On the nexus between Stock Market Fluctuations and the Demand for Money in Saudi Arabia

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Abstract

This research paper estimates the augmented money demand function for Saudi Arabia while incorporating stock prices as one of the key determinants and utilizing quarterly data spanning over the period of 2010-2018. The estimated money demand function coincides with theoretical expectation regarding income and interest rate over long run. In Particular, the demand for money is statistically significant and positively related with income while it's negatively related with interest rate. On stock prices, the findings suggest that they are statistically significant and have positive impact on money demand over the long run. Moreover, the estimated error correction model indicates that it takes money demand about two quarters to adjust to its equilibrium condition.

Keywords: stock prices, money demand, Cointegration, Saudi Arabia, ECM

1. Introduction

Money demand remains as one of the most important topics in monetary economics that has been under investigations intensively from researchers and policymakers. Therefore, there has been a vast literature, theoretically and empirically, attempting to comprehend the dynamics of money demand and identify its key determinants. The prevailing empirical research points out to essential factors other than those specified by theories contributing to explaining the behavior of money demand. For instance, oil prices, exchange rate, asset prices, and inflation are key elements explaining the variation in money demand in selected economies as empirical evidence shows on different countries. An additional factor affecting the demand for money being identified by Friedman (1988) is stock price that might have a positive or negative impact on money demand.

Based on Friedman's argument, the positive impact of stock prices on money demand comes from three channels. First, rising stock prices may generate additional wealth notably when the income generated from these stocks being sorted. Secondly, higher returns of stock prices could encourage people to demand more money, especially when these returns are expected to be persist. The last channel could be through the increase of stock prices that may lead to higher volume of financial transaction leading to higher demand for money in order to facilitate such transactions. Conversely, the negative association between stock price fluctuations and the demand for money, according to Friedman (1988), might be observed when stock prices booming discourage people to demand money. In other words, people would prefer to keep their stocks instead of holding money. To this point, the impact of stock price variations on money demand seems to be undetermined from theoretical perspectives, and hence warrants further empirical evaluation.

Therefore, some economists follow the steps of Friedman (1988) by augmenting stock prices as a key determinant of money demand. Their empirical evidence seems to vary from an economy to another depending on the structure of these economies. Nonetheless, money demand literature for Saudi Arabia does not consider the role of stock prices in capturing changes in money demand.

Henceforth, the main objective of this study is to analyze whether stock market has a positive or negative impact on the demand for money in Saudi Arabia. This is important for policymakers especially after the inclusion of the Saudi stock market on emerging market indices by FTSE Russell as well as the inclusion of the Saudi stock market on the MSCI (Modern Index Strategy Indexes) and S&P DJI (Standard and Poor Down Jones Index) during 2019. In other words, understanding money demand is vital since it helps monetary policymakers in designing the appropriate policies and conducting timely intervention. For this reason, it is important before estimating money demand function to ensure that it is specified correctly.

The reminder of this this research paper is outlined as follows. Section 2 provides a theoretical foundation followed by literature review in section 3. The employed dataset is

contained in section 4, while the utilized empirical analysis is presented in section 5. The conclusion of the paper is contained in section 6.

2. Theoretical Background

Most theories, when modeling money demand, consider a scale variable for economic transaction and an opportunity cost measure of holding money as key determinants of money demand as documented by Ericsson (1998). In particular, the specification of real money demand function in the long run takes the following form.

$$\frac{M}{P} = f(Y, OC) \tag{1}$$

where $(\frac{M}{P})$, M, P, Y, OC denote the real money balance, monetary aggregate, price level, a scale variable measuring real economic transactions, and the opportunity cost of holding money representing the anticipated returns from holding financial assets, respectively. According to Dobnik (2013), modelling the demand for money in terms of real money balance, as equation (1) shows, has some benefits. First, the demand for nominal money is expected to adjust fully to variation in price level over the long run. This in turn would lead to the preferred level of real money balance to remain unchanged implying the validity of long-run price homogeneity assumption as indicated by most theories. In addition, assuming the validity of long run homogeneity would mitigate the probability of identification problem between money supply and money demand that may occur.

Although, this specification of money demand function is the most widely used form, other empirical studies utilize additional variables (e.g. exchange rate, inflation rate, oil prices, housing prices, etc.) due to their essential role in explaining money demand dynamics. In addition, economists such as Friedman (1988) augmented money demand function with stock prices as a measure of wealth. In accordance with Friedman (1988), the impact of stock prices on money demand might be either a positive wealth effect or a negative substitution effect. With regards to the positive impact, it occurs based on alternative cases as indicated by Friedman. The first case, higher stock prices may generate more wealth. An additional case shows that rising stock prices may reflect higher anticipated returns on risky assets compared to safe assets. In last case, an acceleration of stock prices might be associated positively with the volume of financial transaction, reflecting higher demand for money to facilitate such transactions. Conversely, the negative substitution effect of higher stock prices might diminish the demand for money since it becomes less attractive. In sum, assessing the net impact of higher asset (stock) prices on the demand for money is ambiguous and need to be determined empirically. Following the seminal research of Friedman (1988), some empirical studies (e.g. Choudhry 1996, Hsing 2007, and Lee & Chang 2008) consider stock price as an additional and influential determinant for money demand. Therefore, we follow the mainstream of the literature by augmenting equation (1) with stock prices as an additional element capturing the behavior of money demand as follows.

$$\frac{M}{P} = f(Y, OC, SP) \tag{2}$$

where Y denotes the real non-oil gross domestic product as a scale variable measuring real economic transactions. For the OC, the opportunity cost of holding money representing the anticipated returns from holding financial assets, measured by domestic interest rate; SP refers to the stock prices. Equation (2) could be expressed in the following form after taken the natural logarithm form for all variables with the exception of the interest rate.

$$\ln\left(M_t^d\right) = \beta_0 + \beta_1 \ln(Y_t) + \beta_2 i_t + \beta_3 \ln(SP_t) + e_t \qquad (3)$$

where e_t represents the error term, while the estimated coefficients are β_0, β_1, β_2, and β_3. According to economic theory, the expected signs for income elasticity and opportunity cost of holding money as proxied by interest rate are expected to be positive and negative respectively. However, the expected sign for stock prices might be positive or negative according to Friedman (1988).

3. Literature Survey

Broadly speaking and given the widespread interest, empirical work on money demand is not new to the economic literature and it has been largely conducted. For example, Banafea (2012) intensively covers several money demand literature reviews, reflecting both theoretical and empirical perspectives, in which various determinants for money demand were explored. The most common determinants for money demand are income and the opportunity cost of holding money. However, other empirical studies for various economies tend to embed alternative factors due to their influential impact. Such factors include inflation (e.g. Alkaswani & Al-Towaijri 1999; Bahmani 2008), exchange rate (e.g. Bahmani-Oskooee & Shabsigh 1996, Bahmani 2008), oil prices (e.g. Alsamara et al. 2017), and stock prices (e.g. Boyle 1990; Hsing 2007; Lee & Chang 2008; De Bondt 2009).

To be in line with the main objective of this paper, there has been an ongoing research investigating the effects of stock market volatility on the demand for money in advanced, emerging, and developing countries, in which the impact varies depending on the structure of the economy. For example, by relying on German data from 1960 to 1989, Thornton (1998) finds empirical evidence supporting the notion of positive impact of stock market variations on the demand for money. Likewise, Mwanzia et al. (2015) attempt to assess the effects of stock market variations on the demand for money using quarterly data for the period 1996-2011 for the case of Kenya. Their empirical analysis reveals that higher stock prices tend to increase the demand for money. However, the findings of Kumari and Mahakud (2012) indicate the negative association between money demand and stock prices in India by employing monthly data covering the period of 1996-2010. Boon and Nood (2008) investigate the response of money demand function to various determinants including stock prices in the euro area by utilizing quarterly data going back to 1970 until 2004. Their conclusion shows the negative impact of equity prices on money demand. For the case of Malaysia, Baharumshah (2004) examines the effects of stock prices on the demand for money using quarterly data from 1976:Q1 to 1996:Q4. His econometric analysis confirms the negative impact of higher stock prices on the demand for money.

Despite the large coverage, money demand studies in the case of Saudi Arabia remain limited and can be broadly clustered into two groups. Namely, the first group utilizes time series techniques, while the other one is based on the analysis of panel data econometric techniques, in which money demand is estimated for a group of countries consisting Saudi Arabia.

To clearly identify the contribution of this paper in light of the existing studies, the remainder of this section covers an overview of the previous work to highlight how this paper comes into play. First, Alkaswani and Al-Towaijri (1999) tried to understand both the short-run and the long-run relationship between money demand and its key determinants with the utilization of annual data spanning from 1977-1997. Based on their findings, evidence shows that while there is significant negative impact of interest and inflation rates on the demand for money over the long run, both output and real exchange rate significantly impact demand for money positively. Their findings also support the presence of a stable money demand is Saudi Arabia in the long-run and show that 35% of the demand for money, when it deviates from its equilibrium, tends to return to its steady state condition.

Bahmani (2008) investigates several macroeconomic factors in determining the demand for money for 14 Middle Eastern economies including Saudi Arabia, using annual data from 1970-2004. By employing an ARDL model, estimates suggest the presence of stable money demand function in most economies. In addition, for Saudi Arabia in particular, the empirical results point out that both income and inflation have a significant impact over the long run, and that money demand when it deviates from its long-run equilibrium tends to adjust by 38% annually. On the other hand, Abdulkheir (2013) shows that it takes about a year and nine months for the money demand to converge to its equilibrium level by using annual observations covering the 1987-2009 period. The study included income, exchange rate, inflation, and interest rate as the determinant factors of money demand in Saudi Arabia over the long run.

By estimating the demand for money over the 1980-2012 period Banafea (2014) shows that there was instability in the money demand in Saudi Arabia and that there is significant positive and negative impacts on money demand stemming from income and interest rates, respectively. Conversely, Al Rasasi (2016) reached the conclusion of having a stable money demand for Saudi Arabia when using quarterly data over the time horizon 1993:Q1 to 2015:Q3 and that income has a significant and positive impact on money demand over the long run, while the interest and exchange rates impacts the demand for money negatively. The study also shows that it takes the money demand about 1.4 percent each quarter to adjust to its steady state condition when it deviates.

Hasanov et al. (2017) confirms the stability of the long run relationship between money demand and its key determinants based on annual data covering the period 1987 to 2016. More recently, Al Rasasi and Banafea (2018) empirical findings show the existence of a stable long and short run relationship between money demand and its key determinants. Their study was based on cash in advance model while using annual data from 2000 – 2016. In their most recent research paper, Al Rasasi and Qualls (2019) estimate money demand function over the period 1980-2017 for Saudi Arabia by treating the issue of converting

annual data prior 1987 from Hijra calendar basis to Gregorian calendar basis. The estimated coefficients agree with theoretical expectations; strictly speaking, changes in output are associated positively with money demand, while swings in domestic interest rate have negative impacts on the demand for money over the long run.

In the same vein, evidence from other money demand-related studies covering the GCC countries including Saudi Arabia (e.g. Harb 2004, Lee et al. 2008, Basher & Fachin 2014, and Hamdi et al. 2015) support the presence of a stable long run relationship among money demand and its determinants over the long run, despite the utilization of several panel data econometric techniques.

Based on the existing literature focusing on Saudi Arabia, it can be implied that none of the empirical research has linked changes in stock market to the demand for money in Saudi Arabia based on our knowledge. Therefore, this study will contribute to the existing literature by analyzing the impact of stock market variations on the demand for money in Saudi Arabia.

4. Utilized Data

To assess the impact of stock market on the demand for money in Saudi Arabia, we used quarterly data starting from 2010:Q1 to 2018:Q4 for various economic variables. These variables consist of broad money supply (M3), real non-oil gross domestic product (GDP), stock market price index, the 3-month Saudi Arabian Interbank Rate as a measure of domestic interest rate, domestic consumer price index. All these data were extracted from different databases; for instance, the data for money supply and interest rate were obtained from Saudi Arabian Monetary Authority, while the data for GDP and CPI were downloaded from the website of Saudi General Authority of Statistics and the International Financial Statistics of the International Monetary Fund respectively. The stock price index was obtained from the Bloomberg database; it is important to note that the quarterly stock price index was calculated by averaging the daily stock price index for each 3-months. To this end, all variables considered in this study with the exception to the interest rate were expressed in logarithm form.

5. Econometric Methods

5.1 Unit root and Cointegration Tests

The assessment of time series stochastic properties is a key requirement in empirical macroeconomic and financial research. By doing so, we avoid the spurious regressions leading to false interpretation of the estimated models as well as false inferences. For that reason, there has been an ongoing research developing various tests to diagnose the stationarity of macro and financial time series. Therefore, we apply one of the most common tests, the Augmented Dickey-Fuller tests, was developed by well-known economists, Said and Dickey (1984). This test can be described based on equation (4) as follows[1].

$$\Delta z_t = \alpha_0 + \beta z_{t-1} + \alpha_1 Trend + \sum_{i=1}^{k} \delta_i \Delta z_{t-i+1} + \varepsilon_t \qquad (4)$$

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[1] It is also important to note that the ADF tests as shown in equation (4), is specified with time trend and constant; however, the test could be conducted with either only constant, or without constant and time trend.

where α_0, $Trend$, Δz_t, Δz_{t-i+1} denote the constant, time trend, and the first difference of the series, and the lagged first difference of the series respectively, while k represents the lag length and it is determined based on the Akaike Information Criterion (AIC). The error term is ε_t, in which $\varepsilon_t \sim iid\ (0, \sigma_\varepsilon^2)$.

The null hypothesis of this test is that the presence of a unit root for a certain time series against the alternative hypothesis of the stationarity of the series. In other words, $H_0 = \beta$ against the alternative hypothesis $H_0 < \beta$. The failure to reject the null hypothesis means the series has a unit root; otherwise, the series is stationary. The outcome of this test, as summarized in table (1), suggests that all variables under investigation suffer from unit root problem meaning that the variables are non-stationary and need to be differenced. When the first difference of the variables is taken, the variables become stationary as confirmed by the test's result.

Table 1. Augmented Dickey–Fuller Unit Root Test

	ADF Test					
	Level Data			First Difference		
	None	Trend	Drift	None	Trend	Drift
NGDP	0.75	-1.65	-1.83	-2.18	-1.79	-1.64
M^d	3.22	-0.61	-2.02	-2.16	-5.86	-2.92
Stock Price	0.43	-1.89	-1.93	-4.53	-4.42	-4.47
Interest Rate	2.30	-3.09	1.02	-3.11	-4.61	-4.10

Note: The ADF 5% critical values are for None=-1.95, Trend= -3.43, and Drift=-2.88.

According to Engle and Granger (1987), when the economic variables are integrated of order one, then it becomes necessary to check for cointegration among these variables. In consequence, we apply the tests of multiple cointegration relationships originated by Johansen and Juselius (1990) to examine the possibility of having a cointegration relationship. The basic intuition of these tests is to determine the rank of the matrix representing the number of the cointegrating vectors. These tests are built on the Vector Autoregressive framework and described by equation (5) ad follows.

$$\Delta Y_t = \varphi + \Pi Y_{t-1} + \sum_{i=1}^{k} \Gamma\, \Delta Y_{t-i} + \varepsilon_t \tag{5}$$

Where Y_t represents the vector of the variables in their level, φ is the constant, Π denotes the long run impact matrix, in which this matrix could be decomposed as $\Pi = \phi\mu$; the matrix containing the cointegrating vectors is μ, while ϕ gauges the average speed of adjustment.

This approach has two alternative tests, the trace and the maximum eigenvalue tests determining the number of cointegrating vectors. These tests are described by equation (6) and (7) as follows.

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{k} \ln(1 - \hat{\lambda_i}) \tag{6}$$

$$\lambda_{max}(r, r+1) = -T \ln(1 - \widehat{\lambda_{r+1}}) \tag{7}$$

Where r is the cointegrating vector and $r = 0,1,2,3,4, ..., k-1$, while T denotes the sample size. Both tests share the same null hypothesis that there are at most r cointegrating vectors, while the alternative hypothesis for both tests is different. For the trace test, the alternative hypothesis is that there are at most k cointegration vector, while the alternative hypothesis for the maximum eigenvalue test is that there are at most r+1 cointegrating vectors.

Table (2) overviews the results of Johansen and Juselius tests, Trace and Maximum Eigenvalue, that confirm the presence of at least one cointegration vector against the alternative of no cointegration vectors among the demand for money and the key factors influencing money demand in Saudi Arabia at 5 percent level of significance. Such findings suggest that these variables are moving in the same direction and they are key determinants of money demand in Saudi Arabia. This in turn suggests the accuracy of the long run relationship and its validity to carry out forecast.

Table 2. Johansen and Juselius (1990) Cointegration Test

Null Hypothesis	Alternative Hypothesis	Test Statistics	5% Critical Value
Panel A: Trace Test			
$r = 0$	$r = 1$	84.71	47.85
$r \leq 1$	$r = 2$	27.26	29.79
$r \leq 2$	$r = 3$	6.55	15.49
$r \leq 3$	$r = 4$	0.04	3.84
Panel B: Maximum Eigenvalue Test			
$r = 0$	$r = 1$	57.44	27.58
$r \leq 1$	$r = 2$	20.70	21.13
$r \leq 2$	$r = 3$	6.51	14.26
$r \leq 3$	$r = 4$	0.04	3.84

Note: r denotes the number of cointegration vectors.

5.2 Interpretation of the Long Run Relationship

The interpretation the long-run relationship provides some insight on the role of money demand and its determinants in explaining the dynamics of money demand over the long run. Estimating equation (3) based on the maximum likelihood estimation method shows the impact of the key elements determining the demand for money over long run. The estimated parameters are summarized in table (3) and indicate that the validity of economic theory with regards the relationship between income and money demand. In other words, higher income would encourage consumer to demand more money in order to meet their daily transactions; this in turn suggests that a 10 percent increase of income would result in raising the demand for money by 14.5 percent. Similarly, the estimated coefficient assessing the effect of rising interest rate reveals the inverse relationship between money demand and domestic interest rate as expected by theory. When it comes to the assessment of the stock prices relation to money demand, our analysis is in favor of the positive impact of stock market performance on the demand for money implying a 1.3 percent higher demand for money due to the rise of

stock market prices by 10 percent. The plausible explanation for this positive association between the demand for money and stock prices could be attributed to the three scenarios highlighted by Friedman (1988). Based on the first scenario, higher stock prices may encourage people to increase their demand for money in order to accumulate their wealth; alternatively, people may demand more money because of the expected returns from these financial and risky assets compared to safe ones. Lastly, the higher volume of financial transactions implies more demand for money. For the case of Saudi stock market, higher volume financial transaction is associated with periods of stock market preforming well leading investors or speculators to demand more money. In the same vein, some stock market speculators preferring higher returns from these risky assets in short periods usually tend to demand more money to achieve their goals. To this end, some people (investors) aim to accumulate their wealth from stock markets by either gaining high returns from the stocks they hold or making higher profits from the stocks they bought at lower prices.

Table 3. Parameter Estimates of Money Demand Function

	β_1	β_2	β_3
Parameter estimates	1.45**	-0.03	0.13
t-values	(-13.14)	(1.49)	(-2.39)

Note: the specified money demand function $M_t^d = \beta_0 + \beta_1 Y_t + \beta_2 i_t + \beta_3 SP_t + e_t$

** denotes 5% significance level.

5.3 The Error Correction Model (ECM)

Once the appearance of a cointegration relationship amid the economic variables under the scope of this research paper is confirmed, we need to understand the restoration of the long-run equilibrium among the demand for money and its determinants. To attain such understanding, we estimate the following error correction model (ECM) based on the Ordinary Least Squares (OLS) estimation technique.

$$\Delta M_t^d = \alpha + \sum_{i=1}^{k} \beta_{i1} \Delta m_{t-i}^d + \sum_{i=1}^{k} \gamma_{i1} \Delta y_{t-i} + \sum_{i=1}^{k} \delta_{i1} \Delta i_{t-i} + \sum_{i=1}^{k} \theta_{i1} \Delta SP_{t-i} + \phi ECT_{t-1} + \varepsilon_t \quad (8)$$

where m_t^d, Y_t, i_t, SP_t, and ε_t are the real money balance, real income measured by real non-oil GDP, domestic interest rate, and stock price index, and the error term at time t respectively. The lag length k is determined by the Akaike information criteria "AIC." The error correction term, ECT_{t-1}, is calculated based on equation (9).

$$ECT_{t-1} = M_{t-1}^d - \beta_0 - \beta_1 Y_{t-1} - \beta_2 i_{t-1} - \beta_3 SP_{t-1} \quad (9)$$

By estimating the error correction model as displayed by equation (8), we would be able to comprehend the return process of money demand to its steady state condition when money demand deviates from its equilibrium condition and well as the short run impacts of money demand determinants. The estimated coefficients of the error correction model are summarized in table (4). It appears that the estimated parameter of the error correction term (ϕ) is negative (-0.6) and statistically significant at 5 percent level. This in turn implies that

the deviation from long run equilibrium could be corrected with the long run path; in specific, it takes about two quarters for the demand for money to return to its long run equilibrium condition. In addition, this implies the stability of cointegration relationship amid the economic variables under investigation. It also suggests that explanatory variables have predictability power in capturing the movements of money demand.

The estimated coefficients for the other variables suggest that only changes in real output have significant impact on the demand for money during the short run, whereas other determinants do not impact the demand for money significantly in the short run. Put it in different way, most factors influencing the demand for money seem to have long run impact rather than short run.

Table 4. Parameter Estimates of ECM

Variables	Parameter estimates	t-values
Constant	0.018	2.848
Δm_{t-1}^d	0.006	0.032
Δm_{t-2}^d	0.197	0.977
Δy_{t-1}	-0.183	-1.240
Δy_{t-2}	-0.332	-3.033**
Δi_{t-1}	-0.029	-0.927
Δi_{t-2}	-0.0003	-0.012
ΔSP_{t-1}	-0.031	-0.481
ΔSP_{t-2}	-0.080	-1.288
ϕ	-0.557	-3.341**

** denotes 5% significance level.

6. Conclusion

Following existing research pointing to the essential role of stock prices on capturing the behavior of money demand, this paper attempts to evaluate the role of stock prices in explaining the movements in money demand over the period of 2010-2018. To reach such assessment, most common econometric procedures were utilized in order to analyze the role of stock prices in addition to the standard determinants being specified by most theories on the demand for money in Saudi Arabia.

The obtained empirical analysis reveals the presence of long run relationship between money demand and its determinants. Specifically, the estimated parameters for output and domestic interest rate are aligned with theoretical expectations with statistical significance over long run. Concerning the impact of stock prices, we find evidence supporting the notion of the positive and significant association between money demand and stock prices in the long run. However, the estimated error correction model reveals that most of the determinants do not have significant impact on the demand for money over the short run. Furthermore, the estimated parameter of the error correction term suggests that money demand adjusts to

equilibrium state within two quarters.

Reaching such findings would enable policymakers to not only understand the behavior of money demand in Saudi Arabia notably the role of stock market, but also to consider this factor in designing their policies. The finding of this paper is crucial for monetary authority through monitoring liquidity level to ensure stable financial and monetary system. Likewise, maintaining a stable money demand function is essential since it is a prior condition to forecast exchange rate based on the monetary models of exchange rate.

In last, this research could be expanded by exploring additional factors such housing prices, oil prices, or government spending that might have a role in determining the demand for money in Saudi Arabia. Likewise, applying advanced econometric techniques such as nonlinear cointegration tests or advanced structural breaks would be valuable contribution to money demand literature relating to Saudi Arabia.

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