

THE EFFECT OF AGRICULTURAL LABOR ON AGRICULTURAL PRODUCTION

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ABSTRACT

The objective of this study is to test the effect of agricultural labor and capital on agricultural production in Jordan. To accomplish this objective Cobb-Douglas model was used. The data were collected through secondary sources. The results showed that the agricultural production is highly dependent on labor and agricultural capital. The results have shown that the labor in the agricultural sector concentrates on foreign labor which is cheaper than local one. The paper concluded that the governmental policies should consider the high reliability on foreign labor as part of production in agricultural sector in Jordan.

Keywords: *agricultural capital, cobb-Douglas model, labor, productivity.*

1. INTRODUCTION

Jordan is a food deficit country, and the food trade balance was worsening throughout the 1990s and 2010s, as the food deficit more than doubled during this period. The relative share of the agricultural sector to the GDP declined from 15% in 1972 (Aresvik, 2005), to less than 4% in 2010 at 1994 prices (CBJ, 2011). However, despite significant expansions of the manufacturing and tourism sectors, agriculture remains an important economic sector in Jordan. Backward and forward linkages between agriculture and the overall economy are strong. The overall agribusiness sector is estimated to represent more than 29% of GDP in the early 1990s, and the agribusiness contribution to employment is estimated to be 13% (Ouedraogo and Hayson, 2007). Hence, on this broad definition, agriculture is a major contributor to the growth of GDP, and to employment, which makes the development of agriculture in Jordan of prime importance.

The Jordanian labor force increased from 445 thousand in 1983 to 1132 thousand in 2010. Over the same period, agricultural labor increased from 32.8 thousand to 65 thousand. This meant that the contribution of the agricultural sector to employing manpower declined from 7.37 percent to 5.74 percent in the same period.

The current agricultural labor market suffers from a shortage of Jordanian labor. Because of the availability of relatively cheap labor from outside, the difficulty of daily mobility of labor to the production regions (mainly Jordan Valley) and the dominance of subsistence agriculture in the rainfed regions, many Jordanian farmers have become more interested in working on a sharecropper basis or leasing their land.

2. RESEARCH OBJECTIVES

Labor is considered one of the important inputs in agricultural sector. It is affected by different factors namely the replacement of the local agricultural labor with foreign one and the attitude of agricultural labor to work in other sector because of the advantages gained by other sectors including high wages compared to the agricultural sector. This study aimed at introducing the extent of replacement of local with foreign labor, the contribution of agricultural labor in production, the elasticity of demand on agricultural labor and the possibility of replacing the labor and capital in agricultural sector.

3. RESEARCH PROBLEM

The agricultural sector witnessed high increase in foreign labor in last decade in Jordan. The

effect and the attitudes changed from local to foreign labor. These changes might lead to affect the productivity of the sector as well as the elasticity of replacement the local labor by foreign labor. This research will investigate this problem and its effect on the agricultural sector in Jordan. This study aims at answering the following questions:

1. To what extent the number of agricultural labor has changed?
2. What is the change in foreign agricultural labor?
3. What is the effect of labor on production in agricultural sector?
4. What is the demand elasticity on agricultural labor?
5. What is the elasticity of replacing the labor and capital in agricultural sector?

4. METHODOLOGY

To accomplish the objectives of this research, the following procedure was followed:

1. Collecting the required data of the local agricultural labor, the foreign labor in different sectors, the foreign labor in agricultural sector, the working capital in agricultural sector for the years 2000-2010.
2. Calculating the percentages of agricultural labor compared to total labor, the percentage of foreign labor in agricultural sector to the total foreign labor.
3. Using Cobb-Douglas function to calculate the effect of labor and capital on agricultural sector production.
4. Calculating the elasticity factor between labor and capital in agricultural sector.

Cobb-Douglas function was used to estimate the production function in the agricultural sector. Function (1) shows that general formula of Cobb-Douglas function. (Heathfield and Wibe, 1987)

$$Q = AL^\alpha K^\beta \dots\dots\dots (1)$$

Where Q is the current agricultural production (thousand JD) with the basic prices, A is a constant, L is the agricultural labor per year, K the predicted real capital for agricultural sector (million JD) and α , β production elasticity for labor and capital.

Function (2) was converted to the logarithmic form to get the form:

$$\ln Q = \ln A + \alpha \ln L + \beta \ln K + U \dots\dots\dots (2)$$

Where U is the random error of the function.

Cobb-Douglas model is characterized by the following:

1. The simplicity of calculating the variables of

the linear function.

2. Estimating the elasticity of production through the summation of the flexibilities of working capital and labor.
3. The marginal production for the different production elements can be estimated through the partial derivation of Cobb-Douglas function.

Ordinarily Least Squares (OLS) was used to evaluate the regression coefficient of production.

The capital in agricultural sector (K) was calculated using incremental capital output ratio (ICOR). This indicates that the function will be as follows:

$$K \text{ (Million JD)} = (\text{production of agricultural sector/GDP}) \times \text{the total economic capital}$$

The labor in agricultural sector was estimated using the following equation:

$$L \text{ (worker)} = \text{permanent labor} + 0.60 \times \text{seasonal labor} + 0.30 \text{ incidental labor}$$

This function is applied in Department of Statistics to estimate the total number of labor in agricultural sector in Jordan (DOS, 2010).

Demand elasticity on labor and agricultural capital was calculated using the following function:

$$c_1 = \frac{\beta}{\alpha + \beta}, c_2 = \frac{\alpha}{\alpha + \beta} \dots\dots\dots (3)$$

Where c_1 is the demand elasticity of labor and c_2 is the demand elasticity of agricultural capital. The results showed that demand elasticity of labor (0.52) in agricultural sector is higher than agricultural capital (0.49). This indicates that increasing the production will increase the demand for labor more than agricultural capital.

5. RESULTS

5.1. The growth of Jordanian agricultural labor force

The Jordanian agricultural labor decreased over years (Table 1). The continuous drop in Jordanian agricultural labor indicates negative sign for the development of agricultural sector. The drop in Jordanian agricultural labor is a result of its replacement by foreign labor. The agricultural business owners move to use foreign labor to decrease the production current expenses. The results have shown that the local agricultural labor was higher compared to foreign agricultural labor in 2001. In the following years the foreign agricultural labor exceeded the local one. The foreign labor in agricultural sector was more than the double in 2005. In 2010, the foreign agricultural labor was about triple and half the local agricultural labor. This reflects the

Table (1): Agricultural Jordanian labor to total agricultural labor force (thousands workers).

Year	Total Jordanian labor (Worker)*	Agricultural Jordanian Labor (Worker)*	Foreign agricultural labor (Worker)*	Percentage of foreign to local agr. Labor (%)
2001	908.3	44.6	37.0	83.0
2002	951.6	37.6	39.0	103.7
2003	969.2	34.4	42.9	124.7
2004	1012.3	36.1	59.0	163.4
2005	1023.6	34.8	71.4	205.2
2006	1055.8	33.0	68.3	207.0
2007	1140.4	30.3	70.9	234.0
2008	1172.7	29.9	75.0	250.8
2009	1220.5	34.1	92.2	270.4
2010	1235.9	25.0	85.5	342.0

* Source: Department of Statistics (2002-2012). Different Issues of Agricultural Statistics Bulletins. Amman, Jordan.

Table (2): The general trend of Jordanian and foreign agricultural labor force.

Variable	Growth rate %	t value	Prob.
2001-2005			
Jordanian agricultural labor	-1.86	3.36	0.0051
Foreign agricultural labor	30.99	4.24	0.001
2006-2010			
Jordanian agricultural labor	-0.96	3.42	0.004
Foreign agricultural labor	8.71	4.51	0.001

Table (3): The effect of foreign labor and agricultural capital on agricultural production using Cobb-Douglas.

Variable	Symbol	Coefficient	t-value	Prob.	VIF
Constant	A	3.387	0.66	0.517	
Labor	L	0.578	9.45	0.001	2.029
Agricultural capital	K	0.614	3.74	0.001	2.029
R ²	0.94				
F-value	113.8				
D.W	1.519				

dependence on the foreign labor in the Jordanian agricultural sector.

Table (2) shows that the Jordanian agricultural labor decreased by -1.86% in the period 2001-2005 and continued to decrease significantly but with lower rate in the period 2006-2010. The foreign labor in agricultural sector growth rate increased by 30.99% annually in the period 2001-2005 and continued to increase in the second period 2006-2010 by 8.71%. The increase of foreign labor is accompanied by decrease in local agricultural labor. This reflects the role of foreign labor in the production of Jordanian agricultural sector. The skillfulness of foreign labor will play a major role in promoting the production in Jordanian agricultural sector. The use of foreign labor in agricultural sector will reduce the expenses and maximize the profit according to the

believe of agricultural business managers (Kamruddin *et al.*, 2007).

5.2. The role of labor and capital in agricultural production

The regression coefficient 0.94 indicates that 94% of variation in agricultural production is explained through agricultural labor and capital. The model was significant. The value of Durbin-Watson (1.519) indicates the lack of autocorrelation. The multicollinearity was tested using variance inflation factor (VIF). The values of VIF indicate the lack of linear correlation between agricultural labor and capital.

The results show that increasing the labor in agricultural sector by 100% would increase the production by 57.8% while the other factors remain constant (Table 3). Increasing the agricultural capital by 100% would increase the

agricultural production by 61.4%. The results showed that the total flexibilities are (0.614+0.578=1.19). This reflects the increasing return to scale in the study period . In other words, a 100% increase in the quantities used in agricultural sector will increase the agricultural production by 119%.

The working capital significantly contributes positively in agricultural production (Table 3). The elasticity of working capital 0.614 is higher than the elasticity of labor which indicates that the response for agricultural capital is higher than the labor within the sector.

In conclusions the results showed that the agricultural sector in Jordan is highly dependent on the foreign labor. The local labor in the agricultural sector is decreasing over years. This indicates that the governmental policies should consider this point as any shortages in foreign labor will affect directly the production in agricultural sector. The results showed that agricultural labor contributed to the agricultural production in Jordan with higher demand on labor.

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تأثير العمالة الزراعية على الإنتاج في القطاع الزراعي

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ملخص

تهدف هذه الدراسة إلى اختبار تأثير العمالة الزراعية ورأس المال الزراعي على الإنتاجية في القطاع الزراعي في الأردن. لتحقيق هذا الغرض استخدم نموذج كوب-دوغلاس. حيث تم جمع البيانات لأغراض هذه الدراسة من المصادر الثانوية. وقد بينت نتائج الدراسة أن هناك تأثير كبير لكل من العمالة في القطاع الزراعي ورأس المال العامل على الإنتاجية. كذلك بينت النتائج أن العمالة الوافدة في القطاع الزراعي هي الأكبر والسبب وراء ذلك يعود إلى انخفاض أجور هذه العمالة. وقد استنتجت الدراسة بأن السياسات الحكومية يجب أن تأخذ بعين الاعتبار الاعتماد الكبير على العمالة الوافدة في هذا القطاع وتأثير ذلك على الإنتاجية في القطاع الزراعي في الأردن.

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