A survey of the effect of trade openness size on inflation rate in Iran using ARDL

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Abstract. *The purpose of this study is to examine the relationship between trade openness size and inflation rate in Iran using ARDL method for the period 1973 to 2010. There is a robust negative relationship across countries, first documented by Romer (1993), between a country's openness to trade and its long-run inflation rate. Given that Iran's economy is dependent on oil incomes and as these incomes influence on inflation, non-oil trade openness has been used in this study. The results show that this variable has negative significant effect on inflation through this period. Other control variables i.e. Growth of Liquidity, exchange rate and output gap affect inflation in the expected directions.*

Keywords: Openness; Globalization; Inflation; Exchange Rate.

JEL Classification: E31; F43; F14; F41.

Introduction

Macroeconomic variables such as output and inflation and factors influencing them are some of the concerns of economists in recent decades. High rates of inflation can cause inefficient trading and profiteering waste of resources, as well as distortion in rational economic decisions that damages the credibility of government policies. High levels of inflation as a sign of underlying problems in macroeconomic management make short economic horizons and financial instability. Inflation also distorts the functioning of the price mechanism. The evidence from various studies on developing countries suggests that relative prices tend to become more volatile as inflation rises even where indexation is prevalent, partly because many governments attempt to protect certain segments of the population from inflation through selective price control measures. In addition, high inflation tends to be more volatile over time. The variability of inflation – both between sectors and over time – makes it difficult to plan ahead and diverts resources away from productive uses (Ashra, 2002).

Tobin (1972) believes that inflation greases the wheels of the labor market. Friedman (1977) argues that high inflation usually associated with more volatility in price changes, which cause fluctuations in the prices and payment. Inflation exists in all countries but it is more in developing countries because of their situations in global economy and their economic structure. Inflation is a big problem in Iran through 3 decades, which is a developing country (Delavari and Rafieeyan, 2012). So that the average inflation rate during 1971 was approximately 13%, 17 per cent in 1981, 23 percent in 1991, and 14.8 percent in 2001. The remarkable thing is that despite the definition of inflation, there is no consensus about its causes. Due to the complexity of inflation and its causes it is differ from one country to the other and from period to period. Therefore very various and numerous structural and non-structural, governmental and nongovernmental factors exist. Monetary and fiscal policies, trade and foreign trade, foreign exchange and foreign policies of governments and socio-economic structures of societies are the most important factors. Dynamics of inflation has changed in the world from 1990s. The average inflation rate in the industrialized countries decreased during this decade. As this rate has been fluctuated about 2 to 3 percent in most years. These developments are not only confined to developed countries and many developing countries have also experienced changes. While high inflation was a feature of many developing economies at that time, today most of these countries have achieved lower inflation. These facts are implicitly refers to the global nature of inflation and analysts argue that it is because of globalization effects. Globalization means a rapid increase in the volume of international trade in goods, services and financial assets that may be effect on inflation in different ways. Openness to influences on the performance of the national monetary authorities in various ways. Moreover, integration of emerging economies such as China, India and Southeast Asian countries in the global trading system increase the global supply of labor, geographical relocation of production and consequently increase productivity and more specialized production based on comparative advantage. Influence of their productions to

global market, which have lower total prices due to the cheap labor, put other manufactures in the intense price competition that can prevent of price increase or lead to increase non-price competition such as innovation and productivity. Also, reducing the relative price of imported goods and services directly may reduce the intensity of the general level of prices. Globalization has created a competitive environment for manufacturers, productivity growth and wage pressures and could affect domestic prices. Relative openness to trade and foreign investment are the most important indicators of economic globalization. Developing countries such as Iran are not been able to gain significant ratio of global trade because of problems such as lack of human skills, production inefficiency, lack of changes and lack of technical expertise required to produce and export goods. Thus, the development of foreign trade can increase the level of workforce skills and capabilities in these counties and increase the level of productivity of factors of production and technological developments and provides the basis for the development of international trade and higher economic growth.

One of the channels of the impact of globalization on inflation is its impact on the relative price of imported goods. If accepted that economies such as China and India reduce the relative price of imported goods in importing countries, the deflationary effect of these countries will be subject to the continuing decline in the relative price of manufactured goods from these countries. However, it seems now, economies such as China and India face with trade surplus. This subject shows the imbalance that cannot be continued through market forces such as impact on inflation rate. In other words, the relative low cost of production in these countries is partly due to the prevention of increase in the value of money. Therefore, it is not improbable that anti-inflammatory effects of the globalization process gradually reduce through this channel. This simple example illustrates the nature and mechanisms of the impact of globalization on inflation outlook to predicts and how much vital it is. Due to the high rate of inflation, especially in recent years in Iran, it is necessary to consider the causes and origins of inflation and finding suitable strategies and policies. Reduction in trade and economic sanctions on Iran in recent years causes the sharp rise in inflation and inflation growth. Testing the impact of trade openness on inflation in the country and achieve the relationship between these two variables can be helpful for economic policy makers in adopting appropriate strategies and policies. More previous research has been done on trade openness and inflation in the country is estimated to have average of countries with different levels; these studies cannot specifically identify the differences in each country. But when the survey was done in a specific country the results will be more accurate and closer to reality.

Review of literature

One of the earliest empirical study addressing the question of the relationship between openness and inflation, although somewhat indirectly, is Triffin and Grudel (1962). Using data from six European countries during the 1950s. They propose that, among countries

that are more open and integrated, inflation generated by a monetary authority can have more of an effect on the balance of payments, than on inflation. However, they only mention in passing that this balance of payments effect can only be short-term, and they assume no optimizing behavior by the government, consumers, or firms.

The first structural model directly addressing the question of openness and inflation was designed by Rogoff (1985). His approach is to extend the Barro and Gordon (1983) framework to a two-country Mundell-Fleming model. As in Barro and Gordon, a labor market friction causes the optimal time-consistent policy of the monetary authority to be increased inflation in order to raise the level of employment. However, in Rogoff's international version, the increased inflation has an extra cost in that optimal employment is a function of the real exchange rate and that the real exchange rate depreciates with higher inflation. Thus the optimal time-consistent inflation rate chosen by a monetary authority is lower as the deteriorating effect on the exchange rate increases. More openness leads to a lower equilibrium inflation rate in this time consistent environment.

Romer's study(1993) is one of the most important studies that examine the effect of openness on inflation according to Rogoff model(1985).various studies, such as Lane (1997), Sachsida et al. (2003) and Yanikkaya (2003), have been done after Romer and supported the idea that there is a negative relationship between openness and inflation. Although Terra (1995) argued this results are confirmed only for countries with high debt during the crisis of 1980. Similarly, Batra (2001) asserted at least in the United States tariffs will not necessarily cause inflation. Gruben (2004) showed that the relationship between openness and inflation in OECD countries is not significant. Kim Beladi (2004) found a positive association between Openness and inflation for some advanced economies such as Belgium and Ireland, while this relationship was negative for other developed economies.

Al-Nasser and Sachsida (2009) examined the relationship between openness and inflation for 125 countries during 1950-1992. The results support the idea of Romer and reject the opinion of Terra.

Lin (2010) assessed the relationship between openness and inflation for 106 countries over the period 2007-1970 using panel data. The results show that the negative effect of trade on inflation is true when inflation is high, but when inflation is low, economic openness has no impact on inflation. Instead of least squares he used regression method, this method examine the relationship between inflation levels in different quarters. In his study the relationship is was negative and significant for the top quartile of inflation, and it was positive and meaningless for the bottom quartile of inflation.

Zakaria (2010) examine the relationship in Pakistan for the years 1947-2007 using time series data. His research results indicate a positive relationship between openness and inflation. Mokhtar (2010) Using multivariate co integration and vector error correction model in Pakistan for the years 1960-2007. The empirical findings indicate that the negative long-run relationship between the openness and inflation. Jafari Samimi,

Ghaderi, Sangin Abadi (2012) examined the effect of openness on inflation in Iran using ARDL method during 1973-2009. The results show that openness has negative effect in shot time on inflation but this relationship is positive in long-tem.in another study for MENA countries during 2000-2007 we can see that this relationship is positive for these countries.

Domestic research on the effects of globalization and openness on inflation is relatively limited. Tayyeb Nia and Zandieh (2009) studied the effects of globalization on inflation in the years 1988-2005 using regression. The results show that the more the economy is open the more it is exposed to globalization. It is expected that the influence of inflation of trade cycles is reduced and inflation volatility is lower. Moreover, the increase in the price of imported goods increases the inflation and transfers the boom and bust of the business in to Iran and affect domestic inflation. Salmanpoor et al. (2009) in a paper entitled the impact of globalization on local inflation with the use of analysis of variance examined the share of variables in inflation volatility. The results show that economy openness and import increase and export have meaningful effects on price levels, especially the share of the last variable.

Slamoueeyan, Shafiei and Jafary (2010) examined the inflation and employment growth in Iran. Their results indicate that a short-term increase in trade openness promotes economic growth and reduces inflation. But this impact on employment growth is negative. Also, the results show that long-term change in the size of one standard deviation in the variable of trade openness, does not affect the three variables.

Fattahi, Moradi, Abbaspour (2012) tested the Relationship between inflation and economic openness in using regression chandak for the years 1961-2007. The results show that at low inflation rates, there is no significant relationship between inflation and economic openness but in higher level there is a positive correlation between these two variables.

Studies of IMF show that globalization reduces inflation about 25% through its direct effect on non-oil import prices. The study showed that countries that are in the top tier of globalization have lower inflation rates and reverse.

ARDL[(1)] Method

In general, methods such as Engel–Granger have nor validate enough for studies with small samples and small number of observations (because of ignoring the short term dynamic interactions between the variables), because the estimations are not unbiased and using t-test statistics will not be validate. (Noferesti, 1999).thus using the methods that have short term dynamic in them are considered. Generally, a dynamic model is a model in which lags of the variables to be entered as follows:

$$Y_t = aX_t + bX_{t-1} + cY_{t-1} + u_t \qquad (1)$$

In order to reduce biased in small samples, it is better to use following relationship:

$$\emptyset(L, P)Y_t = \sum_{i=1}^{k} b_i(L, q_i)X_{it} + \acute{c}w_t + u_t \tag{2}$$

The above pattern is an autoregressive distributed lag model

$$\emptyset(L, P) = 1 - \emptyset_1 L - \emptyset_2 L^2 - \cdots - \emptyset_P L^P \tag{3}$$

$$b_i(L, q_i) = b_i + b_{i1}L + \cdots + b_{iq}L^q \qquad i = 1,2,\ldots,k \tag{4}$$

Where L is lag operator; w: vector of fixed variables such as intercept, dummy variables, time trends or exogenous variables with a constant lag. The equation should be estimated for all states and for all values means $(m + 1)$ $k + 1$ times. M is maximum lag that is determined by the investigator, k is the number of explanatory variables. One of the equitation is selected in the next step through one of the criteria such as Akaike, Schwarz-Bayzen, Hanan- Queen or adjusted coefficient (Tashkini, 2005).

Pesaran and Shin (1995) recommend using the Schwartz - Bayesian information criteria on the interval specified by the model. Because this provision saving in the number of interrupts in order to not to miss so many degrees of freedom.

One of the advantages of this method is that regardless of the question of the model variables, I (0) or I (1) is applicable. In other words, this method does not need to divide the variables into dependent variables of zero and one (Tashkini, 2005).

Introducing the variable

Several variables are used to estimate the model used in this research. INF is the dependent variable, inflation, has been developed from the consumer price index. Openness of trade (excluding oil) is the ratio of total imports and exports of non-oil GDP without oil. MG is liquidity growth that is the most important factor affecting inflation. EXR is exchange rate growth and GAP is the output gap that is obtained using the HP - Prescott. The data used in this study for the period 1973-2010 have been extracted from the Central Bank of Iran, Iran Statistical Center and the World Bank.

The experimental results

The first step in estimating a time series model is to examine the pattern of static variables. In general, each time series is called stationary if its mean and variance are constant over time and the value of covariance between two time periods depending only on the distance or lag between the two period and it is not related to the real-time calculation of covariance. The statistics Dickey – Fuller has been used to investigate Stationarity of variables and Schwartz criterion to determine the optimal number of lags. Then, using the Vector Error Correction Model with massive breaks, long-run relationship and short-run dynamics are studied.

The dynamic form of model is as follows:

$$INF = C + \sum_{i=1}^{n_1} \beta_{1t} OPEN_{t-i} + \sum_{i=0}^{n_2} \beta_{2t} MG_{t-i} + \sum_{i=0}^{n_3} \beta_{3t} GAP_{t-i} + \sum_{i=0}^{n_4} \beta_4 EXR_{t-i} + \beta_5 D \quad (5)$$

Where n_1, n_2, ... , n_4 are optimal orders for the model variables, C is intercept and D is dummy variable of revolution.

The results of estimating models as mentioned in the previous section, stationary series examination is important in estimation of time-series regression models. So at first, static variables have been examined using (ADF). The results are shown in the table below:

Table 1. *Unit root test on the variable in the level*

Explanation	inf	open	exr	gap	mg
Statistic for the model with intercept and no trend	-4.1331	-1.3801	-6.0873	-4.8230	-5.5852
The critical value at 5%	-2.9528	-2.9528	-2.9528	-2.9528	-2.9528
Numbers of gaps	ADF(1)	DF	DF	ADF(3)	DF

As we can see in the table above, inflation, exchange rate growth, growth of liquidity and output gaps were stable but the trade openness variable is not sustainable, thus, re- test has been done for this variable.

Table 2. *Unit root test on the first difference of the non-stationary variables*

Explanation	dopen
DF Statistic or the model with intercept and no trend	-5.6217
The critical value at 5%	-2.9528
Order of ADF	DF

The table shows that non-oil trade openness is stable with first difference (dopen show that first difference of open variable). So it is I(1). Given that all variables are I(1) and I(0); ARDL model can be used for estimation.

Results of the Dynamic ARDL model

Based on the study of Pesaran et al. (2001), using the ARDL method to determine the appropriate intervals, we can obtain long-term adjustment coefficients between the variables. In Johansson method, a same gap is selected for all variables while, in ARDL model optimal gaps are selected through criteria such as the Schwarz–Beyzin, Hanan Quinn, and Akaike. In the following table the results of dynamic model that was presented in the form of equation 5 through Schwarz–Beyzin is shown.

Table 3. *Results of the estimation of the dynamic model ARDL (1,2,0,1,2)*

Prob.	T-Ratio	Standard Error	Coefficient	Regressor
.106	1.6835	.10498	.17673	INF (-1)
.147	1.5010	10.0815	15.1320	OPEN
.990	-.012218	13.9333	-.17024	OPEN(-1)
.027	-2.3548	11.5553	-27.2107	OPEN (-2)
.001	-3.7105	.8430E-5	-.3128E-4	GAP
.002	3.4553	.029113	.10060	MG
.000	4.1090	.030964	.12723	MG(-1)
.773	.29140	.0014861	.4330E-3	EXR
.005	3.0881	.0015016	.0046370	EXR (-1)
.000	4.7003	.0015507	.0072889	EXR (-2)
.000	4.1586	2.3411	9.7359	C
.024	-2.4162	4.4878	-10.8433	D
R-Squared	.82930	R-Bar-Squared	.74767	
DW-statistic	2.0940	F(11, 23)	10.1584[.000]	
Serial Correlation	.55270[.457]	Functional Form	2.5215[.112]	
Normality	.73372[.693]	Heteroscedasticity.76215[.383]		

As it is seen in Table 3, non-oil trade openness has negative and significant effect on inflation with two intervals. Output gap, liquidity growth and development of the exchange rate have significant impact on inflation. D is the dummy variable of revolution indicating that its effect is negative and significant. The coefficient of determination, which is 82 percent, indicates the explanatory of the model. There is no problem for consequential form, autocorrelation variance and normality. F statistic is statistically significant.

Long-term estimation

The following table shows the variables long-term coefficients. Based on the estimated coefficients non- oil trade openness has significant and substantial negative effect on inflation. So, non-oil trade with other countries reduces inflation. Growth of liquidity and exchange rate has significant positive effect on long-term inflation and the output gap, which shows that when the value of domestic production is more than potential production, the inflation increase.

Table 4. *The results of Long-term estimation of coefficients of the ARDL model*

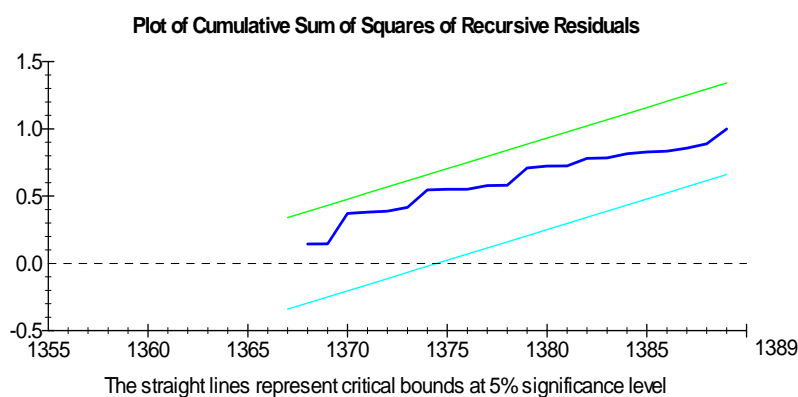| Regressor	Coefficient	Standard Error	T-Ratio	Prob.
OPEN	-14.8784	7.5576	-1.9687	.061
GAP	-0.3800	0.1063	-3.5735	.002
MG	0.27674	0.051868	5.3354	.000
EXR	0.1512	0.0038175	3.9324	.001
C	11.8260	1.9943	5.9299	.000
D1	-13.1711	5.9799	-2.2026	.038

ECM test results

ECM model estimation results have been shown in the table below. According to this table; ECM model is statistically significant in this study that indicate the relatively high speed of adjustment. ECM significant factor indicating a long-term significant relationship between the variables in the model. Consistent with theoretical expectations, if we move from t period to period (t + 1) 82/0 percentage of deviation from the path of long-term model can be corrected in the next period. In other words, any shocks or imbalances in inflation will return back to equilibrium after a period of approximately one year. So move to the equilibrium rate will be relatively high.
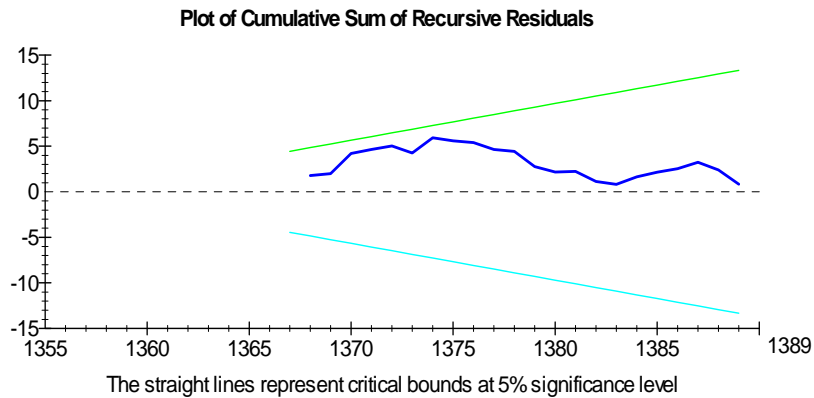
Table 5. *The results of ECM model*

Regressor	Coefficient	Standard Error	T-Ratio	Prob.
Dopen	15.1320	10.0815	1.5010	.145
dOPEN1	27.2107	11.5553	2.3548	.026
dGAP	-.3128E-4	.8430E-5	2.3548	.026
dMG	.10060	.8430E-5	3.7105	.001
dREXR	.4330E-3	.0014861	3.4553	.002
dREXR1	-.0072889	.0015507	-4.7003	.000
dC	9.7359	2.3411	4.1586	.000
dD	-10.8433	4.4878	2.4162	.023
ecm(-1)	-.82327	.10498	7.8419	.000
R-Squared	.84553	R-Bar-Squared	.77165	
DW-statistic	2.0940	F-stat.	15.7367[.000]	

Stable and diagnostic tests

The stability of estimated coefficients have been examined using Cumulative Sum of Recursive Residuals (CUSUM) and Cumulative Sum of Squares of Recursive Residuals (CUSUMQ) tests. The results are shown in diagrams 1 and 2.

Plot of Cumulative Sum of Squares of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

As it can be seen, the Cumulative Sum of Recursive Residuals does not pass of significant level of 5% and H0 is accepted. Thus, estimated coefficients have stable structure in that period. In this test significant level is considered 5% and the results is shown in diagrams. The results are shown in digram2. As this diagram shows, the stability of the confidents is confirmed in significance level of 3%. This test is used for assessing moment ally diversion in regression coefficients.

Conclusion

This study examined the long-term and short-term effects of trade openness on inflation rate, using ARDL method. Short-term and long-term results of the estimation model suggest that trade openness variable (without oil) has a significant negative effect on inflation. With increasing trade and expanding exports and imports, foreign products with the cheaper prices and better quality are entered to the country. On the other hand, with the exposure of local products in the international market, domestic producers have to compete with similar foreign products with the production of high quality and lower price production. Thus, we can control inflation with increase in non-oil trade and the implementation of policies such as reducing import tariffs, reducing tariff barriers, improvement and development of relations with other countries. The results suggest that liquidity growth and the exchange rate have positive and significant effect on inflation and the output gap has a negative effect on inflation.

Note

[1] Autoregressive distributed lag model.

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