International Journal of Agricultural Management and Development (IJAMAD)
Available online on: www.ijamad.iaurasht.ac.ir
ISSN: 2159-5852 (Print)
ISSN:2159-5860 (Online)

Does Agriculture Price Index Respond to Exchange Rate Fluctuations in Iran?

Mohammad Abdi Seyyedkolaee [1*], Amir Mansour Tehranchian [2], Ahmad Jafari Samimi [3] and Seyyed Mojtaba Mojaverian [4]

Received: 26 July 2016,
Accepted: 01 January 2017

Abstract

Since some raw materials, semi manufactured, intermediate and capital goods in agricultural sector are imported, the exchange rate fluctuations can affect the cost price of products in this sector. Recently, we are facing considerable fluctuations in exchange rate that has an important impact on all sectors including the agriculture. As a result of an increase in import prices in agricultural raw materials, the exchange rate fluctuates. In other words, this relationship is strengthened by lower domestic supply due to the stimulation of the exports of agricultural products induced by an increase in exchange rate. The present study deals with the impact of exchange rate fluctuations on agricultural price index in Iran using MGARCH method. The results show that the past shocks of exchange rate have a positive impact on agriculture price index at the 1% significance level. Moreover, despite the fact that the current fluctuations of agriculture price index do not relate to its past fluctuations, the past fluctuations of exchange rate have a positive impact on current fluctuations of exchange rate.

Keywords:
Agriculture sector, Exchange rate, Iran's economic, MGARCH method

[1] Assistant Professor, Department of Economics, University of Mazandaran, Iran
[2] Associate Professor, Department of Economics, University of Mazandaran, Iran
[3] Professor, Department of Economics, University of Mazandaran, Iran
[4] Associate Professor, Department of Agricultural Economic, Sari University of Agricultural Sciences Natural Resources, Iran
* Corresponding author's email: m_abdi1358@yahoo.com

INTRODUCTION

Iran's economy, like other economies, is a multi-sectoral economy composed of the sectors of agriculture, industry and mining, oil, and services. Among these sectors, the agricultural sector has a special place. The agricultural sector has an important part in the economy of developing countries, and it can help the economic development in various ways such as the supply of labor and capital, raw materials and meals, market for manufactured goods in the industrial sector, and foreign currency. In the 1950s and 1960s, many developing countries considered economic development synonymous with industrial development and with an emphasis on this perception, they have codified their economic development plans at the expense of ignoring or neglecting agriculture. But after two decades, they found that economic development is impossible without the development of agriculture and lack of investment in agriculture can slow down or halt the economic development. Hence, countries, one after the other, gradually understood the role of agriculture in economic development and turned to the balanced growth strategy (Najafi, 2003). At a superficial glance, the agricultural sector has a decisive role to play given the fact that it supplies 85% of food needs and 90% of raw materials for the agricultural alternate industries has 27.6% share in non-oil export and 18% share in employment [1]. The potential for creating jobs, earning exchange through exports, providing some raw materials particularly for industrial service sectors, and also creating a market for the output of the other sectors are among the reasons for the importance of agriculture in the national economy. Therefore, the study of factors affecting production and prices in the agricultural sector has been taken into consideration by researchers especially in the agricultural economy sphere in the world.

Since some raw materials, semi manufactured, intermediate and capital goods in agriculture are imported, the exchange rate fluctuations can affect the price of products in this sector. In recent years, we have been facing a considerable fluctuation in the exchange rate with an enormous impact on all sectors including the agricultural sector.

In economics, exchange rate related to the outside world is an important factor and shows itself in economic policy. Exchange rate affects the price of imported goods and services in the internal market and the price of domestically manufactured goods. Its fluctuations and subsequently change in prices propose the problem of Exchange Rate Pass- through (ERPT).

ERPT can be defined as the percentage of domestic price of the imported goods per one percentage of exchange rates between importing and exporting countries (Sek & Kapsalyamova, 2008). ERPT occurs completely when at the same time with increasing in exchange rate as much as one percent, imported goods price increases one percent (Devereux & Engel, 2002); otherwise, ERPT occurs trivial or incomplete.

Xu and Orden (2002) investigated the exchange rate impacts on prices evaluated for five traded farm outputs and four traded nonfarm-produced inputs in Canada and the United States. The analysis confirms that short-run adjustments toward the Law of One Price (LOP) occur for the five agricultural outputs and to a lesser extent for the three intermediate inputs, while such price adjustment is refuted for farm machinery. Co-integration tests also showed price convergence to stationary long-run equilibrium relationships for the five farm outputs but not for the inputs. Yeboah et al. (2009) evaluated the effects of the U.S. dollar exchange rate versus the Mexican peso for four traded nonfarm-produced inputs in the U.S. The results showed that the price of agricultural products was not affected by exchange rate. Obayelu and Salau (2010) estimated the response of aggregate agricultural output to exchange rate and price movements of food and export crops in Nigeria using available time series data that span about 37 years from the Central Bank of Nigeria (CBN) Annual Reports. The results of the Vector Error Correction Model (VECM) showed that total agricultural output responded positively to the increases in exchange rate and negatively to the increases in food prices both in short and long

[1] Statistical Center of Iran, the statistical yearbooks in the period of 1980-2015.

run. Safari et al. (2014) used the Autoregressive Distributed Lag (ARDL) model to investigate the effect of exchange rate instability on agricultural exports in the period of 1981-2011. The results of their study showed an inverse relationship between volatility of exchange rate and the agricultural exports. Hara et al. (2015) studied the recent changes in ERPT in Japan. They estimated ERPT into domestic prices using time-varying parameter estimation. The estimation results showed that the rates of exchange rate pass-through into the Producer Price Index and the Consumer Price Index had been increasing since the late 2000s. Savoie-Chabot and Khan (2015) believe that in an open economy like Canada, exchange rate movements can have a material impact on consumer prices. This is particularly important in the current context, with the significant depreciation of the Canadian dollar vis-a-vis the U.S. dollar since late 2012. A closer look at the current situation in Canada led them to the conclusion that presenting a range of evidence suggests that ERPT has played an important role in recent inflation dynamics.

In the present study, we use Multivariate Generalized Autoregressive Conditional Heteroskedasticity (MGARCH) to empirically explore the impact of exchange rate pass-through on agriculture price index in Iran. This paper consists of four sections. Section 2 deals with methodology. In this section, the model and variables are discussed. Section 3 presents the estimation results and findings of the paper. Finally, in the last section, we will provide the concluding remarks.

MATERIALS AND METHODS

In this study, all data were gathered from Central Bank of Iran (CBI). Also, the annual information of free market nominal exchange rate and agriculture implicit price index available for the years 1971-2012 were applied.

Here, the exchange rate means bilateral exchange rate that is defined as one Dollar per Rials. Thus, in the present study, the exchange rate is defined indirectly. It is common to use the inverse of exchange rate due to the low value of the national currency.

Since the agriculture implicit price index is not available in statistical centers, we use the formula below for its calculation:

Agriculture implicit price index = (Agriculture value added at constant prices)/(Agriculture value added at current prices) 100* (1)

Single variable GARCH model

Uncertainty modeling in financial time series was considered in the form of Autoregressive Conditional Heteroskedasticity (ARCH) with Engle's work. ARCH models provide a suitable framework for analyzing the variability in the time series. But this model has restrictions and problems. One of the problems is related to the determination of lags. On the other hand, the non-negative assumption may be violated, in which case, the estimation is difficult (Souri, 2013). To cope with these problems, several ARCH models were considered that most of them were single variable ARCH models. Then, its generalization to GARCH and MGARCH models was considered. These models can explain distinguishing features of time series including kurtosis, leverage effects and the volatility clustering that were not estimable by single variable ARCH and GARCH models. MGARCH models are used to model the simultaneous variability of two or more variables. In this case, it may affect the variability of variables on each other. In multivariate case, it is usually assumed that the variability of variables is constant (Heidary & Mollabahrami, 2011).

GARCH model specifications, which have been used so far, include Vector GARCH (VECH) model, Constant Conditional Correlation (CCC) model, BEKK model, and Dynamic Conditional Correlation (DCC) model. BEKK[2] model is also used in this study.

BEKK model

To ensure positive definiteness, a new parameterization of the conditional variance matrix H_t was defined by Baba et al. (1990) and became known as the BEKK model that is viewed as another restricted version of the VECH model.

[2] Baba, Engle, Kraft and Kroner

It achieves the positive definiteness of the conditional covariance by formulating the model in a way that this property is implied by the model structure (Su & Haung, 2010).

The form of the BEKK model is as follows:

$$H_t = CC' + \sum_{j=1}^{q} \sum_{k=1}^{k} A'_{kj}\, \varepsilon_{t-j} \varepsilon'_{t-j} A_{kj} + \sum_{j=1}^{p} \sum_{k=1}^{k} B'_{kj}\, H_{t-j} B_{kj} \qquad (2)$$

where A_{kj}, B_{kj} and C are $N \times N$ parameter matrices, respectively and C is a lower triangular matrix (Su & Haung, 2010).

The purpose of decomposing the constant term into a product of two triangular matrices is to guarantee the positive semi-definiteness of H_t. Whenever $K>1$, an identification problem would be generated for the reason that there is not just a single parameterization that can obtain the same representation of the model. The first-order BEKK model is:

$$H_t = CC' + A'_{\varepsilon t-1 \varepsilon' t-1} A + B' H_{t-1} B \qquad (3)$$

The BEKK model also has its diagonal form by assuming A_{kj}, and B_{kj} matrices are diagonal. It is a restricted version of the DVECH model. The most restricted version of the diagonal BEKK model is the scalar BEKK one with $A=aI$ and $B=bI$ where a and b are scalars.

Estimation of a BEKK model still bears large computations due to several matrix transpositions. The number of parameters of the complete BEKK model is $(p+q)KN^2+N(N+1)/2$. Even in the diagonal one, the number of parameters soon reduces to $(p+q)K \times N+N \times (N+1)/2$, but it is still large. The BEKK form is not linear in parameters, which makes the convergence of the model difficult. However, a strong point lies in that the model structure automatically guarantees the positive definiteness of H_t. Under the overall consideration, it is typically assumed that $p = q = K = 1$ in BEKK form's application (Su & Haung, 2010).

This model will be estimated in next section.

RESULTS AND DISCUSSION

The studied variables based on the Augmented Dickey-Fuller (ADF) test are presented in Table 1. The results show that the absolute value of Augmented Dickey-Fuller statistics for agriculture implicit price index and the free market nominal exchange rate at the 5% level is greater than the critical values, and, therefore, the variables are stationary at this level.

According to long period length, there is the possibility of structural failure in variables. If there were structural changes in the time series, we should have used Phillips–Perron unit root test. Existence of such changes in Iran's political and economy structure in recent years - given that there is a profound impact on macroeconomic variables - seems logical. As a result, if we accept such changes, Augmented Dickey-Fuller unit root test results will not be reliable. Therefore, to ensure the full stability of variables, we used Phillips-Perron test.

The studied variables based on the Phillips-Perron test are also shown in Table 1. The results show that the absolute value of Phillips-Perron statistics for agriculture implicit price index and the free market nominal exchange rate at the 5% level is greater than the critical values, implying that the variables are stationary at this level.

F statistic is used to check the ARCH impacts whose results are presented in Table 2. Based on the results, the null hypothesis indicates the

Table 1

The Results of Augmented Dickey-Fuller (ADF) and Phillips-Perron Unit Root Tests

Variable	Dickey- Fuller statistics	Critical values	Result	Phillips-Perron statistics	Critical values	Result
Agriculture implicit price index	-2.99	-2.94	Stationary at the level	-2.93	-3.18	Stationary at the level
Free market nominal exchange rate	-3.15	-2.93	Stationary at the level	-2.93	-3.07	Stationary at the level

Table 2
The Results of Existence Test of ARCH Impacts

Variable	p-value	F-statistic	Result
Agriculture implicit price index	0.000	329.52*	There is heteroskedasticity
Free market nominal exchange rate	0.000	145.36*	There is heteroskedasticity

*p<0.05

absence of ARCH impacts on the series. According to Table 2, the existence of ARCH impacts on fluctuation series of the agriculture implicit price index and the free market nominal exchange rate is confirmed. In other words, the null hypothesis that there is hemoskedasticity is rejected and the heteroskedasticity in the series is confirmed. Thus, we can use ARCH and GARCH models to test hypotheses.

The results of the BEKK bivariate GARCH model for agriculture implicit price index and free market nominal exchange rate are in Table 3. Accordingly, M (1,1) is the intercept of agriculture price index variance estimation and B1 (1,1) illustrates impressionability of agriculture price index variance from its past values. A1(1,1) indicates impressionability of agriculture price index variance from the square of its past shocks. M (2,2) is the intercept of exchange rate variance estimation and B1 (2, 2) illustrates impressionability of exchange rate variance from its past values. A1 (2, 2) illustrates impressionability of exchange rate variance from the square of its past shocks. The significance of A1 (1, 1) coefficient at the 1% level % illustrates impressionability of agriculture price index fluctuations from the square of its past shocks. In other words, the sensitivity of agriculture price index toward the square of its past shocks is equal to 1.450. Also, the significance of A1(2,2) coefficient indicates that the exchange rate affects as much as 1.065 from the square of its past shocks. Given the insignificance of B1 (1, 1) coefficient, we can argue that the current fluctuations of agriculture price index is not affected by its past fluctuations. While considering the significance of B1 (2, 2) coefficient at the 1% level of, it can be argued that the fluctuations of the exchange rate are greatly affected by their past fluctuations and this impressionability is positive. In other words, the past fluctuations of exchange rate have a positive impact on the current fluctuations of exchange rate.

Also, according to the results of this study, it can be argued that at the 1% significance level, the past shocks of exchange rate have a positive impact on the agriculture price index and this impact is equal 0.020 (G1(1,2) coefficient). Moreover, the past shocks of agriculture price index have an impact of about 63.207 on exchange rate (G1 (2,1) coefficient).

Table 4 shows the results of portmanteau test for investigating the correlation between model error terms. Based on the results in this table, the null hypothesis of no correlation between the model error terms is not rejected. In other words, there is

Table 3
The Results of BEKK Model for Variables

Parameter	Coefficient	p-value
A1(1,1)	1.450**	0.000
A1(2,2)	1.065**	0.000
B1(1,1)	-0.134	0.389
B1(2,2)	0.511**	0.000
M(1,1)	1.573	0.137
M(2,2)	204224.3*	0.022
G(1,2)	0.020**	0.000
G(2,1)	63.207**	0.000

*p<0.05, **p<0.01

Table 4
The Results of Portmanteau test for Cross-Correlation of Two Variables Residuals

Lags	Degrees of Freedom	Q statistic	p-value
1	4	55.42	0.07
2	8	91.77	0.09
3	12	114.78	0.15
4	16	130.92	0.23
5	20	147.24	0.21
6	24	165.64	0.30
7	28	185.49	0.25
8	32	205.61	0.31

no correlation between the model error terms.

As was observed, the fluctuations of agriculture price index are affected by the exchange rate. In fact, according to the results of this research, the relationship between fluctuations of agriculture price index and the exchange rate is positive; this means that Agriculture price index increases exchange rate. Higher exchange rate results in higher prices of the agricultural products by increasing the prices of imports of agricultural raw materials. On the other hand, reducing the domestic supply in order to stimulate agricultural export accompanied with the increase in exchange rate strengthens the above relationship.

Findings of this study are not consistent with the results of Yobo et al. (2009), but confirm the findings of Obayelu and Salau (2010), Hara, et al. (2015) and Savoie-Chabot and Khan (2015).

CONCLUSION

Iran, like other economies, has a multi-sectoral economy that has been formed from the sectors of agriculture, industry and mining, oil, and services. Among these sectors, the agricultural sector has a special place. Since some raw materials, semi manufactured, intermediate and capital goods in agriculture are imported, the exchange rate fluctuations can affect the price of products in this sector. Recently, we have been facing considerable fluctuations in exchange rate that have an important impact on all sectors including the agriculture. In this study, the impact of exchange rate on agriculture price index of Iran was investigated. The results illustrate that the past shocks of exchange rate have a positive impact on agriculture price index at the 1% significance level. Also, the sensitivity of agriculture price index to square of past shocks is equal to 1.450. Moreover, the past fluctuations of exchange rate have a positive impact on current fluctuations of exchange rate. Fluctuations of exchange rate and agriculture price index demonstrate the instability of the economy. Therefore, the government should adopt policies to reduce the fluctuations of exchange rate market. Among these policies, we can suggest the monetary and fiscal discipline and liquidity controlling.

ACKNOWLEDGEMENT

The authors would like to thank everyone who participated in this research.

REFERENCES

Devereux, M. B., & Engel, C. (2002). Exchange rate pass-through, exchange rate volatility, and exchange rate disconnect. *National Bureau of Economic Research (NBER) Working Paper, No.8858.*

Hara, N., Hiraki, K., & Ichise, Y. (2015). Changing exchange rate pass-through in Japan: Does it indicate changing pricing behavior? *Bank of Japan Working Paper, No. 15-E-4.*

Heidary, H., & Mollabahrami, A. (2011). Portfolio optimization using multivariate GARCH models: Evidence from Tehran stock exchange. *Financial Research, 12*(30), 35-56.

Najafi, B. (2003). The role of agriculture growth on Iran's economic growth (1959-1996). *First Conference on Agriculture and National Development, 8-9 December, Tehran, Iran (pp. 165-185).*

Obayelu, A. E., & Salau, A. S. (2010). Agricultural response to prices and exchange rate in Nigeria: Application of co-integration and Vector Error Correction Model (VECM). *Journal of Agricultural Sciences, 1*(2), 73-81.

Safari, S., Rahmani, M., & Ahmadi, H. (2014). Effect of exchange rate volatility on agricultural exports (According to Agricultural General Policies). *Journal of Macro and Strategic Policies, 2*(5), 97-109.

Savoie-Chabot, L., & Khan, M. (2015). Exchange rate pass-through to consumer prices: Theory and recent evidence. *Bank of Canada Discussion Paper/Document d' analyze, No. 2015-9. Available on: http://www.bankofcanada.ca/wp-content/uploads/2015/10/dp2015-91.pdf.*

Sek, S. K., & Kapsalyamova, Z. (2008). Exchange rate pass-through and volatility: Impacts on domestic prices in four Asian Countries. *Munich Personal RePEc Archive (MPRA) Paper, No. 11130. Available on: https:// mpra.ub.uni-muenchen.de/11130/ 1/MPRA_paper_11130.pdf*

Souri, A. (2013). *Econometrics with application of Eviews 8 & Stata 12*. Farhangshenasi Press, Tehran.

Su, W., & Haung, Y. (2010). *Comparison of multivariate GARCH models with application to zero-coupon bond volatility*. Unpublished thesis, Lund University, Department of Statistics, Lund, Sweden.

Xu, M., & Orden, D. (2002). Exchange rate effects on Canadian/U.S. agricultural prices. *Annual meeting of the American Agricultural Economics Association, Long Beach, California, July 28-31.*

Yeboah, O. Shaik, S., & Allen, A. (2009). Exchange rates impacts on agricultural inputs prices using VAR. *Journal of Agricultural and Applied Economics, 41*(2), 511 -520.

How to cite this article:

Abdi Seyyedkolaee, M., Tehranchian, A., Jafari Samimi, A., & Mojaverian, M. (2017). Does agriculture price index respond to exchange rate fluctuations in Iran?. *International Journal of Agricultural Management and Development, 7(4), 407-413.*

URL: http://ijamad.iaurasht.ac.ir/article_527231_fbbcb78d474672415cd002d95d8c1ddc.pdf