Aquatic Science and Fish Resources

http://asfr.journals.ekb.eg

Print ISSN: 2682-4086 Online ISSN: 2682-4108

The Impact of Policies Related to Confronting the Water Gap on Egyptian Agricultural Exports

Musaad A. Ragab, Salwa M. A. Abdel Moneim, Sayed A.A. Al-Khashin, Nourhan E. Al-Iraqi *

Department of Agricultural Economics - Faculty of Agriculture - Ain Shams University, Cairo – Egypt

ARTICLE INFO

Article history:
Received: May.23, 2024
Received in revised form: Jul.29, 2024
Accepted: Sept.24, 2024
Available online: Sept.25, 2024

Keywords
Water footprint ,
policies to confront the water gap,
agricultural exports,
agricultural commodities

ABSTRACT

Egyptian agricultural exports are considered one of the most important sources of national income and contribute about 15% to the total Egyptian merchandise exports. Agricultural production operations for export are linked to many other economic activities, as Egyptian agricultural exports are often characterized by the fact that their commodity structure depends on exporting the raw agricultural commodities that are Water intensive consumption, and the countries receiving agricultural exports are concentrated in European and Arab countries.

In light of the scarcity of water resources in Egypt, the importance of the policies taken by country in limiting the water gap is evident. However, in light of the overlapping variables affecting agricultural production, these policies may overlap and conflict with each other, as the research problem represented in the overlapping effect of policies to confront the water gap and their inconsistency in particular. In light of the worsening threats facing agricultural production operations for export related to the lack of water resources.

Based on the research problem, the research aims to measure the impact of policies related to confronting the water gap on Egyptian agricultural exports in the short, medium, and long Run, in preparation for proposing appropriate policies and mechanisms to improve the structure of Egyptian agricultural exports to keep pace with the worsening problem of water shortage in Egypt.

INTRODUCTION

Egyptian agricultural exports are considered one of the most important sources of national income and contribute about 15% to the total Egyptian merchandise exports. Agricultural production operations for export are linked to many other economic activities, as Egyptian agricultural exports are often characterized by the fact that their commodity structure depends on exporting the raw agricultural commodities that are Water intensive consumption, and the countries receiving agricultural exports are concentrated in European and Arab countries.

In light of the growing water problems and its crises, the agricultural export process has taken on new dimensions, represented by preserving the water resource as one of the most important agricultural resources, while at the same time continuing to benefit from the returns achieved from agricultural exports.

In light of the growing concept of virtual water and taking into account the amount of water used in agricultural production for export, water footprint indicators for exports have emerged as one of the most important new concepts that are taken into account when formulating policies related to export, whether they are production policies or related to irrigation or linked to the export of goods that are water intensive **(Sayed, 2004).**

RESEARCH PROBLEM:

In light of the scarcity of water resources in Egypt, the importance of the policies taken by country in limiting the water gap is evident. However, in light of the overlapping variables affecting agricultural production, these policies may overlap and conflict with each other, as the research problem represented

* Corresponding author: at Ain Shams University.
E-mail addresses: nourhaneleraky360@gmail.com
doi: 10.21608/ASFR.2024.291939.1060

in the overlapping effect of policies to confront the water gap and their inconsistency in particular. In light of the worsening threats facing agricultural production operations for export related to the lack of water resources.

RESEARCH OBJECTIVES:

Based on the research problem, the research aims at measuring the impact of policies related to confronting the water gap on Egyptian agricultural exports in the short, medium, and long Run, in preparation for proposing appropriate policies and mechanisms to improve the structure of Egyptian agricultural exports to keep pace with the worsening problem of water shortage in Egypt. From this main objective, a set of objectives appears, and the sub-section aims at shedding light on the following:

1- Developing the Egyptian agricultural exports, their commodity and geographic distribution, and their quality in global markets **(Hamza, 2015).**

2- Water footprint indicators of the most important Egyptian agricultural exports.

3. General features of policies related to confronting the water gap and their role in improving the structure of Egyptian agricultural exports **(Saeed, 2020).**

RESEARCH METHODOLOGY AND DATA SOURCES:

To achieve its objectives, the research relied on both qualitative and quantitative economic analysis methods through the use of general time trend equations, in addition to using an estimate of the water footprint and its indicators for the most important agricultural exports. To estimate the impact of policies related to confronting the water gap on Egyptian agricultural exports, a vector autoregressive (var) model was used, as this model has many advantages in estimating the mutual impact among the variables under study, the most important of which is comprehensiveness in analyzing the impact, elasticity in actually identifying the behavior of the independent variables in the model, and the accuracy in measuring and predicting these variables on the dependent variable.

The research relied mainly on published and unpublished secondary data issued by relevant authorities such as the Ministry of Agriculture and Land Reclamation, the Central Agency for Public Mobilization and Statistics, and the Ministry of Irrigation and Water Resources, in addition to using references and research related to the research topic.

THEORETICAL FRAMEWORK OF THE RESEARCH:

1- The concept of virtual water:

Virtual water is defined as the water inherent in the product implicitly, and is referred to as the water needs of the product, and in some cases it is called Water included, or exogenous water **(Saeed, 2015).**

2- Water Footprint:

It is defined as the total volume of fresh water used in the production of goods and services that an individual or community consumes. Through the concept of the water footprint, the actual consumption of water can be determined for agricultural, industrial, and domestic purposes. The water footprint consists of two parts:

(a) Internal Water Footprint, which is estimated by calculating the amount of virtual water used for agricultural purposes, minus the amount of virtual water exported through agricultural products to other countries **(Al-Khashin, 2021)**.

(b) External Water Footprint, which is estimated by calculating the amount of virtual water imported from abroad, minus the amount of virtual water re-exported from imported products **(Sayed, 2016).**

3- Indicators for estimating the water footprint:

Total water footprint = the amount of virtual water imported from abroad + the amount of virtual water exported.

Percentage of self-sufficiency in local water resources = (amount of virtual water exported ÷ total water footprint) x 100.

4- The theoretical framework of the Vector Autoregressive Model:

To measure the current impact of the most important policies related to confronting the water gap on Egyptian agricultural exports, as well as to predict their future impacts, a Vector Autoregressive Model (var) was used, and It is characterized by many advantages in estimating the mutual impact between the variables under study, the most important of which is comprehensiveness in analyzing the impact, flexibility in actually identifying the behavior of the independent variables in the model, and accuracy in measuring and predicting these variables on the dependent variable**.** The work of this model comes within the framework of multiple variables time series, the current observations of the series items are linked to both the previous observations of the series items and the previous observations of another variable in the standard model equation. Thus, VAR models allow the transfer of information and estimates between variables of the model, and then the mutual impact of the independent and dependent variables in the model can be known in both directions (unlike the multiple autoregressive model, which measures the effect in one direction). The VAR model contains a number (K) of variables and a number of time lag periods (p) and through the model, it is possible to create a type of statistical regularity in entering the variables and to take the dynamic mutual influences among the variables into account when estimating the model according to the following

$$\begin{cases} y_t^1 = a_1^0 + \sum_{i=1}^{k} a_{11}^i y_{t-1}^i + \sum_{i=1}^{k} a_{12}^i y_{t-2}^i + \cdots + \sum_{i=1}^{k} a_{1p}^i y_{t-p}^i + \varepsilon_t^1 \\ y_t^2 = a_2^0 + \sum_{i=1}^{k} a_{21}^i y_{t-1}^i + \sum_{i=1}^{k} a_{22}^i y_{t-2}^i + \cdots + \sum_{i=1}^{k} a_{2p}^i y_{t-p}^i + \varepsilon_t^2 \\ \vdots \\ y_t^k = a_k^0 + \sum_{i=1}^{k} a_{k1}^i y_{t-1}^i + \sum_{i=1}^{k} a_{k2}^i y_{t-2}^i + \cdots + \sum_{i=1}^{k} a_{kp}^i y_{t-p}^i + \varepsilon_t^k \end{cases}$$

Whereas:

Yt : is a random variable

t : refers to time

(p) indicates the number of lag periods, and (K) indicates the number of variables

$$\mathbf{Y_t=\alpha_1+b_1y_{t-1}+b_2y_{t-2}+c_1x_t+c_2x_{t-1}+c_3x_{t-2}+d_1R_t+d_2R_{t-1}+d_3R_{t-2}+E_1}$$

$$\mathbf{X=\alpha_2+b_3y_t+b_4y_{t-1}+b_5y_{t-2}+c_4x_t+c_2x_{t-1}+c_5x_{t-2}+d_4R_{t-1}+d_5R_{t-2}+E_2}$$

$$\mathbf{R=\alpha_3+b_6y_t+b_7y_{t-1}+b_8y_{t-2}+c_6x_t+c_7x_{t-1}+c_8x_{t-2}+d_6R_{t-1}+d_7R_{t-2}+E_2}$$

The model is also characterized by choosing the appropriate number of lag periods. This is done by testing the appropriate lag periods from zero until the best possible value of the lag (P). This is done through several criteria, the most important of which is the Akaaki test criterion (AIC). The Akaaki test can be estimated through the following equation:

$$AIC = \hat{\sigma}^2 \exp\left[2\left(\frac{p+q}{N}\right)\right]$$

Where (p, q) represents the number of estimated parameters in the model

RESULTS AND DISCUSSION

First: The current situation of Egyptian agricultural exports.

Egyptian agricultural exports are considered one of the basic components of total Egyptian exports. The agricultural export industry in Egypt takes on social dimensions other than the economic dimension because it represents direct and indirect job opportunities characterized by sustainability for workers. However, it is affected by many other phenomena, and thus its development is affected by many changes which it makes important to study, recognize and their contribution to the total Egyptian exports, and the factors that affect it.

1- Development of the value of Egyptian agricultural exports.

It is shown in supplemntary data Table 1 an Fig.1 that the value of Egyptian agricultural exports developed significantly during the period 2000-2023, where it increased from about $0.5 billion in 2000 to about $1.3 billion in 2007, and in 2023 it reached about $7.4 billion.

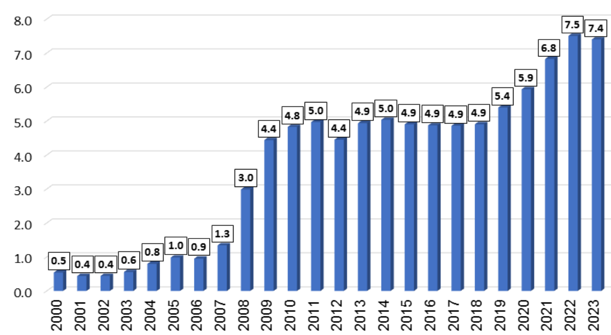

Fig. 1. Development of Egyptian agricultural exports during the period 2000-2023 (billion dollars)

Source: Database of the International Trade Center, https://www.trademap.org

By studying the general time trend of the total value for agricultural exports during the period 2000-2023, which is shown in SD Table 1, it turns out that the linear form is the appropriate mathematical form to express the development of the value of Egyptian agricultural exports, as it is the highest in value of (F), and it is also evident that there is a statistically significant annual increase at the probability level of 0.01, and the annual increase was estimated at about 0.2 billion dollars with an annual rate of change of about 3.7% of the general average which attains about 5.1 billion, while the coefficient of determination was about 0.70, meaning that 70% of the increase that occurred in the value of Egyptian agricultural exports during the study period is due to factors reflected by the time element. The rest of the percentage is due to other unmeasured factors.

2- Egyptian agricultural exports in light of the concept of virtual water.

The objective of focusing on Egyptian agricultural exports in light of the concept of virtual water, especially fresh agricultural commodities of vegetables, fruits, and medicinal and aromatic plants, is to try to establish a set of foundations that contribute to drawing a map to reconsider the structure of agricultural exports to global markets in In accordance with the available water resources in Egypt, in preparation for estimating the deficit or surplus in the Egyptian agricultural trade balance.

By studying the contribution of commodity groups to virtual water exports in Egyptian agricultural exports, it is clear from the data in Table 2 that the largest commodity group contributing in Egyptian agricultural exports for fresh goods from virtual water is the vegetable group, with a virtual water quantity in about 699 million cubic meters, and the total amount of exports amounted in about 1.7 million tons. The fruit group came in second place with a virtual water quantity of about 363 million cubic meters and the total amount of exports amounted in about 0.42 million tons. In third place was the group of oil crops (the most important of which is peanuts) with a virtual water quantity in about 119 million cubic meters. The total amount of exports amounted in about 45 thousand tons, and in fourth place was the group of medicinal and aromatic plants, with a virtual amount of water amounting in about 59 million cubic meters, and the total amount of exports amounted in about 49 thousand tons.

1) The most important fruit exports in terms of the amount of virtual water exported is the mango crop, with a virtual amount of water exported amounting to about 12 million cubic meters, which represents about 4% of the total amount of water exported for the fruit group, with a total amount exported amounting to about 7.7 thousand tons, and Strawberries crop occupies the second rank, with a virtual amount of water exported amounting to about 9.2 million cubic meters, which represents about 2.5% of the total amount of water exported for the fruit group, with a total amount exported amounting to about 40 thousand tons.

2) The most important vegetable exports in terms of the amount of virtual water exported are vegetables that are frozen with a virtual amount of exported water amounting to about 100 million cubic meters, which represents about 14.3% from the total amount of water exported to the vegetable group, and with a total amount exported of about 238 thousand tons, the potato crop occupies the second rank with a virtual amount of water exported amounted to about 90.7 million cubic meters, which represents about 12.9% from the total amount of water exported to the vegetable Group, and with a total amount exported amounted to about 717.9 thousand tons.

3) The most important exports of medicinal and aromatic plants in terms of the amount of virtual water exported is the basil crop, with a virtual amount of water exported amounting to about 26 million cubic meters, which represents about 27% of the total amount of water exported for the group of medicinal and aromatic plants, with a total amount exported of about 9 thousand tons, and the Attar crop occupies the second rank with a virtual amount of water exported amounted to about 19.2 million cubic meters, which represents about 20.1% of the total amount of water exported for the group of medicinal and aromatic plants, with a total amount exported of about 3.7 thousand tons.

From the above and through the data in Fig. 2, it is shown that the most agricultural commodities in the amount of virtual water exported are frozen vegetables, due to the need of these exports for washing and soaking operations in addition to their water needs, then potatoes occupies the second rank due to their cultivation in more than one loop for export, onions and garlic occupy the third rank because of increasing the quantities exported to global markets and the large weight of the fruit, in addition to basil and attar, which are medicinal and aromatic plants, and grapes and mango, which are fruits.

1- Egyptian agricultural imports in light of the concept of virtual water.

The light has been shed on Egyptian agricultural imports in light of the concept of virtual water, especially with regard to agricultural imports of grains and oil crops, in light of the difficulty of estimating virtual water for manufactured oils and red meat.

By studying the contribution of commodity groups to virtual water imports to Egyptian agricultural imports as an average for the period 2018-2023, it is shown from the data of Table 4 that the largest commodity groups contributing to Egyptian agricultural imports of fresh commodities from virtual water is the grain group with a virtual water amount of about 9027 billion cubic meters and the total amount of imports amounted to about 1.3 million tons. The group of oil crops occupies the second rank with a virtual amount of water amounting to about 252.6 billion cubic meters and the total amount of imports amounted to about 96 thousand tons, while vegetables came in the third rank and medicinal and aromatic plants occupy in the fourth place with a virtual amount of water. It amounted to about 10.44 billion cubic meters, 1.5 billion cubic meters each, respectively.

By studying the virtual water quantity for the most important commodities within the most important commodity groups for Egyptian agricultural imports as an average for the period 2018-2023, it is shown from the data in Table 5:

1) The most important grain imports in terms of the amount of virtual water exported is the wheat crop with a virtual amount of water exported amounting to about 4428 million cubic meters, which represents about 49% of the total amount of water exported for the grain group, with a total amount imported of about 6.5 million tons.

2) The most important imports of oil crops in terms of the amount of virtual water imported is the sunflower crop, with a virtual amount of water exported amounting to about 1459 million cubic meters, which represents about 57.8% of the total amount of water imported for the group of oil crops, with a total amount imported of about 55.3 million tons.

2- Water footprint indicators of the most important Egyptian agricultural

Water footprint indicators express the percentage of self-sufficiency from local water resources in virtual water trade for agricultural commodities. it is shown from data of table 6 as an average for the period 2018-2023, the following:

- The total water footprint of the fruit crop group amounted to about 383.6 million cubic meters, while the self-sufficiency rate of local water resources in the virtual water trade was about 94.6%, and the lowest fruit crop in this percentage was bananas at 31.2%.
- The total water footprint for the group of vegetable crops amounted to about 709 million cubic meters, while the self-sufficiency rate of local water resources in the virtual water trade was about 98.53%, and the lowest vegetable crop in this percentage was potatoes at 76.3%.
- The total water footprint for the group of cereal crops amounted to about 9,033 million cubic meters, while the self-sufficiency rate of local water resources in the virtual water trade was about 0.06%, and the largest cereal crop in this percentage was rice in a percentage of 2.6%.
- The total water footprint for the group of medicinal and aromatic plant crops amounted to about 97 million cubic meters, while the self-sufficiency rate from local water resources in the virtual water trade reached about 98.4%.
- The total water footprint for the group of oil crops amounted to about 371.6 million cubic meters, while the self-sufficiency rate of local water resources in the virtual water trade was about 32.2%, and the largest oil crop in this percentage was peanuts in a rate of 88.26%.
- By reviewing the general features of the water footprint indicators of the most important Egyptian agricultural commodities, it was found that an increase in the rate of self-sufficiency in local water resources for each of the groups of fruits, vegetables, and medicinal and aromatic plants (with the exception of bananas and potatoes, as Egyptian imports of these two crops increased, while the groups of grains and oil crops witnessed A decrease in these indicators (except for the peanut transformer).

Second: Basic features for governmental policies related to confronting the water gap:

In light of the increasing water gap resulting from the Egyptian water balance deficit and the continuous decline in the average of per capita share from water, there was a set of government policies related to water resources followed during the period 2000-2022 to reduce the negative effects of this gap on the Egyptian economy in general and Egyptian foreign trade in particular **(Ahmed, 2015).** This is done by reducing the depletion of water resources and rationalizing their uses, and since the agricultural sector is considered one of the sectors that uses water most irrationally, it is clear from Fig. 2 that there is a set of policies related to agricultural production aspects and aspects related to methods of rational uses of irrigation water, as well as Aspects related to foreign trade policies for water-intensive agricultural commodities.

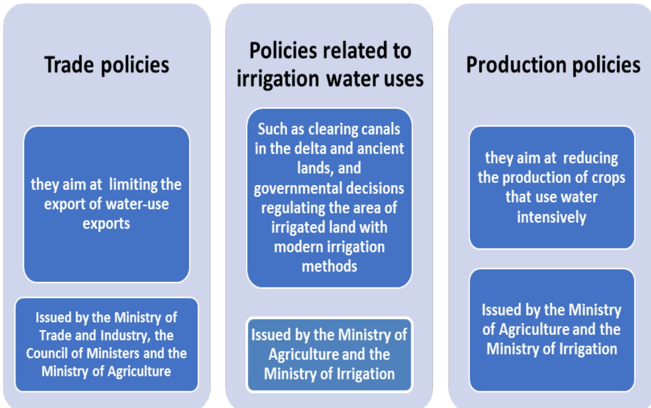

Fig. 2. Basic features of government policies related to water resources and their impact on the agricultural trade balance
Source: Prepared by the researcher.

1- Production policies:

Production policies were represented by decisions aimed at reducing the production of crops that use water intensively, issued by the Ministry of Agriculture. Through the data in Table 7, it is clear that the number of government decisions regulating the production of water-intensive crops for the period 2002-2022 amounted to about 14 decisions in 2002 and increased to about 63 decisions in 2022. These results demonstrate the increased desire among government agencies to regulate the production of water-intensive crops as one of the effective means to reduce water use in the agricultural sector and thus reduce the Egyptian water gap. These decisions included a group of crops, the most important of which are rice, bananas, tar, sugarcane, and other agricultural commodities **(Bashir *et al.,* 2021).**

2- Policies related to irrigation water use:

Policies related to the use of irrigation water aimed at reducing water losses resulting from irrigation operations, the most important of which was the clearing of canals in the delta and ancient lands, and government decisions regulating the area of land irrigated by modern irrigation methods **(Ibrahim, 2002).** These policies included two types of measures, the first of which was linked to government decisions regulating the area of land irrigated by modern irrigation methods while the second was linked to canals that were cleared and developed with modern systems to rationalize water use. from the data in Table 7, it was shown that the number of government decisions related to irrigation water uses for the period (2002-2022) amounted to about 8 decisions in 2002 and increased to about 30 decisions in 2022. The length of the canals that were cleaned and developed with modern systems to rationalize water use reached about 59.9 thousand meters in 2002, and reached about 63.8 thousand meters in 2022. These results illustrate the efforts made to improve the efficiency of irrigation water use during the study period.

3- Trade policies:

Trade policies are considered one of the indirect means of reducing the food gap through their role in limiting the export of water-intensive exports. From the data in Table 7, it is clear that the number of government decisions related to exports of water-intensive agricultural commodities reached 5 decisions in 2002 and reached 34 Resolution 2022.

Third: The impact of government policies related to overcoming the water gap on Egyptian agricultural exports

In light of the Updates that confront agricultural production, whether for local needs or for export, governmental policies related to confronting the water gap have had an impact on Egyptian agricultural exports, and the basic features of this impact can be presented through the use of the Vector Autoregressive Model, which is abbreviated to (var) to measure the impact of structural changes occurring in the most important production policies, irrigation water use policies, and trade policies (as independent variables that cause shocks) on the value of Egyptian agricultural exports (as a dependent variable affected by shocks caused by independent variables), as it is of great importance when estimating the VAR model, it is important to assume the relative arrange for the model variables, as The arrangement of the variables in the vector of internal variables plays an important role in the process Structural identification for the effects of structural changes in the independent variables on the dependent variable, because changing the arrangement changes the structure of the shocks relationship, and choosing the appropriate arrangement of the variables often depends on the researcher's vision according to the rules of economic theory **(Abdel Samie *et al.,* 2024).**

The Vector Autoregressive Model can be applied to measure the impact of structural changes occurring in government policies related to water resources on Egyptian agricultural exports through three steps, which are as the following:

- Statistical inference for the model:

After many statistical attempts, the most important quantitative variables that express government policies related to water resources and that affect Egyptian agricultural exports were expressed in the Vector Autoregressive Model, which are shown in Table 8 in each of the following:

X1 = number of governmental decisions regulating the production of water-intensive crops

X2 = number of governmental decisions related to exports of water-intensive agricultural commodities

X3 = number of governmental decisions regulating the area of land irrigated by modern irrigation methods

X4 = the length of the canals that have been cleared and developed with modern systems to rationalize water uses (thousand meters)

- Structural analysis of variables and model estimation.

Structural analysis of the variables and model estimation were conducted according to a set of steps as follows:

A. Testing the stationary of time series for model variables:

Before estimating the model, it is important to work on stabilizing the time series, as the extent to which the stationary time series of variables is stable has been identified through the unit root test (Augmented Dickey-Fuller test statistic) for the original series (at the level of the original data). Table 9 shows all model variables were settled at the first level of data (after taking the first differences) at the probability level of 0.01, and thus it is possible to work on estimating the model **(Abu Al-Enein, 2005).**

B. Causation test:

The primary goal of this test is to identify the extent of the existence of a mutual causal relationship between the variables of the model, as one of the requirements for estimating the VAR model, as by studying the causal relationship between the first differences of the model variables (the dependent variable and the independent variables), it is clear from Table 10 that by conducting Granger test that the independent variables (x1, x2, x3, x4) cause the dependent variable (y) to occur and that the causal relationship is in two directions, as it turns out that the statistical significance value of the test is less than 0.05, meaning that the causal relationship is reciprocal between the variables of the model.

C. Model Estimation:

After studying the stability of the time series of the model variables, and ensuring the existence of a causal relationship, the optimal degree of lag was set for the model to prepare it for measuring the impact of the structural changes of the independent variables on the dependent variable. It is clear from Table 11 that the lowest value of the Akaaki coefficient was (-12.9) at Two-year lag period, so the two-year lag period is the one at which the Akaaki test value (AIC) is the lowest and is the appropriate period for estimating the model.

The model was estimated, as the data of Table 12 shows that Egyptian agricultural exports (y) were affected by both the same variable in the previous year (yt-1) (a lag period of one year) and the year before the previous (yt-2) (a lag period of Two years) and the values of the independent variables (x1, x2, x3, x4) in the previous two years (two-year lag periods) according to the following:

- There is a positive impact of government decisions regulating the production of intensive crops (x1) on Egyptian agricultural exports (y) in the second year, as these decisions contribute to reducing the cultivated areas of rice, bananas, sugarcane, corn, chickpeas, and peanuts, in favor of providing areas for growing other crops that are exported. The most important of them are leafy vegetables and crops used in manufacturing frozen vegetables, such as strawberries, peas, broccoli, and beans.
- There is a negative impact of government decisions related to exports of water-intensive agricultural commodities (x2) on Egyptian agricultural exports (y) in the first and second years. This may be due to the nature of implementing such decisions taking place after taking into account contracts for agricultural export operations, which are often medium Run contracts. The time frame is approximately 3 to 6 months in advance.
- There is a negative impact of government decisions regulating the area of land irrigated with modern irrigation methods (x3) on Egyptian agricultural exports (y) that appears with the first year and continues for several years after which the impact is positive. This may be due to the high costs of modern irrigation and the farmer’s need for a period of more than a year to compensate for these costs. Concerning the transition from traditional irrigation to modern irrigation.
- A positive impact of the policies related to cleaning canals carried out by the state on Egyptian agricultural exports appears in the second year, and this may be due to the need for these efforts for a period of no less than 7 months to clean the canals, underlay them, and remove weeds from them.
- It is worth to be mentioned that the value of the determination coefficient in the estimated model was

about 0.97, while the value of (F) was about 34.9, which indicates that the model is statistically significant at the probability level of 0.01, and that about 79% of the causes of change in the dependent variable are caused by the independent factors proposed in the model.

D. Model validity test:

To ensure the validity of the results estimated by the model and to determine the extent of their reliability, a stability test for the VAR model was conducted, as the results of Fig. 3 and Table 13 indicate that all values of the inverse roots are less than the correct one and are within the selection circle, that is, the VAR model The estimator is a stable model.

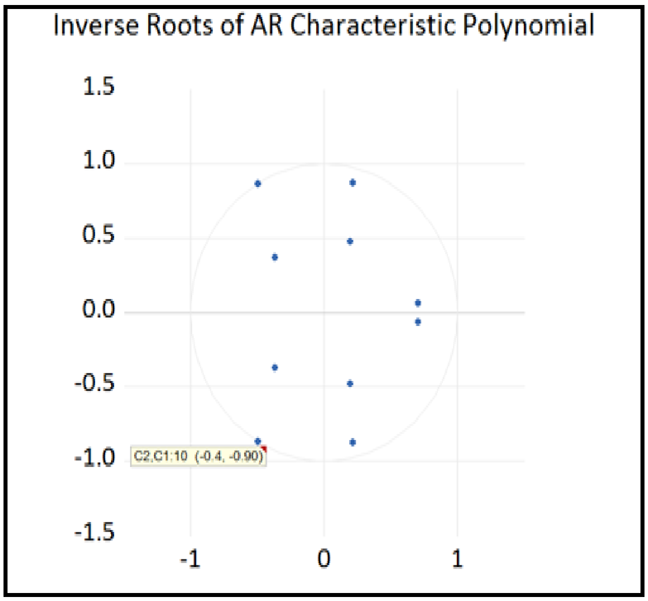

Fig. 3. Results of the inverse roots test for variables in the VAR model related to water resources affecting the agricultural trade balance in Egypt for the period 2002-2022.

Source: Results of statistical analysis for Table 8.

From the above and through the outputs and results of the VAR model, it is clear that the positive and overlapping impact of most governmental policies related to water resources on the most important factors affecting Egyptian agricultural exports (y) during the study period, as it is clear that there is a positive impact for each of the governmental decisions regulating the production of intensive crops (x1), and the policies related to cleaning canals carried out by country on Egyptian agricultural exports (x4), while there is a temporary negative impact for a period of two years for both government decisions related to exports of water-intensive agricultural commodities (x2), and government decisions regulating the area of land irrigated with modern irrigation methods (x3).

3- Estimating the impact of structural changes occurring in the most important government policies related to water resources on Egyptian agricultural exports:

Through the results of estimating the previous model, it becomes clear the importance of working to predict the expected effects of each of the independent variables expressing government policies related to water resources on Egyptian agricultural exports in the short and long Run, which can be done through the shocks model in the VAR model methodology, and the extent of the impact can be estimated. Egyptian agricultural exports (dependent variable) with deviations occurring in the most important government policies related to water resources (independent variables) through the following results:

A. The response of Egyptian agricultural exports to a structural shock in

By estimating the response of Egyptian agricultural exports (y) to the occurrence of a structural shock in government decisions regulating the production of intensive crops (x1), it appears from Fig. 4 that these decisions are expected to have a positive future impact on Egyptian agricultural exports that will continue for a period of 4 years after which it will decrease. This effect (as the value of the effect is heading towards zero) indicates the importance of working to review agricultural production policies for export every 4 years to ensure the continuation of this positive effect.

B. Response of Egyptian agricultural exports to a structural shock in government decisions related to exports of water-intensive agricultural commodities (x2):

By estimating the response of Egyptian agricultural exports (y) to the occurrence of a structural shock in government decisions related to exports of water-intensive agricultural commodities (x2), it is clear from Fig. 5 that these decisions are expected to have a negative impact on these decisions on an ongoing basis. This is due to the structure Egyptian agricultural exports during the period 2002-2022 were based on the export of water-intensive goods, and these results indicate the importance of working to improve the structure of Egyptian agricultural exports to rely on crops that are efficient in exploiting water resources and in which the added value increases, especially manufactured agricultural exports of vegetables and fruits.

C. The response of Egyptian agricultural exports to a structural shock in government decisions regulating the area of land irrigated by modern irrigation methods (x3):

By estimating the response of Egyptian agricultural exports (y) to the occurrence of a structural shock in government decisions regulating the area of land irrigated by modern irrigation methods (x3), it appears from Fig. 6 that these decisions are expected to have a negative future impact in reducing Egyptian agricultural exports that will last for a year. (Four seasons) This may be due to producers bearing the costs of transferring from traditional irrigation to modern irrigation, which lasts for a period of two years, which indicates the importance of working to support producers by providing the necessary financing to switch from traditional irrigation to modern irrigation By providing appropriate loans on easy terms that help them save the costs of modern irrigation production requirements.

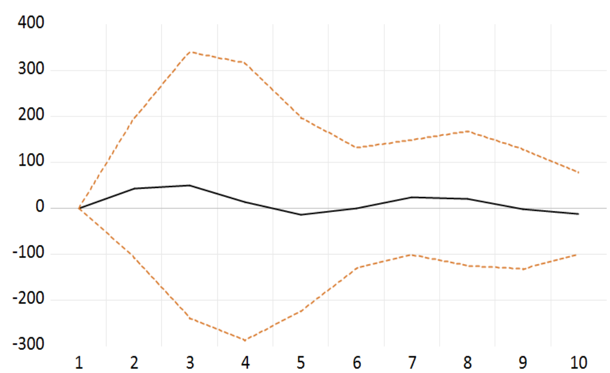

Fig. 4. Results of the response of Egyptian agricultural exports to a structural shock in government decisions regulating the production of intensive crops in Egypt for the period 2002-2022.

Source: Results of statistical analysis for Table 8.

From the above, and by reviewing the general features to estimate the response of Egyptian agricultural exports to the structural changes occurring in the most important government policies related to water resources, it becomes clear that these policies require that they be reviewed every 4 years at most, as well as work to improve the structure of Egyptian agricultural exports to include exports that are competent in using the water resource. In addition to supporting producers by providing the necessary financing to switch from traditional irrigation to modern irrigation by providing appropriate loans on easy terms that help them save the costs of modern irrigation production requirements.

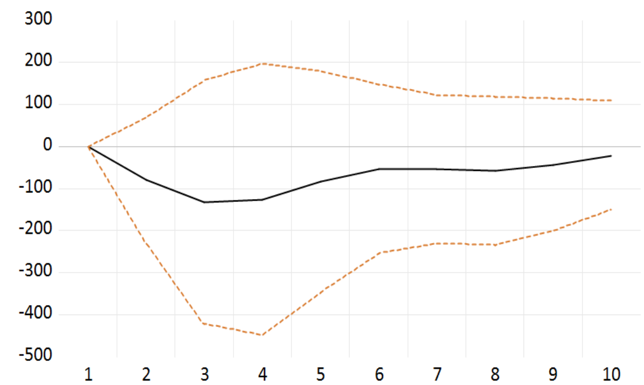

Fig. 5. Results of the response of Egyptian agricultural exports to a structural shock in government decisions related to exports of water-intensive agricultural commodities in Egypt for the period 2000-2020.

Source: Results of statistical analysis for Table 8.

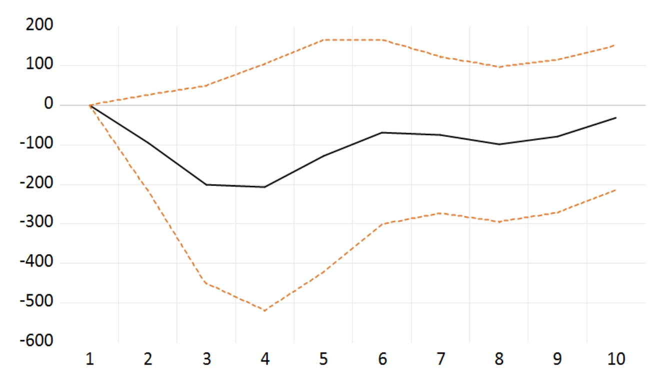

Fig. 6. Results of the response of Egyptian agricultural exports to a structural shock in government decisions regulating the area of land irrigated by modern irrigation methods in Egypt for the period 2002-2022

Source: Results of statistical analysis for Table 8.

CONCLUSION AND RECOMMENDATIONS:

Within the framework of the findings of the research, the following are recommended:

- Work to review agricultural production policies for export every four years to ensure the continuation of this positive impact represented by government decisions regulating the production of intensive crops, so that the impact of these decisions is evaluated every four years.
- Working to improve the structure of Egyptian agricultural exports to rely on crops that are efficient in exploiting water resources and which increase the added value, especially processed agricultural exports

from vegetables and fruits, especially with regard to reducing the yield of medicinal and aromatic plants and grape and mango fruit crops, and increasing the export of valuable processed vegetables. High additive.

- Supporting producers by providing the necessary financing to transfer from traditional irrigation to modern irrigation by providing appropriate loans on easy terms that help them save the costs of modern irrigation production requirements.

- Expansion of policies related to rationalizing the use of irrigation water and reducing water losses resulting from irrigation operations, such as the most important of which are the cleaning of canals in the delta and ancient lands, and government decisions regulating the area of land irrigated with modern irrigation methods.

REFERENCES

Abdel Samie, F. K.; Mahran, H. M. and Agouza, I. M. (2024). The current and future impact of policies related to confronting the water gap on the Egyptian agricultural trade balance . Suez Journal of Political and Economic Sciences, 34 (1): 153-193.

Abu Al-Enein, A. (2005). Estimating the economic return on irrigation water for some agricultural crops, Master's thesis, Department of Agricultural Economics, Faculty of Agriculture, Ain Shams University, 202 p.

Ahmed, M. S. (2015). An economic study of the development of Egyptian agricultural exports to the Mediterranean basin countries in light of water and technological constraints. Master Thesis, Department of Agricultural Economics, Faculty of Agriculture in Cairo, Al-Azhar University, 168 p.

Al-Khashin, A. A. (2021). An economic study of the water footprint and its indicators for the Egyptian orange crop. Egyptian Journal of Agricultural Economics, 31 (4):1031-1046.

Bashir, M. A.; Elkazaz, N. M. and Bakri, H. H. (2021). Possibilities of rationalizing irrigation resources in Egypt. Al-Azhar Journal of Agricultural Research, 46 (1): 217-228.

Database of the International Trade Center, (2023). https://www.trademap.org.

Hamza, Y. (2015). An analytical study of the use of agricultural drainage water and its effects on the production of the most important field crops in Damietta Governorate. Journal of Agricultural Economics and Social Sciences, 6(11):1911 – 1924.

Ibrahim, S. A. (2002). Economic and environmental impacts of using low-quality irrigation water under agricultural conditions in Egypt. Egyptian Journal of Agricultural Economics, 12 (3):1645 – 1660.

Ministry of Trade and Industry, (2002-2022). General Authority for EL-Ameria Printing Press, Egyptian Gazette website, various issues , Egyptian Gazette website, various issues.

Saeed, M. S. A. (2015). An economic study of the development of Egyptian agricultural exports to the Mediterranean basin countries in light of water and technological constraints. Master Thesis, Department of Agricultural Economics, Faculty of Agriculture in Cairo, Al-Azhar University, 246 p.

Saeed, M. S. A. (2020). The future of Egyptian agricultural exports in light of the modern trends of the World Trade Organization. PhD Thesis, Department of Agricultural Economics, Faculty of Agriculture, Ain Shams University, 282 p.

Sayed, M. A. I. (2004). Evaluation of the optional supply policy for wheat in Egypt, Master's thesis, Department of Agricultural Economics, Faculty of Agriculture, Ain Shams University, 258 p.

Sayed, S. Y. (2016). Economic Analysis of the Sources of Growth or Decline in Egyptian Agricultural Commodity Exports. Egyptian Journal of Agricultural Economics, 26 (2): 1245-1260.