The Impact of Inflation on Stock Prices with panel data (Case study: Tehran Stock Exchange)

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ABSTRACT
Knowledge of stock price behavior is very important for investor. This price is influenced by a number of factors in the financial market. This paper shows the different effects of inflation on stock price of bigest ten company in Tehran Stock Exchange. To examine the different sensitivity of stocks according to Shiblee paper (2009), The study is done on tehran Stock exchange. Chose 10 bigest companies during the period 2000-2013 and take CPI as an example of inflation, because it is the closest to the investor decision. The findings show according to our samples that, the inflation independent variable has different effects on this sector with panel data methods. CPI effect has a strong negative influence at most companies in our sample.

INTRODUCTION
Of the most prominent economic forces, on the stock prices is inflation because impact on stock returns. This paper estimates of stock sensitivity to changes in inflation. We well show the influence of the inflation and other macro economics on the stock price, through our study.

Numerous empirical studies establish that inflation has a negative shortrun effect on stock returns but few studies report a positive, long-run Fisher effect for stock returns [1].

The sensitivity of stocks to expected inflation will depend on, duration and a company’s ability, to rise prices consequently. As stock price increase bond price well decrease. Several studies that offered compelling statistical evidence, of inflation’s negative effect on stock returns [11].

Financial economists also argued that, because stocks are claims on physical, or real, assets, stock returns ought to co vary. Positively with actual inflation, there by making them a possible hedge against unexpected inflation [11].

The predominant academic view is that high expected inflation predicts low stock returns, a perspective largely based upon studies that focus on monthly and quarterly returns. Although this negative inflation effect on returns was found to be weaker at longer horizons, the short-horizon results have weighed most heavily on the perceptions of financial economists, as evidenced by the variety of efforts aimed at producing a compelling theoretical rationale, efforts that continue to date [10].

According to the results of the effect of inflation on the price of the stock, check it in Iran as well as the necessity of the track.

Literature Review:
Sharpe Steven (1999) finds that the negative relation between equity valuations and expected inflation is the result of two effects: a rise in expected inflation coincides with both (i) lower expected real earnings growth and (ii) higher required real returns. In his paper examines the effect of expected inflation on stock prices and expected longrun returns. Ex ante estimates of expected long-run returns are derived by incorporating estimates of investor expectations of future corporate cash flows into a variant of the Campbell- Shiller dividend-price ratio model. In this model, the log earnings-price ratio is expressed as a linear function of expected future returns, expected earnings growth rates, and the log of the current dividend-payout ratio. Investor expectations of earnings growth are inferred from equity analysts’ earnings forecasts; inflation expectations are drawn from

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surveys of professional forecasters. I find that the negative relation between equity valuations and expected inflation is the result of two effects: a rise in expected inflation coincides with both (i) lower expected real earnings growth and (ii) higher required real returns. The earnings channel is not merely a reflection of inflation’s recession-signalling properties; rather, a substantial portion of the negative valuation effect appears to be the result of a negative relation between expected long-term inflation and projections of long-term real earnings growth. The effect of expected inflation on required (long-run) real stock returns is also substantial. A one percentage point increase in expected inflation is estimated to raise required real stock returns about one percentage point, which amounts to about a 20 percent decline in stock prices. At the same time, the inflation related component in expected real stock returns has a high degree of commonality with the component related to the expected real long-term bond yield.

Using stock price and goods price data from six industrial countries, Anari and Kolari [1] show that long-run Fisher elasticities of stock prices with respect to goods prices exceed unity and range from 1.04 to 1.65, which tends to support the Fisher effect. We also find that the time path of the response of stock prices to a shock in goods prices exhibits an initial negative response, which tims positive over longer horizons. These results help reconcile previous short-run and long-run empirical evidence on stock returns and inflation. Also, they reveal that stock prices have a long memory with respect to inflation shocks, such that investors should expect stocks to be a good inflation hedge over a long holding period.

Moshiri and et al examine the Fisher hypothesis, which denotes a positive relationship between nominal stock return and inflation rate, using a wavelet multi-scaling method that decomposes a given time series on a scale-by-scale basis. The wavelet approach based on time-scale decomposition provides a valuable means of testing the Fisher hypothesis and resolves the problem of conflicting results in the literature. results show a negative relationship between inflation and the TSE returns in short-run horizon and a positive relationship in long-run horizon.

Pereira and Garmendiat test [8] for real channels by using data on Emerging Markets. These have the advantage of offering high variation in inflation both across time and countries. Results provide robust evidence for real channels in three ways. First, there is a negative correlation between realized inflation and future real earnings, as Friedman claimed. Second, inflation correlates positively with risk, as recently discussed in Bekaert and Engstrom [4]. Third, as suggested by Ritter and Warr, leverage ameliorates the negative correlation between inflation and real stock prices.

the researcher finding show in the most of the instance there were no strong causal relationship between stock price and the interest rate John Murphy in his book Technical Analysis of the financial Markets. As market interest rate rise, the investor required rate of return increase, the discount value of bond payments decline, when the higher discount rate is applied thus the present value of bond decline. Which forces the bond price to decline and also bond price affected by the factor that influences interest movement including economic growth inflation…?

Level of inflation expected to increase there will be up ward pressure on interest rates and on required rate of return on bond verse per verse.

Kumari [5] investigates the relationship between stock returns and inflation in India during 1991:4 to 2009:3. Weekly, monthly and quarterly indexes of BSE Sensex and NSE Nifty are used. Weekly, monthly and quarterly Wholesale Price Index (WPI) and monthly Consumer Price Index (CPI) are used as measures of inflation. The analysis is also carried for the subperiod 2002:4-2009:3, and the pre-crisis and post-crisis analysis is conducted through the analysis of the subperiod 2005:1-2009:4. Unit root tests, Granger causality test and regressions are performed for examining the nexus between the variables. Vector Autoregression (VAR) methodology has been employed to investigate the causal link between stock returns and inflation. Impulse Response Functions (IRF) check the response to disturbance in the system. The results suggest that there is no significant relation between stock returns and inflation in post-reform period in India.

Burkhardt [4] provide empirical evidence indicating that inflation risk is time-varying and priced in the cross-section of individual stocks in the U.S. and UK equity markets. I establish that the way inflation risk is priced in equity markets is closely related to the cyclicality of inflation. Burkhardt show that the market price of inflation shocks is positive (negative) when inflation is pro-cyclical (counter-cyclical) and hence comoves positively (negatively) with measures of economic activity. As a consequence, risk premiums on stocks with positive/negative exposure to inflation shocks depend on whether the economy is in a pro- or counter-cyclical inflation regime. A zero-investment strategy that goes long low (high) inflation-beta stocks and short high (low) inflation-beta stocks when inflation is counter-cyclical (pro-cyclical) yields economically large and statistically significant return premiums in both markets, even after controlling for well-known risk-factors.

Nath Sahu & et al, the intention of this study is to investigate the impact of the inflation rate on stock market in India during the period 1993 to 2013. The Johansen’s cointegration test suggests that there exist significant negative long-run co-movement between the rate of inflation and stock prices in India. The result of vector error correction model indicates that in short-run the inflation rate negatively affects the Indian stock market, and, the Granger Causality test reveals that the inflation rate causes the stock market movement in India.
The variance decomposition analysis reveals that both the Indian stock markets are strongly exogenous in the sense that shocks to inflation rate explain only a small portion of the forecast variance error of the market indices. Finally, from the impulse response function analysis it is noticed that a positive shock on inflation rate has a negative and persistent effect on Indian stock markets.

Boons (2014) use individual stocks to estimate the IRP, because this provides author with a heterogenous cross-section of exposures. boons nd that the IRP is a significant -5.5% since them1960s, but reverses to an insignificant positive value in the recent decade. Consistentm with this reversal, wend that the IRP is more negative in recessions historically, but more positive in the two latest recessions. he show that both the introduction of Treasury Inflation Protected Securities (TIPS) in 1997, an attractive alternative inflation hedge, and a reversal in the covariance between inflation and the real economy at the end of the 1990s contribute to this reversal. The sendings are consistent with inflation as a state variable in the intertemporal capital asset pricing model (ICAPM).

Pereira and Garmendia [8], explains the negative correlation between realized inflation and real stock prices under a rare-event framework. Agents make use of realized inflation rates to update their beliefs on the time-varying probability of a rare-event (stagflation or hyperinflation). A higher stagflation probability implies a higher correlation between inflation and real stock prices (dividend yield). they show that for a Bayesian beliefupdating agent, the expectation on the Fed commitment to low inflation is key in order to explain the magnitude of the correlation. To test the model predictions, they perform a Markov Regime switching estimation and identify two statistically different regimes: one regime in which agents expect a strong commitment to low inflation by the Fed; and another regime in which they expect a low commitment to low inflation. Inflation correlates higher with stock prices in the second regime than in the first one. Finally, he show that the rare-event approach is more robust than the money illusion approach a-là Modigliani and Cohn.

Hypothesis:
H_0: If the monthly US Federal Reserve Bank inflation (CPI) increases. Monthly stock price decrease.
H_1: If the monthly US Federal Reserve Bank inflation (CPI) increases. Monthly stock price will not change or increase.

Theoretical Framework:

Framework expressed According Shiblee paper. Stock Valuation: Value investing is a very popular stock strategy where investors seek out companies, which they believe have the ability to create profits at an acceptable level during a sustained holding period. An acceptable level of profits would probably mean, doing better than the market average, but it would be different for every investor. What is the same for all value investors is the desire, to buy a well performing stock at a bargain price.

Common Stock is equity (ownership) that has no priority for dividend or in bankruptcy.

Stockholders are residual claimants on the firm and receive dividends. Cash flows to stock’s owners arrive in 2 forms: (i) dividends by the firm and (ii) stock price paid by the capital market on the sale of the stock. In fact, pricing stocks are more difficult than pricing bonds, because the cash bond’s cash flows are sure whereas the cash flows of the stock are not sure. The stock has infinite life, and the required rate of return for stocks is unobservable.

Stockholders rights: Shareholders have the right to elect corporate directors, who set corporate policy and select operating management, only shareholders have this right, thus they control the corporation through this right. The general rule for electing directors is one share one vote and not each shareholder has vote. However voting can take one of the following types, depending on the corporation:
1. Cumulative voting – when the directors are all elected at once. Total votes that each shareholder may have equals the number of shares times the number of directors to be elected. In general, if N directors are to be elected, it takes 1 / (N+1) percent of the stock + 1 share to assure a deciding vote for one directorship. Good for getting minority shareholder representation on the board.
2. Straight (majority) voting – the directors are elected one at a time, and every share gets one vote. Good for freezing out minority shareholders.
3. Staggered elections – directors’ terms are rotated so they aren’t elected at the same time. This makes it harder for a minority to elect a director and complicates takeovers.
4. Proxy voting – grant of authority by a shareholder to someone else to vote his or her shares. A proxy fight is a struggle between management and outsiders for control of the board, waged by soliciting shareholders’ proxies.

Stock represents an ownership claim on the firm. The stockholder receives dividends of Div. Since the firm has an infinite maturity the cash flow continues forever. Stock Price Sensitivity to Changes in growth (g %):

In general, the following rules specify the price of the stock, everything equal:
- The larger the dividend growth rate the higher price of the stock
- The larger the proportion of earnings paid out as dividends the higher the stock price.
- The lower the level of interest rates, the higher the price per share.
Less risky companies worth more than risky companies. The risk less rate of interest, \( r \), is looked at as a risk less rate of interest, \( r_f \), plus a risk premium, \( r_P \), \( r = r_f + r_P \), so the lower the risk premium the lower the required rate of return the higher the stock price [11].

Inflation: What Is Inflation?

Inflation is defined as a sustained increase in the general level of prices for goods, and services. It is measured as an annual percentage increase. As inflation rises, every dollar you own buys a smaller percentage of a good or service.

The value of a dollar does not stay constant when there is inflation. The value of a dollar is observed in terms of purchasing power, which are the real, tangible goods that money can buy. When inflation goes up, there is a decline in the purchasing power of money. For example, if the inflation rate is 2% annually, then theoretically a $1 pack of gum will cost $1.02 in a year. After inflation, your dollar can't buy the same goods it could beforehand.

Causes of Inflation:
- This theory can be summarized as "too much money chasing too few Demand-Pull Inflation goods". In other words, if demand is growing faster than supply, prices will increase. This usually occurs in growing economies.
- When companies' costs go up, they need to increase prices to maintain their Cost-Push Inflation. Increased costs can include things such as wages, taxes, or increased costs of profit margins imports.

Inflation: How Is It Measured?

Measuring inflation is a difficult problem for government statisticians. To do this, a number of goods that are representative of the economy are put together into what is referred to as a "market basket." The cost of this basket is then compared over time. This results in a price index, which is the cost of the market basket today as a percentage of the cost of that identical basket in the starting year.

In America, there are two main price indexes that measure inflation:
1. Consumer Price Index (CPI) - A measure of price changes in consumer goods and services such as gasoline, food, clothing and automobiles. The CPI measures price change from the perspective of the purchaser.
2. Producer Price Indexes (PPI) - A family of indexes that measure the average change over time in selling prices by domestic producers of goods and services. PPIs measure price change from the perspective of the seller [11].

Model:

According Shiblee paper [11], We want to determine if there is any relationship between The dependent variable : stock prices , with the Inflation, GDP, Unemployment, Money supply independent variables:

The panel data regression equation is:

\[
Y = X_1 \beta_1 + X_2 \beta_2 + X_3 \beta_3 + X_4 \beta_4 + \varepsilon
\]

\( Y \) : Stock price
\( X_1 \) : Iran central Bank inflation (CPI)
\( X_2 \) : Iran central Bank GDP
\( X_3 \) : Iran central Bank Unemployment
\( X_4 \) : Iran central Bank money supply (M0)
\( \varepsilon \) : error term

Estimation method:

We use panel data method to estimate the parameters of interest. The panel data approach has several advantages compared to the cross-sectional approach often used in financial research.
1. Due to an increase in the number of data points, degrees of freedom are increased and multicollinearity problem is reduced thus the efficiency of econometric estimates is improved.
2. Panel data can control for individual heterogeneity due to hidden factors, which, if neglected in time-series or cross-section estimations leads to biased results. Heterogeneity is captured by firm specific fixed effects or random effects components based on the characteristics of the data set.

We write the model in matrix notation [2]:

\[
y_t = \mu_t + \nu_t
\]

\[
\varepsilon_t = \mu_t + \nu_t
\]
$u_t$ is a random term which comprised of two parts, $\mu_i$ is firm specific effect and $v_t$ is a random term. $E(x_{it}|\mu_i) \neq 0$ and $v_t \sim iid (0, \sigma_v^2)$. $x_t$ and $\mu_i$ are uncorrelated. Depending on the underlying assumptions, the model(s) can be estimated assuming fixed firm specific effects or random effects. In fixed effects model, $\mu_i$, the firm-specific effects, are fixed. In the random effect model (which is chosen here) $\mu_i$ are random with known distribution. An advantage of the random effects model is the inclusion of time invariant variables such as industry dummies. We are interested in the parameters associated with the distribution, i.e. $\mu_i \sim iid(0, \sigma^2_\mu)$, $\lambda_t \sim iid (0, \sigma^2)$, $\nu_{it} \sim iid (0, \sigma^2_v)$. The variance components, $\sigma^2_v$, $\sigma^2_\mu$ are used to transform the data. The variance component $\sigma^2_u$ is obtained from the pooled regression [3].

\[
\begin{align*}
&v_{\text{ar}(x_{it})} = \sigma^2_v \sigma^2_\mu, \sigma^2_\mu = (\sigma^2_v \sigma^2_e)^{1/2}, \\
&(2) \ y_{it}^* = y_{it} - \hat{\beta}_0 x_{it} + \nu_{it}^*, \\
&(3) \ y_{it} = \sum_{t=1}^T y_{it}, \\
&(4) \ y_{it} = \sum_{t=1}^T y_{it}, \\
&(5) \ x_{it} = \frac{1}{\sqrt{T}} \left( \sum_{t=1}^T \left( \frac{\sigma^2_v}{\sigma^2_v + \sigma^2_\mu} \right) \right) \\
&(6) \ \theta = 1 - \left( \frac{\sigma^2_v}{\sigma^2_v + \sigma^2_\mu} \right) \\
\end{align*}
\]

We then estimate the following model on the transformed variables using OLS.

\[(7) \ y_{it}^* = \beta_0 + \beta_1 x_{it}^* + u_{it}^*,\]

Ordinary least-square regression on transformed data is called feasible GLS, which consistent and efficient estimation of the parameters. Note that in Random effects model, $0<\theta<1$. If $\theta=0$ the model reduces to OLS, if $\theta=1$ the model equates within fixed effects model [2].

To determine the type of data used in the model is a combination of different tests. The most common, Limer test, using the fixed effects model is the model for panel data. Hausman test for fixed effects model using the random effects model.

Table 1: The diagnostic tests for panel data.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Level of reliability</th>
<th>Test statistic</th>
<th>P-value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock prices</td>
<td>I(0)</td>
<td>-11.47</td>
<td>0.000</td>
<td>Unit root in Level</td>
</tr>
<tr>
<td>Unemployment</td>
<td>I(0)</td>
<td>-7.443</td>
<td>0.000</td>
<td>Unit root in Level</td>
</tr>
<tr>
<td>Inflation</td>
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<td>0.000</td>
<td>Unit root in Level</td>
</tr>
<tr>
<td>Money supply</td>
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<td>-21.034</td>
<td>0.000</td>
<td>Unit root in Level</td>
</tr>
<tr>
<td>GDP</td>
<td>I(0)</td>
<td>-5.581</td>
<td>0.000</td>
<td>Unit root in Level</td>
</tr>
</tbody>
</table>

Sample Description:
The sample consisted of all available data collected during 2000 – 2013 period concerning monthly Close Price values of 10 studied companies. Data about monthly Inflation Rate, Consumer Price Index (CPI), Unemployment Rate, money supply variables were also collected for the same period (168 months in all).

Unit root tests in panel data:
Unit root tests in panel data by Kvah was based on the study by Levin and Lin, Levin, Lin and Chu and Myrr Brynvang and have sons and Shane was developed. The results of the reliability of their data, based on the method described by Levin and Lin as follows:

Table 2: Unit root test.

<table>
<thead>
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Analysis:
The results of tests of fixed effects (F limr test ) and Hausman test indicates that the data panel and must be estimated with random effects. A panel data regression Analysis test was applied to study the effect of Inflation.
Rate and other macro variables such as GDP, Unemployment Rate and Money Supply variables on Stock Price values like it is shown below:

All Studied Companies Close Price = -12.28 - 2.35 Inflation + 0.16 GDP - 3.54 Unemployment + 0.02 Money Supply

The relation between Monthly Inflation Rate and Close Prices values according to Studied Companies:
- there are a linear relation between Monthly Inflation Rate and each one of the studied companies’ Close Prices values.
- R square values (0.8) were relatively high and All variables are significant at the 95% level estimates.
- algebraic signs inflation variable were negatives, therefore according relations were negatives, also H0 was accepted.
- The effect of Inflation Rate Consumer Price Index (CPI), GDP, Unemployment:
  - impact of GDP and money supply variables on stock prices are positive and effect of unemployment is negative.
  Also analyses one to one with OLS regression shows: algebraic sign of calculated coefficient for inflation on stock prices, was negative. The according H0 was accepted.
  - R square values for “All Studied Companies” were relatively high (over 0.88). therefore, the study can conclude that the variation in according Close Price values were highly effected by Inflation, GDP, Unemployment and Money Supply variables.

**Conclusion and Offers:**

**According to the data of the study, the research found results:**

  for inflation and unemployment, both have a negative influence on all companies. and positive relation between the money supply and GDP variables and stock price.

  The research found that, our variables have same effects on the companies we selected, which . But it has different sensitivity to our variable, the research can say that another forces affect the price in this company to give us this result. It could be internal or external forces, so we have different results.

  According to the variable chosen by researcher, the strongest variable effect among our collection was money supply. It has strong positive influence on most companies in our sample. The researcher can depend on this variable for forecasting the stock price.

  The basic variable was CPI, it has a strong negative effect on all companies.

  Based on these results, the government will support the stock market returns should also take actions to prevent inflation and recession do. Also, due to the positive effect of money on stock prices and inflation, the monetary policy should not use for this purpose.

  Other researchers can develop this study by adding other variables, such as (Interest rate, Housing retail, Import/export index, Unit labor cost, wage, etc..)

**REFERENCES**