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# The Effect of the Targeted Subsidies Plan on the Stock Returns: Iranian Evidence

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**Abstract**

The current study aims to investigate the relationship between Iran's Targeted Subsidies Plan and the stock returns of listed companies on the Tehran Stock Exchange (TSE). Stock returns is obtained from the indices of three industries: pharmaceuticals, chemicals, and machinery and equipment. Moreover, the present research uses gold price and dollar price as control variables. The Targeted Subsidies Plan is the independent variable that takes the value of zero before implementation and one after implementation. Multivariate regression is used for data analysis over the period 2009-2011. The results indicate that there is no relationship between the Targeted Subsidies Plan and market returns. Moreover, paired t-test is applied to verify the results of regression analysis, which rejects the results of the regression model. This is because of the higher accuracy of regression analysis compared to paired t-test which only examines one variable. Therefore, we rely on the results of regression analysis and reject the existence of a significant relationship between the Targeted Subsidies Plan and the stock returns of the studied industries.

**Keywords:** Targeted Subsidies Plan, stock returns, Tehran Stock Exchange.

## Introduction

Targeted Subsidies Plan has been called one of the most fundamental decisions in Iran's Economic Development Plan. The plan initiated in 2010 with the purpose of replacing subsidies on food and energy with targeted social assistance, while at the same time revealing the true value of items that were formerly paid, in part or entirely, by the government. It also aimed to reduce the economic gap between rich and poor, since previously the subsidies were mostly taken up by upper deciles. A part of the subsidies on food and energy are paid to the public in cash (60% in

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2011) and the rest is invested on construction and cultural activities. Targeted Subsidies Plan is referred to as the “biggest surgery” to the nation’s economy in half a century.

Targeting methodology can be summarized as follows (Vahapassi, 2004;Houssou, 2010):

1. Group targeting: A specific group (e.g. women) is covered by the subsidies. Although this is an easy method, it often involves a large number of people.
2. Means test: Means test determines whether an individual or family is eligible to receive subsidies. If the income of people can be easily and accurately be determined, this will be a very practical method.
3. Proxy means test: This method is used when the income of individuals cannot be accurately determined. Certain economic and social indices are usedinstead of income. In fact, proxy means test is an informal method for determining the target group.
4. Self-selection: In this method, the selection of particular subsidies can be left to the potential recipients themselves.

Due to inaccuracy of direct methods, the use of indirect indices or the proxy means test (PMT) is very useful. Zahur (2009) provided a review of PMT-based tests, and Grosh (1994)showed that proxy means tests tend to produce the best incidence of outcomes when compared with the other targeting mechanisms. As shown by Persaud (2005) and Zeller (2009), PMT is the most objective means test for assessing ones eligibility for social welfare assistance. This mechanism assesses each potential beneficiary on the basis of certain economic indices, rather than on income or wealth. These indices are:

1. Household characteristics, e.g. education, age, gender, and size;
2. Ownership of assets that can easily be identified and measured (e.g. home, automobile, etc.);
3. Location of the household (e.g. urban or provincial).

One of the main objectives of the Targeted Subsidies Plan is to restructure Iran’s economy which depends on oil revenues, leading to low-quality production, inability to compete, and disregard for optimal fuel consumption. The implementation of this plan increases the total cash in people’s hands. Although a part of these funds are expended on energy (e.g. fuels and gas, water, and electricity bill), the increased cash may be used in investments, especially in the stock market.

This Targeted Subsidies Plan is expected to increase the costs of companies, especially in such core industries as pharmaceuticals and chemicals. Subsequently, this can change the stock price index and stock returns of these industries. Therefore, the purpose of this article is to examine the effect of the Targeted Subsidies Plan on the market returns of core industries.

**The problem**

There have been many analyses of the Targeted Subsidies Plan. Since this plan has recently been initiated and during this time stock price index fluctuations have been high, the effect of the plan on stock price index is disputed. Do increased costs of listed companies reduce stock price index? Or does increased cash in people's pockets increases the index and consequently increase returns?

Targeted subsidies revealed the actual value of certain items, including:

- Energy (gas, gasoline, kerosene, crude oil, liquefied petroleum gas, natural gas, and electricity),
- Water and wastewater services,
- Public transportation (aerial and rail services),
- Postal services,
- Basic goods (wheat, rice, oil, milk, and sugar).

Among these items, energy prices and transportation prices are the priority. Experts argue that although implementation of the Targeted Subsidies Plan may have positive effects in the short- and long-term (e.g. better signaling of prices, price transparency, and more efficient resource allocation in the stock market) (Abde Tabrizi, 2009), listed companies are bound to face increased risk and reduced stock price index. The reason is that the rise in energy prices increases the price of goods and services, thus increasing production costs and reducing the efficiency of listed companies. Some experts believe that if people invest the money from the subsidies in long-term investment in the stock exchange, they will have higher income and will be able to cover their costs, which in turn affects inflation after implementation of the Targeted Subsidies Plan. They believe that managing how the subsidies are spent is very important, for without proper management the increase in people's demands for consumption goods can lead to the failure of the plan (Sanginian, 2010).

Several strategies were planned to prevent the negative consequences of the Targeted Subsidies Plan, but they were never put into effect. These

strategies included grants, short-term and long-term loans with low interests, changing high energy-consuming production lines to low energy-consuming ones, and regulating import and export tariffs, aiming to prevent any damages to industries that highly depended on energy. Except for low-interest loans to few industries, these strategies were not implemented. As a result, industrial and manufacturing entities are faced with serious problems due to the contractionary policies of the banking system that failed to provide the loans.

Definition and distribution of subsidies in today's economic systems has a far more important role than other economic issues such as determining interest rate, salary cap, or wages. The experiences of other countries cannot be copied and must be examined by taking into account the subtleties of that economy. The prerequisite for the success of a subsidization program is to account for the local and national circumstances of the country.

After the collapse of the socialist system in Poland, targeting of energy subsidies was implemented and became one of the most successful plans in the Eastern Bloc. Subsidies became more systematic and the financial discipline of the government was heavily controlled. In Bulgaria, energy prices changed over a period of three years to reveal their actual price. In Indonesia, the government uses the direct subsidies to oil products to support low-income or poor families. In China, the government plans to gradually remove the subsidies to the energy sector over a period of 10 years. In Turkey, a macroeconomic policy package was adopted in 2001: introduction of a floating exchange rate system, reduction of government deficit, independence of the central bank, reform of financial markets, and privatization of telecommunications and energy sectors (Alizadeh, 2010).

Early implementation of the Targeted Subsidies Plan showed that individual reform in the energy sector creates many problems due to its direct and indirect impact on microeconomic (e.g. businesses and households) and macroeconomic (e.g. inflation, liquidity, and money demand).Thus, this plan must be considered from a broader perspective to incorporate different areas such as the foreign exchange market, money market, and so on (Nahavandian, 2012).

It must be noted that payment of subsidies affects not only the prices, but the preferences of consumers, thus increasing the consumption of subsidized goods. On the other hand, since consumers do not pay the

actual price of the goods, they will not use them efficiently. Therefore, increasing subsidies will lead to increased government costs and deficits.

Since economic reforms affect the market mechanism and market performance of any country, the present research investigates the effect of the Targeted Subsidies Plan on the performance of TSE-listed firms. Stock market returns is one of the most important measures for evaluating firms' performance. Since it has been claimed that implementation of this plan has increased the production costs of industries, the dependent variable is the market returns of industries such as pharmaceuticals, chemicals, and machinery and equipment one year before and after the implementation of the plan (2009-2011). To account for the effect of industry classification, each of the hypotheses of the research is examined separately for different industries.

**Literaturereview**

There are no similar studies on Iran's Targeted Subsidies Plan. Therefore, in this section the literature on the effect of economic factors on market returns is provided. It has been argued that stock prices are determined by certain macroeconomic variables such as interest rates, exchange rates, and inflation. Numerous studies have addressed the effect of economic forces on stock returns in different countries. For instance, arbitrage pricing theory was used by Ross (1976) and Chen et al. (1986) to explain the effect of some macroeconomic variables on the stock returns in US capital markets. Their findings showed that factors such as industrial production, inflation, and the term structure of interest rates were significant predictors of stock returns.

Chen et al. (2005) studied the relationship between macroeconomic and non-macroeconomic variables and hotel stock returns in a sample of hotel companies listed on the Taiwan Stock Exchange. The findings indicated that among the macroeconomic variables (i.e., money supply, the growth rate of industrial production, expected inflation, the change of unemployment rate, and the yield spread), only money supply and the unemployment rate significantly explained the movement of hotel stock returns. On the other hand, all non-macroeconomic forces selected (i.e., presidential elections, the 921 earthquake, the 2003 Iraqi war, the outbreak of SARS, sports mega-events, the Asian financial crisis, and the 911 terrorist attacks) had significant influences on the hotel stock returns.

In a study of Turkish companies, Aygoren and Saritas (2004) showed that stock price index and stock returns were negatively associated with inflation in the period 1992-2002.

Karamustafa and Kucukkale (2004) examined the effect of a set of macroeconomic variables (i.e. money supply, exchange rate of US Dollar, trade balance, and the industrial production index) and stock returns in Turkey. The results suggested that these variables are not significant predictors of stock price index and stock returns. On the contrary, this study showed that stock returns are the leading predictor of macroeconomic performance for the Turkish case.

Chopin and Zhong (2000) re-examined the relationship between stock returns and inflation in the post- World War II period. They found that both real activity and monetary fluctuations generate the contemporaneous correlation between stock returns and inflation.

Variables such as inflation, liquidity, and exchange rate affect stock prices, and this is supported by numerous empirical studies over the past decade. The dynamic relationship between macroeconomic variables and stock returns has been extensively studied. The basis of these studies is that stock prices reflect the present value of the future cash flows Therefore, both future cash flows and expected returns (discount rate) are required. As a result, economic variables affect both future cash flows and expected returns and can affect stock prices (Elton and Gruber, 1991).

Fernandez (2009) described the dynamics of stock returns of 10 leading mining firms over a politically unstable period, marked by 9/11 and the subsequent invasion of Iraq. The results suggested that firms belonging to the same industry did not necessarily exhibit identical patterns of return volatility.

Jammazi and Aloui (2010) studied the effect of crude oil shocks on the stock market returns of for UK, France, and Japan over the period 1989-2007. Using a combination of wavelet analysis and Markov Switching Vector Autoregressive approach, they showed that crude oil shocks do not affect the recession stock market phases (except for Japan).

Li and Hu (1998) examined the responses of the stock market to macroeconomic announcements in the US setting. They studied the effect of unpredicted changes in such variables as money supply, inflation, employment, housing starts, and trade balances on the stock market. Their findings indicated that increase in money supply leads to immediate rise in

interest rate, which in turn decreases the present value of future cash flows and ultimately decreases stock prices.

Gultekin and Gultekin (1983) examined the relationship between stock returns and inflation in twenty six countries. They tested the Fisher hypothesis that common stock returns and expected inflation rates are independent of each other. The results showed that for the majority of studied countries the relationship between stock returns and inflation is not significant (i.e. the relationship was negative for four countries and positive for two countries).

Boudoukh and Richardson (1993) came to the conclusion that there is a one-to-one relationship between expected inflation and stock returns. The empirical results of Graham (1996) indicated that the relationship between inflation and stock returns is unstable, being positive in some periods and negative for other periods. The findings of Caporale and Chulho (1997) also showed that inflation has a negative effect on real stock prices. Thorbecke (1997) showed that monetary policies have a major effect on stock returns and expansionary policy increases ex-post stock returns.

Lee (1996) found that there is a significant negative relationship between real stock returns and inflation. Chatrath et al. (1997) reported a significant negative relationship between real stock returns and the unexpected component of inflation. Najand and Rahman (1991) found evidence of a causal relationship between stock returns and inflation. Hernández (1990) also reported a significant relationship between real stock returns and inflation.

Fama and Gibbons (1982) tested the relationship between inflation, real returns, and capital investment. Their findings were consistent with the results of Mundell (1963) and Tobin (1965) who argued that real expected returns and expected inflation rates were negatively associated. These researchers believe that this is the result of the positive relationship between expected returns, financial assets, and real activities.

Ahmed and Bouis (2002) used a proxy means test[1] and Supply to examine the targeting of subsidies in Egypt. They identified the key factors in households' consumption: household size, highest number of years of schooling of any employed household member, household member aged above 15 years who have never attended school, monthly electricity bill, monthly telephone bill, having private toilet, having a

[1] Developed by International Food Policy Research Institute (IFPRI) in collaboration with the Egyptian Ministry of Trade

motor vehicle, and having a refrigerator. These variables could predict 71.8 percent of the actual needy.

Hao et al. (2009) proposed a model for calculating urban transit subsidy in Beijing using utility theory. The results showed that the subsidy classification and the subsidy calculating model not only can fully satisfy the travel demands of public transit riders, but also can effectively calculate the subsidy amount, which realizes the utility maximization of government subsidy.

Akhlaghi (2012) examined the effect of the Targeted Subsidies Plan on the stock returns of TSE-listed firms. He used the indices of three industries in multiple linear regression analysis for the period 2009-2011. The results showed that no relationship exists between the stock returns of companies and the implementation of the plan.

Abedi (2012) examined the second phase of the Targeted Subsidies Plan. He believes that this plan will be successful if: (1) foreign exchange rate is controlled, (2) non-subsidy leverages are used for excessive consumption, (3) subsidies are indirectly paid to sectors that produce basic goods, reducing the cost of production while preventing the import of similar products, (4) supporting the supply sector, (5) increasing interactions with the other countries and reducing the sanctions, and (6) reviewing the payment of subsidies, target groups, and the amount of subsidies based on the extent to which household are affected by the elimination of energy subsidies.

Sajadi et al. (2010) investigated the long-term relationship between stock returns and a set of macroeconomic variables (i.e. inflation rate, growth rate of money supply, exchange rate, and oil revenues). The results suggested a long-term relationship between the macroeconomic variables and stock returns.

Pirayi and Shahsavar (2008) studied the effect of certain macroeconomic variables on Iran’s stock market. They used seasonal data of different variables such as GDP, money supply, inflation, and exchange rate for the period 1991-2006. The results showed that stock price index is positively associated with GDP and price levels and negatively associated with exchange rate.

Azizi (2007) studied the relationship between inflation and stock returns in Tehran Stock Exchange. Using monthly data of inflation, cash returns, total returns, and stock price index for the period 1998-2003 and applying VAR method and Granger causality test, the results showed that

inflation is a predictor of cash returns and total returns, but does not explain the changes in stock price index.

This review shows that the relationship between inflation and stock returns is varied across different countries and different periods.

## Methodology

### Population and sample

The present research focuses on the changes in stock returns of three core industries: pharmaceuticals, chemicals, and machinery and equipment. The population consists of all the companies listed on the TSE that belong to these industries, and the sample comprises the stock returns of these industries during the period 2009-2011.

### Variables

The independent variable in this study is the Targeted Subsidies Plan. The dependent variable is the stock returns of TSE-listed firms that can be calculated from the following formula using the daily data available on TSE's website[1]:

$$R_t = \frac{(P_t - P_{t-1})}{P_{t-1}}$$

where $R_t$ denotes the stock returns in day $t$, and $P_t$ and $P_{t-1}$ denote the price index of the related industry in day $t$ and $t-1$ respectively. Dollar price and gold price (one gram of 18-carat gold) were used as control variables. The gold and dollar prices were extracted from a valid website[2].

### Hypotheses

The purpose of this research is to examine the effect of Iran's Targeted Subsidies Plan on the stock returns of TSE-listed firms. Therefore, the hypotheses can be developed as follows:

- Hypothesis 1: There is a significant relationship between the Targeted Subsidies Plan and the stock returns of the pharmaceutical firms listed on TSE.
- Hypothesis 2: There is a significant relationship between the Targeted Subsidies Plan and the stock returns of the chemical firms listed on TSE.
- Hypothesis 3: There is a significant relationship between the Targeted Subsidies Plan and the stock returns of the machinery and equipment firms listed on TSE.

[1] www.irbourse.com
[2] www.mesghal.com

**Procedure**

The stock returns of the three industries were separately calculated in Excel software, and the regression models were estimated for each industry. The proposed regression model is as follows:

$$\ln(R+1)_t = \beta_0 + \beta_1 TSP_t + \beta_2 GP_t + \beta_0 DP_t + \varepsilon_t$$

where $R_t$ is market returns, $TSP$ is the Targeted Subsidies Plan (which takes a value of 0 and 1 for the period before and after the implementation of the plan), $GP$ is gold price, and $DP$ is dollar price. Paired t-test will be applied as an additional test to examine the effect of the Targeted Subsidies Plan on the stock returns of TSE-listed companies.

**Results**

**Hypothesis 1**

Based on the first hypothesis, there is a significant relationship between the Targeted Subsidies Plan and the stock returns of the pharmaceutical firms listed on TSE. The regression model for this hypothesis is as follows:

$$\ln(R_1+1)_t = \beta_0 + \beta_1 TSP_t + \beta_2 GP_t + \beta_0 DP_t + \varepsilon_t$$

As can be seen in Table 1, the $R^2$ of the model is 0.031, indicating that about 3% of the changes in the dependent variable (stock returns of pharmaceutical firms) can be explained by the independent and control variables.

**Table 1. Model summary**

| Model | Correlation Coefficient | $R^2$ | Adjusted $R^2$ | Standard Error | Durbin-Watson Statistic |
|---|---|---|---|---|---|
| 1 | 0.176 | 0.31 | 0.25 | 0.00200338 | 1.814 |

**Table 2. Analysis of variance**

| Components | Sum of Squares | df | Mean Squares | F-statistic | $p$-value |
|---|---|---|---|---|---|
| Regression | 0.000 | 3 | 0.000 | 3.106 | 0.174 |
| Residual | 0.002 | 479 | 0.000 | | |
| Total | 0.002 | 482 | | | |

The $p$-value in Table 2 for the null hypothesis of the adequacy of the model ($H_0 : \beta_1 - \beta_2 - \beta_3 - 0$) is equal to 0.174 which is greater than 0.05; therefore, the null hypothesis is accepted at the 95% confidence level and the adequacy of the model is rejected.

**Table 3. Coefficients of dependent and independent variables**

| Variables | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|
| | Estimation | Standard Error | | $t$ | $p$-value |
| Constant | 0.005 | 0.002 | | 1.950 | 0.052 |
| TSP | 0.000 | 0.000 | 0.34 | 0.439 | 0.661 |
| GP | -9.451E-10 | 0.000 | -0.043 | -0.232 | 0.816 |
| DP | -3.327E-7 | 0.000 | -0.159 | -0.987 | 0.324 |

According to the data in Table 3, the $p$-value is 0.661 which is greater than 0.05; thus, there is no significant relationship between the Targeted Subsidies Plan and the stock returns of pharmaceutical firms listed on TSE. The estimated model is as follows:

$$\ln(R_i + 1)_t = 0.005 - (1.393E - 4)TSP_t - (9.451E - 10)GP_t + (3.327E - 7)DP_t + \varepsilon_t$$

The scatterplot of the standardized residuals (Figure 1) against standardized predictions shows no specific trend and the observations are symmetric along the zero line. Thus, homogeneity of variance of the residuals can be confirmed. Considering Table 4, the $p$-value of Kolmogorov-Smirnov test is 0.051 which is greater than 0.05, thus verifying the normal distribution of the residuals. Since there is a linear relationship between the residuals and the dependent variable, normality of residuals reflects the normality of the data.

**Table 4. The results of Kolmogorov-Smirnov test for all the three hypotheses**

| | | Standardized Residuals for H1 | Standardized Residuals for H2 | Standardized Residuals for H3 |
|---|---|---|---|---|
| **Normal Parameters** | N | 483 | 481 | 483 |
| | Mean | 0.0000000 | 0.0000000 | 0.0000000 |
| | SD | 0.99688311 | 0.99687010 | 0.99688311 |
| **Most Extreme Differences** | Absolute | 0.125 | 0.117 | 0.115 |
| | Positive | 0.125 | 0.117 | **0.115** |
| | Negative | -0.098 | -0.108 | -0.084 |
| **K-S Z** | | 1.424 | 1.257 | 1.369 |
| **Asymp. Sig.** | | 0.051 | 0.075 | 0.058 |

The Durbin-Watson statistic in Table 1 is 1.814 which is close to 2, and thus we can accept the independence of residuals. Moreover, the $p$-value of the runs test is 0.064 which is greater than 0.05 and the independence of residuals can be confirmed at the 95% confidence level. This suggests that we can fully trust the results of the regression model.

The $p$-value of paired t-test (Table 5) is 0.015 which is less than 0.05. Therefore, the Targeted Subsidies Plan has a significant effect on the stock

returns of pharmaceutical firms. Further, Table 6 shows that the stock returns of the pharmaceutical firms has been 0.00236 before implementation of the plan and 0.00126 after its implementation, suggesting a reduction in mean stock returns of these firms.

**Table 5.Paired t-test for all the three industries**

| | | Mean | SD | SE | t | df |
|---|---|---|---|---|---|---|
| Pair 1 | Pharmaceuticals B/Pharmaceuticals A | 0.001101 | 0.006960 | 0.000448 | 2.456 | 240 |
| Pair 2 | Chemicals B/Chemicals A | 0.001222 | 0.010245 | 0.000663 | 1.845 | 238 |
| Pair 3 | Machinery B/Machinery A | 0.001623 | 0.007698 | 0.000496 | 3.273 | 240 |

**Table 6. Paired samples statistics for the three industries**

| | | Mean | Total | SD | SE |
|---|---|---|---|---|---|
| Pair 1 | Pharmaceuticals B | 0.00236 | 241 | 0.004595 | 0.000296 |
| | Pharmaceuticals A | 0.00126 | 241 | 0.004758 | 0.000307 |
| Pair 2 | Chemicals B | 0.00228 | 239 | 0.006903 | 0.000447 |
| | Chemicals A | 0.00106 | 239 | 0.007857 | 0.000508 |
| Pair 3 | Machinery B | 0.00128 | 241 | 0.006096 | 0.000393 |
| | Machinery A | -0.00035 | 241 | 0.005459 | 0.000352 |

**Hypothesis 2**

According to the second hypothesis, there is a significant relationship between the Targeted Subsidies Plan and the stock returns of the chemical firms listed on TSE. The regression model for this hypothesis is as follows:

$$\ln(R_2 + 1)_t = \beta_0 + \beta_1 TSP_t + \beta_2 GP_t + \beta_0 DP_t + \varepsilon_t$$

As shown in Table 7, the $R^2$ of the model is 0.012, indicating that about 1% of the changes in the dependent variable (stock returns of chemical firms) can be explained by the independent and control variables.

**Table 7. Model summary**

| Model | Correlation Coefficient | $R^2$ | Adjusted $R^2$ | Standard Error | Durbin-Watson Statistic |
|---|---|---|---|---|---|
| 2 | 0.018 | 0.012 | 0.005 | 0.00319339 | 1.828 |

**Table 8.Analysis of variance**

| Components | Sum of Squares | df | Mean Squares | F-statistic | $p$-value |
|---|---|---|---|---|---|
| Regression | 0.000 | 3 | 0.000 | 1.860 | 0.135 |
| Residual | 0.005 | 477 | 0.000 | | |
| Total | 0.05 | 480 | | | |

The $p$-value in Table 8 for the null hypothesis of the adequacy of the model ($H_0 : \beta_1 = \beta_2 = \beta_3 = 0$) is equal to 0.135 which is greater than 0.05; therefore, the null hypothesis is accepted at 95% confidence level and the adequacy of the model is rejected.

**Table 9.Coefficients of dependent and independent variables**

| Variables | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|
| | Estimation | Standard Error | | $t$ | $p$-value |
| Constant | 0.006 | 0.004 | | 1.637 | 0.102 |
| TSP | 0.000 | 0.001 | -0.047 | -0.595 | 0.552 |
| GP | 4.914E-9 | 0.000 | 0.141 | 0.760 | 0.448 |
| DP | -6.625E-7 | 0.000 | -0.201 | -1.234 | 0.218 |

According to the data in Table 9, the $p$-value is 0.552 which is greater than 0.05; thus, there is no significant relationship between the Targeted Subsidies Plan and the stock returns of chemical firms listed on TSE. The estimated model is as follows:

$$\ln(R_t + 1)_t = 0.006 - (3.013E-4)TSP_t - (4.914E-9)GP_t + (6.625E-7)DP_t + \varepsilon_t$$

The scatterplot of the standardized residuals (Figure 2) against standardized predictions shows no specific trend and the observations are symmetric along the zero line. Thus, homogeneity of variance of the residuals can be confirmed. Considering Table 4, the $p$-value of Kolmogorov-Smirnov test is 0.075 which is greater than 0.05, thus verifying the normal distribution of the residuals. The Durbin-Watson statistic in Table 7 is 1.828 which is close to 2, and thus we can accept the independence of residuals. Moreover, the $p$-value of the runs test is 0.066 which is greater than 0.05 and the independence of residuals can be confirmed at the 95% confidence level. This suggests that we can fully trust the results of the regression model.

The $p$-value of paired t-test in Table 5 is 0.066 which is less than 0.10. Therefore, the null hypothesis is rejected at the 90% confidence level, indicating that the Targeted Subsidies Plan has led to significant changes in the stock returns of chemical firms. Also according to Table 6, the mean value of stock returns of chemical firms is 0.00228 before implementation of the plan and 0.00106 after its implementation, suggesting a reduction in mean stock returns.

**Hypothesis 3**

Based on the third hypothesis, there is a significant relationship between the Targeted Subsidies Plan and the stock returns of machinery and equipment firms listed on TSE. The regression model for this hypothesis is as follows:

$$\ln(R_2 + 1)_t = \beta_0 + \beta_1 TSP_t + \beta_2 GP_t + \beta_0 DP_t + \varepsilon_t$$

As shown in Table 7, the $R^2$ of the model is 0.026, indicating that about 3% of the changes in the dependent variable (stock returns of machinery and equipment firms) can be explained by the independent and control variables.

**Table 10. Model summary**

| Model | Correlation Coefficient | $R^2$ | Adjusted $R^2$ | Standard Error | Durbin-Watson Statistic |
|---|---|---|---|---|---|
| 3 | 0.162 | 0.026 | 0.20 | 0.00249769 | 1.860 |

**Table 11.Analysis of variance**

| Components | Sum of Squares | df | Mean Squares | F-statistic | $p$-value |
|---|---|---|---|---|---|
| Regression | 0.000 | 3 | 0.000 | 4.282 | 0.535 |
| Residual | 0.003 | 479 | 0.000 | | |
| Total | 0.003 | 482 | | | |

The $p$-value in Table 11 for the null hypothesis of the adequacy of the model ($H_0 : \beta_1 = \beta_2 = \beta_3 = 0$) is equal to 0.135 which is greater than 0.535; therefore, the null hypothesis is accepted at 95% confidence level and the adequacy of the model is rejected.

**Table 12. Coefficients of dependent and independent variables**

| Variables | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|
| | Estimation | Standard Error | | $t$ | $p$-value |
| Constant | 0.000 | 0.003 | | -0.071 | 0.944 |
| TSP | 0.000 | 0.000 | -0.021 | -0.275 | 0.784 |
| GP | -6.548E-9 | 0.000 | -0.238 | -1.292 | 0.197 |
| DP | 2.637E-7 | 0.000 | 0.102 | 0.626 | 0.531 |

According to the data in Table 12, the $p$-value is 0.784 which is greater than 0.05; thus, there is no significant relationship between the Targeted Subsidies Plan and the stock returns of machinery and equipment firms listed on TSE. The estimated model is as follows:

$$\ln(R_s + 1)_t = -(2.154E-4) - (1.082E-4)TSP_t - (6.548E-9)GP_t + (2.637E-7)DP_t + \varepsilon_t$$

The scatterplot of the standardized residuals (Figure 3) against standardized predictions shows no specific trend and the observations are symmetric along the zero line. Thus, homogeneity of variance of the residuals can be confirmed. Considering Table 4, the $p$-value of Kolmogorov-Smirnov test is 0.058 which is greater than 0.05, thus verifying the normal distribution of the residuals. The Durbin-Watson statistic in Table 10 is 1.860 which is close to 2, thus indicating the independence of residuals. Moreover, the $p$-value of the runs test is 0.063

which is greater than 0.05 and the independence of residuals can be confirmed at the 95% confidence level. This suggests that we can fully trust the results of the regression model.

The $p$-value of paired t-test in Table 5 is 0.001 which is less than 0.10. Therefore, the null hypothesis is rejected at the 90% confidence level, indicating that the Targeted Subsidies Plan has led to significant changes in the stock returns of machinery and equipment firms. Also according to Table 6, the mean value of stock returns of the machinery and equipment firms is 0.00128 before implementation of the plan and -0.00035 after its implementation, suggesting a reduction in mean stock returns.

**Conclusion**

The results of the present research showed that the Targeted Subsidies Plan was not significantly associated with the stock returns of the three studied industries. This can be because the price index of an industry is calculated from the price of each share. The Targeted Subsidies Plan has, on the one hand, increased the costs of industries and, on the other hand, has increased the price of shares. Therefore, this plan has had no significant effect on the returns of the studied industries. However, the results of paired t-test suggested a reduction in the mean stock returns of the industries after the implementation of the plan. The reason for this inconsistency is the higher accuracy of regression analysis compared to paired t-test. The former incorporates several variables while the latter examines only one variable at a time. Thus, we consider the regression results as the basis and reject the existence of a relationship between the Targeted Subsidies Plan and the stock returns of the three industries.

The effect of the Targeted Subsidies Plan on investors differs based on the type of their investments. There are investors who wish to buy the shares of the companies that are currently active in the stock exchange. For this group, targeting subsidies increases the transparency of economic activities and subsequently the activities of the stock exchange. On the other hand, increased foreign exchange rate had a positive effect on import companies and increased the overall profitability of the companies. Thus, the stock price of these companies increased and many investors ardently invested on them. The second group includes those who intend to initiate new economic activities with heavier investments. For them, increased energy prices due to the targeting plan means increased cost of production

and more difficult investments in the future. Thus, naturally the motivation for investment decreases.

**Limitations**

1. This research has only used a specific set of indices which can limit its generalizability.
2. The results of this research must be discreetly generalized to other economic contexts, for this study has been carried out in a developing country with its own economic and social structures.
3. Lack of access to other control variables such as interest rate, inflation rate, monetary policy, and economic sanctions is another limitation of this research.

**Recommendations for future research**

1. The present research can be repeated with other industries, such as metals and mining industries.
2. The effects of the Targeted Subsidies Plan can be examined for a longer period.
3. This research can be repeated in 30 months after the implementation of the plan with more control variables.

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