STOCK RETURN AND MONETARY VARIABLES IN İSTANBUL SECURITIES EXCHANGE: A COINTEGRATION ANALYSIS

A MASTER'S THESIS
SUBMITTED TO THE DEPARTMENT OF ECONOMICS
AND THE INSTITUTE OF ECONOMICS AND SOCIAL SCIENCES
OF BILKENT UNIVERSITY
IN PARTIAL FULFILLMENT FOR THE DEGREE OF
MASTER OF ECONOMICS

By

A. REHA ARGAÇ

September, 1995

STOCK RETURN AND MONETARY VARIABLES
IN ISTANBUL SECURITIES EXCHANGE :
A COINTEGRATION ANALYSIS

A MASTER'S THESIS
SUBMITTED TO THE DEPARTMENT OF ECONOMICS
AND THE INSTITUTE OF ECONOMICS AND SOCIAL SCIENCES
OF BILKENT UNIVERSITY
IN PARTIAL FULFILLMENT FOR THE DEGREE OF
MASTER OF ECONOMICS

By

A. REHA ARGAÇ

September, 1995

I certify that I have read this thesis and in my opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Economics.

Assoc. Prof. Kürşat Aydoğan

I certify that I have read this thesis and in my opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Economics.

Assist. Prof. Gülnur Muradoğlu

I certify that I have read this thesis and in my opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Economics.

Assist. Prof. Kıvılcım Metin

Approved by the Institute of Social Sciences and Economic Sciences

Director:

ABSTRACT

STOCK RETURN AND MONETARY VARIABLES IN ISTANBUL SECURITIES EXCHANGE: A COINTEGRATION ANALYSIS

A. REHA ARGAÇ
Master of Economics
Supervisor: Assist. Prof. Kıvılcım Metin
September, 1995

This study investigates the long run relationship between stock prices and monetary variables and examines the different aspects of the relation for the period between 1988 and 1995, and for three subperiods within this range using daily data. The discrimination between the periods are made due to the strict changes in the volume of trade in ISE which indicate us a structural change.A recently developed statistical theory, i.e. the cointegration theory, which is based on the use of time series regressions and permits us to study the long-run relations of the nonstationary time series, is used for examining the relation.The results show that especially in last five years, there is a tendency to weaken the relation between monetary variables and the stock prices in Turkish stock market. This tendency can be explained by the rapid increase in the volume of trade causing an increase in the number of investors utilizing the same set of information.

Key words: ADF, Cointegration, Efficient Market Hypothesis (EMH), Istanbul Securities Exchange (ISE).

ÖZ

İSTANBUL MENKUL KIYMETLER BORSASINDA HİSSE SENEDİ GETİRİLERİ VE PARASAL DEĞİŞKENLER: BİR KOENTEGRASYON ANALİZİ

A. REHA ARGAÇ
Yüksek Lisans Tezi, İktisat Bölümü
Tez Danışmanı: Yrd. Doç. Kıvılcım Metin
Eylül, 1995

Bu çalışma, hisse senedi fiyatları ile parasal değişkenler arasındaki uzun dönem ilişkiyi ve 1988 ile 1995 yıllarını kapsayan dönem ve bu dönemin üç alt dönemi için bu ilişkinin değişimlerini günlük veri kullanarak incelemiştir. Dönemler arasındaki ayrım, bize Istanbul Menkul Kıymetler Borsasında yapısal bir değişikliğin olduğunu gösteren işlem hacimlerindeki belirgin değişikliklere göre yapılmıştır. Bahsedilen ilişkiyi incelemek için, zaman serilerinin regresyonlarının kullanımına dayanan ve durağan olmayan zaman serilerinin uzun dönem ilşkilerini incelemeye olanak sağlayan, son yıllarda geliştirilen ve adına koentegrasyon teorisi denilen istatistik teorisi kullanılmıştır. Sonuçlar, özellikle son beş yılda, Türkiye hisse senedi piyasasında parasal değişkenler ve hisse senedi fiyatları arasındaki ilişkinin zayıflama yönünda bir eğilimi olduğunu göstermiştir. Bu eğilim, aynı bilgi kümesini kullanan yatırımcıların sayısının artmasıyla bağlantılı olarak işlem hacmindeki hızlı artışla açıklanabilir.

Anahtar Kelimeler: ADF, Koentegrasyon, Piyasa Etkinliği Hipotezi, Istanbul Menkul Kıymetler Borsası (IMKB).

ACKNOWLEDGEMENTS

I am grateful to Assist. Prof. Kıvılcım Metin and Assist. Prof. Gülnur Muradoğlu for their supervision and guidance throughout the development of this thesis and would like to thank Assoc. Prof Kürşat Aydoğan for his valuable comments and suggestions which contributed to the improvements of this study.

I would also like to thank my business friends from İş Bank and Sanem for their supports.

I finally and especially would like to thank my family for their support and encouragements.

TABLE of CONTENTS

1- INTRODUCTION

The information revealed by macroeconomic variables is an important set of information for the behaviour of the stock prices. Fama (1991) encourages the researches to relate the behaviour of stock returns to the real economy. There are several studies that examine the links between stock prices and economic variables in the world (Bulmash&Trivoli (1991), Hancock (1989), Pearce&Roley (1985), Schwert (1990), Darrat (1988), VanderHoff&VanderHoff (1986)) and in Turkey (Erol & Aydoğan (1991)). Macroeconomic variables are more important in thin markets like Turkey in comparison to mature markets. In developing countries, the capital accumulation and economic activity are initiated by government policies. For example, in Turkey, 60% of the industrial production is controlled by the state and the private companies are also sensitive to government policies. Besides, the volume of trade is low and the information about the company performances has been limited and untimely for a long time. The stock market of Turkey i.e. Istanbul Securities Exchange (ISE), being a thin market and a market of a controlled economy, is a good candidate for testing the relation between the real economy and the stock market. This relation, if exists, creates opportunities for high profits to the investors who can react to the changes in economic policies.

There are some recent studies about the efficiency of the Turkish markets. For example, Muradoğlu&Metin (1995) and Muradoğlu&Önkal (1992) tested the semi-strong form of the efficiency hypothesis in Turkish market; and Muradoğlu&Ünal (1994) and Alparslan (1989) tested the weak form efficiency of the thinly traded Turkish stock market. For the aim of examining the relations between the Turkish stock market and monetary variables, we use a recently developed statistical theory, i.e. the cointegration theory, which is based on the use of time series regressions and permits us to study the long-run relations of the nonstationary time series. Muradoğlu&Metin (1995) used the same technique to test the market efficiency and the existence of a relationship between stock prices and inflation which is investigated by assuming the possible existence of a proxy effect in both the long and the short runs using monthly data. Our study replicates this study by using daily data and by dividing it into three periods with respect to the volume of trades of ISE. So, in this study, the relations between stock returns and macroeconomic variables are examined for the case of Turkey by using monetary variables as a set of publicly available information.We examine the periods individually and we observe the effects of monetary variables on stock returns and the development of the Turkish stock market in this sense. For more accurate analysis, more monetary and fiscal variables should be used. But both the lack of availability of the announced daily data and the external effects like insider trading, political effects, psychological effects, unemployment rate etc. prevent more accurate analyses. However, our aim, in this study, is not to forecast the value of the composite index but just to test whether there is a long run relation between monetary variables and the stock prices. So, the variables selected provide meaningful results.

Accordingly, the study is organised as follows. In Chapter 2, We present the Turkish economy, the main features and the developments of Turkish stock market in last ten years. Chapter 3, then, presents the market efficiency hypothesis and a review of literature about the market efficiency and studies that examine the links between macroeconomic variables and stock returns both in the world and in Turkey. In Chapter 4, the econometric theory is explained and after introducing the definition of the stationarity, we present the underlying theory of Dickey and Fuller (1981) unit root test, which is used to determine the order of integration and to analyze whether there exists cointegrating relations among the variables, is presented. Then we introduce the theory of cointegration and Engle-Granger Two-Step approach to test the existence of long run equilibrium relations among the macro-economic variables and the stock prices. In Chapter 5, first, the properties of the data set are reported. Second, the results of unit root tests and the cointegration tests are presented. Finally, we present the results of long run static equations, which are used to explain the long run behaviour of the stock prices. Finally, in Chapter 6, conluding remarks, the discussions about the results and posssible implications for investors are presented. The related tables and the figures are presented at the end.

2- THE BACKGROUND

The financial system in Turkey was strictly regulated by the government and highly inefficient until 1980. Turkey started a structural change in the process of liberalization and integration of financial markets during the beginning of 1980 with the newly announced policies of the Turkish government. Turkey initiated to test the market-oriented economic regime instead of the government-regulated one in order to alleviate the involvement of government in financial markets. These policy changes are the expected changes in a developing country to reach to the level of developed ones and to achieve market efficiency which is an expected property of a mature market. Within this process, Turkey is a good candidate for case study for the set of developing countries.

The deregulation of the interest rates and the liberalization of the foreign exchange regulations in 1989 to ease capital movements provided the freedom of the banking system, permission for holding foreign exchanges and open exchange accounts and hence, full convertibility of Turkish lira.

In 1986, Interbank money market is introduced for one and two week maturities and overnight transactions. Yearly targeting of monetary aggregates are first introduced by Central Bank in this year. Another property of this year was that the stock market became operational with the establishment of Istanbul Securities Exchange (ISE) in the early period of this year although the legal framework for a securities exchange had been completed in 1982. In the beginning, 42 companies were listed and today there are more than 200 stocks acting in the ISE. The period, including years 1986 through 1988, was characterized as a learning process for all of the participants in the markets. Until a manual system is established in the end of 1987, the activities were permitted to individual investors and the trade floor activities were not limitted to licanced brookers. In 1989, with the aim of further liberalization, foreign portfolio investments on ISE became possible. This foreign investment gave a boost to the market, the volatility increased and the market became highly sensitive to the foreign exchange rates. In 1991, ISE has structured its main index with two sub-indices which were called 'the Financials index' and 'the Industrials index'. The new composite index consisted of 75 stocks. At the end of 1993, computer aided procedures were established and this was an important development to increase the volume of trade and hence, to protect the market from insider traiders. As a result of this, the market proceeds in the way of efficiency. In November 1994, a computer assisted system started to trade all of the stocks acting in the market. Today, the calculation of composite index includes over 100 stocks and the settlements are made in two days while the trading occurs in two sessions within a day.

The years 1990 and 1993 are important years for the development of ISE, because the volume of trade has made sharp increases in these years. The annual trading volumes are listed below:

The Volume of Trades in ISE

Year	Volume of Trades
1988	83.0
1989	751.6
1990	5226.1
1991	8314.4
1992	8378.2
1993	21278.1
1994	23203.0
1995*	4053

note: Money values are in millions of U.S. dollars
' * ' : for 2 months of 1995.
source: Aydoğan&Muradoğlu, 1995

The sharp jumps in 1990 and 1993 show the different phases of development in the Turkish stock market. The Gulf Crisis, which is effective between August of 1990 and March of 1991, and the economic crisis in Turkey in April, 1994 and the usage of computer aided system are the main factors that effect the volume. The Gulf Crisis, for example, is examined by Özer&Yamak (1992) and the impacts of the crisis on stock returns and volatility in ISE are studied. There are other studies that examine the effects of sudden changes in macro variables to the stock returns. For example, Erol & Aydoğan (1991) show that portfolio returns display sensitivity to macroeconomic variables such as changes in unexpected inflation and real rate of return.

Finally, before finishing the chapter, it is appropriate to give the annual growth rates of the variables in order to see the developments year by year (Table-1). 1989 was an explosive year for the stock returns and stock prices increased for 494%. The increase in exchange rates were not so much in comparison to the other years. In 1992, the composite index decreased for 8.4% due to the election and uncertainty in political side. 1993, as being the second explosive year for the stock returns because of the time elapsed after Gulf crisis, caused a 417% increase in stock prices. At the end of 1993, international creditworthiness was downrated and the Turkish lira was drastically depreciated because of the high output growth in 1992 and 1993, foreign indebtedness, inflationary pressures, public sector and trade deficits. The result was the economic crisis in the early period of 1994. It started in the financial markets and spread into the real part of the economy. It was an embarrassing year for the whole country. The stabilization package, suggested by IMF, came into force and it covered an immediate increase in prices of goods and services produced by State Economic Enterprises (SEE), privatization of them and decrease in real wages and public expenditure. Consumer price inflation was 126% and the wholesale price inflation was 150% in 1994. The growth rate of M1, M2 and currency in circulation reached to 3-digit numbers in this year. The increases in exchange rates were high because of the depreciation of Turkish lira.

Table-1. Annual Growth Rates of the Variables

Year	Ise	Dollar	Mark	Yen	Sterlin	M1	M2	Curr.
1988	% -46	% 77	% 58	% 75	% 71	% 48	% 71	% 57
1989	% 494	% 28	% 34	% 12	% 14	% 81	% 81	% 93
1990	% 47	% 27	% 43	% 34	% 51	% 44	% 44	% 81
1991	% 34	% 74	% 72	% 87	% 70	% 45	% 62	% 44
1992	% -8.4	% 68	% 58	% 70	% 36	% 89	% 69	% 68
1993	% 417	% 69	% 58	% 88	% 65	% 66	% 50	% 71
1994	% 32	% 166	% 196	% 198	% 179	% 81	% 120	% 100
1995*	% 75	% 11	% 25	% 32	% 15	% 17	% 33	% 34

note: The values are the percentage changes from beginning of the year to the end of the year.
* : For two months of 1995.

Above developments in Turkish economy, for more than a decade, causes Turkey to be a good case study for the set of developing and post-communist countries in the process of structural change and liberalization. The aim of this study is to examine the effects of the monetary variables on the Turkish stock market and examine how those effects differ during this process.

3- THEORETICAL FRAMEWORK

This chapter aims to familiarize with the efficient market hypothesis (EMH) together with the survey of the studies that used the efficient market hypothesis and that examined the links between stock prices and economic announcements.

3.1 Efficient Market Hypothesis (EMH) :

An efficient market, as a short cut description, is a market where prices incorporate all the information available to the market (Fama, 1970). A weaker and economically more sensible version of the hypothesis is introduced by Jensen (1978) and says that prices reflect the information to the point where the marginal benefits of acting on information do not exceed the marginal costs. Fama, in the 1970 rewiev, made a distinction between three potential levels of efficiency: the *weak form*, the *semi-strong form* and the *strong form.*

(a) Weak efficiency: The market is efficient in the weak sense if share prices fully reflect the information implied by all prior price movements. Price movements in effect are totally independent of previous movements. As a result, investors are unable to make profits from studying charts of past prices. Prices would respond only to new information or to new economic events.

(b) Semi-strong efficiency: The market is efficient in the semi-strong sense if share prices respond instantaneously and without bias to newly published information. The implication is that the prices that are actually arrived at in such a market would invariably represent the best interpretation of the information. Searching for bargain opportunities from an analysis of published data is useless.

(c) Strong efficiency: The market is efficient in strong sense if share prices fully reflect not only the published information but also all relevant information including data not yet publically available.

These three levels are not independent and the confirmation of the latter one implies the confirmation of the former one or ones.

The efficient market theory is important because if security prices can be relied upon to reflect the economic signals which the market receives, then they can also be looked to in turn to provide useful signals to both suppliers and users of capital, the former for the purposes of constructing their investment portfolios, and the latter for establishing criteria for the efficient disposition of the funds at their disposal (Keane, 1983).

3.2 Literature Survey :

In the literature, there are several studies for testing the efficiency of stock markets by using the macroeconomic variables in information sets. Fama&Blume (1966) proved that the developed markets are efficient in the weak and semi-strong sense. Serletis (1993), as being the one who used cointegration method for testing the market efficiency, found that stock prices and monetary variables do not cointegrate in the U.S. market and hence the stock market in U.S. is efficient. Hancock (1988), also, found that the U.S. stock market is semi-strong efficient with respect to both monetary and fiscal variables.This was done in his study by using the fitted and the residual values obtained from forecasting equations as estimates of anticipated and unanticipated policy actions respectively. The study of Pearce&Roley (1985) indicates that anticipated components of economic announcements do not significally affect the daily stock price movements which is consistent with the efficient market hypothesis. Bulmash&Trivoli (1991) found that stock prices in U.S. are predicted by the various lagged economic factors like actual inflation, monetary effects (M2), interest rates, debt monetization and unemployment rate. In the study of Darrat (1988), it is indicated that in Canada, past monetary actions don't have significant effects on current stock returns but the information on fiscal policy have some effects. The studies in developed countries support the efficient market hypothesis, but the studies in thin markets, although they are a few in number, find out different results about the efficiency of the stock markets. Macroeconomic variables are important information sets for developing countries where the operations are not deep. These variables are efficient indicators of the market since collecting these informations is not costly for investors (Mishkin, 1982). Erol&Aydoğan (1991) found that portfolio returns are sensitive to macro economic variables. Muradoğlu&Metin (1995) tested the semi-strong form of efficiency in Turkish stock market using the cointegration method and concluded with the inefficiency of the market. In the study of Muradoğlu&Ünal (1994), stock prices in Turkish stock market deviates from random walk and hence from independence. Muradoğlu&Önkal (1992) rejected the semi-strong form of efficiency in Turkish stock market and reported a significant lagged relationship between fiscal policy, monetary policy and stock returns. In the study of Alparslan (1989), the weak form efficiency of Turkish stock market is accepted by using filter rules. Özer&Yamak (1992) examined the effects of Gulf Crisis in Turkish stock market and found that the crisis caused drastic changes in stock returns and volatility in ISE.

Most of the studies described above for Turkish case reject the efficiency of the stock market and provides evidence that stock returns in the Turkish market deviate from random walk. In fact, the other studies suggest that in most of the thinly traded markets, efficiency is rejected and the stock prices are not independent from the macroeconomic variables. In mature markets of the developed countries, the semi--strong form of efficiency can not be rejected and hence, the macroeconomic variables do not have significant effects on stock prices.

4- ECONOMETRIC THEORY

Two topics of econometric theory used in this thesis, namely, stationarity and cointegration will be examined in this chapter.

4.1. Stationarity :

A stochastic process is said to be *stationary* in a weak sense, if the statistical properties of the data i.e. its mean and variance don't change in time. Then, a stochastic process X_t is said to be stationarity if:

$$E (X_t) = \mu = \text{constant} \quad ; \quad Var (X_t) = \sigma^2 = \text{constant} \; ; \quad (4.1)$$

and:

$$Cov (X_t X_{t+j}) = \sigma_j . \quad (4.2)$$

So the means and the variances are constant over time and the covariance between two periods depends only on the intervals separating the dates (j) and not on the date itself. A stationary process should satisfy all of those conditions.

With another point of view, a time series is stationary if:

$$Y_t = E (Y_t) + \varepsilon_t , \quad (4.3)$$

where

$$E (\varepsilon_t) = 0 , \quad (4.4)$$

$$E (\varepsilon^2_t) = \sigma^2 , \quad (4.5)$$

$$E (\varepsilon_t \varepsilon_k) = 0 \quad t \neq k . \quad (4.6)$$

An autoregressive model as given below,

$$y_t = \alpha + \beta y_{t-1} + \varepsilon_t \quad (4.7)$$

is stationary if $| \beta | < 1$ and the observations fluctuate around a mean of zero. If $| \beta | > 1$, then the model is explosive hence it is nonstationary. Most of the time series behave in this manner. Nevertheless, the theory surrounding stationary time series can often be applied to nonstationary series by taking first or higher order differences.

If a stationary series has an autoregressive representation with a *white-noise error* which means that it satisfies (4.4) through (4.6), it is called *integrated of order zero*, denoted as I(0). If a nonstationary series can be transformed to a stationary series by differencing k times then it is called *integrated of order k*, denoted as I(k).

Before starting to examine the methods for testing the order of integration, we should give some simple definitions in order to be familiar with the literature.

(4.7) is called a *random walk* if α is zero and it is called a *random walk with drift* if α is different from zero.

A *local linear trend model* is :

$$y_t = \mu_t + \varepsilon_t \tag{4.8}$$

where ε_t is an irregular white noise disturbance term and μ_t is a *stochastic trend*

$$\mu_t = \mu_{t-1} + b_{t-1} + \eta_t \tag{4.9a}$$

$$b_t = b_{t-1} + \nu_t \tag{4.9b}$$

in which η_t and ν_t are also white noise disturbance terms. The level of the series is given by μ_t and b_t is the slope. The stochastic trend reduces to *deterministic trend* when both η_t and ν_t have zero variance and so

$$y_t = \alpha + bt + \varepsilon_t \qquad \text{where} \quad \alpha = \mu_0 . \tag{4.10}$$

A mixed stochastic-deterministic trend process is also possible and is described as:

$$y_t = \alpha + bt + y_{t-1} + \varepsilon_t. \tag{4.11}$$

4.2. Unit Root Tests :

Before any sensible regression analysis, we should identify the order of integration of each variable. A unit root test proposed by Dickey and Fuller (1981) is an appropriate method for determining the order of integration and will be used in this research.

In the autoregressive model given in (4.7), a straightforward procedure would seem to be to test for $\beta = 1$. If the error term is white noise then the model (4.7) seems to be a random walk when $\beta = 1$ and such a process is not I(0) i.e. not stationary. However, if $|\beta| < 1$, then it is I(0).

The Dickey-Fuller (DF test) test is based on the equivalent regression to (4.7), namely:

$$\Delta y_t = \delta y_{t-1} + \varepsilon_t. \tag{4.12}$$

where

$$\Delta y_t = y_t - y_{t-1} \quad \text{and} \quad \delta = \beta - 1.$$

The procedure is to test the negativity of δ in the ordinary least squares regression of (4.12) where the *null* (H_0) and the *alternative* (H_1) hypotheses are:

$$H_0 : \delta = 0$$

$$H_1 : \delta < 0.$$

The rejection of the null hypothesis implies that the process is integrated of order zero. To evaluate the hypothesis, we use the critical values tabulated in Fuller (1976), table 8.5.2., because student t-ratio does not have a limiting normal distribution because of the unit root.

If we reject the null hypothesis, then the test finishes and we conclude that y_t is I(0). But, if we can't reject the null then we should test whether the order of integration is one or not. To test this, we repeat the procedure for:

$$\Delta\Delta y_t = \delta \Delta y_{t-1} + \varepsilon_t. \tag{4.13}$$

This procedure goes on by differencing y_t each time until we become able to reject the null hypothesis. Of course, it might be the case that the series is not integrated and no differencing can be able to reject the null. Another problem that might occur is the problem of *overdifferencing* which can be understood by having high positive values of DF-test instead of negative values. This can be the case when the series is integrated of some order but the test fails to give a clear indication of this order.

Note that in (4.7) we don't use any drift or trend. But it is also possible to evaluate the test by using drift or trend or both of them. However, in this case, the critical values differ than the ones used for (4.7) but this critical values area also available.

Before finishing DF-test, we should examine one another problem. In above procedure, we don't take into account of the condition on error process. If ε_t is autocorrelated, then OLS estimation is not efficient for (4.7). To avoid this problem, as suggested by Dickey and Fuller (1981), we should use lagged left-hand side variables as additional explanatory variables to approximate the autocorrelation. This test suggested by Dickey and Fuller (1981) is called *Augmented Dickey-Fuller* test and is denoted as *ADF*. This test is the most widely used and the most efficient test for determining the order of integration.

With a small modification in (4.7), we can obtain the equation used in ADF tests, as given below:

$$\Delta y_t = \delta y_{t-1} + \Sigma^k_{i=1} \delta_i \Delta y_{t-i} + \varepsilon_t. \qquad (4.14)$$

where k is large enough to capture the autocorrelation and small enough to save the degrees of freedom.

The rest of the procedure and the critical values are same with the DF test.

4.3. Cointegration Analysis :

This part provides an introduction and an analysis of an important and relatively recent approach to many economic applications which is called *cointegration.*

This recently developed approach provides us to deal with nonstationary variables in economic analysis. If there is a long run relationship between two nonstationary variables, the idea is that deviations from this long run path are stationary. If this is the case then the variables are said to be cointegrated. By the help of the definition of cointegration developed by Engle&Granger (1987) as presented below, it is persuasive that time series can be cointegrated only if they are integrated of the same order.

The formal definition is as follows :

$x_t, y_t \sim CI(d,b)$ i.e. x_t and y_t are cointegrated of order d,b where $d \geq b \geq 0$

if,

1- Both series are integrated of order d,

2- There exists a linear combination of x_t and y_t i.e. $a_1x_t + a_2y_t$, which is integrated of order d-b.

More generally:

If $\mathbf{x_t}$ denotes an $n\times 1$ vector and each of series in x_t are I(d) and there exists an $n\times 1$ vector $\boldsymbol{\alpha}$ such that $\mathbf{x'_t} . \boldsymbol{\alpha} \sim I(d\text{-}b)$, then $\mathbf{x'_t} . \boldsymbol{\alpha} \sim CI(d,b)$.

α is called the *cointegrating vector*. Cointegrating vector does not have to be unique when x_t is an $n\times 1$ vector.

The idea behind cointegration can be explained easily by considering the case $d=b=1$. Both series are nonstationary, and an arbitrary linear combination, $y_t - ax_t$, where a is a constant, will most probably be nonstationary. However, because the series are cointegrated, there must be some values of a such that $y_t - ax_t$ is I(0) rather tham I(1). In other words, long run movements cancel out. Thus, there is some kind of steady-state relationship between the variables. In the case of a=1, the steady-state relationship is such that y_t and x_t can not drift too far apart.

We use a method that is used widely in estimating the linear combination of variables which is integrated of order zero: the *Engle-Granger Two-step* approach. The details about the procedure are presented below.

4.3.1 The Engle and Granger Two-step Procedure:

We can formulate the cointegration regression to test for cointegration between a pair of series, as follows:

$$y_t = \alpha + bx_t + u_t. \qquad (4.15)$$

By the definition of cointegration, it is clear that we should test whether the residual u_t is I(0) or not when the series are integrated of the same order. To test this, we use the equation given below;

$$\Delta u_t = \delta u_{t-1} + \sum_{i=1}^{k} \delta_i \Delta u_{t-i} + \varepsilon_t. \quad (4.16)$$

which is nothing but the equation that is used in ADF test with the difference that the series in question is the residual u_t i.e. a linear combination of the series x_t and y_t. The null hypothesis is that H_0 : x_t and y_t are not cointegrated. This null hypothesis is same with saying ε_t is not I(0). In other words, if x_t and y_t are cointegrated, then ε_t is I(0). The t-statistic on δ is used to test the null of non-cointegration and the critical values for ADF cointegration test are given in Engle and Granger (1987).

5. EMPIRICAL RESULTS

The first part of this chapter provides the definition of the data set, the variables used in analysis, the sources of the data and related problems. Then the empirical results of testing stationarity and cointegration, which permits a long-run analysis of the time series to study the relationship between stock returns and macroeconomic variables, are presented. Finally, in the last part, the results of long run static equations are examined.

5.1 The Data Set :

The data set used in this study consists of 1831 daily observations of each of the variables of concern for the period 1.01.1988 - 30.04.1995.

Stock returns are represented by the daily composite index value of Istanbul Securities Exchange (ISE). This data is available in the weekly bulletins of ISE.

The monetary variables are chosen with the criterion that they are announced daily and are used in a high frequency by the investors in their investment decisions. In Turkey, the major monetary variables that are expected to have some possible effects on the stock prices are the money supply, interest rates and exchange rates. On the basis of these criterions, money supply is represented by, (i) *currency in circulation,* (ii) *M1* which is currency in circulation plus demand deposits i.e. narrow money, (iii) *M2* which is M1 plus time deposits. The interest rates are represented by the use of *overnight interest rates* because these rates are the most sensitive interest rates to the financial affairs and they are available on a daily basis. The third set of variables that we use is the set of exchange rates. These exchange rates are *U.S. dollar, Deutsche mark, sterling and yen.* The Turkish lira-U.S. dollar exchange rate is included due to the frequent open market operations of the Central Bank using dollar reserves. Mark is also included because of its widely usage in the financial markets and the last two exchange rates are included to test whether they have any significant effect in financial media or not. All data are collected from the Central Bank of Turkey.

The inflation, which is one of the most important economic indicators of economy, is not announced on a daily basis and so it is not used in this study but instead of inflation we use the currency in circulation and the other monetary aggregates M1 and M2 which have direct relationships with inflation (Muradoğlu&Metin, 1995).

The data set is divided into three sub-periods on the basis of volume of trade of ISE. When the trading volumes are examined, there are some obvious differences between years. These differences are due to the Gulf Crisis at the end of 1990, the economic crisis in Turkey in 1994, the transition to the computer aided system in stock market and some other related financial, political and economic affairs. First period of the data includes 1988 and 1989. Second period includes the data from the year 1990 to the end of 1992. The last period includes 1993, 1994 and 1995 (up to 30th of April). The analysis is made for the whole period and all of the three periods individually and the results for the whole period and for three seperate periods are summarized in the following part of this study.

In Table-2, descriptive statistics are given. The mean, the variance, skewness, excess kurtosis and normality chi^2 values of the variables, both in level form and in first differences, are tabulated. The mean and the variance are straightforward. Skewness statistics are used to assess the symmetry of distributions. Outliers can be responsible for an apparently large skewness estimate. Excess kurtosis measures how fat the tails of the distribution are. Fat tails mean that outliers or extreme values are more common than in a normal distribution. Normality chi^2 test stands for rejecting or accepting the normality of the variable, in question. For a standard normal distribution the numbers would be: zero for mean; one for standard deviation; zero for skewness and excess kurtosis. When we examine Table-2, for all of the variables' distributions, the normality is rejected. Composite Index is nearly normal in level form but rest of the variables reject normality. These results are due to the high volatility in daily data.

Table-2. Descriptive Data Analysis

SERIES	Mean	Std. Dev	Skewness	Excess Kurtosis	Normality CHI^2
ISE	8.258	0.164	-0.212	-0.039	6.143 *
INT. RATE	4.118	0.229	-1.105	6.404	194.33 **
DOLLAR	8.344	0.414	0.103	-1.425	137.53 **
MARK	7.869	0.432	0.194	-1.280	115.98 **
YEN	3.439	0.471	0.062	-1.350	112.61 **
STERLING	8.915	0.410	0.015	-1.305	98.659 **
M1	10.451	0.370	0.130	-0.920	44.075 **
M2	11.414	0.402	0.139	-1.261	100.19 **
CURRENCY	9.688	0.410	-0.148	-0.840	37.502 **
ΔISE	0.00074	0.0313	0.081	1.429	47.506 **
ΔINT. RATE	0.00134	0.049	-0.317	18.754	1607.0 **
ΔDOLLAR	0.00176	0.0065	-7.032	145.29	701.64 **
ΔMARK	0.00182	0.0065	-8.835	197.445	1212.1 **
ΔYEN	0.00195	0.0072	-4.681	91.318	1340.3 **
ΔSTERLING	0.00167	0.0073	-6.102	115.21	678.45 **
ΔM1	0.00191	0.0116	1.0799	7.666	276.54 **
ΔM2	0.00187	0.0044	1.5139	8.188	183.95 **
ΔCURRENCY	0.00199	0.0224	-0.273	16.240	1371.1 **

' * ' : Normality is rejected at 5% significance level.
' ** ' : Normality is rejected at 1% significance level.

5.2 Time Series Properties of the Variables :

The ADF test is used to analyze the time series properties of the data. For each of the nine variables, we apply the ADF test to study the stationarity i.e. the unit roots.

The results of ADF tests are presented in Table-3. The series are all in the log forms and Δ denotes the first difference of the variables of our interest. In Table-3.1, Table-3.2, Table-3.3 and Table-3.4, the ADF tests of whole period, first, second and third periods are given respectively. There are two tables for each period and the first ones present the test statistics for a unit root in levels and the second ones demonstrate the same statistics in first differences for the variables that have a unit root in the level specification.

The last three columns demonstrate the ADF values for each variable and differ from each other by including constant or trend. For the first one, the regression equation is a random walk; for the second and third ones, it is a random walk with drift and a random walk with drift and trend, respectively.

The second column is important and represents the value of k in equation 4.14. To specify the optimum lag length, we consider several criteria. A maximum lag length, we choose thirty as an arbitrary selection, is specified and the equation is estimated with $k=1,2,...,30$. For each estimation, the final prediction errors (FPE) are examined and the one with the smallest FPE is selected. An alternative way is to estimate the regression with the maximum lag length specified and examine whether the last included lag (max. lag is the last included one in first try) is significant or not. If it is significant then we specify it as the appropriate lag length. If it is not significant then we exclude the last lag and repeat the estimation and check whether the last one is significant or not. The process goes on in this manner up to the point that we find a significant lag (Selcuk, 1993).

Both of the criterions are used and they give the same lag values which are presented in second columns of tables. With these lag lengths, it is observed that the errors are not autocorrelated.

In all cases, the variables have a unit root in levels i.e. they are not I(0) in 1% significance level. First differenced series do not exhibit a unit root in almost all cases and have significant test statistics at %1 level. The only exception is $\Delta M2$ in Table-3.4.2., but even in this case, the test statistics are significant at %5 level.

So, according to ADF test results, we can conclude that almost all of the series are integrated of order one, characterized as I(1), with significant test statistics at %1 level and all of the series are I(1) with significant test statistics at %5 level.

5.3 Results of Cointegration Test :

For cointegration, the null hypothesis that is no cointegration between stock prices and the other variables against at least one available cointegrating vector is tested. The procedure explained in section 4.3.1 is used for this test.

The Engle-Granger two-step procedure involves regressing the appropriate variables or a set of variables on stock prices in order to obtain the residulas resulting from those regressions. The second step is to apply ADF test to that residuals because the cointegration test, as suggested in section 4.3.1, is based on testing for unit root in that residuals. The results of those cointegrating regressions are tabulated in Table-4.1 through Table-4.4.

The first column, called the independent variables, represents the variables that enter to regression on stock prices to obtain the resulting residuals. The second column represents the lag length used for unit root test in the residuals and the appropriate value of the lag length is found by the same method described in section 5.2. The rest of the columns represent the ADF test statistics and differ from each other by including or excluding constant and trend in the regression. The critical values for ADF cointegration test are given in Engle and Granger (1987). However, these critical values are tabulated only for the case that the regression equation of residuals have no constant and trend, i.e.

it is a random walk. So, the comparisons between critical values and our results are made only on the third columns of Table-4.1 through Table-4.4. The other columns are tabulated only for additional information. It is observed that there are no strict changes between those values.

The main reason for dividing the whole period into three seperate periods and examining the periods seperately is the result of cointegration tests which uses the whole data, given in Table-4.1. When we use the whole data, it is easily seen in Table-4.1 that the stock prices do not cointegrate with any of the variables or with any group of variables. But, some earlier studies (Muradoğlu and Önkal, 1992) present evidence for the lack of efficiency of the Turkish stock exchange. So it seems to be appropriate to examine the periods seperately and when we examine the periods individually, these results of cointegration change and differ from one period to another.

In the first period covering the years 1988 and 1989, stock prices do not cointegrate with any of the variables even at the 5% significance level. The results are improved when more than one variable is included to the cointegrating regressions, but they are still not enough to provide an evidence on a cointegration between these variables and stock prices except for two cases. It is evident from Table-4.2 that when M1 and the Turkish lira-U.S. dollar exchange rate are entered together to the cointegrating regression, the stock returns cointegrate with them even at 1% significance level.. A stronger result is obtained when we add interest rate in addition to these two variables. But, most of the variables for period-1 are incapable of explaining the long run behaviour of the stock prices.

In period-2, including years 1990, 1991 and 1992, the variables are cointegrated with the stock prices at 5% significance level when they enter to the regression individually (Table-4.3). The results are improved substantially when the number of variables entering to the regression increases. In all of the combinations tested, they seem to be cointegrated with stock returns at 5% significance level and in some of them, they are cointegrated even at 1% significance level. Interest rate and M2, together with lira-dollar or lira-yen exchange rate seem to be cointegrated with stock prices at 1% significance level. The most significant result of cointegration test occurs when we use M2 and interest rate together with all of the four exchange rates at the same time. When we use M1 instead of M2, the result is still good.

The results for period-2 show that the monetary variables can be used to describe the long run trend in stock prices. The stock market seems to be inefficient for monetary policy which is also suggested by the earlier studies for Turkey's case (for similar results, see Muradoğlu&Önkal, 1992).

In period-3, including years 1993,1994 and first four months of 1995, the cointegration tests give different results with respect to period-2. None of the variables individually or together cointegrate with the stock prices at 1% significance level (Table 4.4). When interest rate, lira-mark exchange rate and M1 enter together to the regression, the best result for cointegration is found but the stock prices and these variables cointegrate at 5% significance level. There exists no cointegrating vector at 1% significance level. So, we are not able to find any combination of variables to explain the long run trend in stock prices at least, at 1% significance level.

5.4 Results of Long Run Static Equations :

Static equations, presented at Table-5.1 through Table-5.5, are used to analyse the long run steady state properties of the relationship between stock prices and macroeconomic variables using OLS to estimate equation 4.15.

Constant and trend are included to equations and also four deterministic dummies for monday, tuesday, wednesday and thursday are included for day of the week effect but none of these dummies cause a significant deterministic seasonality and they are not reported in Table-5.1 through Table-5.5. R^2, DW and F-test results are also included.

In almost all of the cases, constant has a significant t-value and in most of them, the trend is also significant. In the bivariate regressions, each independent variable is significantly related to the stock prices except a few cases.

In Table-5.1,which uses the whole data, lira-dollar exchange rate has always significant coefficients when there is no any other exchange rate in the equations. The other exchange rates and the monetary aggregates always have significant coefficients. Interest rate is not significant in the bivariate regression and in multivariate regressions it is still not significant when it enters to equation together with currency in circulation or with dollar.

In period-1, the period covering the early years of stock market, all of the variables including constant and trend used in static equations have significant coefficients. The only exception is M2 when it enters the equation together with dollar and interest rate, but it becomes significant when the exchange rate is different than dollar. Another observation about this period is that mark, although it has a negative significant coefficient in general, has a positive significant coefficient when it enters to the equation together with the other exchange rates. The results of other equations say that the exchange rates have significant negative coefficients in explaining the long run trends of the stock prices. The positive coefficient of mark in that equation can be explained by the absorbation of the negativity effect by the other exchange rates. The same property of mark is also valid in the equations using the whole data.

The period-2, which covers the years 1990 through 1992, should have special importance, because it is the only period that the cointegration tests reject its null hypothesis. This implies that the stock prices and the macroeconomic variables are cointegrated.

These results of static equations for this period, unexpectedly, give lower R^2 and F-test values with respect to other periods (Table-5.3). This is an interesting result because R^2 is defined as the proportion of the variance of the dependent variable which is explained by the variables in the regression. Low R^2 means that we left out some of the information which explains the ISE. We believe that we covered all economic variables of interest, however some of the historical events which effects the ISE could be ignored in this stage. So, before examining the results of the static equations for this stage, we repeat the static equations by using step dummies due to the corner-stones of the economic history within this period. These step dummies are determined as follows: The graph of 1-step residuals $\pm 2\sigma$ are shown bordered by $0 \pm 2\sigma$ by using recursive least squares (RLS) estimation (figure 10.1 through 10.29) . The points outside the 2 standard-error region are either outliers or are associated with coefficient changes. For the points that lie outside of the region from the upper part, we define a step dummy which has a value of minus one for that points and zero elsewhere. For the lower part, we define the value as plus one and zero elsewhere. For all of the points or the set of the points that lie outside the intervals, we define a step dummy variable and use this dummy variable in regressions in order to decrease the effect of these outliers. These dummies have always significant coefficients in the equations. The other observation is that the value of R^2, although it is not as much as the others, is increased in these cases (Table-5.5).

The monetary aggregates i.e. M1, M2 and currency in circulation, and the interest rate have positive coefficients in the equations in which they are significant. The effects of exchange rates differ from the previous periods and dollar and yen has negative coefficients while mark and sterling have positive ones. Dollar and mark have higher t-values in absolute value with respect to yen and sterling when they enter to the equations together and this observation is reasonable since we know that dollar and mark have important roles in Turkish economy. In bivariate regressions, M2 seems not to be related to the stock prices. But its coefficient becomes significant when it enters to the equations with intrest rate and dollar or yen. Interest rate, although the value of its coefficient is near zero, always has significant coefficients.

In period-3, including years 1993,1994 and first four month of 1995, the variables, except the interest rate and M1, have significant coefficients in the bivariate regressions. The coefficients of the exchange rates are negative in most of the equations but when they enter the equations together, yen and sterling change sign. The coefficients of sterling, in these equations, are not significant but the coefficients of yen is strictly significant. Especially, in the equations that all of the exchange rates enter together, mark and yen have significant coefficients while dollar and sterling loose their significancy. M1 seems to be insignificant in all of the equations and M2 is the dominant monetary aggregate. Another observation for this period is that the coefficients of interest rate become significant whenever it enters the equations together with M2. In the other cases, it looses its significance.

6- CONCLUSION

This study investigates the long run relationship between stock prices and monetary variables and examines the different aspects of the relation for the period between 1988 and 1995, and for the subperiods within this range.

We test the relation between stock prices and monetary variables by using a recently developed technique which is called the cointegration analysis. Cointegration type of specification incorporates long run constraints on changes in stock prices which are recognised recently. The monetary variables used to represent the economy are selected with the criteria that they are available on a daily basis and are used by investors for portfolio decisions. We use four different types of exchange rates which are lira-dollar, lira-mark, lira-yen, lira-sterling exchange rates and the overnight interest rates and monetary aggregates like M1, M2 and currency in circulation.

The data set used in this study, covers the years between 1988 and 1995. Three subperiods of this data set are also used individually and provide us to examine the differences between the subperiods and to make some comments for the development of efficiency in Turkish stock market. The discrimination between the periods are made due to the strict changes in the volume of trade in ISE which indicate us a structural change. The empirical results of Engle-Granger two-step procedure indicate that for the case of period-2, i.e. the period covering the years 1990, 1991 and 1992, the monetary variables and the stock prices cointegrate. There is a strict relation between those variables in long run patterns and hence, the stock prices deviate from being a random walk. For the other periods, the results are different and in long run patterns, the monetary variables and the stock prices are drifting apart which means that they do not cointegrate, at least at 1% significance level. The period-1 can be characterized as a learning process for all of the participants in the market and in this period, there are limited individual traders and the players are all professionals. Therefore, looking only at period-2 and period-3 makes sense, and the market, within these two periods, tends to advance from cointegration to no cointegration. The exchange rates seem to have negative effects on stock returns while the monetary aggregates have positive effects.

At this point, we must mention that the long run static equations for period-2, although the monetary variables and the stock prices seem to be cointegrated, have low R-square values which indicate that some of the information is left out. Another point is that the exogenous shocks are very likely to make the technical results misleading because of long run historical series of the data. The unexpected events like the Gulf Crisis in 1990 and the Turkish economic crisis in April, 1994, although it can be discussed whether they are really so, are the known crisis but there are some other unexpected shocks that is not possible to be foreseen and our recommendation is that the investors, for a successful investment, should have a very good comment of Turkish stock market and Turkish economy and should analyze and evaluate not only the monetary variables, but also the possible shocks and unexpected developments in financial institutions, as well as the changes in the trend of political stability.

Our results show that especially in last five years, there is a tendency to weaken the relation between monetary variables and the stock prices in Turkish stock market. This tendency can be explained by the rapid increase in the volume of trade causing an increase in the number of investors utilizing the same set of information. The computer aided system is another cause for the increase in the volume of trade. The liberalization process in Turkish economy, causing a decrease in governmental control in financial markets, and recent developments are important factors in this result.

Finally, according to the results it might be the case that the Turkish stock market develops rapidly especially in recent years and become a good candidate for being a mature market instead of a thin market.

7- REFERENCES

Alparslan, S.M. (1990), Tests of Weak Form Efficiency in Istanbul Stock Exchange, *Unpublished MBA thesis*, Bilkent University.

Aydoğan, K. and Muradoğlu G. (1995), Do Markets Learn from Experience? Price Reaction to Stock Dividends in the Turkish Market, *Discussion paper, 94-16-C,* Department of Management, Bilkent University.

Boumahdi, R. and Thomas, A. (1991), Testing for Unit Roots Using Panel Data: Application to the French Stock Market Efficiency, *Economics Letters*, 37, 77-79.

Bulmash, B.S. and Trivoli, W.G. (1991), Time-lagged Interactions Between Stock Prices and Selected Economic Variables, *The Journal of Portfolio Management,* Summer, 61-67.

Charemza, W.W. and Deadman, D. F. (1992), "New Directions In Economic Practice", University Press, Cambridge.

Darrat, A.F. (1988), On Fiscal Policy and the Stock Market, *Journal of Money Credit and Banking,* 20,355-63.

Dickey, D.A. and Fuller, W.A. 1981), Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root, *Econometrica,* 49, 1057-72.

Engle, R.F. and Granger, C.W. (1987), Cointegration and Error Correction: Representation, Estimation, and Testing, *Econometrica,* 55, 251-76.

Erol, Ü. and Aydoğan, K. (1991), Asset Pricing in an Emerging Market: TheTurkish Case, paper presented in the *18th Annual Meeting of European Finance Association,* held in Rotterdam-Holland.

Fama, E.F. and Blume, M. (1966), Filter Rules and Stock Market Trading Profits, *Journal of Business,* 39, 266-41.

Fama, E.F. (1970), Efficients Capital Markets: A Review of Theory and Empirical Work, *Journal of Finance,* 25, 383-417.

Fama, E.F. (1991), Efficient Capital Markets: II, *Journal of Finance,* 46, 1575-1617.

Fuller, W.A. (1976), "Introduction to Statistical Time Series", J.Wiley&Sons, Inc., New York.

Hancock, D.G. (1989), Fiscal Policy, Monetary Policy and the Efficiency of the Stock Market, *Economics Letters,* 31, 65-69.

Jensen, M.C. (1978), Some Anomalous Evidence Regarding Market Efficiency, *Journal of Financial Economics,* 6, 95-101.

Keane, S.M. (1985), "Stock Market Efficiency: Theory, Evidence and Implications", Philip Allan Publishers Ltd., Oxford.

Mishkin, F.S. (1982), Does Anticipated Monetary Policy Matter? An Econometric Investigation, *Journal of Political Economy,* 90, 22-51.

Muradoğlu, G. and Önkal, D. (1992), Semi-Strong Form of Efficiency in the Turkish Stock Market, *METU Studies in Development,* 19(2), 197-208.

Muradoğlu, G. and Oktay, T. (1993), Weak Form Efficiency in the Turkish Stock Exchange: Calendar Anomalies, *Hacettepe İktisadi ve İdari Bilimler Fakültesi Dergisi,* 11, 51-62.

Muradoğlu, G. and Ünal, M. (1994), Weak Form Efficiency in the Thinly Traded Turkish Stock Exchange, *The Middle East Business and Economic Review , 6(2),37-44.*

Muradoğlu, G. and Metin, K. (1995), Efficiency of the Turkish Stock Exchange with respect to Monetary Variables: A Cointegration Analysis, *European Journal of Operational Research,* forthcoming.

Özer, B. and Yamak, S. (1992), Effect of Gulf Crisis on Risk-Return Relationship and Volatility of Stocks in Istanbul Stock Exchange, *METU Studies in Development,* 19(2), 209-224.

Panas, E.E. (1990), The Behaviour of Athens Stock Prices, *Applied Economics,*22, 1715-27.

Pearce, D.K. and Roley, V.V. (1985), Stock Prices and Economic News, *Journal of Business,* 8(1), 49-67.

Schwert, G.W. (1990), Stock Returns and Real Activity: A Century of Evidence, *Journal of Finance,* 45, 1237-57.

Selçuk, F. (1993), Testing for Unit Roots: Bayesian Approach versus Classical Tests, An Application to the Turkish Economy, *METU Studies in Development,* 20, 357-79.

Serletis, A. (1993), Money and Stock Prices in the United States, *Applied Financial Economics,* 3, 51-54.

Taylor, S. (1986), "Modelling Financial Time Series", J.Wiley & Sons Ltd, Avon.

Vanderhoff, J. and Vanderhoff, M. (1986), Inflation and Stock Returns: An Industry Analysis, *Journal of Economics and Business,* 38, 341-52.

<u>TABLES :</u>

Table 3.1.1. ADF Tests for I(0) Using Period 1988-95

SERIES	LAG	Without Constant and Trend	With Constant	With Constant and Trend
ISE	10	2.133	0.1862	-2.2112
INT. RATE	29	-0.1779	-3.4249 *	-3.8684 *
DOLLAR	24	3.9381	0.7617	-1.5863
MARK	24	4.0626	1.1192	-1.5659
YEN	24	4.2439	1.5051	-1.1175
STERLING	24	3.7351	0.6892	-1.6623
M1	25	5.8875	0.4519	-2.6082
M2	25	4.7213	0.5827	-1.8586
CURRENCY	20	6.002	0.1204	-2.9900

Table 3.1.2. ADF Tests for I(1) Using Period 1988-95

SERIES	LAG	Without Constant and Trend	With Constant	With Constant and Trend
ΔISE	9	-11.4013**	-11.6091**	-11.6464**
ΔINT. RATE	28	-10.1991**	-10.1971**	-10.1952**
ΔDOLLAR	23	-5.2291**	-6.5194**	-6.6158**
ΔMARK	23	-5.0335**	-6.4014**	-6.5665**
ΔYEN	23	-5.2307**	-6.5813**	-6.8389**
ΔSTERLING	23	-5.3476**	-6.5044**	-6.5909**
ΔM1	24	-6.1399**	-8.6078**	-8.6308**
ΔM2	24	-3.2478**	-5.7040**	-5.7527**
ΔCURRENCY	19	-9.8232**	-11.6143**	-11.6172**

note : 1- All series above are in log forms. Symbol 'Δ' stands for first difference.
2- 'Currency' stands for 'Currency in Circulation'.
3- * : significant at 5 % ; ** : significant at 1 % .

Table 3.2.1. ADF Tests for I(0) Using Period 1988-89

SERIES	LAG	Without Constant and Trend	With Constant	With Constant and Trend
ISE	11	1.0054	0.7963	-1.0302
INT. RATE	27	-0.5192	-1.6281	-3.5954*
DOLLAR	21	3.7882	-3.1927*	-0.017
MARK	20	3.0592	-0.7376	-2.1718
YEN	20	2.2246	-2.2986	-1.1146
STERLING	20	2.4643	-2.2918	-1.7221
M1	20	3.7041	1.3282	-2.0102
M2	20	4.4493	1.2086	-2.3628
CURRENCY	20	2.8917	-0.3939	-1.7133

Table 3.2.2. ADF Tests for I(1) Using Period 1988-89

SERIES	LAG	Without Constant and Trend	With Constant	With Constant and Trend
ΔISE	10	-5.4063**	-5.4891**	-6.4349**
ΔINT. RATE	26	-6.2245**	-6.2312**	-6.2759**
ΔDOLLAR	20	-3.3447**	-5.1674**	-6.1590**
ΔMARK	19	-3.4784**	-4.6759**	-4.6765**
ΔYEN	19	-3.7166**	-4.4503**	-4.8990**
ΔSTERLING	19	-3.7111**	-4.5061**	-4.8572**
ΔM1	19	-3.6511**	-5.1671**	-5.4544**
ΔM2	19	-2.6234**	-4.6899**	-4.9122**
Δ CURRENCY	19	-4.3826**	-5.2914**	-5.2812**

Table 3.3.1. ADF Tests for I(0) Using Period 1990-92

SERIES	LAG	Without Constant and Trend	With Constant	With Constant and Trend
ISE	10	0.0812	-3.4227*	-3.4331*
INT. RATE	28	0.4992	-2.7921	-2.7373
DOLLAR	21	3.8078	0.5229	-2.2766
MARK	16	4.9639	0.3246	-2.0898
YEN	28	3.6201	0.4412	-3.9713*
STERLING	16	3.6410	-1.1319	-1.2242
M1	25	4.2791	-0.7003	-1.3591
M2	25	5.0588	1.6087	-1.3237
CURRENCY	15	4.5153	-1.2459	-2.5253

Table 3.3.2. ADF Tests for I(1) Using Period 1990-92

SERIES	LAG	Without Constant and Trend	With Constant	With Constant and Trend
ΔISE	9	-7.8805**	-7.8725**	-7.8574**
ΔINT. RATE	27	-5.1614**	-5.1881**	-5.2295**
ΔDOLLAR	20	-2.6496**	-4.6268**	-4.7007**
ΔMARK	15	-2.9048**	-5.7696**	-5.7793**
ΔYEN	27	-2.1304*	-4.2128**	-4.8762**
ΔSTERLING	15	-4.0349**	-5.5134**	-5.5981**
ΔM1	24	-3.2497**	-5.3484**	-5.4084**
ΔM2	24	-1.1512	-5.0183**	-5.2957**
Δ CURRENCY	14	-11.5801**	-12.6020**	-12.6270**

Table 3.4.1. ADF Tests for I(0) Using Period 1993-95

SERIES	LAG	Without Constant and Trend	With Constant	With Constant and Trend
ISE	14	2.3852	-1.7498	-3.0051
INT. RATE	29	-0.2032	-2.2949	-2.2689
DOLLAR	24	1.7947	-0.8888	-2.2167
MARK	24	1.9533	-0.6423	-2.4304
YEN	24	2.0823	-0.7749	-2.4411
STERLING	24	1.9492	-0.9249	-2.2221
M1	26	3.3998	-0.1833	-2.0003
M2	26	2.3062	0.3435	-2.1311
CURRENCY	18	4.0713	-0.5174	-1.9703

Table 3.4.2. ADF Tests for I(1) Using Period 1993-95

SERIES	LAG	Without Constant and Trend	With Constant	With Constant and Trend
ΔISE	13	-6.2381**	-6.7466**	-6.7807**
ΔINT. RATE	28	-5.3877**	-5.3822**	-5.3876**
ΔDOLLAR	23	-2.9304**	-3.4759**	-3.4898*
ΔMARK	23	-2.8072**	-3.4589**	-3.4482*
ΔYEN	23	-2.8789**	-3.6446**	-3.6492*
ΔSTERLING	23	-2.8628**	-3.5081**	-3.5165*
ΔM1	25	-3.4521**	-4.8646**	-4.8631**
ΔM2	25	-2.0598*	-3..0792*	-3.2016
Δ CURRENCY	17	-6.9654**	-8.1671**	-8.1613**

note: Critical values for ADF tests are: -1.94 for without costant and trend case; -2.868 for with constant case; -3.421 for with constant and trend case at 5% sig. level. At 1% sig. level, these values are: -2.57; -3.446 and -3.981, respectively.

Table 4.1 Test of Cointegration Between Stock Prices and Macroeconomic Variables Using Period 1988-95

INDEPENDENT VARIABLES	LAG	Without Constant and Trend	With Constant	With Constant and Trend
DOLLAR	13	-2.022	-2.021	-2.087
MARK	10	-1.916	-1.915	-1.952
YEN	13	-1.814	-1.813	-1.862
STERLING	13	-1.988	-1.987	-2.041
M1	10	-2.517	-2.514	-2.486
M2	10	-2.402	-2.398	-2.384
CURRENCY	20	-2.692	-2.689	-2.652
INT. RATE	9	-1.459	-1.441	-3.491
INT. RATE + DOLLAR + M1	20	-2.825	-2.827	-2.803
INT. RATE + DOLLAR + M2	20	-2.702	-2.706	-2.708
INT. RATE + DOLLAR + CURRENCY	20	-2.951	-2.954	-2.946
INT. RATE + MARK + M1	20	-2.812	-2.814	-2.785
INT. RATE + MARK + M2	20	-2.702	-2.706	-2.708
INT. RATE + MARK + CURRENCY	20	-2.911	-2.912	-2.904
INT. RATE + YEN + M1	20	-2.842	-2.845	-2.813
INT. RATE + YEN + M2	20	-2.715	-2.719	-2.723
INT. RATE + YEN + CURRENCY	20	-2.962	-2.964	-2.955
INT. RATE + STERLING + M1	20	-2.785	-2.787	-2.761
INT. RATE + STERLING + M2	20	-2.725	-2.728	-2.728
INT. RATE + STERLING + CURRENCY	20	-2.931	-2.933	-2.924
CURR. + $ + DM + YEN + STERLING	15	-2.566	-2.567	-2.556
CURR. + $ + DM + YEN + ST. + INT.	15	-2.638	-2.638	-2.626
INT. RATE + CURRENCY	20	-2.661	-2.663	-2.654
CURRENCY + DOLLAR	20	-2.936	-2.939	-2.933
M1 + INT. RATE	20	-2.502	-2.504	-2.483
M1 + DOLLAR	20	-2.794	-2.796	-2.776
INT. RATE + DOLLAR	13	-2.026	-2.025	-2.092

NOTE : 1- Abbreviations used above are :
'Curr.' or 'Currency' for 'Currency in Circulation' ;
'Int.' or 'Int. Rate' for 'Interest Rate' ;
' $ ' for 'Dollar' ;
' DM' for 'Mark' ;
' St.' for 'Sterling' .

2- The values are the ADF test results for the residuals of the related equation

3- ' * ' denotes the significance at 5% level. ' ** ' denotes the significance at 1% level.

4- Critical values are: -3.17 at 5% significance level; -3.77 at 1% significance level. The critical values are only tabulated for without constant and trend case, so we use this column for comparison. The other columns are tabulated for information.

Table 4.2 Test of Cointegration Between Stock Prices and Macroeconomic Variables Using Period 1988-89

INDEPENDENT VARIABLES	LAG	Without Constant and Trend	With Constant	With Constant and Trend
DOLLAR	11	-0.407	-0.387	-0.906
MARK	5	-0.325	-0.315	-0.658
YEN	11	0.027	0..061	-0.962
STERLING	11	-0.089	-0.061	-1.013
M1	20	-1.568	-1.580	-1.121
M2	11	-1.092	-1.088	-0.886
CURRENCY	20	-1.065	-1.054	-0.802
INT. RATE	9	-0.261	-0.239	-1.046
INT. RATE + DOLLAR + M1	5	-4.627 **	-4.630	-4.616
INT. RATE + DOLLAR + M2	20	-2.084	-2.082	-2.081
INT. RATE + DOLLAR + CURRENCY	13	-1.398	-1.379	-1.465
INT. RATE + MARK + M1	5	-2.398	-2.391	-2.373
INT. RATE + MARK + M2	5	-0.972	-0.956	-0.935
INT. RATE + MARK + CURRENCY	13	-0.251	-0.213	-0.151
INT. RATE + YEN + M1	20	-2.693	-2.692	-2.666
INT. RATE + STERLING + M1	5	-3.361 *	-3.360	-3.357
M1 + S + DM + YEN + STERLING	19	-2.805	-2.788	-2.768
M1 + S + DM + YEN + ST. + INT.	20	-3.083	-3.063	-3.050
M1 + INT. RATE	20	-1.452	-1.460	-0.984
M1 + DOLLAR	5	-4.41 **	-4.413	-4.399
M1 + MARK	5	-2.146	-2.139	-2.113

Table 4.3 Test of Cointegration Between Stock Prices and Macroeconomic Variables Using Period 1990-92

INDEPENDENT VARIABLES	LAG	Without Constant and Trend	With Constant	With Constant and Trend
DOLLAR	10	-3.441 *	-3.445	-3.442
MARK	10	-3.423 *	-3.424	-3.433
YEN	10	-3.437 *	-3.438	-3.438
STERLING	10	-3.419 *	-3.421	-3.434
M1	10	-3.422 *	-3.432	-3.434
M2	10	-3.426 *	-3.427	-3.433
CURRENCY	10	-3.417 *	-3.417	-3.435
INT. RATE	10	-3.456 *	-3.546	-3.593
INT. RATE + DOLLAR + M1	13	-3.773 **	-3.771	-3.770
INT. RATE + DOLLAR + M2	14	-3.958 **	-3.954	-3.951
INT. RATE + DOLLAR + CURRENCY	13	-3.638 *	-3.637	-3.634
INT. RATE + MARK + M1	10	-3.587 *	-3.587	-3.595
INT. RATE + MARK + M2	10	-3.510 *	-3.511	-3.511
INT. RATE + MARK + CURRENCY	10	-3.595 *	-3.594	-3.603
INT. RATE + YEN + M1	10	-3.834 **	-3.831	-3.832
INT. RATE + YEN + M2	10	-4.082 **	-4.079	-4.080
INT. RATE + YEN + CURRENCY	10	-3.661 *	-3.660	-3.658
INT. RATE + STERLING + M1	10	-3.568 *	-3.568	-3.576
INT. RATE + STERLING + M2	10	-3.475 *	-3.475	-3.473
INT. RATE + STERLING + CURRENCY	10	-3.602 *	-3.602	-3.614
M1 + $ + DM + YEN + STERLING	10	-3.806 **	-3.806	-3.799
M1 + $ + DM + YEN + ST. + INT.	10	-4.047 **	-4.046	-4.039
M2 + $ + DM + YEN + ST. + INT.	10	-4.089 **	-4.089	-4.078
INT. RATE + CURRENCY	10	-3.602 *	-3.602	-3.614
M1 + INT. RATE	10	-3.587 *	-3.587	-3.596
M1 + DOLLAR	13	-3.699 *	-3.697	-3.697
M1 + MARK	10	-3.434 *	-3.435	-3.445
CURRENCY + DOLLAR	13	-3.598 *	-3.598	-3.595
CURRENCY + MARK	13	-3.509 *	-3.509	-3.516

Table 4.4 Test of Cointegration Between Stock Prices and Macroeconomic Variables Using Period 1993-95

INDEPENDENT VARIABLES	LAG	Without Constant and Trend	With Constant	With Constant and Trend
DOLLAR	10	-2.523	-2.531	-2.491
MARK	10	-2.669	-2.683	-2.620
YEN	10	-2.571	-2.578	-2.538
STERLING	10	-2.6373	-2.648	-2.600
M1	14	-2.915	-2.934	-2.915
M2	14	-2.745	-2.781	-2.664
CURRENCY	10	-3.236 *	-3.241	-3.207
INT. RATE	16	-1.496	-1.608	-2.795
INT. RATE + DOLLAR + M1	5	-3.358 *	-3.359	-3.326
INT. RATE + DOLLAR + M2	16	-2.513	-2.550	-2.498
INT. RATE + DOLLAR + CURRENCY	13	-3.290 *	-3.299	-3.276
INT. RATE + MARK + M1	5	-3.622 *	-3.623	-3.588
INT. RATE + MARK + M2	16	-2.670	-2.705	-2.640
INT. RATE + MARK + CURRENCY	13	-3.470 *	-3.480	-3.458
INT. RATE + YEN + M1	5	-3.197 *	-3.199	-3.172
INT. RATE + YEN + M2	9	-2.523	-2.534	-2.481
INT. RATE + YEN + CURRENCY	13	-3.171 *	-3.174	-3.155
INT. RATE + STERLING + M1	5	-3.432 *	-3.433	-3.398
INT. RATE + STERLING + M2	16	-2.566	-2.604	-2.549
INT. RATE + STERLING + CURRENCY	13	-3.331 *	-3.336	-3.312
INT. RATE + CURRENCY	13	-3.092	-3.100	-3.083
CURRENCY + DOLLAR	10	-3.266 *	-2.271	-3.234
CURRENCY + MARK	5	-3.136	-3.134	-3.094
CURR. + S + DM + YEN + STERLING	12	-3.592 *	-3.588	-3.599
CURR. + S + DM + YEN + ST. + INT.	12	-3.543 *	-3.539	-3.551
CURRENCY + YEN	10	-3.215 *	-3.221	-3.188
CURRENCY + STERLING	10	-3.287 *	-3.292	-3.253

Table 5.1 Static Equations Using Period 1988-95 (Dependent Variable =Lindex)

C	TR	$	DM	YEN	ST	M1	M2	CUR	INT	R^2	DW	F
8.122 25.39	0.0029 31.11	-0.29 -6.39	---	---	---	---	---	---	---	0.8869	0.0051	2385.1
6.923 22.59	0.0026 25.47	---	-0.14 -2.74	---	---	---	---	---	---	0.8849	0.0049	2337
0.599 92.81	0.0029 36.77	---	---	-0.29 -7.95	---	---	---	---	---	0.8882	0.0052	2411.3
7.729 21.16	0.0028 29.16	---	---	---	-0.22 -4.52	---	---	---	---	0.8856	0.0051	2349.7
-18.12 -19.54	-0.003 -15.29	---	---	---	---	2.78 26.51	---	---	---	0.9165	0.0143	3332.7
-3.854 -4.002	0.0002 0.508	---	---	---	---	---	1.036 10.32	---	---	0.8907	0.0054	2473.8
-8.214 -11.03	-0.002 -7.71	---	---	---	---	---	---	1.83 19.21	---	0.9038	0.0134	2851.8
6.156 61.801	0.0234 107.93	---	---	---	---	---	---	---	-0.019 -0.755	0.8844	0.0050	2321.1
-21.56 -23.19	-0.004 -17.25	-0.576 -15.15	---	---	---	3.51 33.25	---	---	0.266 12.49	0.9297	0.0415	3009.5
-10.09 -8.954	0.0007 -3.08	-0.65 -13.42	---	---	---	---	2.046 16.79	---	0.256 9.246	0.9021	0.0183	2098.8
-7.015 -9.300	-0.001 -5.64	-0.487 -11.39	---	---	---	---	---	2.067 21.78	0.07 3.13	0.9103	0.0182	2311.3
-22.58 -23.84	-0.004 -17.69	---	-0.505 -12.33	---	---	3.54 32.35	---	---	0.26 12.06	0.9269	0.0398	2887.4
-10.99 -9.310	-0.001 -3.49	---	-0.57 -10.56	---	---	---	2.049 15.71	---	0.253 8.73	0.8986	0.0172	2019.2
-7.833 -10.31	-0.001 -6.272	---	-0.373 -8.162	---	---	---	---	2.048 20.98	0.063 2.758	0.907	0.0170	2229.2
-24.1 -25.82	-0.004 -17.43	---	---	-0.45 -15.57	---	3.45 33.04	---	---	0.26 12.39	0.930	0.0405	3030.1
-11.74 -10.12	-0.001 -2.42	---	---	-0.48 -13.18	---	---	1.86 15.88	---	0.24 8.50	0.902	0.0158	2091.3
-9.32 -12.55	-0.001 -5.78	---	---	-0.396 -12.1	---	---	---	2.03 21.64	0.07 3.16	0.911	0.0179	2332.9
-21.31 -22.49	-0.004 -17.34	---	---	---	-0.52 -12.66	3.47 32.24	---	---	0.27 12.27	0.927	0.0398	2900.3
-10.68 -9.32	-0.001 -4.08	---	---	---	-0.67 -12.6	---	2.16 16.83	---	0.28 9.76	0.901	0.0204	2074.1
-7.1 -9.32	-0.001 -6.31	---	---	---	-0.46 -10.05	---	---	2.085 21.59	0.076 3.34	0.909	0.0183	2273.9
-9.89 -9.22	-0.001 -6.88	-0.27 -1.38	3.31 13.91	-1.26 -8.85	-1.81 -8.93	---	---	1.65 17.73	---	0.920	0.0160	2082.2
-10.47 -9.76	-0.001 -7.61	-0.25 -1.28	3.45 14.47	-1.27 -8.57	-1.99 -9.69	---	---	1.72 18.34	0.10 4.71	0.920	0.0190	1916.9
-8.51 -11.07	-0.002 -7.87	---	---	---	---	---	---	1.85 19.22	0.04 1.83	0.910	0.0141	2450
-6.49 -8.8	0.001 -5.23	-0.47 -11.49	---	---	---	---	---	2.02 21.5	---	0.909	0.0162	2627.4
-2.24 -22.57	-0.004 -18.26	---	---	---	---	3.16 28.92	---	---	0.215 9.65	0.921	0.0285	3027.4
-16.67 -18.98	-0.003 -13.1	-0.501 -12.82	---	---	---	3.01 29.59	---	---	---	0.924	0.0175	3149.5
8.137 24.86	0.003 31.1	-0.30 -6.35	---	---	---	---	---	---	-0.005 -0.21	0.887	0.0051	2043.3

note : 1- Four deterministic dummies for day of the week effect are added to equations but none of them caused a significant deterministic seasonality.
2- First numbers are the coefficients and the second ones are the t-statistics of that variable.
3- Abbreviations used are:
C: constant ; TR: trend ; $: dollar ; DM: mark ; ST: sterling ; CUR: currency in circulation
INT: interest rate ; DW: Durbin Watson statistics ; F: F-test

Table 5.2 Static Equations Using Period 1988-89 (Dependent Variable =Lindex)

C	TR	$	DM	YEN	ST	M1	M2	CUR	INT	R^2	DW	F
54.83 52.35	0.013 52.83	-6.92 -46.62	---	---	---	---	---	---	---	0.87	0.086	1682.9
38.77 18.67	0.008 19.37	---	-5.029 -15.77	---	---	---	---	---	---	0538	0.0204	291.6
16.14 64.83	0.008 49.25	---	---	-4.54 -40.79	---	---	---	---	---	0.84	0.0594	1314.4
43.09 42.37	0.008 44.06	---	---	---	-4.84 -36.47	---	---	---	---	0.81	0.0508	1073.2
-31.82 -21.52	-0.008 -20.43	---	---	---	---	4.368 25.59	---	---	---	0.70	0.0527	584.93
-20.26 -5.86	-0.005 -5.61	---	---	---	---	---	2.766 7.59	---	---	0.38	0.0074	153.38
-6.99 -4.97	-0.002 -4.89	---	---	---	---	---	---	1.67 9.24	---	0.409	0.0139	173.46
6.82 33.0	0.001 10.51	---	---	---	---	---	---	---	-0.19 -3.97	0.329	0.0152	123.08
32.48 14.5	0.007 13.34	-5.52 -30.66	---	---	---	1.48 10.93	---	---	-0.094 -5.0	0.899	0.098	1117.6
53.44 23.28	0.012 21.58	-6.83 -44.36	---	---	---	---	0.116 0.65	---	-0.09 -4.22	0.875	0.087	878.66
46.7 34.43	0.01 28.56	-6.47 -44.72	---	---	---	---	---	0.71 8.44	-0.14 -6.74	0.891	0.108	1020.8
-9.21 -2.82	-0.003 -4.28	---	-2.17 -7.34	---	---	3.48 17.69	---	---	-0.17 -5.58	0.739	0.0586	352.56
21.98 5.79	0.004 4.08	---	-4.97 -16.5	---	---	---	1.80 5.89	---	-0.19 -4.8	0.602	0.0345	181.93
29.72 9.64	0.006 7.15	---	-4.45 -13.07	---	---	---	---	0.84 4.82	-0.29 -7.47	0.594	0.0504	182.23
5.32 2.97	0.004 7.27	---	---	-3.76 -24.36	---	1.13 6.49	---	---	-0.16 -7.36	0.867	0.0993	818.28
23.15 8.47	0.003 5.40	---	---	---	-3.78 -21.44	1.45 8.01	---	---	-0.17 -7.16	0.849	0.0748	702.7
15.58 4.57	0.005 8.85	-2.2 7.42	3.99 12.66	-2.27 -5.17	-2.73 -6.07	0.73 5.58	---	---	-0.09 -5.35	0.929	0.12	930.49
14.74 4.22	0.005 8.6	-2.32 -7.64	4.21 13.1	-2.23 -4.97	-2.79 -6.02	0.76 5.69	---	---	---	0.925	0.10	1023.8
-30.82 -20.91	-0.008 -20.99	---	---	---	---	4.32 25.65	---	---	-0..13 -4.20	0.71	0.060	408.8
32.49 14.17	0.008 13.52	-5.58 -30.36	---	---	---	1.49 10.69	---	---	---	0.895	0.095	1413.9
-13.17 -4.02	-0.004 -4.81	---	-1.90 -6.32	---	---	3.65 18.23	---	---	---	0.722	0.046	433.6

Table 5.3 Static Equations Using Period 1990-92 (Dependent Variable =Lindex)

C	TR	$	DM	YEN	ST	M1	M2	CUR	INT	R^2	DW	F
16.55 21.94	0.002 10.82	-1.08 -10.99	---	---	---	---	---	---	---	0.14	0.043	60.5
4.87 4.87	-0.001 -3.42	---	0.48 3.39	---	---	---	---	---	---	0.02	0.037	5.84
11.35 31.5	0.003 8.50	---	---	-1.18 -8.57	---	---	---	---	---	0.09	0.044	36.84
3.20 3.43	-0.001 -5.44	---	---	---	0.62 5..43	---	---	---	---	0.04	0.039	14.81
5.15 4.67	-0.001 -2.85	---	---	---	---	0.31 2.82	---	---	---	0.01	0.037	4.06
8.47 4.09	0.0001 0.07	---	---	---	---	---	-0.01 -0.1	---	---	0.0002	0.036	0.09
5.13 7.69	-0.001 -4.7	---	---	---	---	---	---	0.35 4.71	---	0.03	0.038	11.19
7.61 66.15	-0.000 -3.08	---	---	---	---	---	---	---	0.17 5.73	0.04	0.040	16.49
14.88 8.60	0.002 4.89	-0.98 -8.66	---	---	---	0.05 0.44	---	---	0.086 2.79	0.15	0.044	32.5
-2.18 -0.85	-0.001 -2.47	-1.14 -11.16	---	---	---	---	1.69 7.29	---	0.24 6.78	0.21	0.056	48.08
16.45 11.94	0.002 6.42	-1.04 -8.99	---	---	---	---	---	-0.07 -0.82	0.084 2.89	0.15	0.044	32.65
-6.20 -3.91	-0.003 -9.26	---	1.24 7.99	---	---	0.44 4.14	---	---	0.33 9.89	0.13	0.053	29.5
-3.60 -1.33	-0.003 -6.2	---	1.17 6.18	---	---	---	0.21 0.74	---	0.32 8.52	0.12	0.05	24.83
-5.29 -3.77	-0.003 -9.47	---	1.33 8.54	---	---	---	---	0.33 4.54	0.28 8.50	0.14	0.052	30.51
8.79 5.73	0.002 3.26	---	---	-0.92 -5.32	---	0.16 1.29	---	---	0.08 2.44	0.10	0.043	20.04
-3.35 -1.25	-0.000 -0.31	---	---	-1.05 -6.90	---	---	1.27 5.30	---	0.19 4.9	0.13	0.050	27.37
10.08 9.62	0.002 4.22	---	---	-0.97 -5.66	---	---	---	0.05 0.64	0.07 2.06	0.10	0.043	19.69
-5.78 -3.6	-0.003 -8.8	---	---	---	0.84 7.50	0.64 5.8	---	---	0.22 7.69	0.13	0.049	27.49
-7.44 --2.75	-0.003 -6.23	---	---	---	0.59 5.24	---	0.91 3.66	---	0.27 7.32	.0.11	0.048	21.92
-0.59 -0.52	-0.002 -7.58	---	---	---	0.71 6.38	---	---	0.27 3.69	0.16 5.34	0.11	0.044	21.99
9.38 5.47	0.001 2.74	-1.12 -8.15	1.05 6.27	-0.76 -4.07	0.5 4.1	-0.22 -1.96	---	---	---	0.26	0.056	43.33
4.30 2.30	-0.001 -1.45	-1.18 -8.78	1.48 8.33	-0.31 -1.58	0.36 2.97	-0.06 -0.49	---	---	0.2 6.15	0.30	0.062	44.39
0.02 0.008	-0.001 -2.81	-1.21 -9.01	1.29 6.43	-0.23 -1.17	0.40 3.35	---	0.438 1.65	---	0.24 6.49	0.30	0.063	44.90
5.41 8.20	-0.001 -3.97	---	---	---	---	---	---	0.26 3.38	0.14 4.67	0.06	0.040	14.95
3.11 2.77	-0.001 -4.48	---	---	---	---	0.45 4.04	---	---	0.19 6.44	0.06	0.042	16.66
17.16 11.19	0.002 6.91	-1.1 -10.57	---	---	---	-0.05 -0.46	---	---	---	0.14	0.043	40.36
2.39 1.70	-0.001 -4.21	---	0.44 3.12	---	---	0.28 2.49	---	---	---	0.02	0.038	5.98
17.05 12.45	0.002 6.81	-1.11 -9.79	---	---	---	---	---	-0.04 -0.43	---	0.14	0.043	40.35
-0.40 -0.30	-0.002 -6.26	---	0.67 4.74	---	---	---	---	0.433 5.77	---	0.06	0.041	15.15

Table 5.4 Static Equations Using Period 1993-95 (Dependent Variable =Lindex)

C	TR	$	DM	YEN	ST	M1	M2	CUR	INT	R^2	DW	F
14.4 29.29	0.005 28.29	-0.63 -11.52	---	---	---	---	---	---	---	0.89	0.031	2377
15.58 36.2	0.006 32.78	---	-0.82 -15.9	---	---	---	---	---	---	0.91	0.041	2828.8
11.01 45.3	0.005 23.65	---	---	-0.54 -9.36	---	---	---	---	---	0.88	0.028	2208.6
15.3 30.1	0.006 29.2	---	---	---	-0.7 -12.9	---	---	---	---	0.90	0.034	2503.7
8.98 7.19	0.003 12.4	---	---	---	---	-0.02 -0.19	---	---	---	0.87	0.021	1880.5
18.56 21.4	0.005 27.2	---	---	---	---	---	-0.82 -11.3	---	---	0.89	0.027	2360.3
10.88 10.24	0.004 14.3	---	---	---	---	---	---	-0.21 -2.0	---	0.87	0.022	1895.5
8.83 126.65	0.003 61.3	---	---	---	---	---	---	---	-0.02 -1.34	0.87	0.022	1887.1
15.21 10.37	0.006 16.59	-0.68 -11.67	---	---	---	-0.05 -0.39	---	---	0.03 1.82	0.89	0.033	1199.3
26.66 26.84	0.008 32.5	-0.37 -6.6	---	---	---	---	-1.17 -13.5	---	-0.13 -7.24	0.92	0.074	1619.8
13.75 12.82	0.005 18.88	-0.7 -11.39	---	---	---	---	---	0.1 0.97	0.05 2.65	0.89	0.035	1201.2
14.39 10.8	0.006 19.3	---	-0.84 -15.9	---	---	0.11 0.98	---	---	0.03 1.75	0.91	0.043	1417.8
24.85 25.01	0.008 34.0	---	-0.49 -8.3	---	---	---	-0.96 -10.2	---	-0.11 -6.3	0.92	0.069	1692.9
12.84 13.1	0.006 21.9	---	-0.9 -16.0	---	---	---	---	0.32 3.16	0.04 2.75	0.91	0.047	1442.1
11.36 7.74	0.005 15.1	---	---	-0.56 -9.25	---	-0.03 -0.24	---	---	0.017 0.89	0.88	0.029	1104
25.56 24.4	0.008 29.96	---	---	-0.22 -3.89	---	---	-1.27 -14.2	---	-0.16 -8.7	0.914	0.083	1538.8
9.86 8.74	0.005 17.44	---	---	-0.59 -8.94	---	---	---	0.12 1.05	0.029 1.61	0.885	0.030	1106.3
15.1 10.58	0.006 17.37	---	---	---	-0.74 -12.93	0.036 0.29	---	---	0.033 1.83	0.897	0.037	1257.8
26.45 26.76	0.0077 32.9	---	---	---	-0.4 -7.08	---	-1.12 -12.5	---	-0.13 -7.15	0.919	0.074	1638.3
13.76 13.16	0.006 19.77	---	---	---	-0.78 -12.8	---	---	0.2 1.88	0.044 2.69	0.898	0.038	1266.3
12.04 10.25	0.004 14.11	---	---	---	---	---	---	-0.3 -2.73	-0.04 -2.28	0.869	0.025	1274.6
14.67 14.38	0.006 19.36	-0.63 -11.3	---	---	---	---	---	-0.03 -0.29	---	0.892	0.031	1582.8
13.89 15.3	0.006 22.8	---	-0.85 -15.9	---	---	---	---	0.19 2.12	---	0.908	0.042	1898.7
20.7 16.27	0.005 22.37	-0.12 -0.38	-3.23 -15.9	2.1 11.92	0.57 1.45	---	---	0.22 2.69	---	0.940	0.072	1502
21.65 16.77	0.005 22.83	0.09 0.29	-3.4 -16.4	2.17 12.3	0.51 1.31	---	---	0.12 1.33	-0.05 -3.43	0.942	0.080	1313.2
10.72 10.77	0.005 17.77	---	---	-0.55 -9.1	---	---	---	0.03 0.3	---	0.884	0.028	1470.1
14.72 14.9	0.006 20.4	---	---	---	-0.71 -12.7	---	---	0.06 0.7	---	0.896	0.034	1667.8
26.5 25.76	0.007 31.18	---	---	---	---	---	-1.41 -17.2	---	-0.19 -11.83	0.912	0.102	1997.9

Table 5.5 Static Equations Using Period 1990-92 by Step Dummies (Dependent Variable =Lindex)

C	TR	$	DM	YEN	ST	M1	M2	CUR	INT	R^2	DW	F
21.45 27.51	0.003 16.57	-1.72 -16.91	---	---	---	---	---	---	---	0.326	0.089	71.382
5.63 5.57	-0.001 -2.70	---	0.37 2.61	---	---	---	---	---	---	0.037	0.039	5.72
12.65 35.41	0.004 12.07	---	---	-1.66 -12.25	---	---	---	---	---	0.223	0.074	42.33
4.25 5.01	-0.001 -4.75	---	---	---	0.491 4.75	---	---	---	---	0.224	0.071	35.52
2.68 2.70	-0.001 -5.62	---	---	---	---	0.57 5.63	---	---	---	0.227	0.073	43.83
11.5 5.66	0.001 1.57	---	---	---	---	---	-0.30 -1.59	---	---	0.083	0.060	11.03
2.77 4.63	-0.001 -9.0	---	---	---	---	---	---	0.61 9.19	---	0.310	0.100	47.49
7.50 69.03	-0.000 -4.118	---	---	---	---	---	---	---	0.194 7.042	0.157	0.078	22.96
16.5 9.54	0.002 6.047	-1.33 -11.33	---	---	---	0.16 1.46	---	---	0.095 3.33	0.302	0.086	39.71
-0.51 -0.22	-0.001 -1.54	-1.57 -15.31	---	---	---	---	1.85 8.81	---	0.25 7.92	0.366	0.107	53.15
21.45 15.19	0.003 9.81	-1.69 -13.79	---	---	---	---	---	-0.06 -0.78	0.076 2.96	0.347	0.114	43.41
-6.90 -4.39	-0.003 -9.63	---	1.21 7.81	---	---	0.54 5.03	---	---	0.34 10.43	0.174	0.062	22.17
-4.33 -1.62	-0.003 -6.43	---	1.098 5.83	---	---	---	0.32 1.13	---	0.33 8.97	0.147	0.057	18.16
-7.99 -5.91	-0.004 -11.74	---	1.43 9.61	---	---	---	---	0.54 7.52	0.31 9.98	0.263	0.076	32.72
7.50 5.12	0.002 3.64	---	---	-1.14 -6.87	---	0.343 2.94	---	---	0.104 3.17	0.228	0.076	27.13
-2.26 -0.89	0.001 1.03	---	---	-1.39 -9.35	---	---	1.26 5.56	---	0.19 4.97	0.239	0.083	28.87
9.59 9.40	0.002 5.07	---	---	-1.29 -7.59	---	---	---	0.20 2.51	0.07 2.16	0.230	0.075	27.49
-10.01 -7.52	-0.004 -13.41	---	---	---	0.80 8.70	1.09 11.71	---	---	0.26 11.15	0.428	0.127	61.15
-6.76 -2.54	-0.003 -6.07	---	---	---	0.54 4.82	---	0.887 3.63	---	0.28 7.54	0.146	0.061	15.77
-2.82 -2.97	-0.003 -11.3	---	---	---	0.53 5.82	---	---	0.69 10.46	0.14 5.77	0.402	0.113	54.93
10.65 5.97	0.0012 3.03	-1.34 -8.88	1.05 6.66	-0.62 -3.30	0.487 4.11	-0.20 -1.8	---	---	---	0.363	0.090	27.71
6.75 3.59	-0.001 -0.7	-1.53 -10.73	1.58 9.89	-0.23 -1.2	0.276 2.46	-0.07 -0.62	---	---	0.23 7.61	0.449	0.106	37.01
2.45 1.04	-0.001 -2.24	-1.56 -11.12	1.43 7.87	-0.14 -0.75	0.30 2.77	---	0.41 1.68	---	0.26 7.92	0.449	0.130	39.59
2.66 4.30	-0.001 -8.72	---	---	---	---	---	---	0.558 7.88	0.153 5.89	0.306	0.106	35.93
1.01 0.94	-0.001 -6.70	---	---	---	---	0.64 6.03	---	---	0.24 8.71	0.206	0.072	27.35
19.92 13.38	0.003 9.20	-1.52 -14.18	---	---	---	-0.01 -0.04	---	---	---	0.287	0.085	49.40
4.38 3.45	-0.001 -1.99	---	-0.14 -1.03	---	---	0.498 4.89	---	---	---	0.251	0.079	27.37
17.73 13.52	0.002 7.80	-1.51 -13.68	---	---	---	---	---	0.23 3.27	---	0.484	0.157	86.37
0.48 0.41	-0.002 -5.79	---	0.24 1.88	---	---	---	---	0.68 9.91	---	0.295	0.091	38.52

FIGURES

FIGURE-1

Graph of ISE and Its First Difference

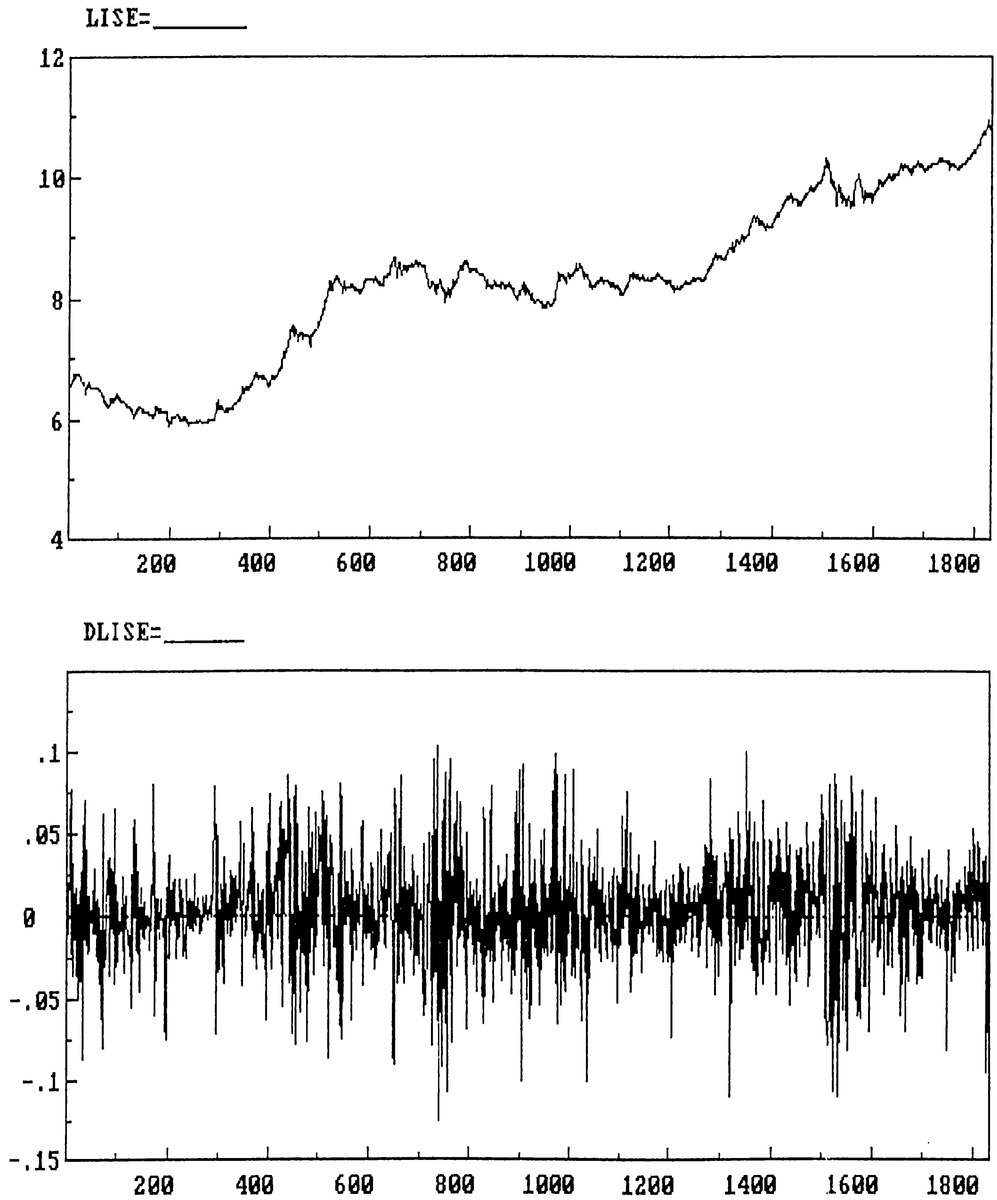

FIGURE-2

Graph of Interest Rate and Its First Difference

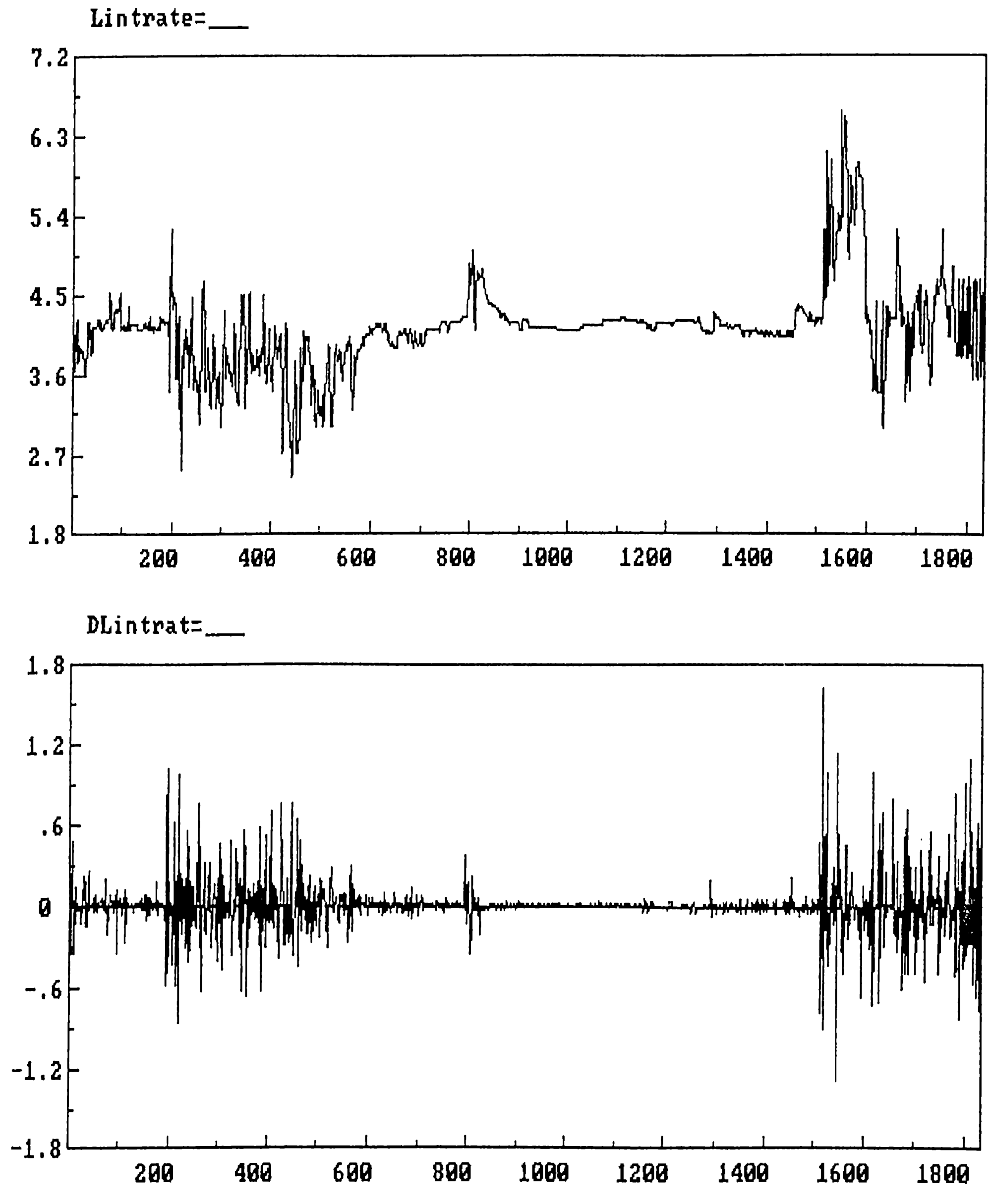

FIGURE-3

Graph of Lira-Dollar Exchange Rate and Its First Difference

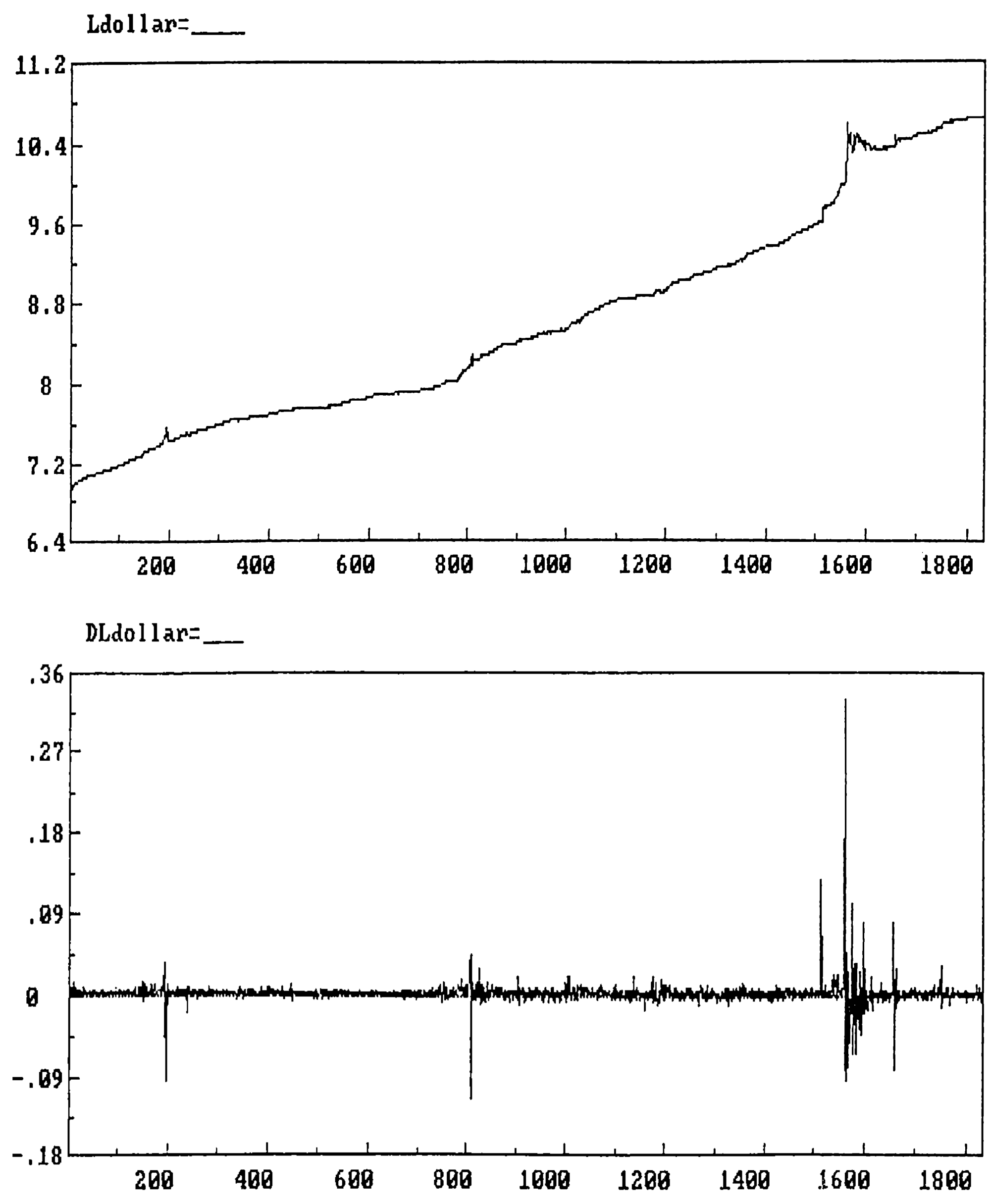

FIGURE-4

Graph of Lira-Mark Exchange Rate and Its First Difference

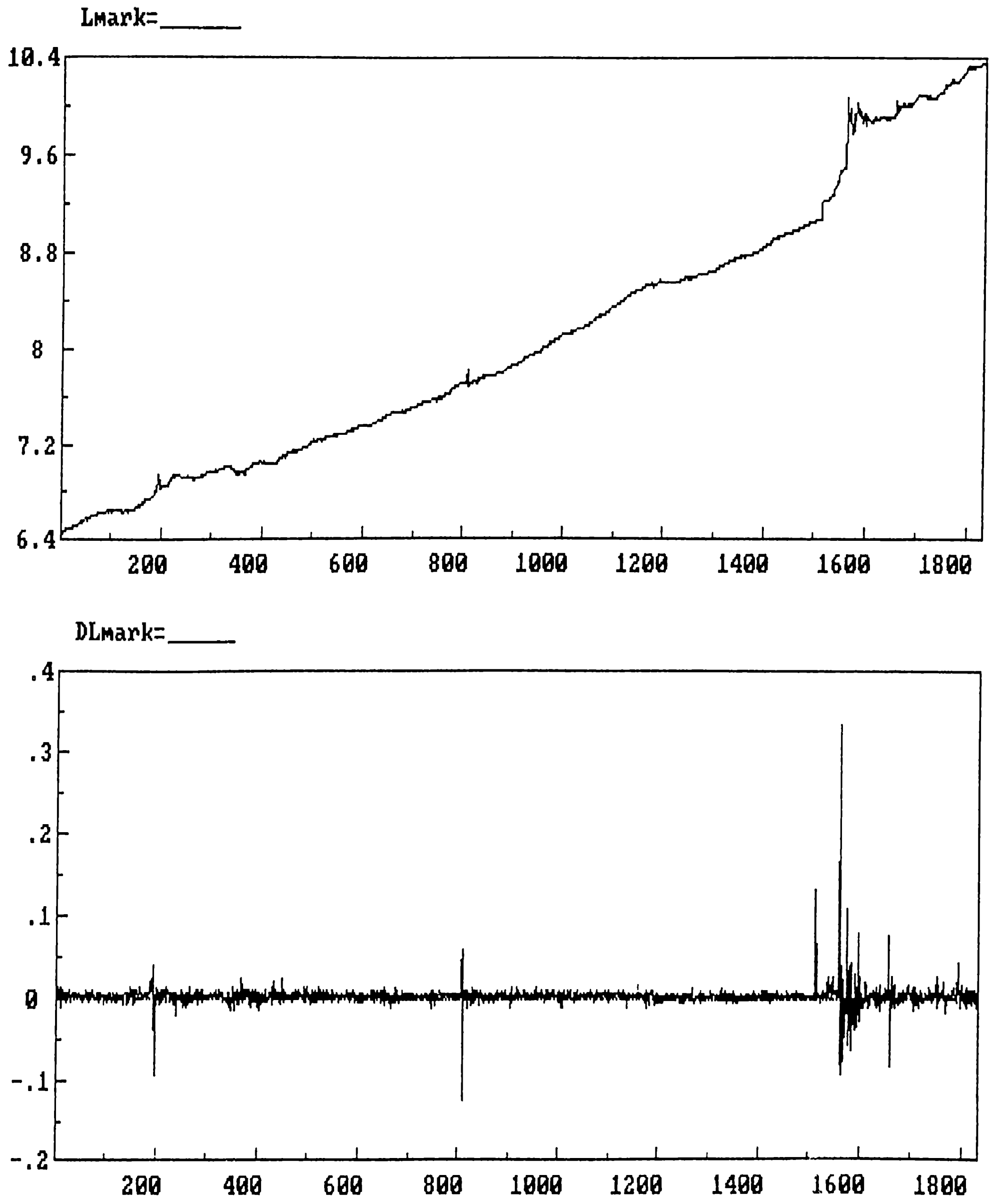

FIGURE-5

Graph of Lira-Yen Exchange Rate and Its First Difference

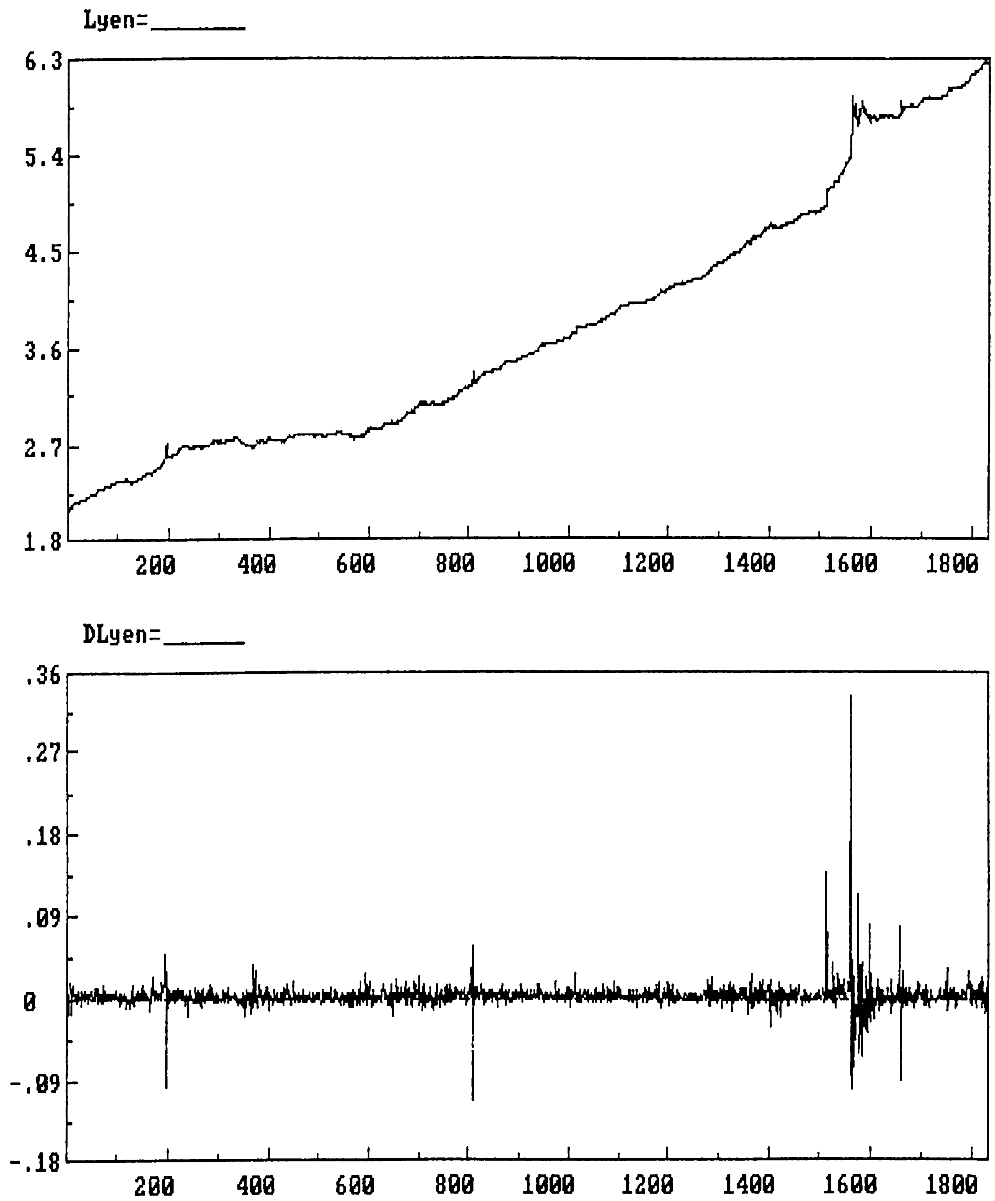

FIGURE-6

Graph of Lira-Sterling Exchange Rate and Its First Difference

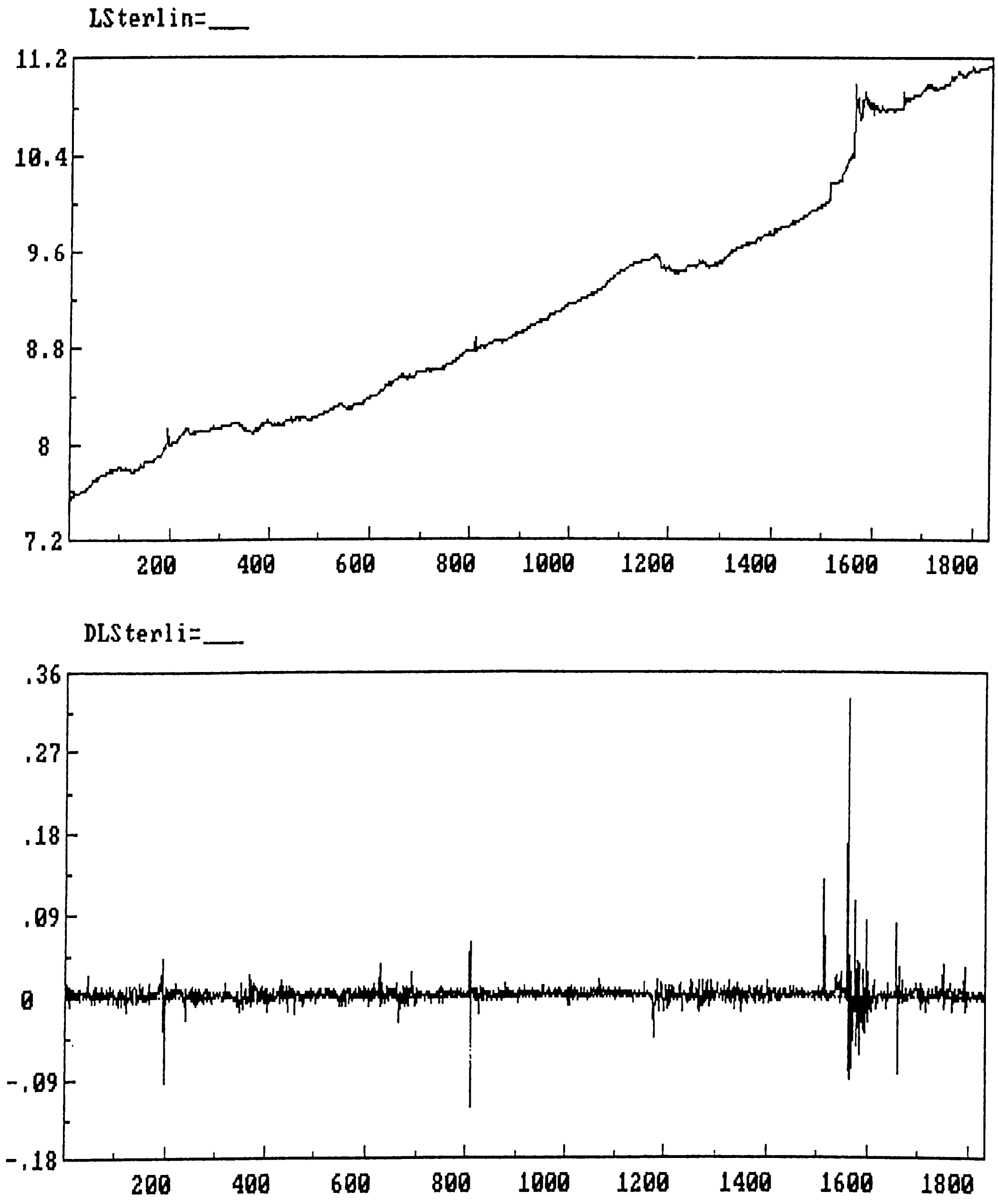

FIGURE-7

Graph of M1 and Its First Difference

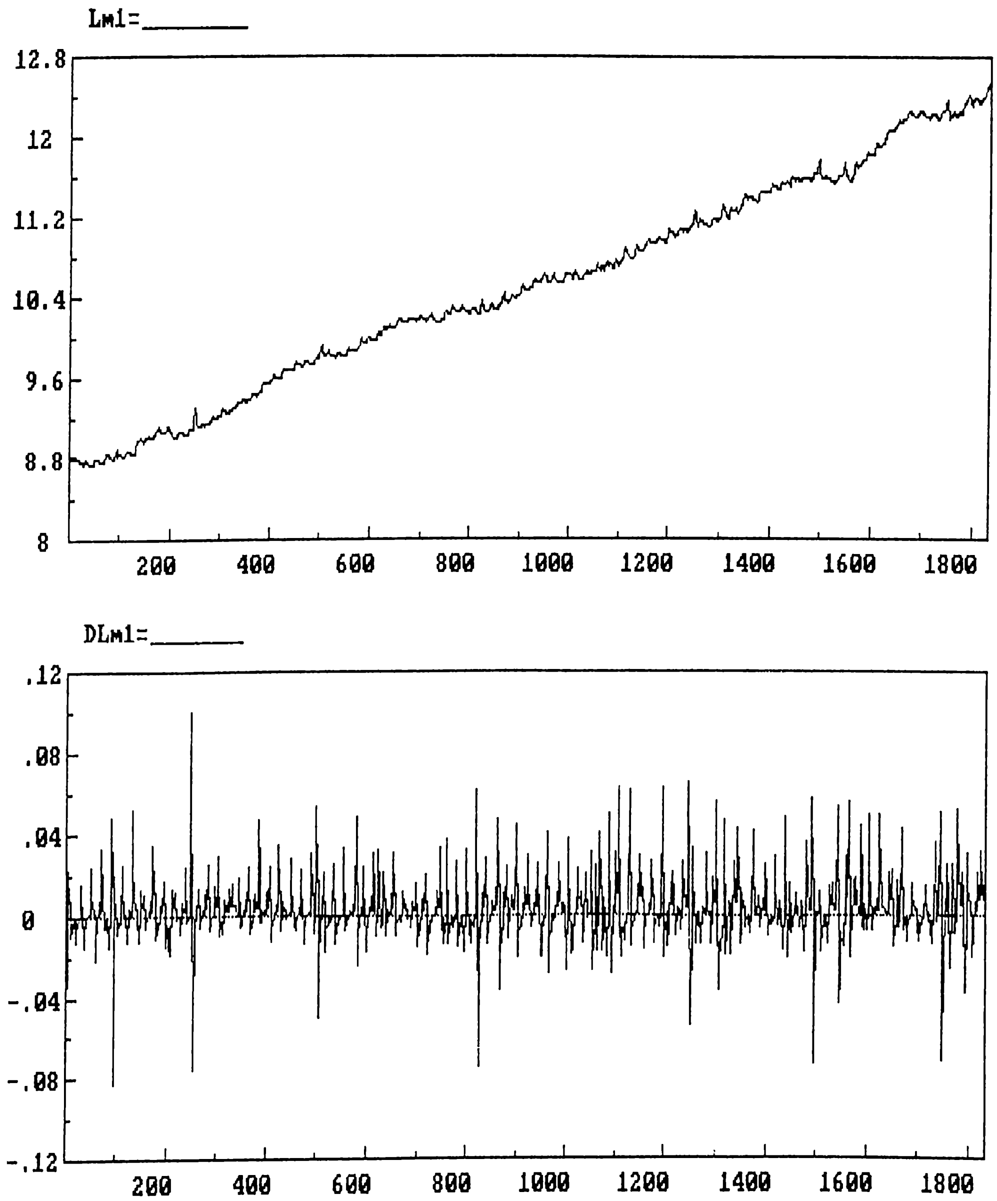

FIGURE-8

Graph of M2 and Its First Difference

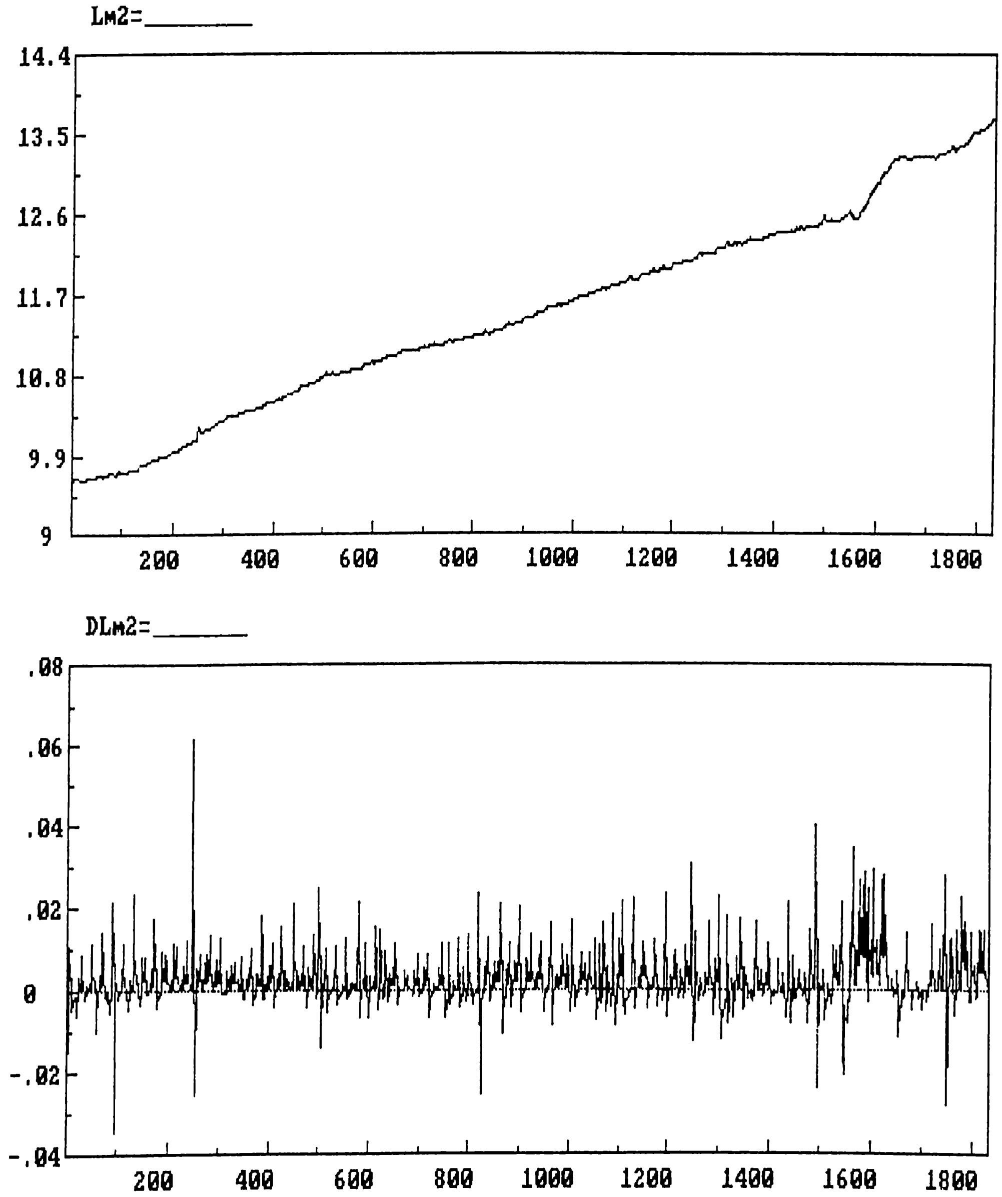

FIGURE-9

Graph of Currency in Circulation and Its First Difference

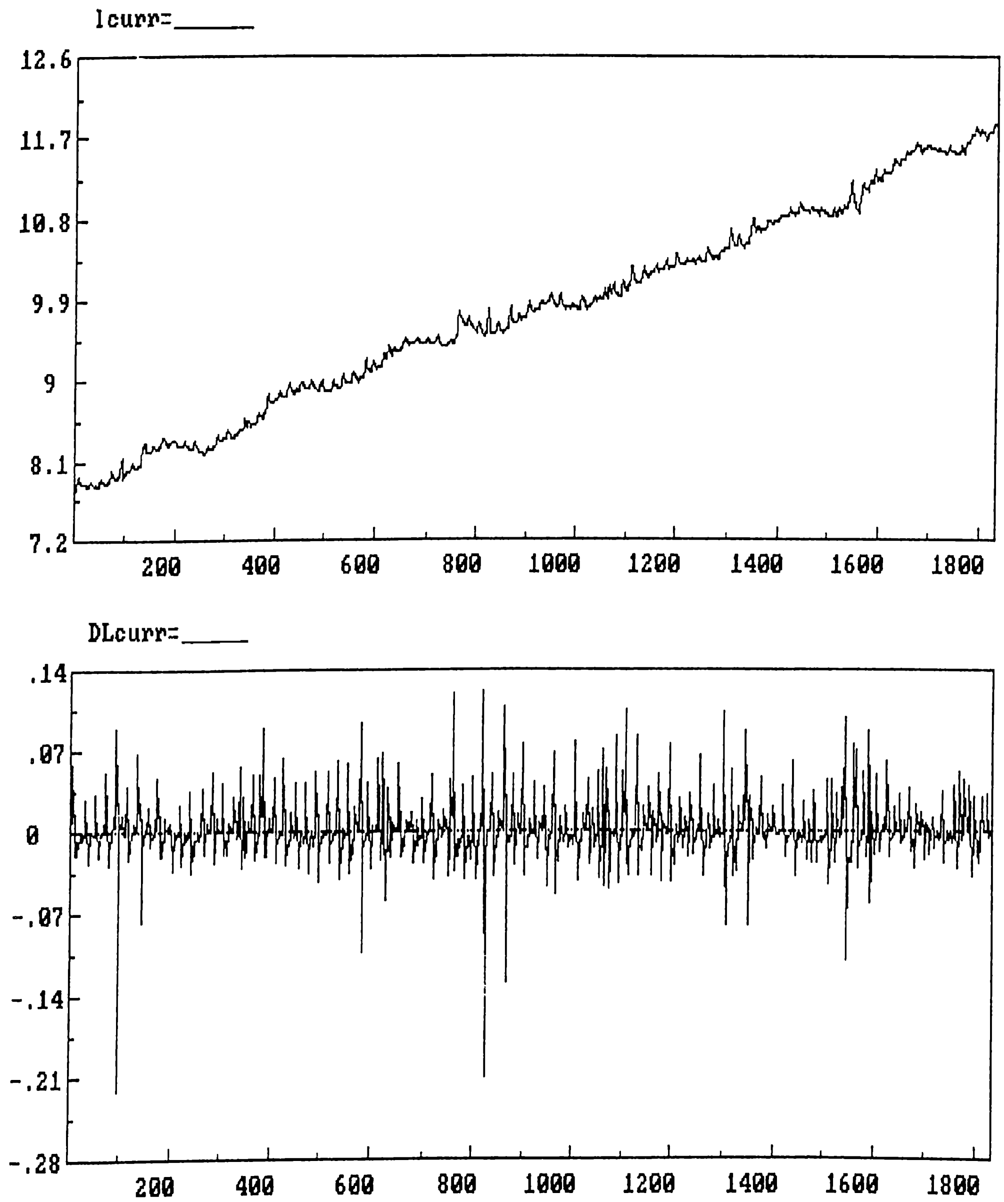

FIGURE 10-1

Graph of 1-step Residuals ± 2σ for Equation-1 in Table 4.3

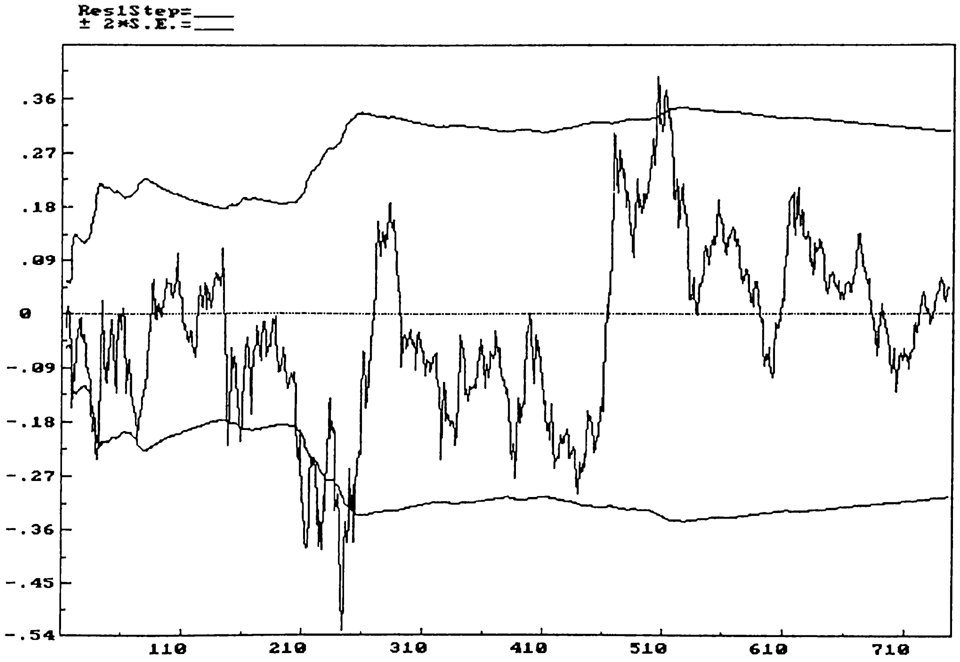

FIGURE 10-2

Graph of 1-step Residuals ± 2σ for Equation-2 in Table 4.3

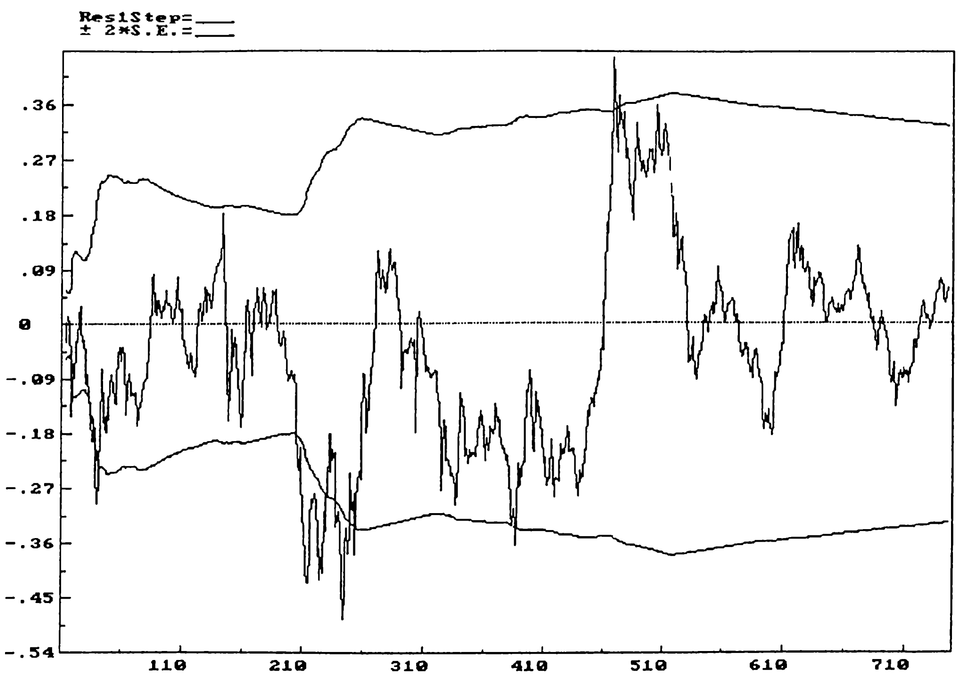

FIGURE 10-3

Graph of 1-step Residuals ± 2σ for Equation-3 in Table 4.3

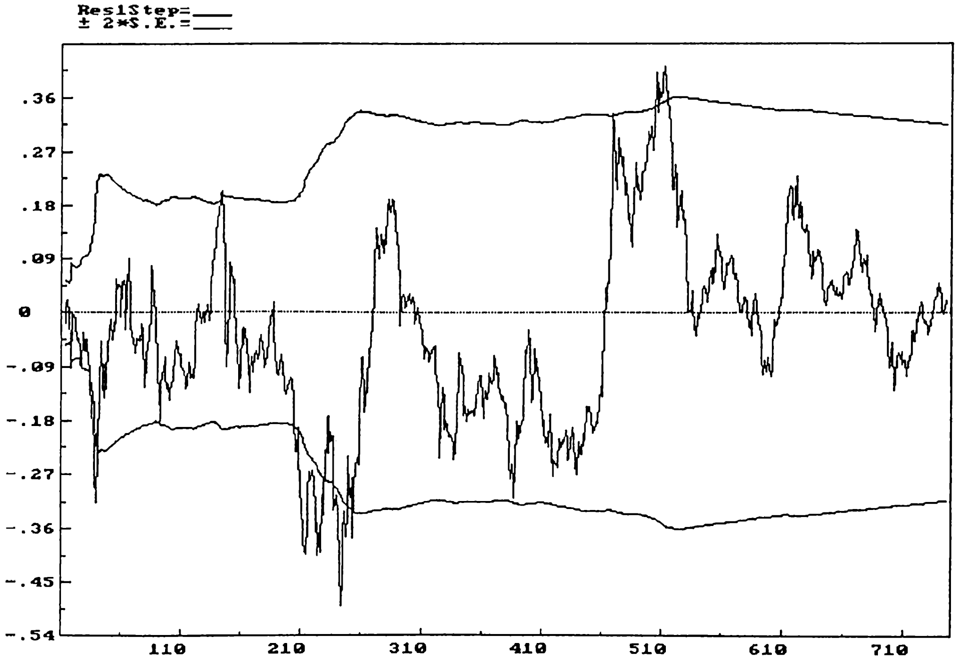

FIGURE 10-4

Graph of 1-step Residuals ± 2σ for Equation-4 in Table 4.3

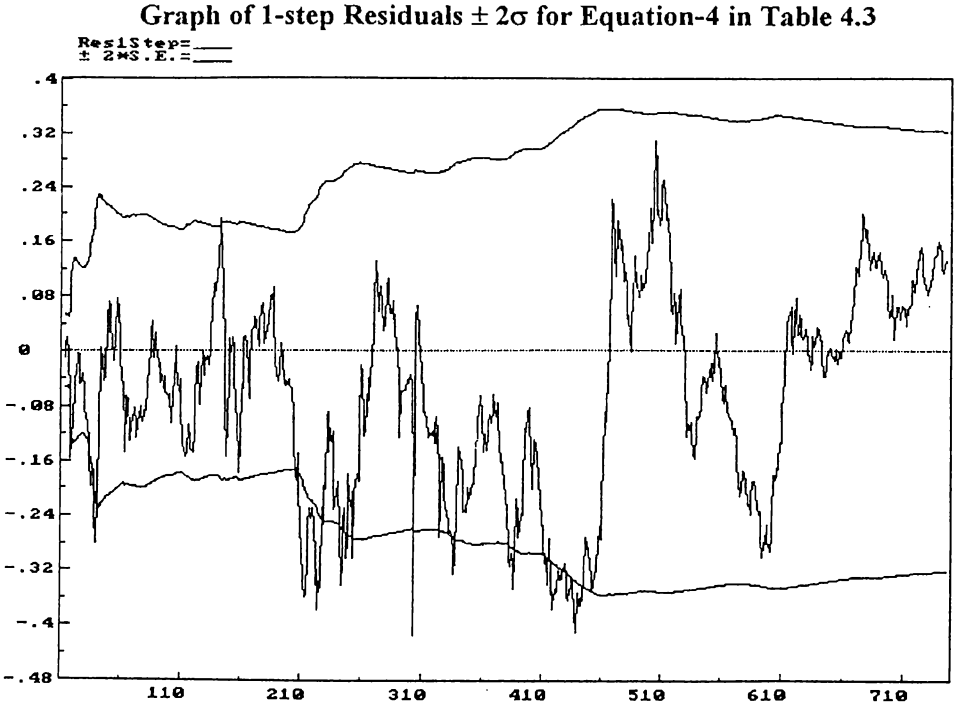

FIGURE 10-5

Graph of 1-step Residuals ± 2σ for Equation-5 in Table 4.3

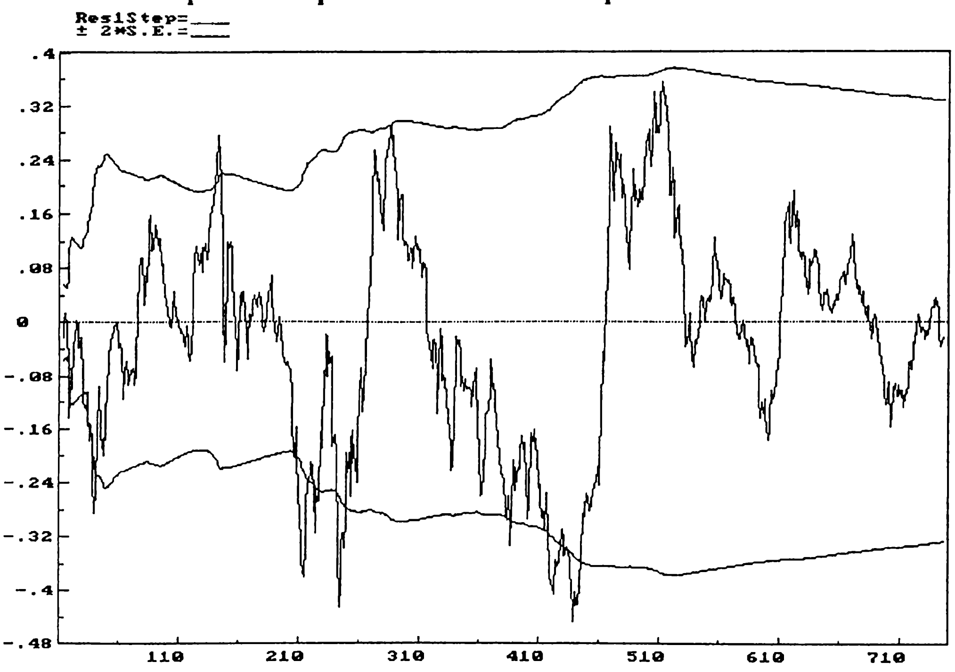

FIGURE 10-6

Graph of 1-step Residuals ± 2σ for Equation-6 in Table 4.3

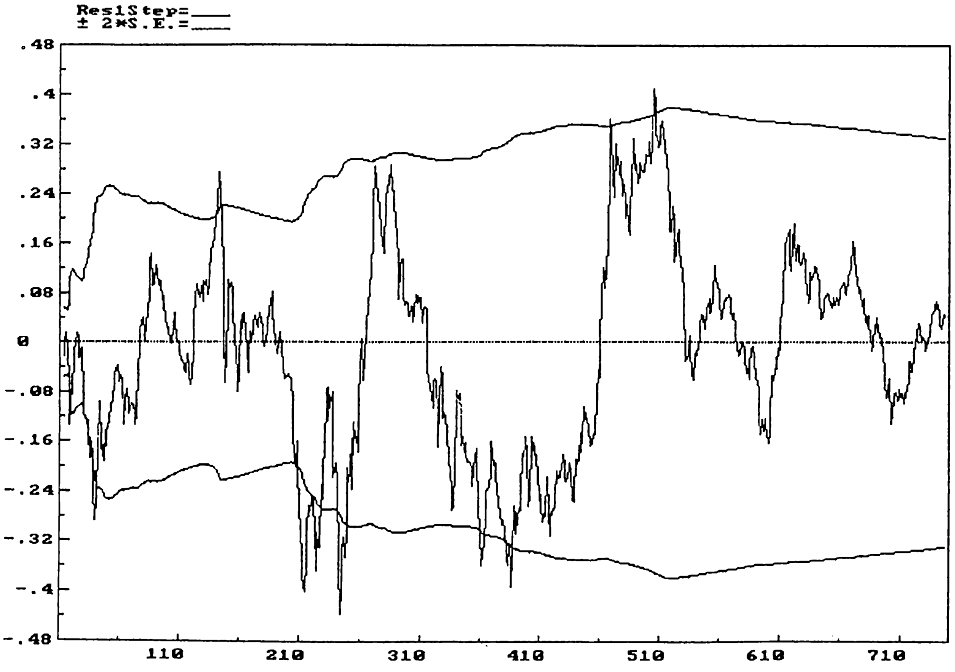

FIGURE 10-7

Graph of 1-step Residuals ± 2σ for Equation-7 in Table 4.3

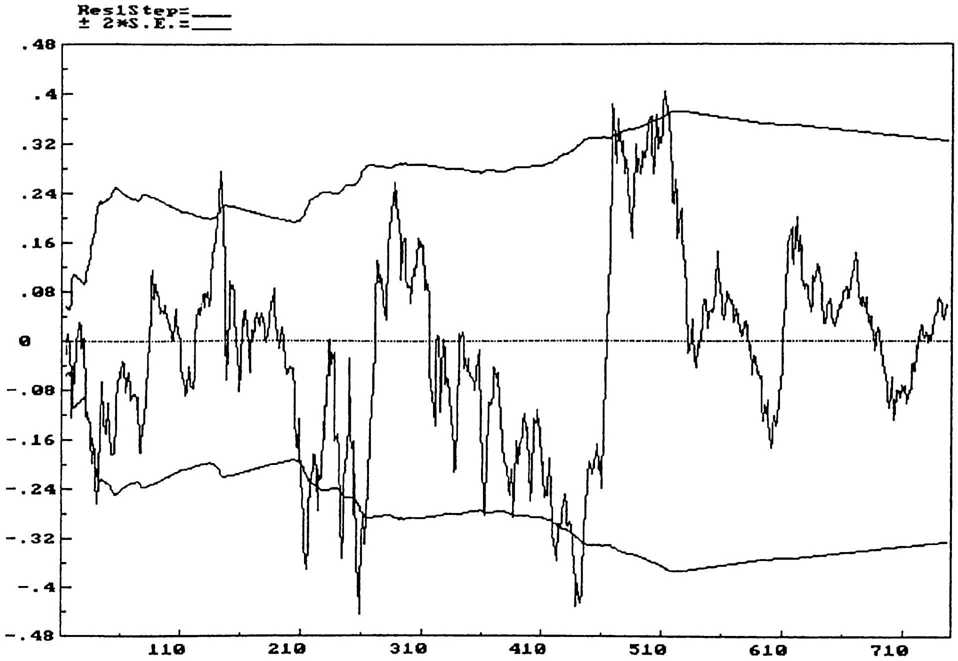

FIGURE 10-8

Graph of 1-step Residuals ± 2σ for Equation-8 in Table 4.3

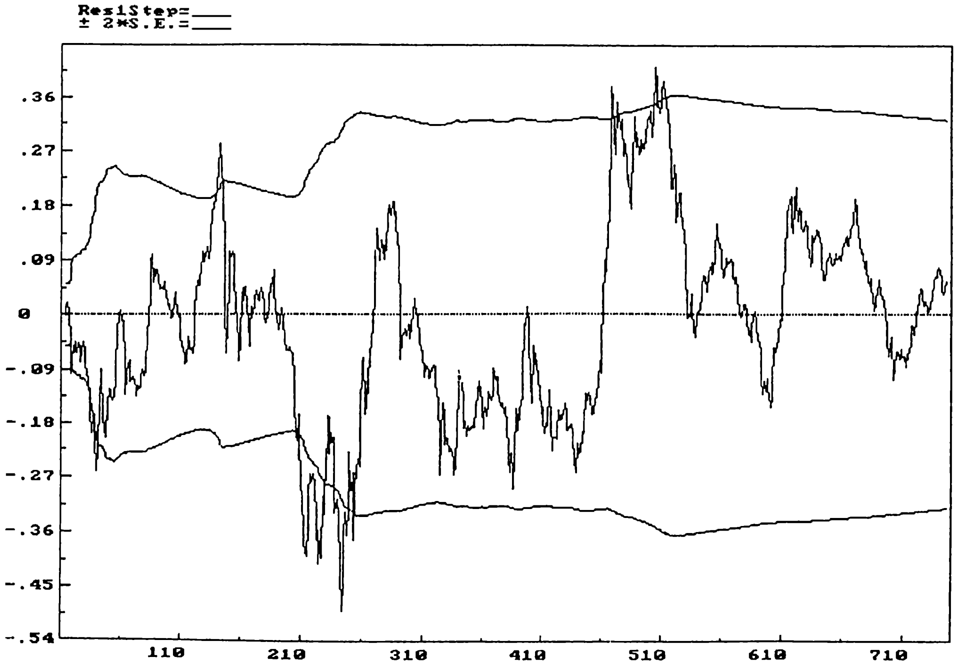

FIGURE 10-9

Graph of 1-step Residuals ± 2σ for Equation-9 in Table 4.3

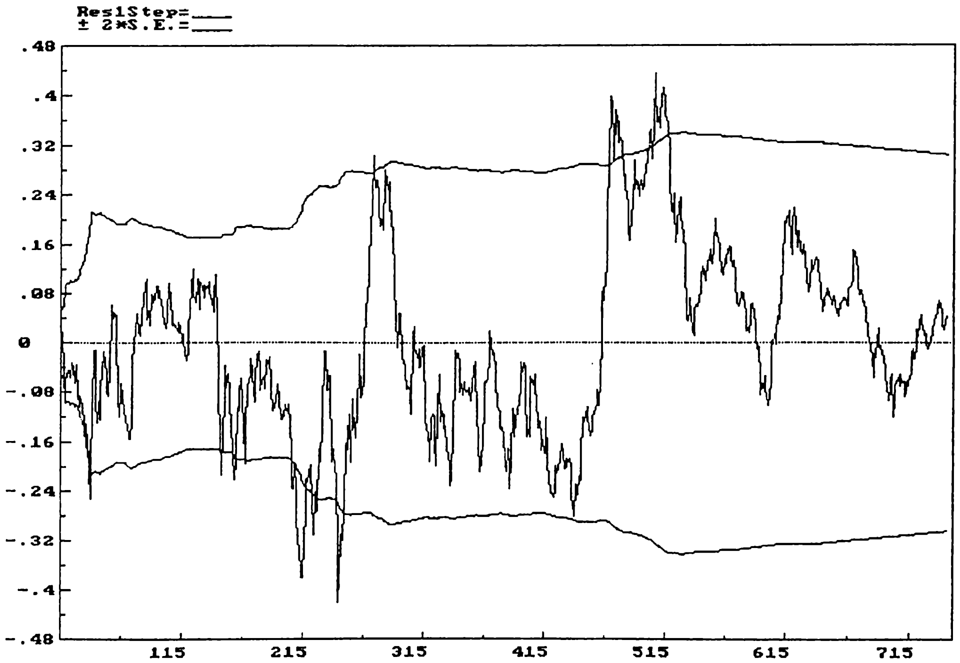

FIGURE 10-10

Graph of 1-step Residuals ± 2σ for Equation-10 in Table 4.3

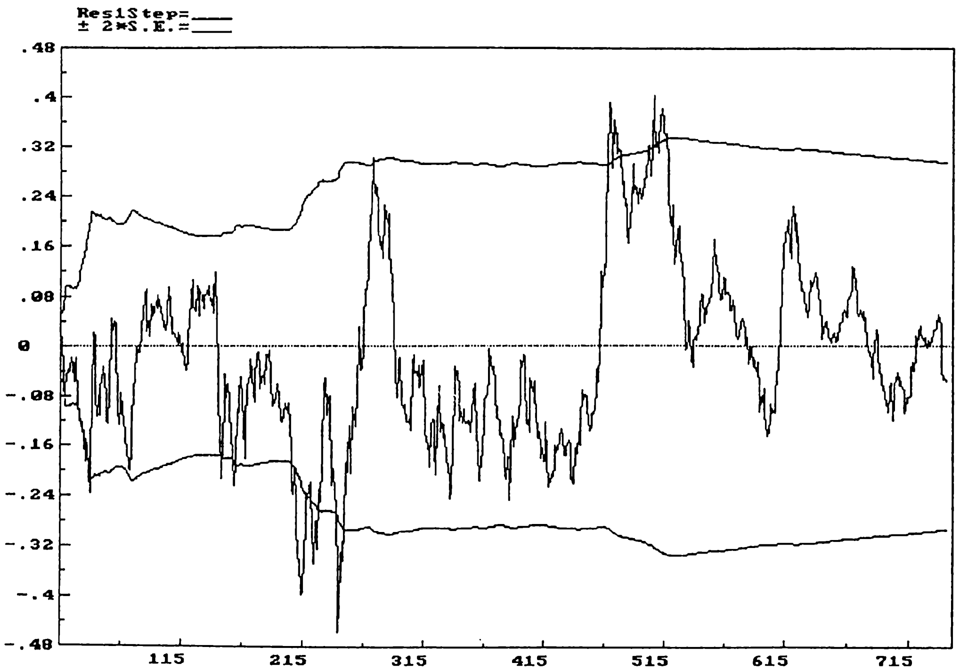

FIGURE 10-11

Graph of 1-step Residuals ± 2σ for Equation-11 in Table 4.3

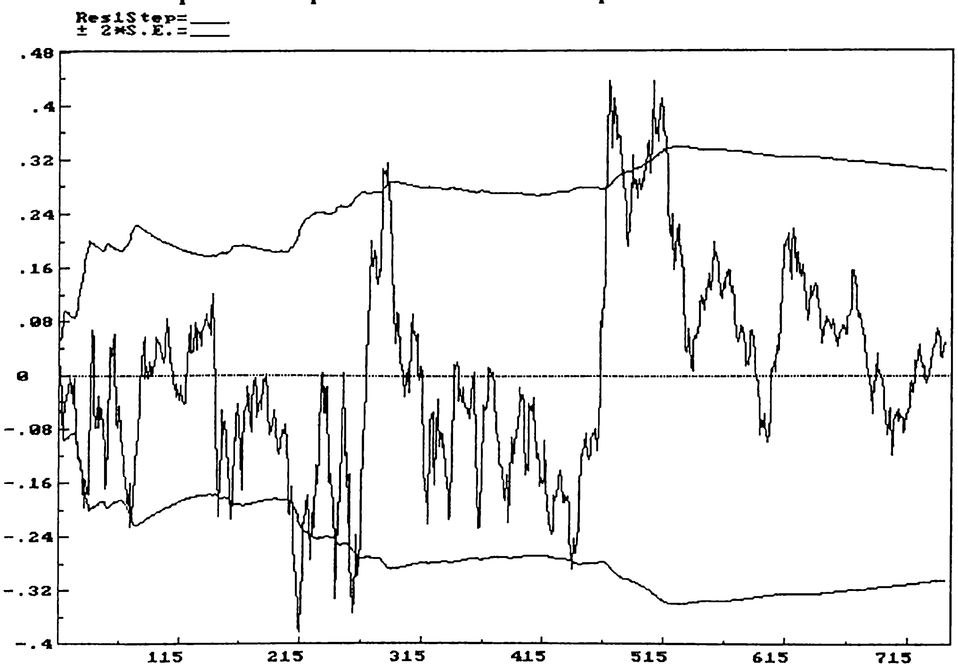

FIGURE 10-12

Graph of 1-step Residuals ± 2σ for Equation-12 in Table 4.3

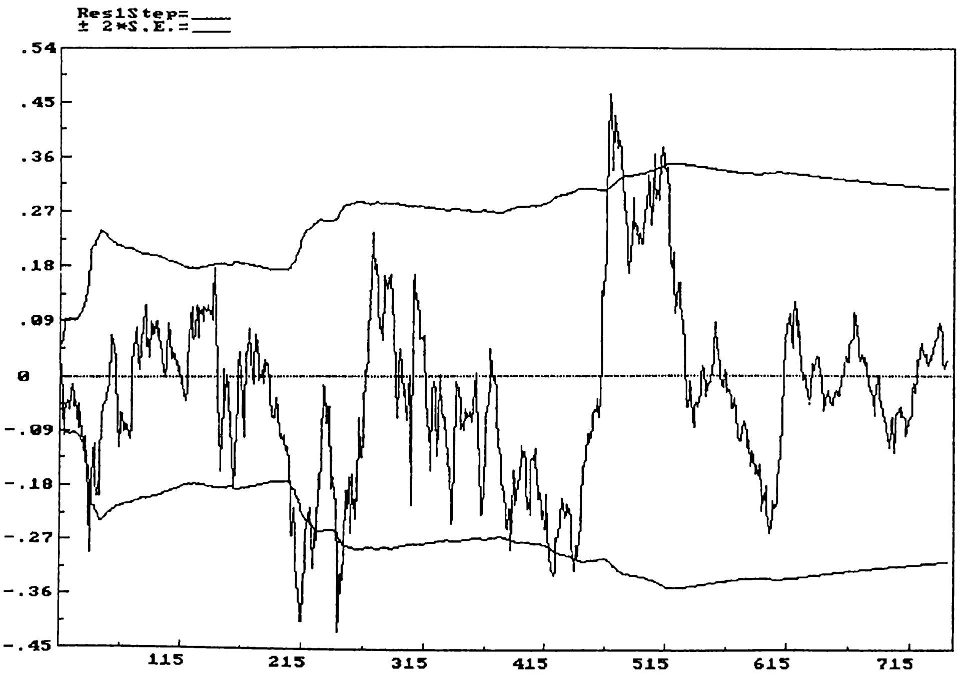

FIGURE 10-13

Graph of 1-step Residuals ± 2σ for Equation-13 in Table 4.3

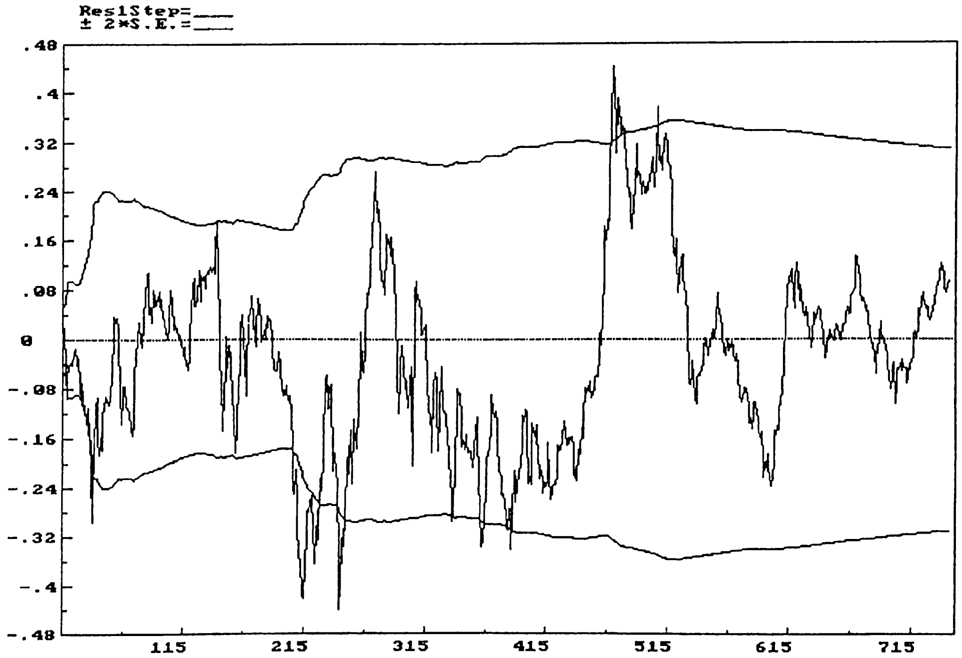

FIGURE 10-14

Graph of 1-step Residuals ± 2σ for Equation-14 in Table 4.3

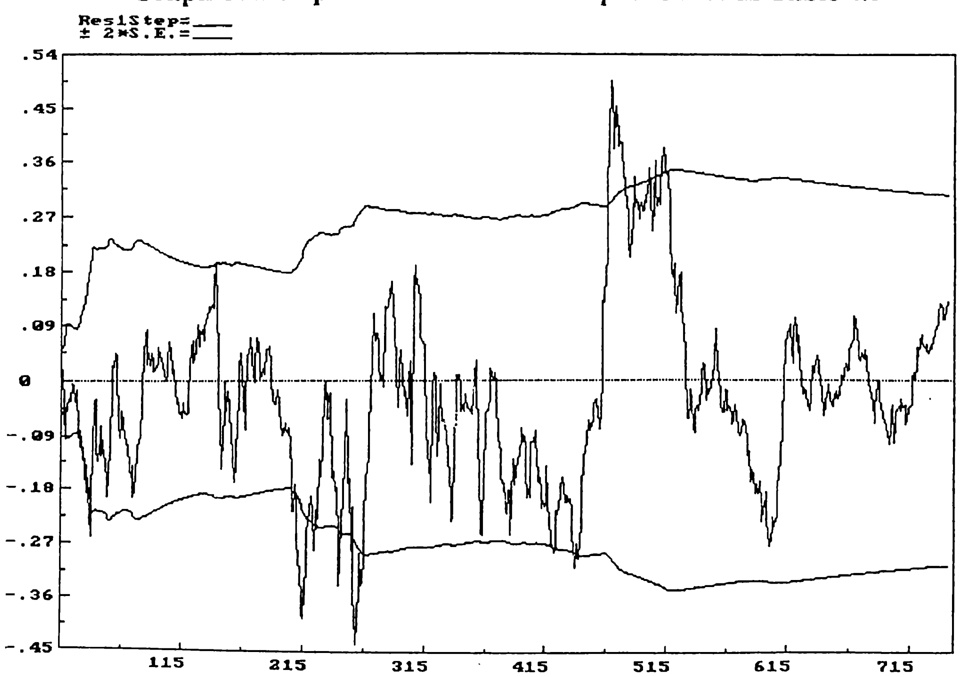

FIGURE 10-15

Graph of 1-step Residuals ± 2σ for Equation-15 in Table 4.3

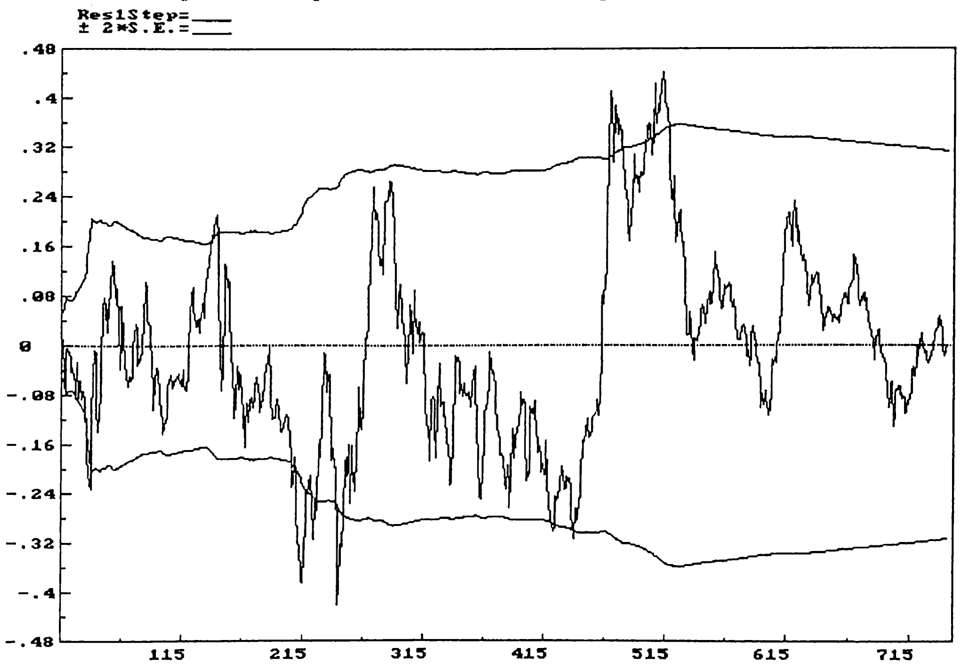

FIGURE 10-16

Graph of 1-step Residuals ± 2σ for Equation-16 in Table 4.3

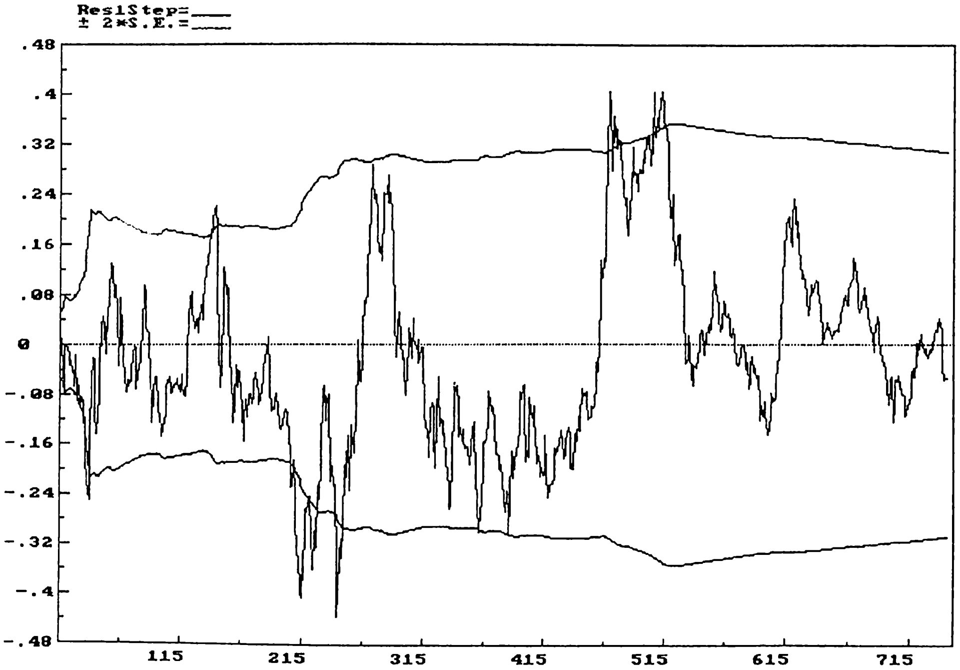

FIGURE 10-17

Graph of 1-step Residuals ± 2σ for Equation-17 in Table 4.3

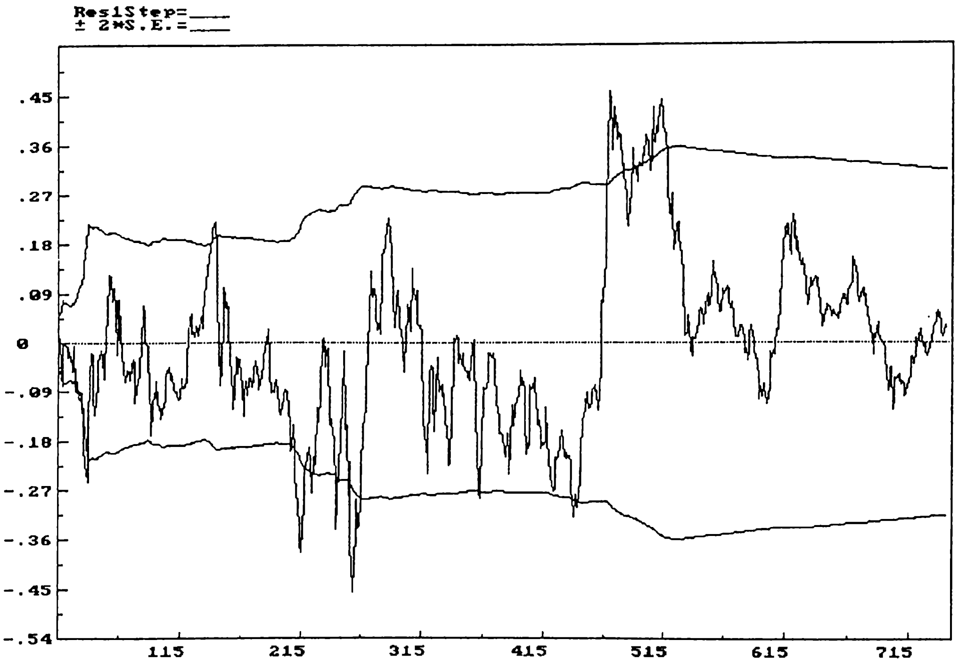

FIGURE 10-18

Graph of 1-step Residuals ± 2σ for Equation-18 in Table 4.3

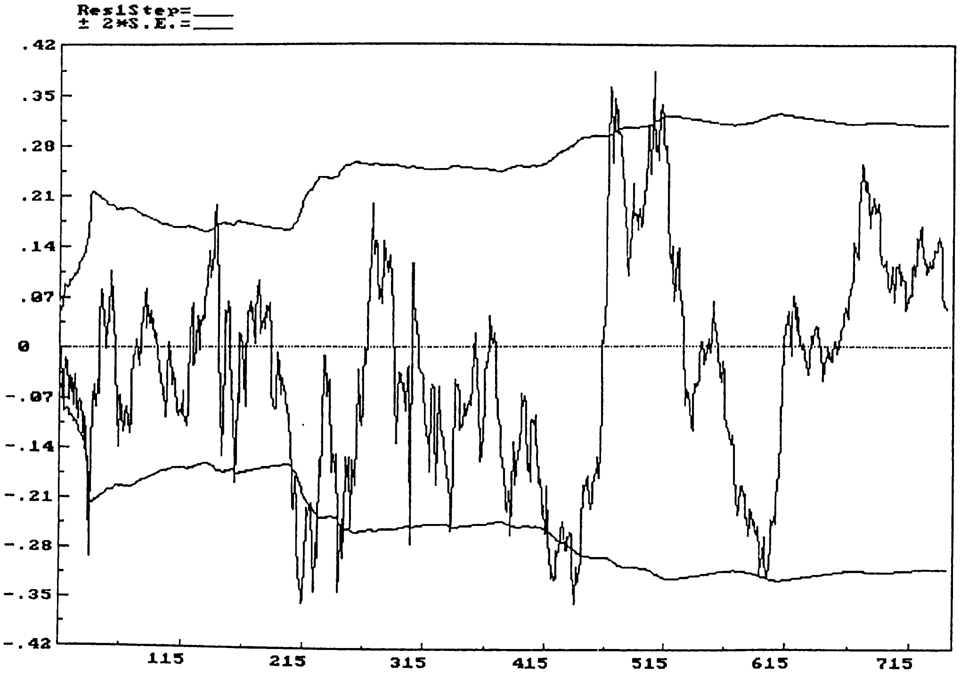

FIGURE 10-19

Graph of 1-step Residuals ± 2σ for Equation-19 in Table 4.3

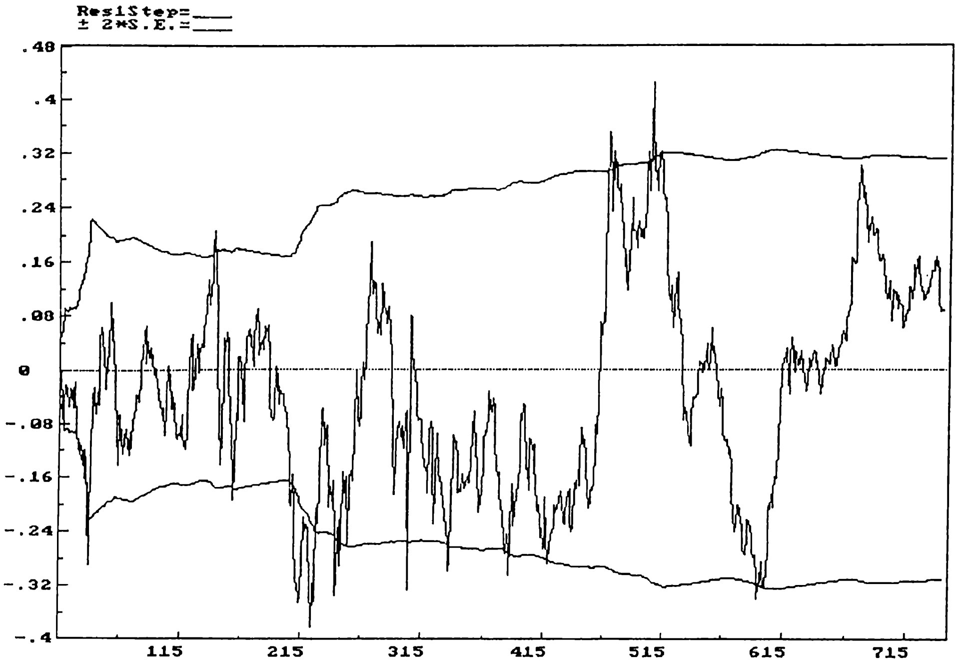

FIGURE 10-20

Graph of 1-step Residuals ± 2σ for Equation-20 in Table 4.3

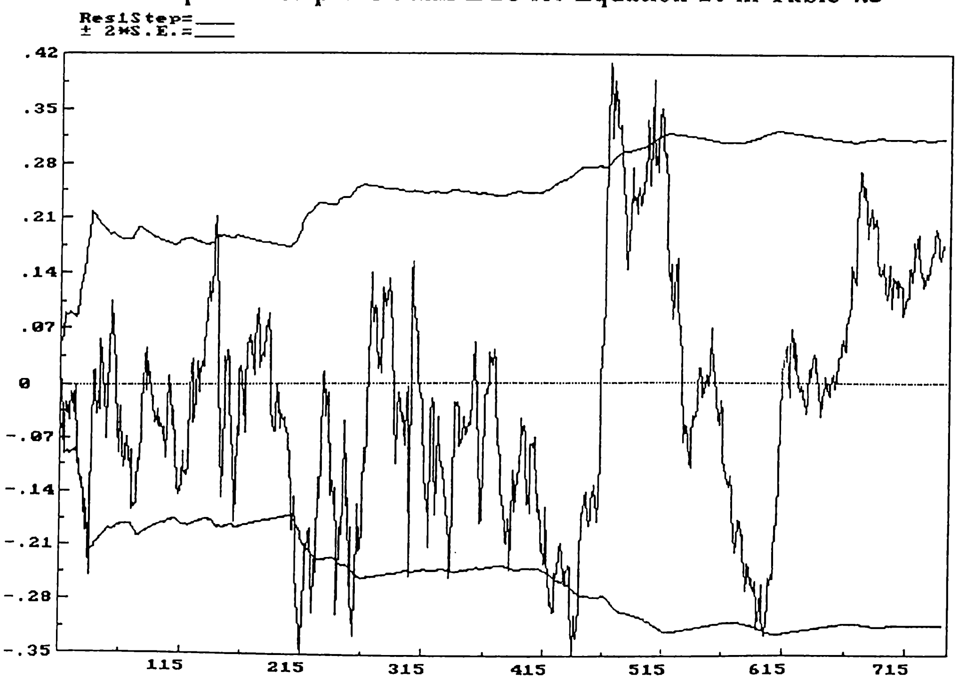

FIGURE 10-21

Graph of 1-step Residuals ± 2σ for Equation-21 in Table 4.3

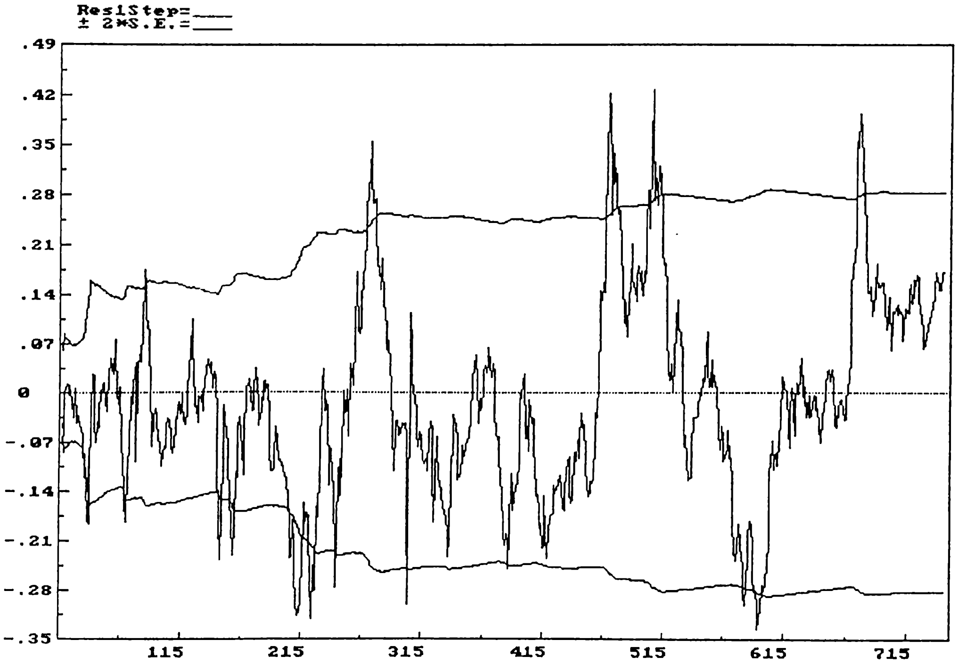

FIGURE 10-22

Graph of 1-step Residuals ± 2σ for Equation-22 in Table 4.3

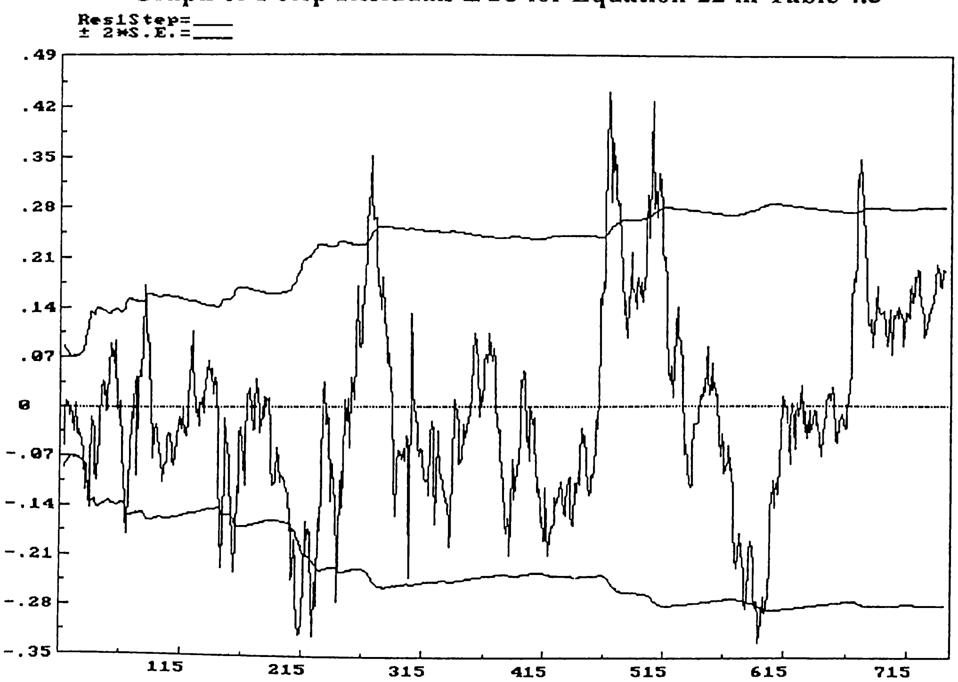

FIGURE 10-23

Graph of 1-step Residuals ± 2σ for Equation-23 in Table 4.3

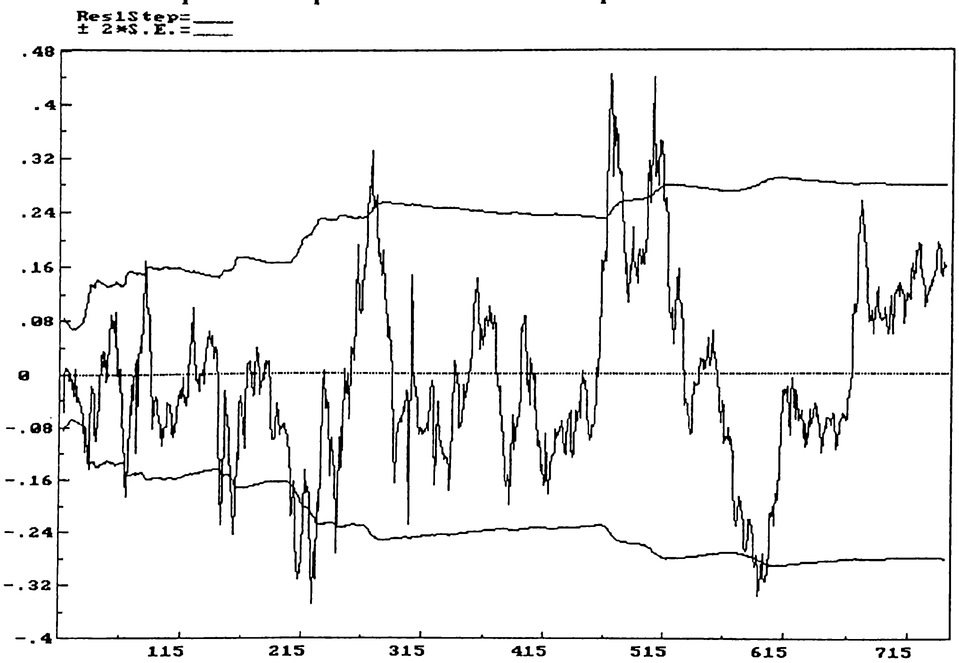

FIGURE 10-24

Graph of 1-step Residuals ± 2σ for Equation-24 in Table 4.3

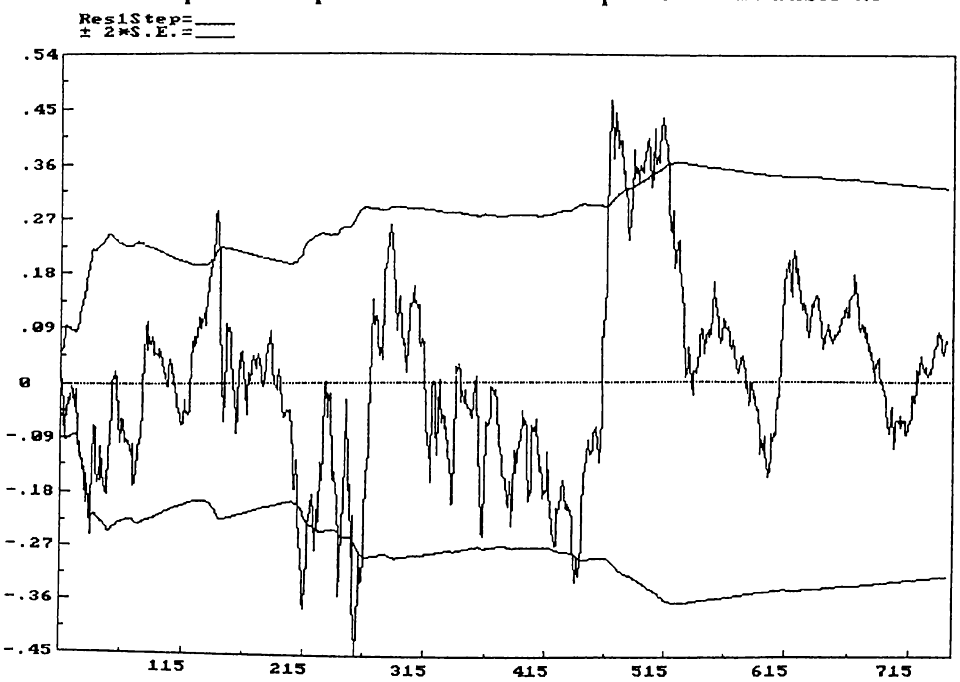

FIGURE 10-25

Graph of 1-step Residuals ± 2σ for Equation-25 in Table 4.3

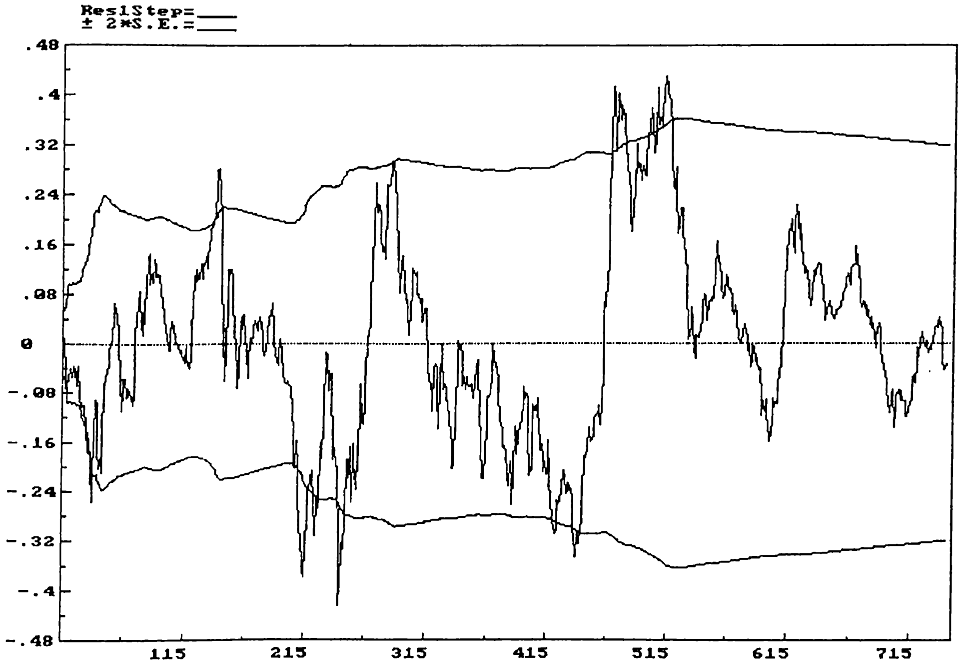

FIGURE 10-26

Graph of 1-step Residuals ± 2σ for Equation-26 in Table 4.3

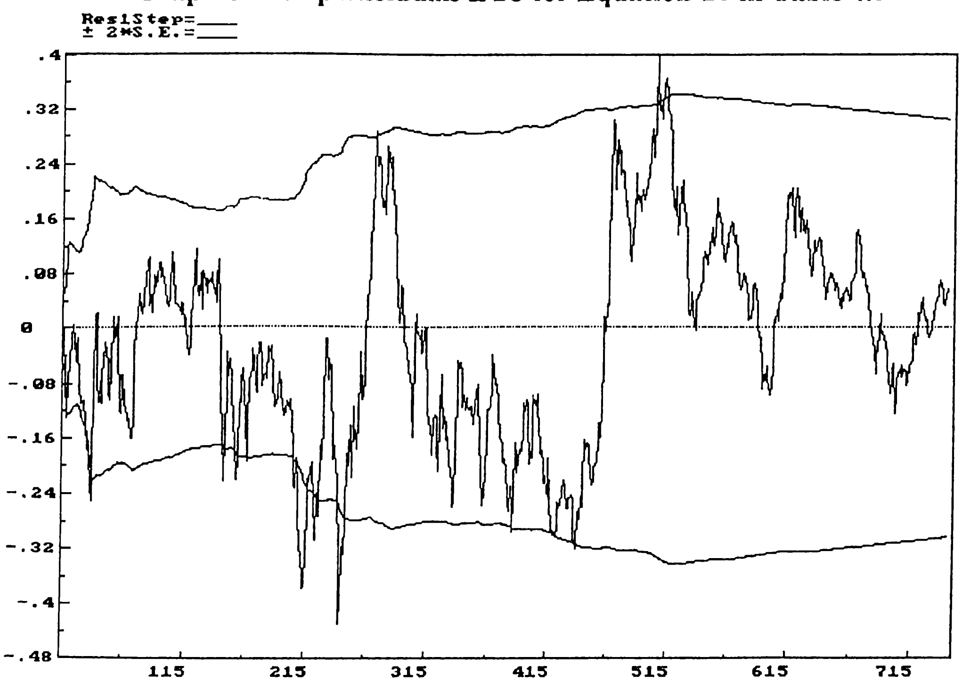

FIGURE 10-27

Graph of 1-step Residuals ± 2σ for Equation-27 in Table 4.3

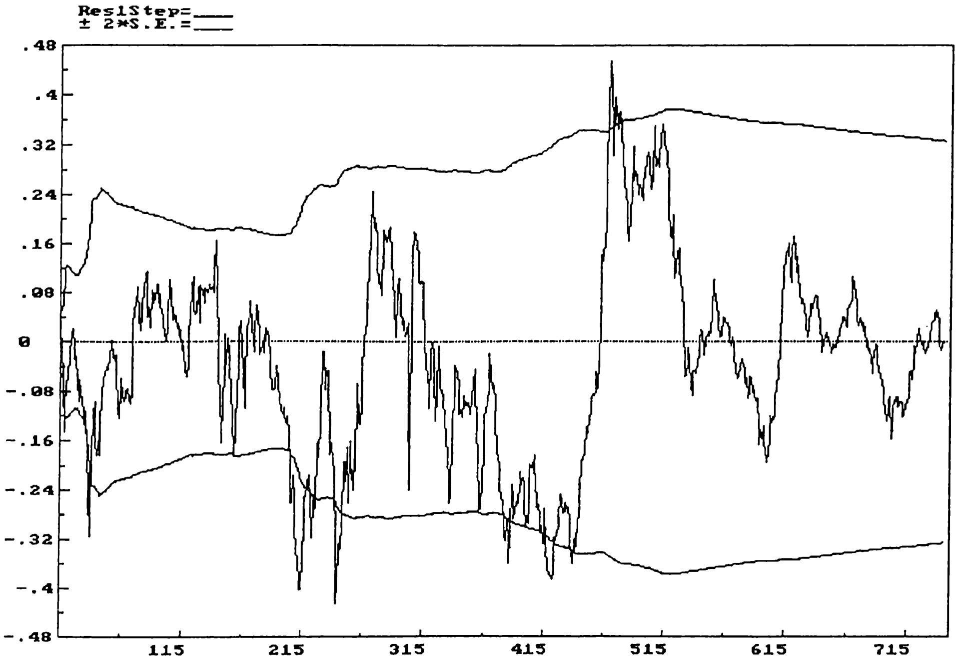

FIGURE 10-28

Graph of 1-step Residuals ± 2σ for Equation-28 in Table 4.3

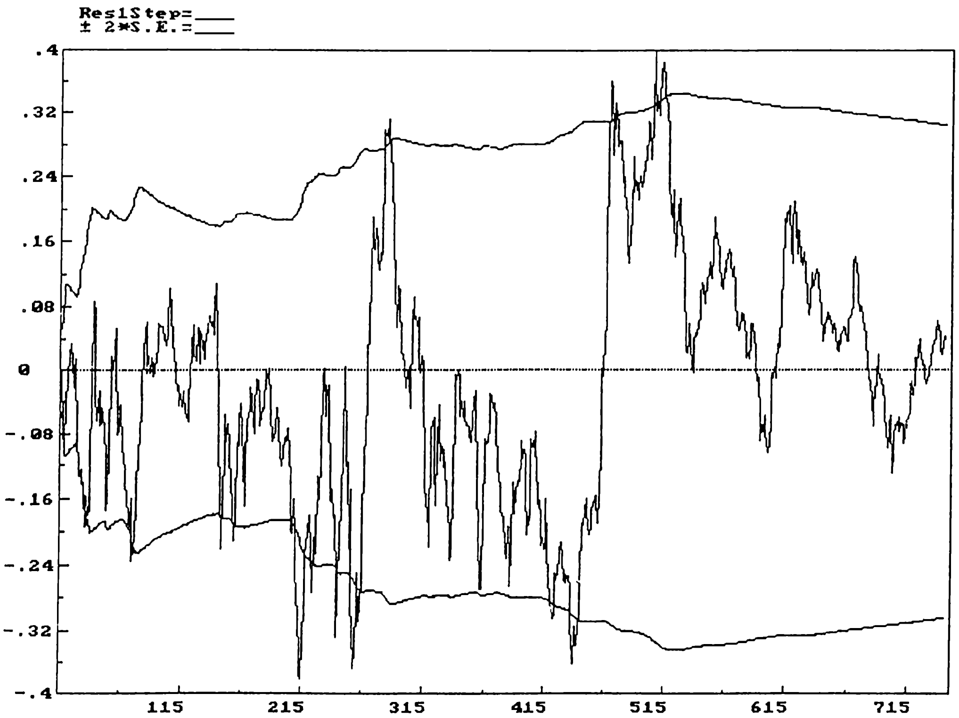

FIGURE 10-29

Graph of 1-step Residuals ± 2σ for Equation-29 in Table 4.3