"Analysis Of The Impact Of Wheat Farmers Decisions Under Risk In Egypt"

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Abstract

Owing to the variable economic and biophysical environment the agricultural sector is prone to several risks and the most common sources of risk in farming can be classified into two main categories first: Business Risk which is the aggregate effect of the production, market (price), institutional and personal (Human) risk and second one is Financial Risk. These types of risk affect both producers and consumers and influence the farmer's production decision toward cultivating particular crop. Price volatility has increased, with sharp swings in product and input prices, Markets have been affected by macro -economic disturbances, agricultural policies are become more decoupled from production and prices, farmers are now more exposed to market forces than in the past. Based on the above conceptual fact, the study focuses on the role of price risk in shaping farmers' supply-response decisions. The results indicate that producers are more responsive to price factor than non-price factors. It is therefore imperative to reduce price risk as to increase the response of producer to supply by stabilizing the price incentive. Consequently, it is required that the government and the agricultural policies makers stabilizing the price incentive ,this approach will allow the government to achieve stability in production and self – sufficiency as well as maintain stable income to the farmers and face the current challenges regarding the price risk volatility.

Key Words: Risk, Supply-Response, Production Decision, stabilizing price incentive.

Introduction

Agriculture is one of the most important sectors in the Egyptian economy; the Egyptian economy relied heavily on the agricultural sector. In the year 2017 agriculture contributed about 11.7% of the GDP, 24.8% of employment and 15% of total exports. Agricultural business is a risky enterprise owing to the fact that agricultural products is very susceptible to climatic change ,environmental fluctuation and many other risks that are difficult to predict or control. Thus, managing risk and uncertainty has become an important subject for agriculture stakeholders. Since any economic activity includes a certain level of risk that varies according to the type of activity, and the agricultural sector has higher risk compared to other economic sectors. Risk and uncertainty may result from one or combination of four factors which may be endogenous or exogenous (Anderson, et al1997).These factors include prices, production input, farm output and institutional factors all or some of the factor affect supply response but majorly price risk. A price risk is the risk that farmers will eventually be worth less than what they paid for it. Therefore, the question is often how to mitigate market price risk and what to when it starts to become a severe problem. One of the most important issues in Agricultural development

economic is supply response of crops (Mushtaq and Dawson 2002). This is because the responsiveness of farmers to economic incentive determines agriculture contribution to the economy where the sector is the largest employer of labour. Agricultural policies play a key role in increasing farm production (Rahji et al, 2008). Supply response is fundamental to an understanding of this price mechanism (Nerlove and Bachman 1960).

Problem statement

Farmers' decisions to cultivate particular crops are influenced mainly by input prices, farm gate prices, net return, net return of competing crops and government policies .These factors create conditions of risk that have clear impact on producers net return ability and consequently on their response to the expansion or reduction with the cultivated area of crops.

The study objectives

The main objective of the study is to analyze the price risk of wheat crop, assess farmers' risk attitude and suggest a program to minimize risk cost through the following:

1. Perusing the current situation of wheat, its evolution according to the most important economic indicators throughout the period (1989-2015).
2. Estimate the supply response of wheat farmers to changes in the price using Nerlovian adjustment model.
3. Determine the short and long-run price elasticities of supply for wheat in Egypt .
4. Presenting some recommendations that can guide achieving farmers' full response to the economic variables in the presence of price risks.

Data sources and Methodology

The study in the process of achieving its aforementioned objectives, relied on qualitative analysis and quantitative analysis method using some of the various measurements, such as time series, regression analysis during the period (1989-2015).Data collected for this study from both published and unpublished sources, including the Egyptian ministry of agriculture, Food and Agriculture organization (FAO) and Central Agency for Public Mobilization and Statistics (CAPMAS) in addition to some electronic websites related to the research subject.

Current situation of wheat crop in Egypt

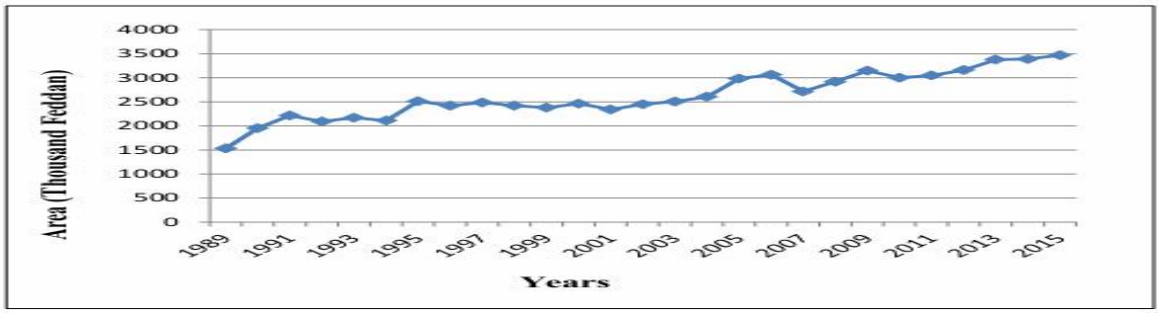
1. Production indicators:

A. Cultivated Area:

Table (1) and figure (1) indicate that the development of the cultivated areas of wheat in Egypt during the period (1989-2015) has increased from 1533 thousand Feddan in1989 to about 3469 thousand Feddan in 2015 with an increase of about 126.35%.Assessing the time series analysis equation of the area planted of wheat in Egypt during the period (1989-2015) and described in table (2) equation (1) indicate that the area has taken a general annual increasing trend statistically significant amounted to about 2.25%. The value of the coefficient of determination (R^2) indicates that 87% of the changes occurring in the area planted with wheat in Egypt during the period (1989-2015) is due to the technical

and economic changes reflecting the prevailing time variable. Meanwhile, the rest of the indicated differences seen in the area are due to factors other than the time variable. The value of coefficient (F) indicates the suitability of the mathematical model used for the statistical nature of the data for the variable under study.

Fig.1. The development of cultivated area of wheat in Egypt during the period (1989-2015).

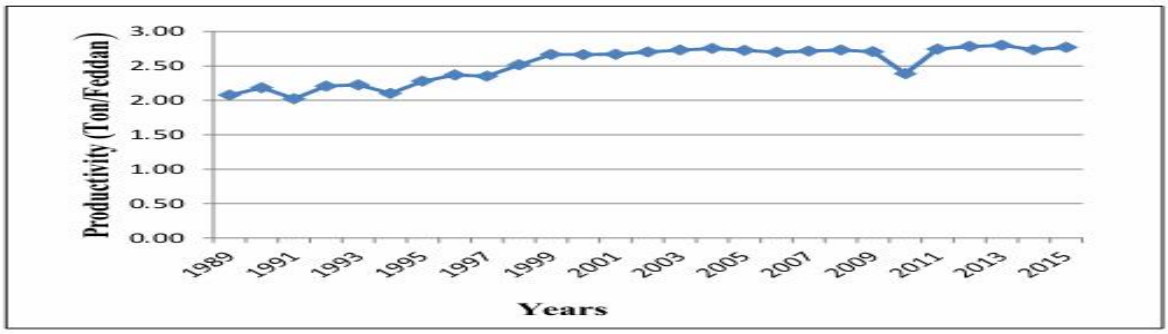


Source: Complied and calculated form data in table (1).

B. productivity

Table (1) and figure (2) show that wheat productivity has increased from about 2.08 in 1989 to about 2.77 ton /Feddan in 2015, with an increase of about 33.5%. By estimating the time series analysis of wheat productivity in Egypt during the study period as shown in table (2) equation (2), it is indicated that the productivity has taken a general annual increasing trend statistically significant of about 1.13% ,the value of the coefficient of determination (R^2) indicates that 60% of the changes occurring in the wheat productivity during the study period is due to the technical and economic changes reflecting the prevailing time variable and the rest is due to other stochastic factors .

Fig.2. The development of wheat productivity in Egypt during the period (1989-2015).

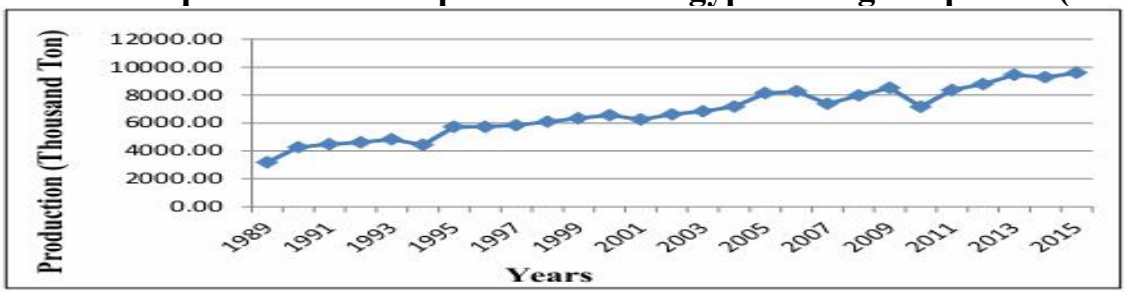


Source: Complied and calculated form data in table (1).

Table (1) and figure (3) indicate that wheat production increased from about 3183 thousand ton in 1989 to about 9608 thousand ton in 2015, increase of about 201.83% during the period. By estimating the time series analysis revealed that wheat production has taken a general trend increasing annually and statistically significant amounted to about 3.38%, and it indicated the value of the coefficient of determination (R^2) indicated that 90% of the changes in the wheat production during the study period attributes to economic and technical variations prevailing during the period of the study and which is reflected by the time variable,

whereas the other variations are due to factors other than those reflected by the time variable, also it indicates the value of the coefficient (F) reconciling with the mathematical model used for the nature of the statistical data of the variable, the subject of the study.

Fig.3. The development of wheat production in Egypt during the period (1989-2015).



Source: Complied and calculated form data in table (1).

Table 1. Development of cultivated area, productivity and production of wheat during the period (1989-2015).

Year	Area (Thousand fed.)	Productivity (ton/fed.)	Production (ton)
1989	1533	2.08	3183
1990	1955	2.18	4268
1991	2215	2.02	4483
1992	2092	2.21	4618
1993	2171	2.23	4833
1994	2111	2.10	4437
1995	2512	2.28	5722
1996	2421	2.37	5735
1997	2486	2.35	5849
1998	2421	2.52	6093
1999	2379	2.67	6347
2000	2463	2.66	6564
2001	2342	2.67	6255
2002	2450	2.70	6625
2003	2506	2.73	6845
2004	2605	2.75	7178
2005	2985	2.73	8141
2006	3064	2.70	8274
2007	2716	2.72	7379
2008	2920	2.73	7977
2009	3147	2.71	8523
2010	3001	2.39	7169
2011	3049	2.75	8371
2012	3161	2.78	8795
2013	3378	2.80	9460
2014	3393	2.73	9280
2015	3469	2.77	9608
Average	2628	2.53	6741

Source: Compiled and calculated from Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, bulletin of the agricultural statistics, different journals.

Table 2. Time series analysis equations of wheat cultivated area, productivity and production during the period (1989-2015).

Variable	Type of equation	Equation	T-Test	F	R^2	Annual growth Rate %
Area (thousand Fed.)	Semi log	$Ln\hat{Y}=7.54+0.02X_i$	12.86*	165	0.87	2.25
Productivity (ton/fed.)	Semi log	$Ln\hat{Y}= 0.77+ 0.01X_i$	7.75*	60	0.70	1.13
Production (Thousand ton)	Semi log	$Ln\hat{Y}=8.31+ 0.03X_i$	15.40*	237	0.90	3.38

***Significant at <0.05.**
Where $\hat{Y}$ is the value of the Dependent variable.
X_i is the value of the time Independent variable during the period (1989- 2015).
Where, I = (1, 2, 3… 27).
Source: Calculated from table (1).

2. Economic indicators

A. Fixed cost

Table (3) and figure (4) indicate that the total fixed cost per feddan varied between a minimum of LE 52 per feddan in 1989 and a maximum of about LE 1987 per feddan in 2015. By estimating the time series analysis for the fixed cost of wheat crop during the study period described in table (4) equation (1) show that the fixed cost has taken a general annual increasing trend statistically significant of about 12.31%.The value of the coefficient of determination (R^2) indicates that 89% of the changes occurring in the wheat fixed cost is due to the technical and economic changes reflecting the prevailing time variable Meanwhile, the rest of the indicated differences are due to other stochastic factors.

B. variable cost

Table (3) and figure (4) show that the total variable cost per feddan ranged between a minimum of LE 356 per feddan in 1989 and a maximum of L.E 3640 per Feddan in 2015. By estimating the time series equation for the variable cost of wheat crop during the study period shown in table (4) equation (2), there was a significant increase of about 8.03 % The value of the coefficient of determination (R^2) indicates that 96% of the changes occurring in the wheat variable cost is due to the technical and economic changes reflecting the prevailing time variable Meanwhile, the rest of the indicated differences are due to other stochastic factors.

C. Total cost

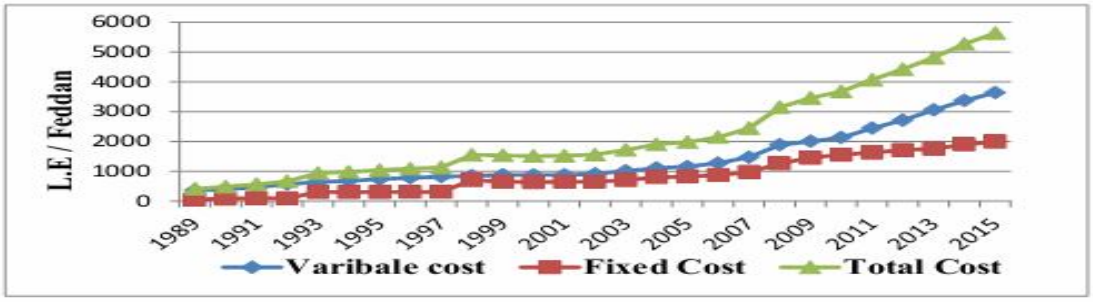
Table (3) and figure (4) show that the total cost during the study period ranged between a minimum of LE 407.59 per Feddan in 1989 and a maximum of LE 5627 per Feddan in 2015. The analysis of the time series equation showed a significant annual increase of 9.18 %.with a coefficient of determination of 0.97, indicate that about 97% of the changes occurring in total cost during the study period is due to the technical and economic changes reflecting the prevailing time variable Meanwhile, the rest of the indicated differences are due to other stochastic factors (Table 4,equation #3).

D. Total revenue

Table (3) and figure (5) show that the total revenue of wheat crop has increased from L.E 1169 per feddan in 1989 to LE 9568 per feddan in 2015 .The result of time series analysis equation during the study period showed a significant annual increase

of about 8.51%, with a coefficient of determination of 0.96, means that about 96% of the variation in total revenue of wheat is explained by the time trend and the rest is due to other stochastic factors (Table 4, equation #4).

Fig.4. Development of wheat fixed, variable and total costs during the period (1989-2015).

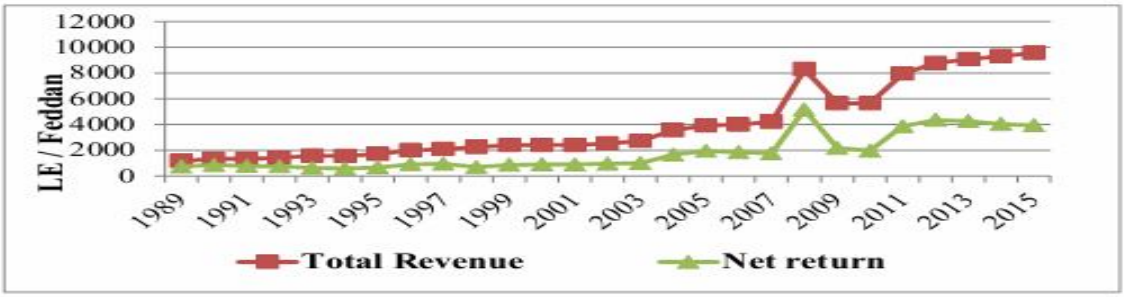


Source: Complied and calculated form data in table (3).

E. Net return

Table (3) and figure (5) show that the net return ranged between a minimum of L.E 585 per feddan in 1994 and a maximum of LE 5159 per feddan .The analysis of the time series equation during the study period show that there was a statistically significant increase of about 8% .the value of the coefficient of coefficient of determination (R^2) indicate that 81% of the variation occurring in the net return of wheat is explained by the time trend and the rest is due to other stochastic factors.(Table 4, equation # 5).

Fig.5. Development of wheat total revenue and net return during the period (1989-2015).

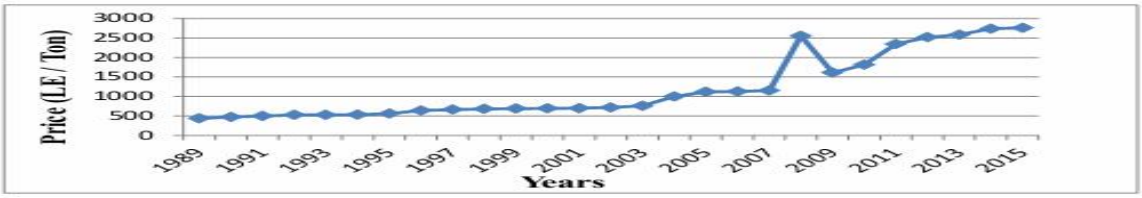


Source: Complied and calculated form data in table (3).

F. Farm gate price

Table (3) and figure (6) shows that the price of wheat varied between a minimum of LE 436 per ton in1989 and maximum of LE 2760 per ton in 2015 .By estimating the equation of time series analysis there was a significant increase of about 7.62% .the value of the coefficient of determination (R^2) indicate that 91 % of the change occurring in the wheat price during the study period is due to the technical and economic changes reflecting the prevailing time variable. Meanwhile, the rest of the indicated differences are due to other stochastic factors.The value of coefficient (F) indicates the suitability of the mathematical model used for the statistical nature of the data for the variable under study. (Table 4, equation #6).

Fig.6. Development of wheat price during the period (1989-2015).



Source: Complied and calculated form data in table (3).

Table 3. Development of wheat total cost and other influencing variable during the period (1989-2015). **(L E/Feddan)**

Year	Fixed Cost	Variable cost	Total cost	Total revenue	Net return	Price (LE/ton)
1989	52	356	408	1169	761	436
1990	82	402	484	1352	868	473
1991	96	467	562	1345	782	498
1992	95	569	664	1435	770	527
1993	300	641	941	1582	641	529
1994	300	681	981	1566	585	533
1995	301	735	1036	1717	682	560
1996	305	782	1087	2010	923	640
1997	309	818	1127	2090	964	664
1998	703	850	1553	2258	706	680
1999	655	878	1533	2409	876	689
2000	636	874	1510	2418	907	693
2001	646	877	1523	2419	897	701
2002	647	912	1558	2531	972	718
2003	704	1011	1715	2731	1016	760
2004	799	1105	1904	3570	1666	1000
2005	828	1153	1981	3937	1956	1120
2006	872	1271	2143	4006	1863	1127
2007	975	1469	2444	4213	1769	1153
2008	1260	1885	3145	8304	5159	2553
2009	1456	2003	3459	5649	2190	1613
2010	1550	2130	3680	5657	1977	1813
2011	1626	2443	4069	7953	3884	2347
2012	1713	2712	4425	8783	4358	2520
2013	1753	3055	4808	9082	4274	2587
2014	1900	3371	5271	9318	4047	2740
2015	1987	3640	5627	9568	3941	2760
Average	835.18	1373.59	2208.77	4039.65	1830.88	1201.27

Source: Compiled and calculated from Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, bulletin of the agricultural statistics, different journals.

Table 4.Time series analysis equations of wheat fixed Costs and other influencing factors during the period (1989-2015).

Variable	Type of equation	Equation	T-Test	F	R^2	Annual growth rate %
Fixed cost	Semi log	$\hat{LnY}=4.62+ 0.12X_i$	14.39*	206.94	0.89	12.31
Variable cost	Semi log	$\hat{LnY}=5.89+0.08 X_i$	24.88*	619.11	0.96	8.03
Total cost	Semi log	$\hat{LnY}=6.17+0.09 X_i$	29.60*	876.38	0.97	9.18
Total revenue	Semi log	$\hat{LnY}=6.88+0.09 X_i$	23.74*	563.77	0.96	8.51
Net return	Semi log	$\hat{LnY}=6.14+0.08 X_i$	10.44*	108.91	0.81	8.00
Price (LE /ton)	Semi log	$\hat{LnY}=5.82+0.08 X_i$	16.21*	262.74	0.91	7.62

***Significant at<0.05.** **Where ln= natural log for the dependent variable (Ŷ)**

Y is the value of the dependent variable.

Xi is the value of the time Independent variable during the period (1989-2015).

Where, I = (1, 2, 3… 27).

Source: Calculated from table (3).

5. Supply response of wheat crop

a. The theoretical framework of supply response

The Nerlovian model is considered one of the most models used to estimate agricultural supply response , The pioneering work of Nerlove on supply response enables one to determine short run and long run elasticities; also it gives the flexibility to introduce non-price shift variables in the model. The partial adjustment lagged model is considered appropriate for crop producers.

The basic form of the Nerlovian model for an annual crop consists of the following three equations:

1. $A^*_t = a_0 + a_1 P^*_t + a_2 K_t + U_t$ (1)
2. $P^*_t = P_{t-1} + \gamma(P_{t-1} - P^*_{t-1})$ (2)
3. $A_t - A_{t-1} = \gamma(A^*_t - A_{t-1})$ (3)

Where:

A_t = *actual area cultivted at time t,*

A_{t-1} = *actual area cultivated at time t-1*

A^*_t = *desired area to be cultivated at time t,*

P_t = *actual farm gate price at time t,*

P_{t-1} = *actual farm gate price at time t-1*

P^*_t = *expected farm gate price at time t,*

P^*_{t-1} = *expected farm gate price at time t-1,*

K_t = *is avector of risk variable ,*

v_t = *other observed ,noneconomic factors affecting supply at time t,.*

γ = *labelled the adjustment coefficient .*

γ Measures the speed of adjustment and assumes values from 0 to 1,It is interpreted as the coefficient of adjustment which characterizes the fact that there are limitations to the rate of adjustment of due to economic and non-economic factors like technological constrains, weather variability, prices and various inflexibilities. Relations with equation (1) and (3) give the reduced form which eliminates the unobserved variable by an observed variable. By eliminating these variables, the estimating or the reduced form Nerlovian equation is achieved. The reduced form equation is given by;

$$A_t = b_0 + b_1 A_{t-1} + b_2 p_{1\,t-1} + b_3 k_t + v_t \quad (4)$$

Where:

A_t = *actual area cultivted at time t,*

A_{t-1} = *actual area cultivated at time t-1,*

P_{t-1} = *actual farm gate price at time t-1,*

K_t = *is avector of risk variable ,*

v_t = *other observed ,noneconomic factors affecting supply at time t*

The reduced form would basically remain the same if we include more independent variables than the ones included in equation (4).

Ahmad, Mahmood and Mahmood, Farhat (1994) study showed that none of the previous studies have included risk as separate variable despite price risk factor is also important as the producer price, such a unobservable variability has to be explained by response model and that's was exactly the problem which lead to develop Nerlovian model .

Where the price risk variable in equation (5) is defined according to Gallagher's modification of Ryan's formulation .In this formulation, price risk variable k_t is specified as weighted total price Variability and has the following specifications.

$$k_t = \frac{(P_{t-1} - 0.33(P_{t-2}+P_{t-3}+P_{t-4}))^2}{0.33(P_{t-2}+P_{t-3}+P_{t-4})} \qquad (5)$$

Where:

K_t = *farm gate price risk variable.*

P_{t-1} = *lagged farm gate price by 1 year*

P_{t-2} = *lagged farm gate price by 2 years.*

P_{t-3} = *lagged farm gate price by 3 years.*

P_{t-4} = *lagged farm gate price by 4 years.*

The short-run and long-run risk price elasticities were computed as follows;

- The risk short-run elasticity $\varepsilon = b_3$.
- While the log-run elasticity $= \frac{b_3}{Coefficiet\ of\ adjustment(\gamma)}$

The conceptual framework for analyzing the supply response of study crops. Firstly selection of outlier's values this was done to avoid spurious regression results and unstable models with respect to degree of freedom ,to analyze the supply response of the price and supply response functions were applied and then the short and long-run supply elasticities were determined .Two model was therefore applied to compare supply response models of study crops during the period (1989-2015) ,the first model measures the supply response of study crops depends on the planted area in the current year affected by both the one year lagged area (A_{t-1}) and lagged price (P_{t-1}) in the absence of a risk variable, while the second one measures supply response of study crops depends on the planted area in the current year affected by both the one year lagged area (A_{t-1}) and lagged price (P_{t-1}) in the presence of risk variable.

B. Supply response estimation of wheat crop.

Table (5) shows that in the unrestricted model the value of the adjusted coefficient of determination ($\overline{R^2}$) indicates that about 95% of the variations in the area occurring in the area planted with wheat were explained by the changes in the one year lagged area (A_{t-1}),one year lagged price (P_{t-1}), and the rest is due to other stochastic factors. The lagged area (A_{t-1}) and the lagged price (P_{t-1}) with a coefficient of a 0.43 and 0.18 respectively is positive and less than one implying that farmers take more than one year to adjust acreage, The positive price and area coefficient are expected and concur with economic theory.

In the restricted model the value of the adjusted coefficient of determination ($\overline{R^2}$) indicates that about 96% of the variation in the area was explained by the changes in the one year lagged area (A_{t-1}), one year lagged price (P_{t-1}), the risk variable (K_t) and the rest is due to other stochastic factors, The coefficient of lagged area (A_{t-1}), lagged price (P_{t-1}) taking into consideration the risk variable (K_t) are positive and less than one with coefficient of 0.56 and 0.11 respectively implying that farmers take more than one year to adjust acreage to changes in supply and the lagged price (P_{t-1}) has a positive and significant effect on the current cultivated area.

The risk variable (K_t) is positive and significant with a coefficient of 0.02 implying that wheat farmers are risk preferring the reason behind this is that the government, usually, provides a guaranteed price of wheat higher than the world price to encourage farmers to expand the cultivated area of wheat and also to secure a certain domestic quota of wheat supply to produce the subsidized local bread and limit the quantity imported.

Table 5. Regression results for supply response of Wheat during the period (1988-2015).

Parameter	Equation	F	$\overline{R^2}$	Standard error
Without risk (Restricted)	Ln Y=3.30+0.43LNA_{t-1}+0.18LnP_{t-1} (3.12)* (3.57)*	157	0.95	0.06
With risk (unrestricted)	Ln Y=2.62+0.56LNA_{t-1}+0.11LnP_{t-1}+0.02lnK_t (4.39)* (2.27)* (2.58)*	146	0.96	0.05
Number of observation=18				

Ln: All the variables are in logarithmic form.
The value given in parentheses indicates t-statistics. *Significant at the 5% level.
Where:
A_t= Area planted under wheat. A_{t-1}= Area of wheat lagged by one year.
P_{t-1}= Farm gate prices of wheat lagged by one year. K_t= Risk factor.
Source: Calculated from table (1) and (3).

C. short –run and long run wheat elasticity

The estimated short-run and long run elasticities with and without risk are summarized in table (6) below. The wheat elasticity for price shows that with the increase in the price of wheat by 1 percent during the period of analysis, the area of wheat has increased by about 18 percent in the short run and 31 percent in the long run. In the restricted model the price elasticity shows that with the increase in the price of wheat by 1 percent during the period of analysis, the area has increased by about 11 percent in the short run and 26 percent in the long run. The risk elasticity was about 2% in the short run and 5% in the long run.

Both the short-run and the long-run elasticities with respect to the lagged price variable are inelastic and their degrees fall in the range of elasticities found in other studies. Incorporating risk variable the explanatory power of the model declined slightly. The intercept decreased from 3.30 in the first model to 2.62 in the second model, short run elasticity decreased from 0.18 to 0.11 and long-run elasticity decreased from 0.31 to 0.26 for the first and second models respectively as a result of price risk. On the other hand the adjustment of coefficient has also decreased from 57

percent in the unrestricted model to 44 percent in the restricted model implying lower adjustment by wheat farmers to price change.

Table 6. Short-and long-run elasticities of wheat acreage during the period (1989-2015).

Variables	With Out risk (unrestricted)	With Risk (restricted)	
	Price	Price	Risk
Short Run	0.18	0.11	0.024
Long Rum	0.31	0.26	0.055
Coefficient of Adjustment	0.57	0.44	

Source: calculated from the data in table (5).

6. Forecasting of cultivated area of wheat according to the supply response analysis.

The wheat cultivated area was predicted through three scenarios during the period (2016-2020) from the results of the supply response analysis (The first scenario is area without risk (unrestricted model) and the second one representing area under risk (restricted model) compared to the results of time series regression model i.e. Area (trend).

Table (7) shows that area planted with wheat under the third scenario (Area trend) has increased from about 3.55 million feddan in 2016 to about 3.88 million feddan in 2020, with an increase of about 9%.In the first (unrestricted model) scenario, the cultivated area has increased from about 3.49 million Feddan in 2016 to about 3.57 million Feddan in 2020 with an increase of about 2.3%. As for the restricted area (area under risk), it has increased from about 3.48 million feddans in 2016 to about 3.55 million feddans in 2020, with a 2 % increase.

Table 7.projected wheat cultivated areas during the period (2016 -2020).

(Million Feddan)

Year	First Scenario(1)	Second Scenario(2)	Third scenario(3)
2016	3.49	3.48	3.55
2017	3.51	3.50	3.63
2018	3.53	3.51	3.71
2019	3.55	3.53	3.79
2020	3.57	3.55	3.88

(1)Area estimation using coefficiet of adjustment under unrestricted model
(2)Area estimaton using coefficient of determination under restriced scenraio.
(3) Area estimation using time series trend.

Source: Calculated from table (1) and table (6).

Stabilizing price incentives are applied; based on increasing the average farm gate prices by 9% (as an incentive to insure stable farm income) which represents 50% of subsidies to agricultural products proposed by European Union to farmers.

Table (8) shows that the wheat price incentive program has increased from about LE 748.75 per feddan in 2016 to about LE 1050.40 per feddan in 2020.The estimated cost of the price incentive program reaches its highest value under the third scenario as it increases from LE 2.66 billion in 2016 to LE 4.07 billion in 2020 whereas, the cost of this program under the first scenario unrestricted model

(area without risk) estimated at almost LE 2.61 billion and LE 3.75 billion in 2016 and 2020 respectively and the lowest cost of this program was for the second scenario restricted model (Area under risk) estimated at about LE 2.61 billion in 2016 and LE 3.72 billion.

Table 8.increasing projected farm gate prices of wheat by 9% under the three scenarios (2016-2020).

Year	Increasing price by (9%) (LE/Ton)	Price incentive(1) (LE/Feddan)	1st scenario(2) (Billion LE)	2nd scenario (3) (Billion LE)	3rd scenario(4) (Billion LE)
2016	3237.58	748.75	2.61	2.61	2.66
2017	3484.22	814.88	2.86	2.85	2.96
2018	3749.65	886.85	3.13	3.12	3.29
2019	4035.31	965.17	3.43	3.41	3.66
2020	4342.72	1050.40	3.75	3.72	4.07

(1)Price incentive = Net return after increasing price by (9%) - Net return before increasing price by (9%).

(2)1st Scenario (price incentive x unrestricted area).

(3)2nd scenario (price incentive x area under risk).

(4) 3rd Scenario (price incentive x area trend).

Source: calculated from table (10) and (3).

As shown in table (9) the change in rental value from the base year 2015 has increased from LE 245 per feddan in 2016 to reach its maximum of about L.E.1564 per feddan in 2020. The percentage of price increase which covers the annual increase of fixed cost from the base year has declined from 306 % in 2016 to reach 67% in 2020.

Table 9. The impact of increasing wheat farm gate price (by 9 %) on covering the change in rental value during the period (2016-2020).

Year	Fixed cost (L.E/Feddan)	Difference in rental value (1) (LE /Feddan)	Percentage increase in price that cover the increase in the fixed cost (2)
2016	2231.7	244.7	306%
2017	2506.4	519.4	157%
2018	2815.0	828	107%
2019	3161.7	1174.7	82%
2020	3550.9	1563.9	67%

(1) Difference in rental value each year (2016-2020) from the base year 2015.

(2) Percentage increase in price =price incentive ÷ difference in rental value.

Source: calculated from table (11) and (3).

Table (10) shows the price incentive program of wheat under the three scenarios; area without risk (unrestricted), area under risk (restricted) and area (trend) i.e.by using time series regression model and the gross domestic product of Egypt during the period (2016:2020). The price incentive under the first and the second scenario has decreased from about 0.10 % of the GDP in 2016 to 0.07 % of the GDP in 2020 .Meanwhile, under the third scenario the price incentive program percentage of the GDP decreased from about 0.10% of the GDP in 2016 to about 0.08 % of the GDP in 2020.

Table 10.price incentive program of wheat crop under the three scenarios during the period (2016-2020).

Price incentive	2016	2017	2018	2019	2020
1st scenario (EGY Billion)	2.61	2.86	3.13	3.43	3.75
% of GDP	0.10%	0.08%	0.08%	0.08%	0.07%
2nd scenario (EGY Billion)	2.61	2.85	3.12	3.41	3.72
% of GDP	0.10%	0.08%	0.08%	0.08%	0.07%
3rd scenario (EGY Billion)	2.66	2.96	3.29	3.66	4.07
% of GDP	0.10%	0.09%	0.08%	0.08%	0.08%
GDP (EGY Billion)	2709	3470	3963	4525	5168

Source: compiled and calculated from: (1) The World Bank collection of development indicators. (2) From table (10).

Recommendations

Based on the previous finding, the study recommends the following:

1. The Ministry of agriculture and land reclamation should set guidance price for the crops so that the farmers can take these prices into account when determining the cultivated area.
2. There is need to stabilize the agricultural prices which will helps farmers to make decision about when to sell their product so as to earn more net return.
3. Positive price incentives to farmers help the government to achieve self – sufficiency as well as maintain stable income to the farmers.
4. Government policies should take a holistic approach to risk management, assessing all risks and their relationship to each other, and should avoid focusing on a single source of risk such as prices

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تحليل أثر قرارات مزارعين القمح فى ظل المخاطرة فى مصر

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الملخص

إن القطاع الزراعي يعد أكثر عرضة للمخاطر من باقي قطاعات الاقتصاد القومي نظراً للتغيرات الاقتصادية وغير الاقتصادية ولعل أكثر أنواع المخاطر شيوعاً هي المخاطر الاقتصادية مثل مخاطر التسويق والتغير فى الأسعار المزرعية وظروف السوق المحلية والعالمية والمخاطر التمويلية مما يترتب عليه تقلبات حادة فى أسعار المدخلات والمنتجات الزراعية والتي تأثر على تلك الأسواق بالإضافة إلى أن السياسات الزراعيه تركت للمزارع حرية إختيار زراعة المحاصيل وبالتالي أصبح المزارعون أكثر عرضة لقوى السوق مما كانوا عليه بالماضي. لذا تهدف الدراسة بصفه عامه إلى إلقاء الضوء على دور مخاطر الأسعار فى تشكيل قرارات استجابة العرض لدى المزارعين وقد أوضحت نتائج الدراسة إلى أن المنتجين أكثر استجابة لعامل السعر عن العوامل غير السعرية لذلك من الضروري الحد من مخاطر الأسعار لزيادة استجابة المنتجين للعرض ولذلك يستوجب على الحكومة وواضعي السياسات الزراعية وضع حوافز سعريه للمحاصيل وذلك لمواجهة مخاطر التقلبات السعرية التي يتعرض لها المزارعين والمنتجين فى الفترة الراهنة مما يؤدى إلى استقرار الإنتاج و الاكتفاء الذاتي للدولة وضمان دخل ثابت للمزارع ومواجهة مخاطر التقلبات السعرية.

الكلمات المفتاحية: المخاطرة ' استجابه العرض 'قرارات الانتاج' تثبيت حوافز الاسعار.