

## The Impact of Macroeconomic Indicators on Agricultural Trade Balance of Iran

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**Abstract: Problem statement:** One of the main targets of Iran's economic development plans in agricultural sector during the recent years was to augment agricultural exports and establish a positive trade balance in this sector. In this research the impact of macroeconomic indicators of Iran and its 20 trading partners on Iran's agricultural trade balance had been investigated. **Approach:** The ARDL approach was applied during the period of (1960-2005). **Results:** The domestic real income had the highest effect on the agricultural trade balance relative to other indicators both in the short-and long-run period. On the other hand, domestic money supply and foreign real income had the lowest effect in long-run and short-run respectively. In addition, real exchange rate had the positive impact on trade balance indicating that the depreciation will improve trade balance. But this is not a robust political instrument for establishing long-run equilibrium. Finally, the ECM results implied the fairly high speed of adjustment to equilibrium. **Conclusion:** The policies that tend to increase domestic income should be planned in such a way that the increased purchasing power of people will be directed to domestic goods rather than foreign goods.

**Key words:** Agricultural trade, Iran, macroeconomic indicators, equilibrium

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### INTRODUCTION

During the first 5 year development plan (1987-1991) the expansion policies, resulted in rapid economic growth and high trade deficit. It was expected that improved relative prices would diminished trade deficit in the long-run, but the occurrence of debt crisis in 1994 and high shrinkage of imports due to quantitative limits, revealed that the policy makers, lacked power to improve the trade balance flow<sup>[1,2,8]</sup>.

In the period after Islamic revolution, the agricultural trade balance was always negative. But, for the first time, it became positive in 2003, due to shift in agricultural production, enhanced value added and also better planning. Moreover, the volume of non-oil exports reached to \$16.3 billion in 2006 that showed approximately 47.2% growth in comparison with the previous year. Agricultural sector with 4.5% of volume and 13.1% of value, assigned the third position after petrochemical and industry sectors (customs administration of Islamic republic of Iran, 2006). However, it's still a long way for agricultural sector to reach its real place in international markets. Therefore, the identification of macroeconomic relationship between income, exchange rate, money supply and trade balance, is an important issue. Among them

Exchange rate is a significant factor in determining trade balance. Investigating the impact of devaluation on trade balance has been studied extensively during the past 20 years.

The impact of devaluation on trade balance is based upon the Marshall Learner's condition; which states that if the sum of the demand elasticities of exports and imports are greater than unity, then the devaluation would improve trade balance in the long-run.

The J-curve hypothesis predicts that the trade balance, as a result of devaluation, will first worsen and then after the passage of sometime it will start to improve. This pattern is mainly caused by the lagged response to the devaluation of the real flows<sup>[13]</sup>.

There has been a great number of researches empirically investigated the impact of exchange rate changes on trade balance. The majority group of these studies have been done on the aggregate level not within the sectors<sup>[3,4,12]</sup>. Rose and Yellen<sup>[11]</sup> investigated the impact of exchange rate changes on trade balance between US and her six major trading partners for the period 1960-1985 and do not find evidence of the J-curve effect.

On the other hand, some of the researches investigated the impact of exchange rate changes on trade balance in agricultural sector. Most of these

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studies have been done in US<sup>[2,6]</sup>. Their Results suggested that the exchange rate is the key determinant of the short-and long-run behavior of the trade balance. It is also found that the income and money supply in both the United States and the trading partners have significant impacts on the US agricultural trade in both the short-and long-run.

The time-series data between Iran and its 20 trading partners during the period of (1960-2005) have been used in this research. These 20 trading partners almost account for 60% of Iran agricultural trade balance.

### MATERIALS AND METHODS

The empirical trade balance model used in this study following the literature is specified as follows:

$$LTB_t = \alpha_0 + \alpha_1 LY_t + \alpha_2 LYF_t + \alpha_3 LM_t + \alpha_4 LMF_t + \alpha_5 LRE_t + \alpha_6 DW_t + u_t \quad (1)$$

Where:

- TB = The measure of trade balance defined as the excess of real exports over real imports
- Y = The real domestic income
- YF = The weighted average of the foreign income
- M = The real domestic high-powered money
- MF = The weighted average of the foreign high-powered money
- RE = Weighted average of real exchange rate index between Iran's Rials and 20 trading partners' currency
- DW = A dummy variable to represents the effect of Iran- Iraq war
- L = Stands for the natural logarithm
- U = The error term

Respecting the signs of the coefficients in Eq. 1, it is expected that an estimate of  $\alpha_1$  would be negative, because an increase in domestic income, will lead to an increase in imports and as a consequence trade balance will be diminished. However, if domestic production of importable goods grows faster than consumption, then  $\alpha_1$  could be positive<sup>[7]</sup>. Estimated value of  $\alpha_2$ , would be positive, since a rise in foreign income, leads to a rise in exports thereby improving trade balance. Domestic money is expected to have a negative sign, as by increasing the money, it will be assumed as an increase in wealth, therefore the expenditure will be raised and the trade balance will be worsened. By similar reasoning it's expected that  $\alpha_4 > 0$ . Finally the exchange rate is expected to have a positive sign if real depreciation is to increase exports and lower imports, which also satisfies the ML condition. But in the short-run, based on the j-curve hypothesis, it's expected that  $\alpha_5 < 0$ .

To Investigate the short-run relationship, an Autoregressive Distributed Lag (ARDL) model developed by Pesaran and shin<sup>[9,10]</sup> has been employed in this study (10, 11). An Error-Correction Model (ECM) derived from the ARDL model can be used to estimate the short- and long- run parameters of the model simultaneously<sup>[3]</sup>.

The ARDL model of Eq. 1 can be formulated as follows:

$$\begin{aligned} \Delta LTB_t = & \alpha_0 + \sum_{i=1}^m \beta_i \Delta LTB_{t-i} + \sum_{i=1}^m \gamma_i \Delta LYF_{t-i} \\ & + \sum_{i=1}^p \varepsilon_i \Delta LM_{t-i} + \sum_{i=1}^q \zeta_i \Delta LMF_{t-i} \\ & + \sum_{i=1}^r \eta_i \Delta LER_{t-i} + \gamma LY_t + \delta LYF_t + \varepsilon \ln M_t \\ & + \zeta LMF_t + \eta LER_t + \phi DR_t + v_t \end{aligned} \quad (2)$$

where, m, n, o, p, p and r are Optimum lags for LTBt, LYt, LYFt, LMt, LMFt and LERt variables respectively.

This approach involves two steps for estimating long run relationship<sup>[10]</sup>. The first step is to investigate the existence of long run relationship among all variables in the equation under estimation. If the sum of the estimated coefficients of the lagged dependent variable is less than 1, then the dynamic model will tend to long-run equilibrium. Therefore, for testing the existence of the long-run relationship among the variables, the hypothesis testing should be carrying out as follows:

$$H_0 : \sum_{i=1}^m \beta_i - 1 \geq 0 \quad (3)$$

$$H_1 : \sum_{i=1}^m \beta_i - 1 < 0 \quad (4)$$

Then the t-statistics for this test is calculated as:

$$t = \frac{\sum_{i=1}^m \beta_i - 1}{\sum_{i=1}^m Se(\beta_i)} \quad (5)$$

If the calculated t-statistics is greater than critical t, developed, then there is a long-run relationship among the variables of the model<sup>[5]</sup>. The second step is to estimate the long run and short run coefficients of the same equation. We run second step only if we find a long run relationship in the first step<sup>[8]</sup>.

The Error Correction Model (ECM) linked to the ARDL model can be stated as follows:

$$\Delta LTB_t = \alpha_0 + \sum_{i=1}^m \beta_i \Delta LTB_{t-i} + \sum_{i=1}^n \gamma_i \Delta LY_{t-i} + \sum_{i=1}^o \delta_i \Delta LYF_{t-i} + \sum_{i=1}^q \varepsilon_i \Delta LM_{t-i} + \sum_{i=1}^r \zeta_i \Delta LMF_{t-i} + \sum_{i=1}^s \eta_i \Delta LER_{t-i} + \varphi DR_t + \lambda EC_{t-1} + u_t \quad (6)$$

Where:

$\lambda$  = The speed of adjustment parameter

EC = The residuals estimated from equation

It is expected that the sign of  $\lambda$  would be negative and its value would be changing between -1 and zero.

The annual data covering the period from 1960-2005 have been used. Agricultural trade balance is defined as the ratio of exports to imports. To calculate foreign income and money supply, it's required to compute trade weights of Iran's 20 trading partners. These weights are calculated by dividing the sum of the exports and imports value of each partner on total value of exports and imports of 20 partners.

### RESULTS

The results of Augmented Dickey-Fuller Test (ADF) for the time series variables shown in Table 1 indicate that all of the variables contain a unit root in their levels but are stationary in their first differences; hence they are integrated of the first order.

After determining integrating order of all variables, the long-run trade balance model in Eq. 2 has been estimated. Since all observations are annual and the number of observations is limited, then the maximum order of lag in the ARDL model has been chosen as 2, employing Schwarz Bayesian Criterion (SBC). The results of the co-integration test of the dynamic model of ARDL are shown in Table 2.

According to the results, there is a long-run co-integration relationship among the variables of the model. Having found a long-run relationship, the ARDL model has been applied to estimate the long run and the short run elasticities (10). The estimated coefficients of the long-run ARDL model, has been reported in Table 3.

The results show that all estimates- except foreign money supply-are significant and have the expected signs (Table 3). The coefficient of the domestic real income is equal to -0.7613 and has the negative relationship with agricultural trade balance. Also it has the greatest impact on the agricultural trade balance among other variables. Negative coefficient of the domestic real income implies that an increase in real domestic income leads to a rise in Iran agricultural imports through the increased purchasing power of Iranian consumers, thereby decreasing the trade surplus.

Table 1: ADF unit root test on variables

Variables	ADF test statistics	1st difference ADF statistics
LTB	-2.51	-5.96***
LY	-2.10	-6.42***
LYF	-1.80	-4.10***
LM	-2.41	-4.46***
LMF	-1.37	-3.57**
LER	-2.25	-4.33***

\*, \*\* and \*\*\*: Significant at 10, 5 and 1% level of significance

Table 2: Estimated coefficient s of ARDL

Variables	Coefficient	Standard error	t-ratio
C	14.9653	3.71230	4.0313***
LTB (-1)	-0.0833	0.10300	-0.8087
LTB (-2)	0.2721	0.07490	-3.6328***
LY	-0.2849	0.09068	-3.1420***
LY (-1)	-0.3173	0.08000	-3.9662***
LYF	0.0612	0.03770	1.6233
LYF (-1)	0.1315	0.04020	3.2712***
LER	0.0739	0.02210	3.3464***
LER (-1)	0.8560	0.37330	2.2931**
LM	-1.5430	0.46910	3.2894***
LMF	0.0250	0.12320	0.2036
DR	-0.0889	-0.37020	0.2402
DR (-1)	-0.0435	-0.01354	3.4712***

F = 30.2378 (0.00), R<sup>2</sup> = 0.9246, DW = 2.19

Table 3: Estimated long-run coefficients for ARDL (2,1,1,1,0,0,2) model

Variables	Coefficient	Standard error	t-ratio
C	18.8321	5.0723	3.7127***
LY	-0.7613	0.1321	-5.7630***
LYF	0.2425	0.0601	4.0349***
LER	0.3518	0.1099	3.2010***
LM	-0.1707	0.0479	-3.5636***
LMF	-0.0062	-0.0283	-0.2190
DW	-0.2034	0.0817	-2.4870**

\*, \*\* and \*\*\*: Significant at 10, 5 and 1% level respectively

Agricultural trade balance has a positive relationship with foreign real income regarding the estimated coefficient of 0.2425. According to the positive sign of this coefficient, with one percent increase in real income of trading partners, the trade balance, will rise about 0.2425%, because by enhancing their purchasing power, they will demand more goods and hence the trade balance will increase.

On the other hand, the positive coefficient of real exchange rate indicates that in the long-run, a rise in the index causes an increase in exports and a decrease in imports, hence increasing the trade surplus. But, regarding its value, this is not a robust political instrument for establishing long-run equilibrium. The negative estimated coefficient of domestic money supply (-0.1707) reveals that a rise in Iran money supply tends to deteriorate the trade surplus since an increase in domestic money supply will be assumed as a rise in net wealth, thus spending, which includes imports, will increase, leading to a worsening in trade balance.

Table 4: Estimated short-run coefficients for ARDL (2,1,1,1,0,0,2) model

Variables	Coefficient	Standard error	t-ratio
ΔLTB	-0.2734	0.0756	-3.6125***
ΔLY	-0.2816	0.0896	-3.1402***
ΔLYF	0.0679	0.0257	2.6387***
ΔLRE	0.1322	0.0580	2.2764**
ΔLM	-0.1403	0.0427	-3.2847***
ΔLMF	0.0046	0.0225	0.2036
ΔDW	-0.0891	0.3700	-0.2408
ΔDW (-1)	-0.2620	0.0753	-3.4781***
ΔC	14.9372	3.7041	4.0326***
Ecm (-1)	-0.6013	0.0640	-9.3891***

F = 26.2749 (0.00), R<sup>2</sup> = 0.88231, DW = 2.18, Note: \*, \*\* and \*\*\*: Significant at 10, 5 and 1% level respectively

Regarding the results obtained, the foreign money supply coefficient has the negative sign that is the opposite of the expectations. Also it is insignificant. Therefore, it can be concluded that this variable has no impact on trade balance.

Finally, the coefficient of the dummy variable of the Iran-Iraq war, has negative sign (-0.2034) and is significant at % that implies the restrictive effects of the economic sanctions and the trade limits.

After investigating the long-run relationship of the variables, the error correction representation for the selected ARDL model has been obtained. The short-run coefficients obtained from the ECM version of the ARDL model has been reported in Table 4. According to Table 4, all of the variables have the expected sign and also they are statistically significant. Hence, there is an evidence of the short-run relationship among the variables. But as the long-run model, foreign money supply isn't significant. The error correction term in the short-run ECM model represents the speed of the adjustment which restores equilibrium in the dynamic model. Regarding to ECM estimation results, the coefficient of ECM (-1) is equal to (-0.6013) for short run model indicating any deviation from the long-term inequality is corrected by 60% over the each year.

### DISCUSSION

The results show that the domestic real income has the greatest impact on the agricultural trade balance relative to other variables both in the short-and long-run. On the other hand, real exchange rate has the positive effect on trade balance indicating that the depreciation will improve trade balance both in the short-and long-run period. Hence there's no evidence of j-curve in Iran's agricultural sector. This findings of the research is coordinate with the results of other researches. Yazici<sup>[13]</sup> investigated the J-curve hypothesis in Turkish agricultural sector .and his finding showed that j-curve

did not exist in this sector. Also Rose and Yelen<sup>[11]</sup> did not find j-curve effect in US. On the other hand According to our finding, Foreign money supply had no relationship with trade balance; While the research by Baek and Koo<sup>[2]</sup> showed the significant effect of this variable on U.S. agricultural trade balance

Domestic money supply has the lowest impact among variables on trade balance in the long-run and its effect is negative. ECM estimation results indicate that any deviation from the long-term inequality is corrected by 60% over the each year. The value of this coefficient implies the fairly high speed of adjustment to equilibrium.

### CONCLUSION

According to the findings of this research, some policy implications can be suggested as follows:

- One of the main factors that worsen the trade balance, both in short-and long-run period is real domestic income. So, the policies that tend to increase domestic income, should be planned in such a way that the increased purchasing power of people will be directed to domestic goods rather than foreign goods. And it can be done by increasing the productivity in agricultural sector, improving the quality of production and better marketing system
- Another important finding is that the devaluation will intensify the trade balance. But it should be noted that the exchange rate isn't a robust instrument in Iran economy duo to internal and external socks, trade restrictions, taxes, subsidies and other of that kind. So it must be used in accompaniment with other policies such as supply-side policies such as rising labor productivity and wages or relaxing rigid labor market conditions

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