

The Contribution of Local and Foreign Labor to Total Factor Productivity in Saudi Arabia

Abdullah Algarini

Collage of Economics and Administrative Sciences, Al Imam Mohammad Ibn Saud Islamic University
PO box 395306, Riyadh 11375, Saudi Arabia

Abstract

This study employs time series to find total factor productivity (TFP) and the contribution of local workers, foreign workers, GDP, trade openness, oil revenue, capital stock, and foreign direct investment (FDI) to TFP. First, this study used accounting growth formula to calculate the time series of TFP growth. Secondly, it used VEC Model to examine the impact of local workers, foreign workers, oil revenue, GDP, capital stock, trade openness and foreign direct investment (FDI) on the TFP. The local workers and foreign workers have a positive impact on TFP in the long run and short run. But, the relationship between local workers and foreign workers is negative in a long run. This relationship means that foreign workers are substitutes for local workers.

1. Introduction

Improvement and strengthening of total factor productivity growth (TFP) is an important approach to accelerate the economic growth in Saudi Arabia. The effect of foreign labor is supposed to be positive on TFP growth. Foreign workers boost the working-age population. They may improve the level of innovativeness through the supply specific skills and completeness. However, there are some factors that may affect negative relationship between numbers of foreign workers and TFP growth. First, many foreign workers do not have enough skills or certificates in order to work in both public and private sectors. Second, nearly 86% of foreign workers have a monthly wage of less than SR 2000, which may affect negatively on local workers productivity (Saudi of Statistics and Information, 2015). Third, there is a belief that the huge influx of foreign workers has raised critical problems and has significant implications on local workers, infrastructure, and public services. Fourth, there are many of illegal foreign workers who benefit of services and public goods are presented as goods supported. For example, when the illegal workers (Yemenis, Africans, and others) enter the labor force, they will not only be competing with local labors for the similar job but they could be a responsibility if their existence and entry are not controlled.

During the last years, the structure of the economy of Saudi Arabia has experienced a dramatic change from dependence on oil towards mining and finally services sectors. In addition, government starts to finance the budget by using some financial policies. Government starts to impose constraints and tax on foreign workers to reduce burden on budget and offer some facilities like education, health and human rights. The government aims to maximize the benefits for local and foreign workers, especially by improving their productivity and allowing for local workers to work in private sector.

The motivation of this study is to analyze the contribution of foreign and local labors to TFP during 1990 to 2016. This study will consider the relationship between local and foreign workers in the long run and short run.

The remainder of this paper is organized as follows. Section two structures the methodology, which includes source of data of capital, labor force, economic growth and the specification of the model by using the accounting growth estimation method. Section three presents the results of the study. Finally, section five consists the conclusions and recommendations.

1.1 Trend of Local and Foreign Labor in Saudi Arabia

Rapid economic growth has led to rapid changes in labor market in Saudi Arabia. As result to increasing demand for labor than supply, there was a need to influx of foreign workers into the local market. There has been a steady influx of foreign labor from different countries such as Pakistan, India, Bangladesh and Egypt. Table 1 summarizes the development of local and foreign workers into Saudi Arabia from 1970 to 2016. It is clear that entry of foreign workers is increasing steadily from 1970 to 1980 and from 2010 to 2016. The highest inflow of foreign workers recorded in the first period compared to the local workers, while the lowest inflow of foreign workers recorded in the fourth period compared to the local workers. During these periods, the government was committed to reform the labor market, with particular emphasis on the increased organize of workers and increasing the skills of the labor force; foreign and local workers. Labor market reforms were crucial to provide a platform for the country to continue to develop towards becoming a more productive.

2. Literature Review

Studies on effect of local and foreign workers have been looking at areas for example; the impact on economic growth or total factor productivity in addition to complementary or substitution relationship between local labor

and foreign labor.

Noor, et al (2011) found that foreign workers in Malaysia have a positive effect on labor productivity, especially in manufacturing sector. However, they did not find any relationship between local and foreign labor.

Wei, Ismail, and Yussof (2014) showed that the aggregate number of the foreign and domestic workers have a positive effect on TFP growth in long run. Moreover, they found that skilled foreign workers have a positive impact on TFP growth while low-skilled foreign workers have a negative impact on TFP growth. Also, Tsao (1985) pointed out that the one of causes of low TFP growth in Singapore's manufacturing sectors is due to the inflow of the low skilled foreign workers and low level of industrial capability.

Ortega and Peri (2014) showed that the effect of foreign workers on TFP is positive effect for a large set of countries such as; France, German, and the United Kingdom. They found that openness to foreign workers leads to increase the range of skills and ideas in host country.

Dolado, Gorla, and Ichino (1994) used a set of 23 OECD countries during the period 1960-1985. They found that the negative output and growth effects of foreign workers are less important relative to local workers. They showed that the increase of net foreign workers reduces the growth rate of output per capita by 0.04 percent points.

In term of labor market, Peri (2012) showed that foreign workers have a positive impact on the American labor market and local workers. He did not find any evidences that foreign workers crowded out employment but he found that foreign workers encourage better use of technology among the low skilled workers.

Regarding the role of foreign workers and its effect on the labor market, Borjas (1991) stressed that such negative influence is only effective for low skilled foreign workers, while, the direction of the impacts of foreign worker on market labor refers to their productivity.

Zaleha et al (2011) indicated that foreign workers contribute positively to the labor productivity in Malaysia. They found that a 1 percent increase in foreign workers implies to improve in worker productivity by 0.172 percent.

This study is different from others. This study can contribute to a better understanding of the effect of foreign and local workers to TFP growth in Saudi Arabia during 1990-2016. This study provides a more detailed insight by dividing the workers into foreign and local workers in order to measure the efficiency and effectiveness of local and foreign workers. Also, this study seeks to make some contributions to the literature on the relationship between foreign and local workers to achieve sustained growth in TFP and economic growth in the developing countries. This study is very important because Saudi Arabia is on 3rd rank for having largest population of foreign workers and it becomes second country for sending remittance to other countries after the USA (World Bank, 2015). Saudi Arabia depends on oil as a resource, so understanding the effects of foreign and local workers on TFP growth is very important to achieve sustained economic growth to support and help achieve welfare for citizens and stability in the world economy. Finally, I illustrate the use of modern statistical methods that are appropriate for this study.

3. Methodology

The original model used in the empirical analysis is a production function that decomposes the source of economic growth into growth of labor force (L), physical capital (K), and technology (TFP). In this study, labor force presents local labor and foreign labor. To enable the estimation of TFP the following equation is modified into a production function as following:

$$Y(t) = TFP(t)F(L_i(t), K(t)) = TFP \cdot K^{\delta_K} \cdot L_i^{\delta_{L_i}} \quad (1)$$

Where $L(t) = \sum_1^2 L(t)_i$ is the summation of local workers and foreign workers.

The analysis uses accounting growth formula of production function for Cobb Douglas to account the time series of TFP as following:

$$\frac{dY/dt}{Y} = \frac{dTFP/dt}{TFP} + \sum_1^2 \frac{dF/dL_i}{F/L_i} \frac{dL_i/dt}{L_i} + \frac{dF/dK}{F/K} \frac{dK/dt}{K} \quad (2)$$

Where economic growth is $\frac{dY/dt}{Y} = g_Y$, TFP growth is $\frac{dTFP/dt}{TFP} = g_A$, contribution of labor is $\frac{dF/dL_i}{F/L_i} \frac{dL_i/dt}{L_i} = g_{L_i}$, and contribution of capital is $\frac{dF/dK}{F/K} \frac{dK/dt}{K} = g_K$. The expression of $\frac{dF/dL_i}{F/L_i} = \delta_{L_i}$ is the share of labor income for local and foreign labor and $\frac{dF/dK}{F/K} = \delta_K$ is the share of capital income. However, the data in this case do not come in continuous-time form, so we apply the rules for deriving proportional changes on this equation in the discrete-time approximation as:

$$\frac{\Delta TFP_{ti}}{TFP_{ti}} = \frac{\Delta Y_{ti}}{Y_{ti}} - \sum_1^2 \delta_i \frac{\Delta L_i}{L_i} - \delta_K \frac{\Delta K_t}{K_t} \quad (3)$$

The following equation is applied for the estimation of TFP growth:

$$g_{TFP} = g_Y - \sum_1^2 \delta_{L_i} g_{L_i} - \delta_K \cdot g_K \quad (4)$$

After obtaining the time series of TFP growth from equation (4), we can get the TFP and investigate the relation

between TFP and local and foreign workers. Cobb-Douglas production function is used in this paper as following:

$$TFP = Y - \delta_K K - \sum_1^2 \delta_i L_i \quad (5)$$

The objective of equation (5) is to find all variables, thus we have used the difference of variable instead of the level form as following:

$$\Delta TFP = \Delta Y - \delta_K \Delta K - \sum_1^2 \beta_i \Delta L_i \quad (6)$$

If we consider the standard model in equation (6), biased result may be obtained. The model shows the impact of GDP, capital, and labor on TFP. However, economic situation in Saudi Arabia, there are many other factors that may contribute to the TFP. TFP covers innovation-based, technological, institutional change, omitted variables, and efficiency change. So, some variables must be added in equation (6) in order to look for effect of local and foreign labor on TFP and also to obtain an accurate estimation for this model. The variables are trade openness (TRD), oil revenue (OILR), foreign direct investment (FDI), and the μ refers to the other variables that might be omitted during the empirical process. We have then rearranged equation (6) and used following equation, which is appropriate to be utilized in our model. This model transfers the variables into difference function in order to reduce the deviation of data. This method makes the result more accurate in the equation below.

$$\Delta TFP = \beta_0 + \beta_1 \Delta GDP + \beta_2 \Delta K + \beta_3 \Delta L_1 + \beta_4 \Delta L_f + \beta_5 \Delta FDI + \beta_6 \Delta OILR + \beta_7 \Delta TRD + \mu \quad (7)$$

Where ΔTFP equals to the difference in TFP that it will be estimated from equation (4). The ΔGDP , ΔK , ΔL_1 , ΔL_f , ΔFDI , $\Delta OILR$, and ΔTRD are the difference in real gross domestic product, real capital, local workers, foreign workers, foreign direct investment, oil revenues, and trade openness, respectively.

These methods are appropriate to use the different relationships to investigate the contribution of local labor, and foreign labor to TFP in different periods that is imposed some policies in labor markets. Also, these methods are able to analyze whether the relationship between local labor and foreign labor are substitutability or complementarity. This issue is one of the crucial factors in determining the direct impact investigation the relationship between two groups of workers on productivity during the period 1990-2016. Finally, we will determine the causal relationship between foreign and local workers.

4. Data Source

In this study, we have used a time series data from 1990-2016. Data source on GDP, capital, trade openness, foreign direct investment, and oil revenue is obtained from World Bank and Penn World Table. Data of local and foreign labor force is obtained from the ministry of labor and social development and World Bank. For the measurement of TFP, it will be calculated by using computer software and applying mathematical methods and accounting growth model.

5. Results and Discussion

5.1 - Growth of TFP

Table 2 shows the estimation of TFP growth in Saudi Arabia during 1990- 2016. This table shows the relationship between TFP growth and GDP, local workers growth, and foreign workers growth. The most result of TFP growth is negative in different periods or strong low. The highest value of TFP growth was 12 % in 1993. This result is not reflect the result of GDP growth that was -1.36 % in the same year. While the low value was -6.93 % in 2001 and the growth of GDP was -1.21 %.

Figure 1 presents a graphical explanation of TFP growth, GDP growth, local workers growth and foreign workers growth. It is observed that TFP growth and GDP growth tend closely together over the period. This result suggests that a time series of TFP growth can explain the changes in GDP growth over the period. Also, the graph of local workers growth is more stable than foreign workers growth over the period. However, the path of foreign workers growth can explain the changes in TFP growth than local workers growth. These results lead us to study the effect of local and foreign workers and others variables on TFP growth.

5.2 Local workers, foreign workers, and other determinants

Based on the Vector Error cointegration Model (VECM), the test of unit root is required to check the stationary of the time series of the variables. The time series of the variables must be stationary in the first difference and also it must be cointegration in the same order.

5.2.1 Unit root test analysis

This section shows the analysis of unit root test for Augmented Dickey Fuller (ADF). Table 3 shows that all variables are stationary in the first difference (1) at both intercept and without intercept i.e. at 1 percent, 5 percent, and 10 percent significant levels. This displays that a false regression can be avoided since all the variables are stationary at first level of differentiation with intercept I (1). If a set of variables are stationary at I (1), it should not be used OLS Model to estimate the relationship between the variables. We can both estimate how many equilibrium relationships and use VEC model or VAR Model. Using Johansen's technique we found

that variables have more cointegrating vectors then we can run the Vector Error Correction (VEC) Model.

5.2.2 Analysis of the Vector Error Correction Model (VECM)

Using the VECM there is a long run and short-run relationship between the variables. Table 4 shows that all of the variables are co-integrated, and there is more than one co-integrating vectors. In the first target equation, the coefficient of correction error term is negative and significant to explain the long run causality between TFP and GDP, local workers, foreign workers, oil revenue, trade openness, capital stock, and foreign direct investment during 1990-2016. Also, in the short run, the coefficient of GDP, local workers, foreign workers, oil revenue, and trade openness is significant to explain TFP as whole. There is a positive causality from local workers, foreign workers and oil revenue to TFP; the change in local workers by 1 worker increases total factor productivity by 1.95×10^{-6} and the change in foreign workers by 1 worker increases total factor productivity by 3.95×10^{-6} . The increase impact positive of foreign workers on TFP refers to most foreign workers work in the private sector that it contributes directly in increase the productivity. In the second target regression, the coefficient of correction error term is negative and significant at 10 percent significance level to explain the long run causality between local workers, TFP, GDP, foreign workers, oil revenue, trade openness, capital stock, and foreign direct investment. The coefficient of foreign workers is negative. This result indicates that the foreign worker is substitutes for the local worker only in long run. While in short run, there is no causality relationship between those variables. However, in the regression 3, there is no long run or short run causality relationship between foreign workers and the remaining variables. In general, there is no short run causality running from local to foreign workers and vice versa.

6. Conclusions and Suggestions

The aim of this study is to examine the impact of local workers, foreign workers on total factor productivity TFP in Saudi Arabia using annual time series during 1990-2016. Beside, the relationship between local and foreign workers is also investigated. Prior to testing for VEC Model, the accounting growth formula was used to find the time series of total factor productivity growth TFP. Also, the ADF test and Johansen cointegration test were used to examine for unit roots and cointegration.

Our results indicate that most result of TFP growth is negative in different periods or strong low increasing and the local workers, foreign workers and oil revenue, yield positive influence on total factor productivity. But, the GDP and trade openness tends to show negative relationship on total factor productivity. Since foreign workers have a positive relationship and significant effect on TFP, we can conclude that the government policies will need a long time to increase the dependency on local workers and reduce dependency on foreign workers by increasing learning by doing to substitute local instead of foreign workers. Further, the study found that there is relationship between local and foreign workers. The result show that local and foreign workers are substitute but not complement to each other in long run. Therefore, reducing the number of foreign workers will affect the performance of local workers.

In order to reduce the dependency on foreign labor, this paper suggests that government policies should face the presence and entry of illegal workers. Therefore, The minimum wage should be activated to discourage employers from hiring foreign workers, as there will be no wage differences between local and foreign workers. Studies by Lee and Yuen (2015) and Meier (2004) come up with the matching recommendations.

For future research, we also recognized that more meaningful results could be obtained if we can analyze data for skilled and low skilled of local and foreign workers in the industries sector in Saudi Arabia and how to affect the total factor productivity and more detailed policy recommendation could be made in this case.

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Table 1: Average number of local and foreign labor in Saudi Arabia: 1990-2016

Workers	Duration				
	1970-1980	1981-1990	1991-2000	2001-2010	2011-2016
Local workers	138373	304115	505472	744300	1101239
Foreign workers	42664	124647	117696	72444	73108

Table 2: Estimation of TFP growth and GDP, local and foreign workers growth

Year	GDP growth	TFP growth	Local workers growth	Foreign workers growth
1990	15.19	10.00	4.79	-1.45
1991	15.01	-3.40	2.62	2.51
1992	3.99	11.08	5.99	5.24
1993	-1.36	12.10	5.64	-9.20
1994	0.56	0.96	3.71	-8.22
1995	0.21	-4.39	4.22	-3.24
1996	2.64	-1.99	5.47	-14.75
1997	1.10	-1.77	10.68	-12.52
1998	2.89	1.19	3.34	-7.26
1999	-3.76	-0.89	2.11	-6.87
2000	5.63	0.72	3.66	-1.75
2001	-1.21	-6.93	2.89	-1.98
2002	-2.82	1.86	3.47	-5.99
2003	11.24	-3.97	3.77	-7.47
2004	7.96	-5.80	2.51	-0.97
2005	5.57	7.19	2.64	2.43
2006	2.79	2.68	2.95	-0.91
2007	1.85	-0.15	3.70	-1.16
2008	6.25	-3.17	8.78	4.17
2009	-2.06	-4.90	4.70	4.54
2010	4.76	-0.84	2.07	-0.01
2011	9.96	-6.92	3.89	5.21
2012	5.38	-1.43	10.22	-3.27
2013	2.67	2.78	13.60	-3.21
2014	3.59	-1.03	1.54	-2.47
2015	4.11	-4.52	0.81	-2.96
2016	1.74	-2.05	-0.02	-4.34

Table 3: Result for unit root test ADF

Variables	ADF test	
	Without intercept	With intercept
GDP	-0.4929421 (.1438321)***	-0.4929421 (.1438321)***
TFP	-0.8596057 (.1833387)***	-0.8596057 (.1833387)***
Local workers	-0.2449317 (.1265832)*	-0.2449317 (.1265832)*
Foreign workers	-0.3781276 (.1590293)***	-0.3781276 (.1590293)**
Oil revenue	-0.8160865 (.1781328)***	-0.8160865 (.1781328)***
Trade openness	-0.7948605 (.1939654)***	-0.7948605 (.1939654)***
Capital stock	-0.3599957 (.1419743)**	-0.3599957 (.1419743)**

Note ***, **, and * is significant at 1%, 5%, and 10% significance level. Upper value is the coefficient value and the value in bracket is the standard deviation.

Table 4: Result of the VEC Model

Variables	Regression 1	Variables	Regression 2	Variables	Regression 3
ΔTFP		ΔWl		ΔWf	
Constant	.0246117 (.0114692)**	Constant	999.9194 (12822.1)	Constant	-7381.999 (3020.161)**
ΔGDP	-1.57e-06 (1.94e-07)***	ΔTFP	3074.105 (117241.9)	ΔTFP	-7879.014 (27615.54)
ΔWl	1.95e-06 (2.70e-07)***	ΔGDP	-0.0745796 (.2167306)	ΔGDP	.0623778 (.0510494)
ΔWf	3.95e-06 (9.78e-07)***	ΔWf	-1.138224 (1.09381)	ΔWl	-0.0589986 (.071081)
Δoil	1.07e-06 (2.11e-07)***	Δoil	.2127535 (.2363595)	Δoil	-0.0369767 (.0556729)
$\Delta TRAD$	-4269572 (.0880113)***	$\Delta TRAD$	-79214.64 (98392.86)	$\Delta TRAD$	6337.783 (23175.78)
ΔK	1.05e-12 (1.02e-12)	ΔK	6.19e-07 (1.14e-06)	ΔK	2.50e-07 (2.68e-07)
ΔFDI	1.46e-12 (1.08e-12)	ΔFDI	-1.58e-06 (1.20e-06)	ΔFDI	3.95e-09 (2.83e-07)
Correction Error	-0.6081019 (.0718558)***	Correction Error	-134182.2 (80331.76)*	Correction Error	-3247.031 (18921.61)

Note ***, **, and * is significant at 1%, 5%, and 10% significance level. Upper value is the coefficient value and the value in bracket is the standard deviation.

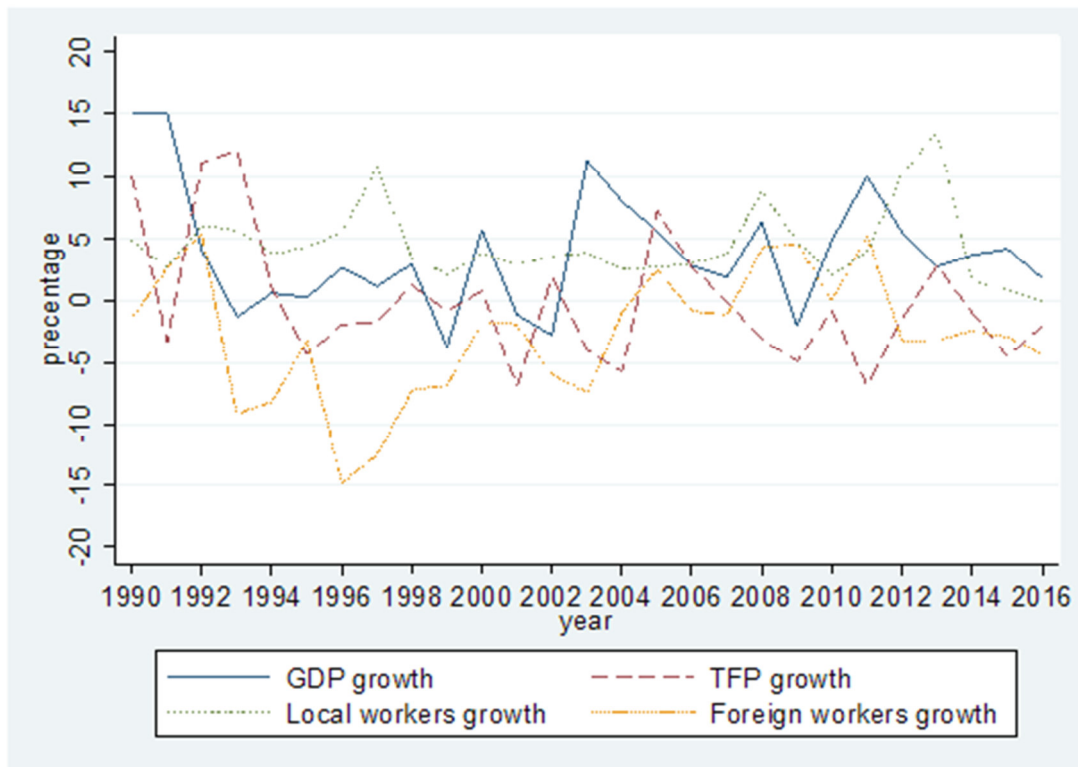


Figure 1: the relationship between TFP growth and GDP, local and foreign workers growth