Causality between economic growth and investment in the United Arab Emirates

Salem A. Al-Jundi*

Department of Accounting and Finance and Banking,
College of Business,
Al Ain University of Science and Technology,
P.O. Box 64141, Al Ain, UAE
Fax: +971-3-7024777
Email: salim.aljundi@aau.ac.ae
*Corresponding author

Mohammed Seghir Guellil

Faculty of Economics,
Business and Management Sciences,
MCLDL Laboratory,
University of Mascara,
29000, Algeria
Email: guellil.poldeva@gmail.com

Abstract: The study aims to work out the exact pattern of causality between economic growth rate and each of investment categories in the United Arab Emirates. Causality is examined by numerous researchers. However, few have studied the relationship between growth and investment at macroeconomic level. To the best of my knowledge no one investigates this topic in the UAE. We demonstrate long-term effects of the investment shares in non-oil gross domestic product on economic growth using cointegration and granger causality tests on time series data. The findings indicate unidirectional causality from private investment to non-oil GDP growth rate, from business investment to non-oil GDP growth rate, and from public investment to government investment. The results could be a good tool for policy priorities in which the private sector, within a dynamic open market, is the strongest engine to expand the non-oil economy, especially in the wake of the sharp decline in oil prices.

Keywords: causality; economic growth; investment; private sector; non-oil GDP; unit root; co-integration; granger causality test; United Arab Emirates; UAE.

Reference to this paper should be made as follows: Al-Jundi, S.A. and Guellil, M.S. (2018) 'Causality between economic growth and investment in the United Arab Emirates', *Int. J. Economics and Business Research*, Vol. 15, No. 4, pp.524–540.

Biographical notes: Salem A. Al-Jundi has been an Assistant Professor of Economics, College of Business, Al Ain University of Science and Technology, UAE since 2008. He teaches courses such as microeconomics, macroeconomics and economic development. His research interests focus on

macroeconomic problems in developing countries, especially oil producing and exporting countries. He has published several peer-refereed journal articles in private sector efficiency, capital accumulation, economic diversification, consumption function, determinants of investment and inflation.

Mohammed Seghir Guellil is an Assistant Professor of Economics in the University of Mascara, Algeria. In 2016, he received his PhD in Economics of the Firm and Market at the University of Tlemcen, Algeria. He taught at this university from 2012 till 2016. His main fields of studies are: econometrics, operational research, economic analysis, statistics, sales forecast and mathematical and economics modelling. He is a permanent member of MCLDL Laboratory (Laboratory of Management of Local Communities and Local Development).

1 Introduction

The paper aims to investigate the causality between economic growth rates and ratios of investment in gross domestic product in the United Arab Emirates (UAE) using 38 years' worth of data, from 1976 to 2014. The UAE economy can be described as heavily dependent on the crude oil sector at the beginning of the 1970s. This sector contributed more than 66% of the GDP in 1975, but this contribution dropped to 31% in 2010 as a result of the economic diversification process (Al-Jundi, 2012a).

The UAE economy is still oil-based. The oil sector is owned by the government and its revenues are determined by international demand for crude oil, the level of growth in the global economy, and decisions made by the organisation of petroleum exporting countries. A dramatic change in the international oil market results in a significant drop in oil prices. Economists prefer to analyse non-oil economies. Economic diversification aims to reduce heavy dependence on the oil sector by developing the non-oil economy (ESCWA, 2001). Based on this, the current paper considers economic growth rates for non-oil GDP and ratios of investment in non-oil GDP.

In national accounts, gross capital formation includes non-residential investment (expenditures for machines and tools), residential investment (expenditures for buildings and infrastructure), and a change in business inventories (Case et al., 2009). When the latter is excluded, the former two aspects are referred to as gross fixed capital formation. Economists use this term as interchangeable with investment. They prefer fixed capital formation because the general public use investment to refer to purchases of shares and bonds in financial markets. The word 'gross' refers to expenditures before deducing depreciation on fixed capital. In this paper, the term investment refers to gross fixed capital formation (Lequiller and Blades, 2006). The UAE National Bureau of Statistics does not publish data on investment categories; thus, the paper takes investment as a sum.

The private sector was limited during the 1970s in the UAE, with few technical and financial capabilities. The government took responsibility for a wide and comprehensive process to boost the economy, investing in projects to expand public services such as schools, hospitals, housing units, roads, and airports, while the public sector invested oil resources (owned by the government) to build industrial projects in electricity, petrochemicals, and fertiliser.

Studies of causality are increasingly useful in this field. They help to determine whether economic growth is caused by investment, or causes investment. The current study may discover that the flow of causality runs in both directions. The results will enhance understanding of the mechanism of the UAE economy. Vital recommendations may be derived from these findings in order to improve policies for stimulating the level of economic activities and increasing the capital stock in society. In addition, this paper aims to fill the gap in the literature pertaining to quantitative studies of the UAE economy. To the best of my knowledge no one studies the causality between growth and investment in the UAE.

According to the Harrod-Domar model, the economic growth rate depends on an increase in capital stock that is equal to net investment (Hagemann, 2009). Additionally, the increase in investment leads to an increase in aggregate demand, to which firms will respond by increasing output. As production and income rise, consumption will follow suit; firms will then respond to this increase in consumption by increasing output again, and so on. The multiplier concept states that an increase in investment results in a multiple increase in output (Case et al., 2009).

At a theoretical level, economic growth basically depends on investment. However, studies have proven that investment is determined by various factors. One important determinant is economic growth. It is crucial to test the time lag between investment and economic growth. When there was positive economic growth in real GDP in the previous year, this can be considered an incentive for firms to invest more in the current year. For example, Al-Jundi and Hijazi (2013) found that a 10 million UAE dirham increase in non-oil GDP results in just over a one million dirham increase in private investment in the UAE. Their study showed that real public expenditures stimulate investment more than non-oil GDP does.

Causality has been examined in the field of economics by numerous researchers. However, few have studied the relationship between economic growth and investment as a whole. As stated in the next section, there is no fixed pattern of causality between these two variables. Extant results have been affected by the data selected, the authors' definitions of variables, and the country chosen – indeed; it seems that the flow of causality has a country-specific nature.

There remains a need to discover the flow of causality between the two stated variables in the UAE. Previous studies and economic theory have not provided clear answers about patterns of causality in the country. However, such explanations would build a strong base for understanding future scenarios for the UAE economy, especially in the wake of the sharp decline in oil prices.

To fill in the gap, it is important to focus on the non-oil economy. Therefore, the current study examines non-oil GDP and investment share in non-oil GDP. In addition, we must differentiate between:

1 private
2 government
3 public
4 business (as a sum of private and public investment)
5 total investments.

The paper seeks to answer the following question: Is there a flow of causality, and, if so, in which direction, between non-oil GDP growth rate (GDP) and one or more of the following:

- Private investment share in non-oil GDP (PRI).
- Government investment share in non-oil GDP (GOV).
- Public investment share in non-oil GDP (PUB).
- Business investment share in non-oil GDP (BUS).
- Total investment share in non-oil GDP (INV)?

The main goal of the study is to discover the exact pattern of causality between non-oil GDP growth rate and each of the investment categories. The results will be useful for conducting further studies in areas such as stimulating economic growth and to encourage the private sector to increase their investment.

2 Literature review

Hatemi-J and Irandoust (2002) found that the flow of causality runs in two directions in Canada and Italy. In Germany, the flow of causality runs in one direction, from fixed investment to economic growth, while the causality runs from economic growth to fixed investment in France, Sweden, and the UK. Ghali and Al-Mutawa (1999) investigated the casual relation between the share of fixed investment in GDP and the growth rate of per capita real GDP on an individual-country basis using seven major industrialised countries. They concluded that causality has a country-specific nature and may run in both directions.

According to the evidence from developed countries during the period 1952–1999, Madsen (2002) concluded that economic growth is most likely caused by investment in machinery and equipment, while investment in non-residential buildings and structures is most likely caused by economic growth.

Using data from 104 countries with six observations per country for the period 1960–1990, Podrecca and Carmeci (2001) examined the relationship between investment shares in GDP and growth rates of per capita GDP. They concluded that causality between investment and growth runs in both directions – that is, investment causes growth, and vice versa. Granger causality from investment to growth was found to be negative, which the authors concluded to be due to predictions of Solow-type growth models.

Khan and Reinhart (1989) built a model of a cross-section sample of 24 developing countries. They stated that private investment has a larger effect on economic growth than does public investment. Amin (2002) said that capital and labour inputs have been the main sources of economic growth in Cameroon. Capital has been more important than labour in terms of contribution to growth. This can especially be seen during the oil boom period (1978–1985).

Bakare (2011) found that there is a significant relation between investment (capital formation) and economic growth in Nigeria. The study supported the Harrod-Domar

model, which states that economic growth is positively related to savings ratio and investment.

Bekhet and Al-Smadi (2016) approved that there is long-run bidirectional granger causality between foreign direct investment and gross domestic product in Jordan according to time series data for the period 1978–2013. However, there is unidirectional causality running from FDI to GDP in the short-run. Ghosh and Sarker (2015) found that FDI has a positive effect on economic growth in the long-term in Bangladesh. They used data of 1980–2012 and applied a vector error correction model and the Johansen cointegration analysis.

Raheem and Adeniyi (2015) studied 33 countries in Sub-Saharan Africa for the period 1970-2010. They concluded that FDI contributes to economic growth, even the remittances have a stronger effect than FDI. The capital flight and debt have negative impacts on growth. Sooreea-Bheemul and Sooreea, (2013) applied panel granger causality analysis and used data from 28 developing and emerging countries for the period 1980–1998. They found that causality runs from economic growth to domestic investment. FDI granger-causes domestic investment, exports, and economic growth. While the improvements in these variables lead to increase FDI. They did not find causality from domestic investment to economic growth.

Kivyiro and Arminen (2015) implemented time series and panel data for 1989–2011 in seven East and Central African countries. It seems that the results from panel data (all countries) are different from time series (country-based). The bidirectional causality is found between FDI and exports, but there is unidirectional causality from exports and FDI to GDP. It is also found there is unidirectional causality from exports to GDP in Uganda and from FDI to GDP in Tanzania. However, GDP causes FDI in Rwanda, FDI causes exports in Uganda. They concluded that GDP granger-causes exports in Congo.

3 Historical trends

The UAE economy has dramatically changed over the last 38 years. The GDP has doubled many times over, and the government has benefited from oil resources since the first oil boom in 1973. The government's attempts to build the non-oil economy, and its strategic approach of encouraging the private sector and political stability, have been successful: the non-oil GDP continuously increased by around 8% annually over the 38 years considered.

The growth rates are much higher than the population growth rates, which make incomes per capita close to that of developed countries. The government and the public and private sectors invested as much as 43% of non-oil GDP for the period 1976–2014. The high rate of investment has put severe pressure on the whole economy, though it has resulted in building a comprehensive infrastructure and necessary projects for sustainable growth.

Figure 1 reveals that, even with fluctuations in business cycles, the non-oil GDP grew by around 6.8% annually for the period 1990–2014, while the private investment share reached an average of 17% of the non-oil GDP. It seems that this investment guided the growth as a general trend. The fluctuations in non-oil GDP were caused by a change in aggregate demand. The level of economic activity is sensitive to government expenditures and the level of growth in the international economy, since the UAE economy is widely open to international markets and follows the free-market mechanism.

It seems that expansion in the construction sector led to a shift in the private investment share to upper levels from 2007.

Figure 1 Non-oil GDP growth rates and private investment shares in UAE

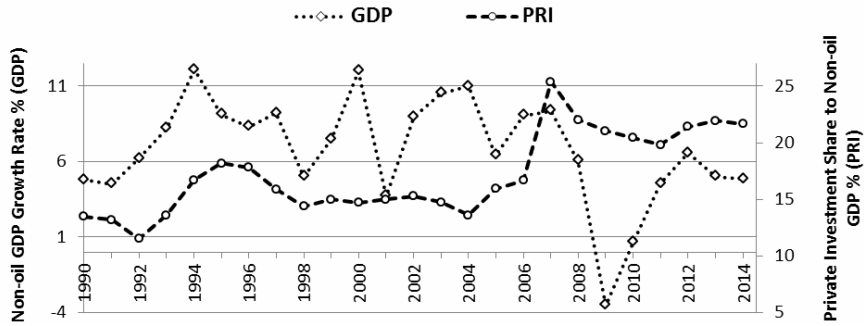


Figure 2 Non-oil GDP growth rates and government investment shares in UAE

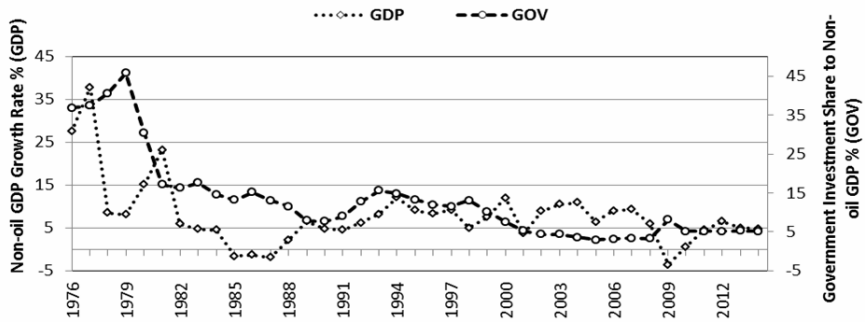


Figure 3 Non-oil GDP growth rates and public investment shares in UAE

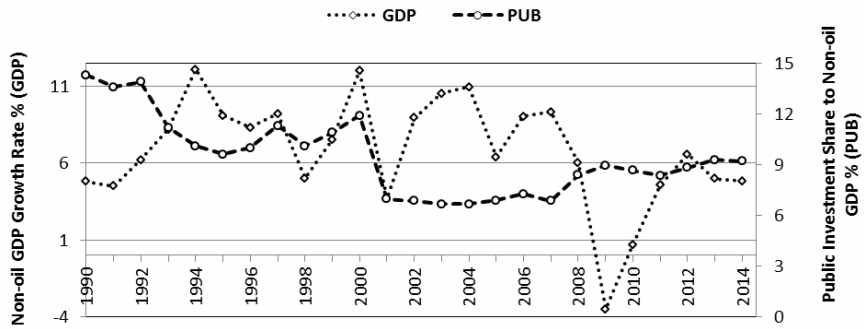
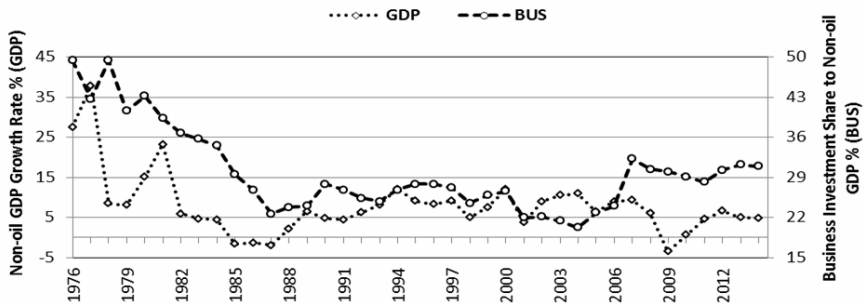


Figure 2 shows that there is a close relationship between non-oil GDP growth rate and government investment as a ratio to non-oil GDP. Three stages can be identified. First, because the non-oil economy was weak during the 1970s, the government invested 38% annually into non-oil GDP from 1976–1980. The second stage occurred during 1981–1999, when the government's investment share in non-oil GDP was around 13% annually. The third stage was during 2000–2014, in which the investment share in non-oil

GDP dropped to around 4.8%. The burden on the government was lower at this point, since it had met the most urgent requirements in areas such as housing for citizens, roads, airports, and governmental offices.

Figure 3 shows that the public investment remained relatively stable during the 38 years considered. Two stages can be discerned. First, public investment in non-oil GDP reached an annual average of 11.5% during 1990–2000. Second, the ratio dropped to 7.8% annually during 2001–2014. Figure 3 indicates that there is no close relation between economic growth and public investment. The government seems to have started to liberalise the economy and place much more emphasis on the private sector.

Figure 4 Non-oil GDP growth rates and business investment shares in UAE



When we add private investment to public investment, business investment can be determined, as shown in Figure 4. It shows a clear relation between economic growth and business investment for the period 1976–2014. While non-oil GDP grew annually 8%, business investment in non-oil GDP reached an average of 30% in the 38 years studied.

Figure 5 Non-oil GDP growth rates and total investment shares in UAE

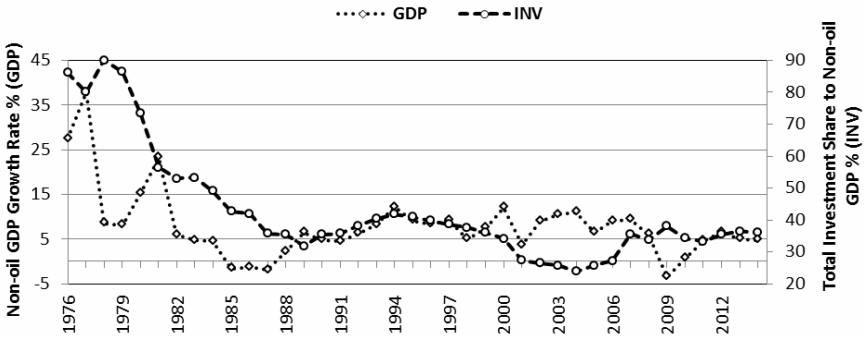


Figure 5 shows the same pattern as Figure 4. The total investment in non-oil GDP reached an annual average of 43%. The huge investment put pressure on the whole economy and brought high inflation (Al-Jundi, 2012b). The initial impression from the above figures is that it seems there is a relationship between growth and investment. Thus, the question arises as to which variable impacts the other.

4 Methodology

The UAE Ministry of Planning did not offer separate data for the private sector; published data for the period 1976–1989 shows government investment and investment of the business sector (as a sum of private and public investment). It may be accepted since the private sector was too weak and the public sector benefited from the oil boom during the 1970s to expand investments (UAE Ministry of Planning, 1993). The paper will use the following terminology to reflect features of the UAE economy:

$$\text{Business sector investment} = \text{private investment} + \text{public investment} \tag{1}$$

$$\text{Total investment} = \text{private investment} + \text{public investment} + \text{government investment} \tag{2}$$

$$\text{Non-oil GDP growth rate}_{2012} = \left[\frac{\text{Non-oil GDP}_{2012}}{\text{Non-oil GDP}_{2011}} - 1\right] \times 100 \tag{3}$$

$$\text{Investment share in non-oil GDP growth rate}_{2012} = \left[\frac{\text{Gross fixed capital formation}_{2012}}{\text{Non-oil GDP}_{2011}}\right] \times 100 \tag{4}$$

With respect to econometric analysis, a long series of data is needed. Unfortunately, international organisations do not offer such consistent series, especially at constant prices, as can be seen from databases of organisations such as The World Bank (2014), UN Statistics Division (2014), and International Monetary Fund (2014).

There is a serious problem with regard to data on the UAE's national resources. The UAE National Bureau of Statistics, now called the Federal Competitiveness and Statistics Authority, was established in 2009. The Ministries of Economy and Planning were in charge of publishing data before 2009; however, this data was collected and published without the presence of accurate international standards or specialised staff. Thus, it is important to note that the data before 2009 is not highly accurate or valid.

Using equation (4), given above, shares of private, government, public, business, and total investment were calculated for the 38 years from 1976–2014. The UAE National Bureau of Statistics (2014) published data on growth rates and investment shares for the period 2001–2014 at constant 2007 prices, and this is the only valuable source of data prepared according to the international standards of the UN. Data up to 2014 is available from the Federal Competitiveness and Statistics Authority (FCSA, 2016).

The growth rates and investment shares were calculated using data published by the Ministry of Economy (2014) for the period 1993–2001 at constant 1995 prices. The growth rates were computed for the period 1990–1993 at constant 1985 prices, while the investment shares were calculated at current prices from data published by the UAE Ministry of Planning (1998), because there is no data for gross fixed capital formation at fixed prices.

The indicators themselves were calculated for the period 1985–1990 from the UAE Ministry of Planning (1993). The growth rates were based on constant 1985 prices while investment shares were based on current prices. Growth rates were calculated for the period 1976–1985 at constant 1980 prices, while investment shares were derived from current prices (Ministry of Planning, 1987).

Thus, the data for non-oil GDP growth rates were calculated using equation 3 and at constant prices for the period 1976–2014. However, each segment or period mentioned had its own base year. The investment (gross fixed capital formation) shares in non-oil GDP were counted partially at constant prices for the period 1991–2013, while the shares were computed at current prices for the period 1976–1990.

In the analysis of a long-term relationship, selecting an appropriate technique is important from a theoretical and empirical point of view. Cointegration is the most appropriate technique for studying the long-term relationship between non-oil GDP growth rate (GDP), private investment share in non-oil GDP (PRI), government investment share in non-oil GDP (GOV), public investment share in non-oil GDP (PUB), business investment share in non-oil GDP (BUS) and total investment share in non-oil GDP (INV).

The empirical strategy used in this paper can be divided into four steps. First, the time series data were subject to Kwiatkowski-Phillips-Schmidt-Shin (KPSS) (Kwiatkowski et al., 1992) unit root tests. Second, if they were integrated in the same order, Johansen cointegration tests (Johansen, 1988) were used. Third, if the series were cointegrated, the vector error correction model (VECM) was estimated using maximum likelihood estimation (MLE) methods (Johansen and Juselius, 1989). Fourth, after estimating the long-term relationship using MLE methods, we proceeded to conduct the granger causality test (Granger, 1980).

5 Findings

Due to the lack of observations on certain variables during the period 1976–1989, the empirical study is limited to the 1990–2014 period, in order to avoid analysing unbalanced data between variables, which would lead to biased results.

5.1 Unit root test

Our analysis began with stationarity tests using the KPSS unit root test. The results are shown in Table 1.

From the results of the unit root tests performed for all of the variables, we drew the following conclusions. The majority of LM statistics for both models were higher than the critical values at the 5% level for the six variables (GDP, PRI, GOV, PUB, BUS, and INV). Therefore, we could reject the null hypothesis of no unit root, which meant that none of the variables were stationary. After differentiation into the first degree of the data, we noted that all LM statistics for each variable were lower than the critical values at the 5% level. We then accepted the null hypothesis, meaning that all data were stationary for all variables. These results led us to a logical way in which to test the presence or absence of a long-term relationship between all variables by applying a cointegration test.

We concluded that all variables were integrated to an order of one I {(1)}, either for the model with trend and constant, or constant. However, before applying the cointegration test, it was necessary to determine the lag order.

5.2 Lag order selection criteria

Having established that all variables were stationary to the same order, in this step we determined the optimal lag order according to six selection criteria for delays of zero to two – we did not go beyond that due to the low number of observations.

Table 1 KPSS unit root tests for the variables

Null: no. unit root				
Methods	*Variables*	*Intercept*	*Trend and intercept*	*Decision*
		LM-stat.	*LM-stat.*	
Level	Log GDP	0.398299	0.188951*	Not stationary
	Log PRI	0.647999*	0.291234*	Not stationary
	Log GOV	0.589948*	0.307622*	Not stationary
	Log PUB	0.470299*	0.156748*	Not stationary
	Log BUS	0.537712*	0.139726	Not stationary
	Log INV	0.214534	0.176842*	Not stationary
First difference	Δ Log GDP	0.410000	0.101089	Stationary
	Δ Log PRI	0.051492	0.048046	Stationary
	Δ Log GOV	0.145551	0.141807	Stationary
	Δ Log PUB	0.246637	0.092969	Stationary
	Δ Log BUS	0.136089	0.055422	Stationary
	Δ Log INV	0.120887	0.121146	Stationary
Asymptotic critical values	1% level	0.739000	0.216000	
	5% level	0.463000	0.146000	
	10% level	0.347000	0.119000	

Notes: *Significance at 5%. Δ is the first difference operator.

Table 2 Lag order selection criteria results

Lag	*LogL*	*LR*	*FPE*	*AIC*	*SC*	*HQ*
0	–132.0683	NA	0.006598	12.00594	12.30216	12.08044
1	–67.08287	90.41453*	0.000598*	8.485467*	11.55898*	10.00695
2	–25.53390	36.12954	0.000808	9.002948	12.85375	9.971415*

Notes: *Indicates lag order selected by the criterion. LR: sequential modified LR test statistic (each test at 5% level). FPE: final prediction error. AIC: Akaike information criterion. SC: Schwarz information criterion. HQ: Hannan-Quinn information criterion.

According to the LR, FPE, AIC, and SC criteria, the selected delay was one. We were then able to proceed to the Johansen co-integration test, followed by VECM (1).

5.3 Johansen co-integration test

This step was designed to confirm or deny the existence of a long-term relationship using the Johansen co-integration test 'Johansen (1988)' and also to know the number of co-integrating equations [No. of CE(s)]. The results are shown in Table 3.

Table 3 Johansen co-integration test results

Unrestricted cointegration rank test (trace)				
Hypothesised no. of CE(s)	*Eigenvalue*	*Trace statistic*	*0.05 critical value*	*Prob.***
None*	0.829658	124.4346	95.75366	0.0001
Up to 1*	0.777181	83.72580	69.81889	0.0026
Up to 2	0.673117	45.19366	47.85613	0.1372
Up to 3	0.544535	23.47613	29.79707	0.2235
Up to 4	0.145859	5.388116	15.49471	0.7663
Up to 5	0.073747	1.761972	3.841466	0.1844
Unrestricted co-integration rank test (maximum eigenvalue)				
Hypothesised no. of CE(s)	*Eigenvalue*	*Max-eigen statistic*	*0.05 critical value*	*Prob.***
None*	0.829658	40.70879	40.07757	0.0424
Up to 1*	0.777181	34.53214	33.87687	0.0417
Up to 2	0.673117	25.71753	27.58434	0.0850
Up to 3	0.544535	18.08801	21.13162	0.1266
Up to 4	0.145859	3.626144	14.26460	0.8965
Up to 5	0.073747	1.761972	3.841466	0.1844

Notes: Trace test indicates two co-integrating eqn(s) at the 0.05 level. Max-eigenvalue test indicates two co-integrating eqn(s) at the 0.05 level. *Denotes rejection of the hypothesis at the 0.05 level. **MacKinnon-Haug-Michelis (1999) p-values.

Table 3 summarises the results of two statistical cointegration tests. From the results, it can be noted that across both tests [trace test and maximum eigenvalue test (Johansen, and Juselius, 1989)] the two first-probability values were less than 5% and the third was more than 5%. Therefore, two cointegrating equations were indicated at the 0.05 level. This shows that there was a cointegration relationship between the variables in the model. The final number of cointegrated vectors with one lag was equal to two – ,i.e., rank (π) = 2. Since this is more than zero and less than the number of variables, the series could be considered to cointegrate among the variables. Nevertheless, we then proceeded to estimate VECM (1) with two cointegrating vectors.

5.4 Vector error correction estimates

The presence of cointegration between variables suggested a long-term relationship between the variables under consideration. Thus, the VECM could be applied. The long-term relationships between GDP, PRI, GOV, PUB, BUS, and INV for two cointegrating vectors for the UAE in the period 1990–2014 are displayed in Table 4 (standard errors are displayed in parenthesis and t-statistics in square brackets).

Table 4 Vector error correction estimates

Sample (adjusted): 1992–2014
Included observations: 23 after adjustments
Cointegration restrictions:
A(1, 2) = 0, A(3, 2) = 0, A(4, 1) = 0, A(6, 1) = 0, A(2, 1) = 0
Not all cointegrating vectors are identified
LR test for binding restrictions (rank = 2)

Cointegrating eq:	*CointEq1*	*CointEq2*
GDP(–1)	–0.318995	–0.205182
PRI(–1)	–0.158896	89.17449
GOV(–1)	18.53427	24.33833
PUB(–1)	0.029751	89.66257
BUS(–1)	18.47378	–65.13359
INV(–1)	–18.54295	–24.06698
C	6.381452	–6.555101

Error correction:	*D(GDP)*	*D(PRI)*	*D(GOV)*	*D(PUB)*	*D(BUS)*	*D(INV)*
CointEq1	*–0.874058*	*0.000000*	*–0.020484*	*0.000000*	*–0.000774*	*0.000000*
	(0.18106)	(0.00000)	(0,00637)	(0.00000)	(1,89 E–4)	(0.00000)
	[–4.82720]	[NA]	[–3.21211]	[NA]	[–4.09137]	[NA]
CointEq2	*0.000000*	*–0.823548*	*0.000000*	*–0.253372*	*–0.550675*	*–0.548961*
	(0.00000)	(0.18562)	(0.00000)	(0.12537)	(0.23253)	(0.23372)
	[NA]	[–4.43684]	[NA]	[–2.02096]	[–2.36823]	[–2.34877]

Note: Standard errors in brackets and t-statistics in square brackets.

Table 4 Vector error correction estimates (continued)

Error correction:	*D(GDP)*	*D(PRI)*	*D(GOV)*	*D(PUB)*	*D(BUS)*	*D(INV)*
D[GDP(−1)]	0.276273	0.436315	0.049856	−0.158480	0.278203	0.330650
	(0.17659)	(0.12280)	(0.15771)	(0.09680)	(0.16335)	(0.22096)
	[1.56444]	[3.55314]	[0.31612]	[−1.63721]	[1.70315]	[1.49643]
D[PRI(−1)]	−1.801502	25.47610	−3.066019	−20.15889	4.477016	1.222664
	(20.5788)	(14.3097)	(18.3785)	(11.2800)	(19.0349)	(25.7486)
	[−0.08754]	[1.78034]	[−0.16683]	[−1.78713]	[0.23520]	[0.04748]
D[GOV(−1)]	−30.57343	10.09266	7.884989	−10.71025	−0.874540	7.619139
	(11.5844)	(8.05533)	(10.3458)	(6.34987)	(10.7153)	(14.4946)
	[−2.63919]	[1.25292]	[0.76214]	[−1.68669]	[−0.08162]	[0.52565]
D[PUB(−1)]	−3.349066	25.16813	−2.745260	−20.35885	3.966332	1.026617
	(20.7739)	(14.4454)	(18.5528)	(11.3870)	(19.2154)	(25.9928)
	[−0.16121]	[1.74230]	[−0.14797]	[−1.78790]	[0.20641]	[0.03950]
D(BUS(−1))	−27.66191	−16.20691	10.45252	10.20197	−5.400149	5.850571
	(18.6971)	(13.0012)	(16.6981)	(10.2486)	(17.2944)	(23.3942)
	[−1.47947]	[−1.24657]	[0.62597]	[0.99545]	[−0.31225]	[0.25009]
D[INV(−1)]	30.46739	−9.552670	−7.648880	10.43198	1.127100	−7.127002
	(11.4472)	(7.95990)	(10.2232)	(6.27464)	(10.5883)	(14.3229)
	[2.66157]	[−1.20010]	[−0.74818]	[1.66256]	[0.10645]	[−0.49759]

Note: Standard errors in brackets and t-statistics in square brackets.

Table 5 Granger causality test results

Lags = 1	*GDP*	*PRI*	*GOV*	*PUB*	*BUS*	*INV*
GDP		0.1133	0.00466	1.43016	0.10029	0.01388
		(0.7397)	(0.9462)	(0.2451)	(0.7546)	(0.9073)
PRI	5.30558*		0.19971	1.72660	1.93308	0.00095
	(0.0316)		(0.6595)	(0.2030)	(0.1790)	(0.9757)
GOV	1.84733	0.49652		0.39472	0.31423	0.05130
	(0.1885)	(0.4888)		(0.5366)	(0.5810)	(0.8230)
PUB	0.05949	1.59842	7.30286*		2.03187	0.11815
	(0.8097)	(0.2200)	(0.0133)		(0.1687)	(0.8103)
BUS	8.78338*	1.50982	0.73121	1.73656		0.05003
	(0.0074)	(0.2328)	(0.4021)	(0.2018)		(0.8252)
INV	0.18111	0.97834	0.71973	2.34693	0.30604	
	(0.6747)	(0.3339)	(0.4058)	(0.1405)	(0.5860)	

Notes: ➡: denotes that there is causality. ▬: absence of causality sense.

✖: means the relationship between each variable and itself. *Significance at 5%.

Error correction terms (ECT) are interpreted as the speed of adjustment of the short-term relationship to long-term equilibrium; ECT should be a negative number, as a positive value means explosive and not reasonable. As shown in Table 4, all the ECT was significant (all t-statistics of ECT were above the t-table value of 2,101). When the variables were shown as logarithms, and two cointegrating vectors were estimated, these coefficients could be interpreted as long-term elasticities. Meanwhile, the VAR(1) coefficients could be interpreted as short-term elasticities (because a model with variables expressed in the first difference represents a short-term relationship).

The results obtained by the estimated VECM (1) provided six equations. For example, in the first equation, D(GDP), the ECT(1, 1) estimated coefficient of the first cointegrating vector was equal to –0.874058; i.e., the estimated coefficient indicated that about 87% of this disequilibrium was corrected in the course of one year, and the ECT(1,2) estimated coefficient of the second cointegrating vector was null [this null value was due to the cointegration restrictions imposed on the ECT(1, 2)].

However, for the fifth equation D(BUS), the ECT(5,1) estimated coefficient of the first cointegrating vector was equal to –0.000774; i.e., about 0,0774% of this disequilibrium was corrected in the course of one year, and the ECT(5, 2) value was equal to –0.550675; i.e., this result highlights that this disequilibrium was corrected in the course of one year by 55%.

5.5 Granger causality test

While cointegration between six variables does not specify the direction of a causal relation, if any, between variables, economic theory states that there is always granger

causality in at least one direction (Hoover, 2012). In this regard, we verified the direction of granger causality between GDP, PRI, GOV, PUB, BUS, and INV. Estimation results for these tests are presented in Table 5.

Our study aims to illustrate the interactive relationships between all the variables – PRI, GOV, PUB, BUS, INV – and between the variables and GDP, but this does not preclude the study of all possible relationships. From the results of the granger causality tests presented in Table 5 we were able to deduce the direction of causal relationships among variables at the critical threshold (error probability) of 5%.

The table shows that there was a cause and effect way between some variables, and that summary one-way granger causality ran from PRI to GDP, from BUS to GDP, and from PUB to GOV. In other words, the assumption of feedback (bidirectional relationship between these variables pairwise in which the causality goes in both directions) was not confirmed between these variables.

Therefore, the impact of PRI and BUS was deemed to affect the non-oil GDP GDP, and PUB was found to affect GOV. Regarding other causal relationships between the variables, no cause and effect was noted.

6 Conclusions and policy implications

This study aimed to examine the hypothesised validity of a dynamic relationship between non-oil GDP growth rate, private investment share in non-oil GDP, government investment share in non-oil GDP, public investment share in non-oil GDP, business investment share in non-oil GDP and total investment share in non-oil GDP for the UAE. We used the cointegration test and granger causality method on six variables represented by time series data based on annual observations ranging from 1990–2014.

The results suggest that the dynamic relationship hypothesis was supported in a meaningful way for some variables, as Johansen cointegration tests confirmed a long-term equilibrium relationship between these variables. In line with several extant studies for different countries, this study validates the factors affecting the non-oil GDP growth rate hypothesis for certain variables for the UAE. These results are of great importance for policy makers and academics.

The results may help the government to establish priorities regarding the assignment of resources for national strategies pertaining to economic growth and the development of investment. In addition, the results for the uncertainty effects can provide information on the impact of government and public investment on economic growth.

The study reveals that the private investment clearly causes non-oil GDP growth rate. Additionally, the growth in the non-oil economy is caused by the business investment which is a sum of private and public investment. There is no evidence that the public investment alone has an effect on growth. When the government goes into large projects (public investment), the latter requires an increase in government investment.

The Government of Abu Dhabi, UAE (2008) released (The Abu Dhabi Economic Vision 2030). The vision puts a large empowered private sector within a dynamic open economy as a first choice of policy priorities. The decision was taken in the beginning of 1970s, while some surrounding countries implemented planned or even mixed economic systems. The study reached to a core conclusion that the private investment is the strongest engine to build the non-oil economy.

7 Recommendations

- Since it is difficult to access long-term and consistent time series data, it is recommended that future studies should depend on a cross-section of data across all Emirates or economic sectors, and a time series that covers a short period.
- The UAE National Bureau of Statistics should collect and publish data on investment categories such as residential and non-residential investment.
- Further studies are recommended in areas such as how to stimulate the growth of the non-oil economy and to encourage the private sector to increase its investment.
- Future research should focus on modelling the relationship between various characteristics of the UAE that influence the contribution of investments in economic growth.

References

Al-Jundi, S. (2012a) 'Economic diversification in the United Arab Emirates', *Economic Horizons*, Vol. 33, No. 122, pp.9–37.

Al-Jundi, S. (2012b) 'Inflation in United Arab Emirates', *Economic Horizons*, Vol. 33, No. 121, pp.9–26.

Al-Jundi, S. and Hijazi, R. (2013) 'Determinants of private investment in United Arab Emirates', *International Journal of Economics, Commerce and Management*, Vol. 1, No. 2, pp.9–37.

Amin, A.A. (2002) 'An examination of the sources of economic growth in Cameroon', *African Economic Research Consortium*, Nairobi, Kenya, Research Paper 116, pp.1–47.

Bakare, S. (2011) 'A theoretical analysis of capital formation and growth in Nigeria', *Far East Journal of Psychology and Business*, Vol. 3, No. 1, pp.12–24.

Bekhet, H. and Al-Smadi, R. (2016) 'The dynamic causality between FDI inflow and its determinants in Jordan', *International Journal of Economics and Business Research*, Vol. 11, No. 1, pp.26–47.

Case, K., Fair, R. and Oster, S. (2009) *Principles of Macroeconomics*, 9th ed., Pearson Education International, NJ.

Economic and Social Commission for Western Asia (ESCWA) (2001) *Economic Diversification in the oil-producing countries: The case of the Gulf Cooperation Council Economies*, United Nations, New York.

Federal Competitiveness and Statistics Authority (FCSA) (2016) *Publications* [online] http://www.fcsa.gov.ae/ (accessed 11 January 2016).

Ghali, K. and Al-Mutawa, A. (1999) 'The intertemporal causal dynamics between fixed capital formation and economic growth in the group-of-seven countries', *International Economic Journal*, Vol. 13, No. 2, pp.31–37.

Ghosh, S. and Sarker, S. (2015) 'Foreign direct investment and economic growth – an empirical study on Bangladesh economy', *International Journal of Economics and Business Research*, Vol. 10, No. 2, pp.167–178.

Granger, C.WJ. (1980) 'Testing for causality: a personal viewpoint', *Journal of Economic Dynamics and Control*, Vol. 2, No. C, pp.329–352.

Hagemann, H. (2009) 'Solow's 1956 contribution in the context of the Harrod-Domar model', *History of Political Economy*, Vol. 41, No. 1, pp.67–87.

Hatemi-J, A. and Irandoust, M. (2002) 'Investigating causal relations between fixed investment and economic growth', *International Economics*, Vol. 55, No. 1, pp.25–35.

Hoover, K.D. (2012) *Economic Theory and Causal Inference*, Philosophy of Economics, Elsevier B.V. [online] https://doi.org/10.1016/B978-0-444-51676-3.50004-X (accessed 10 October 2016).

International Monetary Fund (2014) *Data and Statistics* [online] http://www.imf.org (accessed 10 January 2014).

Johansen, S. (1988) 'Statistical analysis of cointegration vectors', *Journal of Economic Dynamics and Control*, Vol. 12, Nos. 2–3, pp.231–254.

Johansen, S. and Juselius, K. (1989) *The Full Information Maximum Likelihood Procedure for Inference on Cointegration – with Applications, Mimeo*, Institute of Economics, University of Copenhagen.

Khan, M. and Reinhart, C. (1989) *Private Investment and Economic Growth in Developing Countries*, International Monetary Fund (WP/89/60), pp.1–16.

Kivyiro, P. and Arminen, H. (2015) 'GDP, FDI, and exports in East and Central African countries: a causality analysis', *International Journal of Business Innovation and Research*, Vol. 9, No. 3, pp.329–350.

Kwiatkowski, D., Phillips, P.C.B., Schmidt, P. and Shin, Y. (1992) 'Testing the null hypothesis of stationarity against the alternative of a unit root, How sure are we that economic time series have a unit root?', *Journal of Econometrics*, Vol. 54, Nos. 1–3, pp.159–178.

Lequiller, F. and Blades, D. (2006) *Understanding National Accounts*, OECD Publishing, Paris.

MacKinnon, J.G., Haug, A.A. and Michelis, L. (1999) 'Numerical distribution functions of likelihood ratio tests for cointegration', *Journal of Applied Econometrics*, Vol. 14, No. 5, pp.563–577.

Madsen, J. (2002) 'The causality between investment and economic growth', *Economics Letters*, Vol. 74, No. 2, pp.157–163.

Podrecca, E. and Carmeci, G. (2001) 'Fixed investment and economic growth: new results on causality', *Applied Economics*, Vol. 33, No. 2, pp.177–182.

Raheem, I. and Adeniyi, O. (2015) 'Capital inflows and outflow and economic growth in Sub-Saharan Africa', *International Journal of Economics and Business Research*, Vol. 10, No. 1, pp.66–80.

Sooreea-Bheemul, B. and Sooreea, R. (2013) 'Missing causality links between foreign direct investment, exports, domestic investment and economic growth', *International Journal of Business and Emerging Markets*, Vol. 5, No. 4, pp.322–340.

The Government of Abu Dhabi (2008) *The Abu Dhabi Economic Vision 2030*, Abu Dhabi.

The World Bank (2014) *Data* [online] http://www.worldbank.org/ (accessed 10 January 2014).

UAE Ministry of Economy (2014) *Economic Statistics Reports* [online] http://www.economy.gov.ae/ (accessed 10 January 2014).

UAE Ministry of Planning (1987) *Economic and Social Development in UAE 1975–1985*, UAE Ministry of Planning, Abu Dhabi.

UAE Ministry of Planning (1993) *Economic and Social Development in UAE 1985–1990*, UAE Ministry of Planning, Abu Dhabi.

UAE Ministry of Planning (1998) *Economic and Social Development in UAE 1990–1995*, UAE Ministry of Planning, Abu Dhabi.

UAE National Bureau of Statistics (2014) *Statistics* [online] http://www.uaestatistics.gov.ae (accessed 16 October 2014).

UN Statistics Division (2014) *Statistical Databases* [online] http://unstats.un.org (accessed 10 January 2014).