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REAL STOCK PRICES AND THE DEMAND FOR MONEY IN SAUDI ARABIA

Key Words

Money demand; Money balances; Transactions; Stock Market; Stock prices; Income effect; Substitution effect; Financial development and innovation.

Abstract

Empirical research on money demand has long been concerned with the degree of substitutability between money and other capital assets and the impact on money holding of financial markets' development and financial innovation. Therefore, movements in stock prices may have two effects on money demand: wealth effect and substitution effect. The emergence of regulated stock market in Saudi Arabia and its rapid expansion has attracted considerable attention and involvement of the private sector. With quarterly data, this study attempts to determine whether there exists a stationary long run relationship between money demand and real stock prices in Saudi Arabia. By employing recent developments in econometrics methodology, the results obtained show that rising stock prices exert an impact on money demand (especially M2) driven by wealth effect. However, the substitution effect may occur, which may reduce money demand and raise the possibility to transfer them to interest bearing assets. Thus, it can be concluded that real money demand function requires the inclusion of real stock prices in the relationship.

Introduction

While the role assigned to money in economic strategy is primarily based on theoretical grounds, empirical evidence, together with conceptual considerations, may indeed play an important role in selecting the particular monetary aggregate that best serves the economic policy. Therefore, empirical research and studies on aggregate money demand have long been concerned with

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the degree of substitutability between money and other capital assets and the impact on money holding of financial markets development and financial innovations. Researchers have suggested that credit card use will reduce the household demand for transactions and precautionary balances. On the other hand, stock prices movements may have two opposing effects on money demand: a positive wealth effect and a negative substitution effect. The positive wealth effect may be due to the fact that increase in stock prices implies an increase in nominal wealth, producing a positive effect. In addition, stock prices increase may reflect an increase in the expected return from risky assets relative to safe assets. Moreover, stock prices increase may induce a rise in the volume of financial transactions that might require higher money balances in order to facilitate these transactions.

However, stock prices may impose a negative substitution effect on money demand. The substitution effect implies that as stock prices rise, equities become more attractive when compared to other components in a portfolio. This may cause a shift from money to stocks.

This issue is particularly relevant to the case of Saudi Arabia. Saudi Arabian financial system has undergone a structural change since early 1970's, and recently the Saudi Arabian financial market has witnessed increasing use of credit and debt cards that enabled individuals to economize on cash and money holdings.

Further, stock market development in Saudi Arabia provides important channels in mobilizing resources and allocating them to productive investment. Thus, the emergence of regulated stock market in Saudi Arabia in the early 1980's and its rapid expansion attracted considerable attention and involvement of the private sector.

The institutional and financial factors that systematically influence the demand for money in an economy over the entire course of its development include the emergence of a variety of nonblank financial intermediaries offering assets that potentially substitute for money. Therefore, the relation between the demand for money balances and its determinants is a fundamental building block in most theories of macroeconomic behavior and is a critical component in the formulation of monetary policy.

Given the dramatic and important changes in the financial sector in Saudi Arabia during the last three decades, the main purpose of this paper is to determine whether there exists a stationary long run relationship between money demand and real stock prices movements in Saudi Arabia. Thus, this study deals specifically with the expected impact of stock prices movements on money demand. Therefore, by using time series quarterly data for Saudi Arabia, the main objective is to determine the size and the direction of the hypothesized effect of stock prices on the demand for money. Another objective is to examine the temporal causality between the stock prices movements and the determinants of the long run real money demand.

Stock Market in Saudi Arabia

Prior to 1985, stock trading was not regulated by the authorities and more often than not, the buyer did reach the seller on individual base (Fifth Development Plan, 1990). However, by late 1970's and early 1980's about 80 stockbrokers were informally putting buyers and sellers of stocks in touch. These brokers had no licenses, capital or credentials. After the al-Mannakh crises in Kuwait in 1982, the lack of regulation with respect to organizing and monitoring trading activities drove the authority in Saudi Arabia to take regulatory actions. Thus, the stock market in Saudi Arabia was formally regulated in 1985 as an over the counter stock exchange, which was, compared to industrial and some developing countries, a recent development. Only Saudi Arabian nationals and recently citizens of the Gulf Cooperation Council are allowed to trade in shares of the Saudi Arabian publicly traded companies. Most companies that went public in Saudi Arabia were newly established corporations with large capital requirements and no operating history. The earliest publicly traded companies were in the cement and regional electricity industries, reflecting the phase of the development in the infrastructure in Saudi Arabia. The biggest jump in the number of publicly traded companies was in the period of 1976-1980 corresponding to a period of economic prosperity and growth in the country. During that period, nineteen new companies were offered to the public. An important feature of these stocks was the fact that the government insisted that these shares be offered at par value as a form of distributing to the public the newly acquired economic gains of the country. These instances of floatation resulted in a tremendous shareholders interest in the stock market and a large segment of the population became involved in buying and selling shares. Several more stocks were released in the market in 1981 when fifteen new companies in a variety of business were offered to the public. Currently the stock market is an over the counter trading system. There are about seventy companies with shares traded in the market. These companies are classified into six categories: Financial, Industrial, Cement, Services, Electricity, and Agriculture sectors. Late 2003 witnessed the addition of the newly established communication company to the service sector in the stock market.

An important step towards developing the financial market was taken with the issuance in 1988 of the government development bonds, thereby promoting the potential for both savers and individual investors to increase their participation in the process of the capital market development. By issuing these bonds the government was aiming at achieving two major objectives as stated by the Saudi Arabian Monetary Agency (SAMA) in its (1989) annual report:

1) to maintain an adequate and normal level of public spending following the sharp decline in oil prices and revenues, by resorting to domestic borrowing to ensure additional resources in order to complete development projects, and
2) to deepen the financial market in the country by creating secure investment instruments of reasonable yield to absorb national savings.

In addition, by November 1991, SAMA started issuing Treasury Bills (TB) with maturities of 4, 13, 25, and 52 weeks. The government continues to issue SR 1.5 billion weekly through SAMA. As of now, there is no secondary market for government bonds or TB's; they are sold to commercial banks and semi-government agencies. Even though corporate laws allow companies to issue bonds, no corporate bonds are issued by now.

Literature Overview

The research on money demand function assumes that there exists an underlying stationary long run equilibrium relationship between real money balances, real income or wealth, and the opportunity cost of holding real money balances. According to researchers, recent financial innovations such as electronic fund transfer system, bank credit card use, and cash management have reduced the demand for money (Garcia, 1977, 1978; Akhand and Milbourne, 1986; McNown and Wallace, 1992; and Duca, 1995b).

However, stock prices are usually not associated with money demand function. According to Friedman (1988), direct studies of the relationship between stock prices and money demand function are not very common, since stock prices are indirectly included in the total nonhuman wealth, which plays a role in money demand function. Accordingly, as Friedman (1988) has pointed out, movements in stock prices may have two kinds of effects on money demand: a positive wealth effect and a negative substitution effect. The positive wealth effect may be due to three different reasons. First, an increase in stock prices implies an increase in nominal wealth, thus producing a positive effect. Further, an increase in stock prices reflects an increase in the expected return from risky assets relative to safe assets. According to Friedman (1988), this change in relative valuation does not have to be accompanied by a decrease in risk aversion or an increase in risk preference. Thus, the resulting increase in relative risk may induce economic agents to hold larger amounts of safer assets, such as money, in their portfolio. Moreover, an increase in stock prices may induce a rise in the volume of financial transactions. Such an increase in financial transactions will require higher money balances in order to facilitate these transactions.

Stock prices also impose a negative substitution effect on money demand, which implies that as stock prices rise, equities become more attractive when compared to other components in a portfolio. Thus, there may be a shift from money to stocks. Therefore, the net effect of stock market prices on demand for money may be positive or negative.

In previous studies of the relationship between stock prices and money demand, stock prices are either related to the volume of transactions, or the return on securities is considered as a variable in the money demand function (Hamburger, 1966; Hamburger and Kochin, 1972; Hamburger and Keran, 1987; Keran, 1971; Field, 1984; Caramazza *et al.*, 1990; Duca, 1994, 1995a). However, Friedman (1988) provides a study of the direct relationship between stock prices and money demand. By using quarterly data from 1961 to 1986 and annual data from 1886 to 1985, he finds suggestive but non-conclusive results for the USA. Depending upon the time period and the data set, Friedman was able to find both the positive wealth effect and negative substitution effect.

Similar results were obtained by McCornac (1991) using Japanese data from 1975 to 1988. While these studies used standard normal regression procedures, Allen and Connolly (1989) used Bayesian model. However, these procedures are inappropriate if the data are non-stationary. Therefore, while in recent studies Mustafa *et al.*, (1999) used GARCH-M model, others such as Serletis (1993), Choudhry (1996), Muscatelli and Spinelli (1996), Ackert and Racine (1999), Ong and Izan (1999) and Coenen and Vega (2001) employed co-integration and error correction methods. Further, Muscatelli and Spinelli (2000) used co-integration, error correction and dynamic OLS (DOLS).

Methodology

According to economic theory and empirical studies (Friedman, 1988; Allen and Connolly, 1989; Boyle, 1990; Choudhry, 1996), money demand functions that include stock market prices may be represented as:

$$(M/P) = f(\, y, i, sp) \qquad (1)$$

This function states that the demand for real money balances (M/P), where M is nominal money and P is the price level, is positively related to real income (y), negatively related to the rate of interest (i), and may be positively or negatively related to stock prices (sp).

Several studies have examined time series variables properties and concluded that most macroeconomic time series data follow random walks. Nelson and Plosser (1982) and Hall (1978) show that major macroeconomic variables exhibit non-stationary behavior over time. Therefore, time series studies (Granger, 1986, Granger and Newbold, 1974, Phillips, 1986, and Ohanian, 1988) have demonstrated that if time series variables are non-stationary all regression results with these series will differ from the conventional theory of regression with stationary series. That is, regression coefficients with non- stationary series will be spurious and misleading (Granger, 1986; Engle and Granger, 1987; Schwert, 1987; and Johansen, 1991).

To avoid spurious relationships and misleading results and to provide valid evidence for the proper relationships between the variables, before proceeding to the cointegration analysis and the estimation of the long run relationship, time series properties of the individual variables should be examined by conducting stationarity or unit root tests.

Researchers have developed several procedures to test for the order of integration. Dickey and Fuller (1979, 1981) developed the augmented Dickey-Fuller (ADF) test, which relies on rejecting a null hypothesis of unit root (i.e., the series are non-stationary) in favor of the alternative hypothesis of stationarity:

$$\Delta Xt = \mu + (\alpha - 1)Xt - 1 + \sum_{t=1}^{n} \gamma t \Delta Xt - 1 + ut \qquad (2)$$

where, Xt is a random variable, Δ is first difference operator, ut is a stationary random error, t is time period and n is number of lags for the dependent variable which is chosen to ensure that the residuals are white noise. The critical values for t-statistics to test the null hypothesis do not have the familiar distribution. Thus, several authors have constructed appropriate critical values for the distribution of the t-statistics (i.e., Fuller, 1996; MacKinnon, 1991).

To determine the proper lags for each variable, the Akaike's final prediction error criterion (FPE) is used as suggested by Hsiao (1979, 1981).

However, the ADF test involves the inclusion of extra differenced terms in the testing equation which result in a loss of degrees of freedom and a resultant of reduction in the power of testing procedure. Alternatively, the Phillips Perron approach (PP), Phillips (1987) and Phillips and Perron (1988), allows for the presence of unknown forms of autocorrelation and conditional heteroscdasticity in the error term. Perron (1988) demonstrates that if a series is stationary about a linear trend but no allowance for this is made in the construction of the unit root test, then the probability of a type II error will be high. Thus, Perron (1988) suggests estimating the following regression by ordinary least squares,

$$Xt = \mu + \lambda(t\text{-}T/2) + \delta Xt\text{-}1 + ut \qquad (3)$$

In conducting co-integration tests, the multivariate cointegration method developed by Johansen and Jueslius (Johansen, 1988, 1991; Johansen and Jueslius, 1990) is used in this study to test the hypothesis of a stationary long run money demand function. Vector error correction models are applied towards the study of the temporal causality between money demand determinants and the real money stock.

The concept of cointegration put simply, two or more non-stationary time series are cointegrated if a linear combination of these variables is stationary. Thus, if the money demand function describes a stationary long run relationship among real money balances, real income, the opportunity cost of holding money and real stock prices, it can be interpreted to mean that the stochastic trend in real money balances is related to the stochastic trends in real income, the opportunity cost of holding money, and real stock prices (Dickey *et al.*, 1991; Dickey and Rossana, 1994).

Cointegration also implies that the transitory components of the series can be given a dynamic specification by means of the error correction models. In other words, a constrained error correction model that captures the short run dynamic adjustment of cointegrated variables can be applied (Engle and Granger, 1987; Miller and Russek, 1990; and Miller, 1991).

The Johansen-Jueslius approach is preferred to the Engle-Granger (1987) method because the Engle-Granger co-integration procedure suffers from several econometric shortcomings. Banerjee *et al*., (1986); Banerjee *et al*., (1993), Davidson and MacKinnon (1993), and Stock (1987) have shown that there is a considerable small sample bias in estimates derived from the Engle-Granger procedure. In addition, Davidson and MacKinnon (1993:724) contend " a relatively low value of R-squared from the co-integration regression should be taken as a warning that the two step procedure may not work well."

Further, Engle-Granger method employs ordinary least squares estimation (OLS) to derive the parameter estimates of the long run or co-integration equations. However, OLS estimates are extremely sensitive to the arbitrary normalization implicit in the selection of the dependent variable in the co-integration regression equation (Enders, 1995; Banerjee *et al*., 1993, Muscatelli and Hun, 1992).

In addition, Engle-Granger procedure does not incorporate short-term dynamics in the co-integrating regression and does not enable the researcher to test for various restrictions or exclusions on individual elements of observed co-integrating vectors.

On the other hand, the Johansen-Jueslius approach is able to overcome Engle-Granger method's shortcomings and provides a very flexible format for investigating the properties of the estimators. It is also capable of determining the number of co-integrating vectors in the relationship. Banrjee *et al*., (1993), Cuthbertson *et al*., (1992) and Gonzalo (1994) have shown that it performs better than other estimators and is the most powerful even for bivariate system.

The Johansen-Jueslius method applies the maximum likelihood procedure to determine the presence of cointegrating vectors in non-stationary time series, where they provide two different tests to determine the number of cointegrating vectors. The Johansen-Jueslius approach to testing for cointegration considers p-dimensional vector auto-regression (VAR) model:

$$\mathrm{Xt} = \Pi 1Xt - 1 + \ldots + \Pi\mathrm{kXt\text{-}k} + \varepsilon\mathrm{t} \quad (4)$$

This autoregressive model may be written as conventional error correction model as follows:

$$\Delta\mathrm{X\ t} = \mu + \Sigma\Gamma\mathrm{t}\ \Delta\mathrm{X\ t} - 1 + \ldots.. + \Pi\mathrm{kXt\text{-}k} + \varepsilon\mathrm{t} \quad (5)$$

Where: $\Gamma = -1 + \Pi 1 + \ldots\ldots + \Pi\mathrm{t}$

and $\Pi = \Pi 1 + \mathrm{t} - \ldots\ldots\ldots\ldots - \Pi\mathrm{k}$

The Π matrix contains information about the long run relationship between the variables. Let the rank of Π matrix be denoted by r; when $0 < 1 < \mathrm{p}$, the Π matrix may be factored into $\alpha\beta'$, where α may be interpreted as p x r matrix of error correction parameters and β as p x r matrix of co-integration vectors. The vector of constants, μ, allows for the possibility of deterministic drift in the data series. Maximum likelihood estimates of α, β and Γ are derived in Johansen (1988). To test the hypothesis that there are at most r co-integrating vectors, one calculates the trace statistic (λtrace). The maximum eigenvalue test (λmax) is based on the null hypothesis that the number of co-integrating vectors is r against the alternative of r + 1 co-integrating vectors. Johansen and Jueslius (1990) provide appropriate critical values for (λtrace) and (λmax) statistics and MacKinnon (1991) and Osterwald-Lenum (1992) developed extended versions of these critical values.

Another and more robust method (particularly in small samples) proposed by Stock and Watson (1993), which also corrects for possible simultaneity bias among the regressors, involves estimation of long run equilibria via dynamic OLS (DOLS). Stock and Watson (1993) suggest a parametric approach for estimating long run equilibria in systems that may involve variables integrated of different orders but still cointegrated. The potential of simultaneity bias and small sample bias among the regressors is dealt with by the inclusion of lagged and lead values of change in the regressors. The procedure advocated is similar to estimators proposed by Phillips and Loretan (1991), Phillips and Hansen (1990) and Park (1992); however, DOLS is preferred due to its favorable performance, as well, in small samples. Stock-Watson (1993) Dynamic OLS (DOLS) is as follows:

$$\begin{aligned}(M/P)t = \underset{j=m}{B'Xt} + \sum_{j=-k}^{J=k} \eta j\Delta yt\text{-}j + \sum_{j=l}^{j=l} \lambda\Delta it\text{-}j \\ + \sum_{j=m} \xi j\Delta spt\text{-}j + \varepsilon t \qquad (6)\end{aligned}$$

$$B = [c,\alpha,\beta,\theta]', X = [1, yt, it, spt]$$

In estimating the long run parameters of the money demand function, the DOLS basically involves regressing any I(1) variables on other I(1) variables, any I(0) variables and leads and lags of the first differences of any I(1) variables. These estimates will facilitate inferences made for the long run. Robust standards errors are derived via the procedure recommended by Newey and West (1987).

Data and Empirical Analysis

This study utilizes time series data for Saudi Arabia. It uses quarterly data covering the period 1985:1-2000: 4. All variables are in real terms and transformed to log terms.

Although real Gross National Product (GNP) is a good indicator of the overall level of income and wealth, it could be argued that, for Saudi Arabia, this variable does not accurately reflect the level of economic activity within the economy. This may be attributed to the economy's reduced ability to influence the oil production level and the price of oil in international markets. With the extraction and export of oil production being the dominant component of GDP and government revenue, a large part of the economic activity within the country is determined outside its system and has very little control over it. Therefore, as Saudi Arabia is an oil-based economy, in which most economic activities are linked to oil, it is generally believed that this basic and important characteristic has a bearing on every aspect of economic activity. While during the last two decades, the significance of oil in the economy has declined, it remains the dominant sector, that is, high correlation between oil-GDP and other variables may exist, thus, to minimize these effects it is preferred to use non-oil GDP. In addition, the use of GDP instead of GNP is supported by the fact that Saudi Arabia does not publish data on GNP. Thus, for this study non-oil GDP represents income. Data on this variable are obtained from Ministry of Planning 'Facts and Figures' different issues.

According to Saudi Arabian Monetary Agency (SAMA), money balances are defined as follows: M1 = currency in circulation + demand deposits; M2 = M1 + savings and time deposits; and M3 = M2 + quasi-money. It is possible that the use of one definition such as M2 is appropriate; however, M2 may not be a good policy measure since economic agents in Saudi Arabia often use cash more frequently. Thus the three definitions of money are used to examine and test the hypothesis in this study. Data on money balances, interest rate and stock prices are obtained from SAMA quarterly reports' different issues.

Empirical results are included in tables 1-5. Table 1 presents the results of the Augmented Dickey-Fuller

Table 1
Unit Roots Tests

Variables	ADF		PP	
	Levels	Differenced	Levels	Differenced
lnY	-0.829	-1.631	-0.676	-12.571*
lnM1	-1.510	-6.861*	-1.344	-8.4619*
lnM2	-2.553	-8.108*	-3.792*	-14.382*
lnM3	-0.831	-7.097*	-0.698	-7.4887*
lnSP	-2.046	-5.383*	-2.279	-7.631*
INT	-1.551	-3.693*	-1.827	-6.1317*

(ADF) and Phillips-Perron (PP) stationarity tests, where the results for both ADF and PP tests reveal that they, except M2 which is I(0) in PP test, are non-stationary in their level terms; however, with first differences they become stationary, i.e., they are I(1). Results of the Johansen-Jueslius cointegration tests appear in Table 2 and reveal that the variables are cointegrated, especially with M1 and M2, thus the presence of co-integration indicates that a long run stable relationship exists between the variables, and we can reject the null hypothesis of no co-integration.

According to Engle and Granger (1987), a system of co-integrated variables can be represented by a dynamic error correction model. Thus we proceed to test for error correction by using the Johansen-Jueslius vector error correction method (VEC) and Table 3 shows the results. The coefficients of VEC term, which range between 0.19 and 0.82, reflect the process by which the dependent variable adjusts in the short run to its long run position. This VEC term provides also a channel through which Granger causality can occur in addition to the traditional channel through lagged independent variables (Granger, 1986). Thus, these results give the direction of causality and the speed of short run dynamic adjustment of the variables to the long run equilibrium, within a quarter in the case of M2, and takes longer to adjust in the case of M3.

Table 2
Johansen-Jueslius Cointegration Tests

Eigen Values	λtrace	5% for λtrace	Hypothesis
lnM1 = f (Yt. i, SP)			
0.319	47.383	54.64	r < 0***
0.216	26.406	34.55	r < 1***
0.151	13.261	18.17	r < 2***
0.080	4.455	3.74	r < 3**
lnM2 = f (Yt, i, SP)			
0.4574	61.685	54.64	r < 0*
0.2450	28.670	34.55	r < 1***
0.1505	13.492	18.17	r < 2***
0.0831	4.687	3.74	r < 3**
lnM3 = f (Yt, i. SP)			
0.3563	40.238	39.89	r < 0**
0.1886	16.446	24.31	r < 1
0.0656	5.163	12.53	r < 2
0.0274	1.500	3.84	r < 3

Table 3
Error Correction Results

$\Delta lnM1t = 0.0146 + 0.071\Delta lnM1t\text{-}1 + 0.207\Delta lnM1t\text{-}2 + 0.001\Delta lnYt\text{-}1 + 002\Delta lnYt\text{-}2$

(1.25) (1.394) (1.768)*** (1.66)*** (1.78)***

$-0.194\Delta INTt\text{-}1 \text{--}0.244\Delta INTt\text{-}2 + 0.0079\Delta lnSPt\text{-}1 \text{--}0.49\Delta lnSPt\text{-}2 \text{--}0.69VECt\text{-}1$

(-1.958)** (-1.235) (1.60)*** (-1.798)** (-3.210)*

Adj-R-sq. = 0.271, F = 3.596**; log like = 105.402; AIC = -3.562, SC = -3.153

$\Delta lnM2t = 1.56 + 0.008\Delta lnM2t\text{-}1 + 0.025\Delta lnM2t\text{-}2 + 0.322\Delta lnYt\text{-}1\text{-}0.69\Delta lnYt\text{-}2$

(0.33) (0.0578) (0.1502) (1.604)*** (0.947)

$-24.5\Delta INTt\text{-}1\text{-}27.9\Delta INTt\text{-}2 + 5.64\Delta lnSPt\text{-}1\text{-}1.91\Delta lnSPt\text{-}2 \text{--}0.82VECt\text{-}1$

(-1.692)*** (-0.1989) (1.1098) (-0.351) (-3.03)*

Adj.R-sq. = 0.415, F = 2.984***, Log Like. = -214.08, AIC = 8.493, SC = 8.902.

$\Delta lnM3t = 0.546 + 0.076\Delta lnM3t\text{-}1 \text{--}0.251\Delta lnM3t\text{-}2 + 0.228\Delta lnYt\text{-}1 - 0.158\Delta lnYt\text{-}2$

(0.34) (0.5549) (-1.92)** (2.335)**. (0.532)

$-0.050\Delta INTt\text{-}1 + 0.149\ \Delta INTt\text{-}2 + 0.0333\Delta lnSPt\text{-}1\text{--}0.01\Delta lnSPt\text{-}1\text{-}0.193VECt\text{-}1$

(-0.069) (0.2163) (1.751)*** (-0.497) (-2.77)*

Adj.R-sq. = 028, F = 2.148*** , Log. Like = 122.60, AIC = -4.287, SC = -3.952.

Table 4
Stock-Watson Dynamic OLS Results

Variables	Estimates (With 1 lag)		
	M1	M2	M3
Constant	-0.186 (-0.393)	0.026 (0.029)	0.177 (0.418)
lnYt	0.874 (10.06)*	0.909 (5.445)*	0.922 (11.916)*
INT	-0.811 (-1.28)	-0.439 (-0.361)	-0.549 (0.976)
lnSP	0.1016 (2.351)**	0.013 (0.153)	0.0404 (1.050)
ΔlnYt	-0.554 (-2.015)**	-1.233 (-2.33)**	0.760 (3.100)*
ΔINT	-0.295 (-0.443)	-0.707 (-0.527)	-0.200 (-0.322)
ΔlnSP	-0.079 (-1.394)	0.165 (1.516)***	-0.038 (-0.745)
ΔlnYt-1	-1.908 (-1.965)**	0.216 (0.068)	0.876 (1.013)
ΔlnYt+1	0.085 (0.4028)	-0.221 (-0.588)	0.077 (0.455)
ΔINTt-1	-0.168 (-0.263)	-0.606 (-0.493)	-0.150 (-0.262)
ΔINTt+1	0.249 (0.403)	-0.717 (-0.604)	-0.151 (-0.275)
ΔlnSPt-1	-0.009 (-0.160)	0.135 (1.297)	0.0166 (0.344)
ΔlnSPt+1	-0.018(-0.323)	0.083(0.773)	0.006-(0.113)
Adj. R-sq. =	0.714,	0.538	0.790
F =	11.821*	3.88*	17.123*
Log Like =	76.372,	41.739	82.506
AIC =	-2.391,	-1.085	-2.623
SC =	-1.908.	--0.601	-2.1396

cont. Table 4
Stock-Watson Dynamic OLS Results

Variables	Estimation (with 2 lags)		
	M1	M2	M3
Constant	-0.547 (-0.942)	0.350 (0.293)	0.042 (0.082)
lnYt	0.944 (8.834)*	0.842 (3.825)*	0.947 (9.994)*
INT	-1.242 (-1418)	-1.573 (-0.872)	-0.369 (-0.475)
lnSP	0.080 (1.383)	0.080 (0.671)	0.0465 (0.907)
ΔlnYt	-1.579 (-1.60)***	0.300 (0.141)	0.716 (0.787)
ΔINT	-0.915 (-1.136)	-1.150 (0.693)	-0.255 (-0.357)
ΔlnSP	-0.098 (-1.63)***	0.180 (1.600)***	0.0447 (0.834)
ΔlnYt-1	-1.238 (-1.157)	0.869 (0.395)	0.629 (0.663)
ΔlnYt-2	-1.498 (-1.401)	1.782 (0.809)	1.025 91.08)
ΔlnYt+1	0.376 (1.226)	0.532 (0.841)	0.120 (0.44)
ΔlnYt+2	0.208 (1.056)	0.186 (0.461)	-0.0157 (-0.459)
ΔINTt-1	-0.280 (-0.365)	-1.384 (-0.880)	-0.030 (-0.045)
ΔINTt-2	-0.360 (-0.503)	-0.420 (-0.285)	-0.130 (-0.204)
ΔINTt+1	0.432 (0.645)	-0.344 (-0.250)	-0.498 (-0.838)
ΔINTt+2	-0.986 (-1.289)	-0.423 (-0.269)	-0.344 (0.508)
ΔlnSPt-1	-0.040 (-0.700)	0.165 (1.600)***	0.0180 (0.340)
ΔlnSPt-2	-0.060 (-1.083)	0.025 (0.221)	0.030 (0.608)
ΔlnSPt+1	-0.049 (-0.697)	0.156 (1.085)	0.019 (0.299
ΔlnSPt+2	-0.037 (-0.555)	0.206 (1.600)***	0.0103 (0.173)
Adj. R-sq. =	0.714	0.561	0.772
F =	7.94*	2.272**	10.401*
Log Like =	78.864	42.029	84.977
AIC =	-2.348	-0.903	-2.587
SC =	-1.628	-0.183.	-1.868

Numbers in parentheses are t-statistics

Table 4 presents the results of Stock-Watson Dynamic OLS results, for M1, M2, and M3. The choice of the number of lags in this test is based on the significance of the lag; however, it was found that lags beyond 2 are not important. Thus, the choice was between 1 and 2 lags. The DOLS results give support to the cointegration results. The results also reveal that there is a substitution effect between M1 and stock prices. This may be due to the fact that people (economic agents) hold more cash in their portfolio, thus stock prices movements cause a shift from cash and demand deposits to earnings bearing equities. On the other hand, it seems that there is a positive relationship between M2 and sock price. These relationships are found in cases when using one or two lags.

Table 5 shows the results of an OLS regression supporting other tests findings that stock prices movements can affect money demand. These results also show that income elasticity is closer to unity in both DOLS and OLS.

Hence, it seems that rising stock prices can exert an impact on money demand (especially M1 and M2) driven by the increase in volume of transactions, besides the typical wealth effect in the net worth of economic agents. However, the substitution effect may occur at the beginning of a bullish period when a shift in portfolios from cash to stocks and equities occurs. This may be attributed to the high activities in the Saudi Arabian stock market witnessed during 1980's. But, when a bubble builds up the opposite can be true, even if prices are rising. This can be seen from the signs on the lags' effects on the results. It could be also that at the beginning of the positive trend, the hypothesized transfer from cash to shares occurs, but after a period of continuous increase it may be that agents prefer returning to safe assets, having benefited from consistent capital earnings.

Further, the problem of parameters non-constancy and the stability over the sample period was assessed and tested by using the Cumulative Sum of Squares (CUMSUM) tests for the equations in Table 5 (M1; M2; M3) and presented in figures 1-3. This test is based on the recursive regression method suggested

Table 5
OLS Regression Results

Variables	ln M1	ln M2	ln M3
Constant	0.394	0.4282	0.5087
	(0.573)	(1.049)	(1.275)
Ln Yt	0.844	0.762	0.8632
	(6.789)*	(10.298)*	(11.953)*
lnSP	-0.016	0.0756	0.0122
	(-0.282)	(2.203)**	(0.365)
lnINT	-0.272	-0.263	-0.264
	(-0.3609)	(-0.585)	(-0.601)
Adj. R-sq =	0.444	0.664	0.7203
F =	15.616*	37.256*	48.205*
Log Like =	39.04	68.0624	69.0624
AIC =	-1.251	-2.288	-2.337
SC =	-1.107.	-2.143	-2.1926

Numbers in parentheses are t-statistics.

by Brown *et al*., (1975). The figures plot the CUMSUM statistics, which are based on the residuals of the recursive regressions together with lines drawn at the percent level of significance. If either of the bordering lines is crossed, the null hypothesis that the regression model is correctly specified is rejected at the 5 percent level of significance.

Figure 1

Plot of Curnulative Sum of Squares of Recursive Residuals of Equation with (M1)

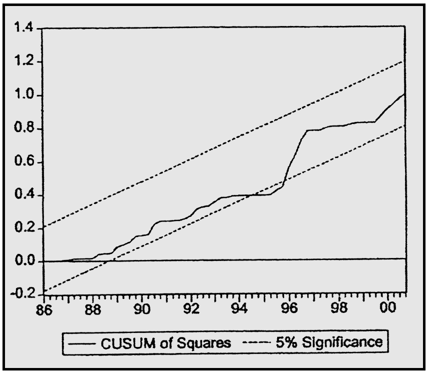


Figure 2

Plot of Curnulative Sum of Squares of Recursive Residuals of Equation with (M2)

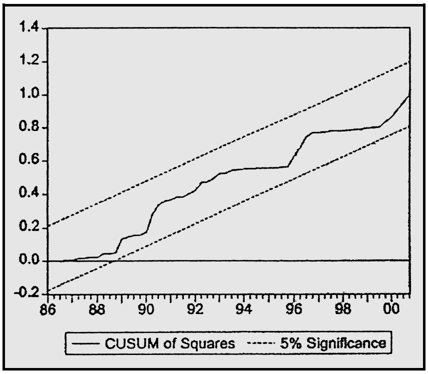
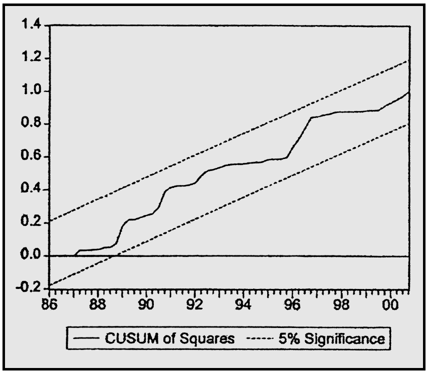


Figure 3

Plot of Curnulative Sum of Squares of Recursive Residuals of Equation with (M3)



Brown *et al*., (1975) argued that this test is useful in situations where the departure from constancy of regression coefficient is haphazard and sudden. It appears from figures 2 and 3 that the CUMSUM of models (M2 and M3) are inside the critical lines. However, figure 1 shows that the squares of the recursive of residuals of model (M1) crossed the critical lines during the 4^{th} quarter of 1994 and 1995 then returned to its pre 4^{th} quarter 1994 level, which suggests that the break is a temporary occurrence. Therefore, this valuation of the hypothesis may be attributed to a reflection of greater financial sophistication, more accelerated financial innovations, developments of the Saudi Arabian financial sector, and greater involvement in stock market activities.

Conclusion

This paper provides an examination of the relationship between the long run money demand function and stock market prices in Saudi Arabia. Three different definitions of money (M1, M2, M3) are used in the study. The Johansen-Juesluis procedure of cointegration is used to test the hypothesis of a stationary relationship between real money balances, real income, the opportunity cost of holding money and real stock prices. Stock-Watson Dynamic OLS procedure is also used to test the relationship. Finally an OLS regression is conducted. The results show that stock prices have effects on the demand for money, especially M2.

The results also show that stock prices movements affect money demand. These results seem to show that rising stock prices can have an important impact on money demand driven by the increase in the volume of transactions and wealth effect. Further, the substitution effect may occur after a period of continuous increase in stock prices.

These findings have important policy implications, since the substitution effect may reduce money demand, especially M1, and raise the possibility that the household may transfer M1 to interest bearing assets. This action has implications for the rest of the economy. It can imply a reduction in interest rates and a concomitant stimulation in consumption, investment, and GNP. This may in turn increase the velocity of money, the demand for goods, and the price level.

Thus, it can be concluded that real money demand function (especially with M1 and M2) requires the inclusion of real stock prices in the relationship. In this case, vector error correction models were applied to investigate the temporal causality between the real money balances and real money demand determinants, including real stock prices, and also to show the speed of adjustment to the long run equilibrium. These results (Table 3) indicate that causality runs from real money determinants to real money demand.

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الملخص

أسعار الأسهم الحقيقية والطلب على النقود في المملكة العربية السعودية

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الدراسات والبحوث الإحصائية المطبقة في مجال الطلب على النقود تهتم بالعلاقة التبادلية بين النقود والأدوات المالية وتأثير ذلك على الاحتفاظ بالأوراق المالية، وتطورات أسواق رأس المال والابتكارات المالية. ولكن توضح بعض الدراسات أن حركة أسعار الأسهم يمكن أن تؤثر على الطلب على النقود من ناحيتين: تأثير الثروة أو التأثير التبادلي. وقد أدى تأسيس السوق السعودية للأسهم وتنظيمها وتطورها السريع إلى لفت انتباه القطاع الخاص، ودفعه للمشاركة الفعلية في التداولات في هذا السوق. باستخدام بيانات إحصائية ربع سنوية، هذه الدراسة تحاول أن تستقصي مدى وجود علاقة طويلة الأجل بين الطلب على النقود والأسعار الحقيقية للأسهم في المملكة. وباستخدام الطرق الحديثة في الاقتصاد القياسي توضح النتائج التي تم التوصل إليها أن ارتفاع أسعار الأسهم يؤثر في الطلب على النقود (خصوصاً M2) عن طريق الزيادة في النقود المخصصة للتعاملات، التأثير المباشر لعامل الثروة. أيضا قد يظهر التأثير التبادلي الذي يخفض الطلب على النقود، أي على إمكانية تحويل هذه النقود إلى أدوات مالية لها مردود. لهذا، فإنه يمكن استنتاج أن دالة الطلب على النقود يجب أن تحتوي أسعار الأسهم الحقيقية بوصفها أحد المتغيرات المهمة في تحديد الطلب على النقود.

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