Khaled N.Alrwis	Adel M. Ghamen
SharafA. BakriAhamad	Nageeb M. Ali Aldawdahi

Ph.D in Agricultural Economics - Institution: King Saud University

Address: King Abdullah Ben Abdulaziz Food Security Chair, College of Food and Agricultural Sciences, Agricultural Economics, PO Box 2460, Riyadh 11451

Abstract: This study aims to find a targeted measure of economic diversification and determine the impact of indicators on gross domestic product (GDP) during the implementation of planned development (1970–2014). The study employs econometric analysis. The results show a decline in the contribution of the oil sector to GDP and government revenues and exports, while the increase in the contribution of the non-oil sectors and to annual growth rates are 0.34%, 0.26% and 9.7 % respectively. The oil export to import ratio also fell, declining at an annual rate of 2.02%, while the non-oil export to import ratio increased at an annual growth rate of 9.2%. The study also showed decline in the Herfindahl–Hirschman coefficient for gross domestic product and fixed investment, in addition to a decline in the value of composite measures, indicatingthe diversification of the Saudi economy;... To accelerate economic diversification, the study recommends the continuation of economic and structural reforms, the acceleration of the process of privatization and the attraction of foreign direct investment.

Keywords: economic diversification, development plans, the Saudi economy

Introduction

Under the development plans for the Saudi economy aimed at reducing the country's dependence on the oil sector, this sector declined in relative importance to gross domestic product (GDP) from 58% during the First Development Plan to 46.7% during the Ninth Development Plan. The Saudi economy is still looking outward at the level of inputs and outputs, with imports playing a considerable role in the supply of goods and services, and is meeting the requirements for economic development. Petroleum exports also play an important and influential role in local economic variables. The public sector has a monopoly on some production activities in Saudi Arabia and there is a predominance of expatriate workers in the private sector labour market. The pursuit of economic diversification is aimed at strengthening the country's economy and depends on growth and income in a variety of sectors, contributing to GDP. Moreover, it depends on flexibility in the most important elements of productivity in terms of labour, capital and technology. Economic diversification also aims to reduce Saudi Arabia's dependence on oil and thus focuses on the development of the non-oil production sectors. Economic diversification can be distinguished in a number of ways. In terms of its goals, it aims at (i) diversification of the goods and services produced and (ii) diversification of exports and export markets. It comprises (i) horizontal diversification, which is intended to create opportunities for the production of new goods in the same sector, and(ii) vertical diversification, denoting a shift from one industry or sector to another

industry or sector. This latter type of diversification promotes and strengthens the linkages between different sectors. Finally, economic diversification can be divided into (i) diversification at the macro level, i.e. at the level of all sectors, and (ii) diversification at the micro level, at any level of an economic entity (Goran, 2015).

In recent years crude oil prices have declined, from US\$110.3/barrel in 2012 to US\$35/barrel in 2015. In light of the Kingdom's commitment to OPEC, a decrease in oil exports is expected, which will thus have an impact on the state budget. To protect the Saudi economy from economic risk, economic diversification and the expansion of the production base are necessary, increasing the revenues obtained from non-oil production sectors and thus increasing their relative share in GDP over future development plans.

Research objectives

This study aims to find atargeted measure of economic diversification and determine the impact of indicators on GDP during the implementation of development plans in Saudi Arabia through the study of the following objectives:

Develop indicators of economic diversification to analyse trends over the implementation of the country's economic development plans (1970–2014).

Estimate the economic diversification coefficient in relation to GDP, government revenues and exports and fixed investments over the period 1970–2014.

Measure the composite impact of economic diversification and other factors on GDPover the period 1970–2014.

The study methodology

This study is based on the achievement of its goals on standard economic analysis, specially by using:

The normalized Herfindahl–Hirschman index was used to estimate diversity in the export sector, adopting the indicator employed by the United Nations Conference on Trade and Development (UNCTAD), expressed as in the following equation (Hirschman, 1964; Lapteacru, 2012):

$$H = \frac{\sqrt{\sum_{i=1}^{n} \left(\frac{x_{i}}{X}\right)^{2} - \sqrt{\frac{1}{N}}}}{\Box - \sqrt{\frac{1}{N}}}$$

where H represents the Herfindahl–Hirschman coefficient as an indicator of economic diversification, N represents the number of activities or sectors, xi represents the value of the variable in the activity or sector and X is the total value of the variable in all activities or sectors. The value of the Herfindahl–Hirschman coefficient ranges between zero and $1(0 \le H \ge 1)$. If the value of the coefficient is equal to zero, there is full diversity in the economy; if the value is equal to 1, diversity is non-existent.

The economic diversification indicators include: (a) the contribution of economic sectors to GDP, (b) the contribution of economic sectors to total exports, (c) the contribution of economic sectors to total government revenues and (d) the proportion of oil exports and non-oil exports to the total value of Saudi imports.

Multiple regression analysis was undertaken to measure the impact of economic diversification and other factors on GDP using ordinary least squares (OLS), expressed using the following equation:

$Y_t = a + b_1 X_{1t} + b_2 X_{2t} + b_3 X_{3t} + e_t$

where Yt denotes real GDP in million Saudi riyals, X1t represents total per thousand labour force, X2t is gross fixed capital in million riyals, X3t represents theHerfindahl–Hirschman coefficient as an indicator of economic diversification in the Kingdom of Saudi Arabia, et is the random error term and \mathbf{a} , \mathbf{b}_1 , \mathbf{b}_2 , \mathbf{b}_3 are the model parameters estimated in linear and logarithmic form. There is a trade-off between the estimated models, according to tests (R2, F-statistic, t-test) and the reference transactions in terms of compatibility with economic logic (William, 2003). Finally, the study employed secondary data published in the annual reports issued by the Saudi Arabian Monetary Agency.

Previous studies

A number of studies have addressed economic diversification and its impact on growth and development. Al-Hiti (2003), for example, found that the success of the Gulf Cooperation Council (GCC) countries in the application of economic diversification policies favoured the continuation of economic reforms, acceleration of the process of privatization, an increase in regional economic cooperation and attracting foreign direct investment. Ling etal, (2005) study measured the degree of industrial diversification and its impact on the productivity growth of the electronics industry in Taiwan. They found that degree of diversity in the electronics industry to be much higher than that estimated for manufacturing industries. Goran (2013) argued that the diversification process must take into account competitiveness, innovation and comprehensive development. The oil sector still plays a prominent role in the economies of the GCC countries, with the oil sector contributing about 45.6% of GDP, approximately 83.9% of the total value of exports and around 84.2% in government revenues in the period 2005-2011. Marzouk (2013) studied the economic diversification of GCC countries. The studyshowed that GCC countries achieved acceptable diversity compared to other rentier countries. have not Aayasrh (2014) calculated the coefficient of industrial diversification in Jordan and found differences in the degree of industrial diversification among the provinces. The study recommended encouraging investment to stimulate the growth of sectors, in addition to the introduction of the principle of diversity in design and planning of industrial policy.Al-Khatib(2014) examined the impact of diversification on growth in the Saudi economy over the period 1970–2011. The study showed that the rate of change in the diversification of exports, imports and government revenues is very weak. Moreover, Saudi Arabia has not achieved its goal of diversifying the production base, with oil exports still accounting for the bulk of merchandise exports and government revenues. Finally, Alguenibt and Ghanem (2016) studied structural changes and how to expand the production base in the Saudi economy. The study showed that structural changes were not significant during the development plans in theshort or the long term. The expansion of the production base is undertaken by

redirecting fixed investments to highlight various economic sectors. In 2014, the redistribution of fixed investmentswas undertaken evenly across economic sectors, resulting in a projected income of approximately 5,096.06 billion riyals. Under any other distribution of fixed investments, income is expected to decline due to the multiplier effect of investment in the private sector.

Research Results

The development of indicators of economic diversification in Saudi Arabia:

Economic diversification is defined as a gradual process of diversifying sources of income, a cumulative process that is known to increase the contribution of the industrial sector and the service sector in GDP. In the case of Saudi Arabia, economic diversification can also be considered a process aimed at reducing the oil sector's contribution to GDP and government revenues reducing the role of the public sector and enhancing the contribution of the private sector to economic activity. The aims of economic diversification are as follows: (1) to expand the opportunities and prospects for domestic and foreign direct investment and increase the numbers of trade partners and international markets; (2) to strengthen the links between economic sectors and thus achieve economic stability; (3) to expand and diversify revenue and increase the value-added sectors of the economy, thus speeding up the process of economic growth; (4) to provide opportunities for national labour; (5) to enhance export industries or disintegrative contribute to the strengthening of the front and rear linkages Industries. Al-Hiti (2003) studied the evolution of economic diversification indicators during the Saudi Arabian development plans (1970–2014). It is clear from the data contained in Tables1 and 2thatthe contribution of the oil sector to GDP decreased from 58% during the First Development Plan to 25.1% during the Fourth Development Plan and then increased to 46.7% during the Ninth Development Plan. The contribution of the private sector increased from 27.7% during the First Development Plan to 49.7 % during the Fourth Development Plan and then decreased to 36.7% during the Ninth Development Plan. Also, the contribution of the public sector increased from 13.4% during the First Development Plan to 23.7% during the Fourth Development Plan and then decreased to 15.8% during the Ninth Development Plan. In general, the contributions of the public and private sectors toGDP increased at an annual growth rate of 1.3% and 0.34% respectively, while the contribution of the oil sector fell at an annual rate of 0.64%. The contribution of the oil sector to government revenues also fell from 90.6% during the First Development Plan to 62% during the Fourth Development Plan, then increased to 90.3 % during the Ninth Development Plan. Also, the contribution of the non-oil sector increased from 9.4% during the First Development Plan to 38% during the Fourth Development Plan and then decreased to 9.7% during the Ninth Development Plan. In general, the contribution of the oil sector to total government revenues declined at an annual rate of 0.06%, while the contribution of the non-oil sector increased at an annual rate of 0.26%. The indicators of economic diversification identified for the Kingdom of Saudi Arabia are as shown in Tables 1 and 2.

Development	Relative share oftotalGDP (%)		Relative share of government revenue (%)		Relative share oftotal exports (%)		Proportion of the value of exportsto total imports (%)		
Plan	Government	Private	Petroleum	Petroleum	Non- petroleum	Proportionof oilexports	Proportion of non-oil exports	Proportion of oil exports	Proportion ofnon-oil exports
First	18,2	۲۷,۷	٥٨,.	٩٠,٦	٩,٤	99,0	.,0	209,8	۲,۰
Second	٨,٧	٣٤,٢	07,7	۸۸,۸	11,7	٩٩,٧	۰,۳	٣٤٩,١	۱,٣
Third	17,9	۳۸٫۱	٤٨,٤	४१,०	۲۰,٥	٩٨,٤	١,٦	۲.٩,٧	۲,٣
Fourth	۲۳,۷	٤٩,٧	70,1	٦٢,٠	۳۸,۰	۸۷,۹	۱۲,۱	1.7,7	15,7
Fifth	22,7	٤٠,٠	۳0,۸	٧٥,٧	٢٤,٣	۹١,٠	٩,٠	10.,9	10,7
Sixth	477,7	٤١,١	٣٤,١	۷۰,۷	29,7	۸۷,۳	١٢,٧	۱٦٠,٥	22,7
Seventh	۲.,٥	۳۸,۹	۳۹,0	۸.,۹	۱۹,۱	۸۸,۷	۱۱,۳	۲۱۰,٤	21,7
Eighth	10,7	٣٤,٥	٤٩,١	۸۸,۲	۱١,٨	۸۸,۲	۱١,٨	221,1	۳۰,۹
Ninth	10,1	۳٦,٧	٤٦,٧	۹٠,٣	٩,٧	٨٥,٧	12,7	۲۰۲,۹	۳۳,0

Source: Saudi Arabian Monetary Agency (2015). Fiftieth Annual Report.

Measuring Indicators Of Economic Diversification And Their ImpactOn The Gross Domestic Product Of The Kingdom Of Saudi ArabiaTable 2: Statistical analysis of the evolution of economic diversificationindicators over the period 1970–2014.

indicators over the period 1970–2014.						
Statement	% growth rate	F	R ²	Equation		
Relative share of GDP						
Government sector	1.3	9.23	0.18	$Ln\hat{\mathbf{Y}}_{1} = 2.502 + 0.013T$ (22.98)**(3.04)**		
Private sector	0.34	12.10	0.37	$\hat{\mathbf{Y}}_{2} = 25.859 + 1.326T - 0.026T^{2}$ (9.58)**(4.90)**(-4.65)**		
Oil sector	-0.64	17.72	0.46	$\hat{\mathbf{Y}}_{\mathbf{s}} = 67.539 - 2.536T + 0.049T^2$ (15.64)**(-5.85)**(5.42)**		
Relative share of	total governi	nent reven	ues			
Oil sector	-0.06	25.73	0.55	$\hat{\mathbf{Y}}_{4} = 98.80 - 2.35T + 0.05T^{2}$ (29.08)**(-6.89)**(7.17)**		
Non-oil sector	0.26	25.73	0.55	$\ddot{\mathbf{Y}}_{5} = 1.20 + 2.35T - 0.05T^2$ $(0.35)^{ns}(6.90)^{**}(-7.17)^{**}$		
Oil and non-oil ex	Oil and non-oil exports to total exports					
Proportion of oil exports	-0.4	102.47	0.70	$Ln\hat{\mathbf{Y}}_{6} = 4.609 - 0.004T$ (445.66)**(-10.12)**		
Proportion of non-oil exports	9.7	93.68	0.69	$Ln\mathbf{\hat{Y}}_{7} = -0.824 + 0.097T (-3.09)^{**}(9.68)^{**}$		
Oil exports and non-oil exports relative to total imports						
Proportion of oil exports	-2.02	9.25	0.31	$\hat{\mathbf{Y}}_{\mathbf{g}} = 509.89 - 26.34T + 0.47T^{2}$ (7.51)**(-3.87)**(3.29)**		
Proportion of non-oil exports	9.2	143.44	0.77	$Ln \hat{\mathbf{Y}}_{9} = 0.091 + 0.092T \\ (0.45)^{ns} (11.97)^{s*}$		

**Significant at the 1% level of probability;*ns* not significant.

Source: collected and calculated by the Saudi Arabian Monetary Agency (2015). Fiftieth Annual Report.

Moreover, oil exports decreased relative to the total export value from 99.5% during the First DevelopmentPlan to 85.7% during the Ninth Development Plan, while nonoil exports increased relative to total exports from 0.5% during the First Development Plan to 14.3% during the Ninth Development Plan. In general, the ratio of oil exports to the total value of exports fell at an annual rate of 0.4 %, while the proportion of non-oil exports increased by an annual growth rate of 9.7%. Oil exports declined as a percentage of the total value of imports from 459.3% during the First Development Plan to 102.2% during the Fourth Development Plan, then increased to 202.9% during the Ninth Development Plan. Also, the value of exports relative to non-oil imports increased consistently from a total value of 2% during the First Development Plan to 33.5% during the Ninth Development Plan. In general, the ratio of oil exports to the total value of imports decreased at an annual rate of 2.02%, while the proportion of non-oil exports increased by an annual growth rate of 9.2% during the period 1970–2014.

Economic diversificationcoefficient estimatesduring development plans:

The coefficients of the composite indicator for economic diversification over the period of implementation of the economic development plans were estimated by calculating the economic diversification average for both GDP and government revenues and exports and calculating the fixed investment coefficient. It is clear from the data contained in Tables 3 and 4 that there was greater diversification in relation to GDP during theFifth and Sixth Development Plans, whereas government revenues exhibit greaterdiversification under the Fourth Development Plan. The Sixth Development Plan shows greater diversification in exports, while the First Development Plan plans was more diversified in fixed investments. The average Herfindahl–Hirschman coefficients for GDP, government revenues, exports and fixed investments are 0.24, 0.45, 0.74 and 0.25 respectively. The average for the composite indicator amounted to 0.42 over the period 1970–2014. The values of the Herfindahl–Hirschman coefficients for GDP, government revenues and exports fell, declining at an annual rate of 2%, 2.22% and 1.38% respectively. The value of the Herfindahl–Hirschman coefficient of fixed investments increased at an annual growth rate of 1.6%. The value of the Herfindahl–Hirschman coefficient for the composite indicator decreased at an annual rate of 0.76% during the study period. There is clear impairment in the Herfindahl–Hirschman coefficient for gross fixed capital investment, in addition to the decline in the value of the Saudi economy during the study period.

Table 3: Evolution of the values of economic diversification coefficientsperiod 1970–2014.

Values of economic diversification coefficients					Development
Average	Fixed investment	Exports	Government revenues	Gross domestic product	Plan
0.51	0.04	0.98	0.70	0.34	First
0.55	0.21	0.99	0.64	0.34	Second
0.46	0.20	0.95	0.42	0.29	Third
0.28	0.20	0.62	0.07	0.21	Fourth
0.35	0.25	0.71	0.28	0.17	Fifth
0.36	0.45	0.60	0.22	0.17	Sixth
0.42	0.44	0.64	0.43	0.18	Seventh
0.44	0.25	0.63	0.63	0.25	Eighth
0.41	0.18	0.55	0.69	0.23	Ninth
0.42	0.25	0.74	0.45	0.24	Average

Source: Saudi Arabian Monetary Agency (2015). Fiftieth Annual Report.

Table 4: Statistical analysis of the evolution of the values of economicdiversification coefficientsover the period 1970–2014.

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Function	R ²	F	%growth rate	Diversification	
$\ddot{\mathbf{Y}}_{1} = 0.403 - 0.0147 + 0.00027^{2}$ (12.82)**(-4.59)**(3.70)**	0.42	15.17	-2.00	Local production	
$ \hat{\mathbf{Y}}_{\mathbf{z}} = 0.893 - 0.056T + 0.001T^2 (12.63)^{**} (-7.94)^{**} (8.19)^{**} $	0.62	33.55	-2.22	Government revenue	
$\hat{\mathbf{Y}}_{2} = 1.102 - 0.024T + 0.0003T^2$ (26.81)**(-5.79)**(3.08)**	0.77	70.50	-1.38	Exports	
$\hat{\mathbf{Y}}_{4} = -0.038 + 0.027T - 0.0005T^{2} (-0.83)^{ns}(5.87)^{**}(-5.03)^{**}$	0.50	21.01	1.60	Fixed investment	
$ \hat{\mathbf{Y}}_{5} = 0.589 - 0.0177 + 0.00037^{2} (17.19)^{**}(-4.89)^{**}(4.29)^{**} $	0.39	13.65	-0.76	Composite diversification	

**Significant at the 1% level of probability;*ns* not significant.

Source: collected and calculated by the Saudi Arabian Monetary Agency (2015). Fiftieth Annual Report.

Measuring the impact of economic diversification and other factors on GDP

Real GDP is influenced by Yt in relation to both (i) the total per thousand labour force (X1t), (ii) gross fixed capital in million riyals (X2t) and (iii) theHerfindahl–Hirschman coefficient for the composite indicator of economic

diversification in the Kingdom of Saudi Arabia (X3t). To conduct the multiple regressions, variables specific to real GDP were used in linear and logarithmic form for the period 1970–2014, demonstrating a preference for the logarithmic model in relation to the data used in the estimates. The multiple regression model is expressed by the following equation:

$$\begin{split} & {\rm Ln}\,\hat{\rm Y}_t = 2.485 \pm 0.021 {\rm Ln}{\rm X}_{1t} \pm 0.859 {\rm Ln}{\rm X}_{2t} \pm 0.467 {\rm Ln}{\rm X}_{3t} \\ & (7.12)^{**} \ (1.96)^* (23.27)^{**} \ (-3.62)^{**} \\ & {\rm R}^2 = 0.97 \ {\rm F} = 474.09 \ {\rm D}. \ {\rm W} = 1. \ {\rm I0} \ {\rm Lm} \ {\rm test} = 1.83 \end{split}$$

**1% level of significance * 5% level of significance

It is clear from the model estimated that an increase of 10% in the total labour force (X1t) and fixed capital (X2t) lead to increased real GDP of 2.1% and 8.59% respectively. The decrease in the value of the Herfindahl–Hirschman coefficient for the composite measure (increasing economic diversification) of 10% leads to an increase in real GDP of 4.67%. In the model, the independent variables explainapproximately 97% of the changes in real GDP; the other changes, estimated at around 3%, are attributable to other factors that are not included in the model. In terms of the value of F, based on the Breusch–Godfrey serial correlation Lagrange multiplier (LM) test, it is round 1.83, which is not statistically significant the 1% level and thusindicates that there is no problem of autocorrelation among residuals. The proposed model also has good efficiency in terms of the data used to estimate the model according to the indicators measuring this, the most important being the Theil inequality coefficient (Theil's U) whichapproached the value zero (Table 5).

Index	Value
Root Mean Square Error	0.18
Mean Absolute Error	0.15
Mean Absolute Percentage Error	1.16
Theil Inequality Coefficient	0.007

 Table 5: Efficiency of the model indicators estimated over the period 1970–2014.

Source: Ownestimation.

Recommendations

From the above, it is clear that despite the state's development plans, Saudi Arabia continues to be dependent on oil as a major source of gross domestic product (GDP) and government revenues. Due to the decline in oil prices, the Saudi economy is exposed to the risk of economic effects on GDP, investment, government spending, exports and the amount of the surplus and the deficit in the state budget. Economic diversification is one of the most important policies that could protect the Saudi economy from risk. To increase the degree of economic diversification, there are arguments in favour of continuing economic and fiscal reforms, accelerating the process of privatization, increasing regional economic cooperation and striving to attract foreign direct investment, as well as adopting monetary and fiscal measures that might encourage the private sector to convert some of its assets into overseas investment and investment in local projects.

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قياس مؤشرات التنويع الإقتصادي وأثره على الناتج المحلي للمملكة العربية السعودية خالد بن نهار الرويس، عادل محمد خليفة غانم، شرف الدين بكري، نجيب الدودحي كرسي الملك عبد الله بن عبد العزيز للأمن الغذائي

الملخص:

استهدف البحث قياس مؤشرات التنويع الإقتصادي وأثره على الناتج المحلي خلال خطط التنمية. واعتمدت الدراسة في تحقيق أهدافها على التحليل الإقتصادي القياسي والبيانات التي تصدرها مؤسسة النقد العربي السعودي. وأوضحت الدراسة تراجع مساهمة القطاع النفطي بمعدلات ضئيلة في إجمالي الناتج المحلي والإيرادات الحكومية والصادرات، في حين إزدادت مساهمة القطاع غير النفطي بمعدلات نمو سنوية بلغت ٣٠,٠%، ٢٦,٠%، ٩,٧% على التوالي. كما تراجعت نسبة الصادرات النفطية إلى الواردات السعودية بمعدل تناقص سنوي بلغ ٢,٠٢%، في حين إزدادت نسبة الصادرات غير النفطية إلى الواردات السعودية

سنوي بلغ ٩,٢%. كما أوضحت الدراسة إنخفاض قيمة معامل هيرفندل – هيرشمان لكل من الناتج المحلي والإستثمار الثابت، بالإضافة إلى تراجع قيمة المعامل المركب، مما يعني حدوث تنويع في الإقتصاد السعودي. وتتاقص قيمة معامل هيرفندل – هيرشمان (زيادة درجة التنويع الإقتصادي) بنسبة ١٠% تؤدي إلى زيادة إجمالي الناتج المحلي الحقيقي بنسبة ٤,٦٧%. ويعتبر التنويع الإقتصادي من أهم السياسات المستخدمة في تتمية وحماية الإقتصاد السعودي من المخاطر. وللإسراع في التنويع الاقتصادي،فإن الدراسة توصي بمواصلة الدولة للإصلاحات الاقتصادية والهكيلية والتعجيل بعملية الخصخصة والسعي إلى جذب الاستثمار الأجنبي المباشر وتشجيعه، وإتخاذ إجراءات نقدية ومالية تشجع القطاع الخاص على تحويل بعض أصوله الموجودة في الخارج وإستثمارها في مشاريع محلية.

كلمات دالة: التنويع الإقتصادي، خطط التنمية، الإقتصاد السعودي.