Order Number 9315494

The dynamic behavior of the Istanbul Stock Exchange Market using a vector autoregression model

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City University of New York, 1993

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THE DYNAMIC BEHAVIOR OF THE ISTANBUL STOCK EXCHANGE MARKET USING A VECTOR AUTOREGRESSION MODEL

by

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A dissertation submitted to the Graduate Faculty in Economics
in partial fulfillment of the requirement
for the degree of Doctor of Philosophy,
The City University of New York

1993

This manuscript has been read and accepted for the Graduate Faculty in Economics in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

11/30/92
Date

Chair of Examining Committee

11/30/92
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Abstract

THE DYNAMIC BEHAVIOR OF THE ISTANBUL STOCK EXCHANGE MARKET USING A VECTOR AUTOREGRESSION MODEL

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Adviser: Professor Salih Neftçi

This dissertation suggests a vector autoregression model to analyze the dynamic behavior of Istanbul Stock Exchange Market (ISEM). The findings show forecasting performance of at least forty percent as good as current analysis of the U.S. stock market. The analysis of the ISEM could be improved upon except for two main problems: Large outliers and time series behavior of exogenous variables in the deterministic part of the model. Deleting the outliers and choosing only the market index and the dummies in the deterministic part improves the results. The second method which significantly improves the data takes the moving average of the data, by getting rid of the daily fluctuations. Large numbers of stock returns from an ISEM data sample exhibit negative

autocorrelations that show ISEM is a thin market. My results show that the Efficient Market Hypothesis is non predictive for analysis of the ISEM.

ACKNOWLEDGEMENTS

I would like to thank *Dr. Salih N. Neftçi* for proposing the subject and directing me throughout. Many thanks to *Dr. Yaman Asıkoglu* (Capital Market Board President of Türkiye) who always encouraged me during my studies. I am indebted to *Dr. Michael Grossman* for his valuable advice.

I owe a debt that I cannot repay to my parents, *Ayten* and *Sadık Okay*, who have been a source of support over the years of my graduate school tenure and have witnessed all of the stages of higher education. I am devoted to them, and dedicate this thesis to them.

Thanks to the Vice governor of the Turkish Central Bank, *Dr. Hasan Ersel* for his time and thoughts about the Istanbul Stock Exchange. I am indepted to *Professor Harry Markowitz* for his guidance and valuable advice for future research.

I am deeply thankful to *Dr. Demir Demirgil*, *Dr. Resad Kayalı* and *Dr. Ali Ülger* who encouraged me to go for a Ph.D. in Economics.

Many thanks to *Robert L. Ferri* for his editing assistance. Special thanks go to *Rod Low* and *the Spatial Analysis and Remote Sensing Laboratory (SPARS)*

of Hunter College for using the computer facilities.

My sister *Esin Okay* spent a summer in Istanbul, keeping me company while I was doing research. I am thankful to her for entertaining me and providing a pleasant distraction to my work.

I finally want to thank my sister *Nilgün Okay*, a Ph.D. candidate in Earth and Environmental Sciences, whose constant optimism, humor caring and encouragement were essential to not only the completion of this thesis.

International House, New York *Nesrin Okay*

November 16, 1992

Dedicated to my parents,

Ayten and Sadık Okay

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I. Istanbul Stock Exchange Market moves towards maturity

I.1. Introduction

The concept and operation of a centralized equity market in Türkiye can be traced back to the second-half of the 19th century. The first was the Bersaadet Securities Exchange established immediately after the Crimean War in 1866. Although the Exchange ceased operations during the several wars which involved the Ottoman Empire, it none the less saw high levels of activity whenever relative political stability prevailed. The Bersaadet Exchange, for example, provided an obvious route for European investors seeking high returns in the large Ottoman Markets.

After the Republic was established, a law was enacted in 1929 to reorganize the exchange as the Istanbul Securities and Foreign Exchange Bourse. The market quickly became active but inevitably fell victim to the Depression when activity and volume fell significantly. For the next fifty years the Istanbul Exchange played only a minor role in the economy as Türkiye

increased its industrial footing. During this period the Exchange was moved from the financial center of Istanbul to the less commercially active capital of Ankara and this again had a negative impact on trading activity. Consequently, few were surprised when the Exchange moved back to Istanbul although activity still remained insignificant.

The major stimulus to equity market development came from the Turkish investment and development banks which had taken equity participations in sound industrial projects and subsequently sold portions of these portfolios to the public. Perhaps unsurprisingly, given the Turkish enthusiasm for vigorous and active trading, these issues found a strong and growing demand from institutional and individual investors. This secondary market evolved rapidly along the lines of an over-the-counter market.

In 1981, the Capital Market Law was enacted and the main regulatory body responsible for the monitoring and supervising of the primary and secondary markets, the Capital Market Board, was established in 1982. As the moves for greater centralization and regulation gathered pace, so secondary market operations were shifted to the Istanbul Stock Exchange

when it reopened in January 1986. The benefits of centralization quickly showed themselves as brokers discovered the greatly increased efficiency of the Exchange's transaction system. A mood of initial reluctance was replaced with one of considerable optimism. Although the volume of business was limited in its early days, the regular publication of transaction volume and prices meant that the Exchange saw a rapid increase in trading.

I.2. Performance of the Istanbul Stock Exchange

The Istanbul Stock Exchange (ISE) is Türkiye's only stock market and it has grown prodigiously over the past five years. Despite low turnover in 1986, as all participants began to familiarize themselves with the structure and operation of the market, the ISE started to gain momentum through 1987. Transaction volume was TL 8.7bn in 1986 but jumped to TL 105.4bn in 1987; in 1988 the volume figure was TL 149bn.

As the market has evolved two particular episodes have marked its development. The fist was in the autumn of 1987; a substantial increase in

interest rates in October (85 per cent on time deposits) meant that unusually the attractiveness of equity investment deteriorated. Consequently, the index which was running at 1149 in August fell to 786 in October. As a counterpoint, the second major episode in the latter part of 1989 evidenced the continued enthusiasm for investing in the stock markets. Lowered interest rates on savings accounts and treasury bills as well as the decelerated devaluation of the Turkish Lira prompted many to turn to equity investment. In several ways, 1989 was a watershed year for the ISE: the index accelerated upwards from April 1989 reaching 2218 in December and nearly breaking the 4100 barrier in February 1990, before dropping back to 3294 in March.

Also, 1989 was the year when both domestic and foreign investors realized the remarkable potential of the ISE: its annual yield of 511.24 per cent in local currency is made all the more striking when compared to the U.S. Dollar devaluation of 1989 which had been 27 per cent. Trading value, a major indicator of market depth, grew eleven fold while share turnover soared by six-and-half times. Market capitalization of the major board rose to a new peak of TL 15.53 trillion. In August 1989, the government

also lifted any restrictions on foreign institutional and individual investors. These included the issue of repatriation of profits as well as the importation of foreign exchange. The Turkish Investment Fund, launched in mid-December 1989 on the New York Stock Exchange, was the first foreign fund that aimed to tap the ISE. Investors were further encouraged by the London listing of the Mediterranean Fund a few days later. Other funds have also followed suit, including Morgan Stanley's Türkiye Fund. The sharp rises in 1989 meant that the Istanbul Exchange outperformed the rest of the world in dollar terms. Average turnover grew a hundred fold during the year, to reach a higher level than those of European Community members such as Portugal and Greece.

The optimism that was an inevitable product of the 1989 performance figures for the ISE seems well founded for 1990: the index reached 5614 just before the outbreak of the Gulf crisis in August 1990. As, in other countries, the Gulf crisis badly undermined investor confidence, and the index swung erratically, falling to 3115 at the beginning of January 1991. The market recovered after the end of the Gulf war, but fell back in the pre-election period of a low point of 2655. During January 1992, with the new government

office, it broke back through the 5000 barrier, before falling again. Nevertheless, there was a substantial increase in the volume of business, and the number of stocks quoted. This should help to relieve one of the main defects of the market, which is its thinness.

The Market is still extremely volatile, and daily changes of 10 per cent in the index are not uncommon. Most large Turkish companies are family controlled and issue little equity. In many cases, recent rises appear to reflect speculative hopes on the part of investors, rather than the actual performance of the companies concerned.

There is also an insufficient regulatory environment. Legislation is currently being prepared to tackle the latter problem, and is expected to provide for penalties against insider trading and misleading advertising, as well as for the formation of an association of brokers and other intermediaries.

I.3. Trading Operation

The ISE provides a trading floor for a broad range of financial instruments including stocks, corporate bonds, revenue sharing certificates, government bonds and treasury bills. There were 89 companies listed on the primary market at the end of June 1990 and the market value then was TL 41.21 trillion. The average daily trading value through June 1990 was 44.4 per cent of the total market capitalization.

Currently the ISE employs a "continuous auction" system in which buyers and sellers write their buy and sell orders on the boards. A transaction is concluded when one member crosses out a buy or sell order and later signs a contract with the counterpart. The settlement and delivery of stocks are executed on the day following the transaction provided that it coincides with the relevant sale or purchase day. All settlements are made between members on a cash basis in Turkish Lira.

All transactions on the ISE are on a cash or spot basis and currently there no futures or options markets either on individual stocks or on

the index. Only authorized institutions and brokers are allowed to trade on the ISE (currently 94 institutions in total made up of commercial banks, investments, brokerages and individual authorized brokers). Some of the world's leading banks have already taken up membership, including Chase Manhattan, Citibank and Manufacturers Hannover; most of the world's leading brokerages have also applied for a seat.

I.4. Investments Trends

A significant feature of the ISE's development has been the authorities' willingness to accommodate and encourage foreign investment. The Capital Market Board has set no limit to foreign holdings in listed companies; this also applies to state-owned concerns privatized under the reform program. Also, since 1986 stock dividends have been exempt from tax for both domestic and foreign shareholders. In addition, capital gains tax rates for foreign investors have been reduced so that the same rates and regulations apply as for domestic holders.

So long as the investor follows a few basic principles that make the Turkish Market distinct from others, the very real attractions of this market can be capitalized upon. In the absence of reliable price/earnings (PE) ratios, many monitor a company's cash flow as a means of judging corporate value. As some of the better investment candidates in the market tend to report lower earnings on account of aggressive investment programs compared to others with more short-term profit biases, earnings can still be misleading within a long-term context.

Another factor which cannot be ignored when monitoring stock prices is the practice of revaluation funding. According to the Turkish accounting system and the Commercial Code, there are two acceptable means for capital raising: either cash or this revaluation technique. The latter is an account wherein reserves are accrued against the incremental values of a company's fixed assets. Increments are calculated by applying a percentage increase that is given by the government to account for inflation. Shares issued against the contribution to the increase in capital by such revaluation funding are dubbed bonus shares. Shareholders use their subscription rights over

nominal par values of stocks (typically the majority of these were TL 1000). It is often the case that all shareholders use their subscription rights and unsurprisingly, share prices go up before such stock splits and are adjusted immediately afterwards.

Another element which is relevant to short-term investors is the dividend distribution strategy adopted by a company. Turkish corporates distribute dividends once a year during April and May. According to the Capital Markets Law a minimum dividend payment of 50 per cent over net after-tax earnings has already been set. In 1990, a new accounting practice was introduced whereby allocation of retirement reserves became compulsory. Many companies had to create an account to cover such reserves and this has had a significant impact on 1990 net earnings for these institutions. The ISE index itself was also affected as most quoted companies were forced to set up such an account.

There are no restrictions for foreign investors wishing to access the ISE: Persons resident abroad, including investment companies and investment funds established outside the country, are permitted to purchase

and sell any and all types of Turkish securities quoted on the exchange utilizing the intermediation of financial institutions and to repatriate the proceeds earned on trading in such instruments and from the sale of the same through banks and Special Finance Institutions.

II. The Dynamic Behavior of the Istanbul Stock Exhange Market using a Vector Autoregression Model

Generally stock prices in the world are notoriously unpredictable and financial economists have developed the theory of efficient markets to explain why prices should be unpredictable. Some of them believe that, with hindsight, they could explain most asset-price movements with authenticated information. The results of the empirical investigations of this paradigm are not very gratifying; with all explanatory factors included only the twenty percent of the daily return volatility in the typical stock can be explained. This is for a sample of the largest firms from the U.S. Market which is the most perfect market (Roll, 1988).

Under these circumstances our task is not to discover either (a) measurable influences that will explain the remaining eighty percent, or (b) a coherent reason why it should forever remain unexplained, but try to analyze the dynamic behavior of one of the youngest stock markets in the world: The Istanbul Stock Exchange Market, (ISEM) using a Vector Autoregression

Model.

As evidenced by the fact that the stock markets of the world are referred to as "the Market", in which claims on the earnings of corporations (shares of stock) are traded. The markets are the most widely followed financial institutions in the world. A big swing in the prices of shares in the stock market is always a big story on the evening news. The attention that the market receives can probably be best explained by one simple fact: it is a place where people can get rich quickly. These considerable fluctuations in stock prices affect the size of people's wealth and as a result may affect their willingness to spend. In Türkiye, stock prices have been extremely volatile since 1989.

The stock market is also an important factor in business firm's investment decisions because the prices of the shares affect the amount of funds that can be raised by selling newly issued stock to finance investment spending. A higher price for a firm's shares means that it can raise a larger amount of funds, which can be used to buy plant and equipment.

We will explore how stock prices behave and propose a different

approach by using a Vector Autoregression model.

II.1. Data Sample and Emprical Analysis

Daily prices of the individual stocks are from the Turkish Capital Market Board, Ankara for the January 1989 - June 1991 time period. Daily closing values of the Istanbul Stock Exchange Index (ISEI) are from the Istanbul Stock Exchange. Weekly published Turkish Treasury Bills having three-, six-, nine-, and twelve- month maturities were available from the Turkish Treasury and Foreign Trade Department. Finally the spot exchange rate of Turkish Lira per Dollar is used for the same sample period of 642 daily observations.

In this study we are concerned only with daily percentage capital rates of return C_{it} for the ten Turkish companies, where: i =1 ,2 ,..., 10 and

$$C_{it} = \frac{P_{it} - P_{it-1}}{P_{it}} \qquad [1]$$

Turkish Lira denominated daily return is

$$R_{it} = \frac{\left[X_i(\frac{TL}{S})_t\right] - \left[X_i(\frac{TL}{S})_{t-1}\right]}{X_i(\frac{TL}{S})_{t-1}} \qquad [2]$$

where X $(TL/S)_t$ is the spot exchange rate (Turkish Liras per Dollar) on day t. Dividends are not included in the capital returns.

For a three year period, we collected four maturity percentages of Treasury securities including Treasury bills with three-, six-, nine-, and twelve-month maturities. Unlike stocks, the characteristics of bills change through time as their maturity date approaches. If a bill's term-structure premium varies with its maturity, the return series for a particular bill will contain systematic changes corresponding to the shortening of its maturity. To control for the effect of changing maturity, the weekly issuance of Treasury securities forced me to construct a daily bill series using the linear

interpolation method. The generated and daily adjusted new series will serve as a risk free rate of interest in the regressions.

Daily closing values of the ISEI were available from the Istanbul Stock Exchange. As a value weighted index, ISEI was given 100 as a base value for January 1986.

II.2. The Framework

This study is an attempt to investigate the dynamic relationship between ten Turkish companies, Turkish Lira denominated daily rate of return, risk free rate of return and Istanbul Stock Exchange Index, in a multivariate context using vector-autoregressions (VAR).

Daily time series data starting from January 1989 until June 1991, is used in the empirical part of this research.

The application of a VAR enables us to consider ten Turkish companies' daily capital rates of returns (C_{it}) as endogenous. Risk free rate of return (Rf_t), Turkish Lira denominated daily rate of return (R_t), and value-

weighted Istanbul Stock Exchange index return ($ISEI_t$) are exogenous variables. We use them to observe the dynamic influence of endogenous variables and the exogenous variables upon each other and upon themselves.

II.3. Methodology

Vector Autoregressions are dynamic models of a group of observations that are assumed to be generated sequentially by a stochastic process through time. Sims has proposed using a VAR model as an alternative to large simultaneous equations models for studying the relationship among the important aggregates. This methodology denies that an a priori theory can ever yield the restrictions necessary for identification of structural models, and argues that for forecasting and policy analysis, structural identification is not needed (Sims, 1980, p.11). Accordingly this approach maintains only unrestricted vector-autoregressive systems which do not allow for a priori classification of the variables into endogenous and exogenous.

The VAR approach represents an important alternative to large-

scale macroeconometric models and has been employed with some success in the area of forecasting (Litterman and Weiss, 1985). In this study the VAR approach will be used to explain the dynamic behavior of the Istanbul Stock Market.

In a VAR system, each variable is regressed on its own lagged values, lagged values of the other endogenous variables as well as lagged values of the relevant exogenous variables. Since in each equation right hand side variables consisting of past values are predetermined we do not have to worry about the existence of simultaneous equation bias.

Thus the system can be consistently estimated using ordinary least squares (OLS). Furthermore estimating each equation separately using OLS produces asymptotically efficient estimates, because the right-hand side variables are the same in every equation.

II.4. Estimation

To eliminate the overfitting of the data we choose only ten common stocks from the Istanbul Stock Market. VAR modeling finds a solution to the overfitting problem by reducing the number of variables or assuming shorter lags against the alternative of imposing exclusionary restrictions on the parameters of the model.

Ten Turkish companies; Akçimento, Çelik Halat, Çukurova Elektrik, Kartonsan, Kordsa, Good Year (Turkish owned), Rabak, Türk Demir Döküm (TDD), Türkiye Sınai Kalkınma Bankası (TSIKB), Yapı ve Kredi Bankası (YAKB), are chosen as endogenous variables in the regressions. Turkish Lira denominated rate of return, risk free rate of return and Istanbul Stock exchange index are the exogenous variables, and they are expected to have an influence on the whole system.

To ensure stationarity, daily rate of return of all variables are taken. Furthermore, each equation contains four dummy variables to account for weekly variation of three month-, six month-, nine month-, and twelve-

month maturity Treasury bills.

The estimated system has the following form:

$$C_{it} = \sum_{j=1}^{10} \alpha_{i,j,1} C_{j,t-1} + \sum_{j=1}^{10} \sum_{E=R}^{ISEI} \beta_{i,j,1} E_{j,t-1} \qquad [3]$$

$$[3] + \sum_{j=1}^{10} \lambda_{i,j,1} D^{z}_{j,t-1} + \varepsilon_{it} \qquad [4]$$

Where C_{it} for all Turkish companies, i from 1 to 10, represents percentage change in the capital rate of return. In each equation, C_{it} for all i and t, stands for the endogenous variables, and α, β, λ are the coefficients. Three exogenous variables (E) represents R (for the Turkish Lira denominated rate of return, R_f (for the Risk Free rate of Return), and the ISEI (for the Istanbul Stock Exchange Index) are included in each equation. In the regressions, D^z, for z =3, 6, 9, 12 represents the dummy variables for Treasury

bills for each of the ten equations. In estimating this system only a one day lag is considered.

III. VAR Model Results

III.1. Time Domain Regressions Results

Tables 1-3 displays the coefficients for vector-autoregressions of the ten analyzed companies of the ISE. I used F-statistics to test if the returns follow a random walk and how the one day lagged returns of the nine other companies and market indices effect the return of each company. F stands for the F statistical hypothesis that lagged value of a variable has a zero coefficient in the corresponding equation. According to Table 1 and 3, Çukurova Elektrik, Rabak, TSIKB are the only three variables which are influenced by their own one day lagged values. Other companies do not appear to be close to a random walk. When we look at the F-test results for each company; Akçimento seems to be influenced only by the past value of Rabak. This means that lagged values of the nine Turkish companies except Rabak

have no predictive power for the current capital rate of return of Akçimento. In other words Akçimento's percentage return is not caused by these variables in the Granger-causality sense. Akçimento's capital rate of return is exogenous with respect to nine companies' capital rates of return. Çelik Halat, Kordsa and YAKB are exogenous with respect to all ten companies. Çukurova Elektrik is exogenous with respect to eight Turkish companies except itself and TSIKB.

Kartonsan is influenced by Kordsa only and is exogenous with respect to nine other companies' returns. Good Year is only affected by lagged returns of Akçimento and Rabak. TDD is exogenous with respect to eight companies' returns except Akçimento and Çelik Halat. Rabak is influenced by its own one day lag, and from the lagged returns of Akçimento and TSIKB. Capital rate of return of TSIKB follows a random walk and is affected by the past return of YAKB. Akçimento, Rabak, and TSIKB are the most influential ones in the regressions. Along the same lines, one observes that there is strong interaction among Akçimento and Rabak. These variables are influenced by the past values of each other.

Establishing the linear relationship between C_{it}. and $ISEI_{it}$ is

tantamount to rejecting the null hypothesis that the coefficient between them is zero. The null hypothesis is rejected at ten percent significance levels for Çelik Halat, Çukurova Elektrik, Kartonsan, Kordsa, and YAKB. For the five other Turkish companies there is no apparent relationship between them and the Istanbul Stock Exchange Index. Furthermore, there is no linear relationship between Risk free rate and capital rate of returns nor is there a linear relationship between Turkish Lira denominated rate of return and percentage rates of return for the ten Turkish companies chosen.

F TESTS RESULTS FOR THE VAR MODEL BETWEEN JANUARY 1989-JUNE 1991

TABLE 1

F-tests	Akçimento	Çelik Halat	Çukurova E.
F - Akcimento	0.1366	0.7715	1.9065
mar.significance	(0.712)	(0.380)	(0.168)
F-Çelik Halat	0.0024	0.8813	0.8941
mar.significance	(0.96)	(0.348)	(0.345)
F- Çukurova E.	0.5974	0.0605	3.3038
mar.significance	(0.44)	(0.806)	(0.069)
F- Kartonsan	0.0516	1.3466	0.6773
mar.significance	(0.82)	(0.246)	(0.411)
F- Kordsa	1.3709	1.7912	0.3512
mar.significance	(0.25)	(0.181)	(0.554)
F- GoodYear	0.1003	1.3874	0.1792
mar.significance	(0.752)	(0.239)	(0.672)
F- Rabak	2.9292	2.2520	0.0014
mar.significance	(0.874)	(0.134)	(0.970)
F -Tdd	0.0005	0.4579	0.0803
mar.significance	(0.982)	(0.499)	(0.777)
F -Yakb	0.7060	0.4869	0.6119
mar.significance	(0.401)	(0.486)	(0.434)
F -Tsikb	0.4011	0.3214	4.5143
mar.significance	(0.527)	(0.570)	(0.034)

F TESTS RESULTS FOR THE VAR MODEL BETWEEN JANUARY 1989-JUNE 1991

TABLE 2

F-tests	Kartonsan	Kordsa	GoodYear	Rabak
F-Akçimento	0.1776	1.5575	5.3446	4.0340
mar.significance	(0.674)	(0.212)	(0.021)	(0.045)
F-Çelik Halat	0.5668	0.3338	1.1035	1.9723
mar.significance	(0.452)	(0.564)	(0.294)	(0.161)
F- Çukurova E.	0.0315	0.6349	0.1338	0.0146
mar.significance	(0.859)	(0.426)	(0.715)	(0.904)
F- Kartonsan	0.2715	0.5366	0.0058	0.0167
mar.significance	(0.603)	(0.464)	(0.939)	(0.897)
F- Kordsa	3.1041	0.8872	0.0032	0.3352
mar.significance	(0.079)	(0.347)	(0.955)	(0.563)
F- GoodYear	1.9060	0.1504	0.5895	0.6569
mar.significance	(0.168)	(0.698)	(0.443)	(0.418)
F- Rabak	0.2916	0.3538	7.2334	2.6956
mar.significance	(0.589)	(0.552)	(0.007)	(0.101)
F -Tdd	0.1014	0.1082	0.5884	0.2283
mar.significance	(0.750)	(0.742)	(0.443)	(0.633)
F -Yakb	0.0904	0.0504	1.5120	0.5474
mar.significance	(0.764)	(0.823)	(0.219)	(0.460)
F -Tsikb	0.0525	2.0998	0.1255	6.0257
mar.significance	(0.819)	(0.148)	(0.723)	(0.014)

F TESTS RESULTS FOR THE VAR MODEL BETWEEN JANUARY 1989-JUNE 1991

TABLE 3

F-tests	Tdd	Yakb	Tsikb
F-Akçimento	6.2257	0.0323	0.2730
mar.significance	(0.013)	(0.857)	(0.602)
F-Çelik Halat	9.4806	0.3045	0.1371
mar.significance	(0.002)	(0.581)	(0.711)
F- Çukurova E.	0.5213	0.1024	0.0141
mar.significance	(0.471)	(0.749)	(0.905)
F- Kartonsan	0.0724	1.7925	0.7869
mar.significance	(0.788)	(0.181)	(0.375)
F- Kordsa	1.0897	1.8119	0.3154
mar.significance	(0.297)	(0.179)	(0.575)
F- GoodYear	0.4144	1.0170	0.9622
mar.significance	(0.520)	(0.314)	(0.327)
F- Rabak	0.6066	0.4416	0.1927
mar.significance	(0.436)	(0.507)	(0.660)
F -Tdd	0.0034	0.0936	0.2768
mar.significance	(0.953)	(0.760)	(0.599)
F -Yakb	0.0607	0.6102	10.4522
mar.significance	(0.805)	(0.436)	(0.001)
F -Tsikb	0.4011	0.3214	4.5143
mar.significance	(0.527)	(0.570)	(0.034)

III.2. Model Diagnostics

Having identified a time domain model, I can then attempt to check its appropriateness. I analyzed each company's plot of residuals against time (Figures III.2.1 to III.2.10) and then compared autocorrelation and partial autocorrelations for these residuals. This was to check the similarity between them in order to determine about the correctness of the model (Atkinson and Weisberg, 1991).

The autocorrelation and partial autocorrelation functions are given in Figures III.2.1a to III.2.10b, respectively. Neither seems unreasonable; they are similar indicating that the model is correct. The suggestion has been advanced in the literature that stock returns may be serially negatively correlated because they are generated by a random walk (Schwartz and Whitcomb, 1977). Since market model residuals are more nearly independent across firms, we can have more confidence by considering them. Furthermore, delays in the execution of trades can generate negative residual autocorrelation and positive index autocorrelation without necessarily

generating autocorrelation of returns.

The primary problem with the residuals is that the variability seems to change considerably. Negatively autocorrelated market residuals and positively autocorrelated market index returns indicate that they are generated by the following "Fisher effect" mechanism: Suppose news occurs that would raise stock prices and that the prices of some stocks, say Group A, fully adjust by the close of trading on day j, while Group B prices do not fully adjust until day j+1. Then, ceteris paribus, the market index will be positive on day j and on day j+1. Hence the market index will be autocorrelated on a daily basis. Group A residuals will be positive on day j, because Group A prices fully adjust on day j, and will be negative on day j+1, as the market adjustment is completed. Similarly, Group B residuals will be negative on day j and positive on day j+1. Hence for both groups the residuals will be negatively autocorrelated. Fisher attributed this effect partly to the fact that infrequently traded issues often close i.e. have their last recorded price well before the end of the trading day.

While most of the observations fit the model and the Gauss

Markov conditions at least approximately, some of the observations do not. This occurs when there is something wrong with the observations or if the model is faulty. Generally, as far as the observations are concerned, there could have been a mistake in inputting or recording data. A few observations might reflect conditions or situations different from those under which other observations were obtained. If the data set on stock prices were to include one or two observations where the properties were particularly run-down or where for unusual circumstances they were sold at prices that did not reflect their "true value", these points would most likely not belong to the model. Observations that do not fit the model might also point to deficiencies in the model. There are two principal purposes in trying to identify them. One is obviously to improve the integrity of the model by eliminating the effects of points that do not belong to it. The other purpose is to identify shortcomings in the model. Points that do not conform to it are the intriguing instances of high variability that helps us to understand the market better. This information can lead to substantial improvements in the model. It can lead to discoveries which are valuable in themselves. As Daniel and Wood (1980, p.29) put it,

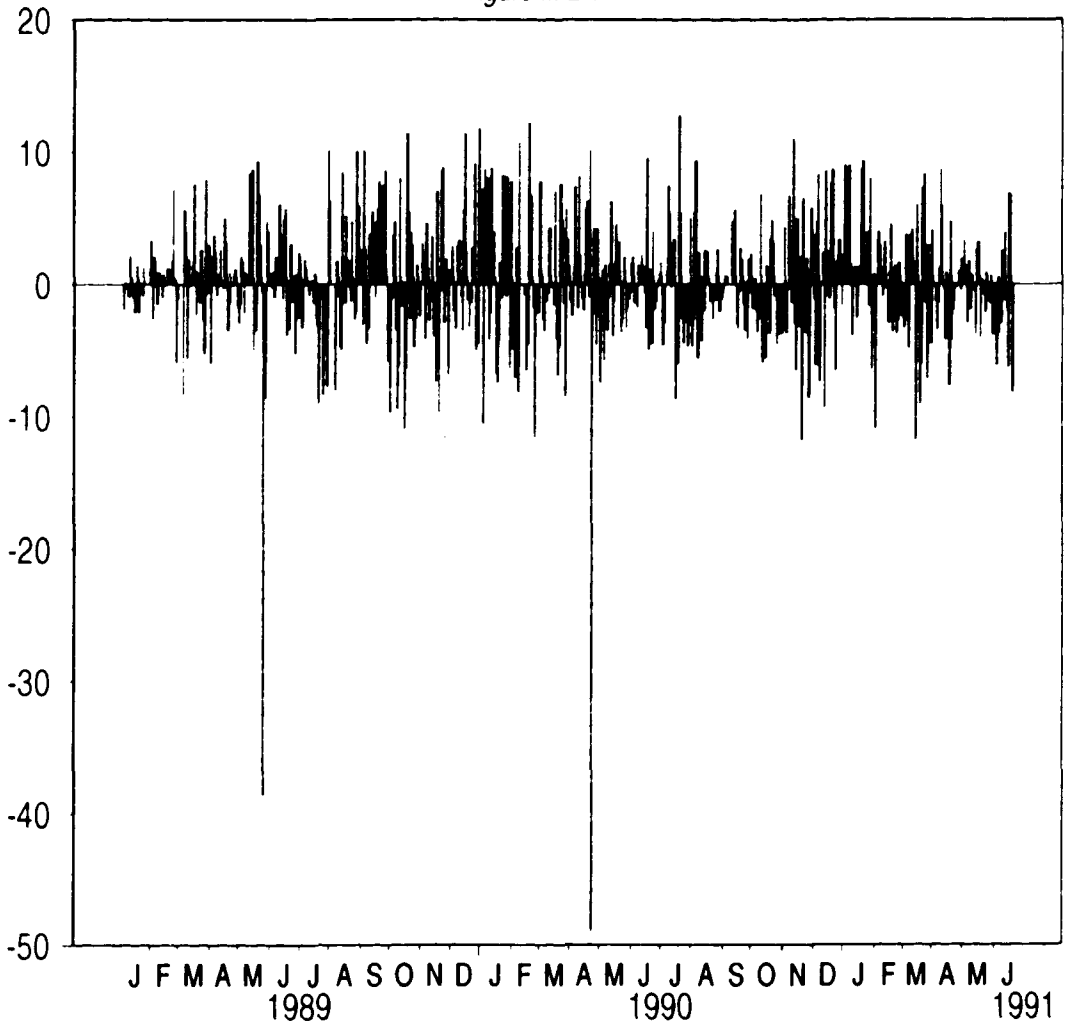
"Numerous patents have resulted from the recognition of outliers".

Observations that do not belong to the model often exhibit numerically large residuals and when they do they are called outliers. They are influential in the sense that their deletion has a large impact on the estimates of the regression coefficients

A point has undue influence when it has a large residual or is located far away from other points in the space of independent variables, i.e. (ISEI) displayed in Figures III.1 to III.10. Residuals listed in Tables 4-6, increase and decrease drastically at influential points for all companies. In Figures III.1 to III.10 the plots of the residuals of the ten securities in the space of ISEI show a significant correlation between those residuals and the ISEI except TSIKB. With a slope of 90 degrees, the residuals of TSIKB are not correlated to the market index return. The examples illustrated in these Figures and Section II.2.1, give a speculative analysis of them. However, whether the model is appropriate or not, we cannot expect to obtain accurate forecast from it.

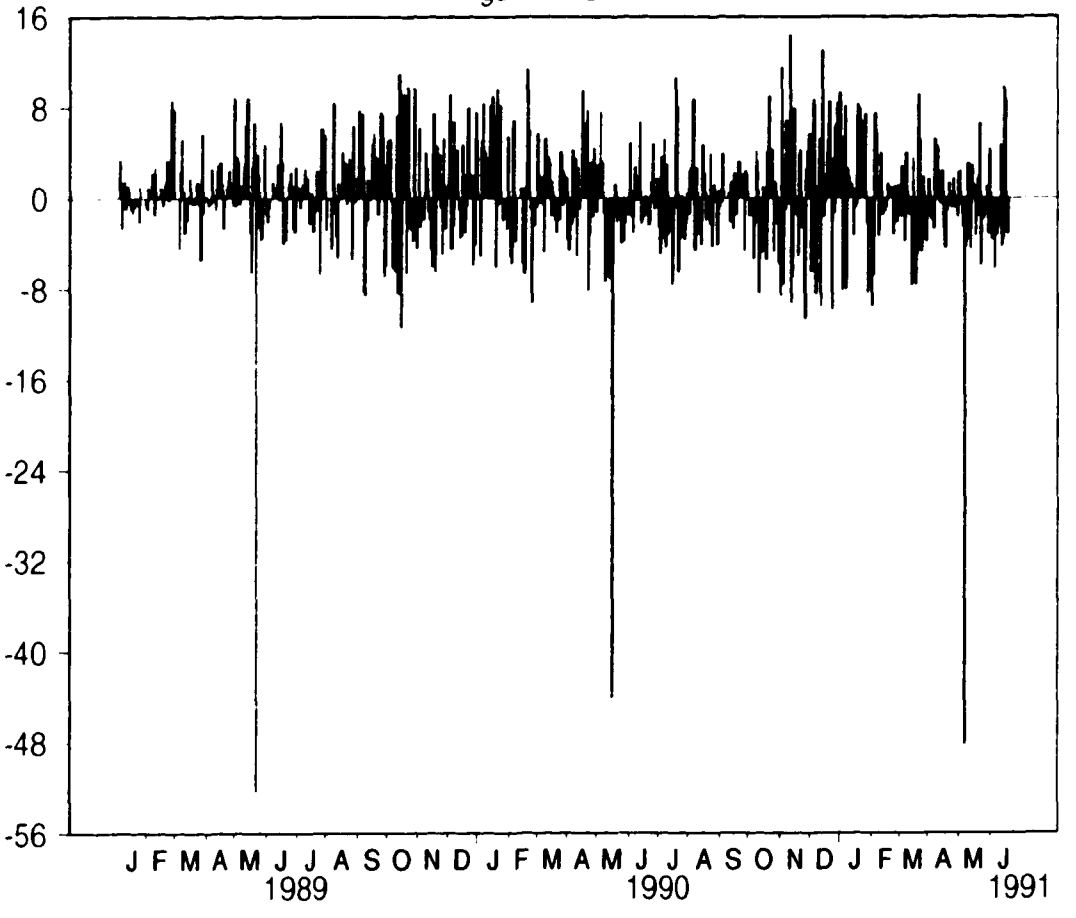
The Residuals of AKCIMENTO

Figure III.2.1



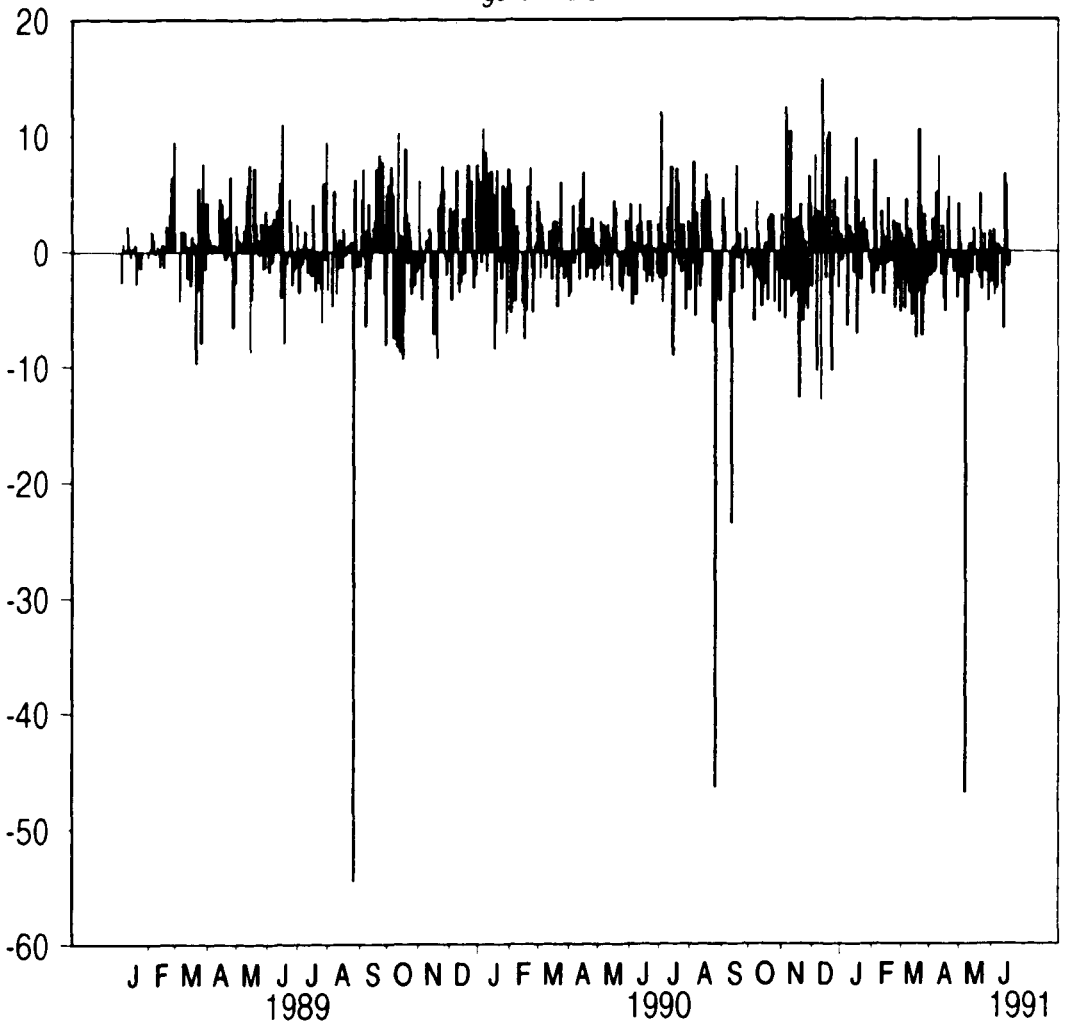
The Residuals of CELIK HALAT

Figure III.2.2



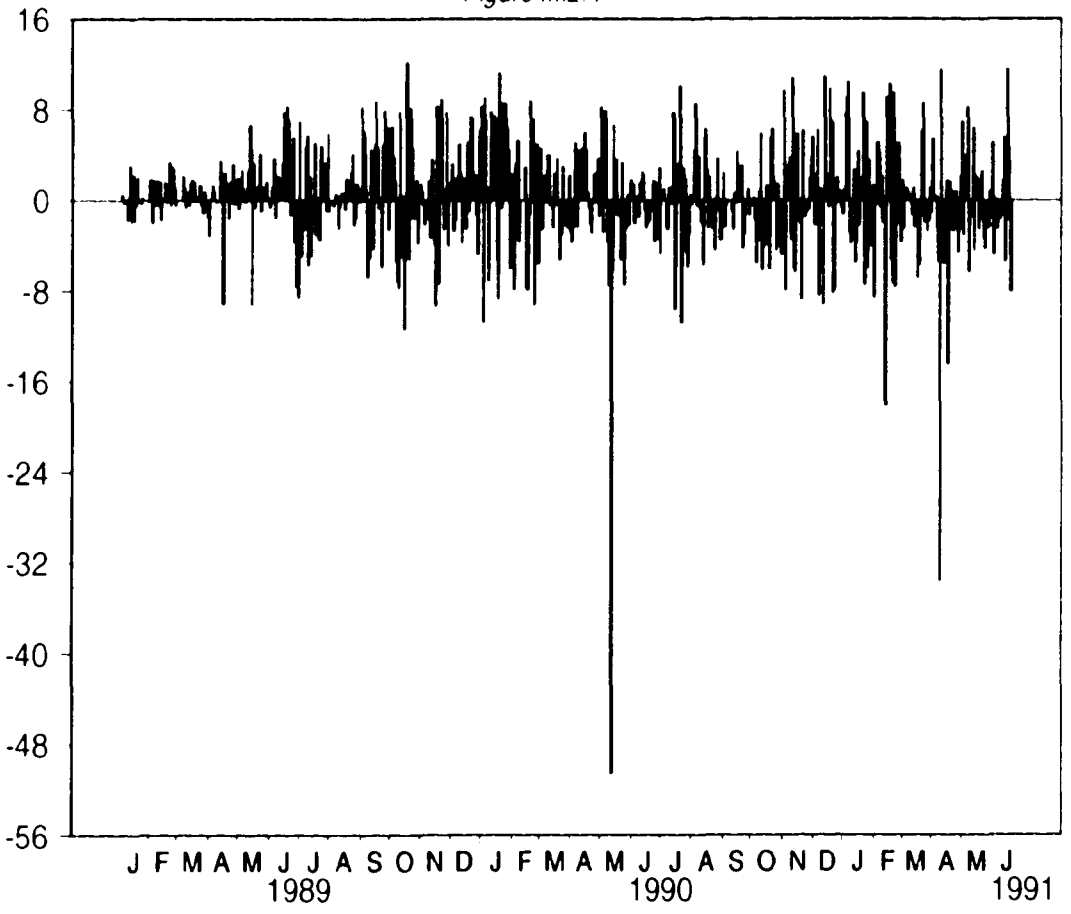
The Residuals of CUKUROVA ELEKTRIK

Figure III.2.3



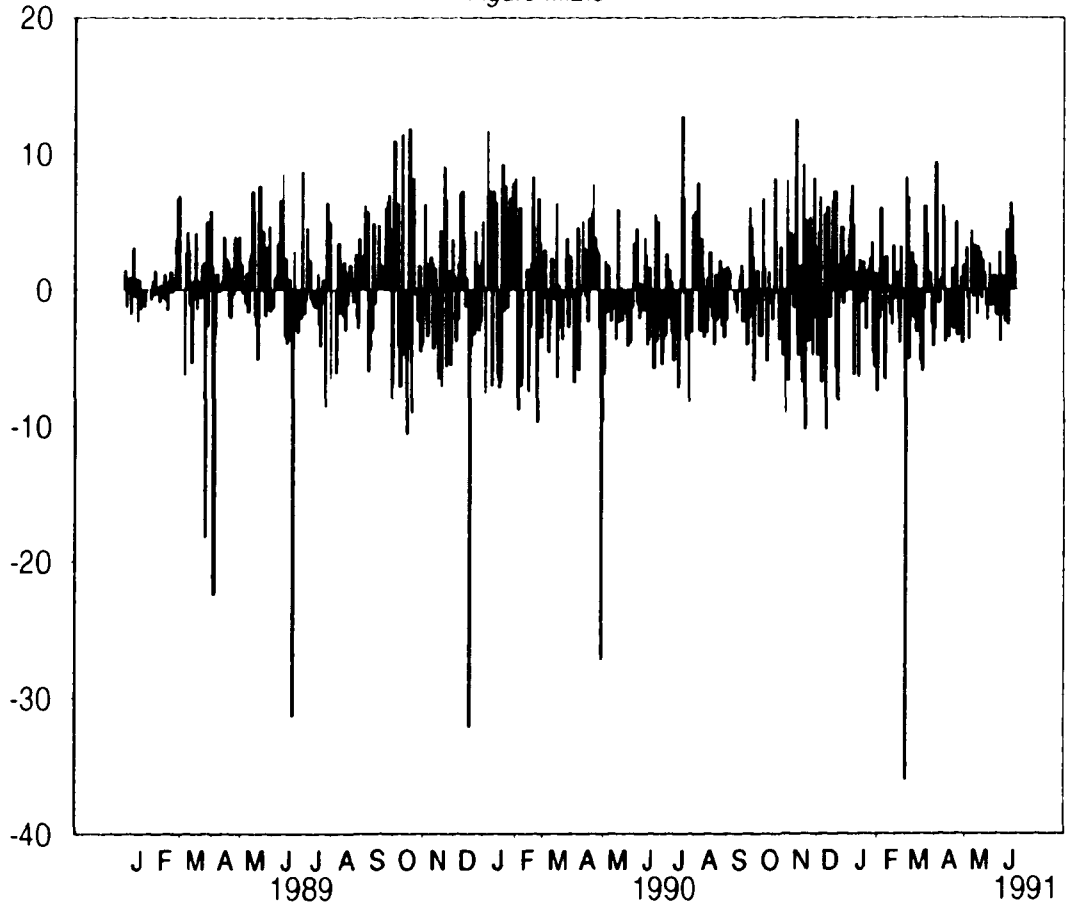
The Residuals of KARTONSAN

Figure III.2.4



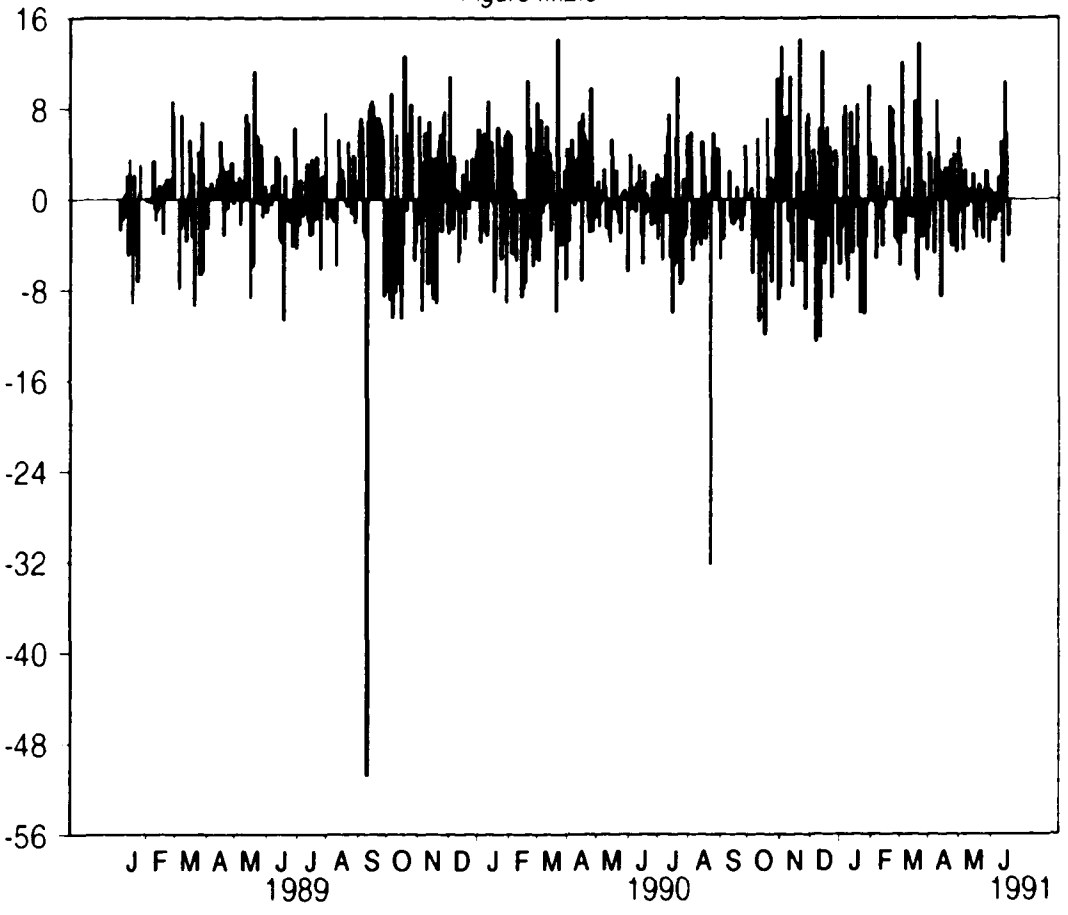
The Residuals of KORDSA

Figure III.2.5



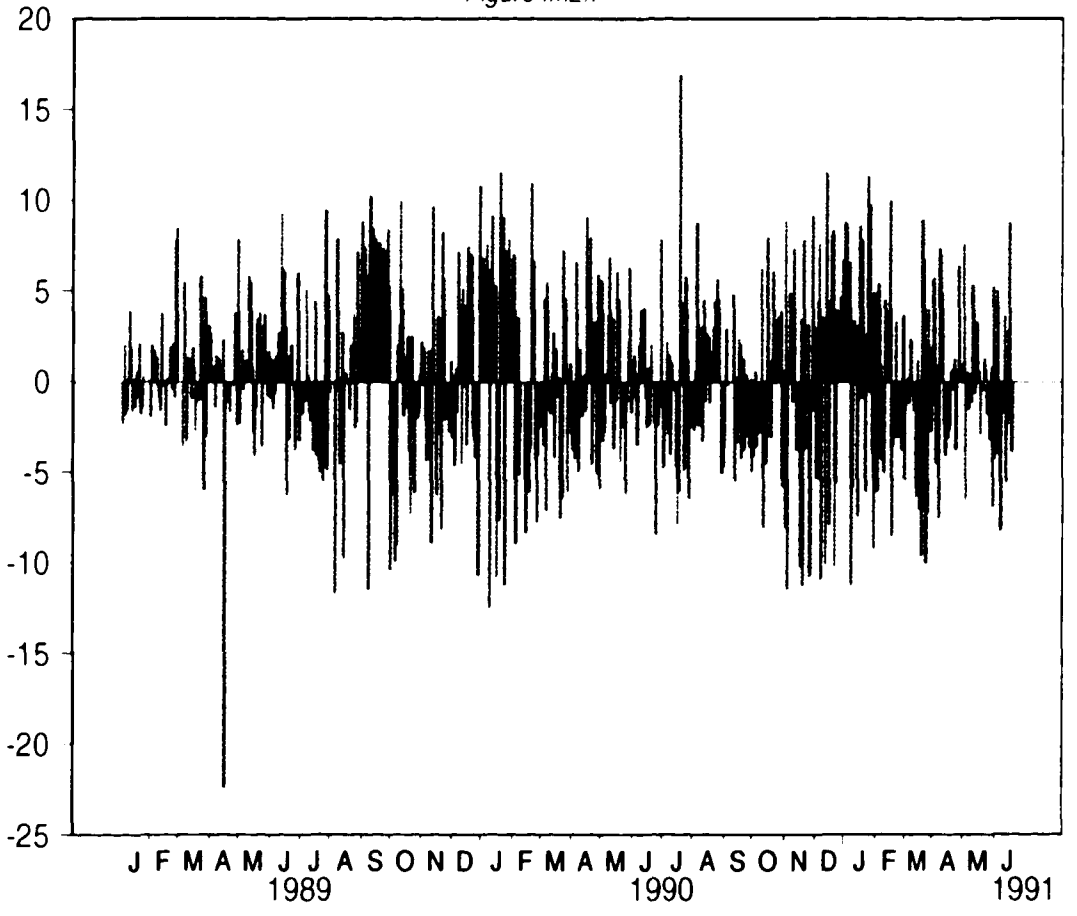
The Residuals of GOOD YEAR

Figure III.2.6



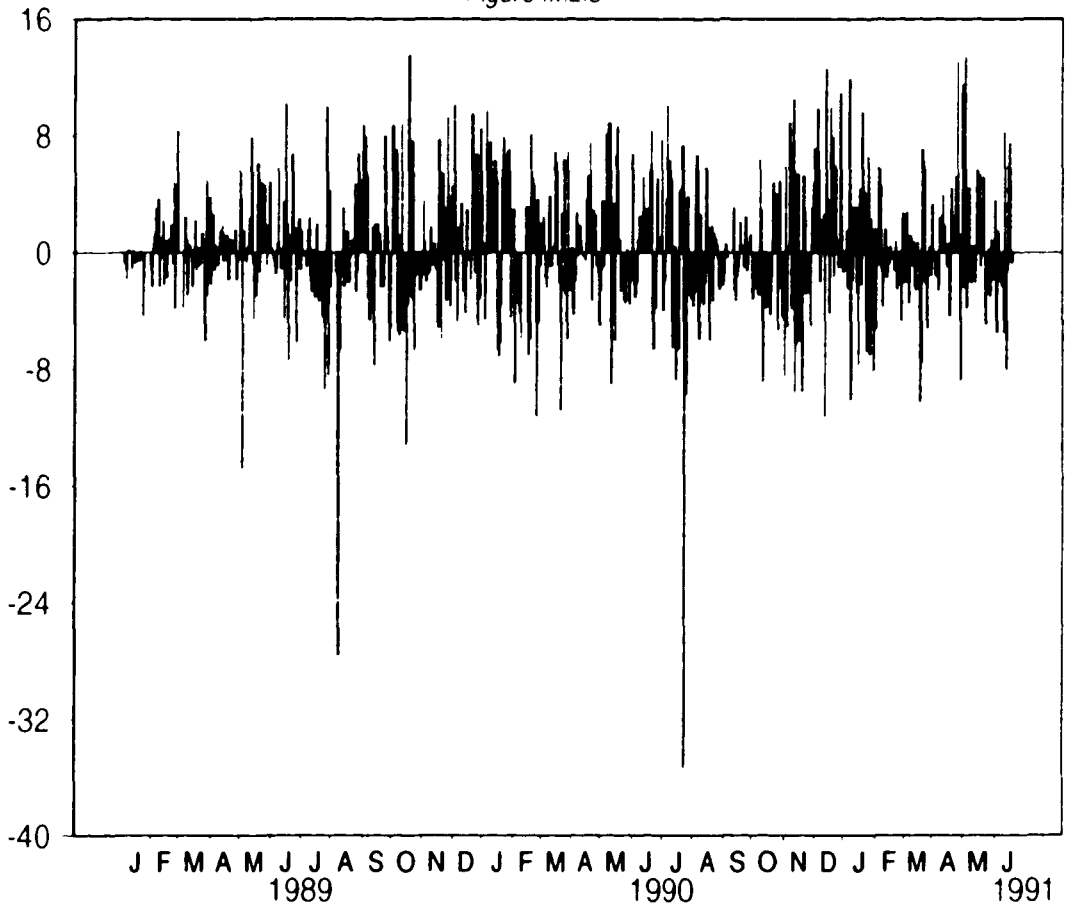
The Residuals of RABAK

Figure III.2.7



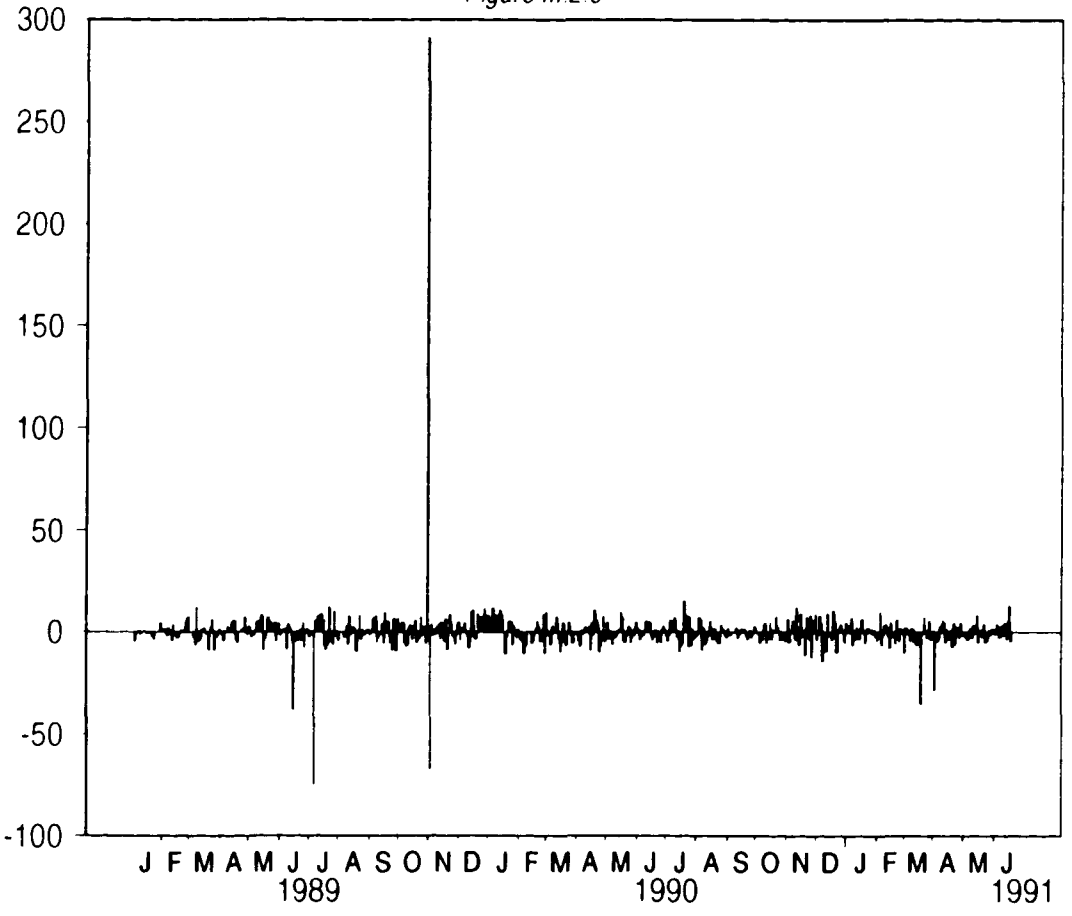
The Residuals of TDD

Figure III.2.8



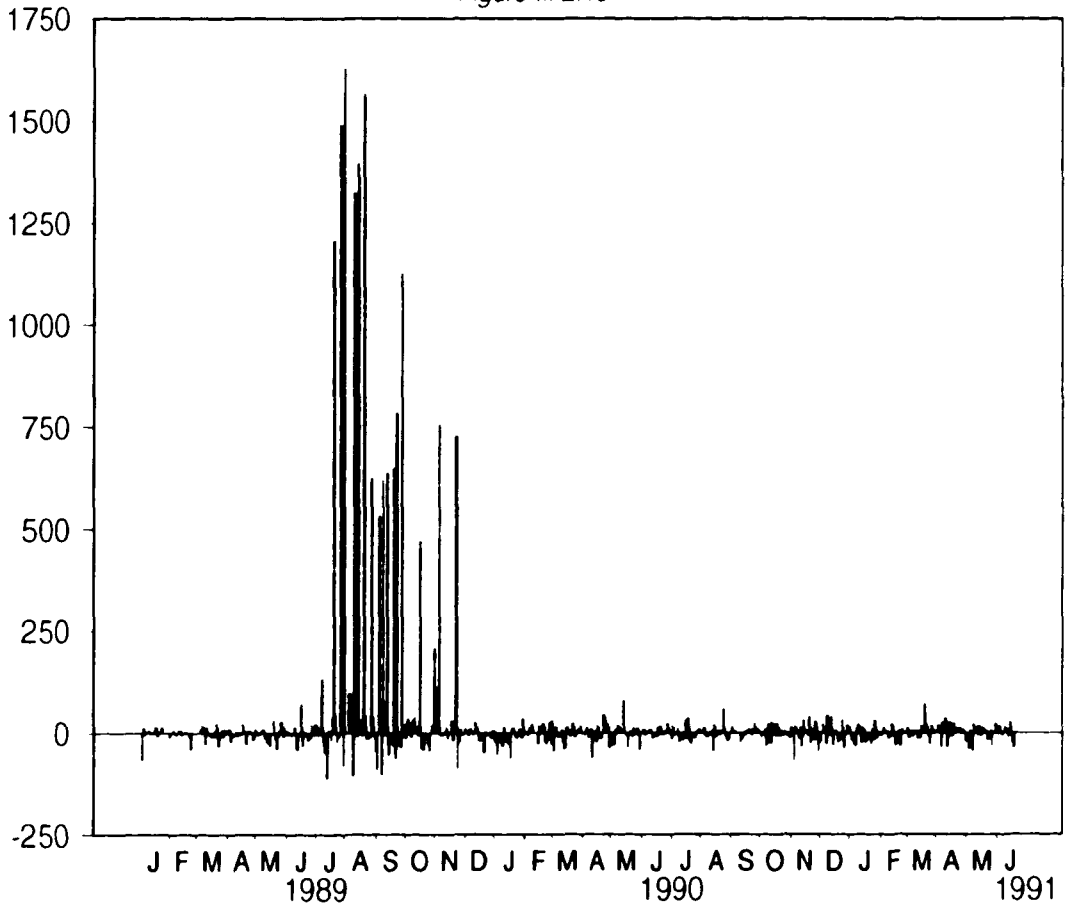
The Residuals of YAKB

Figure III.2.9



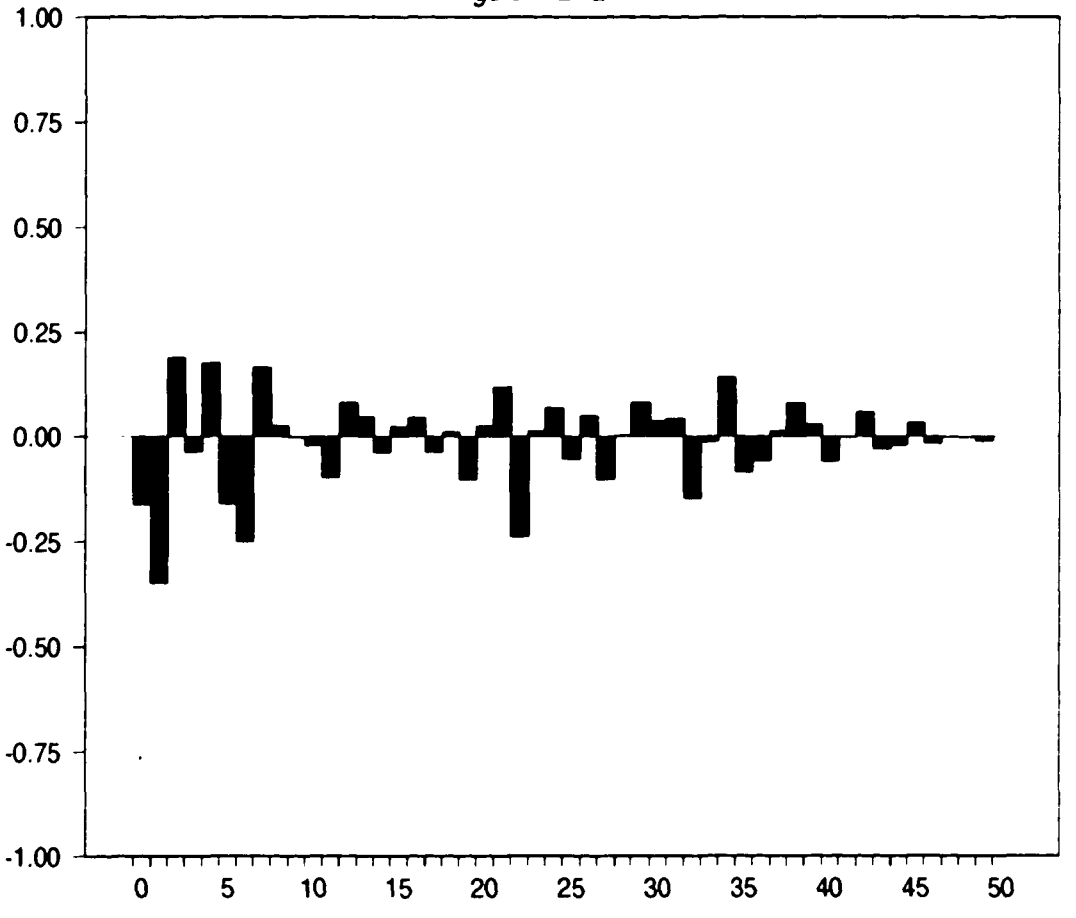
The Residuals of TSIKB

Figure III 2.10



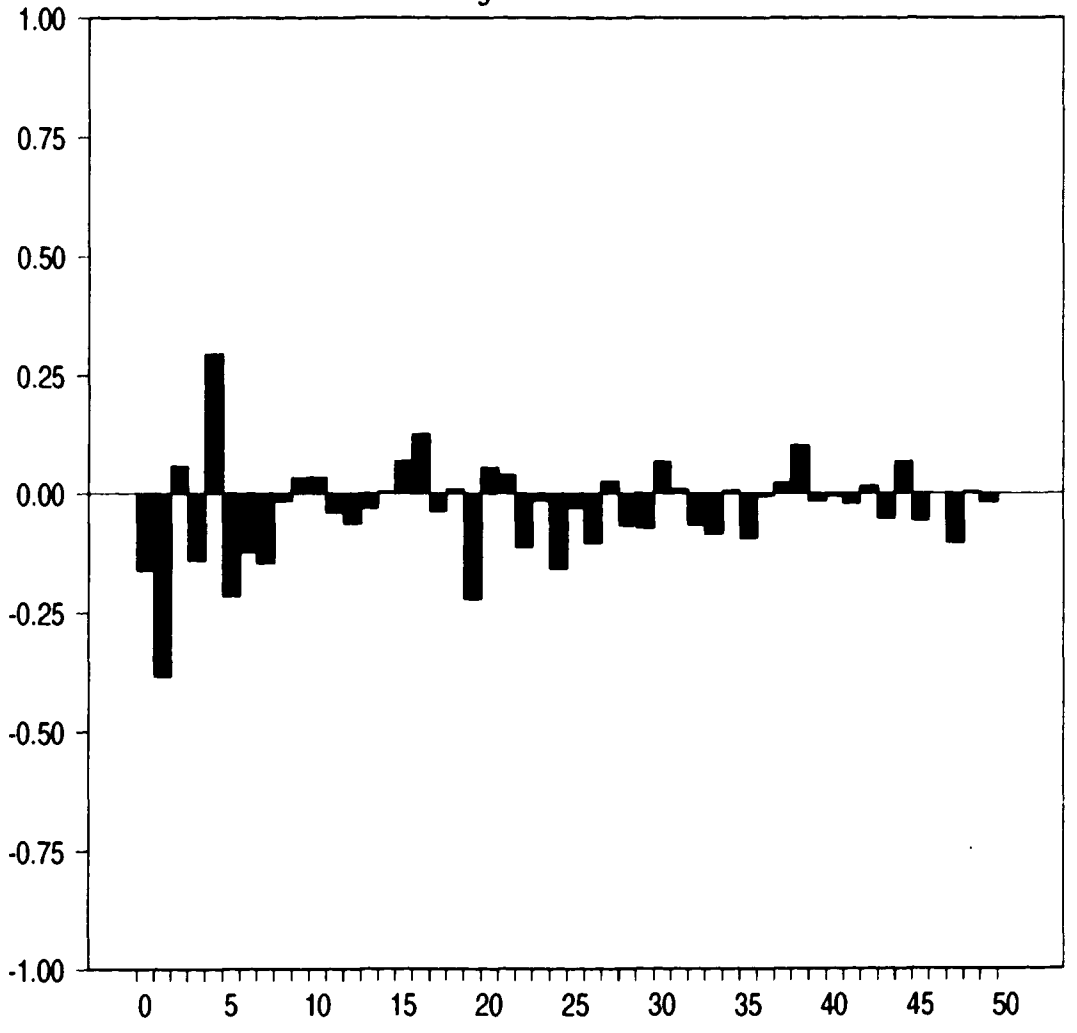
Estimated Autocorrelations for the residuals of AKCIMENTO

Figure III.2.1a



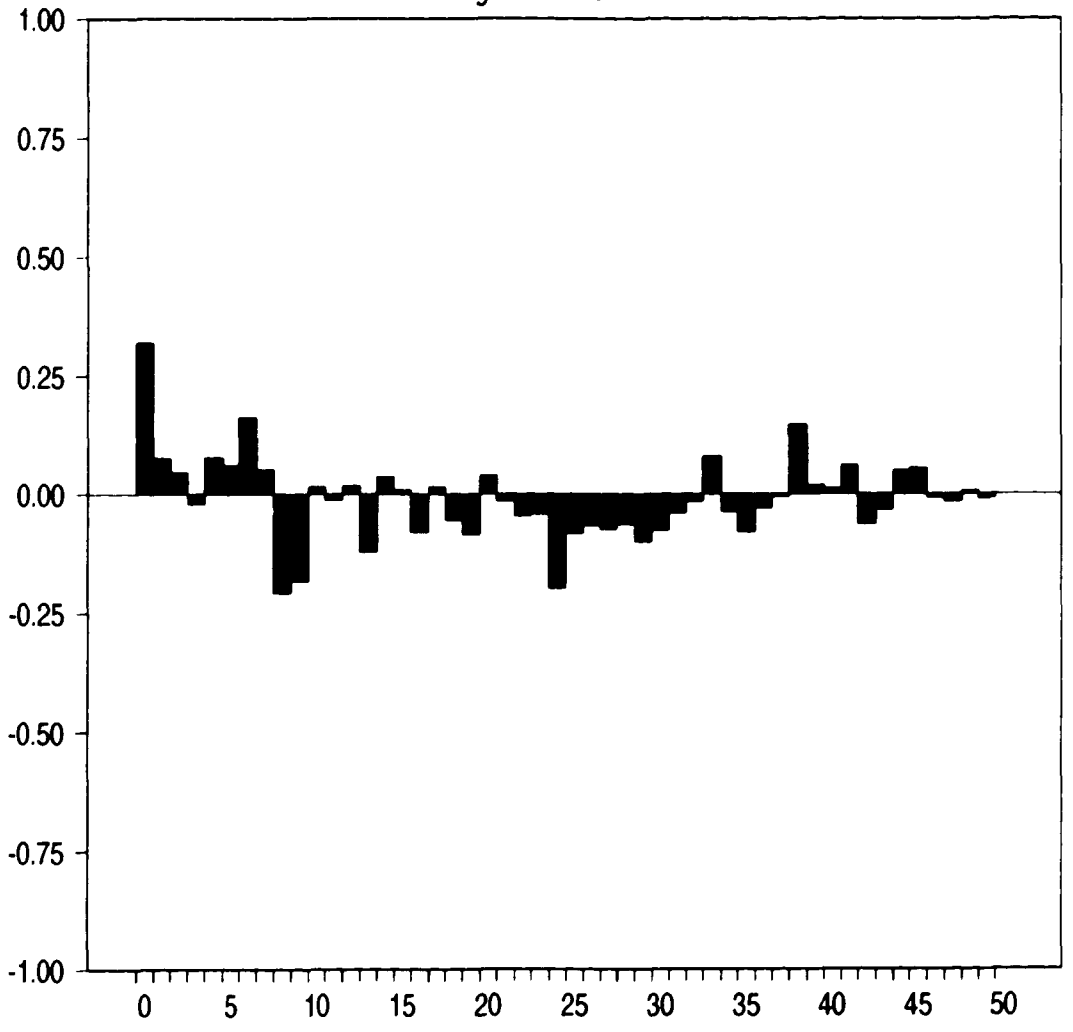
Estimated Partial Autocorrelations for the residuals of AKCIMENTO

Figure III.2.1b



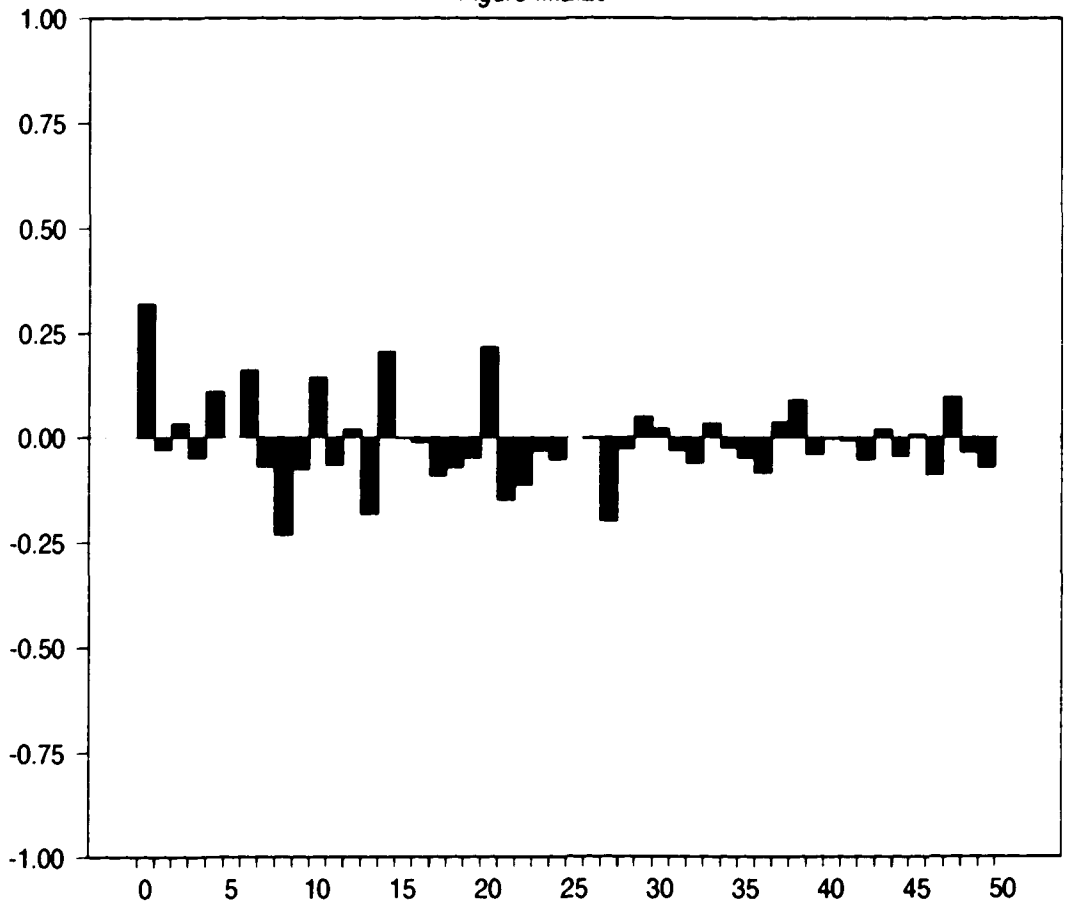
Estimated Autocorrelations for the residuals of CELIK HALAT

Figure III.2.2a



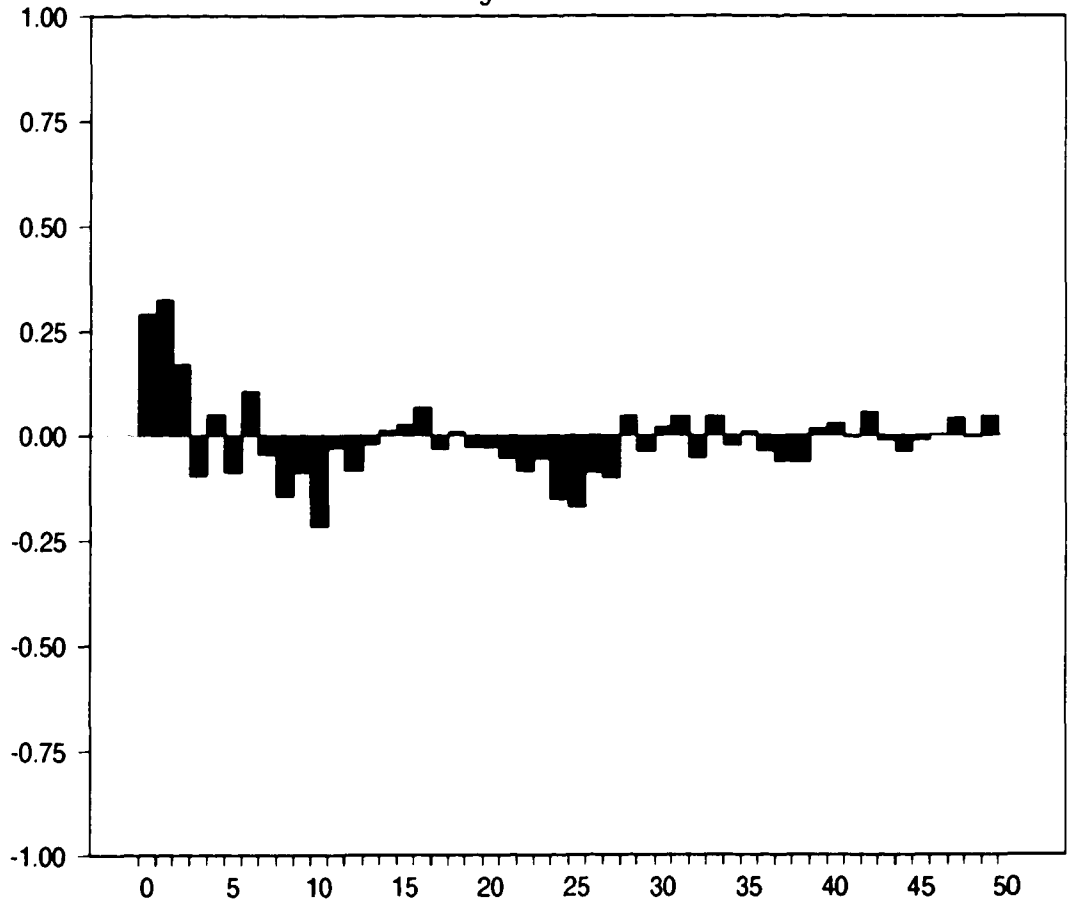
Estimated Partial Autocorrelations for the residuals of CELIK HALAT

Figure III.2.2b



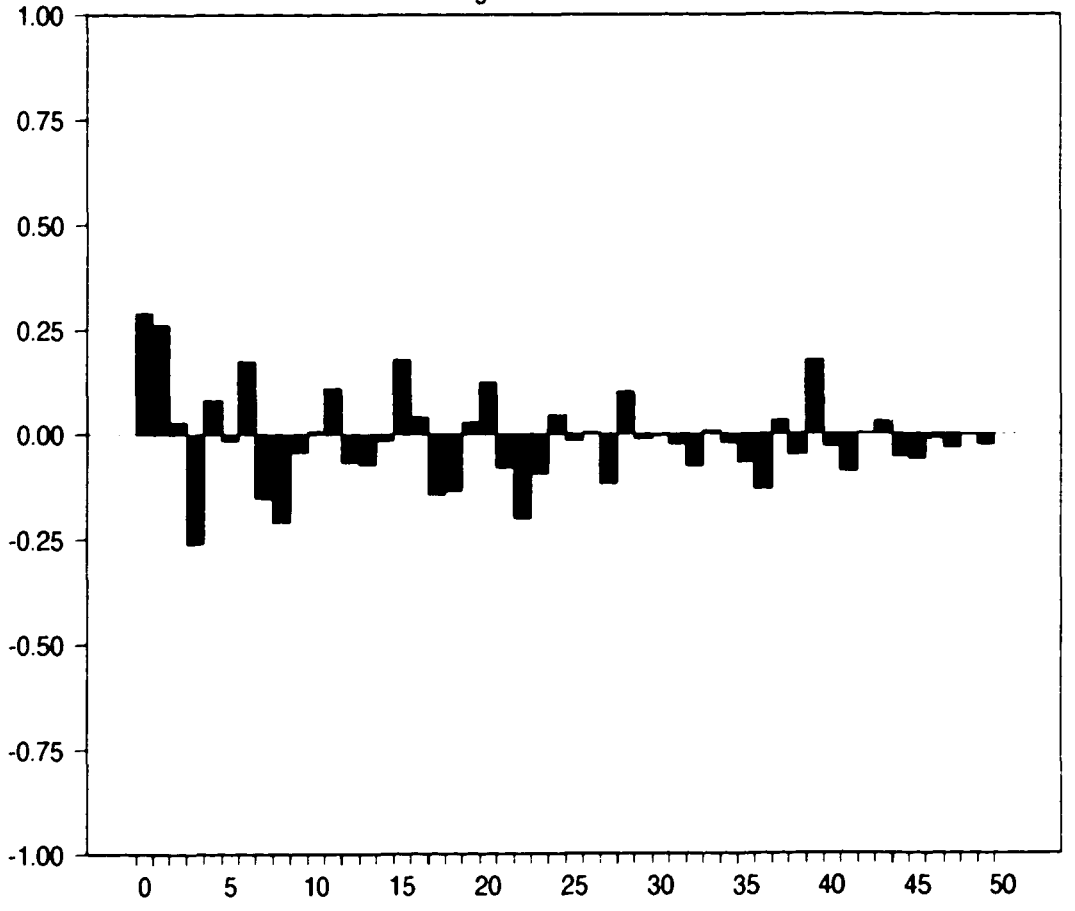
Estimated Autocorrelations for the residuals of CUKUROVA ELEKTRIK

Figure III.2.3a



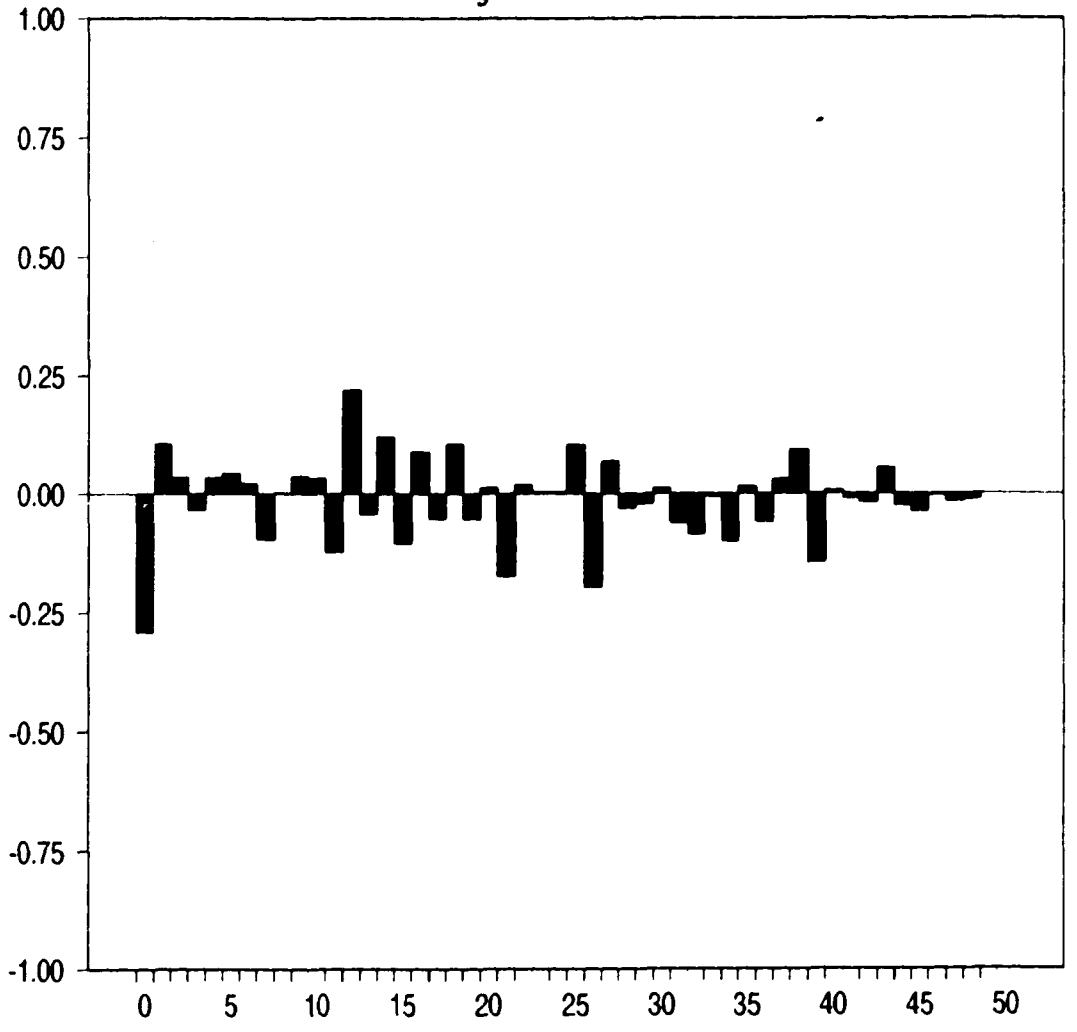
Estimated Partial Autocorrelations for the residuals of C. ELEKTRIK

Figure III.2.3b



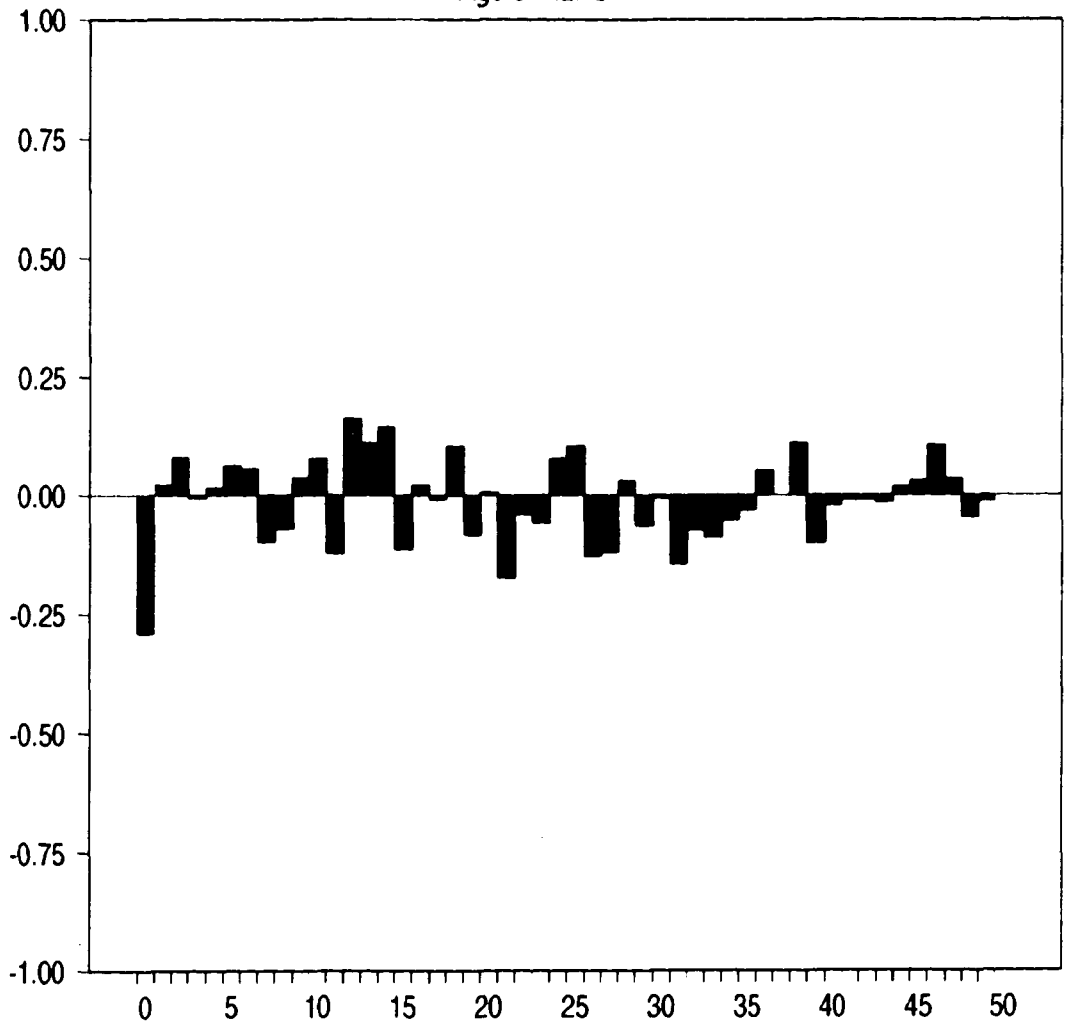
Estimated Autocorrelations for the residuals of KARTONSAN

Figure III.2.4a



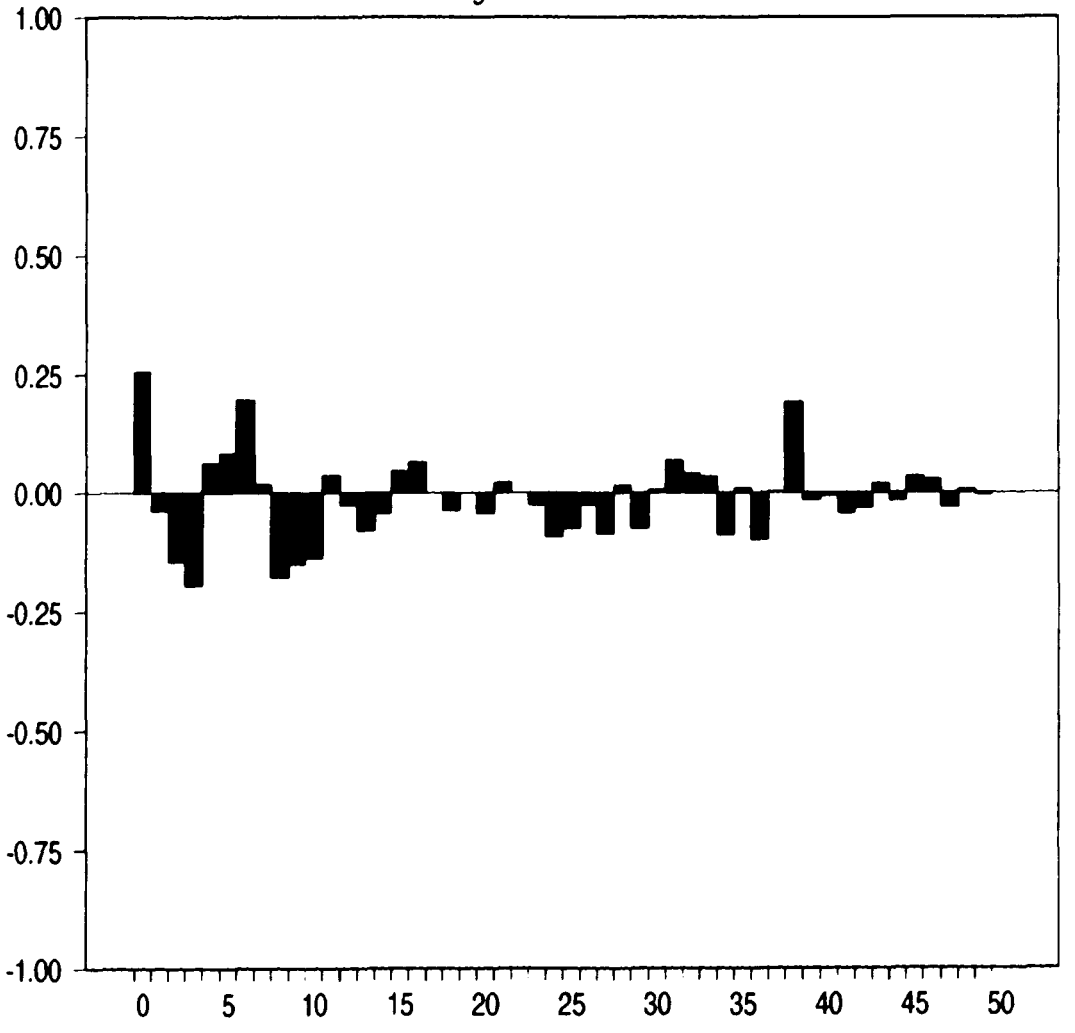
Estimated Partial Autocorrelations for the residuals of KARTONSAN

Figure III.2.4b



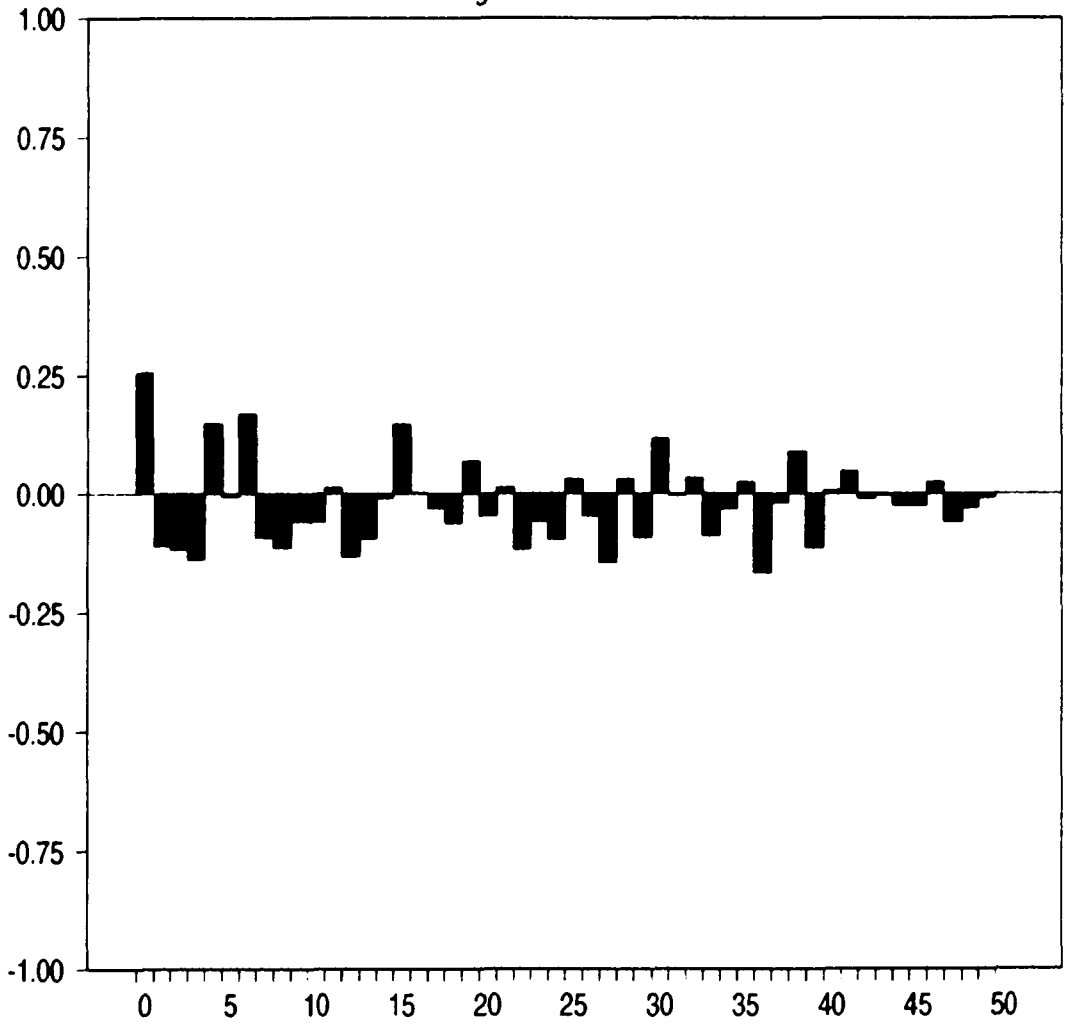
Estimated Autocorrelations for the residuals of KORDSA

Figure III.2.5a



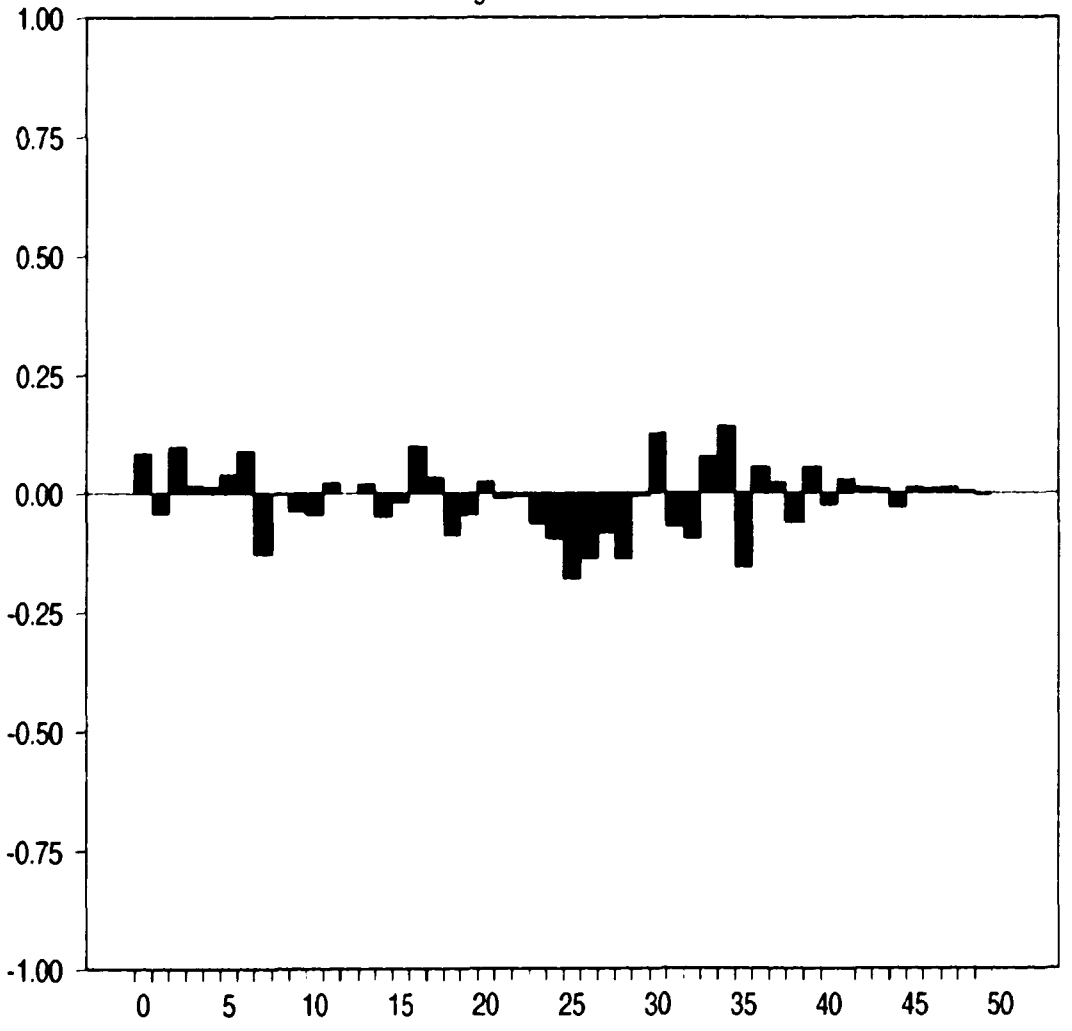
Estimated Partial Autocorrelations for the residuals of KORDSA

Figure III.2.5b



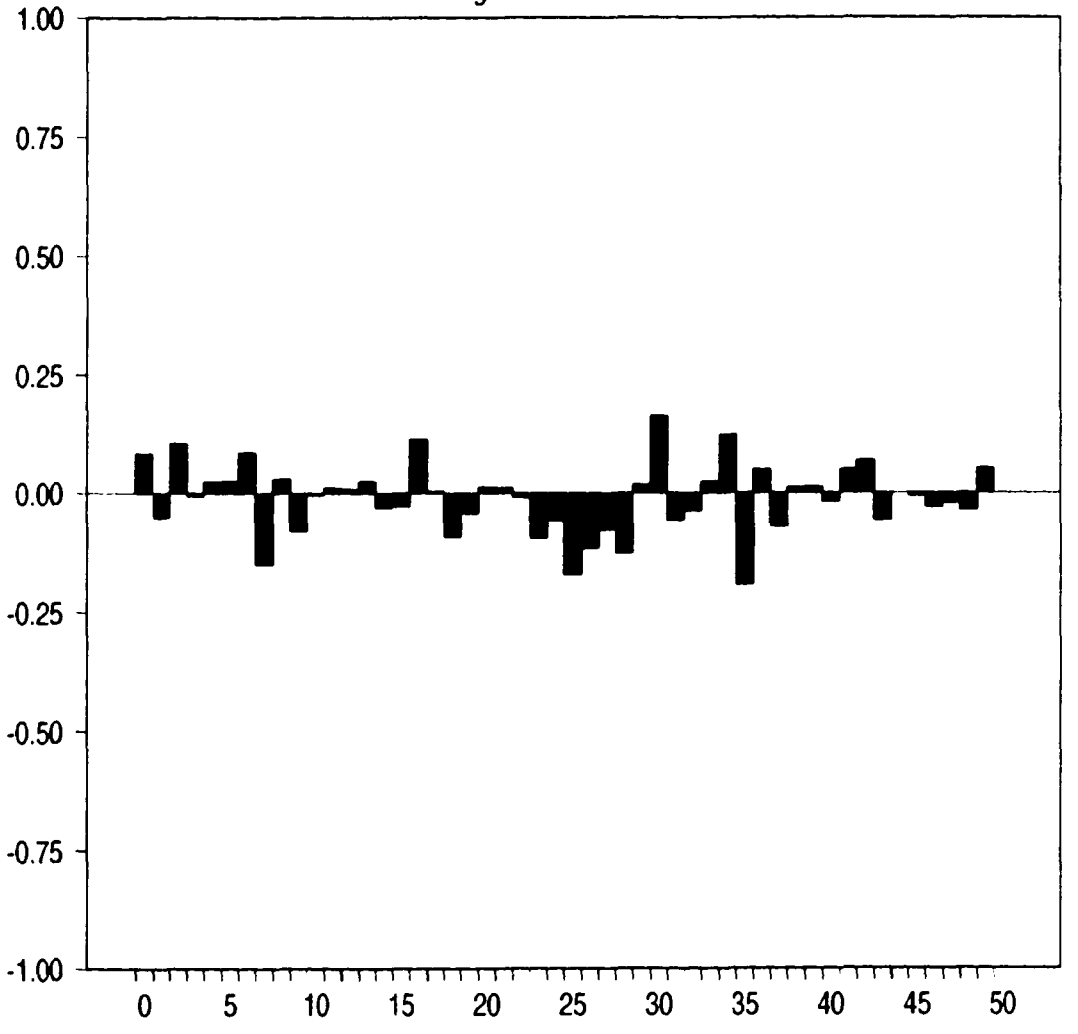
Estimated Autocorrelations for the residuals of GOOD YEAR

Figure III.2.6a



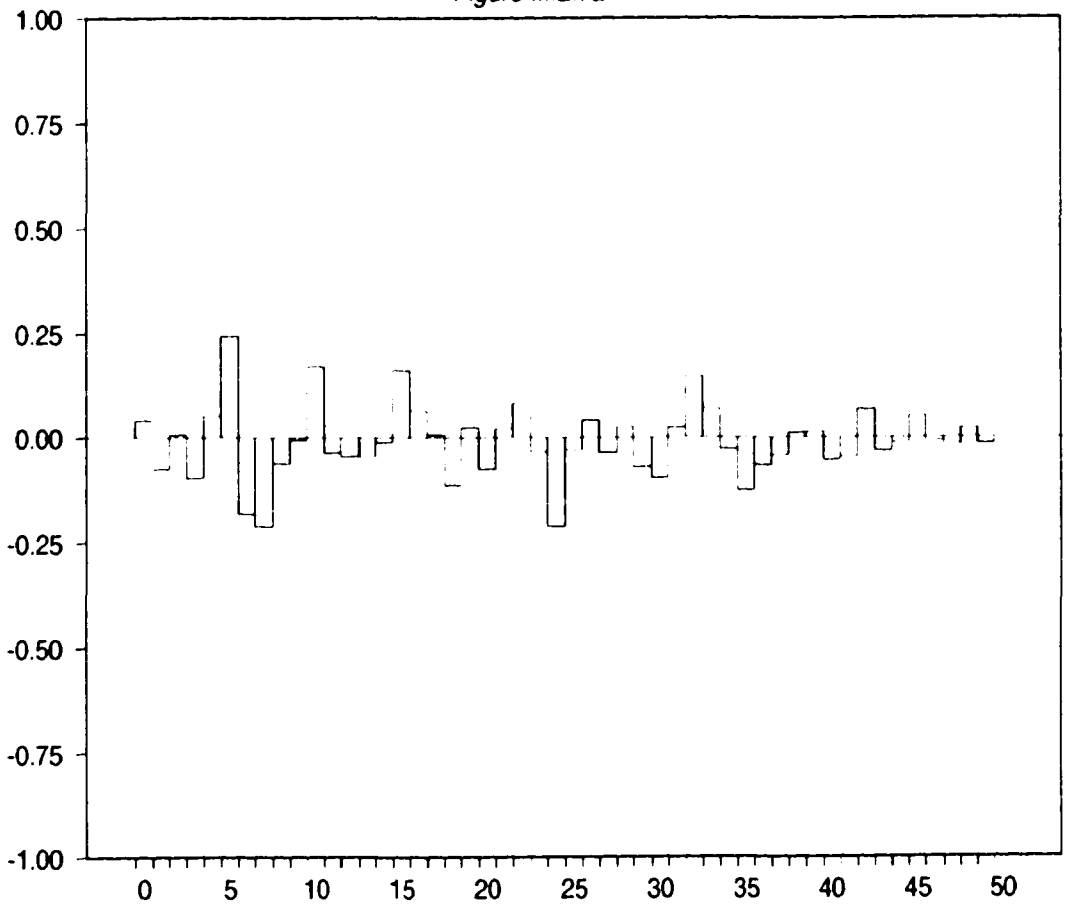
Estimated Partial Autocorrelations for the residuals of GOOD YEAR

Figure III.2.6b



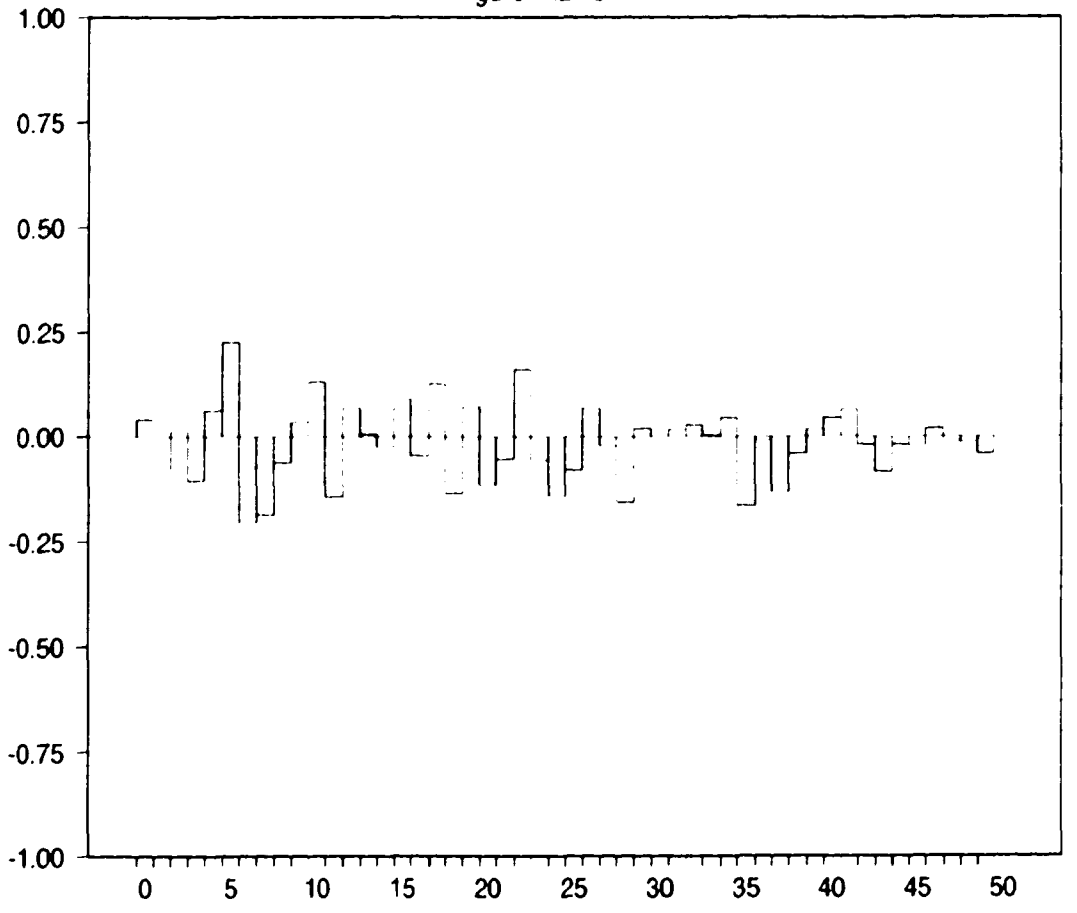
Estimated Autocorrelations for the residuals of RABAK

Figure III.2.7a



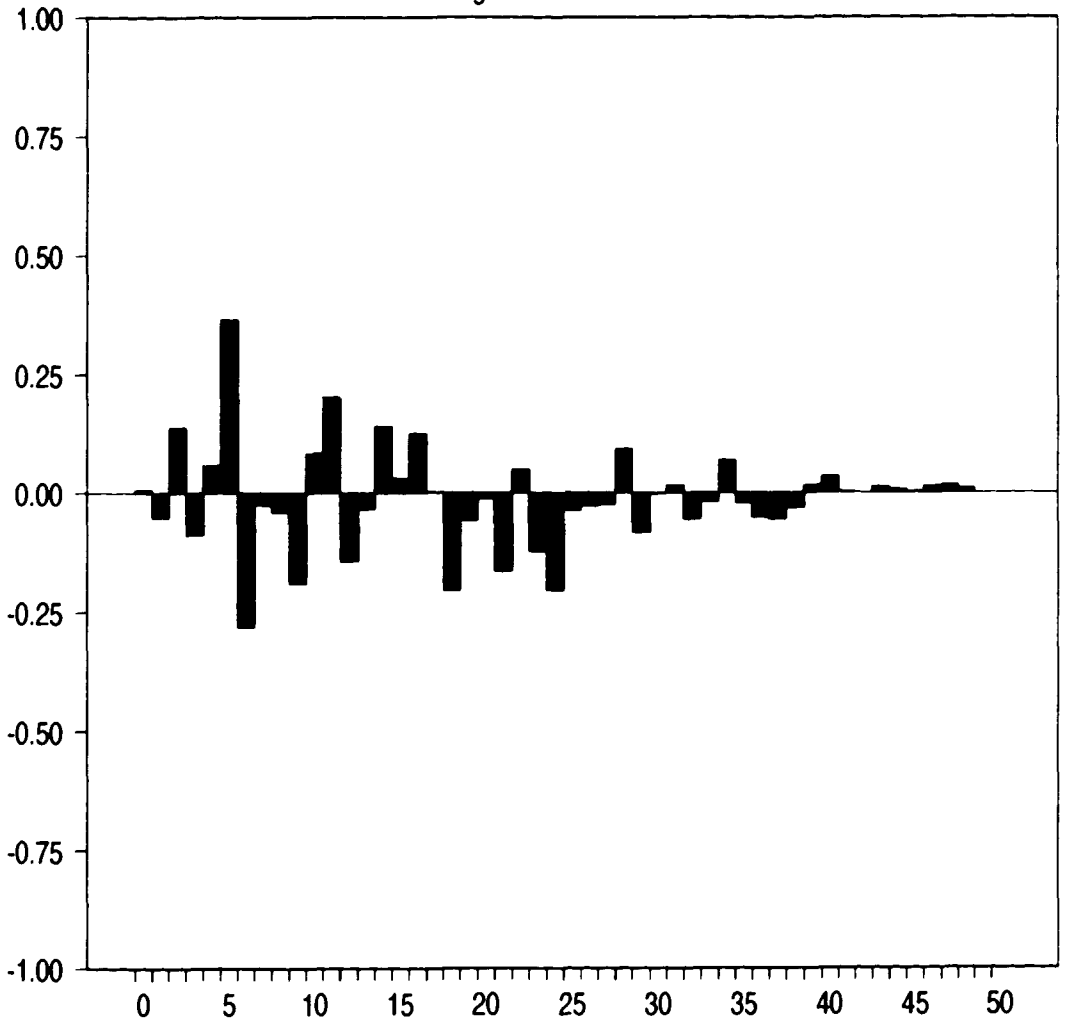
Estimated Partial Autocorrelations for the residuals of RABAK

Figure III.2.7b



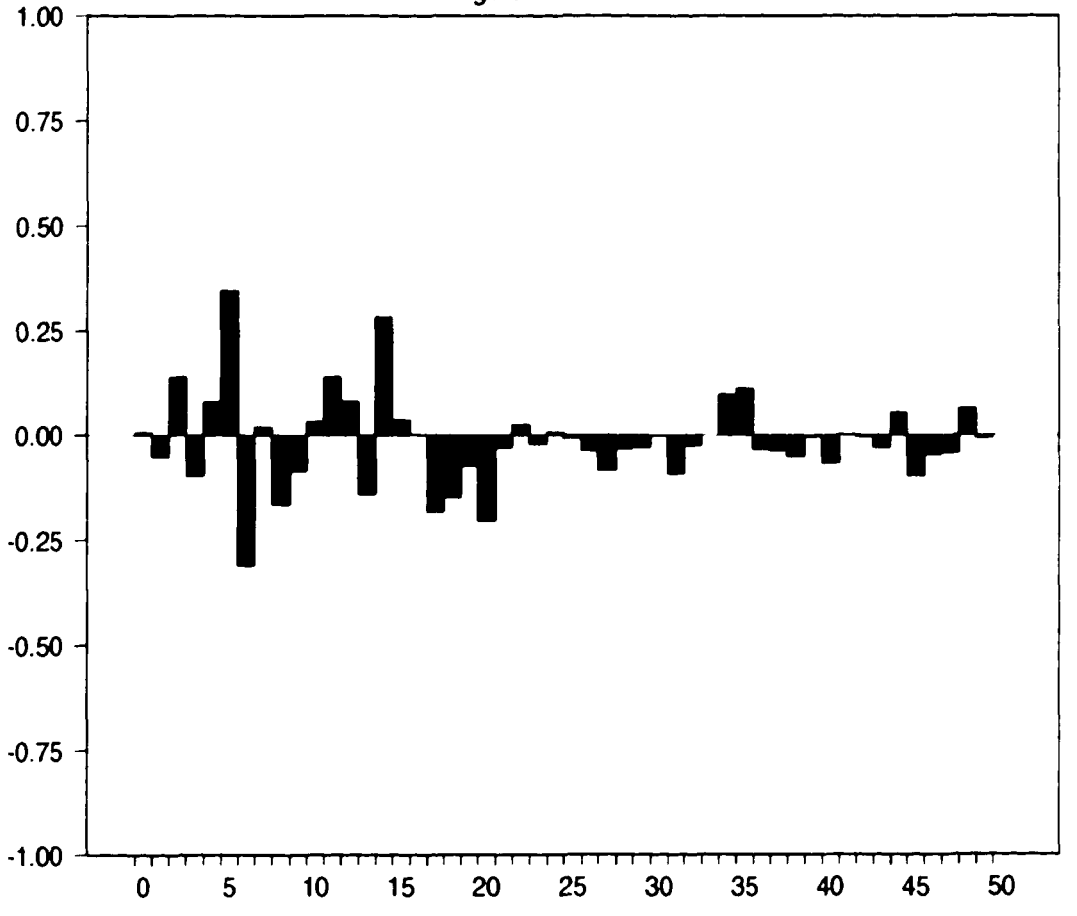
Estimated Autocorrelations for the residuals of TDD

Figure III.2.8a



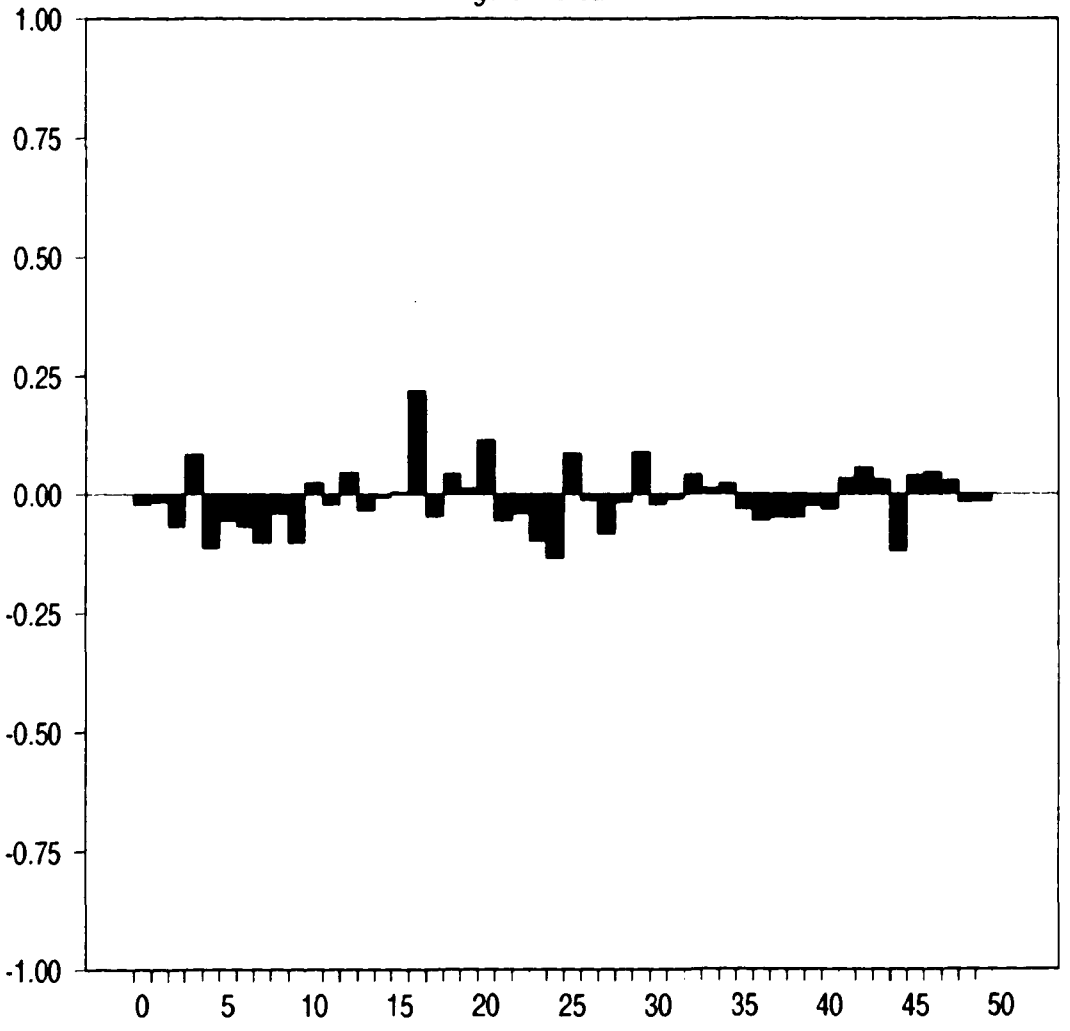
Estimated Partial Autocorrelations for the residuals of TDD

Figure III.2.8b



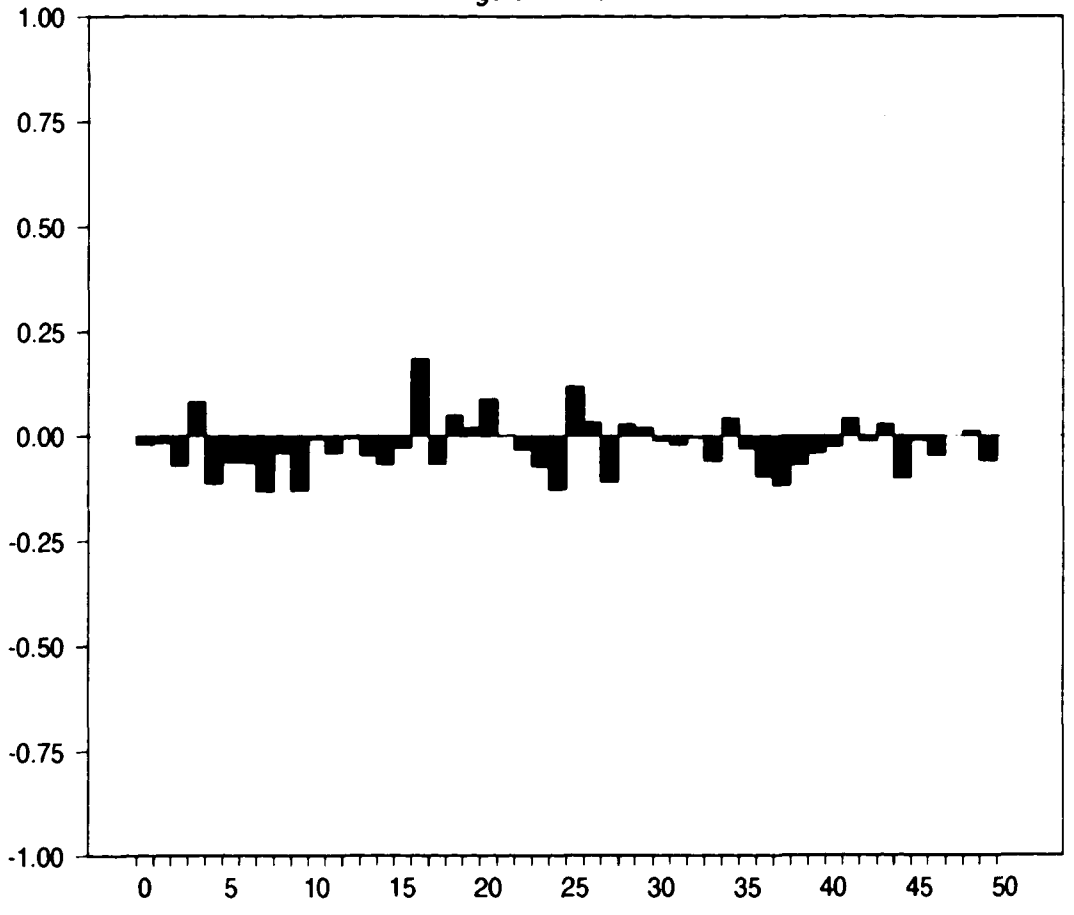
Estimated Autocorrelations for the residuals of YAKB

Figure III.2.9a



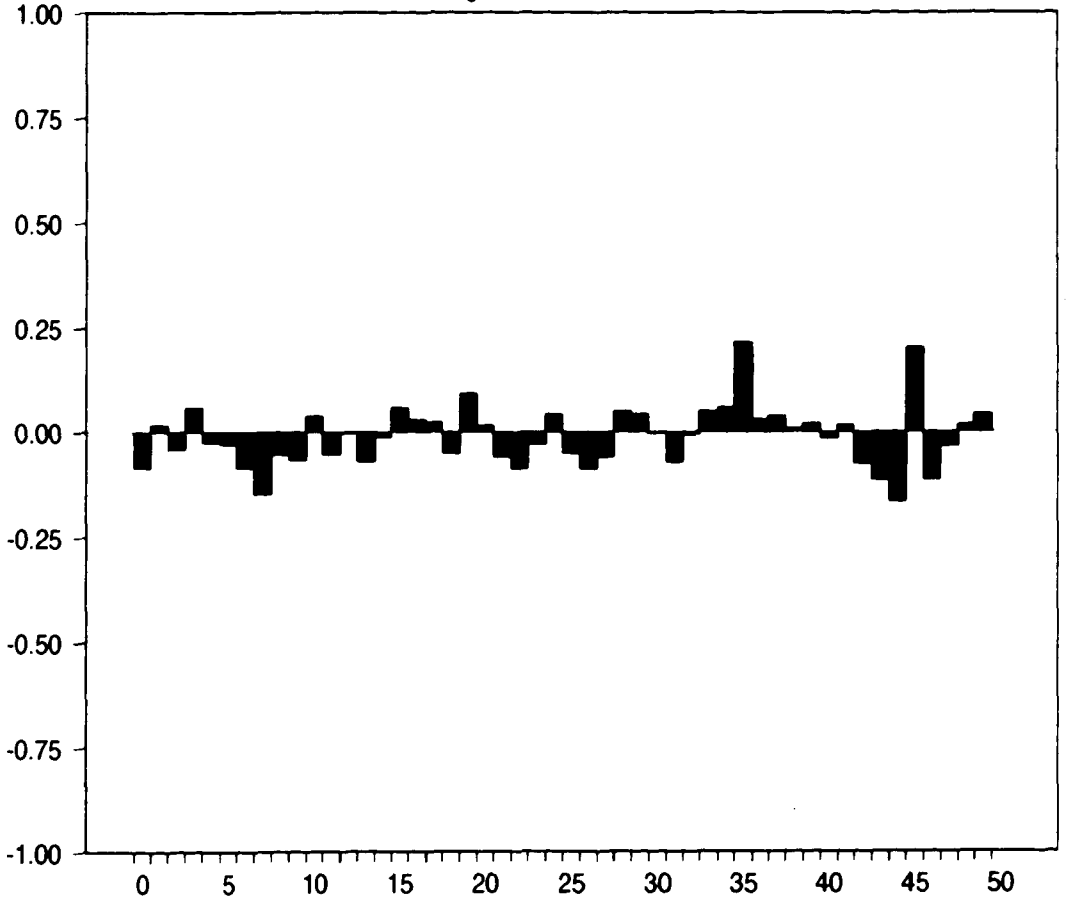
Estimated Partial Autocorrelations for the residuals of YAKB

Figure III.2.9b



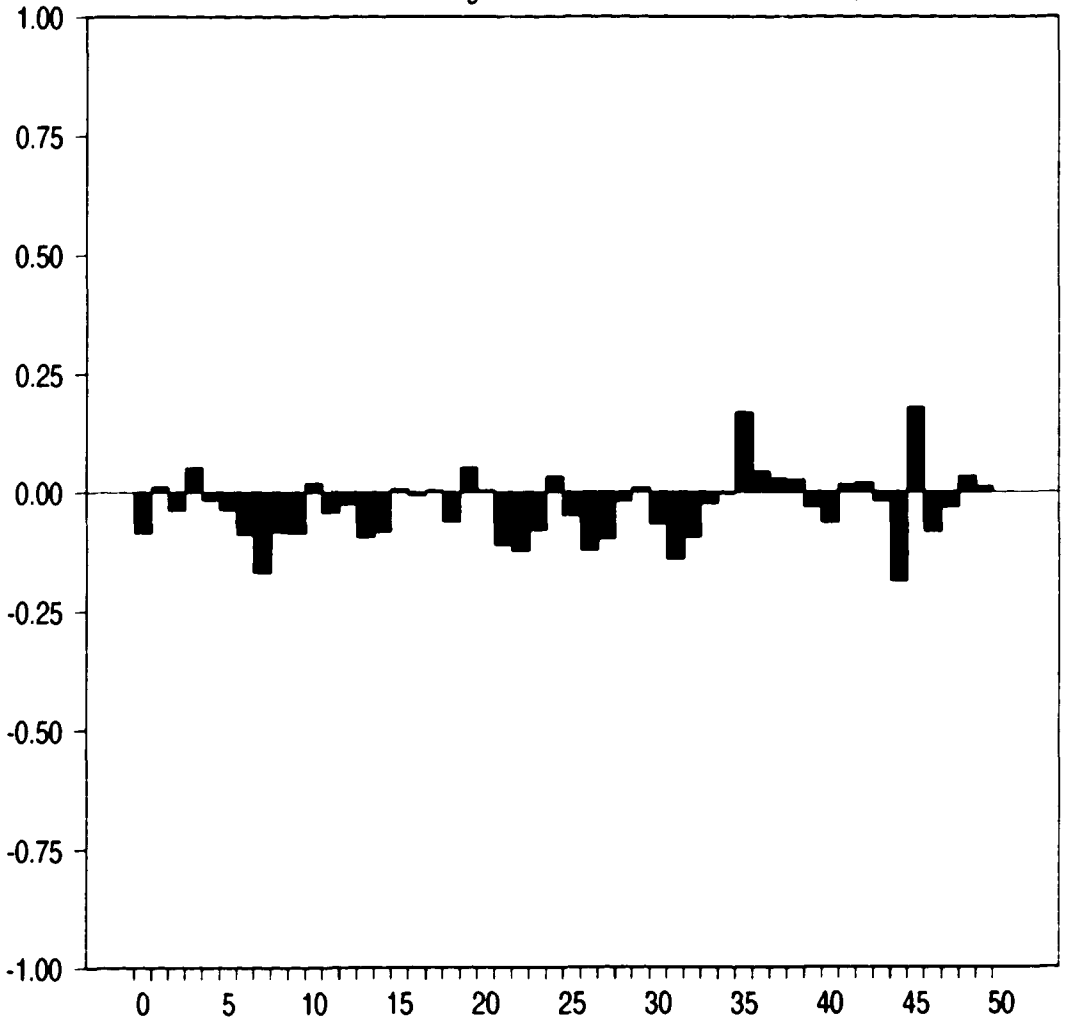
Estimated Autocorrelations for the residuals of TSIKB

Figure III.2.10a



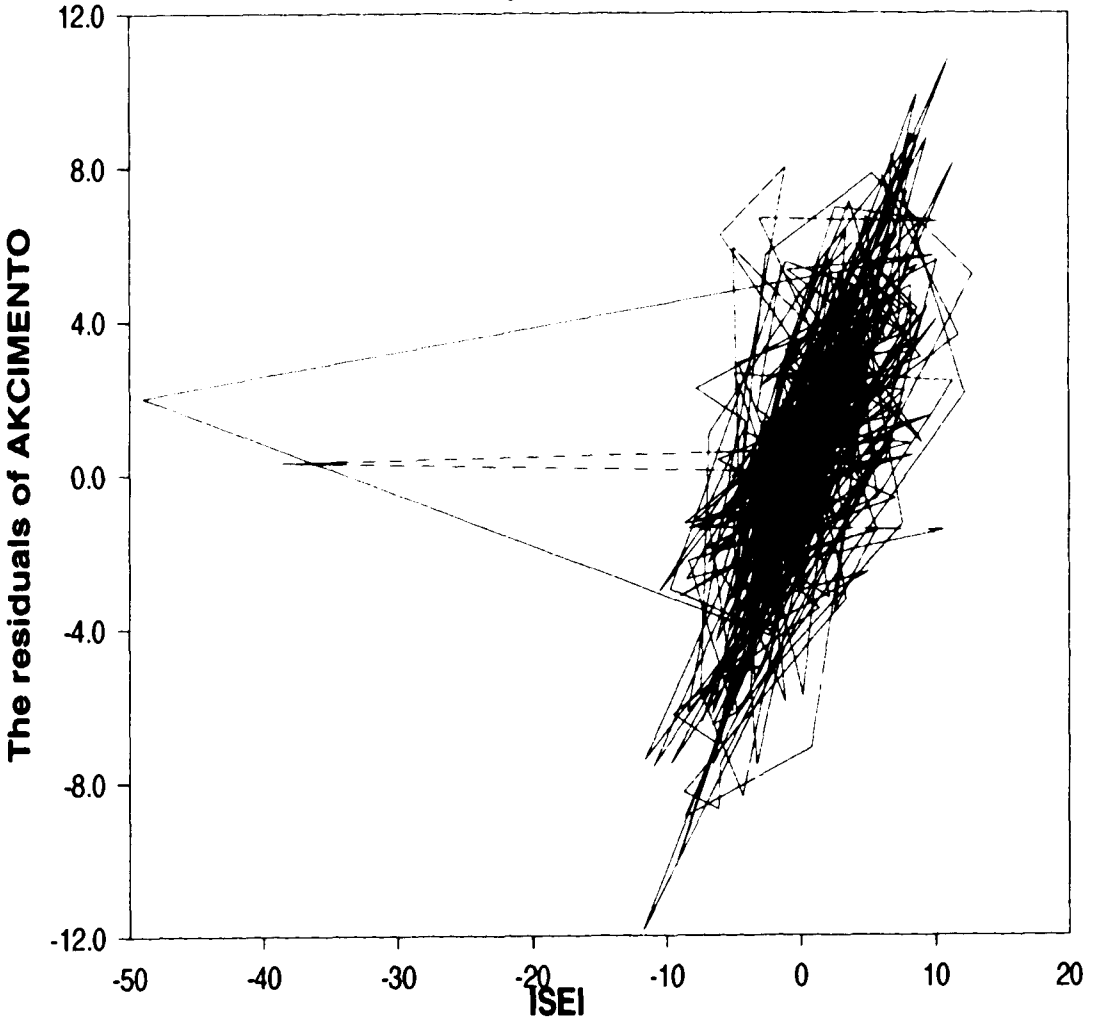
Estimated Partial Autocorrelations for the residuals of TSIKB

Figure III.2.10b



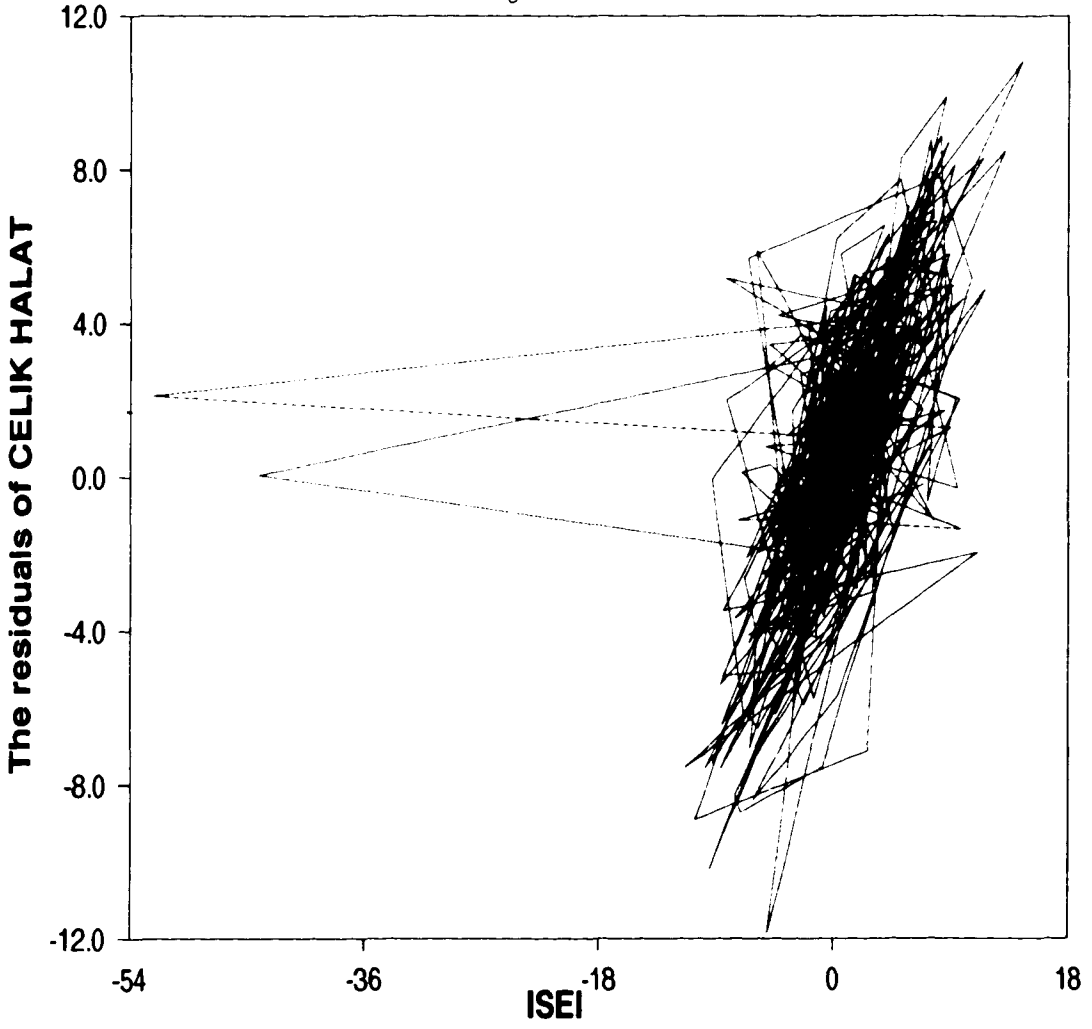
The residuals of AKCIMENTO vs. ISEI

Figure III.1.1



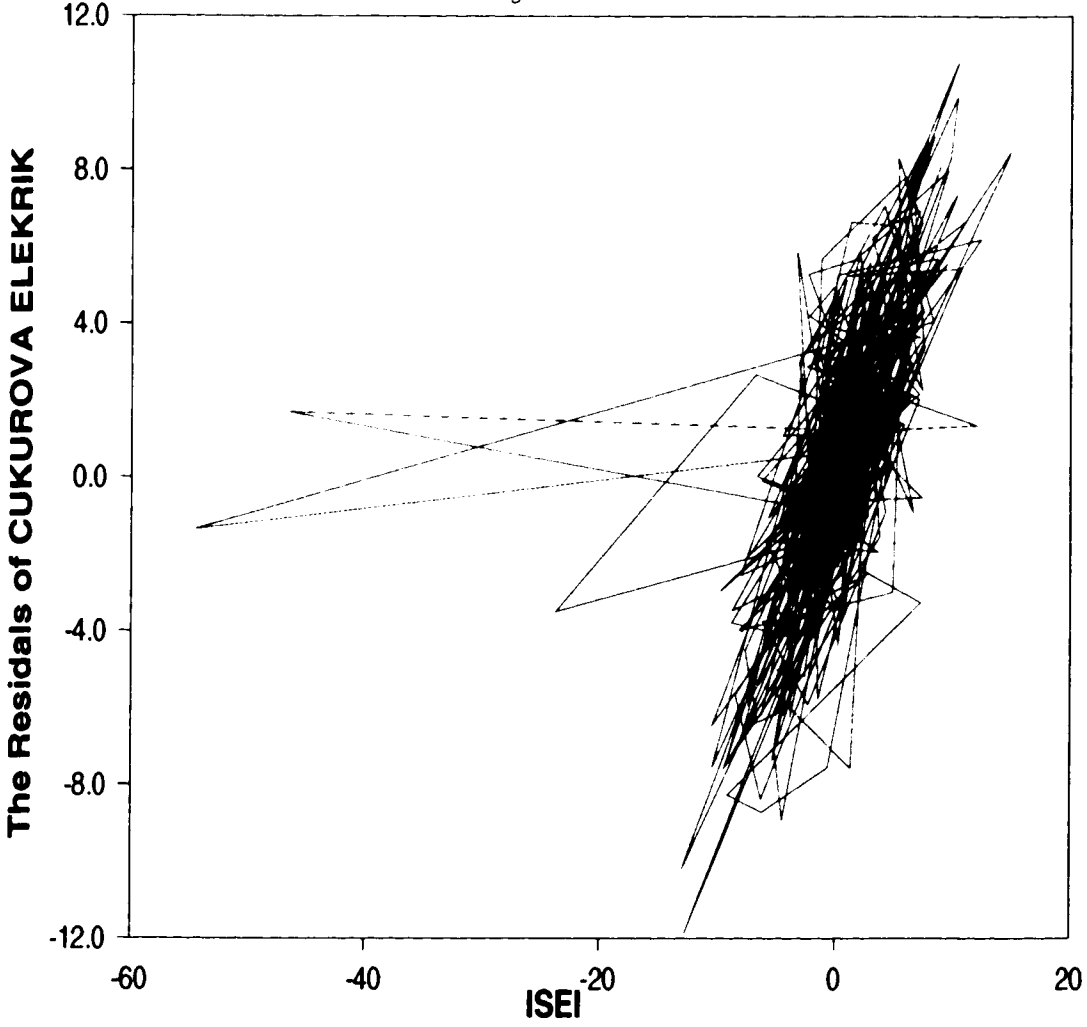
The residuals of CELIK HALAT vs. ISEI

Figure III.1.2



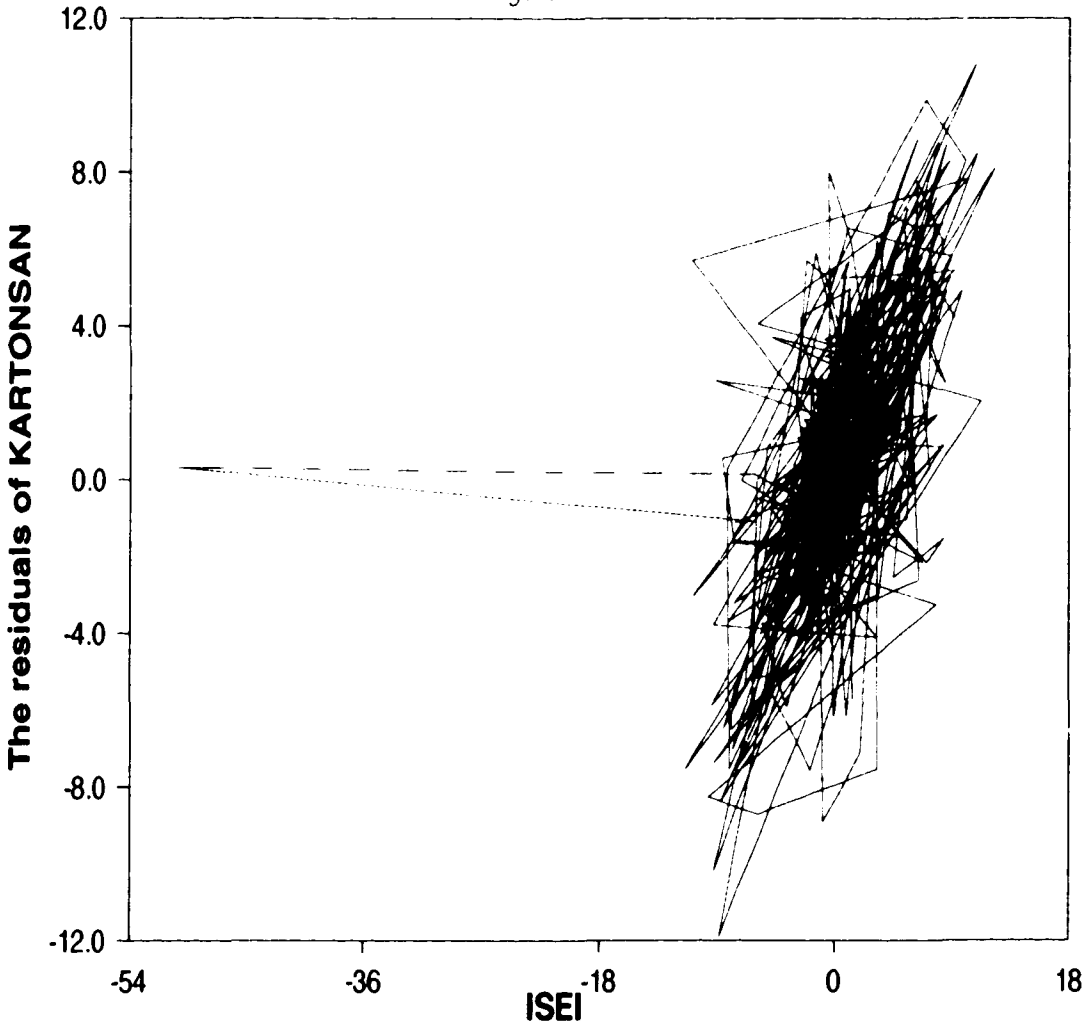
The residuals of CUKUROVA ELEKTRIK vs. ISEI

Figure III.1.3



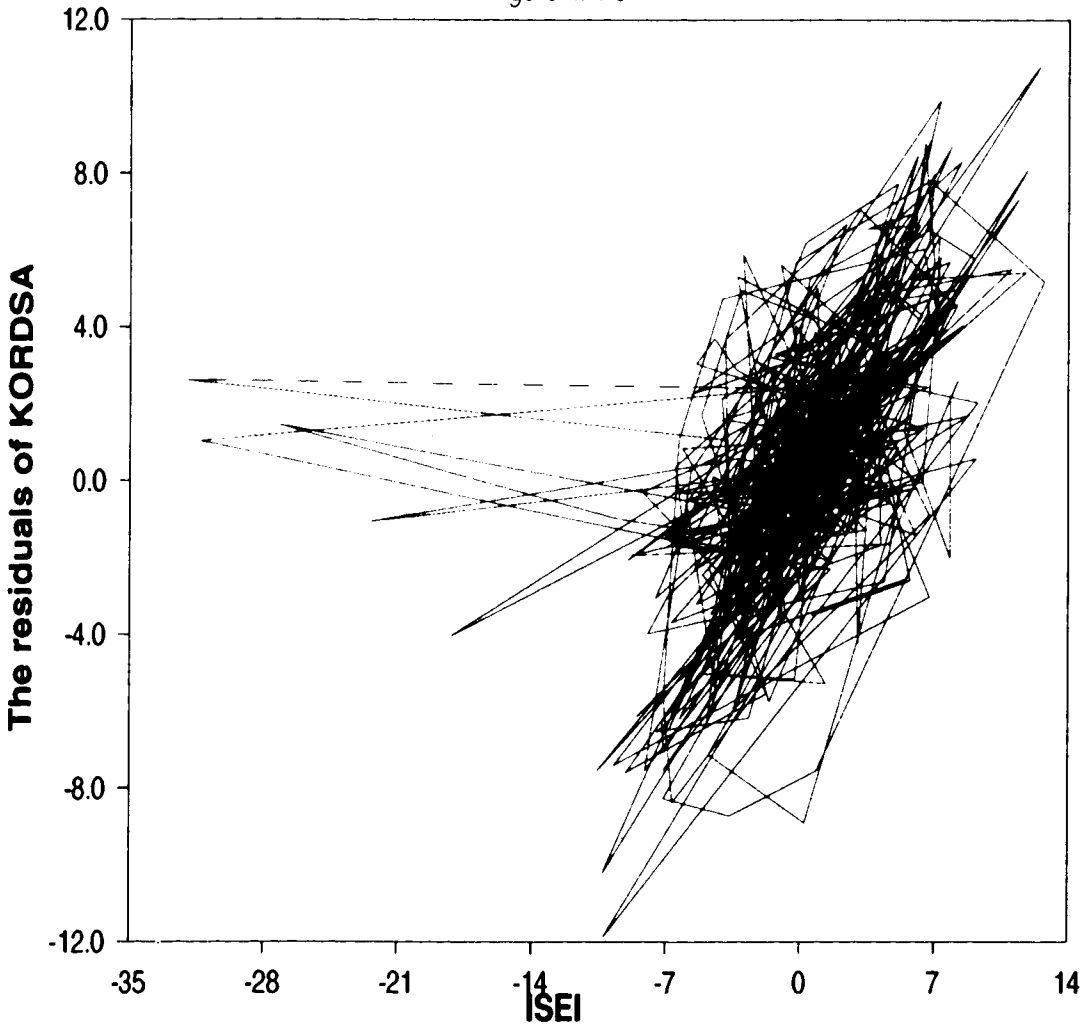
The residuals of KARTONSAN vs. ISEI

Figure III.1.4



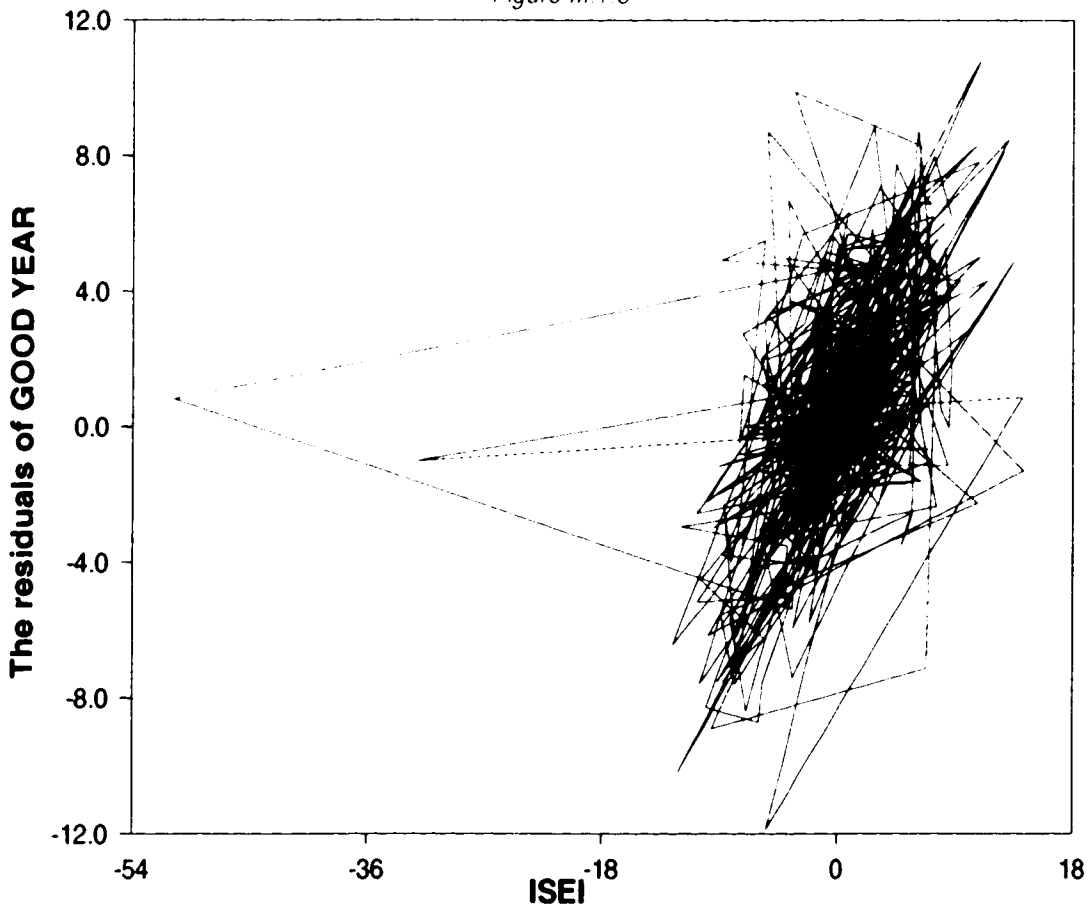
The residuals of KORDSA vs. ISEI

Figure III.1.5



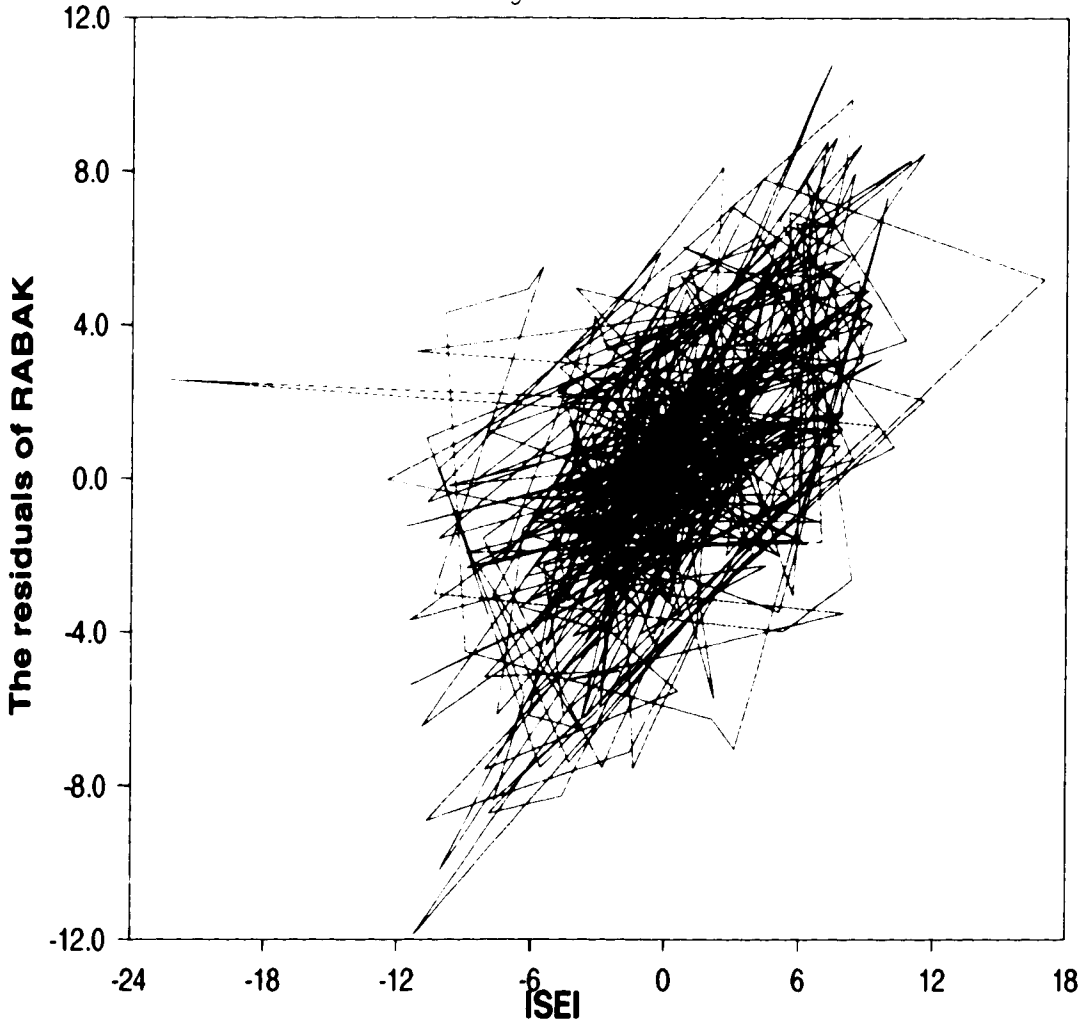
The residuals of GOOD YEAR vs. ISEI

Figure III.1.6



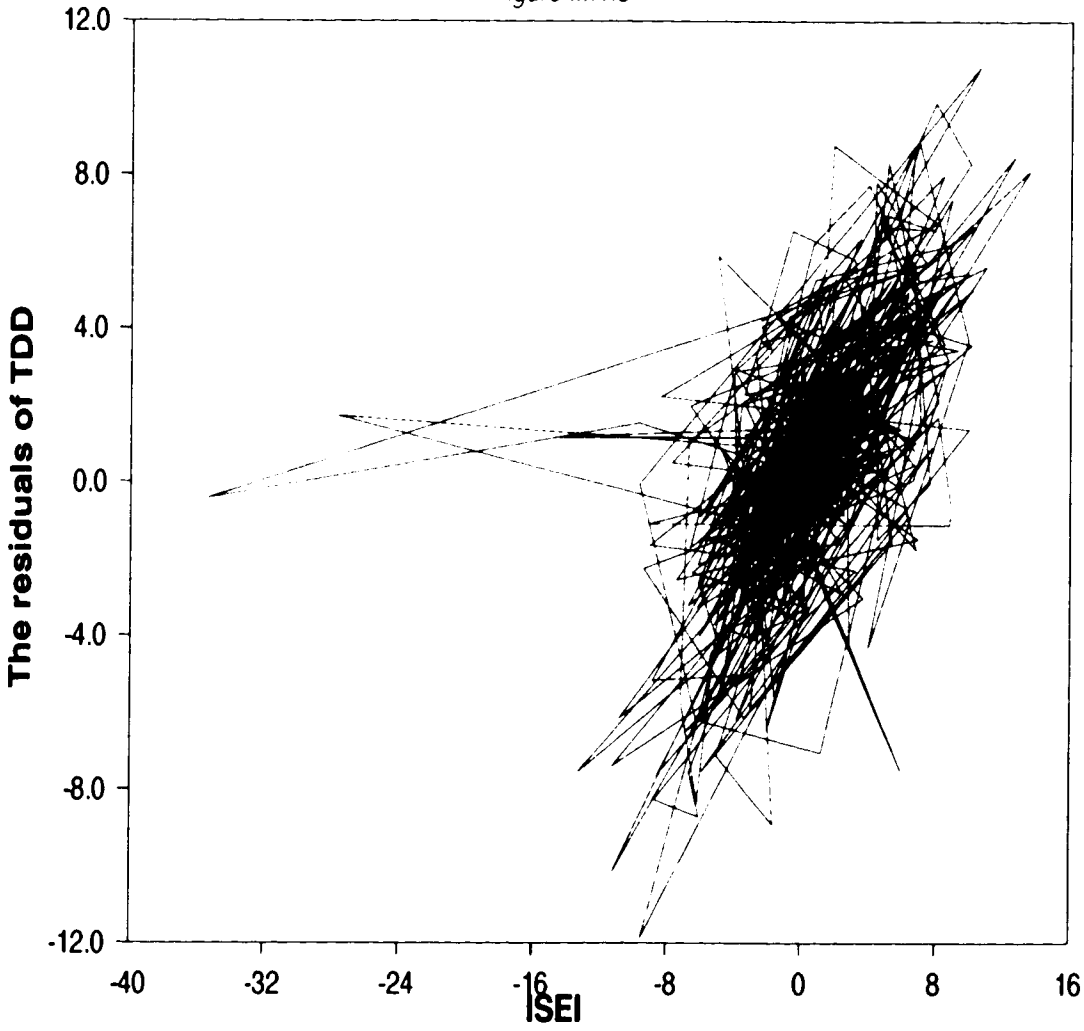
The residuals of RABAK vs. ISEI

Figure III.1.7



The residuals of TDD vs. ISEI

Figure III.1.8



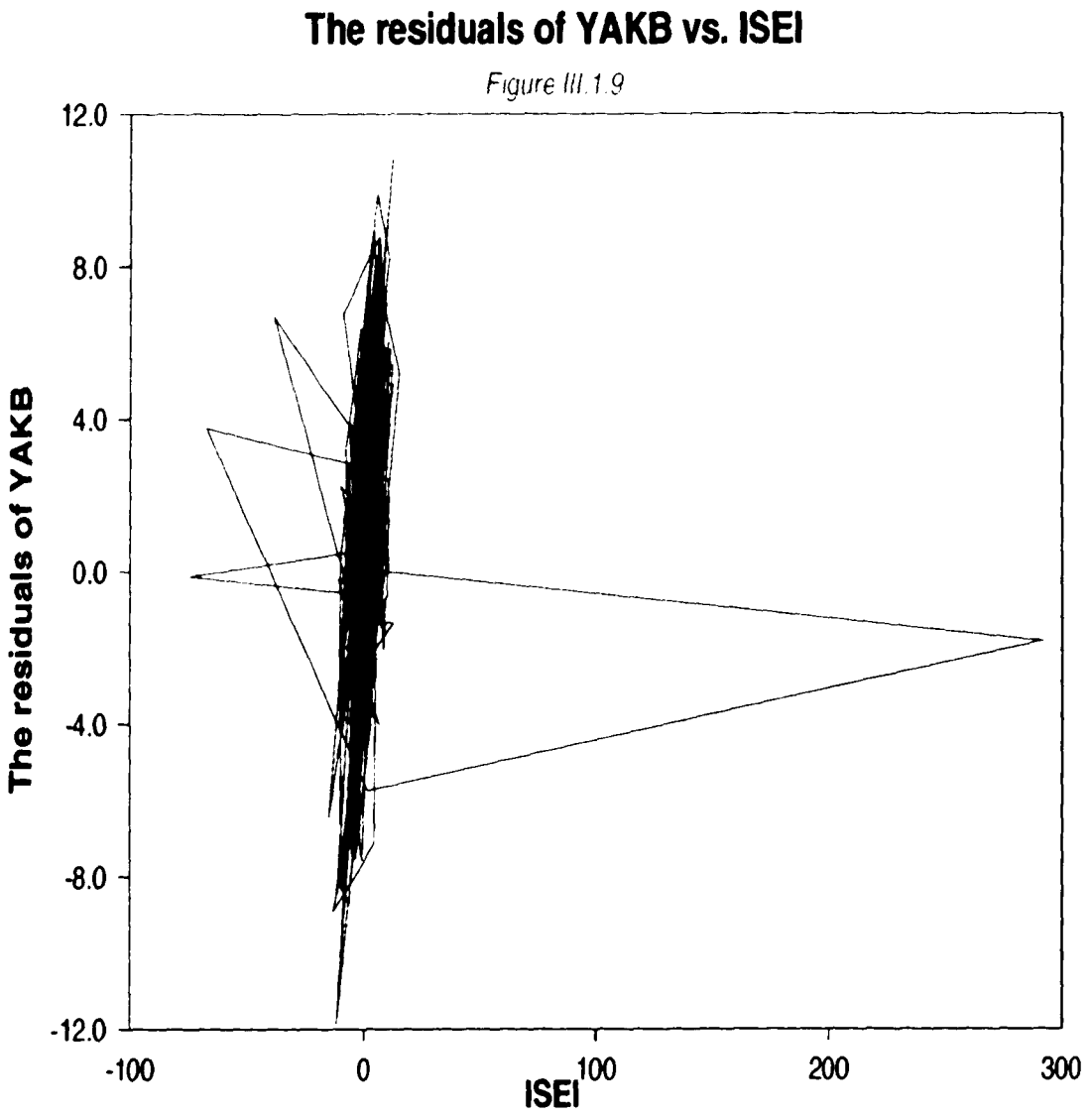
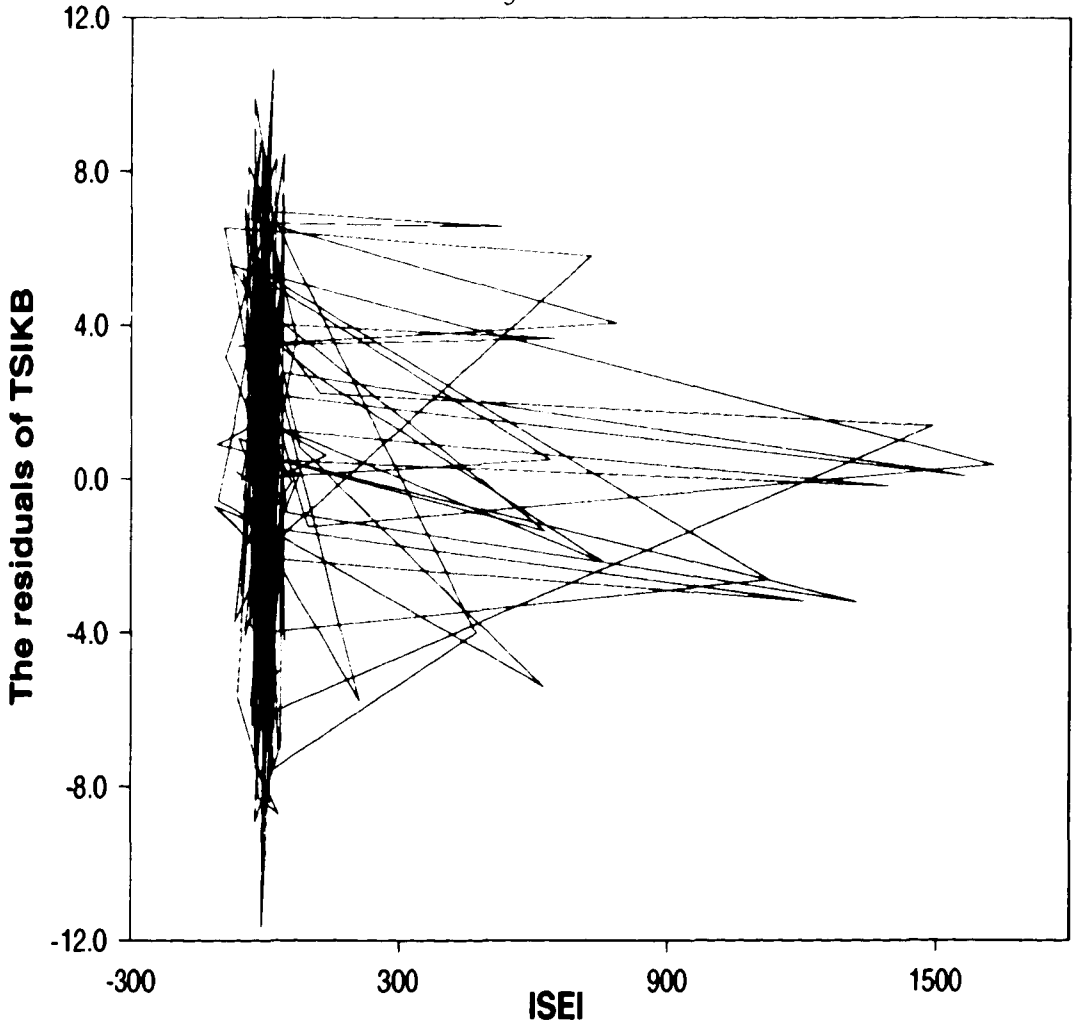


Figure III.1.9

The residuals of TSIKB vs. ISEI

Figure III.1.10



III.2.1. Performance of the ISE between January 1989 - June 1991 and Detected Outliers in the ISE Sample

In 1988 the trading volume of the ISE was TL11562 bn ($8 bn), 84 per cent of which was in Treasury bills and government bonds. The trading volume of the ISE rose above the rate of inflation in 1989, reaching TL 5941 bn in January - April 1989 compared with TL 3202 bn in the same period of 1988, mainly stimulated by the increase in sales of public securities. The volume of trading rose 98 per cent in the second quarter of 1989 over the same period in 1988. This was prompted by the continual decline in interest rates making securities more attractive. By August 1989, trading had risen to TL 3631 bn compared with TL 974 bn in August 1988. The boom was initiated in August 1989 by Government Decree No 32, which threw open the exchange to foreign investors. It leveled off during autumn 1989 and fluctuated through to late October, due to uncertainties over Mr. Özal's election. Once the new president was installed in office the price rise resumed during the last two months of the 1989. Among foreign investors, the Türkiye Investment Fund,

which was successfully launched on the New York stock exchange in November 1989, was a powerful new presence. Further inflows were expected from other institutions in Japan, Switzerland, West Germany, France and the United Kingdom. This increased activity was good news for those who look to the stock exchange to develop, coaxing private savings into industrial investment and out of gold or other unproductive investments. However, 90 percent of the trading was still in public sector securities. Large residuals, especially for YAKB and TSIKB, were observed in the ten sample securities exhibited in Tables 4-6.

The index reached 2217 at the end of 1989 and an extraordinarily high figure of 3811 on January 24, 1990. At this point, the discovery of forged shares in the private electricity generating company Çukurova Elektrik set off a 500 point fall in the index over the following three days, emphasizing the extreme volatility of the market.

After the dizzying price rises registered during the previous four to five months, prices on Istanbul's infant stock exchange stabilized during February and March of 1990. The stock exchange index, which stood at 3461

at the end of January 1990, reached its peak of 4100 in the middle of February 1990 and drifted down to 3484 by March 5, 1990. The index then recovered to 3569 by March 23, but dropped back to 3294 at the end of the month. Worries caused by the resignation of the finance minister were held to have accounted for the latest fall. The Istanbul Stock Exchange index fell back to around 3700 in the first week of May, before rising to 4226 in the second week of July and 5750 on August 2, 1990, just before the Kuwait Crisis erupted. From our sample, Akçimento prices show a decrease of about 50 percent on of May 8, 1990 causing a large residual in the regressions. This is followed by Kordsa on May 14, 1990 with a negative change of 30 percent. On May 28, 1990 Kartonsan's price level decreased by about 15 percent. Two days later Çelik Halat price level decreased by about 52 percent. Meanwhile, the total value of shares traded per week rose from TL 241 bn in the first week of May 1990 to a peak of TL376 bn in the second week of June 1990. At this point, it appeared that the market had easily been able to absorb the largest amount of new stock issued by both the privatization program and the existing private firms.

The initial reaction of the market to the Gulf Crisis was negative,

but not panicky, as the index had dropped back to 5430 by August 6, 1990. However, heavy selling set in on the following day and the index fell by 19 percent to 4429 by August 10, 1990 bringing it almost back to the level it held in early May, 1990. The ISE staged an impressive recovery in September 1990 and the early part of October 1990: From our sample, on August 10, 1990 Rabak's price level show an increase of 15 percent. On August 2, 1990 the index had stood at 5614; after touching a low point of 4168, it recovered to around 5300 during the first week of October. TDD's percentage fall in its price level is about 35 percent on August 15, 1990. On September 17, Good Year price level fell by 32 percent. Çukurova Elektrik on the other hand followed them with a decrease in its price level of about 50 percent on September 20, 1990 and about 24 percent on October 5. In the last week of the month, however, a steady slide began, which lasted into November, so that the index dropped from 4967 on October 24 to 3257 on November 30, marking a fall of over 34 percent in five weeks. After touching a low point of 2823 on December 25, 1990 the index recovered during the first two months of 1991. There was a rally during the first week of December 1991, pushing the index

back through 4000, but a steady fall thereafter: so that on the first day of trading in 1991 it stood at 3115. The outbreak of the air war against Iraq had the paradoxical effect of restoring investor confidence, since it suggested that the crisis would be over fairly quickly. By the end of the land war over Kuwait, in the last week of February, the index had climbed back to around the 5300, only 600 points short of the high record which it had reached just before the Iraqi invasion of Kuwait. Then the market stabilized, as it absorbed several new privatization issues, and the index ended March, 1990 at around 4600. Following the recovery of the Istanbul stock exchange, after the Gulf war, the stock index drifted down during April and the first half of May, to close at 3475 on May 17, 1990. It then picked up, as the reduction in bank interest rates brought more funds into the market, ending May 24 at 4043. During this period, Kartonsan's price level fluctuated greatly on March 1, 1990 causing an important outlier effect and dropped by 17 percent on March 14, whereas Kordsa's price level fell by 36 percent on April 1, 1990. YAKB followed them on April 24, with a percentage decrease of about 36 percent in the price level. Kartonsan showed huge outlier effects on May 20 and 28 with negative

percentages of 33 and 15 respectively in its price level (Table 5). There was then another fall, and a stabilization during June, 1990 at around 3600. The relative dullness of the market was accounted for by uncertainty about the domestic political outlook, worries about inflation, and the absorption of new privatization issues. The boom conditions which the exchange enjoyed during 1989 and the first half of 1990 were over. The index is now well below the level of 5923 which it reached just before the Iraqi invasion of Kuwait. From our sample; Çelik Halat and Çukurova Elektrik marked this period with respectively 49 and 48 percent decreases in their price levels, on June 17, causing large residuals in the regressions. With big outliers, there is a three month pattern in TSIKB from September 1989 to November 1989; since it did not appear again I felt it is an insignificant portion of the data (Tables 4-6). The slump in prices was partly attributed to continued sales of stocks in former state economic enterprises by the government's Public Participations Administration, in the face of weak demand. Moreover, potential investors were evidently discouraged by the expectation that the post-election government would have to take severe belt tightening measures if inflation

was to be brought under control.

Equities had performed badly during 1991, since the index had only risen by just over 34 per cent between the beginning of January and the end of December. This was considerably below the rate of inflation, as well as the returns investors could have got by putting their money in a 12 month deposit account or in a foreign exchange. Moreover, of the 130 stocks quoted on the exchange, 55 closed 1991 at lower prices than they had held at the beginning of the year.

The data showed that the Istanbul Stock Exchange is still a speculative market, with investors looking for short-term capital gains rather than long-term returns. A general fall in inflation, plus a reduction in the government's enormous calls for cash and the growth of more institutional investors as well as measures for preventing insider trading were to overcome this defect. Further development of the market also depended on developing its regulatory systems as well as physical facilities. To provide more liquidity to the market, insurance companies and pension funds must be allowed to invest in the market and a free market in bullion must be established knowing

that private citizens in Türkiye hold as much as $80 bn, about twice Türkiye's total overseas debt, in gold. The country imports about 140 tons of gold per year exporting less than half of this portion in the form of jewelry.

DELETED OUTLIERS IN THE ISE SAMPLE BETWEEN JANUARY 1989-JUNE 1991

TABLE* 4

DATE	AKÇIMENTO	ÇELIK HALAT	ÇUKUROVA E.	TSIKB
05.08. 1989	-48%			
05.24.1989		-52.42%		
05.29.1989	-38%			
09.09. 1989			-54.55%	
09.29.1989				805.26%
10.02.1989				-90.70%
10.05.1989				1191.67%
10.06.1989				-92.26%
10.24.1989				459.53%
10.25.1989				-83.83%
11.08.1989				710.35%
11.09.1989				-87.66%
11.13.1989				775%
11.13.1989				-88.58%
11.29.1989				707.70%
05.31.1990		-47.40%		
09.20.1990			-46.72%	
10.05.1990			-23.75%	
06.17.1991		-48.57%	-47.91%	

*The numbers show the percentage change in returns

DELETED OUTLIERS IN THE ISE SAMPLE BETWEEN JANUARY 1989-JUNE 1991

TABLE* 5

DATE	GOOD YEAR	KARTONSAN	KORDSA	TSIKB
03.27. 1989		-1.5%	-18.09%	
04.04. 1989		0%	-22.54%	
06.26. 1989			-32.47%	
09.04.1989				623.41%
09.08.1989				-85.18%
09.12.1989				542.86%
09.11. 1989			7.15%	
09.18. 1989	-53.27%			
09.19.1989				-86.70%
09.20.1989				676%
09.21.1989				-86.60%
12.18. 1989		5.45%		
12.25. 1989			-30.62%	
05.14. 1990			-27.70%	
05.28. 1990		-50.88%		
09.17. 1990	-31.96%			
03.01. 1991		0%		
03.14.1991		-17.59%		
04.01.1991			-35.87%	
04.20.1991		-33.33%		
05.28.1991		-14.82%		

*The numbers show the percentage change in returns.

DELETED OUTLIERS IN THE ISE SAMPLE BETWEEN JANUARY 1989-JUNE 1991

TABLE* 6

DATE	RABAK	TDD	YAKB	TSIKB
04.17.1989	-21.92%			
05.03.1989		-14.73%		
06.19.1989			-39.63%	
07.10.1989			-75.09%	
07.19.1989				-94.33%
07.26.1989				1191.67%
07.27.1989				-92.26%
08.02.1989				1477.78%
08.04.1989				-93.88%
08.07.1989				1655.56%
08.08.1989				-93.74%
08.10.1989				1474.08%
08.14.1989		-29.69%		
08.15.1989				-93.29%
08.16.1989				1346.81%
08.17.1989				-93.24%
08.21.1989				1404.35%
08.23.1989				-93.21%
08.25.1989				1555.82%
08.28.1989				-93.54%

*The numbers show the percentage change in returns.

III.2.2. Adjusted R Square

The average explanatory power of the model can be represented by the R square adjusted for degrees of freedom. This estimated adjusted R square gives a non-descriptive result for the model. Therefore to increase the adjusted R square a consideration of periods when there is no reported news about the firm or its industry is necessary. Regressions run with the remaining information-cleansed observations give a higher R square value. Most of the fluctuations observed in 1989 give the idea that insiders sometimes receive forewarning, and significantly move the price in response to their trades.

In Charts III.2.1- III.2.3, the adjusted R squares are higher when influential points are excluded. But still the average explanatory power of the VAR model is modest.

The next steps would be to compare ISEM with other stock markets in the world. It should be noted that even in perfect looking stock markets the ability to explain the stock prices is modest (Roll, 1988). The R square calculated for even well-accepted models like CAPM and APT are near

0.20 with daily U.S. stock market data. In these markets it is observed that the information-cleansed data slightly increases the R square. Far from being compared to U.S. capital markets, ISEM shows a similar behavior when we delete the influential points from the data set.

When we look at the adjusted R square it ranges from -0.005 (for YAKB) to 0.06 (for TDD) in Chart III.2.1, which is the result of an unsatisfactory fit of the data to the model. Our results are very likely to stem from the problems:

In the Figures III.2.2.1 to III.2.2.2, there is a reasonable correlation between the Risk Free Rate of Return, the ISE index, and the TL-denominated rate of return. This is not an amazing result when we think that in any economy these three explanatory variables are usually interrelated and that time series are correlated even when there is no underlying relationship between them. My thesis then was to choose the ISE index as a good proxy for the two others and do the regressions using the ISE index and the four dummies in the deterministic part. This improved the results by almost 40 percent.

To deal with the outliers problem, two methods were used to deal

with the data. One method was to delete those outliers given in the previous section: The Adjusted R square improved significantly compared to the first regressions conducted by the uncleansed data. After adjustment the adjusted R square ranges, from 0.003 to 0.094. For each company regression results show an improvement especially in the adjusted R square by almost 40 percent. The point is that in these models not only did we delete the outliers but I also chose the ISEI exogenous variable besides the dummy variables. The results did not improve when I considered the USD and R_f in the deterministic part of the equations.

The second method is to take the moving average of the data. Representing the moving average of the data consists of choosing seven days lag for each variable. VAR applied to this data brings drastic improvements in the results. We can explain approximately 70% of the variations in the stock market using the VAR model. Each dependent variable follows a random walk and the their adjusted R square ranges from 0.65 (for YAKB) to 0.82 (for TSIKB), (Chart III.2.3). Furthermore, in the OLS regressions, the number of exogenous variables in the Granger causality sense, show an encouraging

decrease.

Deleting the large residuals and taking the moving average of the data improved our results; those large price fluctuations causing big outliers, are probably due to the insider trading in the stock market.

ADJUSTED R SQUARE WITH UNCLEANSED DATA

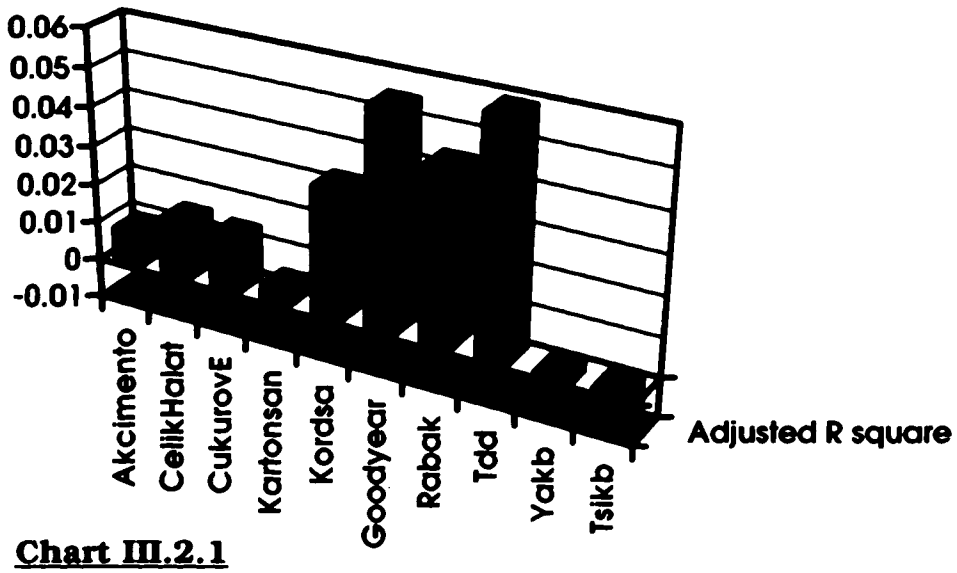


Chart III.2.1

ADJUSTED R SQUARE WITH DELETED OUTLIERS

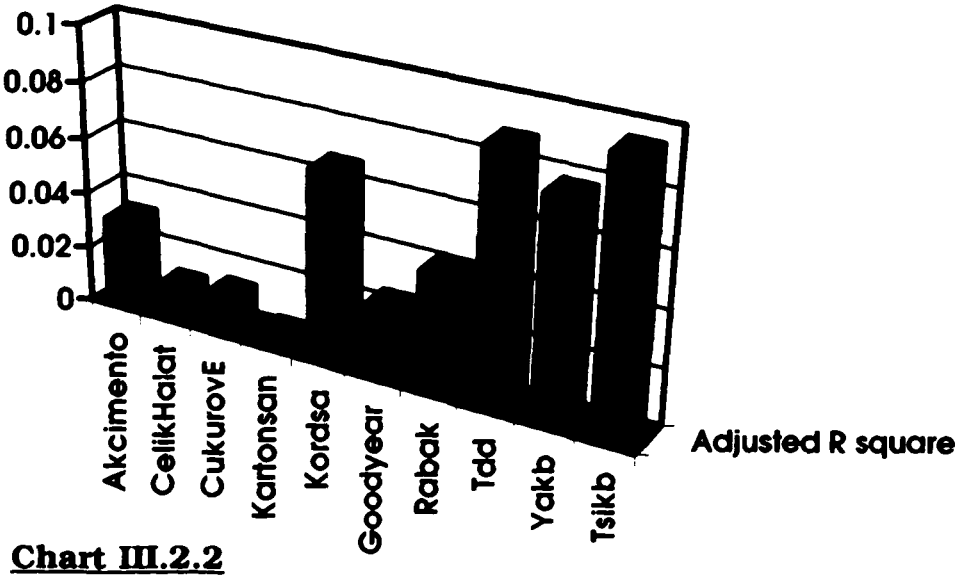


Chart III.2.2

ADJUSTED R SQUARE WITH MOVING AVERAGE REPRESENTATION OF THE DATA

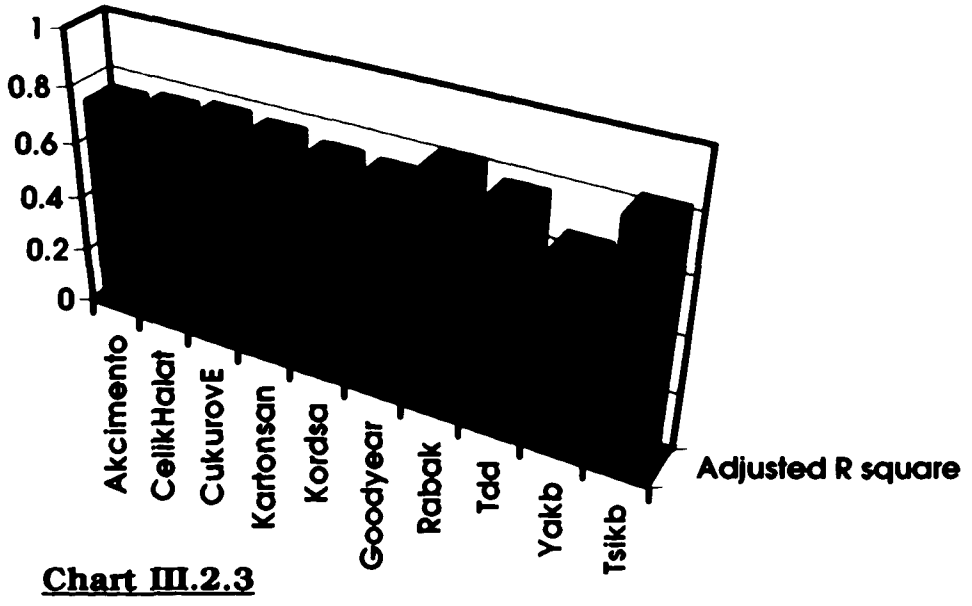
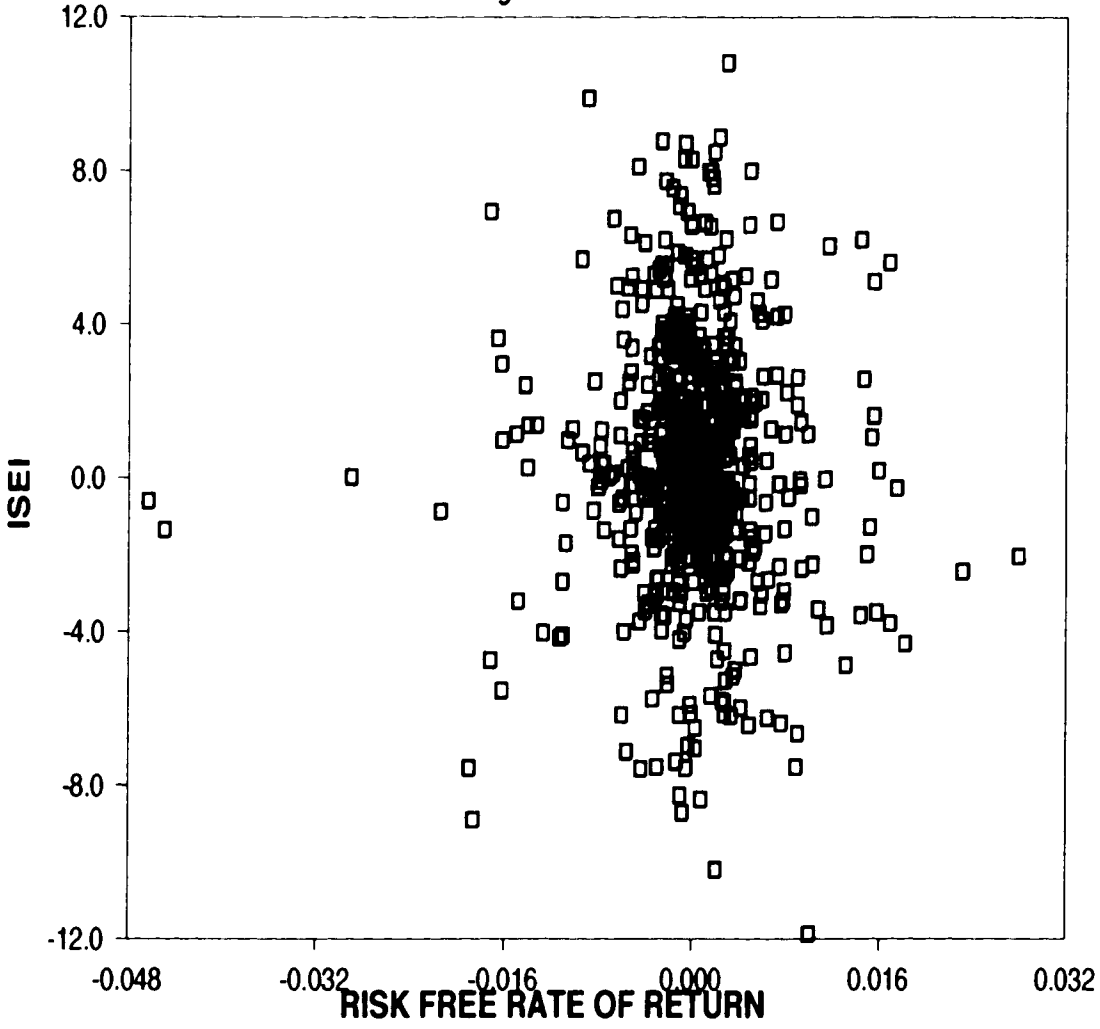


Chart III.2.3

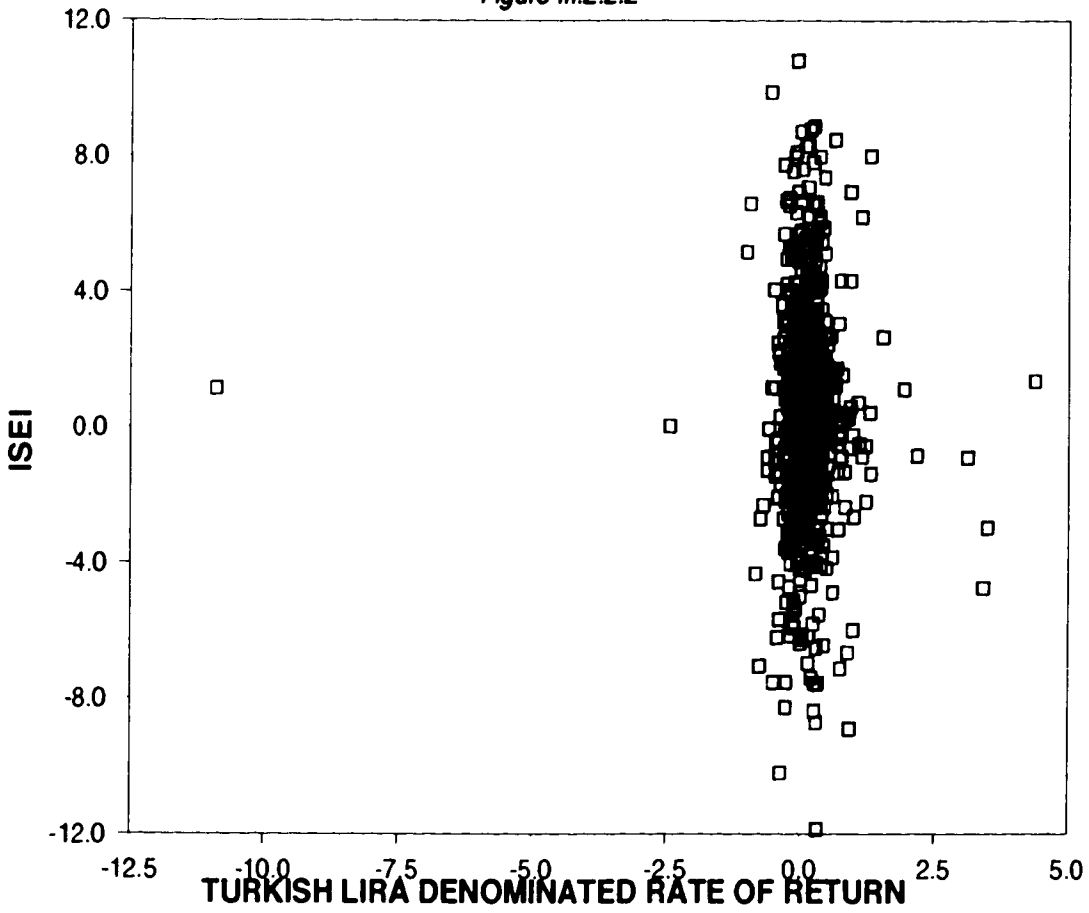
RISK FREE RATE OF RETURN vs. ISEI

Figure III.2.2.1



TURKISH LIRA DENOMINATED RATE OF RETURN vs. ISEI

Figure III.2.2.2



IV. Application of Vector Autoregressions: Determining the Efficiency of the ISEM

IV.1. Introduction

The basic intuition of efficient markets is that individual traders process the information that is available to them and take positions in assets in response to their information as well as to their personal situations. The market price aggregates this diverse information and in that sense it reflects the available information.

The efficient markets hypothesis asserts that

$$E(C_t \mid I_t) = (1+r_t) \qquad [5]$$

where E is the expectation taken with respect to a given information set I_t,that is available at time t and includes r_t, C_t represents the percentage of capital returns on securities and r_t is the riskfree rate of interest.

The Efficient Market Hypothesis is given empirical content by specifying the information set that is used to determine prices. The categories of information sets of efficient market theories that are employed in empirical work were articulated by Fama (1970) in the form which we now use. These categories describe a hierarchy of nested information sets. As we go up from the smallest to the biggest set, we can talk more about efficiency when we have increasing amounts of information.

At the far end of the spectrum is strong-form efficiency. Strong-form efficiency asserts that the information set used by the market to set prices at each time t contains all of the available information that could possibly be relevant to pricing the asset. Not only is all publicly available information embodied in the price, but all privately held information as well. After the strong-form efficiency comes the semistrong-form efficiency. A market is efficient in the semistrong sense if it uses all of the publicly available information. The important distinction is that the information set is not assumed to include privately held information, i.e. information that has not been made public. The tendency in empirical literature has been to take a view

of semistrong efficiency, and to adopt the position that if the information was in the public domain then it was available to the public and should be reflected in prices. This ignores the cost of acquiring the information, but the intuitive justification for this position is that the costs of acquiring such public information are small compared to the potential rewards. If the asset is traded on an organized exchange, then of all the information that is clearly available, no information is as accessible and cheap as its past price history to the public. At the bottom of the ladder in the efficiency hierarchy, weak-form efficiency requires only that the current and the past price history be incorporated in the information set. If there is empirical validity to the Efficient Market Hypothesis then, at the very least, the market for an asset should be weak-form efficient, that is, efficient with respect to its own past price history.

IV.2. Emprical Testing

The empirical implications of efficiency with respect to a particular information set are that the current price of the asset embodies all

of the information in that set. Since the categories of information are nested, rejection of any one type, say weak-form efficiency, implies the rejection of all stronger forms. According to weak-form efficiency, the current price of an asset embodies all of the information contained in the past price history. This implies that,

$$E(C_t \mid C_{t-1}, C_{t-2}, \ldots\ldots) = (1+r_t) \qquad [6]$$

The most dramatic consequence of the EMH and certainly the one that receives the most attention from the public, is the denial of the possibility for successful trading schemes. If, for example, the market is weak-form efficient, then an investor who makes use of the technical information of past prices can only expect to receive a return of the opportunity cost $(1+r_t)$. No amount of clever manipulation can improve this result (Leroy, 1982).

An investor concerned only about mean and variance of portfolio return (Markowitz, 1991), will use the market prediction to improve the mean/ variance trade-off of portfolio return by moving the portfolio toward securities

predicted to have high returns and away from securities predicted to have low returns. Hence, using knowledge about the previous month's returns, the investor produces a portfolio with superior mean/variance performance. This will violate the weak-form of market efficiency, in the sense that the expected return for each security, based upon the knowledge of the yesterday's rate of return is different from the expected return based only upon the current security price.

In our vector autoregressions, the Granger[1] procedures provide tests of capital market efficiency. According to Table I, Çukurova Elektrik, Rabak, and TSIKB are the only variables which are influenced by their own one day lagged values. The F statistics of eight Turkish companies: Akçimento, Çelik Halat, Kartonsan, Kordsa, Good Year, TDD, and YAKB, in the Çukurova Elektrik equation are not significant. This means that Çukurova

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1. Assuming that Y and X are two stationary stochastic time series, Y is Granger-caused by X if Y can be predicted more efficiently when the information in the past and present X is taken into account in addition to all other information in the universe.

Elektrik is exogenous with respect to these eight variables but is caused by itself and TSIKB in the Granger-causality sense. Vector Autoregressions with a lag of two days show lagged values of Rabak and YAKB to have statistically significant coefficients. Rabak is caused by its lagged values in the Granger-causality sense implying that one day and two days lagged values of Rabak have predictive power for the Rabak's current capital rate of return. The null hypothesis that two days lagged value of YAKB has a zero coefficient can be rejected with 95 percent confidence. The fact that the lagged coefficients of Rabak are statistically significant constitutes a rejection of the weak-form Efficient Market Hypothesis (Cooley and Leroy, 1985). Consecutively, the EMH is rejected for the equations of Çukurova Elektrik and TSIKB.

At least two of the three assumptions of the EMH are unrealistic in an actual market place. First, transaction costs (brokerage fees, opportunity cost of margin, etc.) exist. Therefore, Jensen (1968) argues that a market is efficient as long as a trading system cannot produce risk-adjusted profits greater than transaction costs.

Second, information is not costless. Returns are earned as traders

bid up undervalued securities and sell off overvalued ones. Grossman and Stiglitz (1980) argue that the cost of acquiring and interpreting information slows price adjustment.

The other empirical implication of the EMH that is often cited as a defining characteristic is that an efficient price series should move randomly. The precise meaning of this in our context is that price changes should be serially uncorrelated.

Consider the serial covariance between two adjacent capital rates of return,

$$C_{ov}(C_{t+1}, C_t) = E([C_{t+1} - E(C_{t+1})][C_t - E(C_t)]) \qquad [7]$$

$$= E(C_{t+1}\,[C_t - E(C_t)]$$

$$= E(E(C_{t+1} \mid C_t)[C_t - E(C_t)])$$

In equation [7], since I did not specify the information set with respect to which the expectations are to be taken, they are unconditional expectations. Under weak-form efficiency, the information set will contain the past rates of

return. Suppose that the interest rate is independent of past returns on the asset. In such a case, since weak-form efficiency implies that I_{t+1} contains C_t, we have

[8]

$$E(C_{t+1} \mid C_t) = E[E(C_{t+1} \mid I_{t+1}) \mid C_t)$$

$$= E[(1+r_{t+1}) \mid C_t]$$

$$= E(1+r_{t+1}),$$

the unconditional expectation of next period's opportunity cost. Putting [7] and [8] together yields,

[9]

$$Cov(C_{t+1}, C_t) = E(1+ r_{t+1})\, E[C_t - E(C_t)] = 0$$

The autocorrelations for the ten ISEM companies security returns exhibited in Figures IV.1 to IV.5 show significant correlations which do not refute the EMH. The autocorrelations for the first nine companies are in the range from 0.27 to – 0.27 (Figures IV.1- IV.4). TSIKB is the only one

that shows the highest autocorrelations in the range of 0.5 to – 0.5 (Figure IV.5).

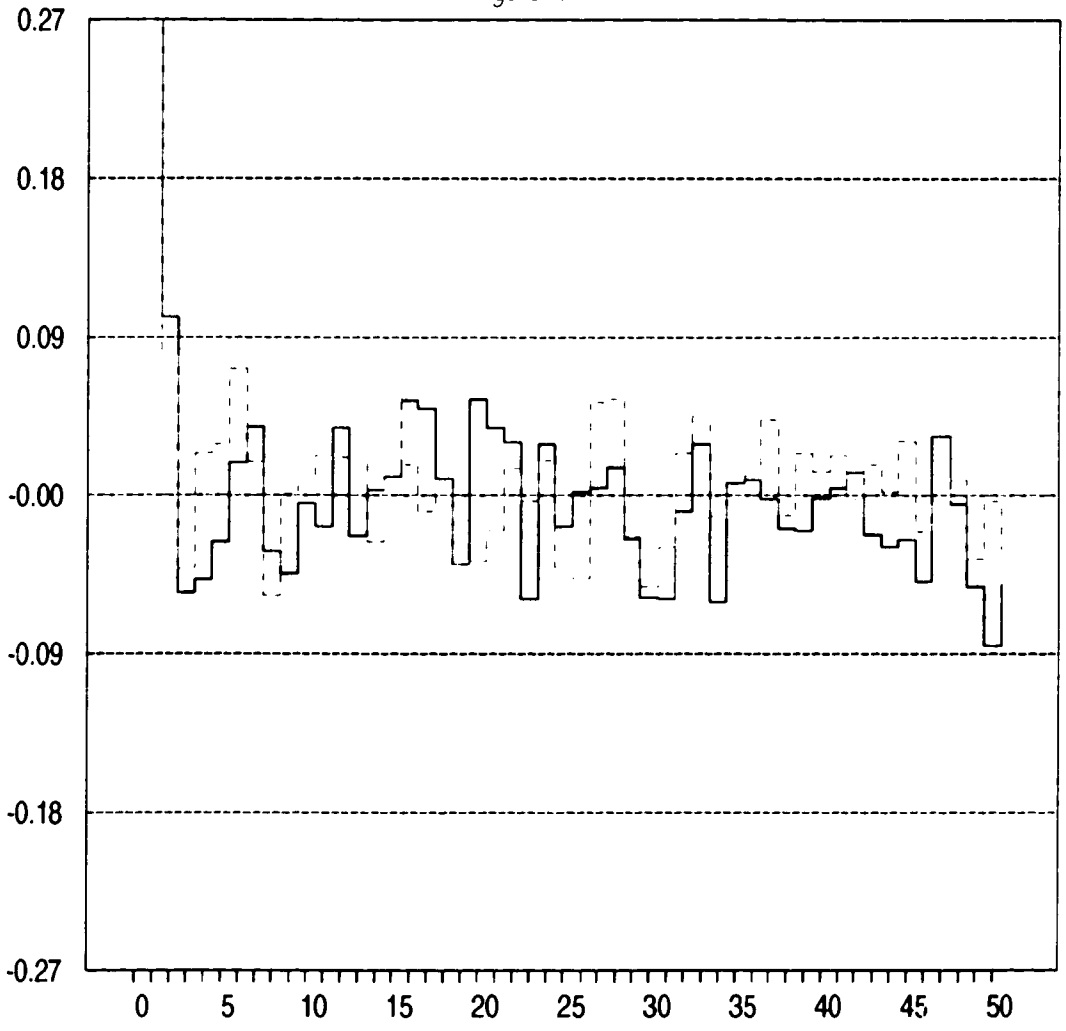
Small autocorrelations have usually been interpreted as evidence for market efficiency. However, no one has discovered the amount of autocorrelation to refute efficiency (Taylor, 1982). Goldman and Beja (1979) have demonstrated that non-clairvoyant specialists who attempt to absorb a fraction of all excess demand will introduce negative autocorrelation into observed returns but that over interference by such specialists could result in observed returns being positively serially correlated. As discussed in Schwartz and Whitcomb (1976), negative autocorrelation might result from specialist intervention to satisfy a depth requirement that delimits the size of permissible price changes. The clairvoyant specialists can reduce, but not eliminate, the error in prices, and the resulting pattern exhibit a positive correlation of returns. Thus the sign and relationship of autocorrelations to a security's thinness are indeterminate. The empirical evidence appears to suggest a positive relationship between autocorrelation and market size. The thinner issues exhibit negative autocorrelation, and the thicker (higher value) issues

exhibit positive autocorrelation (Cohen *et al.*, 1980). Following this, our results show that YAKB and TSIKB are high value securities compared to the eight others with seventeen and twelve negative autocorrelations respectively. Out of ten securities eight are thin, proving the fact that ISEM is a thin market.

Further research may be carried out to compute serial correlation coefficients of portfolios formed from these securities, in order to test the hypothesis that correlation in daily market indices is caused only by the nonsynchronous trading of component securities (Perry, 1985).

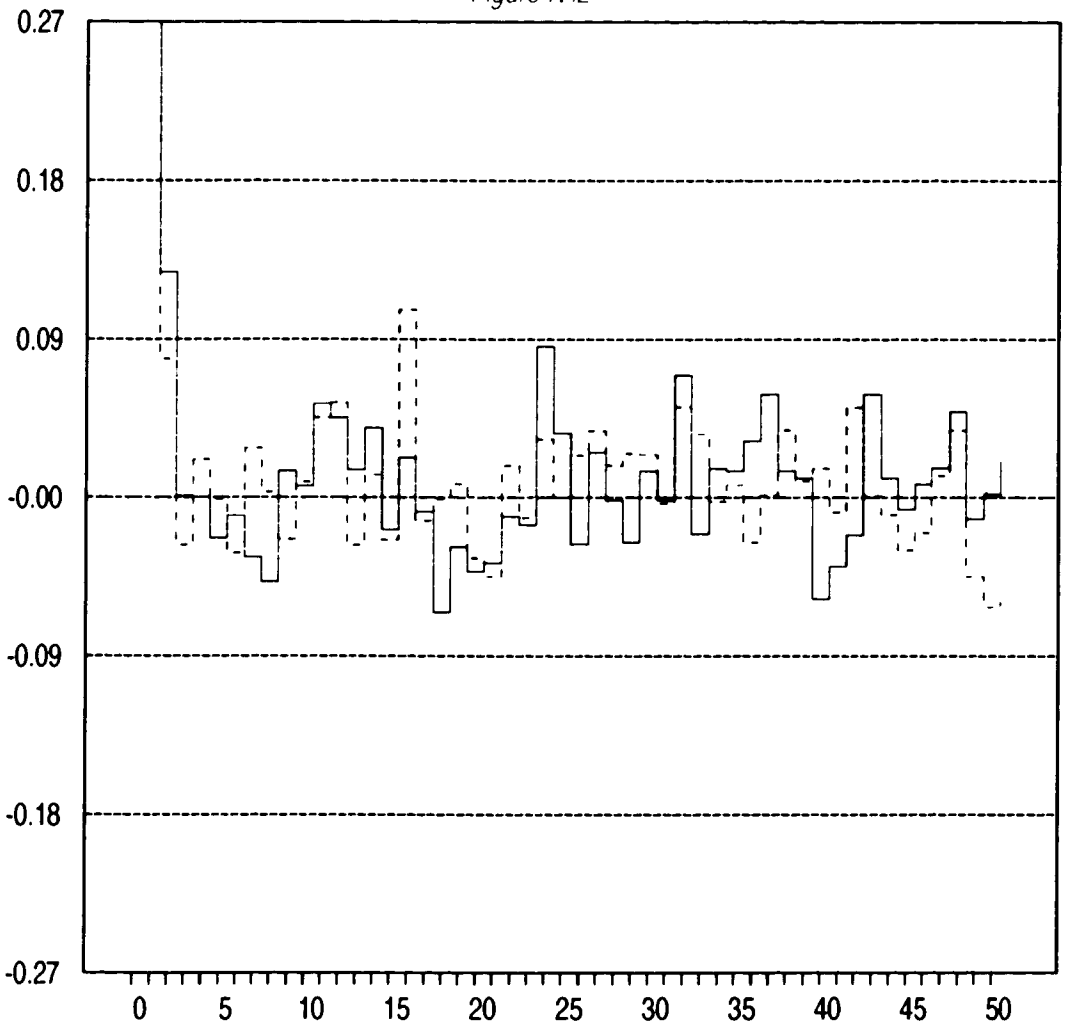
Autocorrelations for AKCIMENTO and CELIK HALAT Returns

Figure IV.1



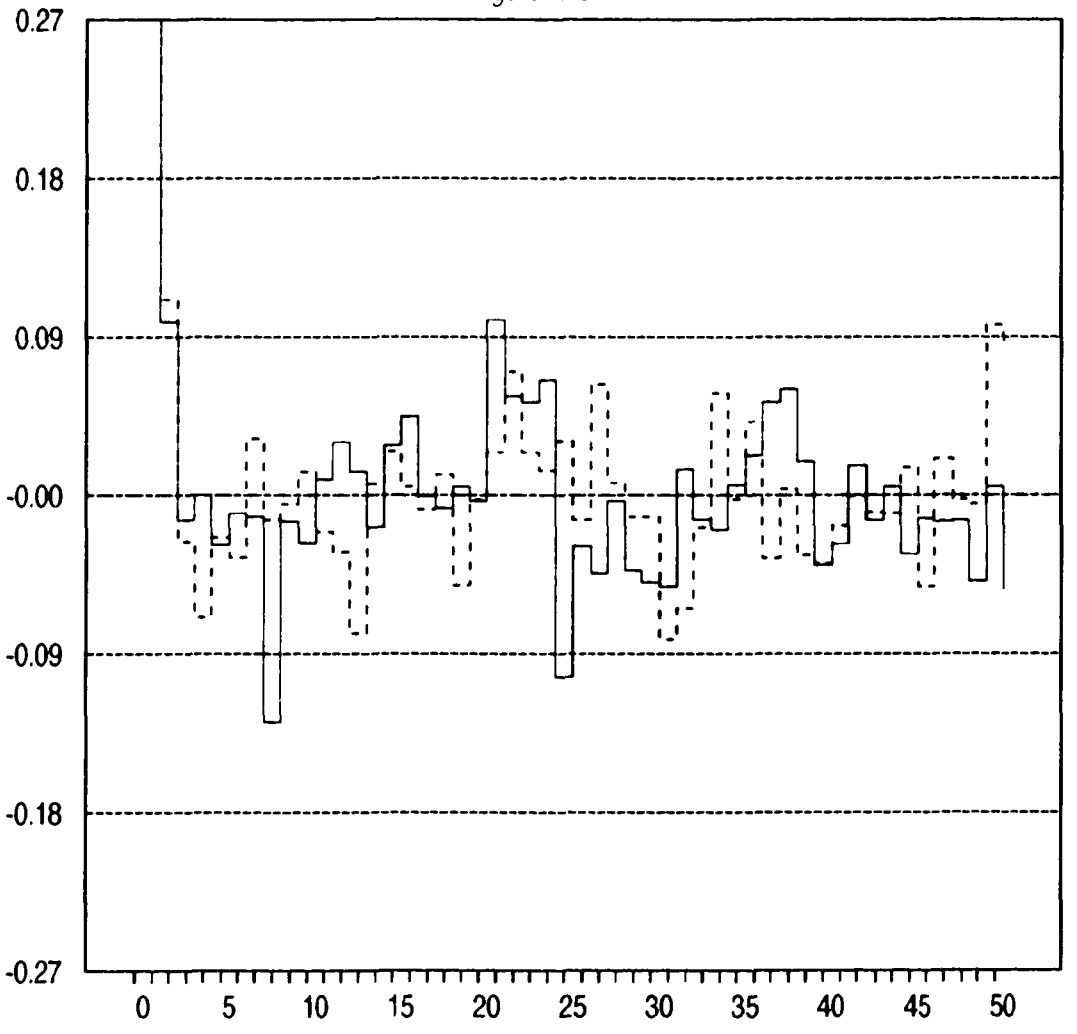
Autocorrelations for CUKUROVA ELEKTRIK and KARTONSAN Returns

Figure IV.2



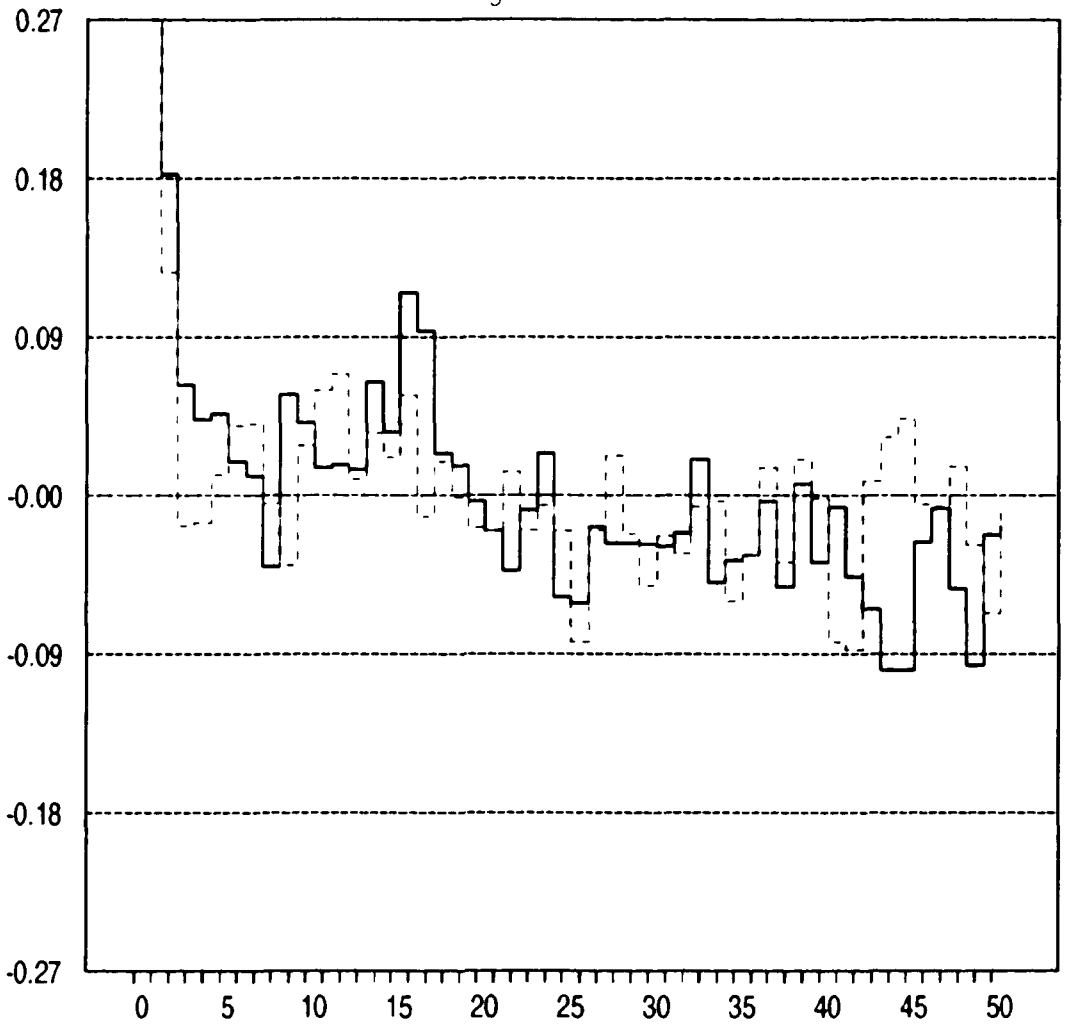
Autocorrelations for KORDSA and GOOD YEAR Returns

Figure IV.3



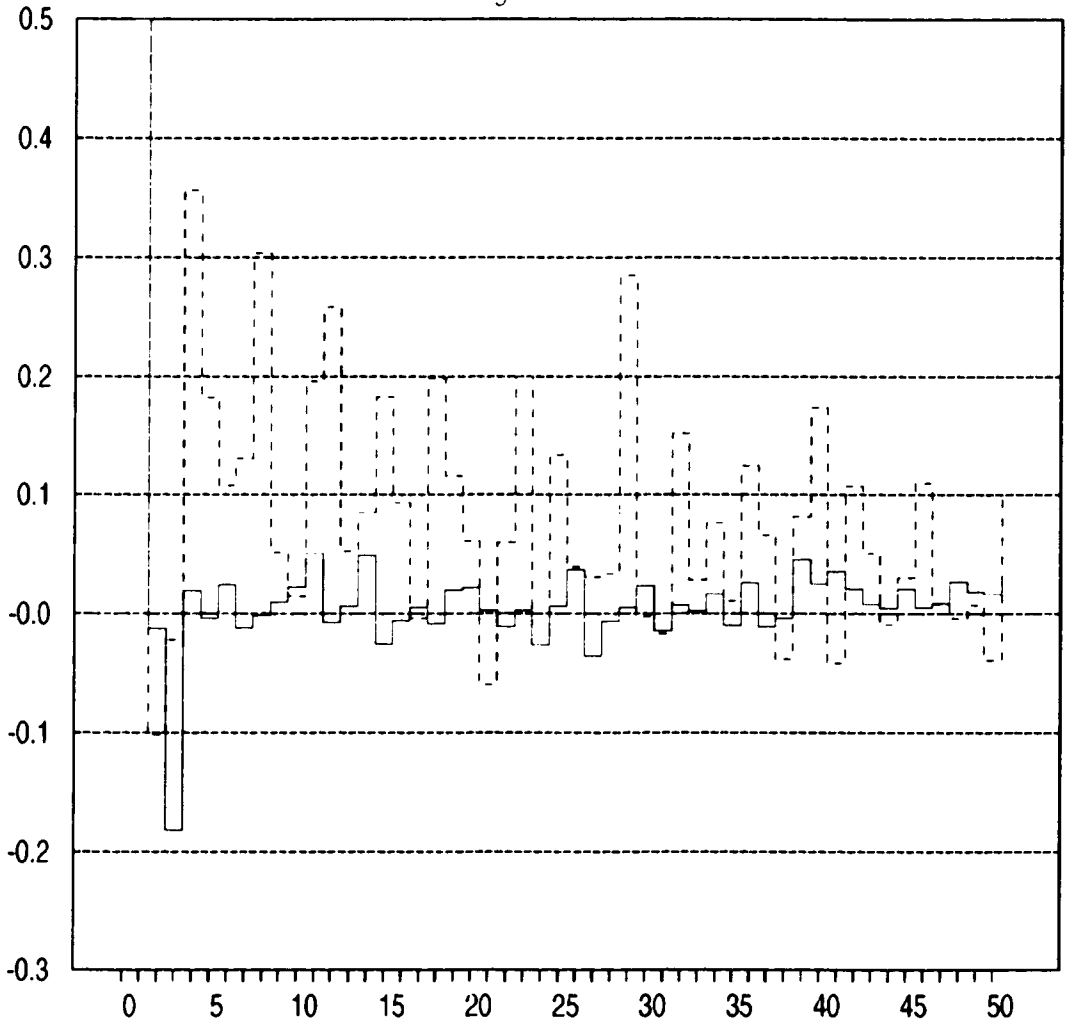
Autocorrelations for RABAK and TDD Returns

Figure IV.4



Autocorrelations for YAKB and TSIKB Returns

Figure IV.5



V. Conclusion

This dissertation suggests a vector autoregression model to analyze the dynamic behavior of the Istanbul Stock Exchange Market (ISEM). The adjusted R square of the VAR model ranges from –0.005 (for YAKB) to 0.06 (for TDD) which is the result of an unsatisfactory fit of the data to the model. It should be noted that even in perfect looking stock markets the ability to explain the stock prices is barely satisfactory (Roll, 1988). The R square calculated for even well-accepted models like CAPM and APT are near 0.20 with daily U.S. stock market data. In these markets it is observed that the information-cleansed data slightly increases the R square. Far from being compared to U.S. capital markets, ISEM shows a similar behavior when we delete the influential points from the data set. The adjusted R square ranges from 0.01 (for Çelik Halat) to 0.094 (for TSIKB). These new findings show ISE's performance to be at least fifty percent as good as the U.S. stock market's.

Section II.2.1 is used to explain the speculative behavior of ISE

in light of the big outliers effects in the model. Eliminating these large residuals or taking the moving average of the data, along with only ISEI and dummies in the deterministic part of the regressions showed improvement in the results with higher adjusted R squares.

Furthermore, the computations show that, in the Istanbul Stock Exchange, there is significant correlation between returns, and that my data sample using the Granger- causality procedure for the financial rates of return, do not refute the efficient market hypothesis. This hypothesis states that all methods of deciding when to buy and sell, over a particular time period and using past prices to evaluate the decisions, are inferior to the strategy of buying at the beginning of the period and selling at its conclusion, after trading costs have been deducted (Fama, 1970).

Empirical literature appears to support that the autocorrelations are due to infrequent trading in the stock markets.

The purpose of considering residual autocorrelation is two-fold: First, we can have more confidence in the results because market model residuals are more nearly independent across firms, and the stock returns may

be negatively serially correlated when they are generated by random walk. Second, to check the correctness of the model. The findings show that an important majority of stocks in the sample, show negatively autocorrelated residuals. The suggestion is that negative residual autocorrelations are strong enough to enable the formulation of abnormally profitable trading strategies which challenges the idea of EMH in the Istanbul Stock Exchange.

The Istanbul Stock Exchange is still a speculative market, with investors looking for short-term capital gains rather than long-term returns. A general fall in inflation, plus a reduction in the government's enormous calls for cash and the growth of more institutional investors as well as measures for preventing insider trading are necessary if this defect is to be overcome.

BIBLIOGRAPHY

Atkinson, A. C. and **Weisberg, S.** (1991): "Simulated Annealing for the Detection of Multiple Outliers using Least Squares and Least Median of Squares Fitting" in *Directions in Robust Statistics and Diagnostics, Part I*, Edited by **Stahel, W.** and **Weisberb, S.**, New York: Springer-Verlag.

Box, G. E. P. and **Jenkins, G. M.** (1970): *Time Series Analysis, Forecasting and Control*, San Francisco: Holden Day.

Central Bank of Turkey (1990): Annual Reports.

Christensen, R. (1991): *Linear Models for Multivariate, Time Series, and Spatial Data*, Chapter V, New York: Springer-Verlag.

Cohen, K., Hawawini, G., Maier, S., Schwartz, R., and **Whitcomb, D.** (1980): "Implications of Microstructure Theory for Empirical Research on Stock Price

Behavior," *The Journal of Finance*, 35: 249-257.

Cooley, T. and **Leroy, S.** (1985): "A theoretical Macroeconometrics, A Critique," *The Journal of Monetary Economics*, 16: 283-308.

Daniel, C. and **Wood F. S.** (1980): *Fitting Equations to Data*, (revised edition), New York: Wiley.

Economist Intelligence Unit (1989): Country Report, No: 1-4.

Economist Intelligence Unit (1990): Country Report, No: 1-4.

Economist Intelligence Unit (1991): Country Report, No: 1-4.

Economist Intelligence Unit (1992): Country Report, No: 1-4.

Economist Intelligence Unit (1990-1992): Country Profile.

Fama, E. (1970): "Efficient Capital Markets: A review of Theory and Empirical Work," *The Journal of Finance*, 25: 383-417.

Fisher, L. (1966): "Some New Stock Market Indexes," *The Journal of Business*, 15:191-225.

Fogler, H. R. and **Ganapathy, S.** (1982): *Financial Econometrics*, New Jersey: Prentice Hall.

Istanbul Stock Exchange Market (IMKB) **Reports** (1989-1991).

Jensen, M. L. (1968): "The Performance of Mutual Funds in the Period 1945-64," *Journal of Finance*, 23: 389-416.

Judge, G. G., Hill, R. C., Griffiths, W. E., Lutkepohl, H. and **Lee, T.** (1988): *Introduction to the Theory and Practice of Econometrics*, New York: Wiley.

Grossman, S. J. and **Stiglitz, J. E.** (1980): "On the Impossibility of Informationally Efficient Markets", *American Economic Review*, 70: 393-408.

Harvey, A. C. (1981): *The Econometrics Analysis of Time Series*, New York: Wiley.

Leroy, S. F. (1982): "Expectations Models of Asset Prices: A Survey of Theory," *The Journal of Finance*, 37: 185-217.

Litterman, R. and **Weiss, L.** (1985): "Money,Real Interest Rates, and Output: A Reinterpretation of Postwar U.S. Data," *Econometrica*, 53: 129-155.

Malinvaud, E. (1966): *Statistical Methods of Econometrics*, Amsterdam: North-Holland.

Markowitz, H. (1991): "Foundations of Portfolio Theory," *The Journal of Finance*, 46: 469-509.

Matlab User's Guide (1991): The MathWorks, Inc.

Mishkin, F. S. (1992): *The Economics of Money, Banking and Financial Markets*, New York: Harper Collins.

OECD Economic Survey of Turkey (1989-1990).

OECD Economic Survey of Turkey (1990-1991).

Perry, P. R. (1985): "Portfolio Serial Correlation and Nonsynchronus Trading." *Journal of Financial and Quantitative Analysis*, 20, 4: 517-523.

Rats 4.0 Manual (1992): Estima.

Roll, R. (1988): "R^2," *The Journal of Finance*, 43: 541-566.

Sen, A. and **Srivatava M.** (1990): *Regression Analysis, Theory Methods, and*

Applications, Chapters 1-8, New York: Springer-Verlag.

Shumway, R. (1988): *Applied Statistical Time Series Analysis*, New Jersey: Prentice Hall.

Schwartz, R. and **Whitcomb, D. K.** (1977): "Time-Variance Relationships: Evidence on Autocorrelation in Common Stocks Returns," *The Journal of Finance*, 32: 41-55.

Sims, C. (1980): "Macroeconomics and Reality," *Econometrica*, 48: 1-48.

Capital Market Board of Turkiye (SPK) **Annual Reports** (1989-1991).

Taylor, S. J. (1982): "Financial Returns Modelled by the Product of Two Stochastic Processes- A study of Daily Sugar Prices, 1961-79," In *Time Series Analysis: Theory and Practice 1*, Edited by **O. D. Anderson**, North-Holland Publishing Company.

Turkish Treasury, Foreign Trade and **Treasury Indicators**, 1989-1991.