COMPARISON OF THE PERFORMANCE OF WHEAT FLOUR MILLS IN IRAQ FOR THE YEAR 2019 BAGHDAD GOVERNORATE CASE STUDY

Mohammed A.J.A. **H.J.MOHAMMED**
Researcher **Assist. Prof.**
Gen. Grain Trad. Com. Min. Trade **Dept. Agric. Econ. Coll. . Agric. Engin. Sci. University of Bagdad**
mohammed.abdaljabar1108a@coagri.uobaghdad.edu.iq

ABSTRACT

This study was aimed to compare the performance of flour mills in Baghdad governorate during 2019. A sample of 53 mills were collected, divided into four categories according to their productivity. The technical and economic efficiency were estimated according to the data envelope method with an input oriented. The results showed that the values of the general average of scale efficiency and technical efficiency constant CRS, and variable return to scale VRS for the sample in the first half according to its production capacity of the mills amounted to (0.876, 0.937, 0.937)% respectively. Compared to the results of the second period (0.896, 0.952, 0.941) %, respectively. As for the results of allocative and economic efficiency in the first period, it amounted to (0.0856, 0.803) %, respectively. Compared to the results of the second period (0.0840, 0.801) %, respectively. In summary, we conclude that the increase in the quantities of raw wheat in the second period of the sample by 7.0% resulted in a positive effect on the results of technical efficiency TEvrs, and this was also indicated by the results of the Malmquist index. As for the decrease in the results of the average economic efficiency of the sample in the second period due to the low economic efficiency of the mills of the first category, which negatively affected the results of the sample as a whole. One of the recommendations of the research is to update the four categories of mills' machines, as it has become a problem in wasting input quantities and mills moving away from optimizing the economic efficiency of those mills. As for the mills of the first category, the levels of production capacities must be raised because the current levels do not serve the flour industry and it negatively affected the average sample efficiency.

Key words: Technical efficiency crs, vrs, Scale efficiency, Economic Efficiency, Productivity.

مقارنة اداء مطاحن دقيق القمح في العراق لسنة 2019 محافظة بغداد حالة دراسية

محمد عبد الجبار احمد **حوراء جعفر محمد**
الباحث **استاذ مساعد**
الشركة العامة لتجارة الحبوب/وزارة التجارة **قسم الاقتصاد الزراعي/كلية علوم الهندسة الزراعية/جامعة بغداد**

المستخلص

استهدفت الدراسة مقارنة اداء مطاحن الدقيق في محافظة بغداد بين فترتين لسنة 2019، اذ جمعت عينة قوامها 53 مطحنة قسمت لاربعة فئات حسب انتاجيتها. تم تقدير الكفاءة التقنية والاقتصادية وفق اسلوب مغلف البيانات ذا التوجه الادخالي، اظهرت النتائج بأن قيم المتوسط العام لكفاءة السعة والكفاءة التقنية بثبات وتغير عائد السعة للعينة في النصف الاول حسب سعتها الانتاجية للمطاحن بلغت(0.876، 0.937، 0.937)% بالترتيب مقارنة بنتائج الفترة الثانية التي بلغت(0.896، 0.952، 0.941)% بالترتيب. اما نتائج الكفاءة التخصيصية والاقتصادية في الفترة الاولى فبلغت(0.0856، 0.803)% مقارنة بنتائج الفترة الثانية التي بلغت(0.0840، 0.801)%. واستنتج البحث بان زيادة كميات القمح الخام في الفترة الثانية للعينة بنسبة 7.0% احدثت ايجابا في نتائج الكفاءة التقنية وفق تغير عائد السعة وهذا ما اثبته مؤشر Malmquist. اما انخفاض نتائج متوسط الكفاءة الاقتصادية للعينة في الفترة الثانية بسبب انخفاض الكفاءة الاقتصادية لمطاحن الفئة الاولى التي اثرت سلبا على نتائج العينة ككل. ومن توصيات البحث تحديث الات مطاحن الفئات الاربعة لكونها اصبحت مشكلة في ضياع كميات المدخلات وابتعاد المطاحن عن تحقيق امثلية الكفاءة الاقتصاية لتلك المطاحن. اما مطاحن الفئة الاولى فيجب رفع مستويات طاقاتها الانتاجية لكون المستويات الحالية لاتخدم صناعة الدقيق واثرت سلبا على متوسط كفاءة العينة.

الكلمات المفتاحية: الكفاءة التقنية بثبات وتغير عائد السعة، كفاءة السعة، الكفاءة الاقتصادية، الانتاجية.

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INTRODUCTION

The flour product is an important daily food source because it contains carbohydrates, proteins, and fats. As the state has continued to provide this product since the previous three decades by providing raw wheat to flour mills in its public and private sectors. In the study year, the quantities of locally produced wheat amounted to about 4.3 million tons (18), which constitutes about 15% of the Arab countries. The quantities of raw wheat are sufficient to meet the needs of the community members of the flour product. In addition to the importance of the product (local flour) it increased during the period of the economic siege imposed on our country since the beginning of 1991 and was included in the ration basket as one of its main terms, and work is still going on until the year of the study in providing the product within the ration basket. Moreover, the processing of raw wheat quantities is carried out by the General Company for Grain Trade and its branches represented by raw wheat silos distributed in all governorates, which is the only main source supplied to the mills (16). The flour industry is considered one of the basic pillars for the development of agricultural industrial projects because it depends on the most important strategic grain crops, while the milled wheat industry is one of the most important agricultural industries (2, 4, 19, 20). Since the early nineties of the last century, the state has sought to pay attention to the flour manufacturing sector by providing all production requirements at a subsidized price, the most important of which is (purchasing wheat, fuel, water and electricity, bags, providing spare materials) to attract local investors in the private sector because the public sector mills cannot secure the community's need for locally produced flour. Support for flour production requirements continued until 2003, after this year, the support for production requirements gradually decreased until the study year was limited to supporting raw wheat only. The study aimed to estimate the Economic Efficiency EE and its components of flour mills in Baghdad governorate for the year 2019. In addition to measuring the productivity of flour mills during this period. As for the research problem, it was summed up in the suffering of flour mills from the high prices of productive resources because they were not covered by government support as in the past. In other words, production does not fall on the possible production curve, that is, it bears additional costs that make it move away from achieving economic efficiency in the exploitation of available resources. One of the hypotheses of the research is that the continued increase in the number of mills by the General Company for the manufacture of grains, while reducing subsidies for production requirements, may negatively affect the quantities of raw wheat processed to the mills, and thus have a significant impact on the high cost of the producing unit and thus affect its economic efficiency. Which requires conducting such a study to provide information about the current situation of the categories of flour mills, measure their economic efficiency, and reveal the extent of deviation in the percentage of available resources that require redistribution in order to achieve optimal use of them. As well as estimating productivity growth. The data that achieves the objectives of the study was obtained using a questionnaire that was designed to include the stage of production and manufacture of flour to the governmental and private mills affiliated to the General Company for Grain Manufacturing, and the number of sample mills reached 53 mills. The sample percentage to the total mills in Iraq is more than 18%.Due to the lack of studies that have been conducted on the efficiency of the milling sector, this economic study is of great importance in knowing the performance of the actual flour mills, and a number of studies have been conducted in this field, including (3, 22).

MATERIALS AND METHODS

First stage: Estimate the technical efficiency TE, Economic Efficiency EE. The data was analyzed according to the input-oriented in data envelope analysis DEA using DEAP 2.1 program to estimate constant return to scale CRS, variable return to scale VRS and scale efficiency SE for mills. In order to estimate the economic efficiency, the DEA model with internal guidance was used according to the variable returns to scale in calculating the allocative efficiency, cost efficiency and two

periods were selected for this study, Each period represents the average half-year production for the research year, because the second period (the second semi-annual period) was characterized by an increase in the quantities of raw wheat over the first by 7.0%, and the percentage of increase was close to all categories of the sample, to meet the consumption requirements of flour. The percentage increase in quantity is the basis for the study and comparison between the two periods. The sample was divided into four categories of mills according to the quantities processed from raw wheat as indicated by the researcher (8). The choice of DEA method is predetermined by the following: it is the nonparametric method that does not demand the obvious specification of functional relations between inputs and output and statistical distribution of an inefficiency; unlike other benchmarking methods it does not demand assumptions of type of behavior of research objects; it allows us to define effective and inefficient manufactures, calculate a quantitative measure of efficiency, build an effective hyper surface and find reference (effective) industrial DMUs. Besides, this method supposes simultaneous use of both cost and physical indicators that allows us to generalize numerous heterogeneous input and output parameters (7).

Second stage: In the case of panel data, DEA permits us to calculate the Malmquist Total Factor Productivity (TFP) Index, which serves to estimate productivity change over a period. This allows us to decompose the TFP into more components: Technical efficiency changes; Technological changes; pure efficiency changes; and scale efficiency changes (14). On other words, the Malmquist TFP index measures the TFP change between two data points by calculating the ratio of the distances of each data point relative to a common technology. The input-output variables used include quantities of capital, labour, raw material consumed used and gross value of output.

Data envelopment analysis model

Using Duality in linear programming, the analysis model used according to the DEA method is on the one hand using the inputs according to the variable return to scale VRS (2).

$\mathbf{Min}_{\lambda,\theta}\theta$

Subject to :

$-y_i + y\lambda \geq 0$

$\theta_{xi}^{*} - x\lambda \geq 0$

N, $\lambda = 1$

$\lambda \geq 0$

Whereas:

θ; It is an indicator of the technical efficiency of TE mills. To estimate scale efficiency SE for mills, requires estimate constant return to scale CRS, variable return to scale VRS. The basis of the research work relied on the variable return to scale VRS. Approach to estimate economic efficiency. In order to determine the variables of the subject of the study according to the DEA method, the outputs will be the value of the total revenue (in thousand dinars), as for the inputs, they are [working hours/hour, and variable capital, which includes (amount of raw wheat, fuel and oils, water and electricity, reserve materials, bags)].

As for the allocative efficiency, AEi, it requires (6):

Xi = vector of quantities used from inputs into the mill.

Wi = prices of the inputs used.

To estimate the economic efficiency EEi (15) or the so-called cost efficiency CE of the mills through the following equation:

EEi = Wi . Xi*/ Wi XI ……..1

As for the allocative efficiency, AE, it can be obtained through the following equation (13):

AEi = EEi / TEi ……..2

As for the economic efficiency, EEi, it is the product of the technical and allocative efficiency, as in the following equation (10):

EEi = TEi * AEi ……..……...3

RESULTS AND DISCUSSION

The sample included a number of mills distributed into a group of mills belonging to each category, the categories differed according to the quantities of raw wheat received by the grain silos, when conducting a field survey, it was found that there was a clear difference in production quantities, tons/day. This is because each mill in the research sample has a specific production capacity from the origin and is called the design capacity. In actual fact, there were some mills that could

not reach the design production capacity, and the actual production capacity was recorded ton/day because it was old. This difference has a significant impact on the efficiency of the mills because it needs an increase in the number of wheat milling days, as shown in the table 1 categories of mills and their numbers and the difference between the average amount of design and actual production capacity (tons/day) for each mill within its category as shown in the fourth column of the table, indicating the relative importance of each category. Which shows that the third category recorded a greater average difference than the rest of the categories, but this does not mean that the third category is devoid of efficient mills.

Table 1. the design and actual production capacity of the Categories of mills

Categories of mills	Total num. of category mills	The average production quantity of the mill (ton/day) according to the design capacity (1)	The average production quantity of the mill (ton/day) according to the actual capacity (2)	(1)-(2)	Ratio%
First category (1-1000) tons	18	94.722	63.333	31.389	15.68%
Second category (1001-1500) tons	11	140.4	92.7	47.7	23.84%
Third category (1501-2000) tons	16	195.4	125	70.4	35.18%
Fourth category (2001 over) tons	8	260	209.375	50.625	25.30%
Total	53	527.759	384.559	200.114	%100

Source: Data of the General Company for the Manufacturing of grains (16)

As for the total quantities of raw wheat processed to the sample mills, it was divided into two periods, because the second period witnessed an increase in quantities by 7.0% for the total sample. The percentages of increase in the quantities of raw wheat differed for each category, as shown in Table 2.

Table 2. Total quantities of raw wheat (tons) for the first and second half of the categories of mills

Categories of mills	Total No .of category mills	Total quantities of raw wheat (tons) The first period	Ratio% (1)	Total quantities of raw wheat (tons) The second period	Ratio% (2)
First category (1-1000) tons	18	14285.2	18.55%	15469	18.78%
Second category (1001-1500) tons	11	12964	16.84%	13999.8	16.99%
Third category (1501-2000) tons	16	26584.36	34.53%	28669.8	34.80%
Fourth category (2001 over) tons	8	23155.04	30.08%	24242.4	29.43%
Total Ratio% (2)/(1)	53	76988.6	% 100 7.0%	82381	% 100

Source: Data of the General Company for the trade of grains (17).

Table 2 shows the importance of the third category and the fourth category and for both periods, respectively, in receiving the quantities of raw wheat processed to them, and their proportions to the total quantities of the sample were more than 64% for both periods. Moreover, the two categories included 24 mills compared to their counterparts from the other categories, whose total mills amounted to 29 mills.

First stage: Estimate Scale Efficiency

Scale efficiency SE expresses the ratio of the measurement of technical efficiency according to constant return to scale CRS, to the measurement of technical efficiency according to variable return to scale VRS (5). The results

were estimated as in table 3.The average technical efficiency estimate constant return to scale CRS, variable return to scale VRS and scale efficiency for the first half of 2019 amounted to about (87.6, 93.7, 93.7%), respectively. That is, mills can remain at the same level of production accompanied by reducing waste in the amount of economic resources by (12.4, 6.3, 6.3)%, respectively, Which resulted in an increase in the cost of grain milling by (12.4, 6.3, 6.3)%, respectively. As for the categories, the best category that recorded an amount of scale efficiency was the third category, which amounted to 98%, That is, there is the possibility of increasing the level of production by 2% with the same amount of inputs used. And to refer to the TE crs, which represents the main axis in estimating scale efficiency, the best category recorded the highest level of efficiency was the fourth category, with an average of 92.7%, meaning there is the possibility of increasing production by 7.3% at the same level of the amount of production inputs, or by reducing production costs by 7.3%, with stability in achieving the same level of production. As for the TEvrs, it represents the main axis in estimating the economic efficiency of this study. The best category recorded the highest level of efficiency was the first category with an average of 97%, meaning there is the possibility of increasing production by 3% at the same level of the quantity of production resources, or by reducing production costs by 3%, with stability in achieving the same level of production. To compare it with the results of the average technical efficiency estimate constant return to scale CRS, variable return to scale VRS and scale efficiency for the second half of 2019 amounted to about (89.6, 95.2, 94.1%), respectively. That is, mills can remain at the same level of production accompanied by reducing waste in the amount of economic resources by (10.4, 4.8, 5.9)%, respectively, Which resulted in an increase in the cost of grain milling by (10.4, 4.8, 5.9)%, respectively. As for the categories, the best category that recorded an amount of scale efficiency was the third category, which amounted to 98.2%, That is, there is the possibility of increasing the level of production by 1.8% with the same amount of inputs used. And to refer to the TEcrs, which represents the main axis in estimating scale efficiency, the best category recorded the highest level of efficiency were the second, fourth category, with an average of 92.8%, meaning there is the possibility of increasing production by 7.2% at the same level of the amount of production inputs, or by reducing production costs by 7.2%, with stability in achieving the same level of production. As for the TEvrs, it represents the main axis in estimating the economic efficiency of this study. The best category recorded the highest level of efficiency was the first category with an average of 97.1%, meaning there is the possibility of increasing production by 2.9% at the same level of the quantity of production resources, or by reducing production costs by 2.9%, with stability in achieving the same level of production. Despite the preference for the results of the categories in the second half, which was accompanied by an increase in the quantities of raw wheat by 7%, there is still a difference in reaching the optimum level. And it seems that there is actually a difference between the design production capacities of grinding machines with their actual production capacities, which are mentioned in Table 1.

Table 3. Estimation of SE, TEcrs, TEvrs for categories of mills In the two period

Categories of mills	TEcrs (1)	TEvrs (1)	SE (1)	TEcrs (2)	TEvrs (2)	SE (2)
First category (1-1000) tons	0.852	0.970	0.878	0.856	0.971	0.881
Second category (1001-1500) tons	0.872	0.923	0.944	0.928	0.958	0.968
Third category (1501-2000) tons	0.880	0.898	0.980	0.901	0.918	0.982
Fourth category (2001 over) tons	0.927	0.954	0.971	0.928	0.964	0.962
Mean	0.876	0.937	0.937	0.896	0.952	0.941

Source: Depending on the results of the DEAP 2.1 program

Allocative efficiency, and economic efficiency of sample mills:

The results for the first half of 2019 of allocative AE, in addition to the economic efficiency EE, indicate about (85.6, 80.3) %, respectively, As the average value indicates that mill owners can redistribute economic inputs in an optimal way, it will save a percentage of (14.4, 19.7) % respectively, of the cost of production while maintaining the same level of production, or it is possible to increase production in the same proportions without adding economic inputs. As its results are shown in table 4.

Table 4. Estimation of AE, EE for categories of mills in the two period

Categories of mills	AE (1)	EE (1)	AE (2)	EE (2)
First category (1-1000) tons	0.839	0.815	0.778	0.757
Second category (1001-1500) tons	0.811	0.747	0.813	0.779
Third category (1501-2000) tons	0.876	0.790	0.880	0.813
Fourth category (2001 over) tons	0.913	0.874	0.936	0.904
Mean	0.856	0.803	0.840	0.801

Source: Depending on the results of the DEAP 2.1 program

Comparing it with the results of the second half of 2019, as shown in table 4, It indicated the results of both allocative AE, economic efficiency EE which were estimated towards (80.4, 80.1)%, respectively. As the average value indicates that mill owners can redistribute economic inputs in an optimal way, it will save a percentage of (16.0, 19.1) % respectively in order, of the production cost while remaining at the same level of production. Or it is possible to increase production in the same proportions without using more economic inputs.By comparing the two periods, it became clear that the decline in economic efficiency in the second period was caused by the results of the first category. As for the rest of the categories, all the results of allocative efficiency and economic efficiency proved their preference in the second period.

Second stage: Measuring the change in the total productivity of resources using the malmquist index

Productivity Total means the amount produced by the total factors of production, so it is the relationship between outputs and all the factors of production that were used to obtain it inputs (1). Or it is the relationship between outputs and inputs represented by a percentage, which is the amount of production attributed to an input of production, meaning the amount of production resulting from the use of a productive input, especially labor and capital (21). In applied studies, it is preferable to use the total productivity over the partial productivity indicators because the latter is affected by the different intensity of the use of production inputs, as the greater the intensity of the use of the production input, the lower its productivity due to the law of diminishing marginal productivity (9). Efficiency and productivity are close in terms of significance, but they are different. An institution may be inefficient, but it can produce more using the current production inputs: that is, it was not on the production possibilities curve, but rather within it. As for productivity, it refers to the quantities produced using one or more factors of production, whatever the degree of efficiency (12). And Malmquist index as shown if the value of the indicator is greater than one, it indicates an improvement in the overall productivity of inputs. Otherwise, it means a decrease in the overall productivity of input, in this study the model was estimated from the inputs side, assuming variable return to scale VRS for flour production mills according to Malmquist indicator for Data Envelopment Analysis DEAP 2.1 program. This indicator depends on the ratios of the output distance functions between time periods t (the reference technological period) and the period t+1. From the analysis of the data in the program, the following indicators appear (11) as shown in table 5

1- Technical Efficiency Change TECH: The average of this indicator for the level of the research sample was 1.027, In other words, the performance of mills in the second half increased by 2.7%. The best results were

recorded for the mills of the second category, amounting to 1,077, meaning that the mills of the second category are used to produce one unit of product with less inputs. Compared to the mills of the fourth category, whose value was less than the value of one by 0.4%, meaning a decrease in its productivity.

2- Technical Change TCH: This indicator measures technological transformations, i.e. it indicates an improvement in the maximum efficiency between two technology periods, the reference period denoted by t and the period t+1, The average technical change of the sample mills was 1,056, the value represents 5.6%, the effect of the technology used in the mills that increased productivity in the second period. In terms of categories, the fourth category was the best and recorded an increase of 13.4% of the technology used in the category mills compared to the first category mills, which recorded a decrease of 0.5%, which decreased the technological level.

3- Pure Technical Efficiency Change PECH: The indicator searches for the main sources of efficiency change (technical or administrative or both). The sample mean value is 1.022, and that the value of the index improvement was estimated at 2.2% and it is related to the values of the index of change in technical efficiency TECH for the mills of the research sample. In terms of categories, the index value was higher than one for all categories, and the best in the second category was 1.055.

4- Scale Efficiency Change SECH: This indicator indicates the movement of mills towards the optimum size of production inputs. The value of the indicator appeared at an average of 1.005, with an improvement of 0.5%. It scored its best value in the second category, 1.021. In contrast, the value of the index decreased from the one in the fourth category by 0.7%.

5- Total Factors Productivity Change TFPC: The average change in the total resource productivity TFPCH for sample mills was 1.084, which is greater than the correct one and indicates an improvement in resource productivity in general, this means that the rate of improvement in the productivity of resources in general in the second half amounted to 8.4%.All categories scored higher than one, and the best value of the indicator appeared in the second category, with a score of 1.147.

Table 5. Change in the total productivity of inputs TFPCH for the Malmquist index comparing the two periods

Categories of mills	TECH	TCH	PECH	SECH	TFPCH
First category (1-1000) tons	1.011	0.995	1.006	1.005	1.006
Second category (1001-1500) tons	1.077	1.064	1.055	1.021	1.147
Third category (1501-2000) tons	1.030	1.094	1.031	1.001	1.127
Fourth category (2001 over) tons	0.996	1.134	1.003	0.993	1.131
Mean	1.027	1.056	1.022	1.005	1.084

Source: Depending on the results of the DEAP 2.1 program

We conclude that the increase in the supply of raw wheat quantities in the second half by 7.0% for the study sample led to a positive effect in estimating the technical efficiency TE according to the constant return to scale CRS, variable return to scale capacity VRS and scale efficiency SE, which proves that the ratio of output to input has priority in the second half of the study year and this It also includes measuring the change in the growth of the total productivity of resources using the Malmquist index. With regard to the decrease in the economic efficiency estimate (EE) in the second half, this is due to the results of the first category, which negatively affected the sample of mills, while the rest of the categories recorded an improvement in the results of economic efficiency. It can be said that the low production capacities do not correspond to the increase in the quantities of raw wheat. In general, the lack of optimization of the results of economic efficiency is caused

by the lack of sufficient support for the production inputs of the milling sector by the state. One of the recommendations of the research is to update the four categories of mills' machines, as it has become a problem in wasting input quantities and mills moving away from optimizing the economic efficiency of those mills. As for the mills of the first category, the levels of production capacities must be raised because the current levels do not serve the flour industry. The research can also recommend restoring the role of the state in supporting production inputs because it increased the costs of flour manufacturing and affected the reduction of economic efficiency, knowing that the levels of technical efficiency were much better than the levels of allocative efficiency.

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