52,5	52,5	53,9	54,5	56,5	59,2	59,5	60,2	61,7	63,7
10	51,3	52,2	52,5	53,1	54,2	54,9	57,2	59,9	59,5	60,6	62,1	64,2
11	51,2	52,4	52,3	53,0	54,0	54,5	57,1	59,8	59,1	60,3	62,0	64,0
12	51,2	53,0	52,6	53,5	54,2	55,0	57,7	60,4	59,6	61,2	62,5	64,8
Average	50,9	51,7	52,6	52,5	54,0	54,5	56,2	58,9	60,0	60,1	61,6	63,5
Year-end	51,1	52,9	52,4	53,7	54,2	55,0	57,8	60,4	59,6	61,2	62,5	64,7

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
01	64,7	66,8	71,4	95,4	106,8	122,7	136,6	154,9	178,0	219,9	276,3
02	63,5	65,8	70,7	94,3	107,1	122,3	135,8	153,7	178,0	220,4	278,9
03	64,9	67,6	72,9	97,3	111,0	125,9	139,5	158,2	183,6	227,3	285,5
04	65,9	68,5	74,2	98,4	112,2	127,2	142,4	161,1	187,5	234,2	291,2
05	66,7	68,8	75,7	99,8	112,5	128,4	143,6	162,5	189,5	237,0	296,7
06	66,2	68,5	77,6	101,0	112,7	129,4	144,6	164,1	191,5	243,2	299,9
07	65,2	67,7	76,6	100,9	111,7	127,8	144,1	161,8	194,0	241,6	298,3
08	64,0	65,7	76,9	98,8	110,6	126,0	142,1	159,2	192,3	239,3	296,0
09	65,5	68,2	81,4	101,6	115,3	129,8	146,1	163,7	197,9	246,1	308,7
10	65,7	69,2	85,2	103,0	118,4	132,0	149,5	166,7	203,3	252,6	316,7
11	65,9	69,8	90,3	104,0	120,1	133,8	151,3	168,6	207,0	261,3	323,5
12	66,7	71,1	92,9	105,4	121,9	136,2	153,6	171,3	213,7	269,7	330,4
Average	65,4	68,1	78,5	99,9	113,3	128,4	144,0	162,1	192,7	240,6	299,7
Year-end	66,75	71,25	94,15	106,10	122,30	136,40	154,25	174,55	216,80	273,00	332,25

Source; National Statistical Service of Greece.

Since 1967 proceeds the year of foundation of the firm there is no need for the Preliminary Steps of DYT to be followed. That is, there is no need to divide the fixed assets into "old" (OFA) and "new" (NFA) by aid of DY. All fixed assets are NFA.

Therefore, from 1969 up to 1972 DYT builds up to the annual additions of NFA and calculates the depreciation

charge of the year in the usual way. That is, the additions of the year as well as the depreciation of the year are taken as the difference between gross value and accumulated depreciation respectively of two adjacent balance sheet statements. Following this, the depreciation of the year is assigned to each annual addition in proportion to the gross value of each addition.

Since up to 1972 there were no retirements, and all fixed assets are NFA, the picture of fixed assets and related depreciation as of 31/12/1972 under DYT is the same with the actual one given in illustration 5.2. The same holds true in 1973 though retirements occured. This is demonstrated below:

DYT - Ordinary Steps, Undepreciated FA and Retirements

1. $d_t^* = F_t - F_{t-1} = 644,160-536,800 = 107,360$

2. $d_t^{*\prime} = D_t - D_{t-1} = 228,576-190,480 = 38,096$

3. $d_t^{*\prime\prime} = \Delta_t - d_t^{*\prime} = 118,096- 38,096 = 80,000$

Under DYT when d_t^* or $d_t^{*\prime}$ is negative or $d_t^{*\prime\prime}$ is a positive number there are retirements. Here $d_t^{*\prime\prime}$ is positive. Hence, there are retirements. Because of it d_t^* is not equal to f_t. Neither is $d_t^{*\prime}$ equal to Δ_t. Rather,

4. $f_t = d_t^* + Rv$ and $\Delta_t = d_t^{*\prime} + Rad$

5. $Rv = f_t - d_t^*$ and $Rad = \Delta_t - d_t^{*\prime} = d_t^{*\prime\prime} = 80,000$

6. <u>Determination of Rv and f_t</u>

6a. Determine the rate of depreciation (r) applied:

$$r = \frac{\Delta_t}{\text{Undeprec. } F_{t-1} + \frac{d_t^*}{2}} = \frac{118,095}{536,800+53,680} = \frac{118,095}{590,480} = 20\%$$

6b. Determine the depreciation of the first addition f_1, supposing that the whole addition was retired in midyear:

$$f_1 \times r = \frac{100,000}{2} \times 20\% = 10,000$$

6c. Determine the accumulated depreciation of the first addition f_1: $70,000 + 10,000 = 80,000$

6d. Determine the gross value (Rv) of retirements:

$$Rv = f_1 \times \frac{Rad}{\text{Acc. deprec. } f_1} = 100,000 \times \frac{80,000}{80,000} = 100,000$$

6e. Determine the gross value of the last addition f_4:

$$f_4 = d_4^* + Rv = 107,360 + 100,000 = 207,360$$

Since the FIFO flow of retirements assumption employed under DYT holds true actually, and since estimated f_1 is equal to the actual one, Rv and Rad as estimated under DYT are equal to the actual ones. Hence, f_4 is equal to the actual one as well. Because of it the results to be obtained as regards depreciation of the year which corresponds to each annual addition as well as net fixed assets to be restated will be the same with the actual ones. Therefore, the retirements have no consequences on the precision of DYT.

In contrast, the retirements of 1973 affect seriously the precision of CAT as regards restated depreciation and net fixed assets of 1973. This is because the retirements of the year usually affect seriously the precision of CAT no matter if the FIFO flow of retirements assumption holds true or not. Thus, while the errors of estimate of CAT for 1973 for restated depreciation and net fixed assets are +2.61% and +9.08%

respectively when there are no retirements, the corresponding errors when there are retirements (i.e. the 1969 addition retired in 1973) are -63.53% and +19.67% respectively.

Supposing now that the 1972 addition rather than the 1969 addition was retired in the middle of 1973. That is, the FIFO flow of retirements does not hold true actually. In such a case DYT, by working in the usual way when all fixed assets are undepreciated and there are no retirements, brings the following results:

DYT - Ordinary Steps, Undepreciated FA and Retirements

1. $d_t^{**} = F_t - F_{t-1} = 571,360-536,800 = 34,560$

2. $d_t^{**\prime} = D_t - D_{t-1} = 266,736-190,480 = 76,256$

3. $d_t^{**\prime\prime} = \Delta_t - d_t^{**\prime} = 110,816- 76,256 = 34,560$

Since $d_t^{**\prime\prime}$ is positive there are retirements. Hence,

4. $f_t = d_t^{**} + Rv$ and $\Delta_t = d_t^{**\prime} + Rad$

5. $Rv = f_t - d_t^{**}$ and $Rad = \Delta_t - d_t^{**\prime} = d_t^{**\prime\prime} = 34,560$

6. <u>Determination of Rv and f_t</u>

6a.

$$r = \frac{\Delta_t}{\text{Undeprec. } F_{t-1} + \frac{d_t^{**}}{2}} = \frac{110,816}{536,800+17,280} = \frac{110,816}{554,080} = 20\%$$

6b. $$f_1 \times r = \frac{100,000}{2} \times 20\% = 10,000$$

6c. 70,000+10,000=80,000 accum. depreciation of f_1

6d.

$$Rv = f_1 \times \frac{Rad}{\text{Acc. deprec. } f_1} = 100,000 \times \frac{34,560}{80,000} = 43,200$$

(43,200 vs 172,800 the actual Rv)

6e. $f_t = d_t^{**} + Rv = 34,560 + 43,200 = 77,760$

(77,760 vs 207,360 the actual f_t)

7. Assignment of Depreciation 1973

Addition 1969: a) (100,000 - 43,200) × 20% = 11,360

b) Retirements $\frac{43,200}{2}$ × 20% = **4,320**

Addition 1973: $\frac{77,760}{2}$ × r = 7,776

Remaining additions: The gross value of each one is multiplied by 20%.

Accumulated Depreciation of Addition 1969:

70,000(accum. depr. 1972) + 15,680(depr. 73) - 34,560(Rad) =

= 51,120

Table 5.7 gives the actual and DYT restated depreciation of 1973 when the 1972 addition is retired. Tables 5.8 and 5.9 give the actual and DYT restated net fixed assets of 1973 respectively.

As can be seen from the tables mentioned above the errors of estimate for restated depreciation and net fixed assets under DYT are +1.11% and +5.23% respectively. That is, the errors of DYT do not seem to be material in this case, especially for restating depreciation.

In contrast, the errors of estimate for CAT due to the mentioned retirement are indeed material even under the 10% rule-of-thumb criterion. That is, the errors are -27.69% and +14.01% respectively for restated depreciation and net fixed assets versus +2.61% and +9.08% when there are no retirements in 1973.

(i.e. Average t_{73}^{*} = D_{73}/Δ_{73} = 266,736/76,256 = 3.49 years or midyear of 1970. Restated depreciation: 76,256 × 94.15/63.50 = 113,063.

Restated net fixed assets: 304,624 × 94.15/63.50 = 451,659)

Table 5.7

Actual and DYT Restated Depreciation 1973. FIFO Not True

Year	Actual Depr.	DYT Depr.	Conv. Factor	Actual Restated	DYT Restated
1969	20,000	15,680	94.15/61.60	30,568	23,965
1970	24,000	24,000	94.15/63.50	35,584	35,584
1971	28,800	28,800	94.15/65.40	41,460	41,460
1972	17,280	34,560	94.15/68.10	23,980	47,780
1973	20,736	7,776	94.15/78.50	24,869	9,326
	110,816	*110,816*		*156,371*	*158,115*

r = E - A / A = +1.11%

Table 5.8

Actual Restated Net F. Assets 1973. FIFO Not True

Year	Additions	A. Depr. 73	Net FA. 73	Conv. Factor	Restated Net FA. 73
1969	100,000	90,000	10,000	94.15/61.60	15,284
1970	120,000	84,000	36,000	94.15/63.50	53,376
1971	144,000	72,000	72,000	94.15/65.40	103,651
1972	Retired	Retired	Retired	94.15/68.10	Retired
1973	207,360	20,736	186,624	94.15/78.50	223,829
	571,360	*266,736*	*304,624*		*396,140*

Table 5.9

DYT. Restated Net F. Assets 1973. FIFO Not True

Year	Additions	A. Depr. 73	Net FA. 73	Conv. Factor	Restated Net FA. 73
1969	56,800	51,120	5,680	94.15/61.60	8,681
1970	120,000	84,000	36,000	94.15/63.50	53,376
1971	144,000	72,000	72,000	94.15/65.40	103,651
1972	172,800	51,840	120,960	94.15/68.10	167,230
1973	77,760	7,776	69,984	94.15/78.50	83,936
	571,360	*266,736*	*304,624*		*416,874*

r = E - A / A = +5.23%

No doubt the errors of estimate of DYT could be much bigger than found if more than one addition were retired or if the increase in the inflation rate from year to year was sharper. In such a case, however, the errors of estimate of CAT could be much bigger than they found as well.

For the reasons already mentioned, the consequences of retirements are extended beyond the year of retirements per se and they are more serious than they are in the year of retirements as regards restated depreciation. Thus, as a consequence of the retired addition of 1972 the errors of estimate for restated depreciation and net fixed assets of 1974 are +2.68% and +3.50% respectively though no further retirements occured in 1974.

If an older than the 1972 addition was retired in 1973 the errors for restated depreciation and net fixed assets would be less than they found. This is because, on the one hand, the younger the retired addition the less the Rad, and consequently the less the Rv and f_t (see equation 5.3.2). On the other hand, the younger the retired addition the bigger the difference between estimated and actually retired addition as regards age (i.e. DYT employes a FIFO flow of retirements). Thus, if the 1970 addition rather than the 1972 addition was retired in 1973, then the errors of estimate for restated depreciation and net fixed assets would be +0.26% and +1.41% for 1973 and +1.69% and +0.74% for 1974.

Therefore, when all fixed assets are undepreciated,

ceteris paribus, the younger the retired addition(s) the more serious the consequences of retirement on the precision of DYT are. In contrast, the older the retired addition(s) the less serious the consequences of retirements.

So far the case was examined in which there was no need to divide the fixed assets under examination into OFA and NFA (i.e. all fixed assets existed at the end of DY were NFA). Now the case is examined in which there is such a need for the separation of fixed assets under examination. This happens when the DY does not go as far back as the first year of the foundation of the company goes.

Thus, in the illustration 5.2 supposing that the period under examination is 1978 to 1980 and there are no retirements up to 1978. In such a case for restating depreciation and net fixed assets as of 31/12/1978 DYT works as follows:

D Y T

A. Preliminary Steps

1. Determine the dichotomous year (DY):

$$DY = Y - [(100\%/r)+1] = 1978 - [5+1] = 1972$$

2. Determine the average age (t^*) of fixed assets at the end of DY:

$$t_{y=2}^{*} = \frac{D_{y=2}}{\Delta_{y=2}} = \frac{190,480}{90,080} = 2.11 \text{ years}$$

3. Determine the years (t) passed from the foundation of the company up to DY:

$$t = 2t^{*} - 1 = 2 \times 2.11 - 1 = 4.22 - 1 = 4 \text{ years}$$

4. Determine the average annual addition (f_t^*) of fixed assets at the end of DY:

$$f_t^* = \frac{F_{72}}{t} = \frac{536,800}{4} = 134,200$$

5. Determine the accumulated depreciation of each addition at the end of DY:

$$d_1 = \frac{D_{72}}{\frac{t\ (t+1)}{2}} \times t = \frac{190,480}{10} \times 4 = 76,192$$

$$d_2 = \frac{D_{72}}{\frac{t\ (t+1)}{2}} \times t-1 = \frac{190,480}{10} \times 3 = 57,144$$

and so on.

Having determined the accumulated depreciation at the DY of each one of the t equal annual additions of OFA the annual additions of NFA are builded up in the usual way. That is, since there are no retirements $f_t = d_t^* = F_t - F_{t-1}$. Also the depreciation of the year (Δ_t) is taken as $\Delta_t = d_t^{*\prime} = D_t - D_{t-1}$ and it is assigned to the undepreciated additions of fixed assets in proportion to their gross value (see below: Ordinary Steps and No Retirements - Year 1978).

Table 5.10 gives the annual additions of fixed assets (i.e. OFA and NFA), the accumulated depreciation of each addition at the end of DY, as well as the depreciation of the year assigned to each addition of fixed assets up to 1978. The accumulated depreciation of the year 1977 is given too. How the additions of 1978, the depreciation of the year 1978 as well as the assignment of that depreciation to each addition of

fixed assets were determined is shown below:

B. **Ordinary Steps and No Retirements[25] - Year 1978**

1. $d^{*} = F_t - F_{t-1} = 2,595,868 - 2,079,890 = 515,978$

2. $d^{*'} = D_t - D_{t-1} = 1,536,897 - 1,197,399 = 339,480$

3. $d^{*''} = \Delta_t - d^{*'} = 339,480 - 339,480 = 0$

T a b l e 5.10

DYT - Fixed Assets up to 1978

Year	Additions	A. Depr72	Depr73	Depr74	Depr...	Depr77	A. Depr77	Depr78
1969	134,200	76,192	26,840	25,295	...	—	134,200	—
1970	134,200	57,144	26,840	25,295	...	—	134,200	—
1971	134,200	38,096	26,840	25,295	...	—	134,200	—
1972	134,200	19,048	26,840	25,295	...	10,285	134,200	—
1973	207,360	*190,480*	20,736	39,084	...	42,564	183,862	23,498
1974	248,832		*128,096*	23,451	...	51,077	172,302	49,335
1975	298,598			*163,715*	...	61,292	150,318	59,202
1976	358,318				...	73,551	109,986	71,043
1977	429,982				...	44,131	44,131	85,251
1978	515,978					*282,900*	*1197,399*	51,152
								339,481

Since d^{*} and $d^{*'}$ are both positive and $d^{*''}$ is zero there are no retirements (i.e. the reader should keep in mind that DYT is based on the figures published in the two financial statement which say nothing about retirements). Since there are no retirements,

4. $f_t = d_t = 515,978$ and $\Delta_t = d_t^{*'} = 339,480$

5. Determine the rate of depreciation to be applied in 1978:

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25. When there are no retirements the ordinary steps are the same regardless of whether in the year of retirements there are fully depreciated additions of fixed assets or no.

$$r = \frac{\Delta_t}{\text{Undeprec. } F_{t-1} + \frac{f_t}{2}} = \frac{339,481}{1,543,090 + \frac{515,978}{2}} = \frac{339,481}{1,801,079}$$

6. Apply the depreciation rate found in (5) to each undepreciated addition except to the last one to which r/2 is applied.

Thus, depreciation of $f_{1973} = 207,360 \frac{339,481}{1,801,079} = 39,085$

Since 39,085 is bigger than 23,498 which is needed in order for the 1973 addition to become fully depreciated, the 1973 addition is assigned 23,498 instead of 39,085 and a new rate is determined which will be applied to the remaining additions:

$$r' = \frac{339,481 - 23,498}{1,801,079 - 207,360} = \frac{315,983}{1,593,719} = 19.82\%^{26}$$

Thus, depreciation of $f_{1974} = 248,832 \frac{315,983}{1,593,719} = 49,335$

and so on (see table 5.10)

Table 5.11 presents the actual and restated depreciation of 1978. Tables 5.12 and 5.13 present the actual and restated net fixed assets of 1978 respectively. As can be seen from these tables the errors of estimate for restated depreciation and net fixed assets are very small (i.e. +0.48% and +0.05% respectively), and they reflect the accuracy of DYT.

If it is supposed that in the middle of 1978 the

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26. Now the rate as determined under DYT is different from the actual one. This is due to the fact that according to DYT 23,498 rather than 20,736 drs are needed in order for the 1973 addition to become fully depreciated. In general, in the case of fully depreciated addition of fixed assets (fully depreciated either actually or according to DYT) the estimated (r) is different from the actual (r) either because the oldest undepreciated addition of DYT needs less/more depreciation to become fully depreciated than it needs actually or because the estimated fully depreciated fixed assets is different from the actual one.

T a b l e 5,11

Actual and DYT Restated Depreciation 1978, No Retirements

Year	Actual Depr,	DYT Depr,	Conv, Factor	Actual Restated	DYT Restated
1973	20,736	23,498	174,65/ 78,50	46,134	52,279
1974	49,766	49,335	174,65/ 99,90	87,003	86,250
1975	59,720	59,202	174,65/113,30	92,057	91,259
1976	71,664	71,043	174,65/128,40	97,478	96,633
1977	85,996	85,251	174,65/144,00	104,300	103,396
1978	51,598	51,152	174,65/162,10	55,593	55,112
	339,481	*339,481*		*482,565*	*484,929*

r = E - A / A = +0,48%

T a b l e 5,12

Actual Restated Net F,Assets 1978, No Retirements

Year	Additions	A, Depr, 78	Net FA, 78	Conv, Factor	Restated Net FA, 78
1969	100,000	100,000	0		
1970	120,000	120,000	0		
1971	144,000	144,000	0		
1972	172,800	172,800	0		
1973	207,360	207,360	0		
1974	248,832	223,948	24,884	174,65/ 99,90	43,504
1975	298,598	209,020	89,578	174,65/113,30	138,084
1976	358,318	179,160	179,158	174,65/128,40	243,691
1977	429,982	128,994	300,988	174,65/144,00	365,052
1978	515,978	51,598	464,380	174,65/162,10	500,333
	2,595,868	*1,536,880*	*1,058,988*		*1,290,664*

T a b l e 5,13

DYT Restated Net FA 1978 - No Retirements

Year	Additions	A, Depr, 78	Net FA, 78	Conv, Factor	Restated Net FA, 1978
1969	34,200	34,200	0	NA	0
1970	134,200	134,200	0	NA	0
1971	134,200	134,200	0	NA	0
1972	134,200	134,200	0	NA	0
1973	207,360	207,360	0	NA	0
1974	248,832	221,637	27,195	174,65/ 99,90	47,543
1975	298,598	209,520	89,078	174,65/113,30	137,312
1976	358,318	181,029	177,289	174,65/128,40	241,148
1977	429,582	129,382	300,600	174,65/144,00	364,581
1978	515,978	51,152	464,826	174,65/162,10	500,813
	2,435,868	*1,436,880*	*1,058,988*		*1,291,397*

r = E - A / A = 0,05%

1969 addition was retired the retirement has no consequences on the precision of DYT. This is because the FIFO flow of retirements holds actually true, and hence Rv and f_t as estimated by DYT are equal to the actual ones as regards both value and age. This is shown below:

DYT - Ordinary Steps, Depreciated FA and Retirements

1. $d_t^* = F_t - F_{t-1} = 2,495,868 - 2,079,890 = 415,978$

2. $d_t^{*\prime} = D_t - D_{t-1} = 1,436,880 - 1,197,399 = 239,481$

3. $d_t^{*\prime\prime} = \Delta_t - d_t^{*\prime} = 339,481 - 239,481 = 100,000$

   Since $d_t^{*\prime\prime}$ is positive there are retirements.

4. $Rad = d_t^{*\prime\prime} = 100,000$

5. $Rv = Rad = 100,000$ (because of the FIFO flow of retirements assumption employed).

6. $f_t = d_t^* + Rv = 451,978 + 100,000 = 515,978$

7. Determine the rate of depreciation applied

$$r = \frac{\Delta_t}{\text{Undeprec. } F_{t-1} + \frac{f_t}{2}} = \frac{339,481}{1,543,090 + 257,989} = \frac{339,481}{1,801,079}$$

8. To find the depreciation of the year which corresponds to each undepreciated addition of fixed assets multiply the gross value of each one of them by r.

Since there are fully depreciated additions with gross value equal to or bigger than Rad and since the FIFO assumption holds true, Rv and f_t are equal to the actual ones both as regards age and value. Hence, the retirements have no consequences on the precision of DYT. The results produced are the same with those obtained

when there were no retirements (see tables 5.11 to 5.13) because the retirements came from assets which are not restated.

If the FIFO flow of retirements does not hold true, that is, if it is supposed that in the middle of 1978 the 1977 addition rather than the 1969 addition was retired, then there are consequences on the precision of DYT. This is shown below:

DYT - Ordinary Steps, Depreciated FA and Retirements

1. $d_t^{**} = F_t - F_{t-1} = 2,165,886 - 2,079,890 = 85,996$

2. $d_t^{**\prime} = D_t - D_{t-1} = 1,407,886 - 1,197,399 = 210,487$

3. $d_t^{**\prime\prime} = \Delta_t - d_t^{**\prime} = 296,483 - 210,487 = 85,996$

   Since $d_t^{**\prime\prime}$ is positive there are retirements. Hence,

4. $Rad = d_t^{**\prime\prime} = 85,996$

5. $Rv = Rad = 85,996$ (vs 429,982 the actual one)

6. $f_t = d_t^{**} + Rv = 85,996 + 85,996 = 171,992$

   (vs 515,978)

7. Find the rate of depreciation applied:

$$r = \frac{\Delta_t - 23,498}{\text{Undeprec. } F_{t-1} + \frac{f_t}{2} - f_{1973}} = \frac{296,483 - 23,498}{1,543,090 + 85,996 - 207,360} = \frac{272,985}{1,421,726}$$

8. Apply the rate of depreciation found to each undepreciated addition except to the last one. To the last one apply r/2.

Table 5.14 gives the actual and DYT restated depreciation of 1978. Tables 5.15 and 5.16 give the restated net fixed assets of 1978. As can be seen from these tables the errors of estimate are +1.22% and +4.79%

respectively for restated depreciation and net fixed assets. That is, the retirements affected somehow the precision of DYT, but not materially, especially as regards restated depreciation.

If the 1975 addition rather than the 1977 addition was retired in the middle of 1978 then the consequences on the precision of DYT, would be somehow more serious than they found. That is, the errors would be +2.46% and +4.14% respectively for restated depreciation and net fixed assets. If the 1974 rather than the 1975 addition was retired then the consequences would be even more serious than they found, especially if the annual additions were equal.

The above is due to the fact that, as mentioned, in the case of fully depreciated additions of fixed assets any bad consequences, especially as regards restatement of depreciation, stem from the fact that under DYT the actually retired addition(s) still participates in the assignment of depreciation of the year (i.e. for DYT the first addition was retired). Hence, supposing constant additions the oldest the actually retired addition (and hence the oldest the Rad) the more the gross value of retirements (Rv) which still participates in the assignment of depreciation of the year and the oldest its age. Consequently, the bigger the mistake as regards restated depreciation.

Therefore, someone could argue that when there are fully depreciated additions of fixed assets which are bigger or equal to Rad then, ceteris paribus, the oldest

T a b l e 5,14

Actual and DYT Restated Depreciation 1978, FIFO Not True

Year	Actual Depr.	DYT Depr.	Conv. Factor	Actual Restated	DYT Restated
1973	20,736	23,498	174,65/ 78,50	46,134	52,279
1974	49,767	47,778	174,65/ 99,90	87,005	83,527
1975	59,720	57,334	174,65/113,30	92,057	88,379
1976	71,664	68,800	174,65/128,40	97,477	93,582
1977	42,998	82,561	174,65/144,00	52,150	100,133
1978	51,598	16,512	174,65/162,10	55,592	17,790
	296,483	*296,483*		*430,415*	*435,690*

r = E-A / A = +1,22%

T a b l e 5,15

Actual Restated Net F,Assets 1978, FIFO Not True

Year	Additions	A, Depr, 78	Net FA, 78	Conv. Factor	Restated Net FA, 78
1969	100,000	100,000	0	NA	
1970	120,000	120,000	0	NA	
1971	144,000	144,000	0	NA	
1972	172,800	172,800	0	NA	
1973	207,360	207,360	0	NA	
1974	248,832	223,948	24,884	174,65/ 99,90	43,503
1975	298,598	209,020	89,578	174,65/113,30	138,082
1976	358,318	179,160	179,158	174,65/128,40	243,691
1977	Retirem,	Retirem,	0	174,65/144,00	0
1978	515,978	51,598	464,380	174,65/162,10	500,332
	2,165,886	*1,407,886*	*758,000*		*925,608*

T a b l e 5,16

DYT Restated Net F,Assets 1978, FIFO Not True

Year	Additions	A, Depr, 78	Net FA, 78	Conv. Factor	Restated Net FA, 78
1969	48,204	48,204	0	NA	
1970	134,200	134,200	0	NA	
1971	134,200	134,200	0	NA	
1972	134,200	134,200	0	NA	
1973	207,360	207,360	0	NA	
1974	248,832	220,080	28,752	174,65/ 99,90	50,265
1975	298,598	207,652	90,946	174,65/113,30	140,191
1976	358,318	178,786	179,532	174,65/128,40	244,199
1977	429,982	126,692	303,290	174,65/144,00	367,844
1978	171,992	16,512	155,480	174,65/162,10	167,517
	2,165,886	*1,407,886*	*758,000*		*970,016*

r = E-A / A = +4,79%

the (undepreciated) retired addition(s) the more serious the consequences on the precision of DYT, especially as regards restated depreciation. Yet, taking into account that under DYT the consequences of retirements are extended beyond the year of retirements per se, then in the aggregate it is the youngest addition which seems to have the most serious consequences on the precision of DYT. This is because under DYT this addition is still in operation and it will affect (through the depreciation of the year assigned to it, wrongly, in the following years) the precision of DYT for more years than any other additions (i.e. the youngest the addition the more the years needed to become fully depreciated).

In the discussion presented so far it was supposed that all retirements come from a unique fixed asset category. Actually, however, retirements may come from two or more categories of fixed assets. In such a case $d_t^{*''}$ is the summation of the individual differences ($d_i^{*''}$) between δ_i (actual depreciation of each category) and $d_i^{*'}$ of those basic fixed asset categories from which retirements have come. In general, $d_t^{*''} = \sum_{i=1}^{n} d_i^{*''}$[27].

With the exception of the case in which the retirements come from wholly undepreciated fixed assets and their gross value is less than the gross value of the last addition (i.e. d_t^{*} is positive and $d_t^{*''}$ is zero) DYT is in a position to know from which exactly basic

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27. If a basic category of fixed assets has no retirements in a given year, the difference between actual and estimated depreciation of the year is zero.

category or categories of fixed assets the retirements of a given year come. However, since in the Greek profit and loss statement only the total depreciation of the year (Δ_t) of fixed assets is given, DYT is not in a position to know exactly the individual $d_i^{*''}$, and hence it is not in a position to compute Rad_i, δ_i, Rv_i and f_{ti} of those basic fixed assets categories from which retirements have come.

To solve the problem of computing the $d_i^{*''}$'s DYT allocates the value of $d^{*''}$ to the individual $d_i^{*''}$'s in a (rather) arbitrary way. That is, the average depreciation expense of the two years which lie on both sides of the year of retirements is computed for that basic fixed asset category, which has usually the smallest gross value in the balance sheet statement in comparison to the other fixed asset categories which have retirements as well. The difference between the so determined depreciation (which is supposed to be the actual one) and the depreciation of the year for that category as computed under DYT constitutes the $d_i^{*''}$. In the same way $d_{i2}^{*''}$ is determined for the next smallest category of fixed assets which has retirements. The same procedure is repeated for determining the remainding $d_i^{*''}$'s except for for the last one (d_m'') which necessarily equals $d^{*''} - \sum_{i=1}^{m-1} d_i''$. In this way any mistakes due to the rather arbitrary allocation of the value of $d^{*''}$ to the individual $d_i^{*''}$'s becomes less than otherwise.

Having determined the individual $d_i^{*''}$, the individual Rad_i, δ_i (where $\sum \delta_i = \Delta_t$), Rv_i, f_{ti} are

computed in the way already described when it was supposed that all retirements come from a given category of fixed assets. The only difference is that each individual $d_i^{*''}$ stands now for $d^{*''}$ for the determination of the (adjusted) individual Rad_i, δ_i, Rv_i and f_{ti}.

The results obtained when DYT was tested for its accuracy (Section 5.4) showed that the technique gives good results even if all fixed asset categories other than buildings are merged into one category. That means that at least in the Greek case there is no need to apply DYT to each one of the fixed asset categories (other than buildings) separately. It also means that someone is not faced with the problem of allocating (in a rather arbitrary way) the total value of $d^{*''}$ to the individual $d_i^{*''}$'s, since it is very unusual for buildings to retire. Finally, it means that far less work is involved in restating fixed assets by use of the technique according to what has been said about the operation of DYT.

In summarising, from what have been written so far about DYT the general conclusion can be drawn that the technique seems to enjoy a remarkable accuracy in comparison to CAT, especially when there are retirements or fully depreciated fixed assets still in operation. This is due to the fact that the technique is independent from the five assumptions required in order for CAT to produce good results. All DYT needs to know is the total depreciation of the year figure as well as the rate of

depreciation, though the knowledge of the latter is not so necessary[28].

DYT is free from the five assumptions mentioned above because of the way in which the annual additions are builded up and the depreciation of the year is assigned to each one of them for restatement purposes, on the one hand, and because it is in a position to recognize retirements and take actions to prevent their bad consequences, on the other.

The recognition of retirements becomes possible thanks to the total depreciation of the year figure given in the Greek profit and loss statement. This figure plays the role of a **safety valve** as regards precision of DYT. This is so because thanks to it the computation of d_t'', which is the key factor for determining Rad and then Rv and f_t, becomes possible.

Though DYT is able to recognize the retirements, it cannot determine the restated gain/loss which results from them. The main reason for it is that it is impossible to know the selling price of the retirements. Nevertheless it calculates gains/losses from retirements. For this purpose the FIFO flow of retirements assumption as well as the assumption that the selling price of the retirements is equal to their net book value are employed. However, because of these two assumptions the results produced are very tentative.

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28. The results of the variation of DYT - Section 5.3.6 - suggest that a DY which goes three to four years back from the first year of the period under examination produces good results.

The inability of DYT to produce good results with respect to (restated) gains/losses from retirements constitute a weakness of the technique. Yet, this weakness is common to any other estimation technique used for the restatement of fixed assets. What is really a serious weakness of DYT is the fact that its remarkable performance is accomplished at the expense of simplicity, data availability, and time required for its operation. In these aspects DYT is undoubtedly inferior to CAT.

Because of the above disadvantages the researcher modified DYT in order for it to become less demanding as regards time and data availability, and hence more practical. The nature and operation as well as the results produced under the variation of DYT, which is called Equal Additions Technique, are discussed in the next sub-section.

5.3.5. Operation of the Equal Additions Technique

The only difference between the Equal Additions Technique (EAT) and the DYT concerns the starting point of their operation. That is, for EAT the starting point is the year which proceeds the first year of the period under examination. For DYT the starting point is the Dichotomous Year (DY) which is given by the equation $DY = Y - [(100\%/r) + 1]$.

Having determined the starting point (year) all other steps followed under each one of the two methods (i.e. Preliminary and Ordinary steps) are identical. In the following paragraphs a summary of the operation of EAT is given.

However, before presenting the Preliminary and Ordinary steps of EAT (which are the steps of DYT as well with the exception of the first preliminary step) it should be noticed that the preliminary steps are followed once (i.e. in the first year of its application). The ordinary steps are repeated each year and they depend on whether or not there are retirements in a given year. When there are no retirements the ordinary steps are the same regardless of whether all fixed assets are undepreciated or not in the year under examination. When there are retirements the ordinary steps are different depending on whether all fixed assets are undepreciated in the year of retirements or not.

E A T

A. Preliminary Steps

1. Choose the year (t) which proceeds the first year of the period under examination as the starting point. If substantial retirements occured in that year, choose the previous year as starting point.

2. Determine the average age of fixed assets existed at the end of the chosen year:

$$t^* = D_t \; / \; \Delta_t$$

3. Determine the year t passed from the foundation of the company to the starting year:

$$t = 2t^* - 1$$

4. Divide the fixed assets existed at the starting year into equal annual additions on the basis of t found in step (3):

$$f_t^* = F_t \; / \; t$$

5. Determine the accumulated depreciation of each annual addition of fixed assets at the starting year

$$d_1 = \frac{D_t}{\frac{t\ (t+1)}{2}} \times t$$

$$d_2 = \frac{D_t}{\frac{t\ (t+1)}{2}} \times (t-1)$$

and so on

When there is excess accumulated depreciation, add it to the next addition(s) until all excess accumulated depreciation has been exhausted.

B_1. Ordinary Steps - No Retirements

1. $$d_t^* = F_t - F_{t-1}$$

2. $$d_t^{*\prime} = D_t - D_{t-1}$$

3. $$d_t^{*\prime\prime} = \Delta_t - d_t^{*\prime}$$

If $d_t^{*\prime\prime}$ is zero and d_t^{*} and $d_t^{*\prime}$ are positive there are no retirements. Hence,

4. Put $f_t = d_t^{*}$ and $\Delta_t = d_t^{*\prime}$

5. Determine the rate of depreciation (r):

$$r = \frac{\Delta_t}{\text{Undeprec. } F_{t-1} + \frac{f_t}{2}}$$

If the first undepreciated addition (f_m) needs less depreciation, say δ', than its share in order to become fully depreciated then assign δ' to it as depreciation of the year and calculate a new rate (r) to be applied to the remaining undepreciated additions of fixed assets:

$$r = \frac{\Delta_t - \delta'}{\text{Undeprec. } F_{t-1} + \frac{f_t}{2} - f_m}$$

6. To find the depreciation of the year which corresponds to each undepreciated addition of fixed assets multiply its gross value by r, except for the last addition which is multiplied by r/2.

B_2. Ordinary Steps - Undepreciated Fixed Assets and Retirements

1. $$d_t^{*} = F_t - F_{t-1}$$

2. $$d_t^{*\prime} = D_t - D_{t-1}$$

3. $$d_t^{*\prime\prime} = \Delta_t - d_t^{*\prime}$$

If $d_t^{*\prime\prime}$ is positive or if d_t^{*} and/or $d_t^{*\prime}$ are negative there are retirements. Hence,

4. $f_t = d_t^{*} + Rv$ and $\Delta_t = d_t^{*\prime} + Rad$

5. $Rad = d_t^{*\prime}$ and $Rv = f_t - d_t^{*}$

6. Determination of Rv and f_t

6a. Determine the rate of depreciation applied:

$$r = \frac{\Delta_t}{\text{Undeprec. } F_{t-1} + \frac{d_t^*}{2}}$$

6b. Determine the depreciation which corresponds to the first addition (f_1) (or additions f_i) assuming that the whole addition was retired in midyear:

$$\text{Depreciation of } f_1 = \frac{f_1}{2} \times r$$

6c. Determine the accumulated depreciation of f_1 at the end of the year of retirements by adding the depreciation found in Step (6b) to the accumulated depreciation of f_1 at the end of the previous year (t-1).

6d. Determine the gross value of retirements:

$$Rv = f_1 \times \frac{\text{Rad}}{\text{Accum. deprec. } f_1}$$

6e. Determine the gross value of the last addition f_t:

$$f_t = d_t^* + Rv$$

6'. When the fallacy of the FIFO flow of retirements is recognized there is no need for the steps 6a to 6e to be followed. Out of necessity $f_t=0$ and $Rv=|d_t^*|$. Hence,

$$r = \frac{\Delta_t}{\text{Undeprec. } F_{t-1} - Rv}$$

7. To find the depreciation of the year which corresponds to each addition, except to the first and the last additions, multiply their gross value by r. The depreciation of the first addition from which the retirement comes is equal to $(f_1 - Rv) \times r$ plus $Rv/2 \times r$. The depreciation of the last addition

is equal to $f_t/2 \times r$.

8. Subtract Rv from the gross value of f_1 and Rad from the accumulated depreciation of f_1.

B_3. Ordinary Steps - Depreciated Fixed Assets and Retirements

1. $$d_t^* = F_t - F_{t-1}$$

2. $$d_t^{*\prime} = D_t - D_{t-1}$$

3. $$d_t^{*\prime\prime} = \Delta_t - d_t^{*\prime}$$

If $d_t^{*\prime\prime}$ is positive or if d_t^* and/or $d_t^{*\prime}$ are negative there are retirements. Hence,

4. $$Rad = d_t^{*\prime\prime}$$

5. Rv = Rad (due to the FIFO assumption)

6. $$f_t = d_t^* + Rv$$

7. Determine the rate of depreciation as if retirement did not occured:

$$r = \frac{\Delta_t}{\text{Undeprec. } F_{t-1} + \frac{f_t}{2}}$$

8. To find the depreciation of the year which corresponds to each undepreciated addition of fixed assets, except to the last one, multiply their gross value by r. To find the depreciation of the last addition multiply its gross value by r/2.

9. Subtract Rv and Rad from the gross value and accumulated depreciation respectively of the first addition.

The choice of the year which proceeds the first year of restatement as the starting point has three important advantages. These advantages are the following:

First, there is no need to determine DY. Hence, there is no need to know the rate of depreciation required by law for the restatement of fixed assets under examination.

Second, there is no need for accounting data (i.e. balance sheet and income statements) which go as far back as six to ten years (depending on the rate of depreciation applied) prior to the first year of the period under examination.

Third, much work is saved because there is no need to calculate the depreciation of the year for each one of the mentioned six to ten years and then assign it to each undepreciated addition of fixed assets. Neither is there any need to go through all the rather cumbersome work involved in determining Rv and f_i when there have been retirements in the mentioned period and all fixed assets have been undepreciated.

Therefore, EAT is superior to DYT as regards both data availability and time of operation required. However, this superiority seems to be gained at the expense of precision up to a certain extent.

Any lack of precision of EAT stems from the fact that it chooses the year which proceeds the first year of the period under examination as DY. To be specific, as the reader may recall, under DYT it does not matter basically if the equal annual additions of fixed assets are different from the actual ones as regards both value and age because all these additions constitute the "old" fixed assets which, being fully depreciated at the

beginning of the period under examination, are not restated. Under EAT, however, it does matter if these equal annual additions are different from the actual ones because not only they participate in the restatement process, but also they constitute the most important (undepreciated) fixed assets under restatement in the first years of restatement.

How much the equal annual additions may differ from the actual ones depends on how much the years (t) passed from the foundation of the company to the starting point, as estimated under EAT, differ from the actual t. t, in turn, depends on the pattern of the (actual) annual additions (i.e. increasing or decreasing additions), as well as on the pattern of the depreciation rate. t also depends on whether all fixed assets are undepreciated or not at the starting point (the reader should recall that $t = 2t^{*} - 1$ and $t^{*} = D_{t} / \Delta_{t}$).

To be specific, if the actual annual additions are increasing then, ceteris paribus, the estimated t is less than the actual one. This difference is accelerated when more and more actual additions of fixed assets become fully depreciated. The same holds true basically when the rate of depreciation is increasing from year to year. When, however, the actual annual additions or the rate of depreciation is decreasing from year to year then the opposite holds true.

When both the annual additions and the rate of depreciation are constant from year to year then estimated and actual t are equal provided that all fixed

assets are undepreciated. When, however, there are fully depreciated additions of fixed assets then the estimated t is bigger than the actual t. The more the (actually) fully depreciated additions of fixed assets the bigger the positive difference between estimated and actual t (i.e. as mentioned in the previous sub-section the equation $t^{*}=D_{t}/\Delta_{t}$ does not reflect reality when fully depreciated fixed assets are still in operation).

Simulation examples have showed that from the three factors which affect t the most influential one is the third factor; that is the presence of fully depreciated fixed assets still in operation. This factor accelerates any existing differences between estimated and actual t. When all fixed assets are undepreciated then the increase/decrease of the actual annual additions or of the rate of depreciation must be a very drastic one to bring a big difference between estimated and actual t, and hence to affect seriously the precision of DYT. Otherwise the performance of the technique is good.

To give substance to the above statements, supposing that the annual additions of a firm, which was established in 1969 and it applies a constant rate of depreciation of 20% each year, are (a) increasing by 20%, (b) decreasing by 20% and (c) they are constant. The errors of estimate for each one of these three cases when (1) all fixed assets are undepreciated (i.e. period under restatement 1972-1973) and (2) there are fully depreciated additions of fixed assets (i.e. period under restatement 1977-1978) are given below.

	Undepreciated Fixed Assets				Depreciated Fixed Assets			
	1972		1973		1977		1978	
Additions	Depr	Net FA	Depr	Net FA	Depr	Net FA	Depr	Net FA
Increasing by 20%	+0,29%	+0,33%	+0,21%	+0,22%	+17,5%	+6,7%	+11,6%	+2,0%
Decreasing by 20%	-0,35%	-0,26%	-0,34%	-0,11%	-11,3%	+0,3%	- 1,6%	+1,5%
Constant	0,0%	-0,10%	0,0%	+0,1%	+ 3,3%	+7,0%	+10,9%	+2,7%

Therefore, it seems that EAT performs well when all fixed assets are undepreciated but not so well when there are fully depreciated fixed assets still in operation. Yet, even in the latter case only in the first year of restatement, or in the first two years of restatement EAT does not seem to produce good results. In all other years of restatement the technique seems to generate good results.

Of course, the results of EAT do not seem to be as good as they are the results produced under DYT. Nevertheless they are much better than the results given under CAT. This is demonstrated in the next sub-section where a comparison among DYT, EAT and CAT is made.

5.3.6. Comparison of CAT, DYT and EAT

From what have been said about CAT in Section 5.3.2 the conclusion can be drawn that this technique is simple, and hence understandable, and requires a minimum amount of information for its operation. All you have to know is the gross value of fixed assets, as well as the accumulated depreciation of the year under examination. Then by dividing accumulated depreciation by depreciation of the year, which is taken as the difference in accumulated depreciation of two adjacent balance sheets, the composite age of fixed assets is obtained, and hence the conversion factor of restatement is determined. Maybe that's why this technique has been used a lot in the USA for the restatement of fixed assets and depreciation.

However, usually the more simplified is a technique, the more the assumptions on which is based, and hence the less accurate are its results. This is true in the case of the CAT. In order to produce good results five basic assuptions must hold true: The annual additions, the rate of depreciation as well as the rate of inflation should be constant from year to year; the fixed assets should have no fully depreciated components still in operation; there should be no retirements during the period under examination.

The most crucial of the assumptions mentioned above seem to be the last two assumptions. These assumptions, and especially that referring to the age of fixed assets, do not seem to hold true in the Greek case. Because of it

CAT does not seem to work at all in Greece and the researcher developed another technique called Dichotomous Year Technique.

What DYT shares in common with CAT is the computation of the average age of total fixed assets and depreciation, as well as the computation of the total depreciation of the year figure when there are no retirements. In all other aspects the two techniques differ significantly.

The first basic difference refers to the starting point (year) of their operation. For CAT each time the starting point is the year under examination. For DYT the starting point is the DY which may go even more than six to seven years back from the first year of restatement.

The second basic difference refers to the way in which net fixed assets and total depreciation charge are restated. CAT restates them by use of an average index which is computed on the basis of the average age of total fixed assets. EAT restates them on an (estimated) annual basis (see Section 5.3.3 and 5.3.4).

The third difference refers to the retirements of fixed assets. CAT ignores them. In contrast, DYT computes gross value and accumulated depreciation of them before computing the addition of the year.

By choosing DY as its starting point and then restating net fixed assets and depreciation on an annual basis while taking into account the retirements DYT manages to become independent from the five assumptions mentioned on which the accuracy of CAT is based. The only

condition needed in order for the technique to produce good results is that the total depreciation of the year must be given in the profit and loss statement. In the rather unusual case in which each year substantial retirements occur a second condition is desirable in order for DYT to produce good results. That is, the retirements should occur on a FIFO flow basis.

DYT, being based on far less assumptions than CAT, seems to generate more accurate results than CAT. This is especially true in the case in which there are fully depreciated fixed assets still in operation or there are retirements. However, the remarkable (in comparison to CAT) performance of DYT in countries like Greece is accomplished at the expense of simplicity, understand-ability, data availability and time needed for its operation.

In an effort to make DYT practically atractive the researcher developed EAT. EAT is a variation of DYT. The only difference between EAT and DYT refers to the starting point. That is, under EAT the starting point is the year which proceeds the first year of the period under examination. In all other aspects of their operation the two methods are identical.

The change of the starting point makes EAT much more attractive than DYT as regards both data availability and time involved in accomplishing it. However, the same change makes the technique less accurate than DYT especially when there are fully depreciated fixed assets still in operation at the end of the starting year. The

reason for it was mentioned in the previous sub-section.

The inaccuracy of EAT is less than that of the CAT because it requires less conditions than the CAT in order to produce good results. That is, constant annual additions and rate of depreciation as well as (and mainly) undepreciated fixed assets (i.e. these conditions affect the estimated t). In addition to it, the way in which net fixed assets and depreciation are restated under EAT (i.e. restatement on an annual basis) makes the technique less dependent on the mentioned assumptions than it is the case with CAT. Because of it, not only the errors produced in the absence of these three conditions are less serious, as mentioned, but also they seem to be restricted basically in the first two years of restatement as table 5.17 shows.

Table 5.17 presents the errors of estimate for the periods 1973-1976 and 1978-1981 under five conditions; that is, under increasing (by 20%), decreasing (by 20%), and constant annual additions[29] with constant rate of depreciation as well as under increasing/decreasing by 20% rate of depreciation (i.e. r=12% and 100% respectively for 1969) and constant annual additions. The year of foundation of the firm under examination is 1969 and the inflation rate of the period is that given in table 5.6.

As can be seen from table 5.17 when in the starting

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29. In the starting year 1969 the additions are 100,000, 800,000, and 200,000 drs respectively.

Table 5,17

Errors of Estimate of DYT, EAT and CAT, %

1a, Period 1973-1976 - Restated Depreciation

	1973			1974			1975			1976		
	DYT	EAT	CAT	DYT	EAT	CAT	DYT	EAT	CAT	DYT	EAT	CAT
Additions up 20%	0,0	+0,6	+ 2,6	0,0	+1,5	+ 8,2	0,0	+1,9	+19,6	0,0	-0,5	+30,2
Additions down 20%	0,0	-0,8	+ 1,2	0,0	-0,8	+ 5,0	0,0	0,0	+19,5	0,0	+0,5	+34,9
Additions constant	0,0	0,0	+ 1,5	0,0	+0,9	+ 6,8	0,0	+0,8	+17,6	0,0	0,0	+32,3
Rate up 20%	-1,4	-1,4	+ 0,5	-0,9	-0,9	+ 1,8	-0,3	-0,3	+23,4	0,0	0,0	+56,8
Rate down 20%	+1,8	+1,8	+14,2	0,0	0,0	+24,1	+1,5	+1,5	+52,1	-0,4	-0,4	+65,9

2a, Period 1978-1981 - Restated Depreciation

	1978			1979			1980			1981		
	DYT	EAT	CAT	DYT	EAT	CAT	DYT	EAT	CAT	DYT	EAT	CAT
Additions up 20%	+0,5	+22,2	+ 23,0	+0,2	+15,1	+ 27,0	0,0	- 4,3	+ 32,5	-0,1	- 0,8	+ 42,7
Additions down 20%	+0,5	-10,9	+104,4	+0,4	- 0,6	+150,8	+0,2	+ 2,8	+185,3	-0,3	+ 7,1	+228,6
Additions constant	+0,6	+ 3,4	+ 77,9	+0,3	+11,0	+104,8	0,0	+ 7,0	+134,6	-0,2	+ 2,1	+172,8
Rate up 20%	0,0	+ 1,1	+118,8	0,0	+ 0,2	+159,3	0,0	0,0	+233,4	0,0	0,0	+330,2
Rate down 20%	+2,6	+33,3	+103,3	-0,8	+29,6	+137,0	0,0	+31,5	+175,8	0,0	+29,2	+204,5

1b, Period 1973-1976 - Restated Net Fixed Assets

	1973			1974			1975			1976		
	DYT	EAT	CAT	DYT	EAT	CAT	DYT	EAT	CAT	DYT	EAT	CAT
Additions up 20%	0,0	+0,9	+ 9,1	0,0	+0,2	+23,1	0,0	-0,5	+41,1	0,0	-0,3	+56,4
Additions down 20%	0,0	-0,6	+ 7,0	0,0	-0,3	+18,7	0,0	-0,5	+42,5	0,0	-1,1	+68,8
Additions constant	0,0	+0,3	+ 7,8	0,0	-0,1	+21,6	0,0	-0,5	+40,3	0,0	-0,5	+62,8
Rate up 20%	+0,7	+0,7	+ 6,5	-0,2	-0,2	+20,6	0,0	0,0	+55,6	0,0	0,0	+85,0
Rate down 20%	+0,5	+0,5	+22,7	+0,6	+0,6	+46,2	-0,2	-0,2	+70,5	0,0	0,0	+95,2

2b, Period 1978-1981 - Restated Net Fixed Assets

	1978			1979			1980			1981		
	DYT	EAT	CAT	DYT	EAT	CAT	DYT	EAT	CAT	DYT	EAT	CAT
Additions up 20%	+0,1	+ 7,9	+ 43,4	0,0	+ 1,9	+ 48,4	0,0	- 0,2	+ 59,4	+0,1	+ 0,1	+ 77,6
Additions down 20%	+0,2	+ 1,6	+151,7	0,0	+ 1,5	+199,5	-0,1	+ 2,0	+253,0	0,0	- 2,0	+320,7
Additions constant	+0,1	+ 7,3	+133,5	0,0	+ 3,2	+143,8	0,0	+ 0,3	+187,0	0,0	- 0,7	+245,8
Rate up 20%	0,0	+ 0,3	+141,4	0,0	0,0	+196,9	0,0	0,0	+281,9	0,0	0,0	+385,7
Rate down 20%	-0,2	+27,1	+130,6	0,0	+19,8	+173,8	0,0	+14,3	+217,8	0,0	+10,3	+256,5

Note: In the case of increasing/decreasing rate of depreciation DYT chose as DY the fourth year prior to the periods under examination (i,e, 1969 and 1974).

year (i.e. 1969 for DYT, 1972 for EAT and 1973-1976 for CAT) all fixed assets are undepreciated the three methods seem to give the same good results (see the year 1973 in which all fixed assets are undepreciated), provided that there are no sharp changes in the inflation rate which affect negatively the precision of CAT (see Section 5.3.2). When, however, in the starting year (i.e. years 1972 for DYT, 1977 for EAT and 1978-81 for CAT) there are considerable amounts of fully depreciated fixed assets still in operation, then DYT still gives good results but not the other two methods.

DYT still produces good results even if there are fully depreciated fixed assets still in operation in the DY because it does not depend on t as the other two methods do (i.e. in the case of fully depreciated fixed assets the equation $t^{**}=D_t/\Delta_t$ by which t is determined does not reflect reality; for EAT and CAT t is crucial).

The errors of EAT are considerably less than those of CAT and they seem to be faded away after the second year of restatement (see the years 1978-1980). In contrast, the errors of CAT become bigger and bigger with the passing of time since more and more additions of fixed assets become fully depreciated.

The errors of restatement of CAT compared with those of the other two techniques become much more serious than they found if retirements are incorporated into the analysis.

Thus, in the example presented and with respect to the first case of increasing additions, if it is supposed

that in 1973 the 1969 addition was retired (i.e. the FIFO assumption holds true) the error of estimate for restated depreciation becomes 0.0% for DYT, +0.3% for EAT, and -63.5% for CAT. If it is supposed that in 1973 the 1972 addition as well as the 1970 addition rather than the 1969 addition were retired (i.e. the FIFO assumption not true) the error for DYT and CAT becomes +1.45% and +1.73% respectively while CAT cannot be applied because the depreciation of the year as determined under the technique is a negative number (i.e. Rad > Δ_t). If in the period 1978-1981 the first addition of 1969 was retired in 1979, there would be no consequences on the precision of EAT and DYT (for the reasons already mentioned), but the error of estimate for CAT (for restated depreciation) would be +13.0%. Finally, if the 1978 addition rather than the 1969 addition was retired in the middle of 1979, the errors as regards restated depreciation would be +1.4%, +17.4% and +40.7% for DYT, EAT and CAT respectively (instead of +0.2%, +15.1% and +27.0%).

Therefore, the general conclusion can be drawn that when all fixed assets are undepreciated and there are no retirements the three methods generate about the same good results. When, however, there are retirements of fully depreciated fixed assets still in operation DYT seems to be undoubtedly superior to EAT and CAT, and EAT undoubtedly superior to CAT. Yet, with respect to practicability it is CAT which is undoubtedly the superior method, followed by EAT.

Consequently, whether it is DYT, or EAT, or CAT

which should be used for restating net fixed assets and depreciation depends on the particular case at hand, on the one hand, as well as on the weight attached by the particular user to practicability and accuracy which are the two conflicting attributes of the three methods, on the other.

In developing countries like Greece whose firms have a considerable amount of fully depreciated fixed assets still in operation, and some retirements of fixed assets occur, it seems that CAT does not work at all, and hence it should be excluded from the choice set. This conclusion is fully supported by the results obtained when the three methods were validated by use of actual Greek data (see Section 5.4). Hence, in countries like Greece the choice is between DYT and EAT.

The researcher believes that in a PHD study the accuracy of the tools used should count more heavily than any other qualities of these tools, since the more accurate the tools, and hence the results produced, the more rigorous the conclusions of the PHD study. Because of it and since the validation test (section 5.4) showed that in the Greek case DYT seems to give more accurate results than EAT, DYT rather than EAT is used in the study for the restatement of fixed assets and depreciation, though EAT is more practical than DYT.

5.4. Validation of the Estimation Techniques

5.4.1. Introduction

In validating the estimating techniques used in the study some constraints inhibit rigorous validation. These constraints are data availability and proper criteria on the basis of which the degree of "errors of estimates" of the estimating techniques will be judged.

With respect to the data, it would be preferable for the data sample to include a large number of companies randomly selected. For reasons mentioned in Section 4.4 the data sample used for validation purposes is neither large nor randomly selected. Specifically, the researcher was able to collect detailed (ie monthly) information with respect to fixed assets and depreciation for only 8 quoted Greek manufacturing companies (i.e. the first sub-sample of the study), as well as monthly data of monetary items (i.e. the third sub-sample of the study). Because of these constraints the validation of the estimation techniques is a partial one and it refers only to the validation of the CAT and DYT, on the one hand, and to the validation of the Average Balance Technique used for the computation of monetary gains/losses, on the other.

With respect to the criteria needed in order to test the validity of the techniques systematically, the

problem is that a standard of materiality does not exist which could be used as a basis to measure the degree of the "errors of estimates". Several studies (see, for example, Dopuch and Watts, 1972) have relied on percentage (ie 10% or 5%[30]) changes as rule-of-thumb criterion of materiality. This is the case with later studies too. Thus, in the mentioned study by Ketz (1978), which tested the performance of the three models mentioned in Section 5.2, a mean error rate of less than 5% was considered to be immaterial.

The percentage test, however, is too simple as a standard of significance to rely on and make inferences. Depending on the decision model employed by the decision-makers, it is possible that a 2% difference to be considered as material[31] (or significant) by a decision maker while a 10% difference to be considered as immaterial by another decision maker using a different decision model for the same decision[32].

A decision model which would apply to both the "estimated" and the "actual" adjusted data to measure the impact of the estimating procedure itself on decision making should serve as a good basis for evaluating the

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30. The exact percentage number needed to distinguish material from immaterial differs in the relevant studies. Thus, Boatsman and Robertson (1974) using the evaluations of 18 CPAS and 15 securities analysts concluded that a 4% difference in net income appeared to distinguish material from immaterial cases. In the study of Rose et. al. (1970) in which students were used as subjects (judges) a 6.5% change in the earnings per share seemed to be material.

31. Material in the sense that it can affect the decision of the decision maker.

32. In this respect Ro argues that "no unique, fixed materiality standard for an item can exist even for a given user if the standard is stated as a magnitude of the item" (Ro, 1982, p.407).

performance of the estimating procedure used in the study. However, an accepted decision model of this kind is not available in the accounting literature for the time being.

Under these circumstances the best thing the researcher could do was to construct an **index of accuracy**, which measures the "errors of estimates" of each one of the methods tested for each one of the companies of the sample for each one of the six years examined and leave the reader to assess for himself the significance of these errors. The error of estimate "r" was defined as the difference between estimated (E) and actual (A) values expressed as a percentage of the latter. That is r=(E-A)/A).

In order to aid the reader in judging the significance of these errors proper statistical tests were performed as well. This was done only when the researcher judged it to be necessary.

However, before testing the estimation techniques used in the study and establishing the "errors of estimates" the validation samples (i.e. first and third sub-samples) should be tested with respect to whether or not they are representative of the remaining companies in the total 30 firm sample. For only if they are representative as regards composition of fixed assets and monetary items respectively then any conclusions drawn with respect to the 'errors of estimates' of the estimation techniques are applicable to the remaining companies of the sample for which these estimation

techniques will be applied. Otherwise, it will serve no purpose to establish errors of estimates.

The test employed for testing the representativeness of the mentioned sub-samples is the Mann-Whitney test. The operation of the test and the results obtained are discussed in the next sub-section.

5.4.2. The Mann-Whitney Test-Findings and Conclusions.

There are several non-parametric tests available for testing the significance of differences between two independent samples. However, tests strictly applicable in this case are the Median test, the Mann-Whitney U test, the Wald-Walfowitz Runs test and the Randomization test (Siegel, 1956, Ch.6).

From the tests mentioned above the Mann-Whitney U test was chosen. This choice was made because the Randomization test for two independent samples which is more powerful test of location is not appropriate because of the comparatevily large size of the firms of the two samples (i.e. n=23). On the other hand, the Median test is not as powerful as the U test whereas the Wald-Wolfowitz runs test, which has the advantage of being sensitive to all kinds of differences and not only to differences in central tendency, as the Median and the U tests are, does not seem to have great power efficiency. According to Smith, its power efficiency is about 75 per cent for sample sizes near 20 (Siegel, 1956, p. 145).

The parametric t test was not used because it assumes that the two independent samples come from normally distributed populations with equal variances. The assumption of normality cannot be tested in this case because one of the two samples is very small (n_1=8 or 9). The U test employed instead (Siegel, 1956, p. 126) does not require the restrictive assumptions associated with the t test.

The operation of the U test for large samples (i.e. n_2>20) is, briefly stated, the following (Siegel, 1956, pp. 120-21):

> *1. State the null hypothesis (Ho); that is, the two samples come from the same population or from identical populations as regards composition of fixed assets or monetary items.*
>
> *2. Determine the value of n_1 and n_2 where n_1 is the smaller and n_2 is the largest sample.*
>
> *3. Rank together the scores for both samples, the rank range being from 1 to $N=n_1+n_2$. When ties[33] occur assign tied observations the arithmetic average of the tied ranks.*
>
> *4. Determine the value of U by applying the formula:*
>
> $$U = n_1 n_2 + \frac{n_2 (n_2+1)}{2} - R_1$$
>
> *where R_1 is the sum of the ranks of n_1.*
>
> *5. Determine the level of significance a. (i.e. a=0.05)*

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33. The ties have only a slight effect on the decision to be made (Siegel, 1956, p. 125). Therefore, the correction factor T is omitted.

6. Determine the rejection region (i.e. one-tailed region). That is, the value of z where

$$Z = \frac{U - \frac{n_1 n_2}{2}}{\text{Sqr root} \left(\frac{n_1 n_2 (n_1 + n_2 + 1)}{12} \right)}$$

7. Make the decision. That is, if the probability p of z (given in table A of Siegel's book) is smaller than a then reject Ho.

For small samples (i.e. n_2 between 9 and 20, as it is the case as regards restatement of fixed assets and depreciation by use of DYT) the operation of the U test is a little different from that already described from step 4 and afterwards. That is:

Step 4. Determine the values of U and U' by applying the formulas:

$$U = n_1 n_2 + \frac{n_1 (n_1 + 1)}{2} - R_1$$

$$U' = n_1 n_2 + \frac{n_2 (n_2 + 1)}{2} - R_2$$

Step 5. Determine the level of significance a (i.e. a=0.05).

Step 6. If the observed value of U or U', whatever is the smaller, is less than the critical value (in tables K and J respectively of Siegel's book) reject Ho.

The financial parameters (i.e. fixed assets and monetary itmes) chosen for testing for significance of differences have been scaled in order to eliminate the size effect on the decision to be made. That is, they have been divided by total assets.

Illustrations 5.3 and 5.4 show how exactly the

Mann-Whitney U test was applied. In the two cases examined (i.e. 3rd sub-sample vs remaining companies in the total firm sample, and 1st sub-sample vs remaining companies except 2nd sub-sample) Ho was accepted in all years for which detailed data have been obtained. That is, the sub-samples come from the same population.

Hence, any conclusion to be drawn regarding "errors of estimates" of ABT and DYT will be applicable to the remaining companies. The same applies as regards errors of estimates of restating the second sub-sample on an actual annual basis. This is so because both the validation sample (i.e. the 1st sub-sample) and the second sub-sample come from the same population as the U test showed. These conclusions are valid provided that the pattern of purchases of fixed assets as well as the pattern of financial policy followed by the remaining companies of the sample is about the same with that followed by the companies of the two validation samples.

Having established the representativeness of the two validation sub-samples, in the next sections the errors of estimates of ABT, DYT and of the restatement on an actual annual rather than monthly basis are determined and conclusions are drawn.

5.3. ILLUSTRATION

The Mann-Whitney U Test for Net Mon. Position

3rd Sub-sample and Remaining Companies - Year 1980

3rd Sub-sample	Net M.P T. Assets	Rank
02	0,11	27
03	(0,18)	23
04	(0,46)	7,5
08	(0,26)	19,5
10	(0,24)	21
12	(0,34)	14
25	(0,16)	24
$n_1=7$		$R_1=136$

Remaining Companies	Net M.P T. Assets	Rank
01	(0,26)	19,5
05	(0,23)	22
07	0,17	29
09	(0,31)	16
11	(0,37)	12
13	(0,43)	9
14	(0,61)	3
15	0,02	26
16	(0,72)	1
17	(0,42)	10,5
18	(0,42)	10,5
19	(0,32)	15
20	(0,47)	6
21	0,18	30
22	(0,50)	4
23	(0,46)	7,5
24	(0,29)	17
26	(0,27)	18
27	(0,36)	13
28	0,13	28
29	(0,13)	25
30	(0,57)	5
31	(0,65)	2
$n_2=23$		$R_2=329$

$$U = n_1 n_2 + \frac{n_2 (n_2 + 1)}{2}$$

$$= 7 \times 23 + \frac{23 (23 + 1)}{2} = 108$$

$$Z = \frac{U - \frac{n_1 n_2}{2}}{\text{Sqr root}\left(\frac{n_1 n_2 (n_1+n_2+1)}{12}\right)}$$

$$Z = \frac{108 - 80,5}{\text{Sqr root}(415,9166)} = \frac{27,5}{20,39} \equiv Z \simeq 1,35$$

For Z = 1,35, P = 0,0885, Since 0,0885 > 0,05, accept Ho.

5.4. ILLUSTRATION

The Mann-Whitney U Test For Net Fixed Assets

1st Sub-sample and Remaining Companies - Year 1976

1st Sub-sample	Net FA T. Assets	Rank	Remaining* Companies	Net FA T. Assets	Rank
01	0,40	11	15	0,63	21
02	0,49	17,5	16	0,25	3
03	0,65	22	17	0,32	7,5
04	0,56	20	18	0,27	6
05	0,48	16	19	0,49	17,5
06	0,44	12	20	0,32	7,5
07	0,24	2	21	0,71	24
08	0,45	13	22	0,26	4,5
$n_1=8$		$R_1=113,5$	23	0,46	14,5
			24	0,39	10
			25	0,26	4,5
			26	0,15	1
			27	0,68	23
			28	0,46	14,5
			29	0,36	9
			30	0,52	19
			31	0,84	25
			$n_2=17$		$R_2=211,5$

$$U' = n_1 n_2 + \frac{n_2 (n_2 + 1)}{2} - R_2$$

$$U' = 136 + 153 - 211,5 = 77,5$$

$$U = n_1 n_2 - U' = 136 - 77,5 = 58,5$$

Since 34 < 58,5, accept Ho.

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* The second sub-sample, that is companies No 09 to 14, were restated on an actual annual basis.

5.4.3. Accuracy of the Average Balance Technique

In computing monetary gains/losses the researcher did his best to gather as many detailed data with respect to monetary items as possible. He did it for two basic reasons. Firstly, the monetary gains constitute the most important feature of GPPA. Hence, the more precise the procedure employed for the computation of monetary gains/losses the more rigorous the results regarding impact of GPPA on accounts. Secondly, the more the detailed monetary data gathered the stronger the validation test regarding precision of the Average Balance Technique (ABT) employed in the study for computing monetary gains/losses for those companies of the sample for which detailed monetary data could not be obtained.

For the reasons mentioned in Section 4.4, the researcher managed to get detailed data as regards monetary items for only nine out of the thirty one companies of the sample for only one to three years out of the six years examined. Specifically, he got detailed data for the years 1979, 1980 and 1981 from 5, 7 and 7 companies respectively.

The data given to the researcher by the companies presented some problems. To be specific, in few cases the trial balance of one of the twelve months was missing. For four out of the nine companies the trial balances of January to February or March were missing too (i.e. for reasons which are beyond the scope of this study many

Greek companies usually prepare off-hand trial balances for the first three months of the year). Finally, the trial balance of December given to the researcher was not the final (the adjusted). Hence, there were discrepancies between the monetary items appeared in the trial balance of December and those which appeared in the related balance sheet statement.

Under these sircumstances, after having obtained the total amount of debits and credits of the items classified as monetary (see Section 6.14), the researcher did the following in order to make the data usable:

1. If the data of a month were missing, the simple average of the total amounts of debits and credits of the two adjacent months was taken.

2 If the data of two or three months were missing the simple average of the total amounts of debits and credits of all actual trial balances was taken.

3. In the very few cases in which the data of December were missing the data of November were taken as data of December too, and not the simple average of November and January of the next year (if these data were not missing) or the average of all trial balances of the year. This solution was given because it was observed (by aid of the data of those companies for which the data of November and December were not missing) that the data of November were more close to those of December than any other data taken as the average figure of two or more trial balances.

4. Any differences existed between trial balances of December and balance sheet monetary data were spread to all twelve months in proportion to their balances, the assumption being that the adjustments made after the preparation of the trial balance of December concerned all the months of the year.

After having made usable the data another problem to be considered was the assumption to be employed for the computation of monetary gains/losses. That is, is it the most recently incurred debt which is retired first or the oldest one? This was so because Jones (1956, pp. 36-37) demonstrated that depending on the assumption employed significantly different results may be obtained for the same set of data.

Since there was no way to prove which of the two assumptions above reflected reality in the Greek case, the researcher decided to use the Average Balance Technique (ABT) which does not require any assumption for its application. Of cource, the ABT was used on a monthly rather than annual basis. Specifically, the formula used for computing monetary gains/losses (Mon. G/L) expressed in end of the year general purchasing power is the following:

$$\text{Mon. G/L} = (\text{ANMP} \times \frac{\text{CPI}_{(t+1)}}{\text{CPI}_{(t-1)}} - \text{ANMP}) \times \frac{\text{CPI}_{(\text{end of year})}}{\text{CPI}_{(t)}}$$

where t = the month of the year under consideration and

ANMP = average net monetary position.

After having computed the monetary gains/losses on a detailed (monthly) basis the monetary gains/losses of the same set of data were computed on an annual basis by use of the ABT as described in Section 5.2. That is, the formula used is the following:

$$\text{Mon. G/L} = \text{ANMP} \times \frac{\text{CPI}_{\text{year-end}(t)}}{\text{CPI}_{\text{year-end}(t-1)}} - \text{ANMP}$$

The results obtained (i.e. monetary gains/losses and errors of estimates) by applying the two methods for each one of the three years examined are presented in table 5.18.

The first thing to be noticed from this table is that only one out of the nine companies suffered monetary losses. Another thing to be noticed is that in only 7 cases out of the 19 cases presented there was an overstatement rather than understatement of monetary gains/losses under ABT. On the average there was an understatement of monetary gains/losses for all three years examined. In all cases the understatement/overstatement was less than 25% except for one case (i.e. company No 29, Year 1981) for which the understatement was 35.1%.

The results obtained were rather unexpected. Provided that in the period examined in this study the rate of inflation was much higher than that prevailing in the period examined by Walther, ceteris paribus, one would expect that an overstatement (rather than

Table 5.19

a) Monetary Gains (Losses) in Thousand Drachmas
b) Errors of the Average Balance Technique

Year 1979

Method	Companies								
	02	03	04	08	09	10	12	24	25
Actual	NA	18,578	43,544	26,868	NA	21,405	20,409	NA	NA
A B T	-	14,877	39,313	28,489	-	24,885	20,566	-	-
Differ.	-	- 3,701	- 4,231	+ 1,621	-	+ 3,480	+ 157	-	-
Error	-	-19,9%	- 9,7%	+ 6,0%	-	+16,2%	+ 1,3%	-	-

Mean error = -1,2%
Mean absolute error = 10,5%

Year 1980

Actual	(5,410)	23,951	44,930	34,593	NA	36,348	28,529	49,995	NA
A B T	(4,833)	18,300	50,714	41,512	-	34,951	27,929	37,867	-
Differ.	(577)	- 5,651	+ 5,784	+ 6,919	-	- 1,397	- 546	-12,029	-
Error	- 9,4%	-23,6%	+12,9%	+20,0%	-	- 3,8%	- 1,9%	-24,1%	-

Mean error = -4,3%
Mean absolute error = 13,7%

Year 1981

Actual	(13,203)	22,013	38,170	46,156	188,285	NA	NA	46,541	117,995
A B T	(11,737)	19,156	39,682	44,485	190,843	-	-	36,959	79,151
Differ.	(1,466)	- 2,857	+ 1,512	- 1,671	+ 2,558	-	-	- 9,582	-41,835
Error	-11,1%	-17,5%	+ 4,0%	- 3,5%	+ 1,4%	-	-	-20,6%	-35,1%

Mean error = -11,8%
Mean absolute error = 13,8%

understatement) of monetary gains/losses bigger than that found by Walther (i.e. 68.3 per cent, Section 5.2) should be observed.

Four possible explanations can be given for this little understatement rather than overstatement.

1. The Greek businessmen follow such an unstable financial policy from month to month and from year to year that the average figure of the net monetary position at the beginning and at the end of the year is less than the average net monetary position of the thirteen months.

2. The validation sample is small. Hence, though the Mann-Whitney U test (Section 5.4.2) showed that it is representative of the total 30 firm sample of the study, it might not be representative of the Greek companies generally, especially as regards pattern of financial policy followed by them from month to month and from year to year. In other words, the results obtained might nave been different from those obtained if the valuation sample was much larger.

3. As Walther himself mentions (1982, p.383) the companies of his validation sample might have used short-cut methods for making GPPA adjustment, instead of utilizing actual detailed information. If this is the case and the short-cut methods used for computing monetary gains/losses were significantly different from the ABT then the different results can be justified, at least partly.

4. The assumptions employed in the study, on the basis of which the differences between trial balance of December and balance sheet monetary data were spread to

all trial balances in proportion to their net monetary position, may not reflect reality. These discrepancies may concern actually the last month or the last months of the year. In such a case the actual monetary gains/losses would be less than those found.

5. Finally, another reason which may have contributed somehow to the different results obtained may be that actually the net monetary position at the end of the missing months January to March was, perhaps, less than that assigned to them by the researcher.

The observed understatement of monetary gains/losses seems to be relatively low. The mean error for the years 1979 and 1980 is less than 5%. Only in 1981 the mean error is a little more than 10% (i.e. -11.8%). Additionally, the mean absolute error lies between 10.6% and 13.7% in all three years. Hence, one could argue that the two methods used for the computation of monetary gains/losses do not differ basically; the observed differences are attributable to chance errors of sampling.

To test the accuracy of the above argument (hypothesis) the Randomization test was employed. The nature and operation of this test as well as the results obtained are discussed in the next sub-section.

5.4.4. The Randomization Test. Findings and Conclusions

The randomization test is a nonparametric statistical tool used in assessing the significance of

differences between two treatments (i.e. methods of valuation, techniques of restatement etc.). Other nonparametric tests which can be applied in this case are the Sign test, the Wilcoxon test and the Walsh test (Siegel, 1956, Ch.5). However, Siegel suggests that the Randomization test should be used when N is small, as in this case, because this test "... uses all the information in the sample and thus is 100 per cent efficient on data which may properly be analyzed by the t test" (Siegel, 1956, pp.93-94).

The researcher uses a nonparametric test instead of the parametric t test for two reasons: First, the set of observations obtained on both treatments are not independent of each other, as the t test assumes, since two different treatments (i.e. estimating and actual methods) are applied to the same set of companies. Second, the t test assumes too, that the set of observations comes from approximately normally distributed populations. This assumption cannot be tested because of the small number of observations (N = 5 to 7).

The operation of the randomization test for small samples briefly stated is the following. (Siegel, 1956, pp. 90-92)

1. State the Null Hypothesis (Ho). That is, there are no differences between the two treatments.

2. Determine the signed (i.e. + or -) differences di between the two treatments (i.e. estimated versus actual results) for each company.

3. Determine the level of significance a. (i.e. a=5%).

4. Determine the sampling distribution; that is the (2^N) possible occurence of Σdi where N is the number of companies included in the sample under examination.

5. Determine the rejection region. The region of rejection consists of the a×(N/2) =b outcomes, which have the most extreme Σdi's. Since the region is a two-tailed region (because the direction of the differences is not predicted), b/2 are the most extreme positive Σdi's and b/2 are the most extreme negative Σdi's.

6. Make the decision. If the Σdi of the di's actually observed is included in the b/2 most extreme outcomes (i.e. region of rejection) then reject Ho and accept Hi.

For 1981 2^7=128 outcomes are equally likely under Ho. Hence, the rejection region consists of the 0.05×128 =6.40≃6 most extreme outcomes. Since the region is a two-tailed region, 6/2=3 are the most extreme possible positive outcomes and 3 are the most extreme negative outcomes.

Table 5.19 gives the three possible outcomes with the most extreme Σdi's at the negative end of the sampling distribution as well as the outcome (n) actually observed. Since the outcome observed is not included in the region of rejection the null hypothesis (Ho) is accepted. That is, the two methods do not differ basically. Accepted is also the null hypothesis in the years 1980 and 1979.

As mentioned earlier in this section, in assessing the significance of differences of the two methods the

T a b l e 5.19

The Randomization Test - The Three Most Extreme Possible Negative Outcomes

	Outcomes							Σd_i
1	- 1466	- 3857	- 1512	- 1670	- 2558	- 9582	- 4135	- 24780
2	+ 1466	- 3857	- 1512	- 1670	- 2558	- 9582	- 4135	- 21848
3	- 1466	- 3857	+ 1512	- 1670	- 2558	- 9582	- 4135	- 21756
...	.....	.....	.....	.....	.....	.....	.....	.....
n	- 1466	- 3857	+ 1512	- 1670	+ 2558	- 9582	- 4135	- 16640

Wilcoxon Mached-Pairs Signed-Ranks test can be used as well. Since the more the statistical tests which come up with the same conclusions the more valid the conclusion drawn, the Wilcoxon test was employed in addition to the Randomization test for the years 1980 and 1981 as described by Siegel (1956, pp. 75-83).

Table 5.20 presents the results of the test. As can be seen from this table the null hypothesis (Ho) was accepted again in both years because for N=7 a T=2 or less allows the rejection of Ho (Siegel, 1956, p. 254). However the T observed was much greater than 2 (i.e. 11 and 6 respectively).

The results of the Randomization and Wilcoxon tests as well as those of the Index of Accuracy should be judged on the basis of the fact that the validation samples is very small as well as on the basis of what have been already written about the standard of materiality to be used in order to measure the degree of

T a b l e 5.20

The Wilcoxon Test - Results

Y e a r 1980

	Actual Method	ABT	d	Rank of d	Rank with less frequent sign
02	(5,410)	(4,833)	(- 577)	-2	
03	23,951	18,300	- 5,651	-4	
04	44,930	50,714	+ 5,784	+5	5
08	34,593	41,512	+ 6,919	+6	6
10	36,348	34,951	- 1,397	-3	
12	28,528	27,928	- 546	-1	
28	49,896	37,867	-12,029	-7	

T = 11

Y e a r 1981

02	(13,203)	(11,737)	(- 1,466)	-1	
03	22,013	18,156	- 3,857	-5	
04	38,170	39,682	+ 1,512	+2	2
08	46,156	44,486	- 1,670	-3	
09	188,285	190,843	+ 2,558	+4	
28	46,541	36,959	- 9,582	-6	4
29	117,586	76,251	-41,335	-7	

T = 6

errors of estimates, on the other.

Having validated the ABT used in the study, the next sub-section is devoted to the validation of the CAT, DYT and EAT used for restating fixed assets and depreciation,

with the ultimate purpose to see which one gives the most accurate results, and therefore should be used in the study.

5.4.5. Accuracy of DYT, EAT, and CAT

As already mentioned the researcher managed to get detailed fixed assets data for eight companies. On the basis of this detailed information he restated fixed assets on a monthly basis. Then he restated the same data by use of DYT, EAT and CAT in order to test their accuracy.

With respect to the exact way in which DYT and EAT were applied, as the reader may recall, strictly theoretically speaking DYT and EAT should be applied separately for each basic category of fixed assets in order to give best results. However, restating separately the five to seven basic fixed assets categories which usually appear in a Greek balance sheet statement involves too much time and cumbersome work.

Therefore, the researcher decided to merge the fixed assets categories other than buildings[34] into one category, and thus to make DYT and EAT more attractive (than before) as a practical tool of restatement. He did it because he had good reasons to believe that this merge would not be at the expense of precision of DYT. These reasons are the following:

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34. Buildings could not be merged because due to their revaluation (see Section 5.4) there was no need to determine DY, and hence the second part of the technique was applied (i.e. determination of NFA).

Firstly, the simple average rate of depreciation for such basic categories of fixed assets such as "furniture and fixtures", "means of transportation" and "deferred charges" is around 14%. This rate is close to the average annual rate of depreciation applied to "machinery", the most important fixed assets category. Hence, these categories could be merged into one rather homogenous category as regards rate of depreciation applied.

Secondly, and maybe more importantly, "machinery" (and installations) along with "buildings" constitute more than 90% of total assets and total depreciation of the year. Each one of the remaining categories constitute only a very small fraction of total fixed assets and depreciation. Hence, even if the rate of 14% on the basis of which dichotomous year, annual additions of OFA, and related accumulated depreciation at the dichotomous year will be determined, is not a representative one for one or more of these categories, the error of restatement (i.e. the annual additions of one or more of these categories, if determined separately, might be older /younger than the average annual additions of the merged categories) expressed as a per cent of fixed assets other than buildings will not be material. Basically the same holds true with EAT.

Thus, DYT and EAT were applied separately for buildings and for the remaining fixed assets and the data generated were restated on an (estimated) annual basis since estimated annual additions and related depreciation were obtained. CAT was applied to all fixed assets

together (except land of course which is not subject to depreciation) because in this way it tended to give better results than when applied to buildings and the remainder of fixed assets separately.

Before presenting and discussing the results obtained by aid of these three methods some more things should be written about application of DYT because they are closely related to the precision of its results.

In order to compute additions of old fixed assets and related accumulated depreciation at the end of the dichotomous year for fixed assets other than buildings, the research was necessarily based on the balance sheet figures, not on the detailed data gathered (i.e. first sub-sample of the study), since the latter data refer to the period 1976-1981. For the same reason the computation of the addition of new fixed assets and related depreciation of the year for each one of the years DY-1 up to 1975 was based on the balance sheet data too.

If due to mistakes in the balance sheet statements the accumulated depreciation of each one of the years DY-1 up to 1975 and/or the total gross value of fixed assets for the years DY up to 1975 were not correct, then annual additions and depreciation of the year as well as related accumulated depreciation for each one of the years DY up to 1975 would differ from the actual ones. The difference would be due to the balance sheet mistakes rather than due to the weaknesses of DYT.

To minimise the possibility of balance sheet mistakes which might affect the precision of DYT, the

following was carried out:

Additions of the year and related accumulated depreciation for old and new fixed assets up to 1975 were first estimated. Then by subtracting the 1976 actual additions and depreciation of the year from actual total gross value and related accumulated depreciation of 1976 respectively, the actual total gross value and accumulated depreciation of 1975 was obtained. Any positive (negative) differences between balance sheet data of 1975 and actual data of 1975 were subtracted (added) from each annual addition and/or from its related depreciaiton, whenever applicable, in a proportionate way (ie in accordance to the gross value of the annual additions and/or their accumulated depreciation).

For the years 1976-1981, DYT computed additions of the year as well as depreciation of the year (which could be different from the actual ones if retirements had occurred and the FIFO flow or retirements assumption were not valid) based on total gross value and accumulated depreciation of the detailed data gathered.

As the reader can realise, this treatment of the balance sheet mistakes (ie it is supposed that there are no mistakes in the detailed data gathered) is not 100% effective. The differences actually refer to specific additions or accumulated depreciation of these additions and not to all additions (and related accumulated depreciation) in a proportionate way. Yet, this treatment was the best available and supposing that the existing differences between balance sheet and actual

data as of 31/12/1975 are not material, any errors of estimates obtained by applying DYT should be attributable to its weaknesses as a technique.

For companies No 1, 2, 3, 4, 6 and 7 the differences between balance sheet and detailed data as of 31/12/1975 were not material (i.e. around 1%). However, for companies No 5 and 8 the total annual additions of fixed assets as appeared in the balance sheet statement as of 31/12/1975 were greater than those of the detailed data by 4.9% and 34.5% respectively, while the total accumulated depreciation was greater by 7% and 59% respectively. How these discrepancies may have affected the accuracy of DYT is mentioned subsequently while discussing the ressults obtained by use of DYT.

The mentioned discrepancies should have affected the accuracy of EAT as well. This is due to the fact that the actual depreciation figure of 1975, which was needed, could not be obtained. Hence, the published depreciation figure of 1975 was used. However, that figure was adjusted to offset any discrepancies existed between published and actual depreciation of 1975, the assumption being that in the case in which there were differences between published and actual accumulated depreciation of 1975, analogous differences existed actually between published and actual depreciation of 1975 as well.

The mentioned assumption, however, is tentative. The fact that a difference existed between published and actual accumulated depreciation of 1975 for a specific company does not necessarily mean that a difference existed as well between published and actual depreciation of 1975. And if indeed such a difference existed, this does not necessarily mean that the difference was analogous to the difference between published and actual accumulated depreciation of 1975, as it was supposed in the study. Yet, the solution given was the best available. The possible effect of the solution given on the precision of EAT is mentioned subsequently while discussing the results produced.

T a b l e 5.21

1st Sub-Sample - Errors (r) of DYT
Restated Depreciation - Amounts in Thousands Drs.

Comp		1976	1977	1978	1979	1980	1981	
01	Differ.	- 501	+ 242	+ 314	- 1609	+ 8697	+13110	a) +11.4%
	Error	- 0.3%	NA	+ 1.7%	- 4.2%	+25.5%	+34.3%	b) 13.0%
02	Differ.	+ 460	- 57	+ 106	+ 1133	+ 2180	NA	a) + 1.2%
	Error	+ 1.5%	- 0.2%	+ 0.3%	+ 2.0%	+ 2.5%	--	b) 1.3%
03	Differ.	+ 533	+ 558	+ 165	+ 1876	- 154	- 1430	a) + 1.8%
	Error	+ 3.7%	+ 3.2%	+ 0.8%	+ 7.0%	- 0.4%	- 3.4%	b) 3.1%
04	Differ.	+ 807	- 705	- 1546	+ 2180	+ 2771	NA	a) + 1.0%
	Error	+ 3.4%	- 2.7%	- 5.3%	+ 4.6%	+ 5.0%	--	b) 4.2%
05	Differ.	+ 1964	+ 808	+ 1055	+ 2366	+ 2225	- 366	a) + 5.1%
	Error	+ 3.6%	+ 3.1%	+ 4.1%	+10.5%	+10.8%	- 1.7%	b) 5.6%
06	Differ.	- 9	+ 34	+ 189	- 181	+ 513	- 42	a) + 0.6%
	Error	- 0.0%	+ 0.2%	+ 1.4%	- 1.3%	+ 3.2%	- 0.2%	b) 1.1%
07	Differ.	+ 243	- 330	- 78	- 182	- 184	+ 445	a) - 0.6%
	Error	+ 1.4%	- 3.2%	- 1.0%	- 2.0%	- 1.5%	+ 3.0%	b) 2.0%
08	Differ.	+ 843	+ 4711	+ 6261	+ 5865	+ 2333	+ 6606	a) + 7.0%
	Error	+ 2.1%	+ 9.5%	+11.3%	+ 9.0%	+ 2.9%	+ 7.5%	b) 7.0%
01-08	M. Error	+ 1.9%	+ 1.4%	+ 1.7%	+ 3.2%	+ 6.0%	+ 6.6%	
	Abs. Er.	2.0%	3.2%	3.2%	5.1%	6.5%	8.3%	

(a) = Mean error
(b) = M. Absolute error

The results obtained under DYT are presented in tables 5.21 and 5.22. As can be inferred from table 5.21, under the 10% rule-of-thumb criterion DYT did not perform well as regards restated depreciation in only 5 out of 45 cases presented. The reasons for this, stated in order of their importance, are the following two:

T a b l e 5,22

1st Sub-Sample - Errors (r) of DYT
Restated Net Fixed Assets + Investment,
(Amounts in thousand drs,)

Comp		1976	1977	1978	1979	1980	1981		
01	Differ,	+ 3588	+ 3901	+ 5096	+ 3463	- 3703	-17638	a)	+ 0,2%
	Error	+ 1,4%	+ 1,3%	+ 1,5%	+ 0,8%	- 0,7%	- 2,8%	b)	1,4%
02	Differ,	- 3431	- 3329	- 3521	- 5538	- 9120	NA	a)	- 3,6%
	Error	- 2,5%	- 2,0%	- 2,1%	- 3,5%	+ 7,5%	--	b)	3,6%
03	Differ,	- 36	- 662	- 549	- 1824	- 1174	+ 1680	a)	- 1,2%
	Error	- 0,0%	- 0,2%	- 0,1%	- 0,4%	- 0,2%	+ 0,2%	b)	1,8%
04	Differ,	+ 2232	+ 3530	+ 6109	+ 6075	+ 4766	NA	a)	+ 1,7%
	Error	+ 1,1%	+ 1,5%	+ 2,4%	+ 2,1%	+ 1,5%	--	b)	1,7%
05	Differ,	+ 3902	+ 3643	+ 3051	+ 1427	- 480	- 154	a)	+ 1,0%
	Error	+ 2,0%	+ 1,9%	+ 1,5%	+ 0,6%	- 0,2%	- 0,0%	b)	1,0%
06	Differ,	+ 289	+ 492	+ 452	+ 2542	+ 2433	+ 9899	a)	+ 0,5%
	Error	+ 0,1%	+ 0,2%	+ 0,1%	+ 0,6%	+ 0,5%	+ 1,5%	b)	0,5%
07	Differ,	+ 706	+ 60	+ 162	+ 667	+ 902	+ 541	a)	- 0,5%
	Error	+ 0,9%	+ 0,0%	+ 0,1%	+ 0,6%	+ 0,7%	+ 0,4%	b)	0,5%
08	Differ,	+18296	+16758	+12889	+12340	+13337	+10106	a)	+ 3,7%
	Error	+ 6,0%	+ 5,0%	+ 3,7%	+ 2,9%	+ 2,7%	+ 1,9%	b)	3,7%
01-08	M, Error	+ 1,1%	+ 1,0%	+ 0,9%	+ 0,5%	- 0,4%	+ 0,2%		
	Abs,Err,	1,7%	1,5%	1,4%	1,4%	1,7%	1,1%		

(a) = Mean error
(b) = M, Absolute error

The Greek law (i.e. P.D 88/1973 specifies the rate of depreciation to be applied each year to each category of fixed assets. Hence, it specifies indirectly the years needed in order for an asset to become fully depreciated. Under the same law when a firm does not apply

depreciation in a given year, that is, it does not exercise its right to depreciate its asset, it cannot apply it after the (specified) useful life of the asset (i.e. lost depreciation allowances).

In the Greek case sometimes a company may apply no depreciation in a given year for income smoothing purposes. If this happens, say, in 1971 then an asset acquired, say, in 1969, and whose useful life is 7 years, will not be fully depreciated at the end of 1976. In such a case and according to what was written in the previous paragraph it would be wrong for DYT to take into account the 1969 addition when assigning the depreciation of the year 1977.

Therefore, and provided that the Greek companies comply with the mentioned law, in the case of fixed assets other than buildings (i.e. due to revaluation it is supposed that buildings were acquired in 1976 (see Section 6.4) DYT should exclude from the assignment of depreciation of the year any addition which at the end of the year under examination is more than eight years old (i.e. 100% : 14% = 7.14 years). That is what DYT did in the first place.

However, by doing this the technique did not give good results for company No 5 of the valuation sample. What was worse, for two of the remaining companies in the total 31 firm sample of the study DYT could not work at all. That is, in the years 1980 and 1981 respectively the depreciation of the year for assignment was bigger than that needed in order for each one of the additions of

fixed assets, which at the end of the year under examination were up to eight years old, to become fully depreciated. This happened because these companies (like company No 5) which in some years did not apply depreciation to some (or all) of their fixed assets, contrary to the requirements of the mentioned law, they continued to depreciate these assets after their useful life.

Hence, for restating fixed assets by use of DYT (and EAT) the researcher finally decided to include in the assignment of depreciation of the year any undepreciated addition, no matter how old it was. The results so obtained are presented in tables 5.21 and 5.22, as mentioned.

The bad results obtained for company No 1 in the years 1980 and 1981 are due to the fact that, on the one hand, the company did not apply depreciation to some assets every year for income smoothing purposes (i.e. in the year 1977 it did not apply depreciation at all). On the other hand, this company complied with the requirements of the mentioned law, as the researcher himself noticed it while gathering the data. Hence, it did not apply depreciation to those assets which were undepreciated at the end of their useful life, while DYT did apply depreciation. Because of it part of the depreciation which actually was assigned to young fixed assets of the company, it was assigned to old (i.e. more than 8 years old) undepreciated fixed assets under DYT. As a result, DYT overstated the restated depreciation of 1980 and 1981 (i.e. it should be mentioned that the

company commenced businesses in 1971).

With respect to the rather bad results obtained in the years 1979 and 1980 for company No 5, and in the years 1978, 1979 (especially) for company No 8 they should be attributed to the mentioned serious discrepancies existed between detailed and balance sheet data (i.e. while these discrepancies actually concerned specific additions they were spread evenly to all additions). In addition to it, a second possible explanation might be that these two companies for some items and for income smoothing purposes might had applied less depreciation than they had to.

Nevertheless, even under the mentioned circumstances, the mean error for all eight companies of the validation sample was less than 5% for the years 1976 to 1979 and only +6% and +6.6% in the years 1980 and 1981 respectively. What, perhaps, is more important even the mean absolute error was less than 5% in the first three years and between 5.1% to 8.3% in the remaining years. Hence, at least under the 10% rule of thumb criterion DYT seems to work well.

If the Greek companies followed the requirements of the mentioned law regarding depreciation of fixed assets and if there were no balance sheet mistakes, then the results of DYT could be much better than those obtained. Additionally, the performance of DYT would be even better if the technique was applied to each one of the categories of fixed assets separately. However, in the latter case is doubtful whether the better precision of

DYT could compensate for the additional work involved in applying the technique.

With respect to the accuracy of DYT as regards restatement of net fixed assets plus investment the results obtained are very good. Not only the mean error for the eight companies but also the mean absolute error is less than 2%.

This remarkable performance is due to two reasons. Firstly, on the one hand, buildings are a homogenous category. On the other hand, there are almost no retirements of investment and especially of land. As a result, DYT gave good results for these categories according to what has been mentioned as regards performance of DYT. Secondly, land, investment and buildings constitute a very significant part of total net fixed assets plus investment on the basis of which the errors of estimates are determined. Hence, the errors of restatement of net fixed assets other than buildings expressed as a per cent of total net fixed assets plus investment are necessarily not so significant as they are in the case of restated depreciation, where the depreciation of fixed assets other than buildings constitute the most significant part of total depreciation.

The results produced under EAT are inferior to those produced under DYT, especially as regards restated depreciation (see table 5.23). This was expected according to what has been said to the Sections 5.3.5 and 5.3.6 regarding the accuracy of the technique. Yet, these results seem somewhat more serious than expected perhaps

T a b l e 5,23

1st Sub-Sample - Errors (r) of EAT, %

a) Restated Depreciation

M ,Error	Comp	1976	1977	1978	1979	1980	1981	Absol, Error
+ 7,3	01	- 7,6	NA	- 7,8	+ 4,4	+19,5	+27,8	13,4
- 4,0	02	- 6,2	-13,2	-10,1	+ 2,7	+ 6,9	NA	7,8
+11,8	03	+21,3	+17,3	+11,6	+11,0	+ 8,5	+ 1,3	11,8
+12,0	04	+15,0	+ 7,0	+ 4,0	+15,7	+18,2	NA	12,0
+ 9,5	05	+12,1	+ 8,6	+ 8,4	+12,1	+14,6	+ 1,4	9,5
- 1,0	06	- 1,8	- 1,5	- 1,0	- 5,6	+ 1,4	+ 2,8	2,3
- 6,9	07	-22,9	-17,9	+ 2,2	- 2,2	- 2,0	+ 1,4	8,1
+13,6	08	+11,0	+17,2	+19,6	+14,9	+ 9,8	+ 8,9	13,6

b) Restated Net F,Assets + Investment

- 2,4	01	- 4,0	NA	+ 1,2	- 0,3	- 1,2	- 6,7	2,7
- 4,8	02	- 7,5	- 3,9	- 1,9	- 3,5	- 7,2	NA	4,8
+ 1,1	03	+ 2,5	+ 1,6	+ 1,2	+ 0,6	+ 0,3	+ 0,4	1,1
+ 7,3	04	+ 8,9	+ 8,1	+ 8,3	+ 6,7	+ 4,6	NA	7,3
+ 1,2	05	+ 0,5	+ 2,9	+ 2,2	+ 1,1	+ 0,0	- 0,0	1,2
+ 0,6	06	- 0,2	- 0,0	+ 0,2	+ 0,8	+ 1,1	+ 1,7	0,6
+ 0,1	07	- 0,7	+ 0,2	+ 0,0	+ 0,4	+ 0,6	+ 0,4	0,3
+ 5,5	08	+ 9,9	+ 7,7	+ 5,4	+ 4,6	+ 3,3	+ 2,4	5,5

due to the way in which the depreciation of 1975, used to determine t and consequently the equal annual additions, was obtained. This is supported by the bad results obtained for company No 8, which had the most serious discrepancies between published and actual accumulated depreciation of 1975. As for the bad results obtained for company No 1 especially in the year 1980 and 1981 the reason is that already mentioned while discussing the results of DYT.

Yet, the results of EAT are much better than the results of CAT. Indeed, in the Greek case the results of CAT are disappointing, especially with respect to the restated net fixed assets (ie the reader should recall

the tendency for an overstatement of net fixed assets under CAT even if the estimated average age of an asset approximates its actual age - Section 5.3.2). Only for one company (ie company no 1) out of eight companies examined and only for one year out of six years examined could CAT be accepted under a 10% rule-of-thumb criterion of materiality (see Tables 5.24 and 5.25).

The above errors of CAT are very different from those found by Walther (Section 5.2) who tested the D-W model. That is, Walther found that the average error of estimate for CAT as regards restated depreciation was +13.73% while in this study the average error is three times to more than seven times bigger than that found by Walther for each one of the years 1976-81.

There seem to be several reasons which in conjunction with what has been said in Section 5.3 can explain this remarkable lack of performance of CAT in the Greek case. These reasons are the following:

1. The fixed assets employed by USA firms might be much younger than those employed by Greek firms (see Section 5.3.1). In support of the note that CAT works better for "young" companies compare the errors of estimate of companies no 1 and 2, which are young companies, with those of the remaining companies, and especially with those of company no 6, which is the oldest company of the sample.

2. The increase in the inflation rate experienced in the USA is less than that experienced in Greece in the period 1976-1981 (see Table 4.1).

T a b l e 5,24

1st Sub-Sample - Errors (r) of CAT, Restated Depreciation
(Amounts in thousand drachmas,)

Comp		1976	1977	1978	1979	1980	1981	
01	Differ,	+ 4896	NA	+ 6924	- 1857	+ 10076	+ 15786	a) + 27,3%
	Error	+33,9%	--	+ 36,6%	- 4,8%	+ 29,5%	+ 41,3%	b) 29,2%
02	Differ,	+ 8599	+11395	+ 18655	+ 11698	+ 11977	NA	a) + 29,2%
	Error	+28,1%	+31,3%	+ 52,1%	+ 20,6%	+ 13,9%	--	b) 29,2%
03	Differ,	+ 7152	+ 9238	+ 11482	+ 13320	+ 8000	+ 11784	a) + 43,2%
	Error	+50,5%	+52,4%	+ 56,4%	+ 49,5%	+ 22,4%	+ 28,0%	b) 43,2%
04	Differ,	+ 9987	+11374	+ 13647	+ 5096	+ 11513	NA	a) + 33,1%
	Error	+42,3%	+44,4%	+ 46,9%	+ 10,8%	+ 20,9%	--	b) 33,1%
05	Differ,	+ 980	+11290	- 12072	+ 18563	+ 23124	+ 27903	a) + 59,6%
	Error	+36,8%	+43,0%	- 46,5%	+ 82,6%	+112,6%	+128,8%	b) 75,1%
06	Differ,	+ 6169	+ 8321	+ 10906	+ 15145	+ 15362	+ 37923	a) + 92,0%
	Error	+59,9%	+71,5%	+ 65,1%	+ 81,5%	+ 95,0%	+179,0%	b) 92,0%
07	Differ,	+ 4420	+ 8568	+ 10737	+ 14214	+ 18425	+ 24708	a) +123,7%
	Error	+25,6%	+82,4%	+142,8%	+161,5%	+159,5%	+170,6%	b) 123,7%
08	Differ,	+12943	+22375	+ 28193	+ 37935	+ 36693	+ 53930	a) + 48,8%
	Error	+31,7%	+45,4%	+ 50,8%	+ 58,0%	+ 45,5%	+ 61,2%	b) 48,8%
01-08	M, Error	+38,6%	+52,9%	+ 38,0%	+ 57,5%	+ 62,4%	+101,5%	
	Abs, Err,	38,6%	52,9%	49,6%	58,7%	62,4%	101,5%	

(a) = Mean error
(b) = M, Absolute error

T a b l e 5,25

1st Sub-Sample - Errors (r) of CAT, Restated Net Fixed Assets
(Amounts in thousand drachmas,)

Comp		1976	1977	1978	1979	1980	1981	
01	Differ,	+104575	NA	+133079	- 11175	+ 53310	+ 59904	a)+ 35,1%
	Error	+ 68,5%	--	+ 67,8%	+ 5,2%	+ 24,5%	+ 24,6%	b) 38,1%
02	Differ,	+ 63943	+100471	+121549	+ 29284	+ 8332	NA	a)+ 52,8%
	Error	+ 58,9%	+ 76,2%	+ 90,6%	+ 25,6%	+ 12,6%	--	b) 52,8%
03	Differ,	+ 84430	+ 93128	+116407	+283274	+122227	+117282	a)+ 77,3%
	Error	+ 68,0%	+ 67,9%	+ 75,6%	+151,1%	+ 54,5%	+ 46,8%	b) 77,3%
04	Differ,	+109358	+148496	+169919	+ 66564	+ 88636	NA	a)+ 57,2%
	Error	+ 63,6%	+ 75,3%	+ 81,1%	+ 28,8%	+ 37,2%	--	b) 57,2%
05	Differ,	+ 51864	+ 59291	+ 73981	+ 67777	+ 94153	+ 76524	a)+129,3%
	Error	+ 61,3%	+ 75,3%	+128,1%	+129,3%	+180,8%	+204,5%	b) 129,3%
06	Differ,	+ 50233	+ 55607	+ 57275	+115668	+233785	+375909	a)+184,8%
	Error	+109,1%	+119,4%	+136,5%	+195,6%	+258,3%	+279,7%	b) 184,8%
07	Differ,	+ 24182	+ 37496	+ 43259	+ 51173	+ 87411	+ 57756	a)+172,0%
	Error	+ 97,3%	+138,4%	+164,4%	+183,5%	+172,5%	+275,8%	b) 172,0%
08	Differ,	+141084	+159083	+163270	-234823	+222237	+520714	a)+ 95,3%
	Error	+ 71,9%	+ 74,5%	+ 74,8%	+ 92,0%	+ 78,4%	+183,3%	b) 95,3%
01-08	M, Error	+ 74,8%	+ 89,6%	+102,4%	+101,4%	+103,6%	+169,2%	
	Abs,Err,	74,8%	89,6%	102,4%	101,4%	103,6%	169,2%	

(a) = Mean error
(b) = M, Absolute error

3. It is also possible that the rate of depreciation applied in the USA is more stable than that applied by the companies of the sample (ie to get an idea of how sensitive CAT is to the rate of depreciation applied each year, see the errors of estimates of company 2 which in 1980 more than doubled the depreciation expense).

4. The last, but not the least important reason may be that, as Walther himself mentions (1982, p.383), the companies of the validation sample might have used short-cut methods for restating depreciation instead of utilizing actual detailed information.

In concluding, DYT was found to perform well, if not very well as regards restatement of depreciation and net fixed assets (plus investment). The variation of the DYT, the EAT, produced not bad results too (i.e. for six out of the eight companies of the first sub-sample of the study, the mean error was less than 10%; even the absolute error lied between 2.3% and 13.6%). These results could be even better than they found if the actual depreciation figure of 1975 rather than the adjusted one was used. As for the results of the CAT they were disappointing for all companies of the validation sample.

Of course, someone could argue that the small number of the validation sample does not permit generalisation of the results obtained. However, there are no good reasons to believe that DYT, in the first place, and EAT, in the second place, do not work well too not only in the Greek case but also in other developing or developed

countries which apply the straight line method of depreciation and the total depreciation of the year figure is released.

Therefore, it seems that the finding of the study is of particular importance for Greece, since it was showed that CAT does not work at all in the Greek case and another estimation technique for the restatement of fixed assets and depreciation is needed. DYT and EAT come to fulfil this need.

The significance of DYT and EAT as tools for restating fixed assets and depreciation can be enlarged if someone takes into account that they can be used in other developing and developed countries not only for restating fixed assets and depreciation in GPPA terms but also for restating these accounts in CCA terms as well, provided that specific indices are used for making the adjustments.

In this study the DYT rather than the EAT was used to make the GPPA adjustments of fixed assets and depreciation. The choice was based on the belief that the accuracy of the tools used in a PHD study should count more heavily than any other qualities of these tools. And the accuracy of DYT was better than that of EAT when both actual as well as simulation data were used for testing accuracy (see Section 5.3.6).

Having validated the estimation techniques used in the study the next chapter should be devoted to the discussion of the detailed mechanical procedures employed to restate each basic category of accounts. However,

before moving into the next chapter the hypothesis should be tested that an actual annual restatement of fixed assets and depreciation does not give significantly different results from an actual monthly restatement of the same assets. Such a test seems to be necessary not only for the reasons mentioned in the next section but also because if the hypothesis holds actually true this indirectly will strengthen up to some extent the conclusion that DYT, in the first place, and EAT, in the second place, indeed work well (i.e. the reader should recall that under these two methods an (estimated) annual restatement of fixed assets is made).

5.5. Monthly Versus Annual Restatement of Fixed Assets

As mentioned elsewhere in the accounting literature, one of the main reasons cited for not preparing inflation adjusted accounts is the costs involved. Hence, if ways can be found to reduce the costs involved in preparing GPPA adjusted financial statements then, ceteris paribus, the chances of GPPA to be adopted by small companies, like many Greek firms, which are very sensitive to the costs involved of introducing a new system, are enlarged.

As evidenced in this study one of the most time consuming GPPA adjustments of accounts is the restatement of fixed assets and related depreciation. This has been evidenced as well in the FASB's field study (1977, p.23): "The most time consuming part of the project related to the aging of the property and equipment and related accumulated depreciation...".

One way of reducing the clerical work and hence the costs involved in adjusting fixed assets is to adjust them on an annual rather than detailed (monthly) basis, provided that the results generated do not differ significantly.

This study is the first one which tested this hypothesis (ie that fixed assets adjustments on an annual and monthly basis do not differ significantly) by restating the fixed assets of the first sub-sample on a monthly as well as on an annual basis, the assumption being in the latter case that the fixed asset items are

acquired uniformly throughout the year. By testing this hypothesis another thing was accomplished as well. That is, the errors of estimates were established for the second sub-sample of the study whose restatement was made on an (actual) annual basis.

The results obtained were rather unexpected in the sense that though the researcher had formed the opinion beforehand that restatement on an annual basis would not be materially different from that on a monthly basis (opinion which led to the development of the DYT) nevertheless he did not expect the differences to be so little. These results are presented in tables 5.26 and 5.27.

As the reader can see form these tables there is a little evidence that depreciation is overstated and this holds true also for net fixed assets. Specifically, as regards restated depreciation, in 44 out of 45 cases the error is less than 3% while for restated net fixed assets plus investment there is an error of less than 3% in 36 cases. What is more important, in only 3 out of the 91 cases (ie restated depreciation and net fixed assets) the error is as high as 5.0%. In all other cases the error is less than 5%. As for the mean and mean absolute error in all years they are less than 3%.

Hence, and provided that the first and second sub-samples of the study come from the same population, as the Mann-Whitney U test showed, there should be only a small mistake in the restatement of fixed assets and depreciation of the second sub-sample which was made on

an actual annual basis. The same should apply to the restatement of fixed assets and depreciation of the quoted Greek companies generally since the sample of the study is a random one according to the finding of the One-Sample Runs test. Becides, there are no good reasons to believe the opposite .

There are no good reasons as well to believe that the results obtained are not applicable as regards restatement of fixed assets and depreciation of the Greek manufacturing companies generally. In this respect the finding of the study is of particular importance for small Greek companies. It means that considerable time and money can be saved by restating fixed assets on an annual rather than monthly basis. The significance of the findings is enlarged if the results obtained are applicable to other developing countries as well.

Table 5.26

Errors of Restatement on an Annual Basis
a. Restated Depreciation (in thousands)

Comp		1976	1977	1978	1979	1980	1981	
01	Differ	+ 160	NA	+ 234	+ 506	+ 658	+ 766	a) +1,5%
	Error	+ 1,1%	--	+ 1,2%	+ 1,3%	+ 1,9%	+ 2,0%	b) 1,5%
02	Differ	+ 745	+ 768	+ 670	+ 486	+ 687	NA	a) +1,5%
	Error	+ 2,0%	+ 2,1%	+ 1,9%	+ 0,8%	+ 0,8%	--	b) 1,5%
03	Differ	- 16	- 28	- 3	+ 6	+ 85	+ 123	a) +0,0%
	Error	- 0,1%	- 0,2%	- 0,0%	+ 0,0%	+ 0,2%	+ 0,3%	b) 0,1%
04	Differ	+ 343	+ 220	+ 275	+ 900	+1077	NA	a) +1,4%
	Error	+ 1,5%	+ 0,9%	+ 0,9%	+ 1,7%	+ 2,0%	--	b) 1,4%
05	Differ	+ 269	+ 316	+ 345	+ 379	+ 449	+ 491	a) -1,6%
	Error	+ 1,0%	+ 1,2%	+ 1,3%	+ 1,7%	+ 2,2%	+ 2,2%	b) 1,5%
06	Differ	+ 37	+ 43	+ 73	+ 103	+ 421	+ 953	a) +1,4%
	Error	+ 0,4%	+ 0,4%	+ 0,6%	+ 0,7%	+ 2,6%	+ 4,0%	1,4%
07	Differ	+ 112	+ 104	+ 137	+ 174	+ 199	+ 192	a) +1,4%
	Error	+ 0,6%	+ 1,0%	+ 1,8%	+ 2,0%	+ 1,7%	+ 1,3%	1,4%
08	Differ	+ 641	+ 731	+ 977	+1173	+1516	+1464	a) -1,7%
	Error	+ 1,6%	+ 1,5%	+ 1,8%	+ 1,8%	+ 1,9%	+ 1,7%	1,7%
01-08	M,Error	+ 1,0%	+ 1,0%	+ 1,2%	+ 1,2%	+ 1,7%	+ 1,9%	
	M,Ab,Err	1,0%	1,0%	1,2%	1,2%	1,7%	1,9%	

T a b l e 5.27

Errors of Restatement on an Annual Basis
b. Restated Net Fixed Assets (in thousand ars)

Comp		1976	1977	1978	1979	1980	1981	
01	Differ	+ 4594	+ 5144	+ 6513	+ 9000	+11057	-13312	a) +2,0%
	Error	+ 1,8%	+ 1,7%	+ 1,9%	+ 2,1%	+ 2,1%	+ 2,2%	b) 2,0%
02	Differ	+ 2562	+ 2625	+ 2648	+ 2769	+ 2931	NA	a) +1,9%
	Error	+ 1,9%	+ 1,6%	+ 1,5%	+ 1,7%	+ 2,3%	--	b) 1,8%
03	Differ	+ 6382	+ 8668	+ 9546	+10197	+13794	+16078	a) +2,1%
	Error	+ 1,8%	+ 2,3%	+ 2,0%	+ 2,0%	+ 2,2%	+ 2,4%	b) 2,1%
04	Differ	+ 4461	+ 5123	+ 6095	+ 7435	+ 8277	NA	a) +2,4%
	Error	+ 2,2%	+ 2,2%	+ 2,4%	+ 2,6%	+ 2,7%	--	b) 2,4%
05	Differ	+ 1282	+ 1170	+ 938	- 788	+ 508	+ 184	a) -0,4%
	Error	+ 0,6%	+ 0,5%	+ 0,5%	+ 0,3%	+ 0,2%	+ 0,1%	b) 0,4%
06	Differ	+ 9781	+11133	+12571	+17215	+23160	-30424	a) +4,2%
	Error	+ 3,9%	+ 3,7%	+ 4,0%	+ 4,3%	+ 4,5%	+ 4,7%	b) 4,2%
07	Differ	+ 3925	+ 3953	+ 4352	+ 5511	- 5291	- 6340	a) -4,5%
	Error	+ 5,0%	+ 4,6%	+ 4,7%	+ 5,0%	+ 5,0%	+ 4,7%	b) 4,8%
08	Differ	+ 7381	+ 8393	+ 8838	+11316	+13630	+15484	a) +2,6%
	Error	+ 2,4%	+ 2,5%	+ 2,5%	+ 2,9%	+ 2,9%	+ 2,8%	b) 2,5%
01-08	M,Error	+ 2,4%	+ 2,4%	+ 2,4%	- 2,6%	- 2,7%	+ 2,6%	
	M,Ab,Err	2,4%	2,4%	2,4%	2,6%	2,7%	2,6%	

CHAPTER SIX

GPPA PROCEDURES FOR RESTATING GREEK ACCOUNTS

6.1. Introduction

Having discussed the estimating techniques used in the study and having tested the validity of the estimation techniques used in the study as well as the hypothesis that adjustments of fixed assets on an annual basis do not differ significantly from those on a monthly basis, the exact way in which each basic category of accounts was restated should be discussed as well.

Therefore, this chapter discusses the general problems associated with the GPP restatement of accounts and the solution given to them. Following this, the nature of each basic category of accounts, the specific restatement procedures employed in adjusting each one of them, and the difficulties associated with these adjustments are discussed as well.

However, before going into the detailed mechanical restatement procedures applied in the study and the problems associated with that restatement, two general remarks should be made here. First, the items to be restated have been classified as non-monetary and monetary items in accordance to what has already been said in Section 3.3.1. Secondly, the money amounts of the accounts are expressed in end-of-the-year general

purchasing power terms for the reasons explained also in Section 3.3.1. As for the cut-off date and index to be used for the restatement of accounts they are discussed in the next sub-section.

6.2. The Cut-Off Date and the Index Number Problems

As mentioned in Section 3.3.1, one of the implementation problems of GPPA is the general index to be used for restatement (ie CPI versus GNP index). In this study the consumer price index is employed mainly for practical reasons. That is, in Greece, the CPI is computed on a monthly basis while the Gross National Product index is computed once a year and is subject to corrections. Given that for the companies of the sample detailed monthly restatement procedures are applied, the use of the GNP index becomes impracticable. Additionally, the current trend in the accounting literature is toward the adoption of the CPI, as mentioned in Section 3.3.1.

The second implementation problem[1] of the GPPA is the cut-off date to be chosen for restatement purposes. In this study 1/1/1959 was chosen as cut-off date. The reasons for that choice, stated in order of their importance, are the following two:

1. In Greece in 1974 a new consumer price index was

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1. The third implementation problem of GPPA, that is nature of monetary gains/losses and appropriate place to report them, is discussed in Section 5.7.13.

constructed by the National Statistical Service of Greece and the chaning of the new with the old index goes as far back as to 1959.

2. The empirical evidence in the USA and Canada[2] is that a cut-off date which goes 15 years back from the first year of restatement produces fairly accurate results.

It is reasonable to believe that the empirical evidence above holds true in the Greek case too, especially if one takes into account that in Greece the annual rates of depreciation applied are bigger than those applied for tax purposes in the developed countries[3], and hence fewer years are needed in order for fixed assets to be fully depreciated. Indeed, only for buildings used by the administration staff of a firm the annual rate of depreciation is 5% and hence more than 15 years are needed in order for them to be fully depreciated. However, land and buildings of the quoted companies were revalued after 1968 and their revaluation dates have been taken as acquisition dates for restatment purposes (see Section 6.4).

The only non-monetary account whose acquisition date might go back beyond 1959 is investment in other companies[4]. This account, however, is not subject to

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2. See FASB (1977) pp. 15-16.
3. For example, in 1974 the depreciation rates for manufacturing buildings, machingery of oil refineries and machinery of the steel industry were: 8%, 15% and 20% respectively for Greece, 3.4%, 11% and 8.5% for the OEC and 3.6%, 6.3% and 5.6% for the USA. For Greece the same rates are applied up to the present (Source: S Sarsentis, General Accounting, Vol, II, Athens; Karamperopoulos, S.A., 1975. p.128).
4. For the reasons to be mentioned in due course the restated equity is taken as the difference between restated assets and liabilities.

depreciation so that to affect earnings which are basically the subject of empirical analysis in the study. On the other hand, as it will be seen in Section 6.6, for the overwelming majority of the companies of the sample the investment to other companies was made after 1968.

Having solved the cut-off date and the index number problems, the next sub-section is devoted to the restatement of fixed assets.

6.3. Restatement of Fixed Assets and Depreciation

The fixed asset items are non-monetary items and as defined here they include the following categories, which appear separately in the Greek balance sheet statement:

1. Land
2. Buildings and building installations
3. Machinery and machinery installations
4. Furniture and Fixtures
5. Means of transportation
6. Deferred charges
7. Tools and instruments[5]
8. Advances for fixed assets

The title of each category of fixed assets above is indicative of its content. Only with respect to the "deferred charges" category it should be mentioned that

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5. According to the Greek law tools and instruments must be fully depreciated in one accounting period. However, the majority of the companies depreciated them in more than one accounting periods. Hence, they are included in the fixed assets category.

in addition to the expenses which concern many accounting periods (such as developmental and pre-operating costs) and hence correctly are included in this category, some other expenses, which should be charged to the Profit and Loss account rather than to the "deferred charges" category, are also included here. The most important of these expenses is the interest on long term loans as well as any other expenses related to these loans, expenditure concerning the insurance of personnel and so on. Since the Greek law (ie article 7.L 4171/61) permits the amortization of these expenses in more than one accounting period and since the aim of this research is to restate Greek accounts, these expenses are also treated as deferred charges for restatement purposes.

A second point concerns the content of "machinery". The majority of machinery is purchased from abroad in foreign currency. Part of the acquisition cost of machinery is usually payable in long term loans. According to Greek law any foreign currency gains/losses resulting from the fluctuation of the exchange rate of the Greek currency should either be charged against the income of the period or against the initial cost of machinery. Either treatment should be followed constantly.

Usually the quoted Greek companies follow the second of the two treatments mentioned above. Hence, in the "machinery" account foreign currency losses are included as well. Though he disagrees with that treatment, the researcher treated these losses as acquisition cost of

machinery as well and restated them accordingly. He did it not only because he restates Greek accounts, but also because in some cases he could not identify these losses.

With the exception of six companies there are no analytical data regarding the magnitude of foreign currency losses[6] which, being charged to initial cost of fixed assets, were subject to annual depreciation. The information for the six companies, which is presented in

Table 5.1

Foreign Currency Losses Charged to Fixed Assets
(Amounts in thousand drachmas)

Comp		1976	1977	1978	1979	1980	1981
01	Amount	7,559	3,222	--	5,493	400	--
	% of Net FA	5,0	2,0	--	3,7	0,3	--
02	Amount	2,352	1,010	NA	NA	NA	NA
	% of Net FA	2,1	0,7	--	--	--	--
22	Amount	NA	NA	NA	NA	NA	12,399
	% of Net FA	--	--	--	--	--	1,0
27	Amount	19,833	NA	NA	NA	NA	NA
	% of Net FA	10,0	--	--	--	--	--
29	Amount	NA	883	422	1,228	3,227	NA
	% of Net FA	--	1,6	0,8	3,3	5,1	--
31	Amount	185,424	88,936	347,500	243,337	191,316	135,150
	% of Net FA	4,6	2,1	7,6	5,0	3,4	2,1

6. Since the Greek currency is not strong, foreign currency gains from notes (or loans) payable for the purchase of machinery are rare. For the companies of the sample, such gains were so rare and so small in magnitude as to be negligible. Nevertheless these gains were taken into account. That is, the initial cost of machinery was reduced in the year in which these gains occured, as if part of machinery was sold.

table 6.1, was obtained by the companies themselves, or from the finacial statements and the accompanied Auditor's Report, or from the Annual Reports to Shareholders.

As can be seen from table 6.1, the foreign currency losses charged to cost rather than to P and L statement are rather immaterial (i.e. less than 5% on the average. If this is the case with the other companies of the sample of the study regarding magnitude of foreign currency losses charged to machinery (or to other fixed assets items), then the effect on earnings from that peculiar treatment should not be material and the generalisability of the results of the study beyond the Greek case should not be affected basically. The same applies with respect to the other Greek peculiarity (ie treatment of income items as deferred charges) since for company no 8, which is the most representative firm of such a treatment, the "deferred charges" category constitutes about 3.8% and 3.9% of total gross fixed assets but only for the years 1980 and 1981.

The only industry for which the "deferred charges" category may constitute more than 5% of total gross fixed assets is the cement industry. Thus, for the first of the four cement companies included in the sample of the study these charges constitute about 14% of total gross fixed assets on the average during the period under examination. For the second cement company they constitute about 9% and for the remaining companies less than 9%. However, it should be mentioned that, as it is

written in the Annual Reports of the cement companies, these high percentages are due to the fact that foreign currency losses resulted from long-term notes payable are also included in this category instead of being charged to "machinery" or to the P and L statement.

The general price level adjustment process for fixed assets and related depreciation was the most time consuming of all adjustments performed. This is especially true with respect to the detailed restatement of the first sub-sample of the study.

Specifically, in order to restate the fixed assets of the sample, the detailed data had to be written down on a daily basis as mentioned. Then the daily data had to be converted into monthly data since the restatment was made on a monthly basis.

To facilitate the punching process of the data the different sub-categories[7] of the same basic category had to be merged and presented as one category. Hence, summations had to be made so that for each month of each one of the years 1959 to 1981 one unique figure of gross value, accumulated depreciation of 1976 to 1981 and depreciation expense of 1976 to 1981 would correspond. Eight files were prepared for the eight companies, whose average size was 400.5 records of 90 characters each. The data punched had to be checked for punching mistakes and then the programmes for the restatement of the data

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7, Some times even five sub-categories were shown separately in the accounting books of a firm, such as machinery of factory A, B, C, ,, or machinery of law Y, Z, W,,, in accordance to the incentives for investment in permanent capital given by different laws in different years.

on a monthly as well as annual (for validation purposes) basis of restatement had to be made.

The fixed assets restatement of the second sub-sample of the study (i.e. companies 09 to 14) was made on an actual annual basis. This restatement was less time consuming than the restatement of the first sub-sample due to the small volume of the data involved. In contrast, the restatement of the remaining companies in the total sample of the study, which was made by aid of DYT, was almost as time consuming as it was the restatement of the first sub-sample.

To ensure accuracy and save time the adjustment under DYT was made through the computer, as it is the case with the adjustment of the first and second sub-samples. These computer programs were designed with the unique purpose to meet the needs of the study. Because of it they are not sophisticated enough to be used by other researchers in other studies. Hence, they are not included in the study.

With respect to the formulas used for making the adjustment, they were based on the general formula of restatement which is:

$$\frac{\text{CPI at the end of the year of restatement}}{\text{CPI at the age of the account}}$$

Thus, the conversion factors used for the restatement on a monthly and annual bases are the following:

$$\frac{\text{CPI at the end of the year of restatement}}{\text{CPI at the month of acquisition of fixed assets}}$$

and

$$\frac{\text{CPI at the end of the year of restatement}}{\text{CPI at midyear of acquisition of fixed assets}}$$

The GPPA gains/losses of retirements were computed on the basis of their selling price and their dates of acquisition and transaction obtained from the companies of the 1st and 2nd sub-samples. For the retirements of the remaining companies of the sample as well as for the retirements of the 1st and 2nd sub-samples for which exact date of disposal or selling price could not be obtained assumptions had to be made.

To be more specific, if the month of disposal was missing, it was assumed that the retirements occured in mid year. If the sales figure was missing the assumption regarding retired land and buildings was that their selling price was equal to their historical cost adjusted for inflation. For the retirements of all other fixed assets the assumption was made that the selling price of the retired items was equal to their net book value.

The missing information regarding retirements should not have a material effect on restated earnings. Tables 6.2 and 6.3, which present retirements of fixed assets (and investment) for which month of acquisition and selling price are missing, show that not many items of significant acquisisiton cost were retired during the period under examination. Additionally, these items were very old and hence their missing selling price should

not be big enough to have a material effect on restated earnings.

From what has been said so far about the restatement of fixed assets it follows that their restatement was time consuming but it did not pose difficult problems. The only exception concerns the restatement of buildings and especially the restatement of advances for fixed assets. The restatement of these assets is discussed in the following sub-sections.

6.4. Restatement of Land and Buildings in Particular

In certain time intervals the Greek government issues legislative decrees or laws by which all companies in the form of Société Anonyme or Limited Liability Co. (as well as certain other companies) have the option or they are obliged to revalue their land, buildings and building installations. The revaluation is made either by special valuers or by use of conversion factors specified in the law.

In the period under examination (ie 1976-1981) the most recent revaluation of the mentioned assets took place in 1977 in accordance with the Law 542/77. That revaluation was compulsory and was made by use of conversion factors specified in Law 542/77. These conversion factors were different for land and buildings and were functions of the period during which the assets had been acquired (see Table 6.4). For land and buildings

T a b l e 6.2
Retirements for Which Month of Transaction and Selling Price Are Missing
1st Sub-Sample

Company No	F. Assets Category	Acquisition Date	Transaction Date	Acquisition Cost	Accumulated Depreciation	Net Book Value
02	Installat.	01-78	? -78	62,614	0	62,614
03	Machinery	02-72	11-77	7,000	0	7,000
03	Machinery	01-59	? -79	6,012,390	6,012,390	0
03	Machinery	01-59	? -80	4,937,423	4,937,423	0
03	Machinery	01-59	? -80	1,754,542	1,754,542	0
03	Machinery	10-69	? -80	91,670	91,670	0
03	Machinery	10-70	? -80	321,865	321,865	0
03	Machinery	09-80	? -81	1,447,279	0	1,447,279
03	Cars	10-70	? -79	170,818	170,818	0
03	Investment	01-59	? -78	120,000	NA	120,000
03	Investment	10-60	? -78	371,712	NA	371,712
06	Land	14-72	? -81	1,863,500	NA	1,863,500
06	Machinery	04-80	? -81	63,645	5,289	58,356
06	Machinery	01-59	? -77	70,086	70,086	0
06	Machinery	01-59	? -80	121,119	121,119	0
06	Machinery	08-71	? -81	99,767	99,767	0
06	Machinery	02-74	? -81	50,178	50,178	0
06	Machinery	06-80	? -81	207,872	12,711	195,161
06	Machinery	07-78	? -79	436,743	42,059	394,684
06	Cars	01-59	? -77	34,991	34,991	0
06	Cars	09-72	? -81	182,636	182,636	0
06	Furniture	02-73	? -79	15,000	15,000	0
06	Furniture	10-71	? -79	23,715	23,715	0
06	Furniture	10-60	? -80	3,044	3,044	0
08	Machinery	11-78	14-81	1,146,731	1,146,731	0
08	Machinery	10-67	14-81	550,000	550,000	0

T a b l e 5,3

Retirements for Which Selling Price is Missing
2nd Sub-Sample

Company No	F. Assets Category	Acquisition Date	Transaction Date	Acquisition Cost	Accumulated Depreciation	Net Book Value
10	Furniture	13-69	13-77	77,710	77,710	0
11	Cars	13-71	13-79	91,377	91,377	0
11	Cars	13-76	13-79	540,940	132,390	408,550
11	Cars	13-76	13-80	194,560	200	194,360
11	Cars	13-70	13-80	74,063	74,063	0
12	Machinery	13-72	13-77	586,500	384,160	202,340
12	Cars	13-74	13-77	666,580	196,974	469,606
13	Machinery	13-55	13-79	137,509	137,509	0
13	Cars	13-69	13-77	60,000	50,400	9,600
13	Cars	13-69	13-78	57,450	57,450	0
14	Machinery	13-69	13-77	3,066,925	3,066,925	0
14	Machinery	13-76	13-77	10,137,600	128,748	10,008,852
14	Machinery	13-75	13-79	3,635,200	42,572	3,592,628
14	Machinery	13-69	13-79	40,628	40,628	0
14	Cars	13-64	13-78	166,500	166,500	0
14	Cars	13-72	13-78	192,426	116,449	0
14	Cars	13-78	13-79	575,500	0	575,500

acquired after 31 December 1974, no revaluation was required, the implicit assumption being that their book values approximated their current values.

The net surplus value generated from the revaluation of the aforementioned assets, that is the net value

T a b l e 6,4

Conversion Factors for Restating Land and Buildings

Acquisition Date	Law 542/77 - Conversion Factor for		Conversion Factors based on the CPI*
	(a) Land	(b) Bldgs	
Up to 31,12,61	5,00	3,00	NA
1,1,62-31,12,65	4,50	2,75	2,51
1,1,66-31,12,69	3,50	2,25	2,27
1,1,70-31,12,72	2,80	1,90	2,08
1,1,73-31,12,73	1,90	1,45	1,73
1,1,74-31,12,74	1,24	1,12	1,36

* Formula used; CPI at 31,12,76/CPI at average acquis, date,

obtained after the deductions of some allowances[8] made by the mentioned law, was capitalised and taxed. The tax rate imposed was 10% on the net surplus value of land and 20% on the net surplus value of buildings (and building installations). Because of the capitalisation of the net surplus value, new shares were offered free to shareholders in proportion to the shares held by them at that time.

In the balance sheet statements as of 31 December 1976[9] the assets of the companies which revalued land and buildings in accordance with L.542/77 had to be shown at their restated values (ie restated gross value and accumulated depreciation). However, the depreciation of 1976 of those assets had to be shown in the Profit and Loss account at historical cost in order for the business results of that period not to be changed. From 1977 and onwards the annual rate of depreciation was applied to the restated gross value of the asset.

Those companies which had already revalued their assets in accordance with the Enforcing Law 148/67 or in accordance with the legislative decrees 1229/72 and 1314/72[10], had the option not to revalue those assets again, provided that the then restated values were bigger

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8. For example, any loss existing at that time was deducted from the surplus value.
9. It should be noted here that according to the Companies Act 2190/1920 the companies may prepare and publish their financial statements within six months after the end of the accounting period.
10. Basically these two legislative decrees are modification to the E.L. 148/67.

than those which could be obtained by way of L 542/77[1]. Thus, two companies of the sample (i.e. companies No 3 and 24) did not revalue the mentioned assets again (i.e. revaluation by way of E.L 148/67), while another eight companies did not revalue their land again (i.e. revaluation of land by way of E.L 148/67 or L.D 1314/72). The remaining companies of the sample revalued their land and/or buildings in accordance with L 542/77.

The revaluation of land and buildings posed two serious problem for the restatement of these assets.

The first of these problems stemmed from the fact that each of the conversion factors applied for revaluing land and buildings in accordance with L 542/77 covered several years usually. Hence, in order to revalue these assets the companies had to group them in accordance to the period of years specified in L 542/77. As a result, detailed acquisition costs and dates had been lost. Lost also were the individual dates and acquisition costs of land and buidlings of those companies which had revalued these assets in accordance with E.L 148/67 (or L.D 1314/72). Hence, the first problem was common to all companies of the sample.

For restatement purposes in order to overcome this problem the date 31 December 1976 was necessarily assigned as the date of acquisition for the assets

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11. It should be noted here that the revaluation of land and buildings in accordance to E.L. 148/62 or L.D 1227/72 and L.D 1314/72 was not compulsory and the revaluation was made not by aid of specified conversion factor but by aid of special valuers. (Valuation Committee of article 9, Companies Act 2190/1920 as modified by Decree 174/1963. Therefore, the then restated values could be bigger than those obtained by way of L 542/77.

revalued in accordance to L 542/77. The revalued cost of land and buildings were taken as their acquisition costs. As a result, historical and restated assets of land and buildings acquired before 31/12/1974 were the same in the year 1976. By the same token for land revalued in accordance to E.L 148/67 or L.D 1314/72 the specific date at which the revaluation took place was assigned as date of acquisition and the new value generated was considered to be the acquisition cost of land.

Since the revaluation of land and buildings in certain time intervals is a practice in Greece, and given that the researcher restates **Greek** accounts it could be argued that the lack of use of detailed historical cost information for restating land and buildings should not be considered as a weakness of the study as regards impact of GPPA on Greek accounts. However, it should be admitted that the mentioned way of restating land and buildings surely restricts somewhat the generalisability of the results of the study beyond the Greek case.

In order for the reader to get an idea of how seriously the generalisability of the results of the study beyond the Greek case is affected by the mentioned treatment as regards restatement or land and buildings, it should be mentioned that in 1976, the only year in which historical and restated depreciation was exactly the same, the average participation of buildings of the first sub-sample of the study in the total depreciation of fixed assets was 15.8%.

The second problem posed by the revaluation of land

and buildings was present only in 1976 and it concerned the determination of additions of 1976 and related depreciation of the mentioned assets for those companies for which DYT was used. The problem stemmed from the fact that while gross value of buildings and related accumulated depreciation were shown at restated values in the balance sheet as of 31/12/76, gross value and accumulated depreciation of 1975 were shown at historical values. Because of it neither additions of land and buildings nor related depreciation could be obtained.

Therefore, out of necessity the additions of 1976, if any, were included in the revalued values of buildings and land to which the date of revaluation was assigned as their date of acquisition (i.e. 31/12/1976), for restatement purposes. As for the related depreciation of 1976 it was obtained in the following way:

The researcher computed by aid of DYT the depreciation of 1976 for fixed assets other than buildings and he summed it. The difference between total depreciation of 1976, given in the income statement, and estimated (by DYT) depreciation of fixed assets other than buildings was necessarily taken as the 1976 historical depreciation of buildings. Provided that no retirements of fixed assets other than buildings occured in 1976 the so obtained depreciation of buildings was equal to the actual one.

In the case in which retirements of fixed assets categories other than buildings occured in 1976, then the depreciation of 1976 for buildings was taken as the

simple average depreciation of buildings of the years 1974 and 1975, provided that the so obtained figure was not materially different form the depreciation which could be obtained by applying the depreciation rate for buildings to the total gross value of buildings in 1975 (i.e. it should be noted here that in a given year a Greek firm in the form of société anonyme may apply additional depreciation). Otherwise, the 1976 depreciation of fixed assets other than buildings was taken as the simple average of their 1975 and 1977 depreciation. The difference between the so obtained (estimated) depreciation and the total depreciation of 1976, given in the income statement, constituted the depreciation of buildings for 1976.

By so determining the 1976 depreciation of buildings in cases of retirements any extra depreciation which was wrongly assigned to buildings instead of being assigned to fixed assets other than buildings (whose depreciation was restated on the basis of historical dates of acquisition) was minimized. Hence, in this respect any understatement of restated depreciation of 1976 should not be material.

The aforementioned problems which were imposed by the revaluation of land and buildings were not as difficult and time consuming as they were the problems posed by the restatement of the "advances for fixed assets", which usually appear in the balance sheet statements of the Greek companies during the period under examination. These problems are discussed in the next sub-section.

6.5. Restatement of Advances for Fixed Assets and of Fixed Assets not Recorded in the Proper Time

Most of the companies for which monthly data of fixed assets have been obtained had in their balance sheet statements advances for fixed assets. These advances referred to buildings (ie construction in progress) and/or to machinery and they were transferred to their proper account upon completion of the transaction (or the service). Hence, in the property records these advances had taken as dates of acquisition the dates of their completion rather than the dates of capital expenditures.

However, fixed assets aging based on date of transfer understates actual asset aging based on date of capital expenditures. This understatement may be material if the amounts of the advances are large enough and they take two or more years (ie construction in progress) to be transferred to their proper account (ie buildings), as is the case with some of the companies of the sample of the study. Hence, the researcher decided to age these advances on the basis of their date of capital expenditures rather than on their date of transfer.

The adoption of the above policy however, posed three problems. First, the dates of capital expenditures had to be identified. Second, since these advances were shown in the property records of the companies as additions of the year of transfer along with the actual additions of the year, in order to not restate them twice

the amounts of these advances should be subtracted from the additions of the year and be assigned their date of capital expenditure. Thirdly, that part of the depreciation of the additions of the year which was related to these advances should be separated and be assigned the earlier date of capital expenditures as well for restatement purposes.

The solution to the third problem was closely related to the solution of the first two problems (i.e. identification of dates and corresponding amounts of capital expenditures (i.e. advances). For if the amounts (and dates) of the advances were known, then their related depreciation could be determined by multiplying the depreciation of the additions of the year (inclusive the advances) by the factor: advances / actual additions of the year.

However, finding dates and amounts of capital expenditures was a very difficult task. This was so because in the year 1982 the researcher asked for dates and amounts of capital expenditures which had occured as many years back as up to 1973 (in the case of construction in progress).

Fortunately, for the majority of cases (especially for advances of large amounts) the researcher managed to get the information needed. In the cases where for some of these advances it was impossible to get the needed information he asked for information regarding the average time period during which the advances occured, as

well as the average time period in which they were transferred to their proper account.

The first piece of this information was used as acquisition date of the advances. The second piece of information was utilised in identifying those additions of the year from which the advances should be subtracted and be assigned the earlier dates of capital expenditures.

Having identified the advances included in the additions of the year of transfer, the identification of the depreciation of the year related to these advances was not a difficult task, as mentioned. However, it was a task which consumed much time since for each one of the advances of 1973 to 1975 which were transferred to their proper account in 1976, the depreciation expense of each one of the years 1976 to 1981 had to be computed. For each one of the advances of 1976 which had been transferred to their proper account in 1977 or later the related depreciation of each one of the years 1977 to 1981 had to be computed, and so one. The computation was made in proportion to the gross value of the individual advances, as mentioned.

In order for the reader to get a concrete idea of the problems posed in assigning dates of capital expenditures to the advances of fixed assets and to see how exactly the researcher overcame these problems the procedures undertaken in the case of company no 2, for which very detailed information about advances were missing, are outlined in the following paragraphs.

In the balance sheet statements of company no 2 the advances for fixed assets were shown separately as "Construction in Progress" and as "Advances for Machinery". The advances for buildings (ie construction in progress) are the following:

Construction in Progress

Before	1974:	NA
Year	1974:	210,000 drs
Year	1975:	703,407 drs
Year	1976:	2,494,709 drs
Year	1977:	8,140,076 drs
Year	1978-81:	NA

Their dates of capital expenditures and related amounts are the following:

Date		Amounts
1/1-31/12/74	(or 13/74)*	210,000 drs
1/1-31/12/75	(or 13/75)	493,407 drs
Advances in the balance sheet as of 31/12/75		703,407 drs
	13/74	210,000
	13/75	493,407
	07/76	127,352
	09/75#	21,150
1/1-31/12/76	or 13/76	1,642,800
Advances in the balance sheet as of 31/12/76		2,494,709
	07/76	127,352
	09/75	21,150
	03/77	1,157,186
	04/77	45,834
	05/77	23,204
	06/77	116,351
	11/77	113,514
	12/77	421,266
1/1-31/12/77	or 13/77	6,114,219
Advances in the balance sheet as of 31/12/77		8,140,076

* The assumption was made that the advances occured evenly from January to December of each year, 13 stands for mindyear.
# Obviously this amount was not included in the advances of 1975 due to ommission.

From the above capital expenditures, the amounts of 703,407 drs and 1,642,800 drs were transferred to their proper account in 1977 and they were recorded along with other capital expenditures of 1977 of 2,547,015 drs as a total amount of 4,983,222 drs at 31/12/77. From the year 1978 and thereafter the depreciation expense started being calculated by the company for the total amount of 4,893,222 drs. Therefore, the researcher had to allocate the depreciation expense of each one of the years 1978 to 1980[12] proportionately to the individual amounts of 210,000 drs, 493,407 drs, 1,642,800 drs and 2,547,015 drs because to each one of them a different date corresponded.

The remaining capital expenditures which constituted the advances of 1977 were transferred to "buildings" in 1978 and from that year the depreciation expense started being calculated. Again, the researcher nad to allocate the depreciation expense of each one of the years 1978-1980 to the nine individual items which constituted the advances of 1977.

The advances for machinery (purchased from abroad) as appeared in the balance sheet statements of the years 1973[13] to 1980 were the following:

12, For companies no 2 and 4 the period under examination was restricted to the years 1976 to 1980.

13, 1973 is the year of merge. In that year the valuation of assets of the companies merged took place.

1973:	965,594 drs	1977:	227,089 drs
1974:	721,017 drs	1978:	811,933 drs
1975:	147,355 drs	1979:	1,441 drs
1976:	3,667,773 drs	1980:	258,599 drs

Unfortunately, it was impossible for the researcher to get exact dates of capital expenditures for the above advances because the company like any Greek company, did not hold records regarding date of capital expenditures for machinery. However, the information was given that these advances usually occurred during the second half of each year and they were transferred and recorded as machinery during the first half of the following year in which the transaction was completed.

The researcher decided to assign new dates of capital expenditures to the advances of machinery as well (though in a rather arbitrary way) within the framework of the information given by the companies regarding time periods of occurence and transfer of these advances. The underlying reasoning for that decison was that the restatement bias due to the rather arbitrary way of assignment of the new dates would be less than that which would have been resulted if the restatement of machinery had been made on the basis of their date of completion of the transaction.

Therefore, and in order for the advances to be separated from the actual additons of the year and to take new acquisition dates, the researcher arbitrarily picked-up an item (or items) of amount(s) larger than the

amount of advances of the year under consideration and broke it down into two components. The first component (or the summation of the first component in the case where more than one amount of machinery had to be broken down) was equal to the amount of the advances of the year and was assigned October[14] of the year which proceeded the year of recording. The second component kept its old date (ie date of completion of the transaction).

Care was exercised so that the items chosen to be broken down to come evenly from dates close to the middle of the first half of the year of recording. To bring an example, the advances of 1978 were arranged in the following way:

Book Date	Item Picked-up	Breaking Down	New Dates Assigned	
		441,340	10/78	441,340
20/2/79	648,336	206,996		
		370,593	10/78	370,593
08/5/79	544,408	173,815		
		Advances of 1978:		*811,933*

Needless to say that in the case where an item had to be broken down into two (or more) components in order for the one of them to be assigned a new date, the depreciation expense related to that item was also broken down into two components. The breaking down was made in

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14. October was chosen instead of the middle of the second half of the year because according to the chief accountant of the company, October serves better as an average date than the middle of the second half of the year.

proportion to the gross value of each one of the two (or more) components.

The advances of fixed assets appearing in the balance sheet statement of the companies for which no detailed fixed assets data or only annual fixed assets data have been obtained were also assigned the middle of the year of capital expenditures as their date of acquisition, the assumption being that these advances occured evenly within a year. In the case of advances concerning construction in progress, in order to separate the advances made in the year under consideration from those actually made in previous years the procedure described in Section 5.3.3 (i.e. incorporating of the advances of the year into the additions of the year) was employed.

The advances for fixed assets resemble the fixed assets items not recorded in the proper time in that both were recorded in a time period which was different from their actual time period of purchase. The recording of items at a wrong time was noticed for the first time by the researcher while he was writing down the fixed assets of the company no 2 and concerned a few items for which the date written on the invoices was different from the date at which these items had been recorded.

Of course, for restatement purposes the researcher assigned as date of acquisition of the items mentioned above the date written on the invoices. This, however, created a problem in the case in which the year written in the invoice differed from the year of recording of the

items. That is, fixed assets which should appear in the balance sheet statement of a given year was shown in the balance sheet of the next year in which the fixed assets had been recorded wrongly[15]. Hence, there was no agreement between fixed assets of the published balance sheets and fixed assets as recorded by the researcher.

The wrong recording noticed in company no 2 was present, but to a much lesser extent to other companies of the sample as well. This, however, in no way should undermine the reliability of the records of the companies of the sample in the eyes of the reader since these mistakes were human mistakes, small in frequency and magnitude. This can be inferred from Table 6.5 which is given below and is referring to the most serious wrong recordings made by company no 2.

T a b l e 6.5

Fixed Asset Items Not Recorded in the Proper Time

Proper Year of Recording	Amounts	Wrong Year of Recording	% of Total Fixed Assets*
1976	2,560,988 drs \	1977 \	
1976	602,356 drs /	1978 /	2.8
1977	3,849,841 drs	1978	2.8
1978	1,289,225 drs	1979	0.9

* Of the proper year of recording.

15. This usually happened for items bought in December of a given year.

6.6. Restatement of Investment

This is a non-monetary account which is usually shown in fixed assets. It concerns stock held permanently.

For restatement purposes a distinction must be made between quoted and unquoted shares held by companies. This is because according to the Greek law the unquoted shares must be shown in the balance sheet statement at acquisition cost (and hence they need restatement). The quoted shares must be shown at LCM, where as market value is taken their average market value of the second fortnight of December. Hence. the quoted shares need restatement only when acquisition cost is lower than market value.

For the majority of the companies of the sample of the study the valuation of investment was made at acquisition cost according to what was written in the Auditor's Report, or in the Annual Report, or even in the balance sheet statement per se. Yet in several cases in the Annual Reports of the companies for which no detailed data have been gathered it was written that the valuation of investment was made by way of the LCM rule without specifying, however, which one, acquisition cost or market value, was the lower.

In the few cases in which neither from the Auditor's Report nor from the balance sheet statements could be inferred the exact way of valuation, the researcher decided to leave such investment as it was in both the

historical and the adjusted balance sheet statements. He did it in order to avoid double restatement of investment, and hence overstatement of restated total assets (on the basis of which ROI was computed) in the case in which the valuation had been made at market value actually.

In all other cases in which the valuation of investment was made at acquisition cost its restatement was made in the following way.

The restatement of investment of the first sub-sample was made on a detailed (monthly) basis except for companies No 2 and 4 whose restatement was made on an annual basis because the actual month of acquisition was missing. The restatement of the second sub-sample was made on an actual annual basis too. As for the restatement of investment of the remaining companies of the sample of the study it was made on an estimated annual basis. The estimated annual additions were obtained in exactly the same way in which DYT computed the annual additions of fixed assets, the assumption being that there were no retirements when the difference (d_t^*) between gross value of inestment of two adjacent balance sheet statements was positive.

Two dificiencies are associated with the mentioned way in which additions and related age of investment of the remaining companies of the sample were obtained. Firstly, in case of retirements not the actual additions and retirements of the year but rather the positive (negative) difference between them was necessarily taken

as additions (retirements) of the year. Secondly, the balance sheet statements gathered by the researcher go as far back as in 1964, in some cases, or in 1968 for all other cases. Hence, for investment appearing in the 1964 or 1968 balance sheet statements 1964 or 1968 was necessarily assigned as its date of acquisition though in fact its actual date might go far back than 1964 or 1968.

Fortunately, the consequences of these dificiencies on restated investment seem to be negligible. This is so for three reasons:

First, and assuming that the FIFO flow of retirements adopted in this study holds true, only 3 companies out of the 30 firms of the sample had investment to which an age (date) different from its actual age might have been assigned by the researcher. Additionally, and more importantly, the magnitude of the investment of these 3 companies was small. This is shown below

Company	Earliest Balance Sheet	Acquisition Cost
No 18	1964	40,000 drs
No 19	1965	275,000 drs
No 29	1965	2,757,000 drs

Second, the increase in the inflation rate during the period 1959-1968 was almost negligible (see table 4.1). Hence, it almost makes no difference if investment acquired, say, in 1959 was assigned 1964 or even 1968 as its date of acquisition.

Third, supposing that the retirements of the first

and second sub-samples of the study (see table 6.6) are representative as regards frequency and magnitude of retirements of investment, then the retirements of investment of the remaining companies of the sample should not be significant enough to have an effect on restated investment, and consequently on restated total assets.

Table 6.6

Retirements of Investment of the 1st and 2nd Sub-Samples

Company	Acq. Date	Trans. Date	Acq. Cost	Selling Price
03	01-1959	13-1978	120,000 drs	?
03	13-1960	13-1978	371,712 drs	?
07	13-1972	13-1977	700 drs	?
13	13-1971	13-1977	86,000 drs	?
14	13-1968	13-1977	951,000 drs	?

Information regarding selling prices of retirements were missing for all companies of the sample. Hence, the assumption was necessarily employed that the selling price of retirements was equal to their acquisition cost. This assumption should not have any significant effect on the overall restated earnings for the reasons already mentioned.

In ending, it should be mentioned as well that while restating investment care was exercised not to adjust that part of investment given free to shareholders as a result of the capitalization of land and buildings already mentioned. This was so because that investment does not constitute additional investment in a real

sense. Rather it reflects partial revaluation of the historical investment held by the companies.

6.7. Restatement of Special Assessment Tax of L 257/76

In 1976, in order to meet the need for increased defence expenditures, the Greek government imposed by way of law (ie L 257/76) a special assessment tax on certain companies (as well as individuals). Specifically, these companies which had either borrowings in excess of a specified amount during the period 30.11.74 to 31.10.75, or they had earned income in excess of a specified amount during the accounting period 1.1.74 to 31.12.74 or 1.7.74 to 30.6.75 were subject to that tax.

The tax imposed had to be paid either by the companies themselves in 1976 or by the financial institutions on behalf of the companies. In the last case, which was the usual one, the companies had to pay the loan made plus the interest within five years.

For tax purposes the companies were allowed to treat the tax payment as a prepaid expense and amortize it either within one accounting period or in more than one accounting periods in the case in which the payment had been made by the companies themselves. If the payment had been made by the financial institutions then the amortization in each accounting period should be equal to the installment paid (ie part of the loan plus interest) by the companies to the financial institutions.

Therefore, in the period under examination (ie 1976-1981) in the balance sheets of the companies this special tax is shown usually both as a deferred charge in the fixed assets category under the name "special assessment tax - L 257.76", and as a liability under the name "loan for special assessment tax - L 257/76".

Since the researcher restates Greek accounts, it could be argued that for restatement purposes he should treat this special assessment tax account in the way the Greek companies treated it, as he did in the case of foreign currency gains/losses charged to fixed assets. However, he decided not to restate this account and its related amortization but leave it as it is in both the HCA and the GPPA balance sheet statement for the following basic reasons:

As mentioned in Chapter 1, pursuit of the main purpose of the study entails answering such important questions for micro- and macro-decision making as the question of whether the real (as opposed to nominal) tax rate imposed on the Greek companies in times of inflation is large enough to justify the demand on behalf of the Greek businessmen for tax relief. Since the special assessment tax of L 257/76 is not a deferred charge (or even an expense) in a real accounting sense. Since the practice in Greece is to consider such taxes as expenses of the accounting period in which they are paid rather than as deferred charges (ie special assessment tax of L 816/78). Since it is rather doubtful whether such taxes would be considered as deferred charges, if GPPA rather

than HCA was practised by the Greek Companies. For these reasons and taking into account as well that for some companies of the sample of the study the magnitude of this tax is material (ie for company no 3 it constituted 13.3% of total net fixed assets in 1976) this special assessment tax should not affect through its restatement as deferred charge the restated earnings of the period 1976-1981 and hence the results of the study. Neither should it affect the restated fixed assets.

The corresponding liability account mentioned was not restated as well. The reason for this is that the interest paid for the loan was included in the special assessment tax account which was not restated. Since the interest charges against loans generally compensate up to a certain extent for the monetary losses suffered by lenders in times of inflation, it would be an inconsistency to compute monetary gains for the debtor when the interest charges of the same loan were not restated.

6.8. Restatements of the Accounts Shareholders - L 542/77 and Tax Payable - L 542/77

As mentioned in Section 6.4 the surplus value generated from the revaluation of land and buildings in accordance with L 542/77 was capitalized and taxed. The tax imposed had to be paid by the companies in 20 equal quarterly installments. The companies, in turn, claimed the tax imposed on them from their shareholders who had to pay the money in ten equal annnual installments. For that purpose the companies were entitled to withhold the

amount due each year from the dividends of the year declared[16].

Therefore two accounts, one claim and one liability are shown in the balance sheets of the period under examination. The claim is usually shown in the fixed assets category under the name "shareholders - L542/77". The liability is shown as a long term liability under the name "tax payable - L 542/77".

Since the revaluation of land, buildings and building installations and the capitalization of the surplus value generated has become a practice in Greece[17] and since the researcher restates Greek accounts he decided to treat the somewhat peculiar claim as well as the corresponding liabiltiy as monetary items. Hence, monetary gains/losses were computed in the way to be mentioned in Section 6.14.

It could be argued that the computation of monetary losses from the somewhat peculiar claim mentioned restricts the generalisability of the results of the study beyond the Greek case. This should not be so, however, because the peculiar claim and the corresponding liability tend to offset each other.

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16. The dividends in Greece are paid in July and August of each year. That is, one to three months after the preparation of the balance sheet statement of the accounting period ended at 31 December. If in a given year no dividends were declared due to losses, two installmenst had to be witheld from the dividends of the next year.

17. See E.L. 148/67 as modified by D 1314/72, L 542/77, and L 1249/82.

6.9. Restatement of Marketable Securities

The drachma size of this account, which is shown in the circulated assets, expressed as a percentage of circulated assets except inventory, is small. Mainly this is due to the low profitability of the Greek companies, on the one hand, as well as due to the underdeveloped stage of the Athens Stock Exchange, on the other.

The account includes usually quoted shares, bonds, and bank bonds. The distinction of the three types of securities is crucial for restatement purposes. This is because, while the quoted shares are non-monetary items undoubtedly, bonds may be classified either as monetary or as non-monetary items depending on the purpose for which they are held.

In this study the position has been taken that bonds constitute temporal investment made primarily for their fixed income characteristic rather than for prices speculation. Hence, they have been classified as monetary items. This position seems to be very reasonable if one takes into account what has been written about the Greek capital market in Section 3.4.2. By the same token, bank bonds were classified as monetary items too[18].

For bonds, being classified as monetary items, monetary losses were calculated in the way to be

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18. Bank bonds in Greece seem to be the most attractive bonds as regards fixed income to be earned.

mentioned in Section 6.14. In the few cases, however, in which the bonds were shown at current values no computation of monetary gains/losses was perfomred. This is because acquisition cost was not known so that for the researcher to compute monetary gains/losses as the difference between adjusted acquisition cost of bonds and current value of them[19].

As regards the bank bonds, though they have been classified as monetary items no computation of monetary losses was performed. They were left untouched in both the historical and the adjusted statement. The reason for this is that they were shown in the balance sheet statement not at acquisition cost but rather at the value to be levied upon their maturity (ie the interest to be earned was included).

With respect to the restatement of (quoted) shares, if their valuation was made at acquisition cost they were restated on a qua annual basis. That is, the additions of the year were taken as the difference between acquisition cost of two consecutive years. Then they were adjusted for half year of general price changes. If their valuation was made at current values then no restatement was performed; no restatement was performed as well to the related gains/losses charged to the income statement.

19, Of course, in the cases in which bonds were shown at current values, gains/losses had been calculated and charged against the income statement. These gains/lossed could not be identified so that for them not to be restated. However, this should have no serious consequences on actual restated earnings not only because these cases were very few but also because marketable securities and especially bonds held by companies were immaterial.

6.10. Restatement of Prepaid Expenses

The prepaid expenses, such as prepaid insurance, advertisement, rent, stationery, are non-monetary items since they represent an expenditure for an amount of services to be received over a specified period of time in the future. To restate them the assumption was employed that the balance in this account at any year end was acquired iniformly throughout that year. Hence, mid-year was assigned as their average date of acquisition and accordingly the general formula for GPPA restatement was applied (ie Account x (CPI at year end/CPI at date of acquisition)).

The assumption employed above is based on the information given to the researcher by the chief accountants of the companies as regards occurence and amortization of prepaid expenses generally. Hence, this assumption should be reasonable.

Since the prepaid expenses enter the income statement upon amortization, for their adjustment as income items it was assumed that the balance of the prepaid expenses account was charged to expense uniformly throughout the immediately following year. Hence, the average CPI of the year prior to the year of assumed amortization in relation to the CPI of the end of the year (of assumed amortization) was used as their conversion factor for restatement (eg CPI 31/12/t / CPI mid-year t-1)

In order for the amortization of prepaid expenses not to be restated twice, a portion of the expenses appearing in the profit and loss statement equal to the assumed amortization of prepaid expenses should be subtracted and restated as mentioned above.

However, it was not known what portion of the amortization entered the cost of goods sold (which along with depreciation is restated in a different way than the other expenses) so that for it to be subtracted from the COGS figure and be restated separately. Because of it, all amortization was subtracted from the "other expenses" category and it was restated separately. This treatement should not have any material affect on the restated earnings due to the immateriality of the size of prepaid expenses.

6.11. Restatement of Foreign Currency

Claims and obligations in foreign currency have been classified as non-monetary items since they are not fixed in terms of drachmas due to the fluctuation of foreign currency exchange rates. This stand is in accordance with that taken by official pronouncements (ie 1974 Exposure Draft of FASB).

The restatement of foreign currency per se did not pose any problem since according to the Greek law the foreign currency accounts are translated at current year end exchange rates. Hence, at any year end these

accounts need no restatement since they are expressions of year end general puchasing power.

However, the restatement of the related foreign currency gains/losses posed an unsurmountable problem. That is, generally speaking in order to restate a gain/loss resulted from the disposal of a non-monetary item someone needs to know two things: Acquisition date and cost, on the one hand, and transaction date and selling price of the item disposed, on the other. Then by subtracting acquisition cost, expressed in general purchasing power at the transaction date, from selling price the GPPA gain/loss is obtained which is then restated in end of the year general purchasing power.

In this study acquisition cost of foreign currency was not known. Hence, no restatement of foreign currency gains/losses could be performed. Because of it the researcher decided to leave foreign currency accounts as well as foreign currency gains/losses as they were in both the HCA and the GPPA statements, provided that these accounts were shown separately in the historical financial statements.

However, the companies of the sample, though they usually showed separately foreign currency accounts and especially the obligation in foreign currency, usually they did not show separately in their income statements the foreign currency gains/losses (perhaps due to their immateriality). Hence, foreign currency gains/losses could not be identified in either the HCA or the GPPA statements.

This lack of identification of foreign currency accounts may have two consequences as regards the accuracy of the study. First, out of necessity any existing (but not shown in the balance sheet) claims/obligations in foreign currency were taken as claims/obligations in domestic currency. As a result, actual monetary gains/losses may have been overstated because of the computation of monetary gains/losses from non-monetary items. Second, income items (ie foreign currency gains/loses) which should have been excluded from restatement may have been wrongly restated because they could not be identified. As a result, net restated earnings amy have been overstated (understated) depending on whether the company under examination had made foreign currency gains (losses).

How serious the two consequences mentioned above may have been, depends on two factors: First, on how much and how frequently the claims in foreign currency of a company, which are not shown separately, are not offset by compensating movements in the obligations in foreign currency . Second, on the drachma size and frequency of the foreign currency gains/losses not shown separately in the income statements.

If the foreign currency gains (losses) charged (but not appeared) in the Profit and Loss statement are in size and frequency about the same with those appearing in table 6.7 (which is based on information released by the companies or on information obtained form the Auditor's or Annual Reports) then the mentioned consequences should

have a rather not serious effect on restated earnings. Otherwise, the effect may be serious.

Table 6.7

Foreign Currency Gains (Losses) Charged to P and L Account
(Amounts in thousand drs)

Company	1976	1977	1978	1979	1980	1981
16 - Amount	NA	NA	NA	8,255	41,697	77,499
% of G Margin	--	--	--	2,3	10,0	15,5
18 - Amount	NA	NA	NA	NA	NA	(5,300)
% of G Margin	--	--	--	--	--	0,9
22 - Amount	(4,724)	(754)	NA	(11,988)	(29,128)	(48,403)
% of G Margin	3,7	0,6	--	3,0	5,2	5,0
23 - Amount	NA	13,862	25,707	19,296	18,959	1,371
% of G Margin	--	17,7	14,6	7,8	4,2	0,3
27 - Amount	(1,125)	(238)	NA	NA	(885)	NA
% of G Margin	2,7	0,8	--	--	3,5	--
31 - Amount	NA	NA	NA	NA	2,080	5,717
% of G Margin	--	--	--	--	0,3	0,6

6.12. Restatement of Advances to Purchases and Sales

These two types of advances are shown as claims and obligations respectively in the historical balance sheet statements. Under GPPA, however, both accounts are non-monetary items since they constitute claims to goods whose value fluctuates.

Usually, in the Greek balance sheet statements a distinction is made between advances for purchases from

abroad, which are called "foreign credit", and advances for purchases from the local suppliers, which are called "advances to suppliers". This distinction is very helpful for restatement purposes since usually the average age of "foreign credit" is one month while the average age of the "advances to suppliers" is 15 days. according to the information given to the researcher by the chief accountants of the companies.

Hence, for restating "foreign credit" and "advances to suppliers" the CPI at December 1 and 15 respectively in relation to the CPI at year-end were used as conversion factors. The conversion factor applied for adjusting "advances to suppliers" was employed too for restating the advances to sales account (ie no distinction is made in the Greek balance sheets between advances made by domestic customers perhaps due to the immateriality of amounts in the latter case).

The balances of the accounts "foreign credit" and "advances to suppliers" of a given year enter the purchases account of the immediately following year. Hence, these two balances are restated as purchases as well. By the same token the balance of the advances from customers account is also restated as sales.

As it will be seen in the next sub-section, purchases are restated for one half year of price changes the assumption being that the purchases occur uniformally throughout the year. However, this is not the case with the advances to purchases which enter the purchases account.

Hence, strictly theoretically speaking, before restating the purchases account the advances to purchases of the previous year should be subtracted from it and be restated separately in accordance to their age. Following this, the restated advances should be added to the restated actual purchases of the year to get the restated purchases account needed for the restatement of inventory and cost of goods sold.

By the same token, before restating the sales figure of a given year the advances to sales (ie advances from customers of the previous year) should be subtracted from the sales account and be restated separately. Then the restated advances to sales should be added to the restated actual sales of the year to get the restated sales account.

As it will be shown in the next sub section, if the advances to purchases constitute less than 10% of total purchases, then the understatement of restated purchases, and consequently of restated cost of goods sold, is immaterial (ie less than 1% understatement of restated cost of goods sold). Hence, in this study the advances to purchases as well as the advances to sales were restated separately only as balance sheet items (and not as income statement items as well), provided that the advances to purchases minus the advances to sales constitute less than 10% of total purchases.

6.13. Restatement of Inventory and COGS

In order to restate inventory and cost of goods sold (COGS) the inventory figures as well as the COGS and purchases are needed. However, in the Greek financial statements only the inventory figure (ie raw materials, supplies, work in process, finished products) is released, but not the COGS (and sales) figure.

Specifically, the income statement starts with Gross Margin before depreciation (or after depreciation has been charged to cost). Then the total depreciation of the year (or the total depreciation minus the depreciation charged to cost) is subtracted as well as the expenses not charged to COGS (ie administrative, selling expenses, etc) to get the net operating income. Following this, the non-operating income is added and the non-operating expenses (losses) are subtracted to get the total net profit of the accounting period.

In order to get the cost of goods sold figure before the depreciation expense the researcher subtracted the gross margin figure from the sales figure. In the case in which in the income statement the gross margin after depreciation charged to cost was given, the depreciation charged to cost (given in the income statement) was added to the gross margin figure. Following this, from the sales figure (given to the researcher upon request) the so obtain gross margin figure was subtracted to get the cost of goods sold figure before depreciation. He did it in order for the depreciation charged to cost not to be

restated twice (i.e. through the restatement of the depreciation of the year, as well as through the restatement of COGS).

Having obtained the COGS figure, the purchases of the year figure was obtained by the equation:

$$\text{Purchases} = \text{COGS} - B1 + E1$$

Then for the reasons mentioned in Section 5.2 the Davidson-Weil model was applied to restate inventory and COGS.

The nature and operation of the D-W model have been discussed in Section 5.2. However, no illustration as regards its application to restate inventory and COGS was given. Hence, here two illustrations are offered one for the restatement of FIFO inventories and the other for the restatement of weighted average inventories. Both illustrations cover a period of two years, that is, 1976 and 1977.

6.1. ILLUSTRATION
Restatement of FIFO Inventory and COGS
Company No 2

Year 1976

Item	HCA	GPPA
Beginning Inventory	46,215	54,672
Purchases	147,787	156,995
Average Purchases	64,279	69,640
COGS	110,494	124,312
Ending Inventory	83,508	87,355

Year 1977

Item	HCA	GPPA
Beginning Inventory	83,508	98,787
Purchases	112,610	120,626
Average Purchases	46,068	50,938
COGS	129,576	149,725
Ending Inventory	66,542	69.688

6.2. ILLUSTRATION

Restatement of Weighted Ave. Inventory and GOCS
Company No 1

Year 1976

Item	HCA	GPPA
Beginning Inventory	112,769	138,574
Purchases	191,804	203,754
COGAS	304,573	342,328
COGS	150,113	168,721
Ending Inventory	154,460	173,607

Year 1977

Item	HCA	GPPA
Beginning Inventory	154,460	196,326
Purchases	187,478	200,823
COGAS	341,938	397,149
COGS	183,678	213,336
Ending Inventory	158,260	183,813

Several Greek companies, such as company no 1 of the sample of the study, include in their inventory the account "foreign credit" mentioned in the previous sub section, while some of them also include the account "advances to suppliers". The researcher excluded both accounts from the inventory figure and restated them separately as non-monetary balance sheet items in the way already mentioned on the grounds of immateriality since they constituted less than 10% of total purchases (see Section 6.12)

Indeed, in 1979 company no 1 had the highest figure of advances to purchases (ie 25,116 drs or 8.6% of the purchases of 1980). The researcher subtracted that figure from purchases and he restated both the advances to purchases and the actual purchase of the year separately. The results obtained are the following:

$$\text{Foreign Credit (adj)} = 25,116 \times \frac{\text{CPI } 31/12/79}{\text{CPI } 01/12/79} \times \frac{\text{CPI } 31/12/80}{\text{CPI } 31/12/75} = 32,596$$

$$\text{Purchases (adj)} = (292,147 - 25,116) \times \frac{\text{CPI } 31/12/80}{\text{CPI mid-year}} = 302,990$$

Total Purchases (adj) = 32,596 + 302,990 = 335,586
(vs 331,488 when foreign credit is not restated separately)

COGS(adj) = 332,962 (Bladj) + 335,586 = 668,548 (vs 664,450)

$$\text{COGS(adj)} = \frac{300,604}{502,882} \times 668,548 = 399,633 \text{ (vs 397,183)}$$

That is, as a result of not taking into account that in the purchases of the year advances to purchases of the previous year are included, which should be subtracted and restated separately, the understatement of GOGS or the loss in precision is:

(397183 - 399633) : 399633 = 0.6%.

Two of the companies of the sample of the study, that is companies No 13 and 14, valuated their finished products at selling prices minus a constant rate of earnings, and not on a FIFO and we. average basis respectively, as they did for their remaining inventories. Because of it before restating total inventory of these two companies the figure of finished products was subtracted and it was left as it was in both the HCA and the GPPA financial statement.

Finally, another two companies (i.e. companies No 10 and 11) changed their method of stock valuation during the period under examination. Specifically, company No 10 switched, from we. average to FIFO in 1979 while company No 11 switched from we. average to FIFO in 1980. Obviously

this created a problem as regards restatement of inventory and cost of goods sold (COGS).

The problem was created because while the ending inventory of the year of change was expressed in FIFO terms (i.e. 131,180 thousand drs for company No 10), the beginning inventory was expressed in we.average terms (i.e. 125,947 for company No 10) since the beginning inventory of the year of change was the same with the ending inventory of the year which proceeded the year of change. As for the COGS (which was 529,176 for company No 10) it was a figure obtained on the basis of BI and EI expressed in different terms as regards method of valuation.

In order to express all three figures, that is. COGS, BI and EI in FIFO terms in the first year of change of the method of stock valuation the researcher did the following as regards company No 10.

Firstly, he expressed ending inventory of 1979 in we.average terms based on the information written in the Auditor's Report according to which because of the change in the method of stock valuation ending inventory was bigger than it should be by 8,000 thousand drs. That is, ending inventory expressed in we.average terms was 131,150 - 8,000 = 123,150. Then, on the basis of the new figure obtained the researcher **estimated** the amount by which beginning inventory (or ending inventory of the previous year) would be bigger under FIFO. That amount was (125,947 : 123,150) × 8,000 = 8,182.

Hence, beginning inventory expressed in FIFO terms should be around 125,947 + 8,182 = 134,129. Accordingly,

COGS should be 529,176 + 8,182 = 537,358 since COGS = BI + P - EI and P, is a constant amount which does not depend on the method of stock valuation.

Since in the year of change (i.e. 1979) all parameters needed for restatement purposes were expressed in FIFO terms, the D-W model for FIFO inventories could be applied. The same procedure was followed in order to restate the 1980 inventory and COGS of company No 11.

The solution given was the best available to handle the problem created by the change in the method of stock valuation, and thus to minimize the consequences involved. In any way, if still there were some consequences, they were restricted only in the first year of change of the method of stock valuation (i.e. 1979 and 1980 respectively for the two mentioned companies).

6.14. Computation of Monetary Gains/Losses

From monetary items monetary gains (losses) are computed under GPPA depending on whether the firm under examination is a net debtor (creditor). As mentioned in Section 3.3.1, claims/obligations which are fixed in terms of money are classified as monetary items.

Hence, in this study all accounts of circulated assets other than inventory, advances to suppliers, prepaid expenses, as well as the accounts which were not restated for the reasons mentioned in previous sections constitute the monetary assets for which monetary losses were computed. By the same token, all liabilities other

than advances from customers, obligations in foreign currency, and special assessment tax L.257/76 constitute the monetary liabilities for which monetary gains were computed.

For the dividends of the year account, directors' fees as well as income taxes of the year no monetary gains were computed, though they have been classified as monetary items. The reason is that these liabilities are created at the balance sheet date (ie year-end) and hence, they are expressions of current general purchasing power.

Monetary gains/losses constitute the most important and the most controversial aspect of GPPA. They are the most important feature of GPPA because this system is the only inflation accounting system which shows (though in a partial way - see footnote no 6 of Section 3.3.1) how effective is the management of monetary resources in times of (general) inflation by taking into account the so called "currency debasement". They are the most controversial aspect of GPPA, on the other hand, because the solutions given to the problems associated with them (ie classification of monetary items, realization of monetary gains/losses, and proper place to report them) have not reached general agreement.

The classification problem has already been discussed in Section 3.3.1. As regards the realization problem (ie realized vs unrealized monetary gains/losses) those who make the distinction between "realized" and "unrealized" monetary gains/losses they refer to the

short-term and long-term monetary items and they put "...the emphasis upon cash receipts and disbursements rather than on the concept of accrual accounting". However, the "...gains and losses have occured in much the same sense that interest has accrued or that bond discount has accumulated or been amortized (AICPA, (1964) p. 43).

Hence, in this study no distinction was made between realised and unrealised monetary gains/losses. This position has been taken in the empirical accounting literature as well (see for example, Davidson and Weil, (1975) or Parker (1977)).

With regard to the proper place to report monetary gains/losses (ie should they be recognised as part of the GPPA net income or they should be shown as a separate category?) it seems that basically the problem stems from the fact that these gains (losses) do not produce cash inflows (outflows) for the firm. Because of it, it is maintained explicitly or implicitly that these gains do not constitute income in a real sense since they cannot be distributed.

Yet, these gains (losses) are real in an economic sense. Due to inflation the debtor will repay the lender with "cheaper" money. Hence, he will benefit at the expense of the lender, provided that there are no interest charges to compensate for the loss to be suffered by the lender due to the currency debasement.

The only case in which the debtor does not benefit from these gains is the case in which he does not make

any use of the money borrowed. Yet, even in such hypothetical case the debtor makes a gain (at the expense of the lender) but this gain is offset by a corresponding loss resulted from holding the money in times of inflation. This loss, however, has nothing to do with the gain from borrowing. Borrowing and holding money (in times of inflation) are two different things.

Hence, it may be argued that, for those who are fully aware of the currency debasement or the money illusion, in times of inflation the loss sufferec by (holding money or) being a creditor (and hence the gain made by being a debtor) is as real as it is the loss suffered by someone who has lost his pocket money. That is why in times of inflation the prudent lender takes into account the anticipated inflation while negotiating the interest rate of the loan.

Additionally, it is argued in the accounting literature (see Modigliani and Cohn (1979) or Petri and Shawky (1983) that not only are these gains real but they can be distributed too, assuming that the debt to equity ratio remains unchanged in real (GPPA) terms. To put it another way, these gains can be distributed if the firm can borrow as much money as is needed in order to maintain the same leverage in real terms.

Of course, there is no need of empirical evidence to maintain that the assumption above may hold true actually as regards the case in which short-term credit is used to finance current business activities. However, it is very difficult, if not impossible, for a firm to keep

unchanged in real terms its leverage, and hence to be able to distribute all monetary gains, if short term as well as long term loans are used to finance its assets. In a real world "...lenders may refuse a firm that apparently uses loans to pay dividends..." (Modigliani and Cohn (1979) p.32). Maybe this is a main reason why many people do not recognise monetary gains (losses) as part of net income.

In this study the position has been taken that monetary gains/losses are part of net income of the period. That stand was taken not only in accordance to what has been written above but for another important reason too:

Monetary gains/losses constitute the unique, the most important feature of GPPA. They are considered to be its great advantage even by those who are not in favour of GPPA (ie Lewis et al (1983) Davidson and Weil (1975)). Hence, exclusion of monetary gains/losses from met income in a way renders GPPA almost useless. Consequently, it would have been an internal inconsistency if the researcher, who has argued in this study that GPPA is a viable solution to the inflation accounting problem particularly for developing countries, like Greece, had taken a negative position as regards recognition of monetary gains/losses as income.

With respect to the computation of monetary gains/losses for those companies for which no detailed data (i.e. trial balances) have been obtained the Average Balance Technique was employed as described in Section

5.2. What might have been the error due to the use of the mentioned estimating technique it has already been discussed in Section 5.4.3.

5.15. Restatement of Owner's Equity and Income Statement Items

As mentioned in Section 5.2 the restated equity was obtained as a residual; that is as the difference between restated net fixed assets and restated liabilities. The reason for this is that the accounting departments do not keep detailed records of paid-in capital.

However, such adjustment understates restated equity. Ceteris paribus, the older the firm the bigger the understatement of its restated equity. This is because while the fixed assets other than buildings under restatement may be 10 or 11 years old at the most (ie adjustment of fully depreciated assets is meaningless) the paid-in capital may be 20, or 30 years old depending on when the firm under restatement commenced business. Perhaps that is why an understatement of restated owner's equity was observed for all three models validated by Ketz (see Section 5.2).

With respect to the income statement, items other than depreciation and cost of goods sold, they were restated for one half year of price changes the assumption being that they occur fairly evenly throughout the year (see Section 5.2).

CHAPTER SEVEN

FINDINGS AND CONCLUSIONS

7.1. Introduction

In the two previous chapters the methodology employed to approximate **ex ante** the impact of GPPA on Greek accounts as well as to accomplish sub-purposes 1-4 was discussed but not the results obtained. Hence, in this chapter the results obtained are reported and conclusions are drawn.

Specifically, the purposes of the chapter are the following:

1. *To present and discuss the results obtained and especially to discuss the findings of the four financial parameters chosen for further empirical analysis.*

2. *To draw conclusions regarding possible implications for micro- and macro-decision making of adopting and operating GPPA in Greece.*

Toward these ends, Section 6.2 presents and discusses the results obtained. Section 6.3 explains briefly the reasons for which four financial parameters were chosen for further empirical analysis and discusses the way in which each one of these parameters was computed as well as the results obtained, on the basis of the analysis made. Finally, in the light of the results obtained, in Section 7.4 conclusions are drawn

with respect to their possible implications for micro- and macro-decision making in Greece.

7.2. Discussion of the Results

Tables 7.1 to 7.6 present the results obtained from adjusting the income statements of the sample of the study for the years 1976 to 1981. Specifically, the results obtained refer to three income concepts: (a) operating income, (b) net income before monetary gains/losses, and (c) net profit before taxation. In these tables presented are also the results as regards monetary gains/losses due to which the adjusted net profit may be very close or very different from the historical net profit.

No results of any kind are presented and discussed with respect to adjusted balance sheet data. The basic reason for this is the following:

The adjusted balance sheet data merely constitute a transformation of HCA data from one basis of measurement (ie money) to another (ie general purchasing power of money). Hence, the adjusted figures generated do not present any particular interest except for owner's equity and total assets which are used in this study for the computation of selected ratios (ie profitability ratios). What basically differentiates GPPA from HCA is the earnings figure which, when restated, may be significantly different due to the monetary gains/losses computed under GPPA. That is why this study concentrates

on the impact of GPPA on earnings basically.

The first thing which is noticed from tables 7.1 to 7.6 is the great difference between historical and restated operating income and net income before monetary gains/losses. This is due to the high rates of inflation prevailing in the period under examination which make two of the most important income items, that is restated depreciation, in the first place, and restated COGS, in the second place, to be very different from the historical depreciation and COGS (see tables 7.8 and 7.9 which present historical and adjusted complete income statements of the companies No 1 and 2 which use we. average and FIFO respectively for stock valuation purposes).

The difference between historical and adjusted (operating income and) net income before monetary gains/losses becomes greater and greater year after year (i.e. decrease of the GPPA profit). Especially, in the years 1979 to 1981 the decrease of the adjusted net income before monetary gains/losses is almost dramatic for many companies. The reasons for this are two basically:

Firstly, the increase in the inflation rate in the years 1979 to 1981 was the highest in the period under examination (see table 4.1). As a result, restated COGS and depreciation expressed as a percentage of the corresponding HCA figures are bigger in these years than in the previous years.

Table 7.1

Three Income Figures - 1976 (Amounts in thousand drs)

Comp	Operating Income		Net profit before M.G/L		Mon. Gains (Losses)		Net profit*	
	HCA	GPPA	HCA	GPPA	HCA	GPPA	HCA	GPPA
1	41472	30062	41455	30000	NA	8285	41455	38285
2	21881	6845	30189	15670	NA	4197	30189	19867
3	6873	1966	10341	5650	NA	4073	10341	9723
4	8257	(2543)	10206	(473)	NA	9113	10206	8640
5	21117	(2411)	22300	(1155)	NA	11687	22300	10532
7	20613	10719	35705	26751	NA	(6178)	35705	20573
8	18563	(8555)	18601	(8515)	NA	15175	18601	6660
9	13168	(47471)	63388	5878	NA	65496	63388	71374
10	56584	44874	60769	49320	NA	(17)	60769	49303
11	(5228)	(7704)	(5688)	(8193)	NA	2787	(5688)	(5406)
12	11844	6310	8575	2837	NA	3485	8575	6322
13	(3583)	(10443)	6837	626	NA	5090	6837	5716
14	14167	5640	21821	6009	NA	28022	21821	34031
15	11012	(229293)	36	(240953)	NA	33459	36	(207494)
16	15101	(27406)	37757	(4401)	NA	39754	37757	35353
17	19876	(9482)	24457	(4616)	NA	21667	24457	17051
18	99841	56532	106963	64098	NA	16751	106963	80849
19	97365	(120464)	166383	(47146)	NA	99274	166383	52128
20	2540	(5918)	424	(8288)	NA	3092	424	(5196)
21	(9761)	(27792)	2237	(15047)	NA	4650	2237	(10397)
22	36461	(25757)	25639	(37253)	NA	17854	25639	(19399)
23	(2234)	(57758)	78223	27286	NA	73867	78223	101153
24	11234	(3870)	15168	309	NA	5955	15168	6264
25	110567	72991	101297	63143	NA	32052	101297	95195
26	12533	680	15515	3848	NA	1617	15515	5465
27	33750	(183521)	82719	(131501)	NA	147207	82719	15706
28	(2682)	(16572)	(171)	(13905)	NA	(2639)	(171)	(16544)
29	15292	9497	1440	(5218)	NA	4800	1440	(418)
30	8931	(18566)	8839	(18664)	NA	10601	8839	(8063)
31	81300	(18660)	111657	13588	NA	199070	111657	212658

* Net profit before taxes,

T a b l e 7.2

Three Income Figures - 1977 (Amounts in thousand ors)

Comp	Operating Income		Net profit before M,G/L		Mon, Gains (Losses)		Net profit*	
	HCA	GPPA	HCA	GPPA	HCA	GPPA	HCA	GPPA
1	29517	15168	26675	11993	NA	13365	26675	25359
2	26330	4522	33332	11951	NA	4817	33332	16768
3	4838	(4341)	13846	5261	NA	6982	13846	12243
4	5677	(7849)	7023	(6406)	NA	15887	7023	9481
5	41742	14986	41974	15235	NA	9605	41974	24840
7	16672	8173	31888	24302	NA	(8497)	31898	15805
8	24732	(4868)	25703	(3829)	NA	14906	25703	11077
9	40348	(25279)	66033	2234	NA	79939	66033	82173
10	44191	27649	45629	29189	NA	5085	45629	34274
11	1891	(995)	2383	(468)	NA	3441	2383	2973
12	10515	4891	8610	1225	NA	5471	8610	6696
13	4177	(3434)	8987	1694	NA	6266	8987	7960
14	1203	(17522)	8391	(12259)	NA	30909	8391	18650
15	(188341)	(467886)	(170079)	(448324)	NA	43067	(170079)	(405257)
16	35247	(13024)	35359	(12904)	NA	68086	35359	55182
17	18506	(15711)	25583	(8130)	NA	18976	25583	10846
18	70497	10930	80212	21337	NA	15016	80212	36353
19	252850	(9575)	352033	96668	NA	242839	352033	339507
20	3323	(4294)	1318	(6442)	NA	4135	1318	(2307)
21	(13820)	(24732)	4530	(5242)	NA	390	4530	(4852)
22	22930	20374	42693	795	NA	24204	42693	24999
23	(130729)	(218773)	25289	(54534)	NA	80764	25289	26230
24	(2723)	(16337)	382	(13011)	NA	9480	382	(3531)
25	51723	(4457)	65704	10519	NA	46373	65704	56892
26	23154	11544	24001	12451	NA	(1164)	24001	11287
27	217214	(90109)	248486	(56611)	NA	144971	248486	88360
28	(1338)	(15177)	(3212)	(18296)	NA	(5871)	(3212)	(24167)
29	4319	(2633)	9237	2534	NA	(3514)	9237	(980)
30	21156	(2652)	21141	(2668)	NA	7872	21141	5204
31	130096	(101838)	145274	(85580)	NA	294215	145274	208635

* Net profit before taxes,

T a b l e 7.3

Three Income Figures - 1978 (Amounts in thousand drs)

Comp	Operating Income		Net profit before M.G/L		Mon. Gains (Losses)		Net profit*	
	HCA	GPPA	HCA	GPPA	HCA	GPPA	HCA	GPPA
1	25772	(556)	22364	(4402)	NA	14313	22364	9911
2	31072	12994	35804	18092	NA	8555	35804	26647
3	12947	195	18817	5683	NA	8145	18817	13828
4	6059	(16260)	9156	(12923)	NA	19081	9156	6158
5	34445	(8474)	35554	(7301)	NA	11381	35554	4080
7	19004	11706	26402	19682	NA	(8844)	26402	10838
8	14592	(20786)	14625	(20858)	NA	12136	14625	(8722)
9	51235	(36026)	83621	(1133)	NA	76163	83621	75030
10	25025	(293)	30951	6086	NA	11091	30951	17177
11	1928	(1643)	2696	(861)	NA	3373	2696	2512
12	15473	9000	9793	2881	NA	8382	9793	11263
13	12093	4530	18289	11206	NA	7425	18289	18631
14	(45909)	(41241)	(14927)	(40479)	NA	35795	(14927)	(4684)
15	(54205)	(364303)	(8398)	(314950)	NA	41245	(8398)	(273705)
16	65778	192	53951	(12550)	NA	100266	53951	87716
17	(15328)	(63022)	(4940)	(51830)	NA	19673	(4940)	(32157)
18	124087	64931	128308	69479	NA	9474	128308	78953
19	215436	(110217)	348954	33638	NA	247259	348954	280897
20	7531	(1539)	4384	(4930)	NA	6360	4384	1430
21	9596	(9686)	7058	(12421)	NA	(665)	7058	(13086)
22	58103	(18140)	55315	(21144)	NA	72568	55315	51424
23	(76914)	(181209)	40619	(56882)	NA	87417	40619	30535
24	20325	(110)	19115	(1414)	NA	11366	19115	9952
25	68409	(6274)	36858	(40268)	NA	50911	36858	10643
26	45999	37904	44705	36510	NA	(2658)	44705	33852
27	251530	(80338)	318477	(8208)	NA	171551	318477	163343
28	(4019)	(19070)	(3749)	(18779)	NA	(6264)	(3749)	(25043)
29	(1174)	(10151)	(2971)	(12088)	NA	3142	(2971)	(8946)
30	14446	(397)	13845	(1044)	NA	19423	13845	18379
31	88399	(198004)	120080	(163870)	NA	239310	120080	75440

* Net profit before taxes.

Table 7.4

Three Income Figures - 1979 (Amounts in thousands)

Comp	Operating Income		Net profit before M.G/L		Non. Gains (Losses)		Net profit*	
	HCA	GPPA	HCA	GPPA	HCA	GPPA	HCA	GPPA
1	132	148	9873	(36500)	NA	37499	9873	995
2	50327	19191	59517	29529 -	NA	5853	59517	35382
3	14973	(6637)	18516	(2651)+	NA	18578	18516	15927
4	(23303)	(55629)	(-5369)	(45968)+	NA	43545	(5359)	(2423)+
5	20244	(27272)	22088	(25179)+	NA	20748	22088	(4431)
7	25632	4931	30320	10205 +	NA	(13780)	30320	(3575)
8	10347	(41749)	10882	(41214)+	NA	26868	10882	(14346)
9	80758	(34547)	108281	(3582)+	NA	77699	108281	74117
10	39027	(11921)	42146	(8412)+	NA	21405	42146	12993
11	1917	(1659)	2660	(1053)+	NA	7897	2660	6844 +
12	2513	(10143)	7110	(8865)+	NA	20409	7110	11544 +
13	27754	6328	35104	14597	NA	14833	35104	29430
14	6297	(23484)	6873	(22958)	NA	64040	6873	41082 +
15	(288012)	(779895)	(160108)	(635994)	NA	70575	(160108)	(565419)
16	90552	(49507)	82669	(59408)	NA	228850	82669	169442 +
17	2697	(56283)	16856	(40353)	NA	37893	16856	(2460)
18	126732	25851	145629	47111	NA	21066	145629	68177
19	525085	(127277)	549876	(99386)	NA	389591	549876	290205
20	(3385)	(19298)	(4380)	(20418)	NA	20520	(4380)	102 +
21	15668	(7982)	14619	(9163)	NA	(4456)	14619	(13619)
22	107261	(49232)	96402	(61449)	NA	203725	96402	142276 +
23	(27162)	(200051)	(77812)	(84835)	NA	150477	77812	65642
24	33213	2179	34599	3739	NA	25249	34599	28988
25	78097	(24911)	58593	(46855)	NA	11377	58593	(35478)
26	37063	23741	34813	21210	NA	2986	34813	24196
27	398748	(221257)	420427	(196867)	NA	412865	420427	215998
28	4448	(18404)	6135	(17820)	NA	(9696)	6135	(27516)
29	(2440)	(14423)	(3135)	(15205)	NA	3129	(3135)	(12076)
30	14371	(33269)	9861	(10064)	NA	83187	9861	73123 +
31	101678	(372003)	143416	(325045)	NA	540895	143416	215850 +

* Net profit before taxes.

T a b l e 7.5

Three Income Figures - 1980 (Amounts in thousand drs)

Comp	Operating Income		Net profit before M,G/L		Mon. Gains (Losses)		Net profit*	
	HCA	GPPA	HCA	GPPA	HCA	GPPA	HCA	GPPA
1	97	(71329)	952	(70359)+	NA	50336	952	(20023)
2	32711	(26628)	43827	(14015)	NA	(5410)	43827	(19425)
3	11024	(21995)	15897	(16466)-	NA	23951	15897	7485
4	(209)	(63344)	8660	(53295)	NA	44930	8660	(8365)
5	15775	(48038)	16642	(47055)	NA	27202	16642	(19853)
7	26090	(3867)	18012	(13436)+	NA	4407	18012	(9029)
8	(1326)	(84026)	15003	(65498)-	NA	34593	15003	(30905)
9	86588	(96803)	109480	(70828)-	NA	163643	109480	92815
10	33205	(28080)	42894	(17086)-	NA	36348	42894	19262
11	2227	(8546)	2521	(8575)-	NA	11046	2521	2471
12	(15430)	(39959)	(6771)	(30134)+	NA	28528	(6771)	(1606)
13	23458	(7137)	33728	4516 -	NA	31208	33728	35724
14	(5442)	(64388)	(1454)	(59863)-	NA	136029	(1454)	76166
15	(149844)	(883308)	(75344)	(798776)	NA	45586	(75344)	(753190)
16	51569	(174414)	93544	(132401)-	NA	346076	93544	213675
17	(28480)	(103254)	(3868)	(75327)-	NA	67732	(3868)	(7595)+
18	158241	24895	184395	54571 -	NA	114492	184395	169063
19	307225	(684384)	566396	(390312)	NA	566101	566396	175789
20	(1194)	(28705)	(5098)	(33135)-	NA	10701	(5098)	(22434)
21	62016	46668	58739	42951 +	NA	(8186)	58739	34765
22	100733	(198786)	95808	(261025)+	NA	297075	95808	36050
23	115981	780	144917	30606 -	NA	177342	144917	207948
24	15497	(38315)	20076	(33120)-	NA	49896	20076	16776
25	206326	47177	183023	9238 +	NA	11604	183023	20842
26	29040	105	29680	831 +	NA	15257	29680	16088
27	236016	(924069)	382552	(757800)-	NA	632127	382552	(125673)
28	11852	(29149)	12425	(30805)-	NA	(10083)	12425	(40888)
29	(331)	(4000)	(4647)	(8897)+	NA	2593	(4647)	(6304)
30	10247	(28301)	9561	(29079)-	NA	160754	9561	131675
31	76487	(641627)	143795	(565700)-	NA	1075515	143795	509815

* Net profit before taxes,

T a b l e 7.6

Three Income Figures - 1981 (Amounts in thousands)

Comp	Operating Income		Net profit before M,G/L		Mon. Gains (Losses)		Net profit*	
	HCA	GPPA	HCA	GPPA	HCA	GPPA	HCA	GPPA
1	(1370)	(55269)	76	(53665)	NA	45589	76	(7977)
2	NA	NA	NA	NA	NA	NA	NA	NA
3	2732	(43761)	9311	(38421)	NA	22013	9311	(16408)
4	NA	NA	NA	NA	NA	NA	NA	NA
5	26995	(39768)	20247	(47249)	NA	29763	20247	(17486)
7	33247	2386	35499	4468	NA	(13206)	35499	(8788)
8	(23546)	(116094)	(3340)	(95174)	NA	46156	(3340)	(49018)
9	49887	(208527)	95466	(157998)	NA	188285	95466	30287
10	108170	(37847)	115474	(29750)	NA	42183	115474	12433
11	2443	(9479)	2940	(10100)	NA	10462	2940	952
12	1508	(32126)	8372	(24517)	NA	27742	8372	3225
13	(220)	(59492)	14120	(43595)	NA	33499	14120	(10096)
14	(188870)	(329522)	(188317)	(328909)	NA	188793	(188317)	(140116)
15	NA	NA	NA	NA	NA	NA	NA	NA
16	(15695)	(364480)	43666	(304917)	NA	508956	43666	204039
17	(56186)	(168678)	(39223)	(149873)	NA	72270	(39223)	(77603)
18	119523	(200094)	160648	(154502)	NA	143323	160648	(11179)
19	NA	NA	NA	NA	NA	NA	NA	NA
20	(20904)	(45509)	(16887)	(41056)	NA	33433	(16887)	(7623)
21	81532	67365	90450	77251	NA	(11518)	90450	65733
22	188057	(53061)	131284	(132511)	NA	421637	131284	289126
23	36070	(224486)	60640	(197713)	NA	183434	60640	(14279)
24	13699	(55117)	16480	(52034)	NA	46541	16480	(5493)
25	518939	331968	448373	248834	NA	117586	448373	366420
26	44092	3246	48105	7695	NA	15385	48105	23080
27	502461	(1376695)	647341	(1127374)	NA	796038	647341	(331336)
28	33661	(36186)	34660	(35303)	NA	(11756)	34660	(47059)
29	6045	(699)	5603	(1189)	NA	2591	5603	1402
30	3276	(94632)	0	(101090)	NA	185192	0	84102
31	64273	(781940)	179125	(654614)	NA	1150179	179125	495565

* Net profit before taxes.

Table 7.7

Per Cent Overstatement (Understatement) of Net Profit, 1976-81.

Company	1976	1977	1978	1979	1980	1981
1	(7,63)	(4,93)	(55,68)	(89,88)	>1000,00	>1000,00
2	(34,19)	(49,69)	(25,57)	(40,55)	(144,32)	NA
3	(5,97)	(11,57)	(26,51)	(13,98)	(52,91)	(276,22)
4	(15,34)	(34,99)	(32,74)	54,87	(196,59)	NA
5	(52,77)	(40,82)	(88,52)	(120,06)	(219,29)	(186,36)
7	(42,38)	(50,43)	(58,95)	(111,79)	(150,12)	(124,61)
8	(64,19)	(56,90)	(159,63)	(231,83)	(305,99)	>1000,00
9	12,59	(24,44)	(10,27)	(31,55)	(15,22)	(68,27)
10	(18,86)	(24,88)	(44,50)	(69,17)	(55,09)	(89,29)
11	4,95	(24,75)	(5,15)	(157,29	(1,98)	(87,68)
12	(26,27)	(22,22)	15,01	62,36	76,28	(61,47)
13	(16,39)	(11,42)	1,86	(16,16)	5,91	(171,50)
14	(55,95)	122,26	68,62	497,73	>1000,00	(25,59)
15	>1000,00	(138,27)	>1000,00	(253,14)	(899,66)	NA
16	(6,36)	56,06	(62,58)	104,96	128,42	(367,27)
17	(30,28)	(57,60)	(550,95)	(114,59)	(96,35)	(97,85)
18	(24,41)	(55,42)	(38,46)	(53,18)	(8,31)	(106,95)
19	(68,66)	(3,55)	(19,50)	(47,22)	(68,96)	NA
20	>1000,00	(275,03)	(67,38)	(102,32)	(340,05)	(54,85)
21	(564,77)	(207,10)	(285,40)	(193,15)	(40,81)	(27,32)
22	(175,66)	(41,44)	(7,03)	47,58	(62,37)	(120,22)
23	29,31	(3,72	(24,82)	(15,64)	(43,49)	(123,54)
24	(58,70)	>1000,00	(47,93)	(16,21)	(16,43)	(133,33)
25	(6,02)	(13,41)	(71,12)	(160,54)	(88,61)	(18,27)
26	(64,77)	(52,97)	(24,27)	(30,49)	(45,79)	(52,02)
27	(81,01)	(64,44)	(48,71)	(48,62)	(132,85)	(151,18)
28	>1000,00	(652,39)	(567,99)	(548,50)	(429,07)	(235,77)
29	(129,02)	(110,60)	(201,10)	(285,19)	(35,63)	74,97
30	(191,22)	(75,38)	32,74	641,53	>1000,00	>1000,00
31	90,45	43,61	(37,17)	50,50	254,54	176,65

Table 7.8

Company No 1 - Income Statements 1976-1981 (in thousand grs)

Accounts	1976		1977		1978	
	HCA	GPPA	HCA	GPPA	HCA	GPPA
Sales	230,000	244,330	240,000	257,088	275,000	300,600
COGS*	150,113	168,721	183,678	213,336	204,696	240,894
G, Margin	79,887	75,609	56,322	43,747	74,304	59,706
Depreciation	8,952	14,424	292	296	10,071	18,895
Depreciation differ,*	+ 182	+ 182	+ 292	+ 292	+ 5	+ 5
Other Expenses	26,647	28,307	26,124	27,894	37,655	40,575
Non Rest, Expenses	2,998	2,998	681	681	808	808
OPERATING INCOME	41,472	30,062	29,517	15,168	25,772	(565)
Non-oper, Income	55	58	28	25	40	43
Gain (Loss) form Retir,	25	(17)	30	(99)	58	(102)
Non-oper, Expenses	97	103	2,895	3,101	3,506	3,777
NET INCOME before Monet, G/L	41,455	30,000	26,675	11,993	22,364	(4,402)
Mon, Gains (Losses)	NA	8,289	NA	13,366	NA	14,313
NET INCOME	41,455	38,289	26,675	25,359	22,364	9,911

Accounts	1979		1980		1981	
	HCA	GPPA	HCA	GPPA	HCA	GPPA
Sales	320,000	360,021	395,000	448,192	200,000	221,722
COGS	238,826	299,664	300,604	397,183	94,822	139,389
G, Margin	81,174	60,357	94,396	51,009	105,178	82,333
Depreciation	19,404	38,644	16,538	34,126	16,907	38,224
Depreciation differ,	+ 51	+ 51	+ 34	+ 34	+ 12	+ 12
Other Expenses	48,339	54,385	77,605	88,056	89,653	99,390
Non Rest, Expenses	3,490	3,490	190	190	--	--
OPERATING INCOME	9,992	(36,111)	97	(71,329)	(1,370)	(55,269)
Non-oper, Income	132	148	975	1,106	1,534	1,701
Gain (Loss) form Retir,	0	(255)	--	--	--	--
Non-oper, Expenses	251	282	120	136	88	98
NET INCOME before Monet, G/L	9,873	(36,500)	952	(70,359)	76	(53,666)
Mon, Gains (Losses)	NA	37,499	NA	50,336	NA	45,689
NET INCOME	9,873	999	952	(20,023)	76	(7,977)

* We, average method of stock valuation,
# The positive (negative) difference between total depreciation of the year as appeared in the income statement and total depreciation of the actual data was added (subtracted) to the income statement so that for the historical net profit, on the basis of which dividends etc, were paid, not to change.

Table 7.5

Company No 2 - Income Statements 1976-1980 (in thousands grs)

Accounts	1976		1977		1978	
	HCA	GPPA	HCA	GPPA	HCA	GPPA
Sales	176,228	187,203	199,641	213,852	223,552	240,850
COGS*	110,494	124,312	129,576	145,725	148,674	163,340
G, Margin	65,729	62,891	70,065	64,127	74,878	77,520
Depreciation	19,624	30,614	22,033	36,358	22,264	35,835
Depreciation differ,	--	--	--	--	--	--
Other Expenses	19,392	20,600	21,702	23,247	26,542	28,557
Non-restated Expenses	4,832	4,832	--	--	--	--
OPERATING INCOME	21,881	6,845	26,330	4,522	31,072	13,088
Non-oper, Income	8,308	8,825	7,002	7,500	4,732	5,098
Gain (Loss) from Retir,	--	--	0	(71)	--	--
Non-oper, Expenses	--	--	--	--	--	--
NET INCOME before Monet, G/L	30,189	15,670	33,332	11,951	35,804	18,186
Mon, Gains (Losses)	NA	4,197	NA	4,817	NA	8,555
NET INCOME	30,189	19,867	33,332	16,768	35,804	26,741

Accounts	1979		1980		1981	
	HCA	GPPA	HCA	GPPA	HCA	GPPA
Sales	286,450	322,275	294,000	333,591		
COGS	170,606	212,005	186,328	241,403		
G, Margin	115,844	110,270	107,672	92,188		
Depreciation	35,093	56,844	45,573	85,587		
Depreciation differ,	+ 6	+ 6	- 861	- 861		
Other Expenses	30,428	34,235	28,527	32,368		
Non-restated Expenses	--	--	--	--		
OPERATING INCOME	50,327	19,191	32,711	(26,268)	NA	NA
Non-oper, Income	9,189	10,338	11,116	12,613		
Gain (Loss) from Retir,	--	--	--	--		
Non-oper, Expenses	--	--	--	--		
NET INCOME before Monet, G/L	59,517	29,529	43,827	(14,015)		
Mon, Gains (Losses)	NA	5,853	NA	(4,833)		
NET INCOME	59,517	35,382	43,827	(18,848)		

* FIFO method of stock valuation,

Secondly, in 1976 revaluation of (land and) buildings took place and out of necessity the researcher took as date of acquisition of buildings (which along with machinery constitute the most important fixed assets of a manufacturing firm) the date of their revaluation. As a result, in 1976 restated and historical depreciation for buildings are basically the same. Year after year, however, the difference between historical and restated depreciaiton becomes greater and greater, since the conversion factor bacomes greater and greater due to the increase in the annual inflation rate. Obviously this affects restated net income (before monetary gains/losses).

Another thing which is noticed from the mentioned tables is the great amount of monetary gains/losses enjoyed by the companies of the sample. In each one of the years 1976 to 1981 no more than 3 to 4 companies out of the thirty firms of the sample suffered monetary losses. All other companies made monetary gains. These gains were greater and greater year after year as a result of two factors: increase in net monetary liabilities and/or increase in the annual inflation rate.

The above finding should be expected after what have been said regarding leverage of the Greek companies, on the one hand, and given the high rates of inflation which Greece experienced during the period under consideration, on the other.

As a result of the monetary gains, the restated net profit (before taxes) of the companies of the sample

improved significantly. For at least half of the sample firms, which showed negative adjusted net income before monetary gains/losses in each one of the years 1976-1981, the negative restated profit became positive. In several cases (i.e. 5 to 8 firms in each one of the years 1976-1981) the restated net profit became even bigger than the historical one. Nevertheless, generally speaking for the majority of the sample firms the adjusted net profit was significantly less than the historical net profit in the period under examination (see table 7.7).

Therefore, the general conclusion which can be drawn is that, indeed, inflation has a serious impact on the earnings of the (quoted) Greek companies. Notwithstanding the considerable monetary gains made by the companies of the sample, for the majority of them the restated earnings decreased materially, and at least for some of the sample firms the decrease was almost dramatic. This is especially true in the years with the highest inflation rate of the period under examination (i.e. years 1979 to 1981 - see table 7.7).

The impact of inflation seems to be different for different firms (see table 7.7). Even for the same company the impact of inflation seems to be different in different years, at least for some of the companies of the sample.

The different impact of inflation on different companies may be explained by the different inflation-sensitive financial characteristics of the companies. For example, capital intensive vs non-capital intensive

companies, young vs old firms, low leveraged vs high leveraged companies, low inventory turnover firms vs high inventory turnover firms (see tables 4.5 to 4.7).

As for the different impact of inflation on the same company in different years, it may be explained mainly by the unstable financial policy which seems to follow at least enough Greek companies during the period under examination. A second reason may be the unstable volume of business activity of some of the sample firms (and hence the unstable inventory turnover) as well as the particular composition of fixed assets (i.e. old vs young) in particular years. Compare, for example, the historical and restated net earnings of companies No 30 and 31 for which their net monetary position (NMP) expressed as a per cent of total assets, as well as their inventory turnover (IT) are given below:

	1976	1977	1978	1979	1980	1981
NMP	(0.12)	(0.21)	(0.32)	(0.49)	(0.57)	(0.65)
No 30 IT	9.05	4.31	4.00	3.79	6.05	9.63
NMP	(0.39)	(0.50)	(0.17)	(0.59)	(0.65)	(0.65)
No 31 IT	6.37	5.96	6.53	6.54	5.31	6.44

The found serious impact of inflation upon earnings may have serious implications for decision making since earnings are taken into account for such important decisions as imposition of taxes, dividends to be paid, measurement of business performance etc. Because of it, four financial parameters, well respected by people who are interested in the affairs of the firm, have been

chosen for further empirical analysis. This is done in the next section.

7.3. Further Empirical Analysis of Selected Financial Parameters

7.3.1. Significance of the Financial Parameters Selected.

The four financial parameter selected for further empirical analysis are: effective tax rate, dividend payout ratios, return on net worth and return on total investment.

The main criterion employed for their selection was their extensive use made in previous empirical studies concerned with the usefulness of inflation accounting (see for example Petersen (1973), Price Waterhouse and Co. (1980), Berry and Gray (1982). The extensive use of these parameters, in turn, is due to their significance for decision making for a variety of users of accounts. This significance has been well documented in the accounting literature. Hence, it would serve no purpose to dwell on the importance of these parameters in detail. Only a few words will be written with respect to their importance for the Greek case.

With respect to the effective tax rate (ie tax rate expressed in terms of GPPA) expected relief from taxation is one of the reasons cited for preference for inflation accounting (see Section 3.5.5). Since the Greek businessmen often complain that during inflation, taxes are imposed upon capital rather than upon real income (ie

income measured in inflation accounting terms), it would be interesting to see if this is actually the case in Greece.

As regards the dividend payout ratio, in the Greek case it would be interesting to see if dividends are paid out of capital rather than income. If this is actually the case, then the existing dividend policies of the Greek firms as well as the Greek law, which requires the distribution of a certain percentage of net profit (ie 30% and 35% during the period under examination), may warrant modification.

Finally, with respect to the importance of the return on owner's and total investment, as Jones wrote many years ago "[i]t is doubtful if any relationship in business and finance is as important as the ratio of net business income to capital employed" (Jones (1956) p. 1). This should be especially true in times of inflation due to the "inflationary" gains reported under HCA as well as due to the erosion of capital employed, which is not taken into account under HCA as well. In the Greek case, in particular, if indeed the real return (ie return measured in GPPA terms) is significantly lower than that under HCA then the prices control imposed by the Greek Government may warrant alteration.

Having established the significance of the parameters, in the next sub-section the way in which each one of these parameters was computed as well as the reasons underlying that computation are discussed.

7.3.2. Computation of the Effective Tax Rate

The taxation on corporate earnings in Greece is different from the corresponding taxation in the UK in that domestic corporations are taxed only on retained profits. Dividends are taxed separately as income from dividends while directors' fees are taxed in a different way. Yet, not all of the retained profits are taxable. In order to encourage reinvestment, the Greek government has issued laws or decrees which, under specified conditions, exempt from taxation earnings used for capital investment and business expansion in general.

The tax rate imposed on corporate profits during the period under examination was 38.4% (ie 35% tax rate plus a deductable surtax of 15% in favour of OGA - Orgainzation for Agricultural Securities - levied on the mentioned rate) for the listed (with the Athens Stock Exchange) companies, and 43.4% for the unlisted companies.

In the Greek income statements and especially in the "Appropriation of Profits" account a provision of the income taxes of the year is usually made (see table 7.10). This provision, however, refers to taxable profits retained and shown in the mentioned account as well as to any possible differences between net profit of the year, as it has been determined by the firm, and net profit as it is going to be determined by the tax authorities (the reader should recall the pervassiveness of the legalistic approach to the Greek financial

T a b l e 7.10

Company No 1 - Appropriation of Profit 1976-1981 (in thousand cre)

Accounts	1976		1977		1978	
	HCA	GPPA	HCA	GPPA	HCA	GPPA
Net Profit	41,455	38,289	26,675	25,359	22,364	9,911
Plus R.P* and/or R.P.Y*	6,986	6,986	3,943	3,943	357	357
Profit for DISTRIBUTION	48,441	45,275	30,618	29,302	22,721	10,268
Distributed as follows;						
1. Provision for inc. taxes	2,866	2,866	765	765	601	601
2. Dividends	42,000	42,000	27,563	27,563	19,845	19,845
3. Directors' Fees	1,000	1,000	600	600	1,000	1,000
TOTAL DISTRIBUTED	45,866	45,866	28,928	28,928	21,446	21,446
4. Ordinary reserve	2,073	NA	1,334	NA	1,118	NA
5. Non-taxable reserves	--	--	--	--	--	--
6. Retained profit	502	NA	356	NA	157	NA
TOTAL RET. PROFIT	2,575	(591)	1,690	374	1,275	(11,178)

Accounts	1979		1980		1981	
	HCA	GPPA	HCA	GPPA	HCA	GPPA
Net Profit	9,873	999	952	(20,023)	76	(7,977)
Plus R.P* and/or R.P.Y*	10,919	10,919	9,393	9,393	--	--
Profit for DISTRIBUTION	20,792	11,918	10,345	(10,630)	16	(7,977)
Distributed as follows;						
1. Provision for inc. taxes	687	687	155	155	73	73
2. Dividends	18,522	18,522	10,187	10,187	--	--
3. Directors' Fees	1,000	1,000	--	--	--	--
TOTAL DISTRIBUTED	20,209	20,209	10,342	10,342	73	73
4. Ordinary reserve	494	NA	3	NA	3	NA
5. Non-taxable reserves	--	--	--	--	--	--
6. Retained profit	89	NA	--	--	--	--
TOTAL RET. PROFIT	583	(8,291)	3	(20,972)	3	(7,904)

* Retained profit of previous years.

Reserves of previous years.

reporting).

Hence, the income tax figure appearing in the "Appropriation of Profits" account is not only an **estimated** one but also very subjective to rely on. For example, one company may judge that 20% of the "public relations expenditures" account will not be considered as expenses by the Inland Revenue Service while another company may judge that 30% or more of the same expenditures will not be considered as expenses from a tax accounting point of view.

The fact that the estimated income tax figure may be very subjective may affect the reliability of a ratio for which net profit after taxation is used for its computation (eg ROI) but not the reliability of the effective tax rate as far as the historical tax rate applied to yield the estimated income tax figure is known. However, some Greek companies do not make any provision for income taxes though income taxes are due. In such a case the effective tax rate cannot be computed.

In order not to be dependent on whether or not a firm makes a provision for income taxes, the following method was adopted in computing the ratio:

To overcome this problem and give the reader a concrete idea of what would be the effective tax rate under the best sircumstances the following methodology was adopted in computing the ratio:

It was assumed that all reported (historical) net profits were retained and all were taxable. Then, by dividing historical net profits before taxes by adjusted

net profits and then multiplying the ratio by 38.4% the actual effective tax rate was obtained (see table 7.11).

As the reader may have realized, the so obtained effective (real) tax rate would be the actual one if and only if the assumption employed here actually true. Such an assumption however, is completely unrealistic. Under the Greek law at least 35% of HC net profit is distributed as dividends.

Hence, and taking into account that the effective tax rate is given by the formula

$$\frac{\text{Taxes paid}}{\text{GPPA retained taxable profit (R.T.P)}}$$

where GPPA R.T.P = GPPA net profit - (HCA) Distributed profit except taxes

for those companies for which the GPPA net profit is less than the HCA profit the actual effective tax rate is much bigger than that given in table 7.11. The opposite holds true for those companies for which the GPPA net profit is bigger than the HCA net profit.

Specifically, supposing that for one of the companies presented in table 7.11 the GPPA net profit is 35% less than the HCA net profit and that 35% of the historical net profit was distributed as dividends. In such a case the actual effective tax rate is by 40.77% greater than that presented in table 7.11.

In the adjusted net profits figure used for computing the effective tax rate monetary gains/losses were included. The reasons for their inclusion have been explained in Section 6.14 as well as in Section 3.5.5.

7.3.3. Computation of the Dividend Payout Ratio and of Return on Net Worth and Total Assets

Under Greek law (Companies Act 2190/1920) 5% of net profits (before taxation) must be retained (ie Ordinary Reserve which is taxable). All other profits (including retained earnings of previous years) may be distributed as dividends, and as remuneration fees, or other fringe benefits, to corporate managers and directors.

In computing the HCA and GPPA dividend payout ratio, dividends as well as the so called directors' fees were divided by historical and adjusted net profits respectively. This treatment was followed because the main purpose of computing the ratio is to see if profits generally are distributed out of capital rather than out of net income.

Someone could argue that the ratio, as computed, may not reveal whether the Greek law concerning distribution of profits as dividends warrants modification or whether the dividend policies of the firms should be reconsidered (ie directors' fees rest entirely upon managers' discretion). Yet, directors' fees constitute a very small portion of the dividends of the year so that for them to alter the basic information content implied by the name of the ratio (see, for example, table 7.10 which is representative in this respect).

In some years retained profits (or distributable reserves) of previous years were distributed as dividends of the year too. In such a case the dividend payout

ratio cannot tell whether dividends are paid out of capital rather than out of income unless the retained profits (or reserves) of previous years are included too in the denominator of the ratio. Hence, a second dividend payout ratio was computed as well which includes retained profits (or reserves) of previous years. These profits were not restated when computing the real (GPFA) dividend payout ratio because they are supposed to represent pocket money of current general purchasing power.

To compute the return on net worth net income was divided by net worth. Net income before taxes rather than net income after taxes was taken because of the mentioned peculiarity of the Greek tax system as regards corporate profit. Besides, the estimated income tax reported in the income statement seems to be too subjective to rely on according to what has been mentioned in the previous sub-section. To compute the return on total assets the interest expenses were added to net profit and the total was then divided by total net assets.

Having explained the way in which each one of the four financial parameters was computed, in the next sub-section the results obtained are discussed.

7.3.4. Discussion of the Results of the Financial Parameters Selected

The way in which the effective tax rate was computed suggests that the greater the difference between historical and adjusted net profit the greater the difference between nominal (historical) and effective tax rate. As mentioned, it was found that the impact of inflation on earnings was serious (i.e. decreased restated net profit). Because of it generally speaking the effective tax rate was much higher than the nominal one in all years of the period under examination (see table 7.11).

Year after year the difference between effective and nominal tax rate bacame greater and greater. The only exception was the year 1977 in which, due to the considerable amount of monetary gains enjoyed by the sample firms in comparison to those gains enjoyed in 1976, the restated earnings of 1977 were not as different from the corresponding historical ones as it was the case in 1976.

To be more specific, in each one of the years 1976 to 1981 (and supposing that all HCA profits were retained and all were taxable), six, four, two, eight, eight and ten companies respectively paid **all** their taxes out of capital rather than out of real earnings. Additionally, 4, 2, 3, 2, 3 and 5 firms respectively paid some of their taxes out of capital rather than earnings (effective tax rate: 102.0%-356.6%). Yet, in each one of these years for

Table 7.11

Effective Tax Rate (%)

Comp	HCA 1976-1981	1976	1977	1978	1979	1980	1981
1	38.4	41.6	40.4	86.6	379.5	ATPDC*	NTP*
2	38.4	58.4	76.3	75.6	77.4	ATPDC	NA
3	38.4	40.8	43.4	52.2	44.6	81.5	ATPDC
4	38.4	45.3	28.4	57.0	ATPDC	ATPDC	NA
5	38.4	81.3	64.9	334.6	ATPDC	ATPDC	ATPDC
7	38.4	66.5	77.4	93.5	ATPDC	ATPDC	ATPDC
8	38.4	107.2	89.1	ATPDC	ATPDC	ATPDC	ATPDC
9	38.4	34.1	30.8	42.2	56.1	45.2	121.0
10	38.4	47.3	51.1	69.1	124.6	85.5	356.6
11	38.4	ATPDC	30.8	40.4	14.9	39.1	311.9
12	38.4	52.0	45.3	33.3	23.6	NTP	106.5
13	38.4	45.9	43.3	37.7	45.8	36.2	ATPDC
14	38.4	24.6	17.2	NTP	6.4	NTP	NTP
15	38.4	NTP	NTP	NTP	NTP	NTP	NA
16	38.4	41.0	24.6	23.6	18.7	16.8	8.2
17	38.4	55.0	90.6	NTP	ATPDC	NTP	NTP
18	38.4	50.8	84.7	62.4	82.0	41.9	ATPDC
19	38.4	122.6	39.8	47.7	72.8	123.7	NA
20	38.4	ATPDC	ATPDC	117.0	NTP	NTP	NTP
21	38.4	ATPDC	ATPDC	ATPDC	ATPDC	64.9	52.8
22	38.4	ATPDC	65.6	41.3	26.0	102.0	17.4
23	38.4	29.7	37.0	51.0	45.5	26.8	ATPDC
24	38.4	93.0	ATPDC	73.8	45.8	46.0	ATPDC
25	38.4	40.9	44.3	133.0	ATPDC	337.2	47.0
26	38.4	109.0	81.7	50.7	55.2	70.8	80.0
27	38.4	202.2	108.0	74.9	74.7	ATPDC	ATPDC
28	38.4	NTP	NTP	NTP	ATPDC	ATPDC	ATPDC
29	38.4	ATPDC	ATPDC	NTP	NTP	NTP	153.5
30	38.4	ATPDC	156.0	28.9	5.2	2.8	NTP
31	38.4	20.2	26.7	61.1	25.5	10.8	13.9

* All taxes paid out of capital (negative GPPA earnings).

No taxes paid (HCA losses).

a few firms (i.e. 3 to 7 companies at the most) the effective tax rate was lower or considerably lower than the nominal one. For the overwelming majority of the remaining companies the effective tax rate was between 10% to 99% higher than the historical one.

Yet, actually the situation with regard to the effective tax rate should be far worse than it appears in table 7.11. This is so because, as mentioned, the effective tax rate should be computed by use of the formula

Taxes paid / GPPA retained taxable net profit

and not by use of the formula

Taxes paid / GPPA net profit

on which the figures of table 7.11 are based. Taking, now, into account that for the majority of the sample companies the GPPA net profit was at least 50% less than their corresponding HCA net profit, as well as that the majority of these companies paid more than half of their HCA net profit as dividends, the reader can get a good idea of how worse (than that presented in table 7.11) is actually the situation regarding effective tax rate of the period 1976-1981.

If the adjusted net profit before monetary gains/losses had been used for computing the effective tax rate on the grounds that "[t]he gain on monetary items does not provide immediate taxpaying ability" (see Davidson-Weil, 1978, p.207), then for the overwelming majority of the companies, if not for all companies of the sample, all taxes would have been paid out of capital

rather than out of real earnings.

In concluding, the effective tax rate in times of inflation seems to be much higher than the nominal one for the majority of the sample companies, even when monetary gains/losses are included in the taxable income. Many Greek companies seem to pay taxes out of real capital. Therefore, the often heard complains of the Greek businessmen that in these inflationary years they pay taxes out of capital rather than out of (real) earnings is justified by the finding of the study.

This finding is of significance as regards managerial and (especially) governmental decision making in the sense that it was pointed out empirically that, indeed, in times of inflation there is a problem with respect to taxation of corporate profit (i.e. the reader should keep in mind that since the Greek firms are highly leveraged, up to now nobody could tell for sure whether or not the mentioned complains were justifiable).

This problem seems to be a serious one if the argument is accepted that taxes should be paid after the general purchasing power of shareholders' capital has been maintained. This is because the taxes paid to the government are considerable. Thus, for the years 1976 and 1981 the provision for corporate taxes (as computed in the Greek case see Section 7.3.2) for those companies of the sample which had made a net profit constituted in the aggregate 36.24% and 38.40% respectively of their HCA net profit (i.e. HCA net profit 1,108,953,000 and 2,167,800,000 drs respectively, and taxes due 401,945,000

and 832,510,000 drs). At the same time these taxes accounted for 60.17% and 80.35% respectively of the restated net profit (inclusive the monetary gains/losses).

The fact that the taxation of corporate profit during inflation seems to be a serious problem, especially if inflation runs at more than 20% per year, does not necessarily mean that the Greek government should switch from the HCA basis of taxing corporate profit to the GPPA basis. Whether or not a change in the present taxation basis should be made (and if so how exactly it should be implemented) or whether or not a tax relief should be provided through, for example, the use of accelerated depreciation allowances is a very serious and difficult matter which undoubtedly goes beyond the scope of this study. The study pointed out that a problem seems to exist and it warrants attention on behalf of the decision-makers involved. This is of importance by itself.

With respect to the dividend payout ratio, the first thing which is noticed from table 7.12a is the great portion of historical net earnings (before taxes) paid out as dividends (and remuneration fees). One plausible explanation of this policy of the Greek companies may be that dividends constitute the main source of income for the owner-shareholder of the Greek firm, which is a purely familly controlled firm (Section 3.4.3). Perhaps that is why company No 14 in the years 1978 and 1980 paid dividends (in the form of interest) to preferable

Table 7.12a

Dividend Payout Ratio; Dividends / Net profit (%)

Comp	1976		1977		1978		1979		1980		1981	
	HCA	GPPA	HCA	GPPA	HCA	GPPA	HCA	GPPA	HCA	GPPA	HCA	GPPA
1	103,7	112,3	105,6	111,1	93,2	210,6	197,7	1954,1	107,0	DPONE*	NDP#	NDP
2	61,0	92,7	61,3	121,9	65,9	88,6	52,6	88,5	84,3	DPONE	NA	NA
3	61,6	65,5	61,4	69,4	45,1	61,4	46,3	53,8	53,9	114,6	92,1	DPONE
4	84,7	100,1	90,1	66,8	86,2	128,2	DPONE	DPONE	91,2	DPONE	NA	NA
5	47,9	101,4	62,2	105,1	73,4	640,2	118,2	DPONE	107,6	DPONE	88,1	DPONE
7	87,3	151,6	85,2	171,5	90,4	220,3	89,8	DPONE	93,6	DPONE	82,8	DPONE
8	81,6	227,8	78,6	182,3	90,8	DPONE	87,5	DPONE	88,5	DPONE	DPONE	DPONE
9	91,3	81,0	91,0	73,1	91,5	102,0	91,4	133,6	90,4	106,7	86,4	272,6
10	67,4	83,1	90,1	120,0	123,0	221,8	90,4	293,2	89,0	195,3	49,6	461,8
11	NDP	NDP	87,0	69,7	76,5	80,7	77,6	30,1	81,8	83,4	70,1	565,9
12	85,8	116,4	85,6	110,0	81,5	70,9	28,1	17,3	NDP	NDP	NDP	NDP
13	60,1	71,9	75,9	85,7	55,7	54,7	57,3	68,4	59,9	56,6	73,3	DPONE
14	91,7	58,8	90,8	40,9	DPONE	DPONE	45,5	7,6	DPONE	3,8	DPONE	DPONE
15	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NA	NA
16	37,8	40,0	46,1	29,6	35,4	21,8	32,4	15,3	20,0	8,8	52,7	11,2
17	42,2	60,6	46,3	109,4	NDP	NDP	44,0	DPONE	NDP	NDP	NDP	NDP
18	14,3	19,0	19,0	41,9	30,3	49,3	34,7	74,0	30,3	33,1	30,4	DPONE
19	87,5	279,0	70,3	72,9	80,3	99,8	72,0	136,3	69,9	225,0	NA	NA
20	NDP	NDP	NDP	NDP	69,6	213,3	NDP	NDP	NDP	NDP	NDP	NDP
21	90,7	DPONE	92,3	DPONE	80,3	DPONE	57,0	DPONE	36,9	62,4	36,0	49,5
22	80,8	DPONE	69,2	118,3	84,2	90,7	55,1	37,4	62,3	165,7	45,5	20,7
23	44,0	34,0	94,5	91,0	87,7	116,7	63,1	74,9	42,1	29,4	81,6	DPONE
24	34,4	83,4	944,5	DPONE	60,5	116,2	40,2	48,0	67,1	80,0	84,8	DPONE
25	51,8	55,1	32,6	37,7	79,3	274,8	67,0	DPONE	37,6	330,3	43,8	53,6
26	93,7	266,0	83,3	177,1	97,3	128,6	96,0	138,2	91,8	169,3	95,9	200,0
27	91,9	484,0	51,0	143,4	53,0	103,4	54,2	105,6	59,6	DPONE	47,0	DPONE
28	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	32,5	DPONE
29	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP
30	95,0	DPONE	91,8	372,9	94,6	71,2	91,7	12,4	94,6	6,9	NDP	NDP
31	41,9	22,0	67,0	46,7	95,3	151,9	93,0	61,8	92,8	26,2	91,6	33,0

* Dividends paid out of negative earnings.

No dividends paid (due to losses).

T a b l e 7.12b

Dividends Payout Ratio: Dividends / Net profit - Reserves (%)

Comp	1976		1977		1978		1979		1980		1981	
	HCA	GPPA	HCA	GPPA	HCA	GPPA	HCA	GPPA	HCA	GPPA	HCA	GPPA
1	88,8	95,0	92,0	96,1	91,7	208,0	93,4	168,8	98,5	DPONE*	NDP*	NDP
2	61,0	92,7	61,3	121,9	65,9	88,3	52,6	88,5	84,3	DPONE	NA	NA
3	45,7	47,8	45,4	49,8	44,6	60,6	41,9	48,0	47,5	90,7	69,4	DPONE
4	84,7	100,1	90,1	66,8	86,2	128,2	100,0	68,2	91,2	DPONE	NA	NA
5	47,3	98,8	51,8	104,0	66,0	323,8	90,1	1064,4	89,8	DPONE	86	DPONE
7	86,9	150,0	84,2	168,0	89,6	215,2	89,6	DPONE	93,1	DPONE	82,8	DPONE
8	81,6	227,8	78,6	182,3	90,8	DPONE	87,5	DPONE	88,5	DPONE	DPONE	DPONE
9	91,3	81,0	91,0	73,0	91,0	101,9	91,4	133,6	90,4	106,7	86,4	272,4
10	67,4	83,1	90,1	120,0	93,2	140,7	90,4	293,2	89,0	198,3	49,6	461,8
11	NDP	NDP	87,0	69,7	74,8	78,8	76,7	80,0	81,6	88,2	70,1	569,9
12	85,4	115,8	85,4	109,8	81,4	70,8	28,1	17,3	NDP	NDP	NDP	NDP
13	57,4	68,0	71,4	80,0	53,6	53,0	57,0	68,0	59,0	55,7	70,6	DPONE
14	91,7	58,8	90,8	40,9	DPONE	DPONE	45,5	7,6	DPONE	8,8	DPONE	DPONE
15	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NA	NA
16	37,8	40,0	46,1	29,6	35,4	21,8	32,1	15,8	15,8	6,8	35,0	10,5
17	42,2	60,6	46,3	109,4	NDP	NDP	44,0	DPONE	NDP	NDP	NDP	NDP
18	13,6	17,7	17,8	36,4	29,1	46,2	33,3	68,0	29,3	31,9	25,1	DPONE
19	87,4	278,8	70,3	72,9	80,3	99,8	71,9	136,3	89,6	222,5	NA	NA
20	NDP	NDP	NDP	NDP	69,6	213,3	NDP	NDP	NDP	NDP	NDP	NDP
21	90,4	DPONE	91,8	DPONE	79,5	DPONE	56,7	DPONE	36,9	62,3	36,0	49,4
22	80,8	DPONE	56,3	85,0	84,2	90,7	55,1	37,4	62,3	165,7	45,5	20,7
23	44,0	34,0	94,4	91,0	87,7	116,7	63,1	74,8	42,1	29,4	61,5	DPONE
24	34,4	83,4	85,5	1179,1	60,5	116,2	40,2	48,0	63,4	75,1	73,9	DPONE
25	51,8	55,1	32,6	37,7	79,3	274,8	67,0	DPONE	37,5	329,8	43,4	53,0
26	93,7	266,0	82,4	173,2	97,3	128,6	96,0	138,2	91,8	169,3	95,9	200,0
27	91,9	484,0	51,0	143,4	53,0	103,4	54,2	105,6	59,6	DPONE	47,0	DPONE
28	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	32,5	DPONE
29	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP	NDP
30	91,8	DPONE	90,9	359,3	92,3	70,0	89,1	12,3	90,6	6,8	NDP	NDP
31	41,9	22,0	66,9	46,6	95,0	151,2	93,0	61,8	92,8	26,2	91,6	33,0

* Dividends paid out of negative earnings.

\# No dividends paid (due to losses).

capital, out of negative net profit plus reserves (i.e. according to Greek law dividends in the form of interest may be paid to preferable shares).

The second thing to be noticed from tables 7.12a and (especially) table 7.12b is the fact that, generally speaking, year after year the difference between HCA and GPPA dividend payout ratio becomes greater and greater: more and more companies paid part (or all) of their dividends out of capital rather than out of real earnings. Especially in the years with the highest rate of inflation (i.e. 1979 to 1981) the difference between HCA and GPPA dividend payout ratio was the greatest. In these years five, seven and eleven companies respectively paid all dividends out of capital rather than out of real earnings.

Not only the years 1979 to 1981 but also the year 1978 was a year during which a great number of companies paid dividends out of capital. This seems to be somewhat strange taking into account that 1978 was the year with the lowest increase in the rate of inflation in the period under examination, and hence the difference between historical and restated net profit was not as striking as it was in the years 1979 to 1981. The explanation for this is the following:

Whether or not dividends are paid out of capital rather than earnings in a given year depends on the interaction of two factors: (a) How much less than the historical profit is the restated net profit of the year. (b) How big is the historical dividend payout ratio of

the year. For example, if a company's historical and restated net profits are 10,000,000 drs and 5,000,000 drs respectively and 40% of the historical net profit is paid out as dividends then the GPPA dividend payout ratio is 80%. If, however, 60% rather than 40% of the historical net profit of the year is paid out as dividends then the GPPA dividend payout ratio becomes (6,000,000:5,000,000=) 120%.

With the exception, perhaps, of the year 1980, the year 1978 was the year with the highest historical dividend payout ratio in the period under examination[1]. Because of it (as well as because of the difference between historical and restated net profit) more than half of the companies of the sample paid part of their dividends out of capital rather than earnings, in 1978.

Yet, there were some companies (i.e. 5, 7, 8, 6 and 3 companies respectively in the years 1976 to 1981) which not only did not paid dividends out of capital but also their dividend payout ratio expressed in real (GPPA) terms was less than the historical ratio. Additionally, in the years 1976 and 1977 there were 4 and 2 companies respectively for which the GPPA and the HCA dividend payout ratios were very close (i.e. less than 10% difference).

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1. Taking into account that in 1978 there was not a very high increase in the inflation rate so that proportionately more dividends than in the previous years to be paid out in order to compensate somewhat for the loss in the general purchasing power of shareholders' money, a plausible explanation for the high historical dividend payout ratio may be the good expectations of future earnings. Indeed, for the majority of the firms of the sample 1979 was a much better year than 1978 as regards historical earnings.

In concluding, as a result of the high nominal (HCA) dividend payout ratio, and the great difference between HCA and GPPA net profit, the real dividend payout ratio was, on the average, at least twice as high as the historical dividend payout ratio in each one of the years under examination. On the average, in each year about half of the sample firms paid dividends out of real capital rather than out of earnings. What is worse, on the average, in each year one sixth of the companies paid **all** dividends out of real capital (i.e. negative restated net profit - see table 7.12b).

Five seem to be the possible explanations for the high nominal (and real) dividend payout ratio. These explanations are not mutually exclusive.

Firstly, it seems that for the Greek owner-shareholder the business income is the only source of income (i.e. family-controlled firms - see Section 3.4.3). The more the inflation the more the imperative the need for income distribution.

Secondly, the Greek businessman prefers, to invest his profit in other businesses which are more profitable and less risky than his manufacturing firm (Section 3.4.3).

Third, perhaps the tax system itself encourages income distribution up to a certain extent (i.e. under the Greek law the income from dividends can be taxed either separetely as income from dividends or as personal income along with other personal incomes; what basis is preferable for the shareholder depends on the situation

at hand).

Four, perhaps Greek businessmen prefer to consume their business income rather than to reinvest it in their business because they "... are generally inclined to indulge in conspicuous consumption" (Section 3.5.1).

Finally, and perhaps more importantly, the Greek businessman is not fully aware of the so called "inflationary gains" so that to realize that part of what is distributed as income of the period actually constitutes distribution of capital, and more specifically distribution of capital maintainance reserves.

Whatever are the possible explanations the fact remains that if the Greek businessmen continue to follow the same dividend policy, then in the long-run the operating capability of their firms will be impaired seriously if the specific as well as the general price indeces increase at about the same rate. This will not happen if and only if the Greek firms can borrow more and more money year after year to pay dividends and the interest rate is equal or less than the increase in inflation.

With respect to the return on investment, the first thing to be noticed from table 7.13, which presents return on total investment, is the low profitability of the Greek companies already mentioned in Section 3.4.3. Despite the inflationary gains made by the sample companies due to the high rates of inflation experienced in Greece during the period under examination, in the

Table 7,12

Return on Total Investment (ROTI), %

Comp	1976		1977		1978		1979		1980		1981	
	HCA	GPPA	HCA	GPPA	HCA	GPPA	HCA	GPPA	HCA	GPPA	HCA	GPPA
1	10,1	8,7	5,6	4,6	5,4	3,1	4,0	2,4	6,0	2,8	5,6	3,6
2	15,7	9,9	15,7	8,2	15,2	10,5	25,4	12,9	17,6	-4,8	NA	NA
3	5,1	3,8	6,3	4,4	6,9	4,0	7,3	4,3	7,8	3,4	7,6	1,1
4	7,9	6,8	7,4	7,2	9,6	7,6	6,5	6,1	11,9	6,6	NA	NA
5	14,6	10,8	15,8	11,1	16,3	8,7	15,1	8,9	16,3	8,0	15,8	8,0
7	15,4	10,4	14,2	8,8	11,9	6,6	14,0	4,4	9,6	2,6	13,0	1,1
8	9,0	6,4	13,2	9,8	12,1	7,0	12,9	7,7	17,9	9,6	18,0	8,8
9	8,7	7,9	9,2	8,3	11,3	8,7	12,3	7,8	13,5	8,8	12,9	6,9
10	15,3	12,2	10,2	7,5	9,4	6,5	12,6	6,8	13,1	8,0	21,3	7,5
11	-1,4	-0,6	9,1	7,3	9,3	6,8	11,3	10,1	12,2	7,6	13,7	6,5
12	6,7	5,5	7,8	6,6	8,4	8,0	9,2	9,0	7,4	7,3	12,0	8,0
13	5,3	3,9	7,7	5,6	10,3	8,1	17,1	10,7	10,5	7,9	8,8	1,3
14	9,6	10,1	8,9	8,9	5,7	6,0	9,5	10,9	7,3	10,6	2,0	5,0
15	1,9	-4,3	-4,8	-10,7	1,6	-6,3	-4,1	-14,5	-0,1	-20,4	NA	NA
16	9,5	8,9	7,0	8,4	8,2	10,0	10,4	14,2	9,2	12,7	6,6	9,9
17	13,2	10,6	10,6	7,1	6,0	1,6	12,0	8,4	9,7	8,3	8,4	3,9
18	17,0	11,9	13,8	6,2	17,1	7,7	17,4	6,3	14,3	8,5	16,7	4,0
19	4,3	2,0	11,1	9,4	11,2	8,4	13,9	7,8	12,0	6,0	NA	NA
20	5,2	1,4	6,3	3,7	9,2	6,7	5,6	6,7	6,5	0,2	2,4	4,6
21	4,0	-1,9	4,6	-0,5	5,6	-4,8	8,8	-5,5	26,0	11,4	31,3	16,6
22	12,3	-2,0	13,0	9,7	11,7	11,0	15,5	17,0	14,0	11,5	14,4	17,5
23	12,7	12,9	8,7	7,9	10,5	8,8	13,9	11,2	15,4	15,5	11,0	6,2
24	9,5	5,6	5,5	3,9	12,0	8,6	17,0	13,5	15,3	12,5	15,8	9,9
25	12,5	11,4	10,1	9,0	9,3	7,3	10,3	5,1	15,6	7,7	20,0	15,4
26	11,2	4,8	14,9	6,9	22,2	15,9	14,8	9,5	12,3	6,5	13,5	6,3
27	6,1	3,6	12,0	6,1	10,7	6,1	12,3	6,8	11,2	4,1	12,8	3,5
28	2,7	-1,7	0,6	-5,2	0,5	-5,3	4,0	-5,3	6,7	-8,1	13,0	-10,4
29	4,4	2,6	10,1	2,5	2,8	-0,8	2,7	-2,4	1,5	0,2	9,7	2,6
30	5,2	0,6	8,5	2,8	3,2	3,0	1,9	5,8	1,5	6,7	0,7	3,7
31	4,2	4,9	4,1	3,9	8,8	5,7	9,4	6,6	8,4	7,9	9,3	7,1
1-31	8,6	5,5	8,9	5,6	9,4	5,8	10,7	6,4	11,0	5,5	10,6	6,1

first three years of that period (i.e. 1976 to 1978) the return on total investment for the sample firms was significantly below what is considered as a good return (i.e. 10% to 12%) in the English speaking countries. In the highly inflationary next three years (i.e. 1979 to 1981) the profitability of the sample firms improved mainly due to the higher inflationary gains of that period rather than due to real earnings (see table 7.13). Thus, the majority of these companies had a historical return above 10% (i.e. 10.7%, 11.0% and 10.6% on the average)

The per cent difference between HCA and real (GPPA) return on total investment is bigger than the per cent difference between historical and restated net profit per se (i.e. compare table 7.14 with table 7.7). The reason for this is the following:

The return on total investment is affected by two factors: (a) Amount of net profit plus interest expenses (b) Amount of total assets. Under GPPA net profit plus interest expenses is less than the historical one for the majority of the sample firms. On the other hand, restated total assets is always bigger than historical total assets. The result of the interaction of these two factors is the mentioned bigger (than that implied by the net profit figure per se) difference between HCA and GPPA profitability.

Generally speaking, on the average there is an understatement of real return on total investment of

Table 7.12

Per Cent Overstatement (Understatement) of Real ROTI

Company	1976	1977	1978	1979	1980	1981
1	(13,86)	(17,85)	(42,59)	(40,00)	(53,33)	(42,42)
2	(36,94)	(47,77)	(30,92)	(49,21)	(127,27)	NA
3	(25,49)	(30,15)	(42,02)	(41,09)	(55,41)	(85,52)
4	(13,92)	(2,70)	(20,83)	(5,55)	(44,53)	NA
5	(26,02)	(29,74)	(46,62)	(41,05)	(50,92)	(52,38)
7	(32,46)	(38,02)	(42,01)	(68,57)	(72,91)	(91,53)
8	(28,88)	(25,75)	(42,14)	(40,31)	(46,35)	(48,93)
9	(9,19)	(9,78)	(23,00)	(35,58)	(34,81)	(45,51)
10	(20,26)	(26,47)	(30,85)	(46,03)	(38,93)	(62,91)
11	57,14	(19,78)	(26,88)	(10,51)	(37,70)	(49,63)
12	(17,91)	(15,38)	(4,76)	(2,17)	(1,35)	(33,33)
13	(26,41)	(27,27)	(21,35)	(37,42)	(24,76)	(85,22)
14	5,20	(0)	5,26	14,73	45,20	150,00
15	(326,31)	(122,91)	(493,75)	(253,65)	(20500,00)	NA
16	(6,31)	20,00	21,95	36,53	38,04	50,00
17	(19,69)	(33,01)	(73,33)	(30,00)	(14,43)	(53,57)
18	(30,00)	(55,07)	(54,97)	(63,79)	(40,55)	(75,04)
19	(53,48)	(15,31)	(25,00)	(43,88)	(50,00)	NA
20	(73,07)	(41,26)	(27,17)	19,64	(95,92)	91,66
21	(147,50)	(110,86)	(185,71)	(162,50)	(56,15)	(46,96)
22	(116,26)	(25,38)	(5,98)	9,67	(17,85)	21,52
23	1,57	(9,19)	(16,19)	(19,42)	0,00	(43,63)
24	(4,05)	(29,09)	(28,33)	(20,58)	(18,30)	(37,34)
25	(8,80)	(10,89)	(21,50)	(50,48)	(50,64)	(23,00)
26	(57,14)	(53,69)	(28,37)	(35,81)	(47,15)	(53,33)
27	(40,98)	(49,16)	(42,99)	(44,71)	(63,39)	(72,65)
28	(162,96)	(966,66)	(1160,00)	(232,50)	(220,89)	(180,00)
29	(40,90)	(75,24)	(128,57)	(188,88)	(86,66)	(73,19)
30	(88,46)	(67,05)	(6,25)	205,26	346,66	428,57
31	16,66	(4,87)	(35,22)	(29,78)	(5,95)	(23,65)
Average M,Absolute Diff,	(47,33) 52,70	(64,67) 66,00	(89,33) 91,14	(43,65) 62,71	(714,35) 743,01	(20,76) 77,82

about 50% in each one of the years under examination. If in 1980 the so extreme value of company No 15 is not taken into account. (i.e. on the average, in each one of the years 1976 to 1981 there is an understatement of real return on total investment for 26 out of the 30 companies of the sample). As for the mean absolute difference between GPPA and HCA expressed as a per cent of the latter, it is well above 50%.

What was written about historical and real return on total investment applies basically to the real return on owner's investment (see table 7.15 and 7.16). Addittionally, it should be mentioned that, on the average, leverage seems to have a good effect on profitability of own capital employed, when measured in HCA terms, but a rather bad effect when measured in GPPA terms. The reason for this is the fact that equity expressed in GPPA terms becomes very large in comparison to the historical equity. As a result real return on net worth becomes so small so that to be finally less than the adjusted interest paid to foreign capital. If historical return on net worth was much higher than that found then leverage would have a favourable impact as well when measured in GPPA terms.

In concluding, with the exception of few companies, the real return on investment of the sample companies is far less than it looks under HCA. In other words, it seems that inflation affects seriously the profitability of the quoted Greek firms. This finding (as well as the findings regarding effective tax rate and real dividend

Table 7.15

Return on Owner's Investment (ROOI) - %

Comp	1976		1977		1978		1979		1980		1981	
	HCA	GPPA	HCA	GPPA	HCA	GPPA	HCA	GPPA	HCA	GPPA	HCA	GPPA
1	21,7	15,7	10,1	6,9	8,1	2,4	3,7	0,2	0,4	-3,3	0,3	-1,0
2	22,6	12,1	22,2	9,1	22,6	13,2	32,4	14,1	23,3	-7,4	NA	NA
3	5,1	3,0	6,7	3,3	8,7	3,3	8,2	3,0	6,5	1,1	4,5	2,1
4	7,8	5,0	5,3	4,8	6,9	2,8	-4,7	-0,9	7,7	-2,7	NA	NA
5	11,3	4,6	18,0	9,0	14,9	1,4	9,5	-1,2	7,1	-5,0	8,6	3,9
7	23,7	13,0	19,2	8,7	15,8	5,6	18,0	-1,6	10,6	-3,6	20,4	-3,3
8	7,8	2,1	8,5	2,8	5,0	-2,1	3,7	-2,9	5,3	-5,6	-1,1	-7,9
9	10,3	7,3	11,2	7,6	14,3	6,2	17,8	4,9	17,5	4,8	15,2	1,3
10	21,2	15,6	15,8	9,8	11,0	4,6	14,9	2,9	15,0	3,6	35,3	2,0
11	-17,9	-9,4	7,4	4,5	8,3	3,4	8,2	7,0	7,7	2,0	9,0	0,2
12	8,3	5,2	8,2	4,9	9,3	7,2	6,4	5,8	6,7	-0,7	7,7	1,0
13	7,9	4,2	10,2	5,1	19,8	10,4	34,5	13,1	30,7	12,0	12,6	-3,0
14	12,1	12,0	4,6	5,6	-9,0	-1,3	3,6	8,4	-0,8	11,6	N.E*	-22,8
15	0,0	-7,8	-9,7	-15,9	-0,4	-10,1	-9,2	-21,4	-8,5	-27,5	NA	NA
16	17,5	12,9	16,2	17,7	24,3	24,0	36,0	34,2	33,5	29,5	15,6	22,7
17	14,2	6,9	14,1	3,9	-2,8	-11,3	9,1	-0,7	-2,1	-1,9	-28,0	-18,6
18	24,0	14,0	16,5	4,6	23,8	7,6	24,2	4,9	26,8	8,8	21,1	-0,5
19	11,0	2,3	21,1	12,0	19,6	8,2	28,2	6,4	24,5	2,8	NA	NA
20	1,7	-10,7	5,1	-4,0	16,3	2,2	-19,4	0,1	-29,3	-22,4	-3446,3	-6,8
21	1,6	-5,9	3,2	-2,6	5,0	-7,2	10,2	-6,8	34,7	13,9	43,2	20,7
22	14,2	-8,7	16,6	7,4	21,1	13,5	32,0	26,6	27,9	5,9	32,4	20,8
23	21,0	17,6	6,8	4,2	10,7	4,6	19,4	8,7	30,1	21,0	12,3	-1,3
24	14,0	3,9	0,4	-2,0	17,2	5,2	27,8	11,7	15,0	5,4	12,8	-1,6
25	26,4	19,5	15,3	9,7	8,5	1,7	13,0	-4,6	35,0	2,2	62,9	30,5
26	18,5	5,6	26,7	10,9	50,0	32,0	40,0	19,7	31,0	10,6	37,6	11,7
27	7,5	0,7	20,4	3,3	23,3	5,1	27,1	5,0	21,4	-2,2	30,7	-4,8
28	-0,06	-5,6	-1,2	-8,0	-1,6	-8,6	2,6	-8,6	5,0	-11,7	13,1	12,9
29	4,7	-0,5	2,3	-0,9	-7,7	-7,8	-9,2	-8,8	-16,3	-3,7	15,7	0,7
30	4,3	-2,3	10,2	1,4	6,7	4,2	4,7	11,2	4,6	13,1	0,0	6,2
31	11,1	8,4	11,1	6,0	9,2	1,8	10,9	3,8	10,9	7,0	13,5	5,2
1-31	11,1	4,7	10,7	4,3	11,9	4,0	13,4	4,4	12,9	1,9	16,4	3,8

* Negative equity.

T a b l e 7.16

Per cent Overstatement (Understatement) of Real ROOI

Company	1976	1977	1978	1979	1980	1981
1	(27,64)	(31,68)	(70,37)	(94,59)	(525,00)	(65,66)
2	(46,46)	(59,00)	(41,59)	(155,48)	(131,75)	NA
3	(41,17)	(50,74)	(62,06)	53,41	(84,05)	(55,33)
4	(35,89)	(9,43)	(59,42)	(80,85)	(135,05)	NA
5	(59,29)	(50,00)	(90,60)	(112,63)	(170,42)	(54,65)
7	(45,14)	(54,68)	64,55	(91,11)	(135,84)	(116,17)
8	(73,07)	(67,05)	(142,00)	(178,37)	(205,65)	(518,18)
9	(29,12)	(32,14)	(56,54)	(72,47)	(72,57)	(91,44)
10	(26,41)	(37,97)	(58,18)	(120,00)	(76,00)	(94,33)
11	48,85	(39,18)	(55,03)	(14,63)	(74,02)	(97,77)
12	(37,34)	(40,24)	(22,58)	(9,37)	(110,44)	(87,01)
13	(46,83)	(50,00)	(47,47)	(62,02)	(60,91)	(123,80)
14	(0,00)	21,73	85,55	133,33	1550,00	--
15	(>10000,00)	(63,91)	(2425,00)	(132,60)	(605,12)	NA
16	(26,28)	9,25	(1,23)	(5,00)	(11,94)	45,51
17	(51,40)	(72,34)	(303,57)	(107,69)	9,52	33,67
18	(41,66)	(72,12)	(68,06)	(79,75)	(67,16)	(102,35)
19	(79,09)	(43,12)	(58,16)	(77,30)	(88,75)	NA
20	(729,41)	(178,43)	(85,50)	100,51	23,54	99,80
21	(468,75)	(181,25)	(244,00)	(166,66)	(59,94)	(52,08)
22	(161,26)	(55,42)	(36,01)	(16,87)	(78,85)	(35,80)
23	(16,19)	(38,23)	(57,00)	(55,15)	(30,23)	(110,56)
24	(72,14)	(600,00)	(69,76)	(57,91)	(64,00)	(112,50)
25	(26,13)	(36,60)	(80,00)	(135,38)	(93,71)	(51,51)
26	(69,72)	(59,17)	(36,00)	(50,75)	(65,80)	68,88
27	(90,66)	(83,82)	(78,11)	(81,54)	(110,28)	(115,63)
28	(833,33)	(566,66)	(437,50)	(430,76)	(334,00)	(1,52)
29	(110,63)	(139,13)	(1,29)	(4,34)	77,30	(95,54)
30	(153,48)	(86,27)	(37,31)	138,29	184,78	>10000,00
31	(24,32)	(45,94)	(80,43)	(65,13)	(35,77)	(61,48)

payout ratio) should apply as well to the manufacturing Greek firms generally, since there are no good reasons to believe the opposite. Additionally, the One-Sample Runs test showed that the sample of the study is a random one.

However, if the mentioned effect is constant over time, that is, if the ordering of firms does not change when profitability is measured in real terms, then the effect has no implications for investors (and other interested parties). The so called displacement effect is examined in the next sub-section.

7.3.5. Correlation between HCA and GPPA Return on Investment

In measuring the degree of correlation between HCA and GPPA return on owner's and total investment respectively the Spearman Rank Correlation Coefficient test is used in this study. The main reason for selecting it instead of the other non-parametric test of correlation, that is the Kendall Rank Correlation Coefficient test, is its extensive use made in relevant empirical studies because the Spearman Rank Correlation test is somewhat easier to compute (Siegel, 1956, pp. 202 and 239).

As for the choice of a non-parametric rather than a parametric test, it is based on the fact that the non-parametric tests make "... no assumption about the shape of the population from which the scores are drawn" (Siegel, 1956, p. 196). Additionally, the computation of

non-parametric measures and tests of significance is easier than the computation of the Pearson correlation test, which is the parametric test of correlation usually applied.

The procedure of the Spearman rank-order correlation test is, briefly stated, the following:

1. Rank the observations of the χ (i.e. HCA ROI) and ψ (i.e. GPPA ROI) variables from 1 to N, where N=the total number of the observations.

2. Find and state the rank of each subject on the χ and ψ variables respectively.

3. Determine the value of di where di is the positive (+) or negative (-) difference between the ranks of the χ and ψ variables.

4. Determine each subject's di^2 and then sum the di^2 to determine Σdi^2.

5. Determine the correlation coefficient r_s by applying the formula:

$$r_s = 1 - \frac{6 \sum_{i=1}^{N} di^2}{N^3 - N}$$

6. Test the significance of r_s. That is, test the null hypothesis (Ho) that the two variables under examination are not associated in the population. If at a=0.05 and a=0.01 and for N=4 to 30 the observed value of r_s equals or exceeds the value tabled (i.e. table F of Siegel's book) refect Ho.

Illustration 7.1 shows how exactly the Spearman rank correlation test was applied. Table 7.17 shows the results obtained.

ILLUSTRATION 7.1

The Spearman Rank Correlation, ROTI - 1976

Comp	HCA	Rank	GPPA	Rank	di	di²
1	10.1	11	8.7	11	0	0
2	15.7	2	9.9	9	-7	49
3	5.1	23	3.8	20	3	9
4	7.9	17	6.8	13	4	16
5	14.6	5	10.8	5	0	0
7	15.4	3	10.4	7	-4	16
8	9.0	15	6.4	14	1	1
9	8.7	16	7.9	12	4	16
10	15.3	4	12.2	2	2	4
11	-1.4	30	-0.6	26	4	16
12	6.7	18	5.5	16	2	4
13	5.3	20	3.9	19	1	1
14	9.6	12	10.1	8	4	16
15	1.9	29	-4.3	30	-1	1
16	9.52	14	8.9	10	4	16
17	13.2	6	10.6	6	0	0
18	17.0	1	11.9	3	-2	4
19	4.3	25	2.0	23	2	4
20	5.25	21	1.4	24	-3	9
21	4.0	27	-1.9	28	-1	1
22	12.3	9	-2.0	29	-20	400
23	12.7	7	12.9	1	8	64
24	9.54	13	5.6	15	-2	4
25	12.5	8	11.4	4	4	16
26	11.2	10	4.8	18	-8	64
27	6.1	19	3.6	21	-2	4
28	2.7	28	-1.7	27	1	1
29	4.4	24	2.6	22	2	4
30	5.22	22	0.6	25	-3	9
31	4.2	26	4.9	17	-9	81

$$\Sigma di^2 = 830$$

$$r = 1 - \frac{6\ \Sigma di^2}{N^3 - N} = 1 - \frac{6\ (830)}{(30)^3 - 30} = 1 - \frac{4980}{26970} = 1 - 0.1846...$$

$$= 0.8154$$

Since 0.815 > 0.432 refect Ho at a=0.01

T a b l e 7.17

Correlation between HCA and GPPA Return on Investment
Years 1976-1981

Year	Return on T. Assets	Return on Net Worth
1976	0.815	0.915
1977	0.681	0.765
1978	0.793	0.869
1979	0.675	0.668
1980	0.456	0.608
1981	0.455	0.317

As can be inferred from table 7.17, there is a rather strong correlation between HCA and GPPA return on total investment in the years 1976 and 1978 (i.e. the years with the lowest increase in the inflation rate during the period under examination) but a rather weak correlation in the remaining years 1977 and 1979-1981. As for the correlation between HCA and GPPA return on net worth, the correlation seems to be a little stronger than that found for return on total investment. Specifically, in the years 1976 to 1978 there is a rather strong correlation but a rather weak correlation in the years 1979 to 1981.

Stated another way, 66.5%, 46.4%, 63.0%, 45.7%, 20.9% and 19.8% of the variation in real return on total investment can be explained by the corresponding historical figure in the period 1976 to 1981 respectively. By the same token, 83.8%, 58.6%, 75.6%, 44.6%, 37.1%, 10.1% respectively of the variation in real return on net worth can be explained by the corresponding historical figure.

These results indicate a significant reordering of

firms in terms of return on total investment in the years 1977 and 1979 to 1981, which are the years with the highest rate of inflation in the period under examination. Basically, the same applies with respect to return on net worth. Especially in 1981 it seems that there is no correlation at all between HCA and GPPA returns on net worth since 1981 was the only year in which the null hypothesis was accepted at both levels of significance.

The finding of the study is in agreement with that of other empirical studies (Section 3.3.3) which found that the impact of inflation on earnings is not constant over time. Hence, it seems that GPPA earnings have information content, especially when the inflation rate is considerably high, as it is the case in the years 1979 to 1981.

The argument advanced in the empirical accounting literature, according to which GPPA earnings figures have information content only when there has been a sharp increase in the inflation rate (see, for example, Ketz, 1983), is not supported by the finding of the study. Though there was a sharp increase in the inflation rate in 1979 (i.e. 11.5% and 24.8% respectively the increase in the inflation rate in 1978 and 1979) and a rather stable increase in the years 1980 and 1981 (see table 4.1), the correlation between HCA and GPPA return on investment was more weak in 1980 and especially 1981 than in 1979. Rather the more the increase in the inflation rate, the more informative the GPPA disclosures become.

7.4. Implications for Micro- and Macro-Decision Making

The results of the study regarding restated corporate earnings, and especially the results of the empirical analysis of selected financial parameters revealed that inflation affects corporate profitability seriously. The real (GPPA) earnings are significantly less than those presented under HCA. Consequently, the effective corporate tax rate is much higher than the nominal (historical) one, and dividends are paid out of capital rather than out of real earnings. What is of more importance, it was found that the impact of inflation on earnings, and precisely on corporate profitability (i.e. return on investment) is not constant over time. This seems to be especially true in the case in which the increase in the inflation rate from year to year is more than 20%.

The implications of these findings of the study for the various users of accounts may be the following:

1. Given that each year a considerable amount of net corporate profit is paid out as taxes, as well as that for the majority of the sample companies the GPPA net profit was at least 50% less than the HCA net profit, it may be important for the Greek government to consider the taxes imposed on corporate profit, if the inflation is going to run at more than 20% per year.
2. It seems important for the Greek firms to consider

their dividend policy because if they continue to pay high dividends in the future and both the specific and general price indeces continue to increase at about the same rate, then their operating capability will be impaired unless they will be able to borrow to pay the higher dividends.

3. Businessmen should not count on the historical numbers regarding profitability; instead they should try hard to improve profitability since the finding of the study is that during inflation the numbers purported to reflect profitability overstate the prosperity of the companies.

4. Given the low profitability of the Greek companies as well as the tendency of firms to pass on their increased costs to their customers it might be important for the unions to consider their policies with respect to wage increases in times of high inflation.

5. Government should consider the implications of prices control on the one hand, and it might also maintain its role in enhancing corporate profitability by continuing to dampen down wage -

cost inflation[2]. Inflation seems to affect badly not only the workers' income but also the profit of firms.

6. Finally, and maybe most importantly, both government and businessmen should think seriously about the case of adopting GPPA for financial reporting at least on a supplementary basis, if in the future the inflation rate continues to be as high as it was in the years 1980 and 1981. This is because the impact of inflation on accounts seems to be serious and the evidence is that it cannot be estimated on the basis of historical accounts (ie there does not seem to exist any strong relationship between historical and adjusted earnings, especially when the increase in the annual inflation rate is more than 20%).

Of course, it is accepted that the adoption and operation of GPPA in Greece will not be an easy task in the first years of its application. This is because though GPPA is based on HCA nevertheless it is a new system in several aspects and as such its application will present enough problems and difficulties to the preparers and users of financial statements who are not familiar with inflation accounting.

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2. In the recent years the government has helped firms with respect to the wage increases problem. In its efforts to content inflation the government prohibited by law (which was in force up to 1987) any wage increases above certain levels determined by it.

However, it is the opinion of the researcher that if the annual inflation rate continues to be as high as it was during the years 1979 to 1981 (ie 25% or so), the costs involved in implementing GPPA (ie starting costs such as training of the accounting staff) will be offset by the expected benefits to derive from the application of the new system. This is because, as argued in Section 3.2 and 3.5.6 the adoption of GPPA is expected to help the various Greek policy makers in choosing effective policies to fight inflation, improve profitability and liquidity of firms, promote industrial expansion and reduce unemployment.

CHAPTER EIGHT

SUMMARY AND CONCLUSIONS

It was demonstrated in this study that in times of price changes HCA cannot serve adequately the needs of the users of financial statements because it suffers from two major deficiences: "unit of measurement deficiency" and "valuation deficiency". Because of these shortcomings, on the one hand, the historical figures purported to reflect the financial position of the entity are a mixture of past and current values instead of representing "a true and fair view". On the other hand, the income figure includes "inflationary" or "fictitious" gains, and hence the users of accounts can be misled. (ie neither current worth is shown nor real income).

Therefore, there is an almost general agreement that HCA should be substituted by a system which reflects changes in price (ie the inflation accounting issue). However, this general agreement is characterised by an almost general disagreement with respect to which one of the various inflation accounting systems proposed is the most appropriate one (ie the inflation accounting problem). This disagreement stems basically from the fact that the usefulness of each one of the inflation accounting systems proposed is based on **a priori** reasoning and untested assumptions.

The empirical research which could give definite answers regarding usefulness of accounting for price

changes has not produced conclusive results. This is because of the shortcomings associated with any research (and the application of any system) which is still in its infancy, as it is the case with inflation accounting. (ie errors involved in estimating the inflation accounting numbers, errors in methodologies applied, errors in interpreting the figures produced etc.).

It seems that before reaching a final solution to the so important and so controversial problem of inflation accounting (if, indeed, there is one solution to it and not different solutions for different purposes) definite answers should be given to some crucial questions referring to the objectives of financial reporting as well as to the desired properties of financial reports. Additionally, enough period of experimentation with various inflation accounting systems should be allowed in order to establish their usefulness empirically.

Due to the mentioned significance of inflation accounting several countries (such as the UK, USA, Australia) have been or are being experimented with one or more inflation accounting systems in order to see which one is the best to be adopted. Other countries (such as Brazil, Chile, Argentina), which have experienced very high rates of inflation for several years, have adopted and oporate inflation accounting systems on a permanent basis. These systems are more or less different for different countries because accounting is the product of its particular environment.

Greece, which has experienced high rates of inflation for more than one decade, has not addressed the inflation accounting problem, despite its particular significance for Greece. This study is an attempt to fullfil this heed. That is, it addresses the inflation accounting problem for Greece, albeit in a partial way.

Specifically, based on the conceptual (mainly) as well as on the empirical evidence, a critical evaluation of the two basic alternatives (GPPA and CCA) proposed was made. Following this, the features of the Greek accounting setting were examined and the adequacy of GPPA rather than CCA was established by **a priori** reasoning; that is, by means of correspondence between features of GPPA and features of the Greek setting.

Having established the a priori relevance of GPPA to the Greek financial reporting the study attempted to approximate **ex ante** the impact of GPPA on Greek accounts in order to see if its adoption is justifiable. Additionally, the study pursued three important sub-purposes. First, it tested the generalisability of CAT as well as the applicability of a new technique (ie DYT) and its variation (i.e. EAT) which are used for the restatement of fixed assets. Second, it tested the generalisability of ABT used for the computation of monetary gains/losses. Third, it tested the hypothesis that there is no significant difference between annual and monthly restatement of fixed assets.

The results obtained as regards the sub-purposes of the study, support four conclusions:

1. The CAT does not work at all in the Greek case. Hence, it lacks general applicability.
2. DYT, in the first place, and EAT, in the second place, work well in the Greek case and perhaps it may be used for restating fixed assets not only in small developing countries, like Greece, but also in developed countries.
3. It seems that the Average Balance Technique works as well in settings others than the USA setting.
4. Costs of operation of GPPA can be saved by restating fixed assets on an annual rather than monthly basis.

The conclusions drawn regarding impact of GPPA on Greek accounts are the following:

1. Inflation has a serious impact on earnings. The impact does not seem to be systematic and hence it cannot be estimated by use of HCA numbers.
2. The effective tax rate is materially higher than the nominal one. Hence, it might be important for the government to consider the tax rate imposed on corporate earnings.
3. The real dividend payout ratio is much higher than the nominal one. In some cases all dividends are paid out of capital. Because of it firms should perhaps, change their dividend policies.
4. The real profitability of firms as measured by returns on net worth and total assets, is low. There are implications for managers, unions and the government in this finding since in the long run,

all three parties have stakes in the continuing viability of Greek companies.

5. Finally, and most importantly, since the impact of inflation on earnings, which are used for decision making by a variety of users, is serious and unsystematic, both businessmen and government should think seriously of adopting GPPA for financial reporting, at least on a supplementary basis, if the increase in the inflation rate continues to be as high as it was in the years 1979 to 1981 (ie 25% or so). The costs involved in implementing GPPA are expected to be offset by the benefits to be incurred to the preparers and users of accounts.

The conclusions of the study might be applicable, up to a certain extend, to other developing countries which resemple Greece, such as Italy, Spain, and Portugal. This is especially true with respect to the conclusion drawn as regards the a priori relevance of GPPA to the Greek financial reporting.

The conclusions of the study are subject to the limitations inherent in this study. These limitations have been mentioned in Section 1.5. What, perhaps, should be stressed here is that the results of the study, on the basis of which conclusions were drawn, are approximations. This is especially true as regards restatement of inventory and cost of goods sold, as well as computation of monetary gains/losses.

As already mentioned in Section 1.5, the Davidson -

Weil model used for restatement purposes was not validated in order for the researcher to see how well it fits the Greek case. Hence, actually restated COGS and inventory might be different from those found in the study. As for the computation of monetary gains/losses, a validation of the Average Balance Technique was made. However, the validation sample was not large enough to permit strong inferences.

What, perhaps, is of more importance as regards computation of monetary gains/losses, is that maybe the ABT works well or even very well in the Greek case. Yet, this does not necessarily means that the monetary gains/losses, as computed (by aid of the ABT) for the remaining companies in the total 30 firm sample for which detailed data have not been gathered, are the actual ones. An outsider cannot accurately distinguish monetary from non-monetary items based only on the published balance sheet statements.

Of course, the researcher did not rely solely on the published financial statements to make the GPPA adjustments. Directors' and Auditors' Reports were used as well extensively with great care, as mentioned in Section 4.4.

However, in some cases not only the balance sheet statement but also the Directors' Report were not detailed enough to separate, for example, the "advances to suppliers/customers" account, which is a non-monetary account, from the "various debtors/customers" account, which is a monetary account. Additionally, in several

balance sheet statements of the sample companies in the account "rebate due from the state" (or in the account "various debtors") fictitious claims were included. That is, taxes and/or penalties imposed by tax authorities and already paid to the state were shown as claims instead of being charged to the profit and loss statement according to the Auditors' Report.

Out of necessity, monetary gains/losses were computed from the "various debtors/creditors" account, in which advances to purchases were, perhaps, included. As for the fictitious claims, no monetary losses were computed (i.e. these claims were left untouched in both the HCA and the GPPA statements). However, a case might exist that some of the Auditors' Report were not detailed enough to point out such fictitious claims.

Therefore, the actual monetary gains/losses might be different from those computed in the study. Only the managers of firm possess enough information to produce accurate results.

With respect to the roads of future research opened by this study, they may be the following:

1. In this research the potential usefulness of GPPA rather than usefulness per se was examined. Hence, it would be very interesting to examine usefulness of GPPA as regards its ability to predict bankruptcy or future earnings or usefulness of GPPA to investors by incorporating the risk related to the magnitude of such useful parameters to investors such as return on captial employed or earnings per

share.

2. It would be interesting as well to examine the usefulness of CCA or usefulness of CCA vis a vis usefulness of GPPA and HCA on an empirical basis.

3. The estimation technique used in the study for restating inventory and cost of goods sold was not tested for its accuracy. Hence, it would be interesting to test the three more sophisticated models used for restating inventory (and COGS) in order to see which one of them performs well in the Greek case, and perhaps in developing countries like Greece, and hence, it seems to enjoy general applicability; or to see what alterations should be made to them when they do not perform well or even what new model should be developed instead.

4. Since in order for an inflation accounting system to succeed, it must be acceptable for taxes, and since not all companies seem to be affected in the same way by inflation it would be interesting to examine the implications involved from accepting GPPA for income tax purposes.

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