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ANALYTICAL PROCEDURES IN AN AUDIT:

REVIEW AND APPLICATION BY CASES

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ABSTRACT

Bu çalışmanın amacı dış denetçilerin artan rekabet kosulları çerçevesinde denetim prosedürlerinde ne gibi değişiklikler yapmakları gerektiğini araştırmaktır. Denetim ücretlerinin artması ve rekabet ortamı denetçileri çok fazla zaman ve masraf gerektiren klasik denetim yöntemleri yerine daha etkin ve daha az masraflı olan analitik denetim yöntemlerini kullanmaya yöneltmiştir. Bu yöntemler denetçinin kendi tecrübelerine dayanan subjectif değerlendirmelerden, oldukça karmaşık istatistiki modellere kadar geniş bir yelpaze oluşturmaktadır. Bu çalışmada her yöntemin avantajları ve limitasyonları araştırılmış ve ampirik olarak uygulaması yapılmıştır. Her bir denetimde hangi analitik yöntemin kullanılacağı. işletmenin yapısına, denetçinin iş tecrübesine ve koşullara bağlı olduğuna göre, hangi analitik metodun kullanılacağı denetçinin kendi başına vernesi gereken bir karardır. Ancak literatürde , daha objektif olan istatsiktiki modellerin kullanılması yönünde bir eğilim bulunmaktadır.

I. INTRODUCTION

In recent years, auditors have faced both increased expectations of a high level of audit quality and an increased competition for audit fees. In response, auditors have found it necessary to search for ways of becoming more efficient and effective by changing the audit format. The traditional audit procedures which require hours of ticking and footing the detailed account balances became an inefficient way of auditing today's complex audit environment.. Therefore the auditors shift their attention to examining the overall reasonableness of the account balances and financial statements."An audit which placed more emphasis on examining the fairness and/or reasonableness would require significant modification of our present audit procedures. In particular it would probably mean a more limited and selective use of the tests of details of transactions and a more extensive and better use of internal control checks and analytical reviews of significant financial ratios and trends. If such an approach were adopted, the result would be an audit accomplished with the use of much less staff time but with an increased reliance on mathematical and statistical methods."[1]

Statement on Auditing Standards (SAS) No.56, (Section AU 329) defines analytical review procedures as "evaluations of financial information made by a study of plausible relationships among financial and nonfinancial data...involving comparisons of recorded amounts to expectations developed by the auditor.". SAS No.56 (1988) also notes that analytical procedures can be more efficient than traditional detailed testing for achieving some of the substantive testing objectives. However, the extend of usage of analytical review by the auditors is an empirical question. A study made by [2:275] with 96 auditors suggest that auditors are not fully utilizing analytical review. Most of the auditors do not change the scope of detailed tests when analytical review reveals that account balances are in order. The auditors are conservative and this conservatism lead to increasing and not decreasing the cost and extend of the audit work .

Analytical procedures may be used in an audit for the following purposes:

1. In the planning phase as part of the overall audit strategy formulation. (planning the nature, timing and extend of the audit procedures)

2. As a substantive test of the resulting balances in the financial statements.

3. As tests of the overall reasonabless of the financial statements.

SAS No.56 requires that analytical procedures be applied for stages 1 and 2 for all audits. This requirement of analytical procedures for all audits shows the importance of these procedures. Analytical procedures are required for review audits also.

In order to apply analytical procedures, the auditor must first develop expectations based on the knowledge about the company and the industry in which the company operates. Sources of information for developing expectations in engagements include:

1. Financial information for comparable prior period(s)

2. Anticipated results like budgets and forecasts

3. Relationships of elements of financial information within the financial statements.

4. Similar information regarding the industry in which the company operates like industry averages and standards.

5. Nonfinancial information such as number of units sold.

After forming the expectations, the auditor might compute the difference between the reported values and the projected values. and determine the statistical significance of the difference. Depending on the significance of the difference the auditor might use professional judgement to determine the necessary audit procedures.

II-ANALYTICAL PROCEDURES IN THE PLANNING PHASE:

In preliminary planning, analytical procedures are used to gain :

1. A better understanding of the client, its business and its industry,

2. To look for balances or transactions that are unusual or unexpected.

In this phase, the company's unaudited information is compared to last year's audited information and any significant changes are highlighted. An unusual balance may indicate a higher risk of error so that the auditor will plan audit procedures on such balances accordingly. For example comparison of the current year data with the last year data may indicate a significant decline of cost of sales as a percentage of revenue. A decline in the production costs may be a reason for this change. But at the same time the auditor must consider the fact that the decline may be due to some errors or irregularities such as fictitious sales,or omitted costs. By uncovering such problems early in the audit, the auditor may perform more detailed audit work in order to find out the reason for the variations.

III.Analytical Procedures as substantive tests:

When analytical procedures are used as substantive tests, they assess the "reasonablenes"of the balances in the year-end financial statements.

[3:223] suggests a seven-step approach for performing analytical procedures.

SEVEN STEP APPROACH	Illustration using an overall test of interest expense
Set objectives	Evaluate whether the account, interest expense is fairly stated for.
Design the analytical procedures	Estimate interest expense using auditor determined expected results.
Use appropriate data	Use average monthly general ledger balance and average interest rate for short-term loans. Use average annual balance and actual interest rate for long-term loans
Apply decision rules	The difference between the auditor's calculation and the general ledger balance will be considered material if the amount exceeds 2% of interest expense
Conduct the tests	Make the calculations
Analyze the results	Decide whether the difference is material on the basis of the decision rule
Draw conclusions	Decide whether additional work is necessary in the audit of interest expense.

IV. ANALYTICAL REVIEW PROCEDURES:

The nature of analytical review can extend from subjective evaluations to the application of sophisticated statistical models. There are mainly three types of analytical procedures:
1. Reasonableness test
2. Ratio analysis
3. Trend analysis

1. Reasonableness test:

" To perform a reasonableness test, the auditor should develop a model that explains changes in a dependent variable (for example, payroll expense) by analyzing changes in independent variables (for example, number of employees, average wages, and average hours worked)"[4:449] In reasonableness test the auditor develops an expectation based on some operating data. For example in looking for the reasonableness of sales figure for the current period, the auditor may multiply the unit price of the product by the number of units sold during the year . When studying the payroll expense, the number of employees may be multiplied by average salary per person or when estimating the passenger revenue for a bus company the number of passengers and average revenue per passenger may be used.

2. Ratio analysis:

Ratio analysis is one of the oldest analytical procedures which compares relationships among account balances.There are mainly two approaches for using financial ratios:
1. Comparison of the company's current situation with that of prior years (time-series analysis)
2. Comparison of the company's financial position with similar companies in the same industry.

(cross-sectional analysis)

Thus, ratio analysis can identify both relationships within the company over time and common relationships between companies in the same industry.

Table 1. Two approaches to ratio analysis

	Accounts	Receivabl	Turnover	
	Firm A	Firm B	Firm C	Industry average
1981	3.6	3.1	3.8	3.5
1982	3.5	2.9	3.9	3.4
1983	3.3	2.9	3.9	3.4
1984	3.3	3.0	3.6	3.3
1985	3.4	3.2	3.5	3.2
1986	3.3	3.3	3.7	3.3
1987	3.3	3.2	3.7	3.5
1988	3.2	3.1	3.8	3.6

If the auditor performs time-series analysis of the ratios of Firm A., then he/she can clearly notice that this firm's accounts receivable turnover ratio is lower than prior years. Cross-sectional analysis also reveals that the ratio is lower when compared to the industry. This finding may be indicative of collectibility problems of Firm A, or that fictitious credit sales exist, or there is overstatement of sales by improper cut-off of sales at the end of the year. In this case, the auditor should investigate the individual accounts like accounts receivable and sales more in detail. The analysis of the aging of accounts receivable would give insight whether the decrease in accounts receivable turnover is due to collectibility problem and expand the scope of the work in auditing the allowance for doubtful accounts.

Ratios commonly used in performing analytical review are liquidity ratios, leverage ratios and profitability ratios.

An Illustration of ratio analysis in an audit: A case study:
X Co.
Balance Sheet
December 31, 1992, 1993 and 1994
(millions of Turkish Lira)

ASSETS	1992	1993	1994
CURRENT ASSETS	1391,071	1,970,416	3,365,517
CASH AND BANKS	34.282	41.560	34.983
MARKETABLE SECURITIES	6,999	189,889	47,905
ACCOUNTS RECEIVABLES	1,025.396	1,343,533	2,048,988
OTHER S.T.RECEIVABLES	2	2	621
INVENTORY	281,149	282,347	903,676
OTHER CURRENT ASSETS	43.243	113,085	329,344
NONCURRENT ASSETS	178.877	312.770	526.978
LONG-TERM ACCOUNTS REC.	1.021	689	306
L.T. FINANCIAL ASSETS	5,015	29,815	59,515
FIXED ASSETS (NET)	172.722	278.476	457,260
INTANGIBLE ASSETS	12	2,004	1,772
OTHER FIXED ASSETS	107	1,786	8,125
TOTAL ASSETS	1,569,948	2,283,185	3,892,4 95

TOT.LIAB. & STOCK.EQUITY	1992	1993	1994
CURRENT LIABILITIES	775,493	849,004	1,955,638
BANK LOANS	293,697	220,767	755,113
TRADE PAYABLES	166,382	262,933	545,934
OTHER S.T. LIABILITIES	127,700	184,099	433,222
ADVANCES	38,480	240	3,339
ACCRUED EXPENSES	149,234	180,965	218,030
LONG TERM LIABILITIES	199,303	373,720	568,264
BANK LOANS	138,524	277,504	443,480
TRADE PAYABLES	0	0	0
OTHER L.T. DEBTS	2,839	5,760	6,064
ADVANCES	0	0	0
RESERVES FOR EXPENSES AND DEBTS	57,940	90,456	118,720
EQUITY	595,151	1,060,462	1,368593
CAPITAL STOCK	200,000	350,000	525,000
EMISSION PREMIUM		1,956	2,456
REVALUATION FUND	48,047	91,954	274,504
RESERVES	114,777	195,111	350,654
NET PROFIT	232,327	421,441	215,979
TOT.LIAB. AND EQUITY STOCKH.EQUITY	1,569,948	2,283,185	3,892,495

X Co.
Income Statement
As of December 31, 1992, 1993 and 1994
(millions of Turkish Lira)

INCOME STATEMENT	1992	1993	1994
GROSS SALES	2,563,216	3,285,047	5,940,883
SALES RETURNS AND ALL.(-)	50,130	41,867	22,371
NET SALES	2,513,086	3,243,180	5,918,512
COST OF SALES (-)	1,686,463	2,142,159	4,258,175
GROSS PROFIT	826,623	1,101,021	1,660,337
OPERATING EXPENSES	273,785	486,234	632,233
OPERATING INCOME	552,838	614,787	1,028,104
NON-OPERATING INCOME	17,754	188,940	129,826
NON-OPERATING EXPENSES(-)	92,053	950	91,023
FINANCIAL EXPENSES(-)	158,136	242,051	667,916
INCOME BEFORE EXTR.ITEMS	320,403	560,726	398,992
EXTRAORDINARY INCOME	43,318	21,830	115,752
EXTRAORDINARY EXPENSES)	20,618	15,881	209,406
INCOME BEFORE TAXES	343,103	566,675	305,338
TAXES	110,776	145,234	89,358
NET INCOME	232,327	421,441	215,979

RATIOS	1992	1993	1994
Current Ratio	1.79	2.32	1.72
Quick ratio	1.43	1.98	1.25
Debt ratio	1.63	1.15	1.84
Inventory turnover	5.99	7.58	4.71
Age of inventory	60	47	76
Accounts receivable turnover	2.45	2.41	2.88
Age of accounts receivable	146	149	125
Total asset turnover	1.6	1.42	1.52
Gross margin	32%	33%	28%
Profit margin on sales	9%	13%	3.6%
Return on total assets	24%	29%	22%
Return on equity	39%	39%	16%

The analysis of liquidity ratios indicate that the current ratio has fallen down to 1.72 which means that current liabilities are rising faster than current assets and this may cause a trouble for the company. When we look at the debt ratio we see that it has gone up to 1.84 from 1.15 from the previous year. This is also consistent with the decline in the current ratio. In this situation, the auditor should be careful in investigating the interest expenses that should be accrued at year end and also the debt covenants which may put some restrictions on the use of the assets.

The analysis of activity ratios indicate that there are some problems in the inventory. Inventory turnover has declined from 7.58 to 4.71 which means that more inventory is compiling and the company may have some selling difficulties. In this situation, the auditor should focus his/her attention to obsolete inventory during the physical count and make sure to expand the scope of the work in auditing the allowance for inventory and also in auditing the inventory pricing.

Analysis of the profitability ratios indicate that the company's profitability has declined from 13% to 3.6 %. Since gross margin % remains almost stable over time, the decline in profit margin should be due to administrative expenses and financial expenses which has increased during 1994. The auditor should expand the scope of the work in auditing administrative expenses and financial expenses.

Limitations in using the financial ratios:

When comparing ratios of similar companies within the same industry the auditor must consider the differences arising from geographic locations, production technologies, capacity utilization and not evaluate the ratios mechanically. For example, a general strike in a company during the year may have adversely affected the company's operations while the other companies have not been affected by such adverse conditions. The auditor should also consider that ratios may not be calculated in a standard manner for all companies within the same industry. For example in calculating inventory turnover, some may divide cost of sales by inventory while others may divide net sales by inventory.

Prior research made by [5:525] notes that "conventional ratio analysis methods seem wholly inadequate for prediction purposes". An alternative approach to ratio analysis is using more advanced statistical procedures like regression and time-series models.

3. Trend analysis:

In trend analysis, the auditor develops an expected result for the current period by analyzing changes in an account balance over the past accounting periods.

This approach is referred to as a "causal approach". "An alternative approach to trend analysis is

to use a diagnostic approach, in which the auditor simply compares the current amount to the trend to see if the current account seems acceptable."[4:441] In application of the diagnostic approach the auditor does not have any expected result for the current period and an account is considered to be acceptable if the account balance seems stable over time. In applying this approach, the auditor should be careful since stability does not always mean that there is no misstatement in the account balance. Within this respect, the auditors should consider using the causal approach as outlined below..

3.1. Simple Trend Analysis:

This technique involves calculating an expected amount based on the past performance of the account balance. Such models may be martingale or submartingale which require less sophistication and easy to implement. In a martingale model the predicted value is the audited value of the account balance in the last audit year. Symbolically, the martingale model is:

$$E(Y_t) = Y_{t-1}$$

In a submartingale model, the predicted value may be the audited value of the last year plus the change in the account balance over the years. Symbolically, the submartingale model is:

$$E(Yt) = Y(t-1) + (Yt-1- Yt-2)$$

For example, if company's sales are increasing by average 5% over years, then the auditor basis his/her expectation for the current year as a 5% increase from the previous year.

3.2. Statistical Modelling Procedures:

Statistical models can be constructed with several components. One of these components may be structural. Structural components are comprised of variables that are involved with or caused by one another. Another component to a statistical model may be time series. Time series components rely on identifying relationships between a variable and the passage of time. Regression models are predominantly structural, while autoregressive models (e.g ARIMA models) rely heavily on the time series component. [6] in his study on the revenue series of six railroads concludes that "the use of ARIMA based models in analytical review in auditing seems beneficial but not as a generally applicable alternative to regression" [6:60]. He also found that the models with "greater information requirements and computation effort are superior in predictive power [6].

Regression Analysis:

" Regression analysis enables us to ascertain and utilize a relation between a variable of interest, called a *dependent* or response variable, and one or more *independent* or predictor variables" [7:450].

If the statistical relation is linear between these two variables, then we can express it as mathematical

equation. When two variables are involved, this is called simple regression.

$$Y_i = B_0 + B_1X_i + u_i \qquad i = 1,2, \ldots\ldots n$$

where:

Y_i = dependent variable (the response in the ith observation)

X_i = value of the independent variable in the ith observation

B_1 = the coefficient of the independent variable

B_0 = intercept

u_i = random error term

However, the simple linear regression model can easily be extended to include two or more independent variables which is then called multiple regression.

$$Y_i = B_0 + B_1X_{i1} + B_2X_{i2} + u_i$$

The Auditor uses regression equation for predicting the balance of an account which is dependent on another account. Some of the examples of the relationship between accounts is: 1) Repair expenses and machine hours 2) Number of units sold and cost of sales 3) Direct labor costs and indirect labor costs 4) Advertisement expenses and Sales 5) Delivery expenses and sales 6) Direct labor hours and production costs.

In 1971 Deloitte Haskins & Sells introduced a computer modelling tool called STAR (Statistical Techniques for Analytical Review) which can build regression models with up to 25 variables.

Limitations of the regression analysis

The regression methodology is relatively inexpensive and easy to apply with the computers. However, the fact that there are a number of statistical assumptions underlying the model should be taken into consideration. Violation of these assumptions may violate the results of the regression analysis.

Regression analysis is particularly useful in prediction of revenue and expense accounts.

BUILDING A REGRESSION MODEL:

CASE STUDY:

In this case , we are going to look for the reasonableness of monthly sales figures for the audit period of a real company operating in the drug industry with the help of regression analysis. We assume that the amount of sales change linearly with changes in cost of sales. Based on this relationship we are going to make a 12-month forecast of sales for the audit period. The forecasted figures will then be compared with the actual results for the audit period and any unusual variations will be accounted for. However, the auditor's problem is to answer the question of how much difference should be considered unusual. Based on the calculation of the standard error of the regression estimate and the statistical assurance (tolerable error) desired by the auditor, the portion of the recorded amount that is considered as unusual should be determined. If the predicted sales is materially different than the actual balance, the auditor should extend the scope of

substantive tests on sales.

Before building the model, one of the first things that an auditor has to decide is what information or data profile to use. In our case , the profile is a time-series profile, in which the sales (dependent variable) and cost of sales (independent variables) are set out by some time period (months). A cross-sectional profile in which the results are set out by operating unit, geographical location or some other basis can not be used in our model. Another consideration is how much base date are required. The experience has shown that a base period of 36 months is satisfactory for STAR time-series models. In our analysis a base period of 24 months is used.

The regression equation is:

$$S_t = B_0 + B_1 \, COS_t + u_t \qquad t = 1, 2, \ldots\ldots 24$$

B_0 = intercept

S_t = Sales in month t

COS_t = Cost of sales in month t

B_0 and B_1 = regression coefficients

u_t = the random error term

The regression statistics are as follows:

Regression Statistics	
Multiple R	0.9911
R Square	0.9823
Adjusted R Square	0.9815
Standard Error	10,390
Observations	24

R^2 = .9823 measures the goodness of fit. R^2 is the portion of the total variation in sales that is explained by the variations in cost of sales. Since R^2 is very high , the model is adequate for predicting the monthly sales figures for the audit period.

Standart error of the estimate (δ) = 10.390

This is a measure of the average amount by which sales fluctuated from the regression line during the base period. This statistic provides a means of estimating a confidence interval (range) for predicting the amount of sales given cost of sales . Thus we can determine a range within which we can predict sales with varying degrees of statistical confidence.

Auditor's Degree of Statistical Confidence	Auditor's Confidence Interval
68%	$(Y_t-1\delta) < Y_t > (Y_t+1\delta)$
95%	$(Y_t-2\delta) < Y_t > (Y_t+2\delta)$
99%	$(Y_t-3\delta) < Y_t > (Y_t+3\delta)$

The regression equation is:

$$Yt = -3,245 + 1.88 \ COS_t$$

Results based on the regression function:

Direction of the test overstatement

observation (audit period)	recorded amount	estimate	residual
January	276,081	279,089	-3,008
February	280,295	277,994	2,301
March	331,289	329,310	1,979
April	415,696	404,800	10,896
May	388,628	394,516	-5,888
June	418,909	426,985	-8,076
July	403,839	410,631	-6,792
August	443,770	408,441	35,329*
September	450,662	458,060	-7,398
October	478,206	475,790	2,416
November	470,540	467,394	3,146
December	448,240	458,442	-10,202

In identifying the material variations, we have set our confidence interval as 99% which means that only August sales has an overstatement which is statistically significant and must be further investigated by the auditor.

V-CONCLUSION:

In this study we tried to review basic analytical review procedures and limitations and advantages of each procedure. Although conventional ratio analysis and simple trend analysis are easy to implement with less staff time and cost, there is an increased shift towards more advanced statistical procedures "due to their objectivity, their formal use of environmental information, and their relationship to statistical sampling" [6:48]. But the determination of the best analytical model" in a cost-benefit sense remains an empirical question to be answered at the individual audit application level."[6:60].

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