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Monetary Policy and Stock Market Cycles in Iran

Roohollah Zare *

** Associate Professor of Economics, Department of Economics, Beyza Branch, Islamic Azad University, Beyza, Iran.*

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CORRESPONDING AUTHOR'S:
***Email:* rz2380@yahoo.com**
0000-0002-2744-5240

Postal address:
Islamic Azad University, Beyza, Fars, 73631-11341, Iran.

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ABSTRACT

The present study examines the impact of monetary policy on nominal and real stock returns in Iran during bull and bear stock market cycles. Estimating the models with a modified version of the Hamilton (1989) Markov-switching model and by employing the quarterly data spanning from 1991/92 to 2016/17, the results indicate that an expansionary monetary policy has a positive and statistically significant impact on stock returns only in bear regimes in line with the prediction of models with financial restrictions. By employing time-varying transition probability Markov-switching models the findings also indicate that an easy monetary policy increases the probability of remaining in a bull regime while reduces the probability of being trapped in a bear one.

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1- Introduction

Investigating the link between monetary policy and stock returns has been very important for monetary policymakers and financial market investors to employ appropriate monetary policy and make the right investment decisions. As stated by Bernanke and Kuttner (2005), financial market is an important channel of monetary policy transmission mechanism. Monetary policy affects its ultimate objectives indirectly via financial markets. Moreover, it has been of great interest to economists whether monetary policy has the same sort of effects in bull and bear stock market cycles. If monetary policy has asymmetric impacts, policy makers should consider stock market cycles[1] when implement monetary policy.

The objective of the present study is to investigate the reaction of stock returns to monetary policy and asymmetries over bull and bear cycles in Iran. Moreover, the impact of monetary policy on the switching probabilities between bull and bear regimes is also examined. Possible asymmetries are examined using Markov-switching (MS) models[2].

This study contributes to the existing literature in the following ways: First, most of the existing literature related to monetary policy asymmetries concentrate on the developed countries especially United State[3]. Due to difference in financial markets conditions and economic structures in Iran with that of advanced countries, the findings in developed economies is not exactly applicable for developing economies[4]. This study fills the gap in the literature by investigating

[1] Bull and bear stock market cycles
[2] We employ a modified version of Markov-switching modes developed by Hamilton (1989).
[3] See section 2.2 for a detailed review of empirical literature.
[4]Iran stock market faces some structural problems in the following areas compared to stock market in developed countries. (1) Major shareholders are state-owned or semi-state-owned such as banks, pension funds and other similar institutions. This may prevent small private investors to be able to compete with them. (2) It faces serious constraints in international communications largely influenced by political factors such as international sanctions and underdeveloped economic infrastructures. (3) The role of debt instruments and derivatives are

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asymmetric impacts of monetary policy in Iran. Second, this study investigates the asymmetric impacts of monetary policy on stock returns over bull and bear stock market conditions in Iran. In recent years, some papers has been published to explore asymmetries Iran. However, Most of the literature related to this issue are dealing with asymmetric effects on real output (see for instance, Sharifi Renani, Salehi, Ghobadi & Salehi, 2012; Gholami, Farzinvash & Ehsani, 2013; Jafari Samimi, Ehsani, Tehranchian & Ghaderi, 2014; Zare, 2015 and Komijani, Elahi & Salehi Rezveh, 2015). As far as we know, the only exception is Mousavi jahromi and Rostami (2015) who examined asymmetries[5] on stock price index in Iran. Third, this study employs fixed-transition probability (FTP-MS) and time-varying-transition-probability Markov-switching (TVTP-MS) models which are not explored in the related literature in Iran. In FTP models, the transition probabilities are static. In TVTP models, we assume the probability of switching between regimes to depend on monetary policy evolutions (Mousavi jahromi & Rostami, 2015).

The rest of paper is structured as follows. The next section reviews the theoretical and empirical literature. Econometric framework and the data are presented in Section 3. Section 4 reports the empirical results of the asymmetries and transition probabilities of switching between regimes. Finally, Section 4 concludes with some policy implications.

very limited in Iran stock market. (4) Share turnover as a measure of stock liquidity is very low. This measure is calculated by dividing the total number of shares traded over a period by the average number of shares outstanding for the period. This ratio is less than 0.2 for Iran but in some developed countries is around 2. (5) Very low rank in terms of market value relative to GDP. This ratio in Iran stock market is around 20% compared to around 80% in developed countries. (6) Floating stocks are much lower than developed countries. This ratio is around 20% in Iran compared to 70% to 90% in developed markets. (7) Low ratio of active shareholders to total population. This ratio is near 10% in Iran stock market compared to 50% in developed countries. (8) High percentage of dividends in Iran stock market. (9) Total value of share traded relative to GDP is low in in Iran stock market. (10) Iran stock market organizations does not have political and economic independence.

[5] Asymmetric effects of positive and negative monetary policy shocks.

2- Literature review

2-1- Theoretical literature

2-1-2- Monetary policy and stock returns

Mishkin (2007) describe the asset pricing channel[6] though which monetary policy affects the stock prices and returns (Mishkin, 2007). According to this channel:

(1) $$Q_t = E_t\{\sum_{k=1}^{\infty} \frac{C_{t+k}}{(1+r_{t+k})^k}\}$$

Where Q_t is the current price of stock, C denotes its cash flows, r is the interest rate to discount the future and E_t is the expectations operator. From this simple model, monetary policy decisions (change in policy rate or money supply) can affect stock prices directly through discount rate $(1 + r_{t+k})^k$, and indirectly by influencing expectations of future cash flows. An increase in interest rate leads to lower expected future cash flow and hence lower stock prices[7].

2-1-3- Asymmetric effects of monetary policy

The theoretical framework for explaining the asymmetries over business cycles can be described by the models with financial restrictions. Recent financial theories of business cycle[8] describe how financial factors may enhance the effects of monetary policy. These models are based on "credit market imperfections" theories. According to these theories asymmetric information between lenders and borrowers prohibits efficient allocation of resources and leads to deadweight losses (agency costs) in optimal financial contracts. The

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[6] According to this channel the price of a financial asset is equal to the discounted present value of expected future cash flows.

[7] Mishkin (1996) also elaborated two views through which monetary policy can influence stock prices: the monetarist view and the Keynesian view. From the monetarist view, expansionary monetary policies increase the optimum money balances and hence enhance the demand for equities and raising their prices. Keynesian argues that the fall in interest rates stemming from expansionary monetary policies making bonds less attractive than equities causing the price of equities to rise.

[8] These theories are developed by Bernanke and Gertler (1989) and Kiyotaki and Moore (1997).

lender should impose agency costs to borrower to solve the moral hazard problem[9]. Moreover, the lender must impose a monitoring cost to the borrower to overcome asymmetric information. These costs reveal in "external finance premium". The balance sheet channel of money transmission mechanism stated by Bernanke and Gertler (1995) predict that the "external finance premium" is contrary to the borrower's net worth (Gertler, 1995).

The fact that borrower's net worth is likely to be procyclical implies that "external finance premium" increase during recessionary phases of business cycle and decrease during expansions. Thus, during recession the "external finance premium" will be relatively high which creates a financial propagation mechanism which intensify the interest rate effects of monetary policy by reducing the investment demand for constrained agents. The above discussion explains why monetary policy is more effective in recessions than expansions.

The models with financial restrictions also explain why monetary policy is more effective in bear cycles than bulls. According to these models, financial restrictions are more in bear cycles[10] because of lower net worth in these periods. The lower the net worth, the greater the external finance premium should be. Higher external finance premium create a financial propagation mechanism which amplify the interest rate effects of monetary policy (Garcia & Schaller, 2002; Chen, 2007).

2-2- Empirical literature

The impact of monetary policy on stock returns has been widely investigated in the last few years. The early literature in the 1960s to 1970s used money aggregate data to measure monetary policy.

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[9] Moral hazard in this context refers to the notion that borrowers who need access to credit may be those who are least likely to be able to repay their debts.

[10] When there is asymmetric information in the financial market, borrowers behave like a financially constraint agent.

However, the empirical findings are different[11]. Since the influential paper by Bernanke & Blinder (1992), this relationship has been reexamined using the interest rate as measure of monetary policy (See for instance Thorbecke, 1997; Patelis, 1997; Conover, Jensen & Johnson, 1999).

Since then, two important contributions have been made to the related literature. The first one emphasizes on the unanticipated monetary policy shocks. Bernanke & Kuttner (2005) argued that stock market is not likely to react to anticipated monetary policy shocks. Accordingly, they extracted unanticipated monetary policy shocks from Federal funds futures by adopting the methodology suggested by Kuttner (2001). After controlling this issue the important finding is that stock returns only react to the unanticipated monetary policy shocks[12, 13].

The second contribution emphasizes on the endogeneity problem due to a bidirectional causality between monetary policy and stock prices. To circumvent the endogeneity problem a very high frequency dataset including daily and intraday dataset has been utilized which often has been referred to as the event study approach in the literature (see for instance Rigobon & Sack, 2004; Bernanke & kuttner 2005; Farka 2009; Chulia, Martens & Dijk, 2010 among others). However, as argued by Tsai (2011) a very high frequency event study

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[11] For instance Keran (1971), Homa and Jaffee (1971) and Hamburner and Kochin (1972) found that monetary policy significantly affect stock returns. Cooper (1974), Pesando (1974), Rozeff (1974) and Rogalski and Vinso (1977) could not find significant relationship between these variables.

[12] In this research we do not follow this methodology for identification of the surprise component of monetary policy since unlike the developed economies, short term interest rate future contracts are not available in Iran.

[13] Refer to Bernanke and Kuttner, 2005; Chulia et al., 2010; Ehrmann and Fratzscher, 2004; Guo, 2004; Rigobon and Sack, 2004; Basistha and Kurov, 2008; Jansen and Tsai, 2010; Neely and Fawley, 2014 for a close review.

approach cannot estimate the dynamic impact of monetary policy[14]. **Tabel 1** provides a summary of the related literature in some developed and developing countries.

Tabel 1. Summary of the Empirical Studies
Source: Research calculations

Authors	Sample countries	sample period	Methods	Findings
Laopodis (2013)	US	1970–1978, 1979–1987, 1987–2005,	VAR models	No relationship between the two variables.
Bouakez (2013)	US	1982:11–2007:11	a flexible SVAR model	Much weaker interaction than suggested by earlier studies.
Jansen & Zervou (2017)	US	June 1989-December 2007	the time-varying parameters model	Monetary policy surprise affects stock prices.
Ibrahim (2003)	Malaysia	Pre and post 1997 crisis	VAR models	Positive relation between monetary supply and stock price
Coleman & Agyire-Tettey (2008)	Ghana	1991 2005	Error correction models	Negative relation between interest rate and stock price
Suhaibu *et al.* (2017)	12 African countries	1979-2013	panel VAR model	Stock markets are positively affected by monetary policy
Zhang *et al.* (2017)	China	2005 - 2012	a non-linear VAR model	Significantly asymmetric effects of monetary policy over stock market cycles
Guo *et al.* (2013)	China	2005 - 2011	The MSVAR–EGARCH model	Significantly asymmetries in different time periods and market cycles
Sharma *et al.* (2019)	India	2003-2008 2008-2013 2013-2016	EGARCH model	Positive relation between monetary policy and stock price in period 3 (2013-2016) in India as compared to period 1 (2003-2008) and period 2 (2008-2013).
Nwakoby & Alajekwu (2016)	Nigeria	1986 –2013	The Johansen co-integration and the	Positive long-run relationship between variables. The granger causality analyses equally showed that this relationship runs from stock market to monetary policy

[14] This limitation and the unavailability of high frequency dataset in Iran motivate me to employ a lower frequency dataset (quarterly data) for investigating the dynamic impact of monetary policy on stock returns in Iran.

			granger causality test	implying that it is the stock market activities that influences the nature and direction of monetary policy to follow.
Fadaeinejad & Farahani (2017)	Iran	April 2003 to March 2015	Multiple regression models	Money supply negatively affect stock price index in Iran.
Bayat *et al.* (2016)	Iran	1995:1-2005:4	DSGE models	The reaction of central bank to deviations of total stock price index from its equilibrium reduces economic volatility and rises overall macroeconomic stability.
Nonejad *et al.* (2012)	Iran	1990 - 2008	VAR models	Monetary policy has a significant positive effect on real and nominal stock price index in Iran.
Ebrahimi & Shokri (2011)	Iran	1999:3-2009:3	Structural vector error correction (SVEC) models	Money supply shocks positively affect stock prices in Iran. However, the magnitude of the reaction of stock prices to shocks from variables such as oil prices, GDP and exchange rate is greater than the shocks from money supply.
Eslamloueyan & Zare (2007)	Iran	1993:3 - 2003:2	Auto regressive distributed lag (ARDL) models	Negative impact of money supply on stock price

Some empirical studies have investigated asymmetries of monetary policy[15]. Chen (2007) using MS models found that monetary policy is more effective in bear cycles. He also found that a contractionary monetary policy increases the probability of switching from the bull market to the bear market regime. Jansen & Tsai (2010) and Kurov (2010) examined the asymmetric response of stock returns to surprise component of monetary policy shocks over bull and bear cycles in an event study approach and found that monetary policy is more effective in bear cycles than bulls. They employed the method suggested by

[15] Lobo (2000), Bernanke and Kuttner (2005) and Chulia et al. (2010) found asymmetries connected to the direction of monetary policy shocks. Guo (2004), Andersen et al. (2007) and Basistha and Kurov(2008) studied the asymmetries over business cycle and showed that monetary policy is more effective in recessions than booms consistent with the prediction of models with financial restrictions.

Kuttner (2001) to measure the surprise monetary policy shocks from the Federal Funds future data. Beatrice *et al*., (2013) using MS-VAR[16] models found that the monetary policy affects house price more strongly in bear regimes. Zare, Azali, Habibullah & Azman-Saini (2014) examined asymmetries in a panel of ASEAN5 countries by employing the PMG[17] method and found that monetary policy has stronger impact on real output in bear cycles than bulls.

In the case of Iran, the related literature are limited (see for instance, Sharifi Renani, Salehi, Ghobadi & Salehi, 2012; Gholami, Farzinvash & Ehsani, 2013; Jafari Samimi, Ehsani, Tehranchian & Ghaderi, 2014; Zare, 2015 and Komijani, Elahi & Salehi Rezveh, 2015, Zare, 2015). These studies examine the asymmetric impact of monetary policy on output and inflation. In the context of asymmetric effects of monetary policy on stock returns in Iran, the literature are even more limited. As far as we are aware, the only exception is Mousavi Jahromi & Rostami (2015) who examined the asymmetric effects of anticipated versus unanticipated monetary policy shocks and easy versus tight policy shocks on stock price index over the period 1991-2010. Due to the limited empirical studies in Iran, we examine the asymmetric impacts of monetary policy on stock returns over bull and bear stock market cycles in Iran.

3- Econometric framework

To examine asymmetries we employ MS[18] models developed by Hamilton (1989). Unlike linear models this approach is nonlinear and can handle asymmetries. Besides, the Hamilton algorithm endogenously determines bull and bear stock market cycles based on the data. In this study the Hamilton (1989) MS model is modified to allow monetary policy to affect stock returns. Moreover, the basic MS

[16] Markov-switching vector autoregressive
[17] Pooled mean group
[18] Markov-Switching

model is extended to a TVTP-MS[19] model to allow the probability of switching between regimes to depend on monetary policy.

1.1. Fixed transition probability MS model (FTP-MS model)

Let $R_t = 100 * \Delta\log(P_t)$, where $\log(P_t)$ is the logarithm of the nominal stock prices. Therefore, R_t is stock returns. Consider the following fixed transition probability MS Autoregressive $(FTP - MS - AR(q))$ model:

(2) $$\varphi(L)R_t = \mu_{S_t} + \epsilon_t, \qquad \epsilon_t \sim i.i.d.N(0, \sigma_{S_t}^2),$$

Where, $\varphi(L) = 1 - L - L^2 - \cdots - L^k$. Term L denotes lag. μ_{S_t} and $\sigma_{S_t}^2$ are state-dependent mean and variance of R_t. Term S_t is a dummy variable (0 for bull or 1 for bear). The transition probability matrix is characterised by:

(3) $$p = \begin{bmatrix} p^{00} & p^{01} \\ p^{10} & p^{11} \end{bmatrix}$$

where $p^{ij} = prob(S_t = j|S_{t-1} = i)$ with $\sum_{j=0}^{1} p^{ij} = 1$ for all i.

In other words, p^{10} is the probability of shift from state 1 to state 0 and is equal to $1 - p^{11}$. At first, it is supposed that transition probabilities are fixed over time with the following logit form:

(4) $$p^{00} = \frac{\exp(\theta_0)}{1+\exp(\theta_0)}$$

(5) $$p^{10} = \frac{\exp(\gamma_0)}{1+\exp(\gamma_0)}$$

The parameters θ_0 and γ_0 define the transition probabilities. Then, we allow transition probabilities to change over time to examine the impact of monetary policy on the probability of switching between

[19] Time-Varying-Transition-Probability Markov-Switching

states. After estimating the parameters, we compute the filtered and smoothed probabilities for dating regimes[20].

3-2- A Modified MS Model

To examine asymmetries over bull and bear stock cycles we estimate a modified MS model as follows:

$$R_t = \mu_{S_t} + \sum_{j=0}^{q} \beta_{S_{t,j}} X_{t-j} + \delta_t Z_t + \epsilon_t \qquad (6)$$
$$\epsilon_t \sim i.i.d.N\left(0, \sigma_{S_t}^2\right)$$

Where X_{t-j} is monetary policy indicator at time $t-j$ measured using real M2 growth rate and changes in real interest rate. The asymmetric impacts of monetary policy can be examined by comparing the coefficients of X_{t-j} in different states. Z_t is a vector of relevant control variables[21]. These variables are important in explaining stock returns by affecting future cash flows.

3-3- Time-varying transition probability MS model (TVTP-MS)

To examine the impact of monetary policy on the probability of switching between alternative regimes we employ a TVTP-MS model. This model assumes that the transition probabilities change in response to the evolutions in monetary policy. The time-varying transition probability matrix can be specified as follows:

[20] Filtered probabilities are inferences about S_t conditional on information up to time t. The so-called filterd probabilities are given by:

$$p(S_t = j|\emptyset_t) = \sum_{i=0}^{1} \dots \sum_{k=0}^{1} p\,(S_t = j, S_{t-1} = i, \dots, S_{t-r} = k|\emptyset_t) \qquad j, i, \dots, k = 0,1 \qquad (7)$$

The smoothed probabilities are inferences about S_t by using all the information available in the sample. These probabilities provide information about the regime in which the series is most likely to have been at every point in the sample. So, they are very useful for dating regimes. In most applications, filtered and smoothed probabilities would lead to very similar conclusions.

[21] These variables include real GDP growth rate, inflation rate and exchange rate growth.

(7) $$p_t = \begin{bmatrix} p_t^{00}(\boldsymbol{Z_t}) & p_t^{01}(\boldsymbol{Z_t}) \\ p_t^{10}(\boldsymbol{Z_t}) & p_t^{11}(\boldsymbol{Z_t}) \end{bmatrix}$$

Where $p_t^{ij} = prob(S_t = j|S_{t-1} = i, \boldsymbol{Z_t})$, and $\boldsymbol{Z_t} = \{Z_t, Z_{t-1}, \dots\}$ is monetary policy. Therefore the probability of switching between alternative states is assumed to depend on monetary policy. Transition probabilities are as follows:

(8) $$p_t^{00}(\boldsymbol{Z_t}) = \frac{\exp(\theta_0 + \theta_1 \boldsymbol{Z_t})}{1 + \exp(\theta_0 + \theta_1 \boldsymbol{Z_t})}$$

(9) $$p_t^{11}(\boldsymbol{Z_t}) = \frac{\exp(\gamma_0 + \gamma_1 \boldsymbol{Z_t})}{1 + \exp(\gamma_0 + \gamma_1 \boldsymbol{Z_t})}$$

Clearly,

(10) $$\frac{\partial p_t^{00}}{\partial \boldsymbol{Z_t}} = \theta_1 p_t^{00}(1 - p_t^{00})$$

(11) $$\frac{\partial p_t^{11}}{\partial \boldsymbol{Z_t}} = \gamma_1 p_t^{11}(1 - p_t^{11})$$

Since $0 \le p_t^{00}, p_t^{11} \le 1$, the signs of $\frac{\partial p_t^{00}}{\partial \boldsymbol{Z_t}}$ and $\frac{\partial p_t^{11}}{\partial \boldsymbol{Z_t}}$ are determined by the signs of θ_1 and γ_1, respectively. Thus, the estimates of θ_1 and $\gamma_1$indicate the impact of monetary policy on the probability of switching between regimes.

3-4- The data

Our empirical application is based on the quarterly dataset of Iran stock market spanning from 1991/92 to 2016/17. We use total share price index to construct nominal and real stock returns. Nominal stock returns are computed from the logarithmic difference of total share price index. Then, the CPI inflation rate is deducted from nominal returns to compute real returns. Real returns are employed for the robustness check of empirical findings. Figure 1 represents the movements of the total share price index. Nominal and real returns are presented in figure 2. As is evident from figure 1 total share price index experiences upward trend to reach a peak in 2014Q1. Then, it is declined until last quarter of 2015 and then resumed its upward trend but still below its peak during the sample period. The summary statistics of the quarterly nominal and real return series are presented in **Tabel 2**. As depicted in the **Tabel 2**, Tehran stock exchange exhibit positive returns over the sample period. The nominal and real mean returns are 5.66% and 1.46% over the sample period, respectively. As reflected by the standard deviation, nominal and real returns display the same volatility. The market returns are positively skewed with more skewness in the case of nominal returns. Kurtosis statistics are lower than 3 indicate thinner tail than normal distribution. The Jarque-Bera test statistics for normality show normal distribution in both nominal and real returns.

Tabel 2. Descriptive Statistics of the Stock Market Returns
Source: Research calculations

	Nominal return	**Real return**
Mean	5.66	1.46
Median	6.20	1.46
Maximum	23.85	16.56
Minimum	-6.43	-12.97
Std. Dev.	8.60	8.55
Skewness	0.12	0.01
Kurtosis	2.00	1.84
Jarque-Bera	1.57	2.02
Probability	0.46	0.36

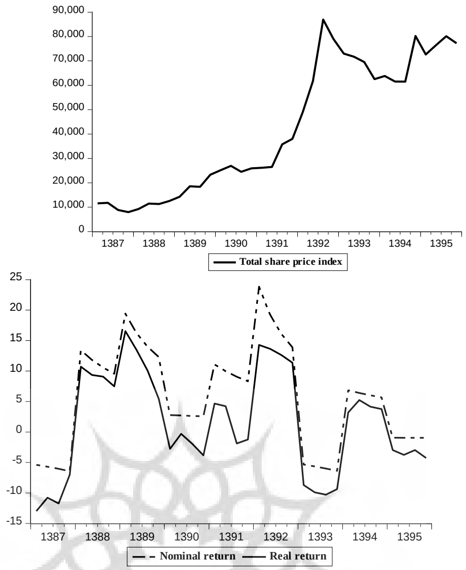

Figure 1. Total Share Price Index, Nominal and Real Returns
Source: Research calculations

We employ two measures of monetary policy: real M2 growth and changes in real interest rate. One year deposit rate is used as the suitable interest rate variable. The selection of appropriate measure of monetary policy is an important aspect of the analysis of monetary policy effects. Using money aggregates as measure of monetary policy has an identification problem since it reflects the endogenous responses of central banks to economic development and a variety of non-policy influences. Moreover, it may show demand for money (Morgan, 1993; Bernanke & Mihov, 1998; Kakes, 1998). Due to these deficiencies Bernanke & Blinder (1992) emphasized the role of interest rate as monetary policy indicator. Accordingly, we employ real interest rate as an alternative monetary policy indicator to check the robustness of the empirical findings.

Other variables considered in the study are as follows. Real output is represented by GDP at constant prices (2005=100). Exchange rate is spot Rial-USD exchange rate. The main source of the data is the economic time series database of the Central Bank of Iran through its official website (http://www.cbi.ir). The results of ADF and PP tests[22] are presented in **Tabel 3** The findings indicate that all the variables considered in the analysis are stationary.

Tabel 3. Unit Root Tests
Source: Research calculations

Variable	ADF	PP
Nominal returns	-3.760	-3.887
Real returns	-4.265	-4.402
Real M2 growth	-4.432	-11.811
Changes in real interest rate	-7.092	-5.029
Inflation rate	-3.336	-6.740
Real GDP growth	-11.118	-11.612
Exchange rate growth	-9.004	-9.174

NOTE: Critical values for ADF and PP are -3.49 (1%), −2.89 (5%), and −2.58 (10%). Lags in ADF are selected by Schwartz Bayesian information criterion (SC).

4- Empirical results

4-1- FTP-MS model

The finding of linear and MS models are depicted in Table 4. No AR lag in R_t is selected based on non-autocorrelated error terms. Based on the likelihood-ratio (LR) test the Marrkov-switching models perform better than linear models. The LR test statistic[23] is 76.92 for the nominal returns data and 59.98 for real returns data[24]. The LR statistic

[22] The augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) unit root tests
[23] LR test statistic is computed as $LR = 2LL\_M2 - 2LL\_M1$. Where LL_M2 is the LogLik of the Markov-switching model and LL_M1 is the LogLik of the linear model.
[24] Garcia (1998) tabulates critical values for the simple two-means, two-variances FTP-MS-AR(0) model under the null of no switching.

is much higher than the 99%-critical value (14.02). According to the findings depicted in Table 4, the MS models identify two regimes with different means and variances conventionally labelled as bull (regime 0) and bear (regime 1). Average expected durations of bull and bear regimes reported in Table 5 show that both regimes are highly persistent. They persists on average around 10 to 12 quarters. Figure 2 shows the smoothed probabilities of regime 0 (bull)[25]. As is evident from Figure 1, both nominal returns and real returns show consistent periods of bull and bear cycles.

Tabel 4. Linear and Ms Models
Source: Research calculations

	Nominal returns		Real returns	
	linear	**FTP-MS-AR(0)**	**linear**	**FTP-MS-AR(0)**
μ	5.097*** (0.818)		0.719 (0.792)	
μ_0		10.767*** (0.876)		6.240*** (0.977)
μ_1		-2.321*** (0.455)		-6.196*** (0.623)
σ	8.181		7.920	
σ_0		1.806*** (0.101)		1.766*** (0.107)
σ_1		1.003*** (0.119)		1.202*** (0.122)
θ_0		2.428*** (0.498)		2.299*** (0.527)
γ_0		-2.357*** (0.562)		-2.242*** (0.554)
p^{00}		0.919		0.909
p^{10}		0.081		0.091
logLik	-351.573	-313.112	-348.325	-318.336

NOTE: The numbers in parentheses are the standard errors.*** represents significant at 1% significance level.

[25] The smoothed probabilities of regime 0 (bull) are computed using the full-sample smoothing algorithm of Kim (1994). Simply taking 0.5 as the cut-off value, the periods with smoothed probabilities greater than 0.5 are more likely to be a bull regime.

Tabel 5. Average Expected Durations of Bull and Bear Regimes
Source: Research calculations

	Nominal returns	Real returns
bull	12.332 quarters	10.414 quarters
bear	11.559 quarters	10.967 quarters

Notes: Average expected durations for regime 0 (bull) and regime 1 (bear) are computed as $\frac{1}{1-p^{00}}$ and $\frac{1}{1-p11}$, respectively.

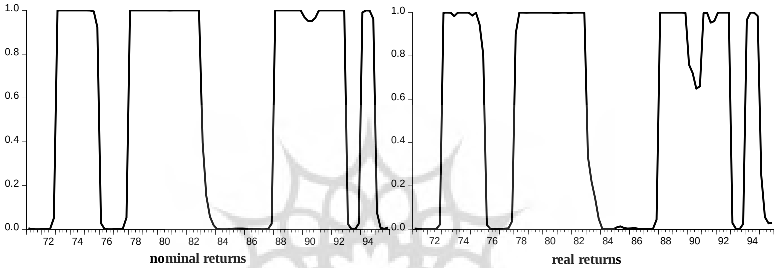

Figure 2. Smoothed Probabilities in Regime 0 (Bull)
Source: Research calculations

4-2- A modified MS model

The results of a modified MS model based on equation (8) are reported in Table 6. The coefficients β_0 and β_1 show the response of stock returns to monetary policy in bull and bear regimes, respectively. The results show that monetary policy significantly affect stock returns only in bear cycles. When we measure monetary policy by real M2, it has a positive impact on stock returns. However, when it is measured by real interest rate it has negatively affected stock returns. In other words, increase in real M2 rise stock returns while increase in real interest rate reduce returns[26]. The stronger impact of monetary policy on stock returns in bear market periods than bulls is in line with the prediction of models with financial restrictions. These findings are consistent with

[26] The empirical results from real returns data are very similar to what I obtained from nominal returns data, thus making my estimates robust.

the findings in Perez-Quiros & Timmermann(2000), Chen (2007), Kurov (2010), Jansen & Tsai (2010) & Beatrice *et al*., (2013).

Tabel 6. FTP-MS models
Source: Research calculations

	Nominal returns		Real returns	
	real M2 growth	Changes in real interest rate	real M2 growth	Changes in real interest rate
μ_0	8.150*** (1.578)	9.911*** (1.247)	8.150*** (1.577)	9.911*** (1.247)
μ_1	-5.218*** (1.199)	-3.062*** (0.859)	-5.218*** (1.199)	-3.062*** (0.859)
σ_0	1.726*** (0.105)	1.771*** (0.107)	1.726*** (0.105)	1.771*** (0.107)
σ_1	0.952*** (0.119)	0.874*** (0.122)	0.952*** (0.119)	0.874*** (0.122)
β_0	-0.158 (0.222)	-0.238 (0.276)	-0.158 (0.222)	-0.238 (0.2756)
β_1	0.293** (0.131)	-0.474*** (0.188)	0.293** (0.131)	-0.474*** (0.188)
θ_0	2.387*** (0.578)	2.377*** (0.578)	2.387*** (0.578)	2.377*** (0.578)
γ_0	-2.437*** (0.510)	-2.443*** (0.509)	-2.437*** (0.510)	-2.443*** (0.509)
p^{00}	0.916	0.915	0.916	0.915
p^{10}	0.084	0.085	0.084	0.085
Inflation rate	0.689*** (0.259)	0.218 (0.211)	-0.311 (0.259)	-0.782*** (0.211)
Real GDP growth	0.066 (0.049)	0.074* (0.046)	0.066 (0.049)	0.074* (0.046)
Growth rate of exchange rate	-0.122* (0.071)	-0.060 (0.069)	-0.122* (0.071)	-0.060 (0.069)
logLik	-305.769	-306.358	-305.769	-306.359

NOTE: Refer to notes of Table 4. Real M2 growth and Changes in real interest rate are monetary policy indicators.

4-3- TVTP-MS model

Does monetary policy affect the dynamics of switching between regimes? To answer this question, we estimate a TVTP-MS model as formulated in section 3.3. Table 7 presents the estimation results of θ_1 and γ_1 from equations (10) and (11). Clearly, it is found that $\hat{\theta}_1 > 0$ and $\hat{\gamma}_1 < 0$ in the case of employing real M2 as measure of monetary policy. Here, $\hat{\theta}_1 > 0$ means that an expansionary monetary policy raises the probability of remaining in a bull regime (ie., $p_t^{00}(Z_t)$).

Furthermore, an expansionary monetary policy reduces the probability of switching from a bull regime to a bear one (ie., $p_t^{01}(Z_t) = 1 - p_t^{00}(Z_t)$). In addition, since we get $\hat{\gamma}_1 < 0$, thus an expansionary monetary policy decreases the probability of being trapped in a bear market (i.e., $p_t^{11}(Z_t)$) while it can increase the probability of switching from a bear market to bull one (ie., $p_t^{10}(Z_t) = 1 - p_t^{11}(Z_t)$).

In the case of employing real interest rate as measure of monetary policy it is found that $\hat{\theta}_1 < 0$ and $\hat{\gamma}_1 > 0$. Here, $\hat{\theta}_1 < 0$ means that negative changes in real interest rate (an expansionary monetary policy) raises the probability of remaining in a bull regime while reduces the probability of switching from a bull regime to a bear one. In addition, since we get $\hat{\gamma}_1 > 0$, thus negative changes in real interest rate (an expansionary monetary policy) decreases the probability of remaining in a bear market while it can increase the probability of switching from a bear market to bull one. The findings of a TVTP-MS model are consistent with the findings of Chen (2007) who employed the same methodology. Chen (2007) showed that a tight monetary policy shock increases the probability of switching from the bull market to a bear one while it reduces the probability of staying in the bull market. However, it raises the probability of being trapped in the bear market regime.

Tabel 7. TVTP-MS Models
Source: Research calculations

	Nominal returns		Real returns	
	real M2 growth	Changes in real interest rate	real M2 growth	Changes in real interest rate
μ_0	8.517*** (1.547)	9.913*** (1.261)	8.517*** (1.547)	9.913*** (1.261)
μ_1	-4.945*** (1.173)	-3.064*** (0.868)	-4.945*** (1.173)	-3.064*** (0.868)
σ_0	1.712*** (0.104)	1.770*** (0.108)	1.712*** (0.104)	1.770*** (0.108)
σ_1	0.942*** (0.118)	0.874*** (0.124)	0.942*** (0.118)	0.874*** (0.124)
θ_0	2.374*** (0.545)	2.514*** (0.544)	2.374*** (0.545)	2.514*** (0.544)

$\boldsymbol{\theta_1}$	0.155 (0.109)	-0.097 (0.150)	0.155 (0.109)	-0.097 (0.150)
$\boldsymbol{\gamma_0}$	-2.409*** (0.689)	-2.392*** (0.590)	-2.409*** (0.689)	-2.392*** (0.590)
$\boldsymbol{\gamma_1}$	-0.253* (0.145)	0.016 (0.274)	-0.253* (0.145)	0.016 (0.274)
logLik	-303.285	-306.128	-303.285	-306.128

NOTE: Refer to notes of Table 4. Real M2 growth and Changes in real interest rate are monetary policy indicators.

5- Conclusion

The present study empirically examine the impacts of monetary policy on stock returns during bull and bear markets in Iran by employing MS model developed by Hamilton (1989). According to models with financial restrictions, monetary policy may have stronger impact in bear cycles than bulls. Employing a quarterly dataset spanning from 1991/92 to 2016/17, the FTP-MS-AR(0) models find two regimes characterized as bull and bear cycles.

The results of a modified MS model indicate that monetary policy significantly affect stock returns only in bear cycles. More specifically, increase in real M2 rise stock returns while increase in real interest rate reduce returns for both nominal and real returns in bear regimes. These findings are in line with the prediction of the models with financial restrictions. Finally, Empirical results from estimating TVTP-MS models suggest that that an expansionary monetary policy raises the probability of remaining in a bull regime while reduces the probability of being trapped in a bear regime.

As a policy implication, monetary policy makers should consider stock market cycles in implementing monetary policies. Especially in bear market periods implementing an expansionary monetary policy may lessen the probability of remaining in bear markets and will raise the probability of switching from a bear regime to a bull one. Moreover, the stock market investors should consider that the impact of monetary policy on stock returns may depend on the phase of the stock market.

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