

## **Factors Affecting Iran's Animal Products Export: A Co-integration Analysis**

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### **ABSTRACT**

Iran's economy dependence on oil revenues has caused some impacts in the form of commodity price fluctuations on current revenues. Accordingly, in the past few years especially in the Second Development Plan, the government included encouragements and reduced the country's dependence on oil revenues in its agenda. Agricultural export, especially livestock and poultry export has a proper status due to its relative advantage. Therefore, this study aims to identify the factors affecting the supply of export animal products. For this purpose, factors affecting the export of livestock products were identified using Co-integration Analysis. Empirical results showed that livestock products export is significantly affected by livestock added-value, changes in price index of export goods, subjective price index of livestock products and climate changes.

**Keywords:** Added-value, Co-integration analysis, Export goods price index, Livestock exports.

### **INTRODUCTION**

Iran's economy dependence on oil revenues has caused many problems for this country. Higher oil revenues, on the one hand, have led to Dutch disease in Iran's economy and lower oil revenues, on the other hand, have dramatically affected the government's development expenditure and even its current expenditure. This is why Iranian policymakers have long addressed the non-oil export and government's budget independence from oil revenues. In this way, non-oil export leap was included in the Third Development Plan and the government has implemented some policies to increase oil revenues.

In economic theories, trade in general and export in particular are recognized as engines of economic growth. To diversify a

country's foreign revenues in international markets, promotion of non-oil export is considered to be an inevitable requirement. To be fully aware of the conditions governing the export of a country, the three areas of production, marketing, and export support should be examined. One problem in developing countries including Iran is the over-reliance on foreign revenues which destabilizes foreign revenues (Pasban, 2006; Jabal Ameli, 2006).

Iran's past experience in foreign exchange volatility requires policymaking to increase the non-oil export particularly agricultural products. Therefore, it is particularly important to identify the factors affecting the export of such goods. Basically, the formation of a strong export sector in the long term needs appropriate policies. On the one hand, these policies are not feasible

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without understanding and determining the factors affecting the export. On the other hand, success in the export of any goods including agricultural products requires three fundamental initiatives: Substantial competitive actions, identifying the target markets, and accurate and timely transfer of competitive products to target markets.

### **Livestock and Poultry Export**

Livestock and poultry export is subject to 87 tariffs. Total export of animal products increased from 75,000 tons in 2001 to 236,600 tons in 2009 (average annual growth rate of 15.4 percent). Among the products of this subsection, the highest volume of export belongs to milk, dairy products, eggs and other products so that the share of total export of this subsection increased from 44.3 percent in 2001 to over 62 percent in 2009. This product group is followed by skin and leather export though its share declined from 30.3 percent to 10.3 percent during this period (Islamic Republic of Iran Customs Administration (IRICA), 2001-2009).

In terms of export value, livestock and poultry export increased from US\$ m 139 to about half a billion dollar (average annual growth rate of 18.8 percent). Among the products of this subsection, skin and leather, milk and dairy products have the highest share of export value (IRICA).

### **Skin and Leather Export**

From 2001 to 2009, by a negative average growth rate of 0.85%, skin and leather export increased from 22,800 to 24,400 tons. However, their export value increased from US\$ m 69 to US\$ m 155. Skin export has remained almost constant in different years. However, animal husbandry sector is one of the most important ones accounting for a significant share of livestock export activities. Skin export depends on livestock slaughter and the absorption capacity of domestic industries. Previously, there were

no skin and leather industries in Iran and the whole raw skin was exported (IRICA).

### **Milk, Dairy Products and Eggs**

In the early years of 1990s, Iran was a net importer of dairy products and eggs but such products export have been on the agenda in recent years despite price fluctuations. However, they have had a rising trend so that their export increased from 33,000 tons in 2001 to about 147,000 tons in 2009 (average annual growth rate of 20.4%). Their export value growth was higher than that of their volume (33.3%) and reached to US\$ m 203 from about US\$ m 20 (IRICA).

**Live Animals Export:** Although the live animals export is still negligible, it has grown in recent years. By an average annual growth of 4.9%, such goods export increased to 57,900 tons in 2008 from 600 tons in 2001. However, it decreased by 50% in 2009. In terms of the export value of live animals, it increased from US\$ m 2 to US\$ m 71. In the meantime, non-price policies play an important role in live cattle exports (IRICA).

### **Wool, Hair and Shaggy Export**

Wool export accounts for a significant share of total export of animal products though preceded by skin export. The export of these goods increased from 2,200 to 3,200 tons with an average annual growth rate of 4.9%. Also in terms of value, it increased from US\$ m 12 to US\$ m 14. Export of these products fluctuated in different years due to the lack of export in one year and its increase in another one (IRICA).

### **Meat and Edible Viscera Export**

Export of meat and edible viscera increased from 14,000 tons in 2001 to about 31,000 tons in 2009. The export of edible viscera accounts for a large part while the share of meat export is negligible. During the same period, the value of these goods increased to US\$ m 95 from US\$ m 32. In recent years, however, meat export has become feasible due to an increase in domestic production. In some years, the aim

of meat export was to adjust the market. It means that meat is exported in the season of supply surplus and it is imported when its shortage is felt (IRICA).

### Other Animal Products

They include honey, honey wax, other edible viscera, rumen and intestines. Exports of honey and honey wax have recently increased considerably. They increased from 1,900 tons in 2001 to 5,800 tons in 2008 while they decreased to 2,200 tons in 2009 (IRICA).

### Overview of Previous Studies

Studies on agricultural products export are mainly conducted using econometric methods but they are also done in the context of some other methods including SWOT analysis to examine strengths, weaknesses, opportunities and threats facing agricultural export such as that done by Khaledi (2008). Kiani and Eghbali (2000) conclude that the real exchange rate deviation from long-run equilibrium path, the real exchange rate fluctuations and the pressure of domestic demand for export goods negatively affect the supply of agricultural export whereas the relative price of export agricultural products, sudden changes in agricultural production and technical advances positively affect the supply of agricultural export.

Maleki (1996) found a new outlook for non-oil export and examined their impacts on the supply of export animal products. Khalilian and Farhad (2002) showed that agricultural added-value (production capacity), relative export prices and domestic consumption (domestic demand) had a significant impact on the supply of agricultural export, whereas the effect of real exchange rate on the supply of agricultural export was not significant.

Shakeri (2004) studied the role of cost and non-cost factors in non-oil export using ARDL technique and concluded that non-oil export depends on productivity and

competitiveness. Although exchange rate variables have a positive effect on export, it is not significant and decisive.

To study Bangladesh's leather export, Akhtar (1990) estimated the export function of this product. The model that assumes Bangladesh's leather export was a function of leather importing countries real income as well as a function of leather export price index relative to international price index. Results indicated that export leather's short-term price elasticity is estimated to be 0.46 while long-term price elasticity is greater than unit (1.175). This shows that export leather market in Bangladesh in the short-term is in a way that as export increases, less foreign exchange is obtained but in the long-term, export leather market will have a good surplus so that any increase in export leads to higher foreign earnings.

### MATERIALS AND METHODS

This study was abstracted from a study by Thomby (1999) which makes use of export supply function with a two-tail logarithmic shape:

$$\ln EX_{it} = \alpha_1 + \beta_1 \ln P_{it}^a + \beta_2 \ln P_{it}^o + \beta_3 \ln PR_{it} + \beta_4 \ln VWT_{it} + \beta_5 \ln GDP_{it} + \beta_6 \ln ER_{it} + \mu_{it} \quad (1)$$

where;

$EX_{it}$  is the export volume of product  $i$  in year  $t$  (tons),  $p_{it}^d$  is CPM which shows domestic price index,  $P_{it}^e$  is total export price measured by export value unit,  $PR_{it}$  is domestic production (tons),  $VWT_{it}$  is the global trading net value (net export value),  $GDP_{it}$  is gross domestic production,  $ER_{it}$  is the exchange rate (\$) and  $\mu_{it}$  is the random error term with normal and random distribution, zero mean and fixed variance.

Based on the standard supply theory, export prices and domestic prices of export goods should be positive and negative, respectively. Since  $P_{it}^d$  determines  $d$  supply and demand forces, the simultaneous appearance of  $P_{it}^e$  and  $P_{it}^d$  in Equation (1) may lead to multi-colinearity. To avoid this problem, the two remaining variables are



**Table 1.** Relationship between dependent variables and independent variable.

Variable	$\frac{P_{it}^d}{P_{it}^e}$	$PR_{it}$	$VWT_{it}$	$GDP_{it}$	$ER_t$
$EX_{it}$	-	+	+	+	+

defined as a variable and as a relative price index, namely  $P_{it}^d/P_{it}^e$ . Therefore, Equation (1) can be re-written as:

$$\begin{aligned} LnEX_{it} = & \alpha_1 + \beta_1 Ln\left(\frac{P_{it}^d}{P_{it}^e}\right) + \beta_2 LnPR_{it} + \beta_3 LnVWT_{it} + \beta_4 LnGDP_{it} + \beta_5 LnER_{it} + \mu_{it} \end{aligned} \tag{2}$$

Table 1 shows the relationship between dependent variables and independent variable.

To investigate the short and long-term relationships of dependent variables and other descriptive variables, one can use Engle – Granger and error correction models (ECM). Engle–Granger is based on the assumption of reliability. Also this technique considers only a long-term relationship. In addition to such limitations, in Engle – Granger based co-integration analyses, the necessity of previous awareness of variables' impacts on each other is another limitation (Zibaei and Mohammadzadeh, 2004).

Error correction model relates variables' short-term fluctuations to their long-term balanced amounts. When model's variables are co-integrated, the residual term of the short-term relationship will be  $I(0)$ . Thus without fear of achieving a false regression, one can estimate ECM ratios by OLS method and use F and t statistics. However, one cannot use ECM for estimating the short-term ratios if co-integrated variables are 0 and 1 (Ibid).

Due to such limitations, some authors – e.g. Pesaran and Pesaran (1997)- have attempted to overcome the deficiencies of the above methods to achieve a better approach to the analysis of short and long-term relationships between variables called ARDL approach. Accordingly, in addition to meeting the need for awareness of a relationship between variables, it is possible to simultaneously study the relationship between variables in which some are reliable

and others become reliable after a one-time difference (Ibid).

ARDL technique is able to project the short and long-term components. It is also able to solve the problems of omitting the variables and auto-correlation. However, obtained estimations from such models are non-biased and efficient since they are generally free of problems such as auto-correlations. Extended ARDL can be written as:

$$\alpha(L,P)EX_t = \alpha_0 + \sum_{i=1}^k \beta_i(L,P)X_{it} + u_t \tag{3}$$

where,  $\alpha_0$  is the constant amount,  $EX_t$  is the export supply and L is the delay factor defined as  $L^j EX_t = EX_{t-j}$ . However,  $X_t$  is the independent variable for export supply. So

$$\begin{aligned} \beta_i(L, p) = & \beta_{i0} + \beta_{i1}L + \beta_{i2}L^2 + \dots + \beta_{iq}L^q \\ \text{and } \alpha(L, p) = & 1 - \alpha L^1 - \dots - \alpha L^p \end{aligned} \tag{4}$$

$X_{it}$  is the  $i$ th independent variable. In the long-term, the following relation between the variables of the present model will be true:

$$\begin{aligned} EX_{t-1} = & EX_{t-2} = \dots = EX_{t-p}, \\ X_{i,t-1} = & X_{i,t-2} = \dots = X_{i,t-q} \end{aligned} \tag{5}$$

In the last equation,  $q$  is the  $q$ th delay of the  $i$ th variable. One can express the long-term relationships between the variables as:

$$EX = \alpha + \sum_{i=1}^k \beta_i X_i + v_i, \alpha = \frac{\alpha_0}{\alpha(1, p)} \tag{6}$$

$$\beta_i = \frac{\beta_i(1, q)}{\alpha(1, p)} = \frac{\sum_{j=0}^q \beta_{ij} L^j}{\alpha(1, p)}, v_i = \frac{u_t}{\alpha(1, p)} \tag{7}$$

Therefore, one can write ECM equation for ARDL model as:

$$\Delta EX_t = \Delta \hat{\alpha}_0 - \sum_{j=2}^p \hat{\alpha}_j \Delta EX_{t-j} + \sum_{j=0}^k \hat{\beta}_{j0} \Delta X_{jt} - \sum_{i=1}^k \sum_{j=2}^q \hat{\beta}_{i,t-j} \Delta X_{i,t-j} - \alpha(1, p) ECT_{t-1} + u_t \quad (8)$$

Error correction component

$$ECT = EX_t - \alpha - \sum_{i=1}^k \beta_i X_{it} \quad (9)$$

These are estimated ratios from Equation (3).  $\alpha(1, p)$  is the partial error correction ratio which measures the velocity of moderation. To estimate the long-term relationship, one can use a two-step method. In the first step, we study the existence of a long-term relationship between variables which is expressed by theory. If it is proved, the short and long-term parameters in the second step are estimated by Equations (3) and (7) (Pesaran *et al.*, 1996). Suppose that the first step predicts that there is a long-term relationship between  $y$ ,  $x$  and  $z$  variables. Without any previous data on long-term relationship between variables, one can estimate three error correction regressive equations where one of the triple variables is considered as dependent variable (Sidiki, 2000). See the equation 10 in the below.

To examine the existence of long-term relationship, one can use  $F$  statistics. Null hypothesis for testing the non-existence of long term relationship is:

$$H_0 = \alpha_y = \alpha_x = \alpha_z = 0$$

It is necessary to compare the calculated  $F$  statistics by Pesaran *et al.* (1996) and decide to support or refuse the null hypothesis. This can be repeated for the second and third long-term relationships. If the calculated  $F$  is greater than the critical area, one can decide

$$\begin{aligned} \Delta y_t &= \alpha_{0y} + \sum_{i=1}^n b_{iy} \Delta y_{t-i} + \sum_{i=1}^n c_{iy} \Delta x_{t-i} + \sum_{i=1}^n d_{iy} \Delta z_{t-i} + \gamma_{1y} y_{t-1} + \gamma_{2y} x_{t-1} + \gamma_{3y} z_{t-1} + \varepsilon_{1t} \\ \Delta x_t &= \alpha_{0x} + \sum_{i=1}^n b_{ix} \Delta y_{t-i} + \sum_{i=1}^n c_{ix} \Delta x_{t-i} + \sum_{i=1}^n d_{ix} \Delta z_{t-i} + \gamma_{1x} y_{t-1} + \gamma_{2x} x_{t-1} + \gamma_{3x} z_{t-1} + \varepsilon_{2t} \\ \Delta z_t &= \alpha_{0z} + \sum_{i=1}^n b_{iz} \Delta y_{t-i} + \sum_{i=1}^n c_{iz} \Delta x_{t-i} + \sum_{i=1}^n d_{iz} \Delta z_{t-i} + \gamma_{1z} y_{t-1} + \gamma_{2z} x_{t-1} + \gamma_{3z} z_{t-1} + \varepsilon_{3t} \end{aligned} \quad (10)$$

without any need to be informed of variables' co-integration degree. If the calculated  $F$  is between two critical borders, we need data on variables' co-integration degree. If the existence of a sustainable long-term relationship between the model's variables is proved in the first step, a two-section process will be used in the second step to estimate the model's parameters. In the first step, the rank of variables' co-integration is determined by Akaike's or Schwartz-Bisin's criteria and then it is estimated by OLS in the second step.

## RESULTS AND DISCUSSION

Export supply function is affected by various factors such as actual exchange rate, export price, added-value and current investments in livestock. Many studies have been conducted on the impact of foreign exchange rate on export and all of them have found that foreign exchange fluctuations reduce export (Mahmoudzadeh and Zibaei, 2004). On the other hand, there is a direct relationship between actual foreign exchange and export. Hence, an important factor affecting the export is the actual foreign exchange rate computed through:

$$ER'_t = ER \frac{CPI_t^d}{CPI_t^f}$$

where,  $ER'_t$  is the actual exchange rate,  $ER$  is the nominal exchange rate,  $CPI^d$  and  $CPI^f$  are domestic consumer price index and foreign consumer price index, respectively (USA in here). Statistics on other variables are also gathered from domestic resources. Accordingly, ARDL model is estimated for livestock products export demand shown in Table 2.

**Table 2.** ARDL (1, 1, 1, 1, and 0) estimation results.

Standard deviation	Coefficient	Description	Variables
0.25144	0.32041	$\hat{\alpha}_1$ Export log with a delay	$LNEX(-1)$
0.32469	-0.94504**	$\hat{\alpha}_2$ Export price to domestic price log	$LNPe/P_d$
0.34104	1.0365**	$\hat{\alpha}_3$ Export price to domestic price log with a delay	$LNPe/P_{d(-1)}$
6.7358	2.4956	$\hat{\alpha}_4$ Domestic goods production log	$LNPR$
6.4608	-10.8870	$\hat{\alpha}_5$ Domestic goods production log with a delay	$LNPR(-1)$
0.070168	0.15538*	$\hat{\alpha}_6$ Export net value log	$LVNWT$
0.075798	-0.20708**	$\hat{\alpha}_7$ Net export value log with a delay	$LVNWT(-1)$
7.9078	1.0534	$\hat{\alpha}_8$ Gross domestic product log	$LVNGDP$
153.8855	39.4878	$\hat{\alpha}_9$ Constant amount	$C$
0.75892	0.22082	$\hat{\alpha}_{10}$ Trend	$T$

F= 13.5272;  $R^2 = 0.968$ , DW= 2.4184.

\*\*\*, \*\*, \* Significant at 10%, 5% and 1% levels, respectively.

Existence or non-existence of a long-term relationship between the descriptive variable and other dependent variables can be examined by comparing F statistics from the above estimation and the suggested F statistics by Pesaran *et al.* (1996). Hence, it was found that there is a long-term relationship between animal products export supply and other variables used in the model. ECM was used to study the short-term relationships between animal products export supply and other variables used. The findings are shown in Table 3.

Among variables which explain the short-term relationship, only export prices to domestic prices and net export value variables are in the 5 and 10% confidence levels. Since global trading net value (export) can have positive or negative impacts depending on more/less export than import and because this impact is positive

here, trade balance has not been optimized and policymakers are looking for encouraging export policies. The coefficient of error correction term which shows how suppliers respond in the short-term in order to move in the long-term balanced route is 0.68. Hence, one can say that suppliers would not respond to policies during one period and it can suggest the low potential and readiness of suppliers to increase the export supply. The value of  $R^2$  shows that almost 90% of changes in animal products export supply in the short-term is explained using above facts. However, the amount of F statistics shows the model's overall significance is in confidence level (99%).

Because the export price is a key determinant in higher export and competitiveness of Iranian goods, use of new production methods and finished cost reduction (FCR) will effectively lead to higher

**Table 3.** Estimation findings of short term animal products supply export.

Standard deviation	Coefficient	Variables	Description
0.32469	-0.94504**	$dLNPe/P_d$	Export price to domestic price difference log
6.7358	2.4956	$dLnPR$	Domestic goods production difference log
0.070168	0.15538*	$dLVNWT$	Net export value difference log with a delay
7.9078	1.0534	$dLVNGDP$	Domestic goods production difference log
153.8855	39.4887	$dC$	Constant amount difference
0.75892	0.22082	$dT$	Trend difference
0.25144	-0.67959*	$ecm(-1)$	ECM ratio

F= 20.7877;  $R^2 = 0.968$ ;  $\bar{R}^2 = 0.899$ , DW= 2.4184.

\*\*\*, \*\*, \* Significant at 10%, 5% and 1% levels, respectively.

export. In this context, higher productivity of production factors could be an important step toward competitive goods.

Higher domestic production is a determinant in increased export. Therefore, it is necessary to adopt policies for higher production. Thus, increased investments in agricultural production as well as export diversification are effective tools for higher export of livestock and poultry products.

Since export is always the result of domestic demand surplus, it is necessary to increase the domestic production in order to achieve animal products sustainable export. Therefore, the way should be paved so that the quality is enhanced and the inputs in livestock sector are provided. Providing such inputs is important since the highest dependence on these inputs (such as barley, corn and so on) is observed. In addition, an important issue which has direct impact on production and in turn on animal products export is a set of initiatives such as productivity, using modern production tools and techniques, investments etc.

Export price index depends on international prices as well as supply and demand. In export supply function, the domestic price index is situated in denominator which is directly related to inflation rate. It will remain fixed if inflation rate is controlled. As a result, the livestock products export will increase following a higher export price index.

Since an important export variable is the foreign currency and it is hidden in export prices, it is very crucial to consider the actual exchange rate in order to enhance the livestock products export. As a result of subsidy reform law, production costs have increased. Therefore it is necessary to adjust the exchange rate to enhance Iranian goods competitiveness.

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### عوامل موثر بر صادرات محصولات دامی ایران: یک تحلیل همجمعی

ب. ملکی، س. آوستیزیان، ز. پر مه، ف. پاسبان

#### چکیده

وابستگی ایران به درآمدهای نفتی موجب شده که نوسانات قیمت این کالا تاثیر شدیدی بر درآمدهای ارزی کشور داشته باشد و هر گونه کاهش در قیمت صادراتی منجر به ایجاد کسری در تراز پرداخت‌های کشور گردد. بر همین اساس بود که در سال‌های گذشته و به ویژه از برنامه دوم توسعه، تشویق صادرات غیرنفتی کشور و کاهش وابستگی به درآمدهای نفتی در دستور کار دولتمردان قرار



گرفت. در این بین صادرات محصولات کشاورزی و به‌ویژه صادرات زیربخش دام و طیور کشور به دلیل وجود مزیت نسبی از جایگاه مناسبی در این حوزه برخوردار است. از این رو بررسی عوامل مؤثر بر صادرات محصولات کشاورزی از اهمیت ویژه‌ای برخوردار است. لذا در این تحقیق به عوامل مؤثر بر عرضه صادراتی محصولات دامی توجه شده است. برای این منظور با استفاده از تحلیل همجمعی و بر اساس آمارهای سری زمانی سال‌های ۸۸ - ۱۳۶۳ عوامل مؤثر بر صادرات محصولات زیربخش دام بررسی شده است. نتایج تجربی تحقیق نشان دادند که ارزش افزوده زیر بخش دام و طیور، تغییرات شاخص قیمت کالاهای صادراتی، شاخص قیمت ضمنی محصولات دام و طیور و تغییرات آب و هوایی به‌صورت معنی‌داری بر صادرات محصولات دامی مؤثرند.