www.irmbrjournal.com September 2016
International Review of Management and Business Research Vol. 5 Issue.3

Assessing Productivity and Economic Growth in Kuwait Agriculture Sector, 1986-2013

BASSIM SHEBEB
Dean and Director of MBA Programs (Acting), Faculty of Business Studies
Arab Open University, Head Quarters Kuwait.
Email: bshebeb@yahoo.com

Abstract

This study assesses the economic growth of Kuwait Agricultural Sector over the time period from 1986 to 2013 and analytically decomposes its major components: multifactor productivity (MFP) growth rate and production-factor intensity (FI). Findings show that the Gulf (Kuwait) War during 1990–1991 almost completely destroyed this sector. However, the annual growth rate of gross output improved substantially and sustained after 1992. Findings also show that the MFP growth (especially from 2006 onward) has been the driving forces for the growth this sector. Findings from a structural vector autoregression (SVAR) analysis show that the government effort in developing this sector has temporary effect on the development of this sector. Government policy should be targeted to improve the MFP growth which has the permanent effect on the growth of this sector.

Key Words: *Multifactor Productivity (MFP), Divisia Index, Kuwait, SVAR.*

Introduction

The economic policy makers in Kuwait over the last few decades have been engaged with straightforward task of diversifying the economic activities. The paramount significance of this task arises because the Kuwait economy has remained highly dependent on oil sector for a long time. The oil sector contributed about 51% of the GDP of Kuwait in 1983 and about 63% in 2013. Generally, the economic and social development plans of Kuwait are built with the main emphasis of having stronger economic and social relationships among various sectors of the economy. Thus, most of local agencies shared the same objective, providing and upgrading the economic and social infrastructure.

Developing and expanding of Kuwait Agriculture sector could be considered as one of the main encouraging outcomes of economic diversification plans. However, over last decades the contribution of Kuwait Agricultural sector to the non-oil GDP of Kuwait increased 0.43% in 1983 to 0.92% in 2013. This means over this time period of 1983-2013, the contribution of this sector to the non-oil GDP has increased by less than 0.5%. However, the contribution of this sector has more than doubled over the time period.

This relatively low contribution may well due to the soil infertility, the high scarcity of sweet water, harsh climate in terms of high temperature, and the lack of well-trained Kuwaiti agricultural workers. However, with all these facts and difficulties about the Kuwait Agriculture sector, it remains an important source of income to small portion of the Kuwaiti investors. One can argue that even though the Agricultural sector plays insignificant economic role in the non-oil economy of Kuwait, it does have an increasingly socially-important role in terms of the food security strategy in Kuwait (FAO, 2016).

Over the last years Kuwait has been working for sustainable agriculture development until 2015 stressing the need to develop its natural resources to improve agricultural products and productivity. The plan is being implemented in association with the Food and Agriculture Organization (FAO)'s experts. According to FAO (2016), ″Kuwait achieved the World Food Summit and Millennium Development Goal's 1st target of halving the number and proportion of undernourished people in the country. In 2013 FAO lauded Kuwait for achieving its anti-hunger goals for 2015. This reflects the pioneering food security strategy in Kuwait. Since then, only 38 states, including Kuwait, have achieved the Millennium Development Goal to end hunger before the deadline set by the UN". In addition, Kuwait has been keen to follow international and regional agreements establishing a fair and market-oriented trading system through programmed reforms and encompassing strengthened rules in order to correct and prevent restrictions and distortions in agricultural markets.

This paper examines the productivity and economic growth in this sector in terms of the improvements of the multifactor productivity (MFP) growth and its contribution to the output growth. Such improvements, if any, would reflect the progresses in agricultural engineering and knowledge that have been taken place over time, as well as the improvement in management processes and well-adaption of the new technology.

Thus, it is about the right-time for Kuwait policy makers to pay more attention to productivity and efficiency issues. It is crucial at this stage to measure and analyze the economic growth and its main components (MFP and Production-Factors intensity, FI) which can be used as powerful analytical tools in understanding the economic performance of Kuwait Agriculture sector. Identifying and estimating the level of multifactor productivity is essential in the evaluation of alternative policies in Kuwait agriculture sector. Furthermore, MFP[1] could arise from technological change, economies of scale, and the improvements in efficiency and the level of capacity utilization. It follows that it is crucial to determine the main underlying concepts of productivity and use this powerful analytic tool in understanding the economic performance of Kuwait agriculture sector. With the process of development and the importance of the structural transformation, it will be very important to understand the fundamental concepts of productivity analysis and measurement that would help in the identification of the appropriate economic policy. To aid this process this study shows how to measure and analyze the most important components of economic growth, mainly the growth rates of the MFP and FI, in Kuwait agriculture sector over the time period 1986-2013.

The rest of the study is organized as follows: Section 2 presents an overview of Kuwait agriculture sector. The model and methodology used in estimating the level of economic (gross output) growth and its decompositions are presented in section 3. Section 4 describes data sources and the empirical findings are presented and analyzed in Section 5. Section 6 analyses the impacts of subsidy and productivity shocks on the growth of agricultural output. Finally, an overall summary of the study and the concluding remarks are presented in section 7.

Kuwait Agriculture Sector: An Overview

The State of Kuwait is located at the northwestern part of the Arabian Gulf. The total land area of the country is estimated at about 17,818 km^2 (1,781,800 ha) including the land areas of the offshore islands. Its total agricultural land represents near 8.6% of the total area of Kuwait which is not small considering the country's vast area of desert (barren land). In term of the landscape, Kuwait soil surface is mostly covered by loose deposits/sand that are continually travels by the action of the wind. This desert-like soil is sandy in texture with carbon-based contents of nearly 1%.

Underground water is the only natural water resource that can be used directly without recycling or treatment. Salty water mixed with purified water is used for livestock and agriculture productions.

[1] MFP represents technological change under the assumption of the growth accounting model and the assumption of no inefficiency and full utilization of the existing capacity.

Recently, the recycled or/and treated wastewater has become another important source of water due to its organic and mineral substances. Over the last years several treatment plants were developed and reactivated to treat wastewater.

Despite the low rate of rainfall and poor soil, historically agriculture has been an important sector for the Kuwaitis (citizens of Kuwait). In the 1961, Kuwait joined FAO. Recently, after longstanding partnership with FAO, a joint declaration of intent has been signed in the year 2013.

Kuwait government agencies provide different type of subsidies to the agricultural producers and investors. The significant level of subsidies has been experienced starting from the year 1990. Since 1990, it reached its maximum-level of more than 45 million Kuwaiti Dinar (about $150 million) in the year 2011. Figure 1 shows the level of government subsidies to the agricultural producers and investors over the time period from 1990 to 2103.

It is worth noting that on 2 August 1990, the agricultural activities in Kuwait had completely stopped due to the Iraq invasion and subsequent war. Thus, major (if not all) infrastructures and all substructures were demolished at two main agricultural areas: Wafra near the border with Saudi Arabia and Abdaly near the Iraqi border. All of the supplies were despoiled, the farms were dogged with mines and the soil was contaminated with oil and chemicals resulted from explosion and burst of over hundreds of the country oil fields (FAO, 1996). Furthermore, given that most of experienced agricultural workers/farmers were non-Kuwaiti who escaped just after the invasion, it added another constraint in the rebuilding process of this sector after 1991.

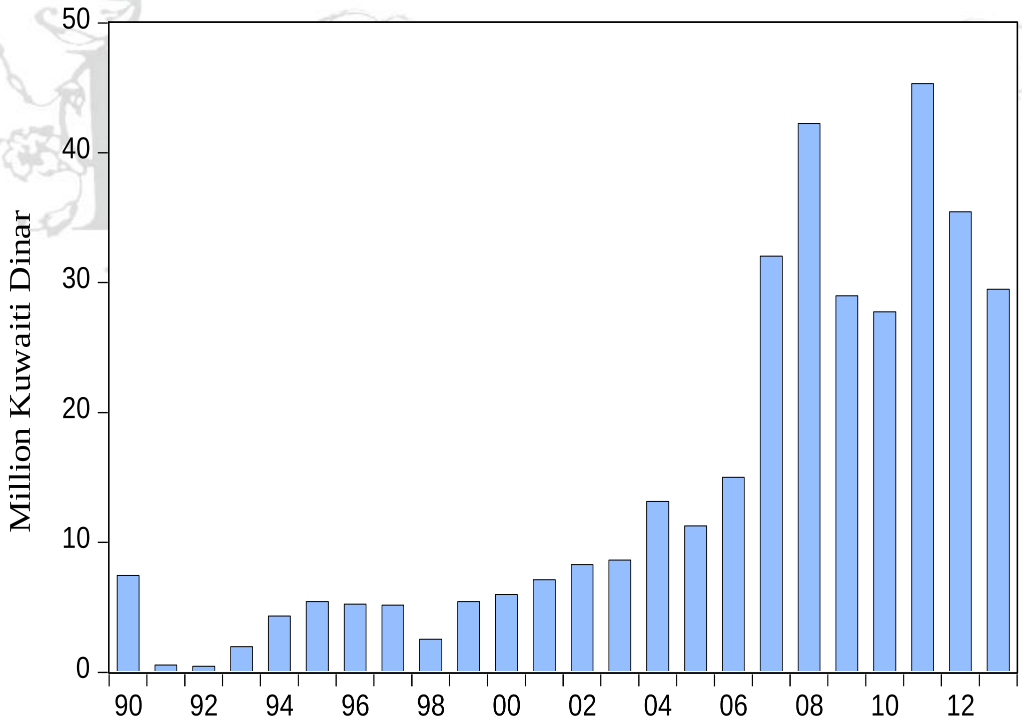

Figure 1: Annual Gross Subsidies to Kuwait Agriculture Sector, 1990 – 2013.

The effects of oil pollution on soil and the weakening structure, the productive capacity of Kuwait agriculture sector showed a significant drop in the productivity and capability of these polluted areas. Figure 2 shows this significant drop of the gross output of this sector just before and after the invasion, that is, in 1989 it was Kuwait dinar (KD) 69.4 million and dropped to only KD10.1 million in 1991.

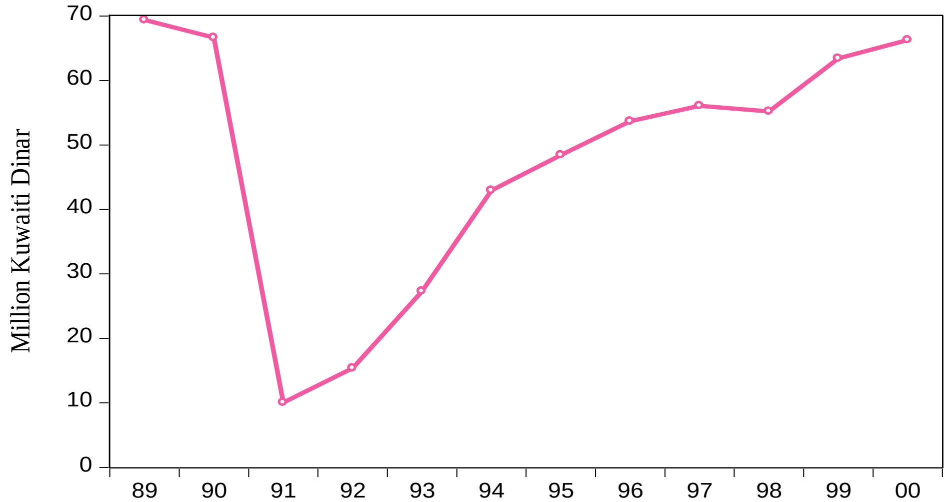

Figure 2: Annual Gross Output of Kuwait Agriculture Sector, 1989-2000.

Productivity Measurement Model

Recent developments in productivity analysis show that the observed multifactor productivity growth can be decomposed into several important measures of economic performance (Shebeb, 2002). These measures are mainly technical change, scale economies, productive efficiency, and capacity utilization (see, for example, Morrison 1988 and Jorgenson, 1995). Identifying and measuring these components of overall productivity (MFP) would provide more accurate and interpretable measure of economic performance. However, due to unavailability of the necessary data, a full structural model that takes into account the contribution of the major components of the overall productivity change would not be possible. Therefore, a relatively restricted model (growth accounting model) is utilized in measuring and analyzing productivity growth in Kuwait agriculture sector. This model and its underlying assumptions are presented below[2]. In particular, as in Shebeb (2016), the main focus is to measure and analyze the growth rates of gross output and its main components: multifactor productivity (MFP) and production factor-intensities (FI).

Given the openness of Kuwait economy, the gross output based modeling of productivity growth would be utilized in this study. A growth accounting model is used. The assumptions underlying the use of this model (production function) are as follows: constant return to scale, Hicks's neutral technical change, perfect competition in the inputs and output markets, full capacity utilization of all inputs, and all production process (operations) are efficient (inefficiency does not exist). The general form of production function can be written as follows:

$$Y_t = A_t f(K_t, L_t, M_t) \qquad (1)$$

where Y_t is the real gross output, A_t is an index of technical change, K_t are inputs of the capital services at time t, L_t are labor inputs, and M_t are intermediate inputs. Differentiating the production function (1) with respect to time gives the growth equation, which can be written as:

$$\frac{dY/dt}{Y} = \frac{dA/dt}{A} + \left(\frac{\partial Y}{\partial K} \frac{K}{Y} \frac{dK/dt}{K} + \frac{\partial Y}{\partial L} \frac{L}{Y} \frac{dL/dt}{L} + \frac{\partial Y}{\partial M} \frac{M}{Y} \frac{dM/dt}{M} \right) \qquad (2)$$

[2] Readers need to bear in mind the underlying assumption at which the analysis of this study has taken place.

Equation (2) shows that the growth rate of gross output as a result of the growth rate of multifactor productivity ($MFP = (dA/dt)/A$) and the growth rates of the weighted average of all production-inputs (FI). MFP growth rate indicates the growth rate of output resulting from the shift of the production function. On the other hand, growth rate of inputs indicate the growth rate of gross output due to movements along the production function. The sum of these effects (changes) of all production-inputs on output when there is no change in MFP (holding technology constant).

Uunderlying assumptions imply that the marginal product of all inputs is equal to the real market price. This implies that the elasticity of output with respect to any input is equal to the share of that input cost in the output. Thus, share parameters are defined as $S_i = X_i/PY$, where i = K, L, M, and X_i is the total payment to the i^{th} input. It also implies that the weights ($\sum S_i = 1$) must sum up to one (Ohta, 1975). This means equation (2) can be rewritten as:

$$\frac{dY/dt}{Y} = \frac{dA/dt}{A} + \left(S_K \frac{dK/dt}{K} + S_L \frac{dL/dt}{L} + S_M \frac{dM/dt}{M} \right) \quad (3)$$

Equation (3) is known as the Divisia index which can be naturally derived from a simple production relationship (Diewert and Nakamura, 2007 and Christensen et al. 1973). Taking the (log) for the inputs and output index and using the average inputs share, we can get the approximation of the Tornqvist index number as:

$$\log \frac{Y_t}{Y_{t-1}} = \log \frac{A_t}{A_{t-1}} + \left(\bar{S}_K \times \log \frac{K_t}{K_{t-1}} + \bar{S}_L \times \log \frac{L_t}{L_{t-1}} + \bar{S}_M \times \log \frac{M_t}{M_{t-1}} \right) \quad (4)$$

where: $\bar{S}_i = [S_{i,t} + S_{i,t-1}]/2,$ and i = K, L, and M. It follows that MFP growth rate can be presented as:

$$MFP = \log \frac{A_t}{A_{t-1}} = \log \frac{Y_t}{Y_{t-1}} - \left(\bar{S}_K \times \log \frac{K_t}{K_{t-1}} + \bar{S}_L \times \log \frac{L_t}{L_{t-1}} + \bar{S}_M \times \log \frac{M_t}{M_{t-1}} \right) \quad (5)$$

Thus the MFP growth rate (log (A_t/A_{t-1})) can be defined as the rate of growth gross output less the rates of growth of the aggregated-all-inputs.

Data: Measurement and Sources

All data used in this research are obtained from the publications of the *Central Statistical Office* (CSO) which is the official data source in Kuwait. Output and input data are collected from the *National Accounts Statistics* and the data for the deflators are obtained from the *Statistical Abstracts* of the CSO.

In reference to the underlying assumptions of the growth accounting model, the total production and processing costs should be equal to the value of the gross output. It follows that inputs shares (weights) are obtained as the input-cost share in gross output (current prices). Thus, theses share are as follows: the share of labor input in total factor payments is derived by expressing national accounts estimates of total compensation as a fraction of gross output at current factor cost; the share of intermediate-inputs is derived by expressing national accounts estimates of value of intermediate-inputs as a fraction of gross output at current factor cost; and the share of capital (national accounts estimates of the value of capital consumption, depreciation) is taken to be the complement of the shares of labor and intermediate-inputs. Computing factor shares on the basis of the current market prices straighten the relative contributions of capital, labor, and intermediate-inputs.

The wholesale price index (production) is used to obtain the real gross output. For intermediate inputs, the wholesale price index (for intermediate inputs) is used. The capital input is deflated by the wholesale price index (end-use capital goods). Labor compensation is deflated by the general consumer price index, CPI. The year 2007=100 is the base year for all price deflators.

Empirical Findings

For years now most countries of the Arabian Gulf have witnessed a drop in the productivity growth. This drop started in the early 2000s and has continued in the 2010s. With this in mind, this study attempts to analyze the economic growth and its bases (MFP growth and growth of FI) in Kuwait Agriculture Sector.

Table 1 shows the annual average growth rates of gross output and production inputs (capital, labor, and intermediate-inputs) in Kuwait Agriculture sector over the time period from 1986 to 2013 (the most recent available data). These growth rates are based on definition provided in equation (5) above. Table 1 also presents the annual average growth rates of gross output and all production inputs over three carefully selected time periods and in 1991 when Iraq invaded Kuwait.

Table 1: Average Growth Rates of Output and Inputs in Kuwait Agriculture Sector

Time Periods	Gross Output (Y)	Intermediate-Inputs (M)	Labor (L)	Capital (K)
1986 – 1990	-1.39%	-3.24%	-3.08%	-3.20%
1991 (Invasion)	-82.69%	-76.75%	-91.06%	-82.38%
1992 – 2005	7.25%	7.02%	3.88%	6.95%
2006 - 2013	2.37%	0.45%	5.69%	0.86%
Overall Mean (1986 - 2013)	2.74%	1.04%	-0.30%	0.76%
Minimum (year)	-82.69% (1991)	-76.75% (1991)	-91.06% (1991)	-82.38% (1991)
Maximum (year)	61.97% (1992)	74.44% (1992)	98.28% (1992)	319.06% (1992)

The annual average growth rate of gross output declined about 83% in 1991 when Iraq occupied Kuwait and demolished the sector. This decline is obviously due to the decline in the growth rates of the production inputs as the growth rates of the intermediate inputs, labor and capital were declined by 76.75%, 91.06%, and 82.38%, respectively. The annual average growth rate of output climbed near 7.25% over the time period of 1992-2005 when the annual average growth rate of capital was 6.95%. This obviously reflects the capacity rebuilding progression that took place after the year 1991.

The growth rates of all inputs were less than the growth rate of the output during the period 1992-2005 which could be an indication of the economies of scale experienced during this period. The annual average growth rates of gross output, intermediate-inputs, and capital decreased during the 2006-2013 compared to the period 1992-2005. On the other hand, the annual average growth rate of labor increased. The impacts of these changes are shown on the MFP and labor Productivity growth rates below.

Table 2 presents the annual growth rates of the gross output (Q), multifactor productivity (MFP), and factor-intensities (FI) in Kuwait agriculture sector for the period 1986-2013. They are constructed based on equation (5) above. The impact of the 1990-1991 War is clear and reflected in huge decline in growth rates output, MFP and FI. Figure 3 gives a more visual picture. As mentioned above that the gross output and capital dropped by more than 82% and 80%, respectively, in 1991.

Table 2: Growth Rates of Gross Output (Y), Multifactor Productivity (MFP) and Factor Intensities (FI), 1986-2013.

Year	Y	MFP	FI	Year	Y	MFP	FI
1986	-	-	-	2000	0.024	-0.106	0.1301
1987	-0.016	-0.085	0.0686	2001	0.032	0.045	-0.0131
1988	-0.102	-0.042	-0.0594	2002	0.060	0.133	-0.0727
1989	0.077	0.199	-0.1229	2003	0.028	-0.031	0.0595
1990	-0.015	-0.026	0.0113	2004	0.007	0.065	-0.0575
1991	**-0.827**	**-0.019**	**-0.8074**	2005	0.079	-0.026	0.1047
1992	0.196	-0.191	0.3865	2006	-0.069	-0.034	-0.0350
1993	0.226	0.012	0.2144	2007	-0.025	-0.083	0.0578
1994	0.183	0.093	0.0907	2008	0.006	0.103	-0.0975
1995	0.044	0.003	0.0412	2009	0.068	0.055	0.0133
1996	0.049	0.117	-0.0678	2010	0.011	-0.068	0.0788
1997	0.023	-0.110	0.1324	2011	0.151	-0.022	0.1727
1998	-0.002	-0.034	0.0315	2012	0.066	0.171	-0.1047
1999	0.064	0.111	-0.0471	2013	-0.019	-0.002	-0.0169

Annual Average Growth Rates

	Y	MFP	FI
1987-2013	1.19%	0.85%	0.34%
1987-1990	-1.39%	1.16%	-2.56%
Year 1991	-82.69%	-1.95%	-80.74%
1992-2005	7.25%	0.58%	6.66%
2006-2013	2.37%	1.52%	0.86%
Minimum	-82.69%	-19.07%	-80.74%
(Year)	(1991)	(1992)	(1991)
Maximum	22.63%	19.94%	38.65%
(Year)	(1993)	(1989)	(1992)

In 1992 the annual growth of MFP was about -19% which could be due to the lack of knowledge and/or management as most of the experienced non-Kuwaiti (expatriate) workers escaped the war in 1990. However, soon after 1991 as the rebuilding capacity of this sector took place the annual growth rates of gross output, MFP, and FI improved significantly. In 1992 the annual growth rate of gross output jumped to 19.6% and annual growth rate of FI rose to 38.6%.

The bottom of table 2 also reports the annual average growth rates of gross output, MFP, and FI for the period 1986-2013 and for three sub periods (1987-1990, 1992-2005, and 2006-2013). It shows that since 1992 the improvements and progression of this sector has been sustained up to most recent years. Such sustained improvements have resulted in positive high annual average growth rates of gross output, MFP, and FI over the time periods from 1992 to 2005 and from 2006 to 2013. Table 2 shows the contributions of the MFP and FI to the growth rate of gross output for the whole sample period. Over the sample period 1987-2013, the average annual growth rate of gross output was 1.19% which has been decomposed into the contribution of the MFP (0.85%) and the contribution of the FI (0.34%).

Over the time period 1992-2005, the average annual growth rate of gross output was 7.25% for which MFP contributed only 0.58% and the major contribution came from the FI (6.66%). This implies about 91.86% of the average annual growth rate of gross output came from the growth in FI reflecting the significant impact of the production factor intensities/ availability over this time period. This also means that the contribution of the MFP to growth of the gross output was about 8% only. This finding is consistent with the expected MFP level during this time period.

The contribution of MFP to the growth of gross output has become more significant and prominent over the time period from 2006 to 2013. It shows that about 64% of the average annual growth rate of gross output was due to the growth of MFP. This significant contribution of the MFP reflects the substantial improvements in know-how and farming and managerial skills over this time period. No doubt it is so promising and economically satisfying contribution of the MFP to growth of the gross output. This finding shows how MFP in Kuwait agriculture sector has helped Kuwait in achieving its anti-hunger goals for 2015.

As mentioned above figure 3 gives a more visual picture of the growth rates of the gross output (Q), multifactor productivity (MFP), and factor-intensities (FI) in Kuwait agriculture sector for the period from 1986 to 2013 ranging between less that ±1% to less than ±38% with the exception of the war year 1991. Figure 3 shows the dominance of the MFP over the FI in the contribution of the growth rates of gross output of Kuwait agricultural sector from 2006 to 2013.

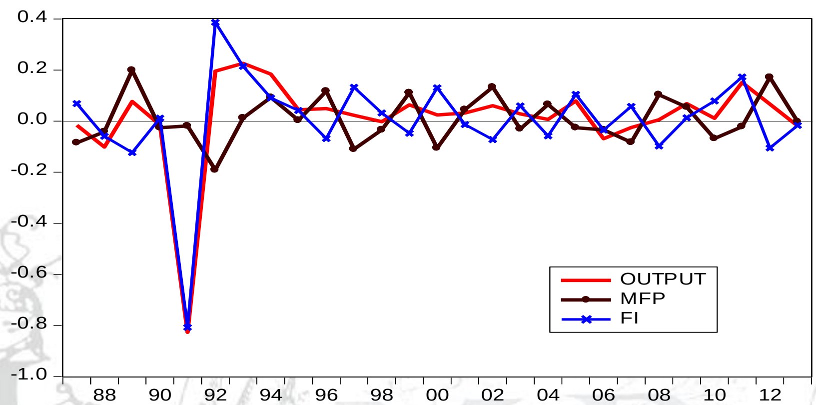

Figure 3: Growth Rates of Gross Output, MFP and FI, 1986-2013.

Impact of Subsidy Shocks on Output

We would like to see whether the estimated MFP growth rate reported in table 2 can be compared with the productivity shock obtained from a structural vector autoregression (SVAR) model. Furthermore, as mentioned above that Kuwait government has been working for sustainable agricultural development and has achieved the first goal of the World food Summit and Millennium Development Goal of halving the number and proportion of undernourished people in the country. Given this background, as also discussed above, the government has been providing generous subsidies to the agriculture sector which clearly depended on the world oil price shock. It is also shown that from the last decade MFP growth has been dominant in the output growth of this sector. We would like to see whether the structural shocks in subsidies have any long-run impact on the MFP hence on output. We use Blanchard and Quah (1989) method to obtain a SVAR. Consistent with our findings reported in table 2, we assume that the supply (productivity) shocks in the agriculture sector have long-run permanent effect on agricultural output but subsidy shocks have no long-run effect on output.

Suppose X_t is the vector of two variables [ordered y_t, s_t] where y_t and s_t are logarithm of real gross agricultural output and agricultural subsidy and, as shown in table 3 below, they are first difference (Δ) stationary, $I(1)$. An infinite moving average representation of these variables can be written as:

$$\Delta X_t = \left(A_0 - A_1 L - .... - A_p L^P\right) u_t \Rightarrow \begin{bmatrix} \Delta y_t \\ \Delta s_t \end{bmatrix} = \sum_{k=0}^{\infty} L^k \begin{bmatrix} a_{11}(k) & a_{12}(k) \\ a_{21}(k) & a_{22}(k) \end{bmatrix} \begin{bmatrix} u_{yt} \\ u_{st} \end{bmatrix} \qquad (6)$$

where L is the lag operator and u_t is the vector of independent white noise structural supply and subsidy shocks [ordered u_{yt}, u_{st}]. In order to identify these structural shocks, we first estimate the reduced form VAR as:

$$\Delta X_t = B_1 \Delta X_{t-1} + B_2 \Delta X_{t-2} + \dots\dots\dots + B_i \Delta X_{t-i} + e_t \quad (7)$$

where e_t is the vector of supply and demand residuals [ordered e_{yt}, e_{st}] from an estimated reduced form VAR model (7) and B 's in equation (7) represent 2x2 matrices of estimated coefficients from the VAR. Then using the idea that the VAR residuals e_t are
composites of the pure innovations or structural shocks u_t as $e_t = Cu_t$ where

$$C = \begin{bmatrix} c_{11}(0) & c_{12}(0) \\ c_{21}(0) & c_{22}(0) \end{bmatrix}. \quad (8)$$

Once C matrix is identified, structural shocks are easily recovered as $u_t = C^{-1} e_t$. To identify the coefficients of C matrix, besides the restrictions on variances and covariances of the structural shocks u_t and we assume that subsidy shocks have only temporary effects on output but have permanent effects on subsidies. On the other hand, supply shocks have permanent (or long-run) effects on both output and subsidies. These assumptions imply $\sum_{k=0}^{\infty} a_{12}(k) = 0$ in equation (6).

For Blanchard and Quah (1989) structural decomposition, at least one of the variables in the system must be nonstationary. Unit root test statistics (based on augmented Dickey-Fuller, ADF and Phillips-Perron, PP) for each variable in equation (6)

Table 3: Unit Roots Test Statistics

	ADF			PP		
Variables	None	Intercept	Intercept and trend	None	Intercept	Intercept and trend
y_t	0.359 (0.781)	–1.517 (0.510)	–2.847 (0.194)	0.317 (0.770)	–1.577 (0.480)	–2.76 (0.235)
Δy_t	–5.24 (0.00)	–5.16 (0.00)	–5.22 (0.00)	–5.37 (0.00)	–5.29 (0.00)	–5.69 (0.00)
s_t	–0.273 (0.577)	–1.22 (0.647)	–5.19 (0.002)	–0.088 (0.643)	–1.25 (0.634)	–5.02 (0.003)
Δs_t	–6.22 (0.00)	–6.63 (0.00)	–6.45 (0.00)	–6.22 (0.00)	–6.85 (0.00)	–7.52 (0.00)

Note: Equations estimated with none means no intercept and trend included in the equation. P-values are in parentheses. Low p-value means the presence of unit root is rejected.

are presented in table 3. Each time series is assessed for stationarity with no intercept and trend (none), with intercept only, and with intercept and trend. Results in table 3 show that both of them are first difference stationary, *I*(1). Structural supply or productivity shocks obtained from the above SVAR are compared (plotted in figure 4) with the (scaled) MFP growth rates reported in table 2. Figure 4 shows a good match between these two series except for few years at the end of the sample period. Excluding few years from the end of the sample (1993–2010), they are significantly correlated with correlation coefficient of 0.57. This means the empirical measure we have employed to obtain MFP growth rate would provide valuable information for the policy makers.

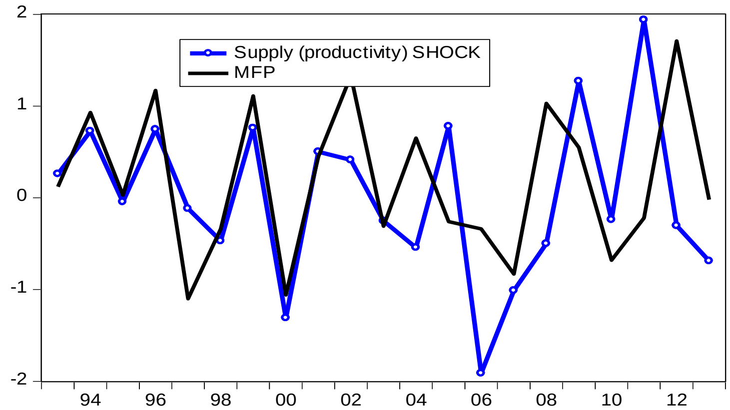

Figure 4: Structural Supply (Productivity) Shocks and MFP Growth Rates

Figures 5 and 6 plot the impulse response functions of the agricultural output in response to two shocks, namely, supply (productivity) and subsidy shocks. These figures report the accumulated responses of output to own and subsidy shocks. They show how the agricultural output reacts when there is one standard deviation (S.D.) in the structural shock. Note that these responses can be interpreted as how the growth in agricultural output changes over time, compared with the case when there are no shocks. As mentioned above results in figure 4 are based on the ordering (y_t, s_t) and figure 5 reports reports results when the ordering is changed from (y_t, s_t) to (s_t, y_t). There is no much qualitative difference when the ordering is changed. Basic result is that the supply (productivity) shock has permanent effect on the growth rate of agricultural output whereas subsidy shock initially increases the growth of output but there is no long-run impact. In either ordering, the productivity shock raises the output instantaneously by about 5% and then stabilizes at about 7.5% in the long-run. This shows the persistence of the productivity shock. On the other hand, subsidy shock raises the output instantaneously by about 2% (figure 4) and then the impact fades away and shows no long-run impact on agricultural output.

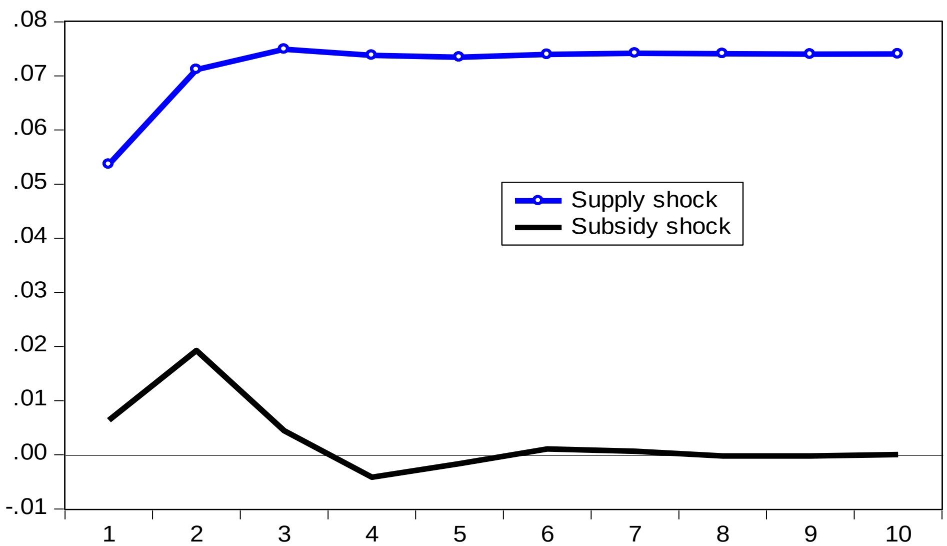

Figure 5: Response of Output Growth to Structural One S.D. Innovation

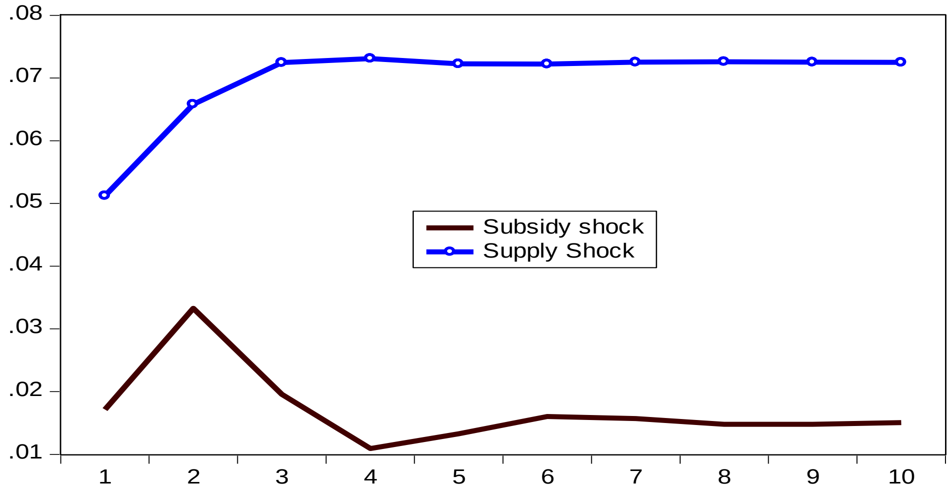

Figure 6: Response of Output Growth to Structural One S.D. Innovations

Table 4: Variance Decomposition (% Change in Agricultural Output)

Periods → Shocks ↓	1	2	3	4	6
Supply	98.59	93.92	88.28	86.52	86.21
Subsidy	1.41	6.07	11.72	13.48	13.79

The variance decomposition results presented in table 4 shows how much supply (productivity) and subsidy shocks determines the changes in the agricultural output at periods (years) 1–4 and at period 6. It is evident that supply shocks explain almost all (98% - 86%) of the forecast error variance of the agricultural output at any forecast horizon.

Summary and Concluding Remarks

One of the objectives of this study is to assess (measure and analyze) the economic growth and analytically decompose its major components: multifactor productivity (MFP) growth rate and production-factor intensity (FI) in Kuwait agricultural Sector over the time period 1987 to 2013. The MFP growth rate was 19.9% in 1989 (a year before the Iraq invasion) and became –19.1% in 1992 (a year after the war). The annual growth rates of gross output and factor intensities in 1991 (during the Iraqi occupation) dropped by more than 82% and 80%, respectively.

However, the capacity-rebuilding of this sector started immediately after the occupation as the annual growth rates of gross output, MFP, and FI improved significantly. In 1992 the annual growth rate of gross output was 19.6% and annual growth rate of FI was 38.6%. The improvements and progression of this sector have been sustained up to most recent years. Such sustained improvements are evident. The high annual average growth rates of gross output, MFP, and FI continued over the two subsequent time periods from 1992 to 2005 and from 2006 to 2013.

Most encouraging (from the perspective of the agricultural sector) is that the MFP contributed significantly to the growth of gross output during the period 2006–2013. We find that about 64% of the average annual growth rate of gross output was due to the growth of MFP over this sample period. We have also seen Kuwait government has keen interest in developing this sector and providing generous subsidies to this sector. We have also studied whether such subsidies have any permanent impact on the growth of this sector. Results from

SVAR analysis show that subsidies contribute temporarily to the growth of this sector. Results also show that the structural productivity shocks match well with the empirical measure of the MFP growth rate. This would provide valuation information to the policy makers. Since the productivity growth is the driving force of this sector, government policies should direct to the enhancement of the MFP growth.

References

Christensen, L.R., D.W. Jorgenson and L.J. Lau (1973), "Transcendental Logarithmic Production Frontiers", *Review of Economics and Statistics,* 55 (1), 28-45.

Diewert, W. E., and A. Nakamura (2007), "The measurement of Aggregate Total Factor Productivity Growth", in J. J. Heckman and E. E. Leamer (Eds), *Handbook of Econometrics*, 4502-4530, Amsterdam: Elsevier Science Publishing.

Food and Agricultural Organization, FAO (2016), *Kuwait and FAO: Partnering for Sustainable Food Security and Resilience in the Region*, May, 2016.

Fao (2016), *FAOSTAT*, http://www.fao.org.

Fao (1996), *Kuwait country report to the FAO international technical conference on plant genetic resources,* http://www.fao.org/fileadmin/templates/agphome/documents/PGR/SoW1/east/KUWAIT.pdf.

Jorgenson, D.W. (1995), *Productivity*, MIT Press, Cambridge, Massachusetts.

Morrison, C.J. (1988), "Capacity Utilization and Productivity Measurement: An Application to the U.S Automobile Industry", in A. Dogramaci (ed.), *Studies in Productivity Analysis,* Boston: Kluwer Nijhoff Press, pp. 163-193.

Ohta, M. (1975), "A Note on the Duality Between Production and Cost Functions: Rate of Returns to Scale and Rate of Technical Progress", *Economic Studies Quarterly,* 25, 63-65.

Shebeb, B. (2016), "Adjusted-Productivity Growth for Resource Rents: Kuwait Oil Industry (2002-2012)", *Applied Economics and Finance*, 3 (2), 128-135.

Shebeb, B. (2006), "Measuring Productivity Growth in the Bahraini Agriculture and Fisheries Sector", *Journal of Economics and Administration*, 20 (1), 17-34.

Shebeb, B. (2002), "Productivity Growth and Capacity Utilization in the Australian Gold Mining Industry: A Short-Run Cost Analysis", *Economic Issues*, 7, 71-81.