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THE RELATIONSHIP BETWEEN CONSUMER PRICE INDEX, PRODUCER PRICE INDEX AND TRADED SHARES AT TEHRAN STOCK EXCHANGE

In recent decades, financial markets and especially the stock market have been a concern to investors on the one hand, and on the other hand, for economists and policy makers, especially in developing countries because these markets are formal, legal and safe places for investment. Studying capital markets, that represent the situation of the countries' economies, can help policy-makers to take right decisions at the level of national economy by identifying the variables that affect capital markets or are affected by it. One of these variables that are discussed in this article is inflation. In this paper, firstly, with the cointegration method, by using the quarterly data for 2000-2009, the effect of changes in stock traded on the consumer price index (CPI) and producer price index (PPI) was evaluated. In both cases, there was an indirect long-term relationship between the two variables. Then we study the relationship between CPI and PPI with changing the value of traded shares at Tehran Stock Exchange by using Granger causality. The results show a one-way causality from changing the value of traded shares to CPI while the relationship is contrast for PPI and there is a one-way causality from PPI to changing the value of traded shares.

Keywords: *value of traded shares; consumer price index (CPI); producer price index (PPI); Granger causality; cointegration.*

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ВЗАЄМОЗВ'ЯЗОК МІЖ ІНДЕКСОМ СПОЖИВЧИХ ЦІН, ІНДЕКСОМ ПРОМИСЛОВИХ ЦІН І ТОРГІВЛЕЮ ЦІННИМИ ПАПЕРАМИ НА ТЕГЕРАНСЬКІЙ ФОНДОВІЙ БІРЖІ

У статті показано, що в останні десятиліття фінансові ринки, зокрема фондовий ринок, цікавили як інвесторів, так і економістів і політичних діячів як надійна і легальна сфера інвестування. Ринок капіталу відображає економічну ситуацію в країні і визначення змінних, що впливають на ринок капіталу або залежні від нього, може допомогти політикам у прийнятті рішень на рівні національної економіки. Одна з таких змінних - інфляція. Оцінено вплив змін на ринку цінних паперів на індекс споживчих цін і індекс промислових цін, аналіз проведено методом коінтеграції на основі квартальних даних за 2000-2009 р.р. В обох випадках виявлено непряму довгострокову залежність між цими двома змінними. Застосовано тест Грейнджера для визначення залежності між індексом споживчих цін, індексом промислових цін і зміною вартості цінних паперів на біржі Тегерана. Результати показали односторонню залежність між зміною вартості цінних паперів і індексом споживчих цін, зворотну залежність для індексу промислових цін і односторонню залежність між індексом промислових цін і зміною вартості цінних паперів.

Ключові слова: *вартість цінних паперів; індекс споживчих цін; індекс промислових цін; залежність Грейнджера; коінтеграція.*

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ВЗАИМОСВЯЗЬ МЕЖДУ ИНДЕКСОМ ПОТРЕБИТЕЛЬСКИХ ЦЕН, ИНДЕКСОМ ПРОМЫШЛЕННЫХ ЦЕН И ТОРГОВЛЕЙ ЦЕННЫМИ БУМАГАМИ НА БИРЖЕ ТЕГЕРАНА

В статье показано, что в последние десятилетия финансовые рынки, в частности фондовый рынок, привлекали как инвесторов, так и экономистов и политических деятелей в качестве надежной и легальной сферы инвестирования. Рынок капитала отражает экономическую ситуацию в стране, и определение переменных, влияющих на рынок капитала или зависимых от него, может помочь политикам в принятии решений на уровне национальной экономики. Одна из таких переменных — инфляция. Оценено влияние изменений на рынке ценных бумаг на индекс потребительских цен и индекс промышленных цен, анализ проведен методом коинтеграции на основе квартальных данных за 2000-2009 г.г. В обоих случаях обнаружена непрямая долгосрочная зависимость между этими двумя переменными. Применен тест Грейнджера для определения зависимости между индексом потребительских цен, индексом промышленных цен и изменением стоимости ценных бумаг на бирже Тегерана. Результаты показали односторонню зависимость между изменением стоимости ценных бумаг и индексом потребительских цен, обратную зависимость для индекса промышленных цен и односторонню зависимость между индексом промышленных цен и изменением стоимости ценных бумаг.

Ключевые слова: *стоимость ценных бумаг; индекс потребительских цен; индекс промышленных цен; зависимость Грейнджера; коинтеграция.*

Introduction. In all countries stock exchange shows an overview of the economy. So, the methods to review the performance and identification of obstacles and stimulations of financial markets and especially stock market are the most important programs of the economics. The capital market is considered the most important and integral part of the economy of each country, the stock market is known as a sign of economic situation. In Iran as well as in other countries capital markets are important for policy-makers and development programs pay special attention to these markets. Stock markets allow the economy that uses wandering and small capital perform in the best possible way and to take part in larger projects with higher productivity. On the other hand, stock exchange has created a competition among the companies that participate in stock market which can help to increase their production level and quality of products. One of the most important tasks of financial research is to identify the variables affecting the stock market in the economy of each country.

Inflation is a variable that has many studies about its relationship with capital markets, but still there is no consensus among experts. Increase in general price level means reducing the purchase power in society and for that reason an individual is concerned about the fluctuations. Discussion of inflation, especially in our country, that has infiltrated into economy in a special form, and is the most important variable that must be carefully studied regarding its relationship with stock markets.

In this research, after the above introduction, trends and charts of consumer price index (CPI), producer price index (PPI) and changes in the value of traded shares are presented between 2000/01 to 2009/10 by using the quarterly data on Iran. In the next section, we discuss the empirical studies related to the subject of debate

inside and outside of our country. In the fifth section by using the cointegration method the effect of changes in the value of traded shares on the consumer price index (CPI) and producer price index (PPI) have been considered by using quarterly data over 2000/01 to 2009/10, and then the Granger causality has been investigated between these variables. Then, at last, the results of this research are presented.

Review of research variables trend and of literature

In this section, we tried to provide a trend about the variables in separate graphs. It is necessary because these variables play an important role in economy.

Figure 1 shows that CPI has increased in the surveyed period.

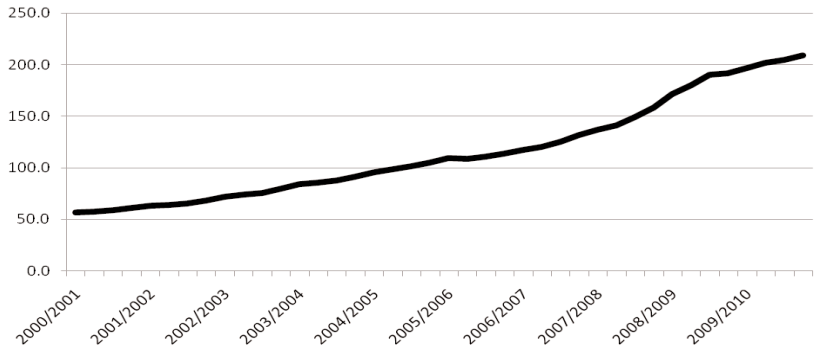

Figure 1. **CPI between 2000/01 to 2009/10**

PPI trend was similar to CPI, see Figure 2.

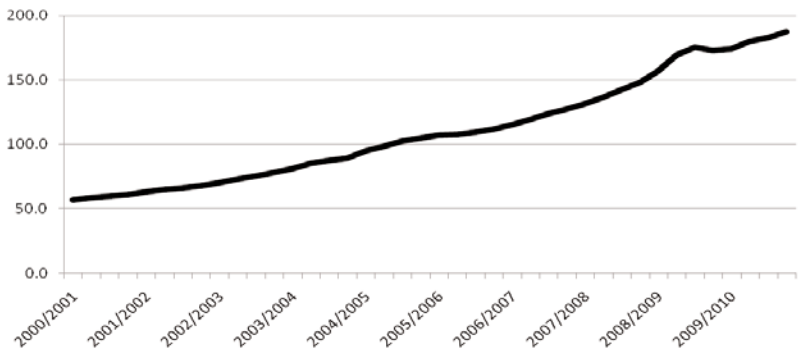

Figure 2. **PPI between 2000/01 to 2009/10**

Figure 3 shows changes in the values of traded shares in the surveyed period. This trend was stable from the beginning of the period to 2003. Trend had fluctuations from 2004 to 2006 and then it returns to the last point. But in 2007 and after that Figure 3 shows fluctuation trend.

On the base of Fisher hypothesis, there is no significant dependence between the real parts of economy and real rates are formed on the base of the factors such as investment performance, and time preferences of savings, and they are independent of inflation expectations. On the basis of this theory, when the inflation rate changes, real return does not change and in fact, the effect of inflation is evident on the nominal rate of return. A theory that increasing inflation rate will raise future expectation of investors and will cause the nominal growth rate of return and common stock known as an inflationary shield, was contradictory and it was rejected.

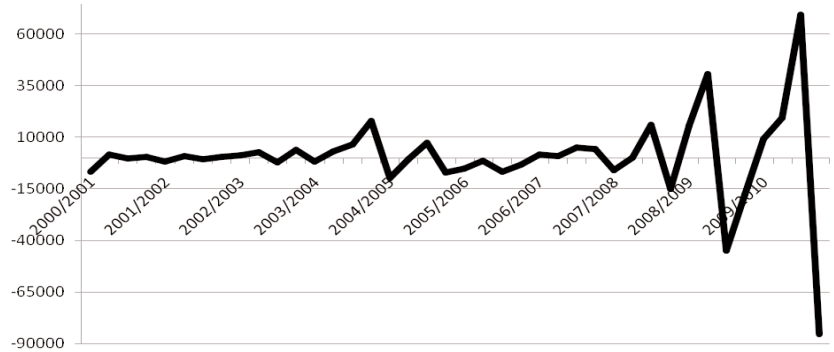

Figure 3. **Changes of the value of traded shares between 2000/01 to 2009/10**

According to Geske and Roll (1983), a series of events and factors in macroeconomics cause changes to stock market returns associated with inflation. They believe that when stock prices decrease, individual and companies' income is reduced, which is actually considered the main government's income. Consequently, if government spending is more than its revenue, treasury faces a deficit of budget and the government is forced to borrow, which will increase the government debt and thus increase the indirect tax anticipated liabilities (individuals and companies tax). The result of the process is also inflation.

Hernandez (1990) used the hypothesis of chain while studying the relationship between stock returns and inflation in Chile during 1960s, 1970s and 1980s in two periods and found that these two variables have no significant relationship.

Fisher's model is based on the fact that real stock returns are independent of inflationary expectations. Based on this model, Boudoukh and Richardson (1993) examined the relationship between expected inflation and stock returns for the US and England from 1802 to 1990. They showed that Fisher's model is only valid in the long run but in the short term this theory is rejected, it means that in the short term the relationship between stock returns and inflation is negative.

Kiseox and Shawnwi (1996) investigated the relationship between stock returns and inflation in the US in 1956 and they believed that increasing inflation permanently will result in reducing stock returns by reducing future real activities.

Graham (1996) also used in a similar review the data from after the World War II. He indicated that the relationship between real stock returns and inflation before 1976 and after 1982 is negative, since in 1976-1987 this relationship was positive.

Caparale and Jung (1997) announced during the investigation that inflation expectations have a negative effect on stock prices.

Choudhry (2001) in an experimental study investigated the relationship between stock returns (nominal and real) and inflation in 4 countries (Argentina, Chile, Mexico and Venezuela) that have high inflation rates during 1980s and 1990s. The results of this study show a direct relationship between the current rate of nominal returns and inflation for two countries (Argentina and Chile). He also tested the relationship between real returns and inflation and concluded that inflation has a negative effect on real stock returns.

Yahyazadefar and Jafari Samimi (2003) investigated in their study the relationship between inflation and real stock returns in the period of 1991/92 to 1996/97 with two methods of chain affect (indirect and direct). The results in indirect method show that the relationship of two variables is not statistically significant while in direct method the relationship between two variables is positive.

Aga and Kocaman (2006) in their paper considered the relationship between stock returns and inflation indicators at Turkish Stock Exchange. They concluded that based on exponential GARCH models industrial price index and consumer price index have no effect on the average of stock price and its volatility, and therefore these macroeconomic variables are not suitable to explain stock returns and volatility at Turkish stock market.

Amirrahimi (2006) in his thesis investigated the effect of inflation on the real stock returns in Tehran Stock Exchange. He indicated that there was no direct relationship between inflation and real returns, and in a long term inflation causes real stock returns reduction.

Rahnamaye Roudposhti (2006) studied the impact of macroeconomic variables on stock returns of investment companies at Tehran Stock Exchange. The results showed that CPI has a direct effect on stock returns of investment companies.

Abbasioun (2009) studied the effect of macroeconomic variables over the entire index of Tehran Stock Exchange. Based on the results, in the long term, the relationship between inflation and the entire index is reversed while in the short term the relationship of these variables is positive.

Lifang et al. (2010) carried out the analysis of inflation and stock returns in Britain. They concluded that in the short and medium terms and under different inflation regimes the stock market in Britain could not resist inflation, but in the long term different inflation regimes caused different effects between inflation and stock returns.

Research methodology. In this research, we used the quarterly data from 2000/01 to 2009/10. We examined the effect of changes in the value of traded shares on CPI and PPI by using cointegration method and Granger causality. In the present paper 3 variables were used:

VTS = Changing the value of the traded shares at Tehran Stock Exchange;

CPI = Consumer Price Index;

PPI = Producer Price Index.

Analyses of the results

Cointegration Method

When using cointegration analysis, statistical properties of variables are very important. Cointegration will test the consistency among statistical properties of the variables. Since generally economical variables are non-stationary and have random trend, the linear combination of non-stationary variables is a non-stationary series generally. However, in this general rule cointegration is an exception and it has close relationship with economical theory, because economical theory being stationary is a combination of economical variables.

The present paper uses the augmented Dickey-Fuller test (ADF) to study unit root and its results are demonstrated in Table 1. Test results demonstrate that all the time series are non-stationary. To be stationary in non-stationary time series, the first

rank differential was used, and according to Table 1, all these series become stationary by differentiating at one time. Therefore, the results of ADF test show that all of the examined variables have been I (1) and consequently have similar rank of cointegration.

Table 1. **ADF-test results**

	ADF Test				
Variable	Trend and Intercept	Result	1st difference	Trend and Intercept	Result
CPI	-1.1681		D(CPI)	-3.6784	
	-4.2191***	non-stationary		-4.2191***	non-stationary
	-3.5331**	non-stationary		-3.5331**	stationary
	-3.1983*	non-stationary		-3.1983*	stationary
PPI	-1.7792		D(PPI)	-4.7385	
	-4.2191***	non-stationary		-4.2268***	stationary
	-3.5331**	non-stationary		-3.5366**	stationary
	-3.1983*	non-stationary		-3.2003*	stationary
VTS	-2.4267		D(VTS)	-13.2053	
	-4.2436***	non-stationary		-4.2436***	stationary
	-3.5442**	non-stationary		-3.5442**	stationary
	-3.2046*	non-stationary		-3.2046*	stationary

(Test critical values: *** 1% level, ** 5% level, * 10% level)

In cointegration analyses by using Johansen analysis method we should determine optimal lag length (P), Akaike Information criterion (AIC), Schwartz Bayesiam criterion (SC), Hannan-Quinn criterion (HQ), final prediction error (FPE), sequential modified likelihood ratio test statistic (LR). According to Table 2 based on all of these criterions, the results are about the relationship between CPI and changes of the value of traded shares P=2 (optimal lag length is equal to 2). Table 3 shows the relationship between PPI and the changes in the value of the traded shares based on all of the results P=3 (optimal lag length is equal to 3).

Table 2.

Lag	LR	FPE	AIC	SC	HQ
0	NA	1.14e+12	33.43663	33.52371	33.46733
1	207.5757	3.16e+09	27.54768	27.80891	27.63977
2	17.96668*	2.24e+09*	27.20244*	27.63782*	27.35593*
3	5.503664	2.33e+09	27.23520	27.84473	27.45009

(Each test at the 5% level)

Table 3.

Lag	LR	FPE	AIC	SC	HQ
0	NA	8.26e+11	33.11580	33.20288	33.14650
1	209.6989	2.15e+09	27.16440	27.42563	27.25650
2	16.48707	1.60e+09	26.86540	27.30078	27.01889
3	13.55853*	1.27e+09*	26.62966*	27.23920*	26.84455*

(Each test at the 5% level)

After obtaining the optimal lag length in each case, we will have the cointegration tests. In Tables 4 and 5 the cointegration test based on maximal Eigen value and Trace test will show a maximal equilibrium in the long-run relationship between CPI and the changes in the value of the traded shares (Table 4) and PPI and the changes in the value of the traded shares (Table 5) respectively at the 5% significance level.

Table 4.

Maximum Eigen value				Trace Test		
H0	H1	Maximum Eigen value Statistic	0.05 Critical Value	H1	Trace Statistic	0.05 Critical Value
r = 0	r = 1	29.5765	14.2646	r ≥ 1	29.5784	15.4947
r ≤ 1	r = 2	0.0018	3.8414	r ≥ 2	0.0018	3.8414

The results of this test demonstrate an equilibrium long-run relationship between CPI and the changes in the value of the traded shares.

The results of this test show is an equilibrium long-run relationship between PPI and the changes in the value of the traded shares.

The equilibrium long-run relationship between CPI and the changes in the value of the traded shares is obtained.

$$CPI = 412.8422 - 0.1053\ VTS + ECT$$
$$(0.0169)$$

Table. 5

Maximum Eigen value				Trace Test		
H0	H1	Maximum Eigen value Statistics	0.05 Critical Value	H1	Trace Statistics	0.05 Critical Value
r = 0	r = 1	40.2088	14.2646	r ≥ 1	41.8277	15.4947
r ≤ 1	r = 2	1.6189	3.8414	r ≥ 2	1.6189	3.8414

The relationship between CPI and VTS obtained is inverse. Changes of VTS coefficient became significant at the 95% level.

The equilibrium long-run relationship between PPI and changes of VTS is obtained.

$$PPI = 323.7911 - 0.0727\ VTS + ECT$$
$$(0.0091)$$

The results are similar to the previous section. The relationship between PPI and VTS obtained is inverse. Changes in the value of the traded shares coefficient became significant at the 95% level.

In analyses of cointegration, contrary to econometrics, traditional procedures for the short-run and long-run structures are separated, because error correction mechanism (ECM) in the short run vacillations of variables relate to long-run equilibrium and have many application. In spite of cointegration among the studied variables and existence of a counteraction relationship between them this model could be used. The results of estimation between CPI and changing the value of the traded shares are provided.

$$D(CPI) = 0.9229 + 0.5581\ D(CPI(-1)) + 0.1908\ D(CPI(-2)) + 7.862\ D(VTS(-1))$$
$$(0.1795) \qquad (0.1845) \qquad (4.8431)$$
$$+ 2.8147\ D(VTS(-2)) - 0.0003\ ECM(-1)$$
$$(3.491) \qquad (0.0005)$$

$R^2 = 0.50$

In this equation R^2 is equal to 0.50 and it shows the explanatory power of this model. Limitation on adding all the effective causes and elements on dependent variable have had many problems, 0.50 could be justified in this manner. Estimation shows that coefficient of ECM is equal to 0.0003 but it does not become significant.

The result of estimation of relationship between PPI and changing the value of traded shares:

D(PPI) = 1.5761 + 0.7663 D(PPI(-1)) - 0.4381 D(PPI(-2)) + 0.2359 D(PPI(-3))
(0.1938) (0.3019) (0.2467)
+1.4089 D(VTS(-1)) - 2. 4728 D(VTS(-2)) - 7.1631 D(VTS(-3)) - 0.0002 ECM(-1)
(0.0001) (7.3694) (4.1433) (0.0015)

$R^2 = 0.49$

In this equation R^2 is equal to 0.49 showing the explanatory power of this model. Limitation on adding all the effective causes and elements on dependent variable have had many problems, 0.49 could be justified in this manner. Estimation shows that ECM coefficient is equal to 0.0002 but it does not become significant.

Granger Causality

According to Engel and Granger (1987) and Granger (1987) if two time series variables have similar rank of cointegration, at least, there is a direct Granger relationship between them. Long-term relationship between CPI and PPI with changing the value of traded shares show that variables at least in one direction are linked. To identify causality between variables, Granger causality test is used. The causality test includes the following bilateral estimates of the regression:

Test of causality between the CPI and the changes in the value of the traded shares:

Regression in this case must be estimated by the following bilateral. Causality test results are illustrated in Table 6.

$$CPI = \sum_{i=1}^{n} \alpha_i VTS_{t-i} + \sum_{i=1}^{n} \alpha_i CPI_{t-i} + U_{1t}$$

$$VTS = \sum_{i=1}^{n} \lambda_i CPI_{t-i} + \sum_{j=1}^{n} \delta_j VTS_{t-j} + U_{2t}$$

It is necessary to tell U_{1t} and U_{2t} in this bilateral regression are supposed to be a non-correlation. As observed in Table 6, there is a one-way causality from the changes in the value of the traded shares to CPI at the 90% level, while there is no inverse of this relationship.

Table 6. **Granger Causality Test**

Null Hypothesis:	F-Statistics	Probability
VTS does not Granger Cause CPI	2.99790	0.06363
CPI does not Granger Cause VTS	1.19743	0.31475

Test of causality between PPI and the changes in the value of the traded shares:

Bilateral regression needed for this sector is estimated. The causality test results are listed in Table 7.

$$PPI = \sum_{i=1}^{n} VTS_{t-i} + \sum_{j=1}^{n} VTS_{t-j} + U_{1t}$$

$$VTS = \sum_{i=1}^{n} \lambda_i PPI_{t-i} + \sum_{j=1}^{n} \delta_j VTS_{t-j} + U_{2t}$$

The results in Table 7 show a one-way causality from PPI to the changes in the value of the traded shares at the 95% level.

Table 7. **Granger Causality Test**

Null Hypothesis:	F-Statistics	Probability
VTS does not Granger Cause PPI	1.95340	0.14230
PPI does not Granger Cause VTS	4.98702	0.00633

Conclusions. In this article the relationship between CPI and PPI with the changes in the value of the traded shares (at Tehran Stock Exchange) was evaluated during the period from 2000/01 to 2009/10 by the using quarterly data. To identify the relationship we were using the cointegration method and Granger causality.

The results show an indirect relationship between CPI and the changes in the value of the traded shares. If the value of the traded shares at the stock market increases (has a positive change) then CPI and PPI would be reduced. Reducing CPI means declining the general price level, and in other words, inflation is reduced.

On the other hand, the relationship between the variables that we study shows that there is a one-way causality in the period under study from the changes of traded stock to CPI at the 90% level. This relationship is opposite for PPI. In the period of the test, there is a one-way causality from PPI to the changes in the value of the traded shares at the 95% level.

The results indicate that if political and economical decision-makers in a country have more attention to capital markets and approving and executing the programs for prosperity, they could reduce the inflation by increasing the market value of transactions. In fact, large and small sources are given to the sector with high productivity and lead generation rather than entering in the inefficient and non-productive sectors. And also by reducing the liquidity and recession of non-productive markets, it provides reducing of general price level. Of course, discussing strategies for increasing the level of transactions and entering the capital to the stock exchange market is too long and it is an opportunity for another article.

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