DO GROSS NATIONAL SAVINGS AND GROSS CAPITAL FORMATION CONTRIBUTE TO OMAN'S ECONOMIC GROWTH? AN EMPIRICAL STUDY

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Abstract

The purpose is to examine the long-term relationship & cointegration among gross domestic product (GDP), gross capital formation (GFC), and gross national savings (GNS) at the current price level in Oman. The study has taken secondary data from the last 10 years (2010–2021). The study design is longitudinal. The studies applied the correlogram test to check whether the series are stationary or not. and also, the Granger causality test to find the direction of the GDP, GFC, and GNS. This study further used the Eagle Granger residual-based cointegration test and DOLS approaches to identify the long-run cointegration between GDP and its independent variable. With the application of the correlogram test, it has been found that GDP and GFC are stationary at their current levels, whereas GNS is stationary at the first difference. The study reported that there is no significant relationship between saving, capital formation, and economic growth at current prices. However, the finding also that there is no long-run cointegration between GDP at current prices and GNS and GFC. As the study is based on the current price which affects nominal GDP, not real GDP. It has been suggested to increase the saving to achieve a constant growth rate.

Keywords
Gross domestic product; Gross National saving; Gross capital formation; cointegration; current; Economy

JEL classification
E1-General Aggregative models

Introduction and literature review

Gulf countries have experienced significant economic growth, primarily driven by the oil sector. This has led to increased revenues, allowing these countries to invest in various sectors such as infrastructure, education, and healthcare. However, relying heavily on the oil sector poses risks due to frequent changes in the price of oil and the finite nature of these resources. Consequently, understanding the factors contributing to economic growth beyond the oil sector is crucial for diversifying their economies and ensuring sustainable development. Finance Map of the World (2013) defined economic growth as an increment in the productivity of goods and services in any country from the previous year.

Roy Harrod (1939) and Evsey Domar (1946) gave a slow growth model, which suggested that if the government encouraged saving in the country, it would lead to economic growth. They gave a mathematical equation, $G = (\Delta Y/Y) = (s/k)$, which states that if you increase saving, it will increase output. According to Prashanth Kanniga (2021), capital formation is the result of saving which further accelerates economic growth by adding the productivity of labor and large-scale production. He also stressed

that if a country increases its saving it can use its resources in the best manner which increase output, reduce unemployment and solve the problem of unemployment and make the economy free from debt.

Chow (1993) researched that in China. Those who have accumulated saving act as an engine for economic growth, saving stimulates fixed capital and the country can achieve high economic growth with sufficient savings. According to (Wollasa. L.Kumo, 2011) insufficient saving and investment specifically in developing nations is a constraint for economic growth, especially in sub-Sahara Africa.

Bakare (2011) used the OLS model to investigate the relationship between capital formation and economic growth in Nigeria. He discovered that there is a significant positive relationship between national income and saving, which accelerates economic growth, and he suggested that the government promote the habit of saving to have sustained economic growth.

C. Mphuka (2010) examines the causality between economic growth and saving in Zambia using the VAR model. Findings indicate that economic growth and saving are unidirectional, which means economic growth is the cause of saving and not vice versa. Nicholas M. Odhiambo (2008, 2009) conducted two studies, one in Kenya and the other in South Africa, to compare the relationship between saving and economic growth. He used causality and co-integration tests to conduct the study. A study proved that there is a significant positive relationship between savings and economic growth.

Mohan (2006) examined the relationship between economic growth and saving at different levels of income. He collected secondary data from 20 countries and found that growth rate leads to saving in 13 countries, but in other countries, growth rate and saving are bidirectional and cause each other. Jagadeesh, D. (2015), investigates the application of the Harrod model in the economy of Botswana to understand the relationship between saving and economic growth. He used the ARDL model to prove his result. The study found that there is a significant relationship between saving and economic growth, and the study also supports the Harrod-Domar growth model. Kaur, S. (2021) found that the GDP of Saudi Arabia is largely dependent on capital formation and gross savings, and she proved a positive linear relationship between gross capital formation and the GDP of the country. K. R. V. Rao (1980): The main objective of this study based on financial planning is to determine how much capital formation and saving have increased in India during the last three decades, which stimulates economic growth. This paper examined the policy of the government as well as the effective utilization of the resources in the country for economic and social welfare. Therefore, the main aim of this study is to find the causal relationship and cointegration between gross domestic product (GDP), gross national saving (GNS), and gross capital formation (GCF) in the Oman economy. This study also focused on whether the behavior of Saving and capital formation contributes to the economic growth (GDP at current price) of the Oman economy.

Rationale of the study

The above research produced diverse findings addressing the relationship between savings, capital formation, and economic development. While some studies claim that savings lead to economic development, others support savings and growth as being indirectly related. The effects of saving and growth are different in different countries, and they purely depend on whether a country is developed or developing. Because per-capita income is different among the countries. However, countries with a high rate of saving lead to capital formation and accelerate economic growth indirectly, and some result shows that economic growth causes saving. There is a mixed view about the relationship among the given variables.

Oman is a developing nation, and there is a low rate of saving. Inadequate saving is a common question in most developing nations, which leads to poor economic growth, a high unemployment rate, and increased poverty. Although this study provides insight into whether saving, capital formation, and GDP have a unidirectional, bidirectional, no relationship or all three are independent of each other, it also examines the cointegration of capital formation, saving, and economic growth in the Sultanate of Oman. Therefore, the main objective of this study is to analyze the role of capital formation and saving in the economic development of Oman at the current price level.

Conceptual framework

We can derive a mathematical model here based on the growth model given by Harrod and Domar which is GDP=f (GCF, GNS) as per our objective. Figure 1 explains the conceptual framework where relationships among GDP, GNS, and GCF have been established and the combined impact of GNS and GCF on gross domestic product. This figure shows that GDP, GNS, and GCF are affecting each other, and GCF and GNS jointly affect GDP.
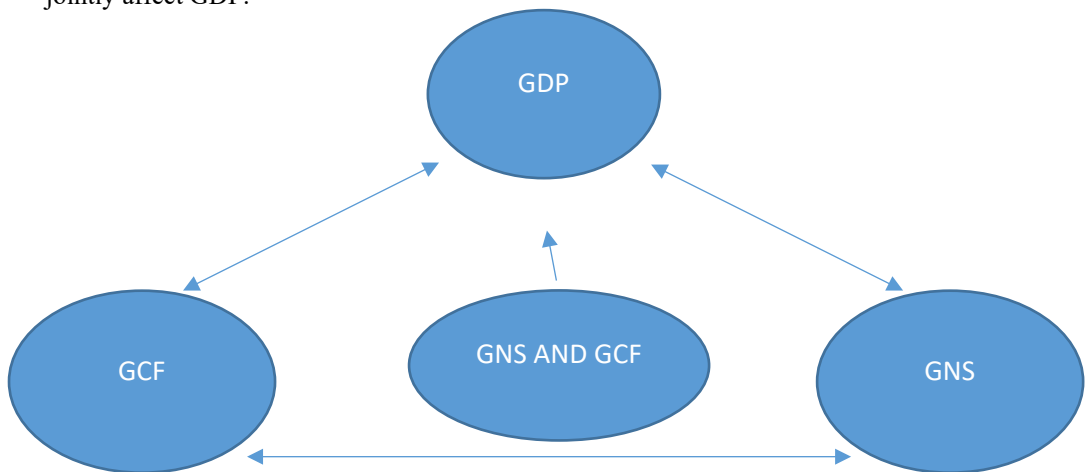

Figure 1 Conceptual framework

Aims and Objectives of the Study

The main aim of this study is to examine the role of savings and capital formation in the economic development of the Sultanate of Oman.

Specific objectives of the study

1. To investigate the causal relationship between gross savings, gross capital formation, and gross domestic product of the country
2. To identify the long-run integration among GNS, GCF, and GDP of Oman

Hypotheses of the study

For objective -1, we have created six null hypotheses.

H0(1)-GDP does not cause GNS.
H0(2)-GNS does not cause GDP.
H0(3)-GDP does not cause GCF
H0(4)-GCF does not cause GDP.

H0(5)-GNS does not cause GCF.
H0(6)-GCF does not cause GNS.
For objective 2, we have created two hypotheses.
1. H (0): There is no long-run cointegration among GNS, GCF, and GDP.
2. H (1): There is long-run cointegration among GNS, GCF, and GDP.

Research Methodology

In this study, we have examined the relationship between GDP, GNS, and GFC in Oman's economy. The study design is descriptive as we have explained the behavior of the given variables. The study constitutes a longitudinal study as secondary data has been collected over the last 11 years. The research design is descriptive and longitudinal, and a quantitative method has been used to reach our objectives. Time series data on gross national savings, gross capital formation, and GDP at current prices covering the period from 2010 to 2021 have been collected from NCSI-Oman (Table 2). Gross Domestic Product, Gross National Savings, and Gross Capital Formation are the variables listed in Table No. 1 of this paper. The econometric software package E-Views for Windows is used to process these statistics.

Table 1 Variables of the study

Variable Type	Variable Name
Dependent	Gross domestic product at the current price
Independent	Gross national savings at the current price
Independent	Gross capital formation at the current price

Table 2 GDP, GNS, GCF for the period (2010-2021)

Time	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Gross National Saving at the current price		1160 7.9 0	1309 8.5 0	1311 0.6 0	1184 4.0 0	6708.60	5502.90	6194.50	9449.00	7457.90	3329.82	5878.23
Gross Fixed Capital Formation at the current price		8508.10	9293.80	10 35 4.80	10 63 1.30	10 29 3.30	11 35 2.30	10 35 9.50	10 72 8.10	9803.40	9215.71	8687.47
GDP at Current Prices	24 99 0.02	29 79 7.76	33 60 8.68	34 58 0.44	35 64 2.81	30 26 4.33	28 88 7.04	31 08 9.35	35 18 4.00	33 85 9.40	29 18 7.16	33 90 9.82

Source: NCSI-Oman

To examine the causality and co-integration among GDP, GNS, and GCF, various time series models have been applied. To test whether the data series is stationary or not, the correlogram method has been applied in the study, and further Eagle Granger residual-based co-integration, and the OLS approach has been used.

We must determine whether the data series is stationary or not before running the Granger causality test and both co-integration tests. All the tests can only be used if the series is stationary. In this study, the correlogram formal method has been used to determine whether the GDP, GCF, and GNS time series is stationary or not, which is going to justify the auto-correlation between data sets over various periods with the

help of the E-views program. Further, the data will be analyzed using the Granger causality and Eagle Granger cointegration models and the OLS model to test the cointegration between the series.

Data analysis and interpretation

In an attempt to find the direction of causality and co-integration between all variables (savings, economic growth, and capital formation) it is important to understand whether the time series are stationary or not. Given below is the autocorrelation of the GDP, GNS, and GCF in Tables no. 3, 4, 5, and 6.

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.177	0.177	0.4778	0.489
		2	-0.356	-0.399	2.6020	0.272
		3	-0.369	-0.258	5.1402	0.162

Sample: 2010-2021, observation-12, lag-3

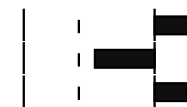**Figure 2 Correlogram of GDP at level**

Here the p-value is greater than 0.05, so we can conclude that the data is stationary at the level. Even the spikes of autocorrelation are in between the vertical dotted lines, which shows that the data is stationary at the level.

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.434	0.434	2.6932	0.101
		2	0.114	-0.092	2.8988	0.235
		3	-0.185	-0.248	3.5137	0.319
		4	-0.279	-0.120	5.1065	0.277

Sample: 2011-2021, observation-11 after adjustment, lag-3

Figure 3 Correlogram of GFC at level

Here p-value is greater than 0.05 so we can conclude that data is stationary at the level. Even the Auto correlation spikes are also in between the vertical lines which shows that the data series is stationary at level.

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.627	0.627	5.6262	0.018
		2	0.111	-0.466	5.8212	0.054
		3	-0.072	0.250	5.9135	0.116

Sample: 2011-2021, observation-11 after adjustment, lag-3

Figure 4 Correlogram of GNS at level

Here p-value is less than 0.05 so we can conclude that the data series is non-stationary at the level. Even the spikes of auto correlation are also outside the vertical lines which

shows that the data series is nonstationary at a level. To make it stationary we have created a new series of GNS with the first difference as given below in Fig no. 5

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.009	-0.009	0.0010	0.974
		2	-0.473	-0.473	3.3607	0.186
		3	-0.295	-0.394	4.8570	0.183

Sample: 2012-2021, observation-10 after adjustment, lag-3

Figure 5 Correlogram of GNS at First Difference (DGNS)

In fig no. 5 Here p-value is greater than 0.05 so we can conclude that data is stationary at the first level not at the level. Even the spikes are also in between the vertical lines which shows that the DGNS is stationary at the first difference.

As a result of the correlogram test, we can conclude that GDP and GCF are stationary at the level and DGNS stationary at the first difference. Further, to perform the causality and co-integration tests, we have used GDP, GCF, and DGNS (gross national saving at first difference) to satisfy our above-mentioned objectives.

Objective-1

Null Hypothesis:	Obs	F-Statistic	Prob.
GDP does not Granger Cause DGNS	8	3.85867	0.1481
DGNS does not Granger Cause GDP		0.16497	0.8551
GFC does not Granger Cause DGNS	8	2.50611	0.2291
DGNS does not Granger Cause GFC		0.38108	0.7121
GFC does not Granger Cause GDP	9	0.71325	0.5434
GDP does not Granger Cause GFC		0.00792	0.9921

Sample: 2010-2021, lag-2

Figure 6 Pairwise Granger causality test

The Granger causality test, as reported in Fig. 6, shows that there is no causality between gross national saving, gross capital formation, and GDP. The p-value is greater than the significance level of 0.05, indicating that null hypotheses are accepted. None of the variables is the cause of the other. All variables are independent, which means GDP, DGNS, and GCF are not statistically significant. Hence, we can conclude that there is no causality among the GDP, DGNS, and GCF. Additionally, the behavior of DGNS and GFC is not able to forecast the behavior of economic growth and vice versa.

Objective -2

To identify the long-run integration among GNS, GCF, and GDP of Oman. We have used two tests. The main assumption of this test is all variables should be stationary which we have satisfied by the correlogram test.

1. Eagle granger residual-based cointegration test

2. OLS (ordinary least square)

Empirical test-1-eagle granger residual-based cointegration test

This test has been performed in three steps

Step-1 Model for Eagle Granger residual-based test

GDP=a+b1 (GCF)+b2 (DGNS)+e where a is the intercept, b1 and b2 are the coefficient and e is the error

Step-2 Estimate its residual error.

Residuals from equation with dependent variable GDP
Modified: 2010 2021 // makeresids error

```
    -3398.1701...
    -489.93573...
    121.497304...
    1634.89004...
   -1426.5551...
   -2640.8739...
    -403.06347...
    2171.51062...
    2010.92121...
    -693.00742...
    3112.78664...
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Sample-2010-2021

Figure 7 Residual error of Eagle Granger residual cointegration test dependent variable GDP

Step-3 Application of unit root test on the error series.

As shown in Fig. 8, the null hypothesis is error has a unit root, indicating that the error series is non-stationary. In the figure, the p-value is 0.1483, which is more than 0.05 significant level, so hypotheses have been accepted and we can conclude that the error series has a unit root and series is non-stationary at level, which proves GDP, which is a dependent variable, is not co-integrated with saving and capital formation.

As the Engle-Granger test considers the null hypothesis that there is no cointegration, which means there is no correlation between GDP (a dependent variable) and DGNS and GCF (an independent variable) in the long run which accepts the null hypothesis of our objective -2 and reject the alternate hypothesis.

Null Hypothesis: ERROR has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.474684	0.1483
Test critical values:	1% level	-4.297073	
	5% level	-3.212696	
	10% level	-2.747676	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
    and may not be accurate for a sample size of 10

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ERROR)
Method: Least Squares
Date: 04/04/23   Time: 16:33
Sample (adjusted): 2012 2021
Included observations: 10 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERROR(-1)	-0.833884	0.336966	-2.474684	0.0384
C	391.5254	611.0750	0.640716	0.5396

R-squared	0.433591	Mean dependent var	651.0957
Adjusted R-squared	0.362790	S.D. dependent var	2384.839
S.E. of regression	1903.709	Akaike info criterion	18.11785
Sum squared resid	28992856	Schwarz criterion	18.17837
Log likelihood	-88.58926	Hannan-Quinn criter.	18.05146
F-statistic	6.124062	Durbin-Watson stat	1.721285
Prob(F-statistic)	0.038429		

Sample-2010-2021

Figure 8 Unit root test with dependent variable GDP
Empirical Test-2-OLS method to test cointegration

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	34388.27	9598.617	3.582627	0.0089
DGNS	0.542417	0.282997	1.916688	0.0968
GFC	-0.144577	0.951461	-0.151953	0.8835

R-squared	0.350177	Mean dependent var	32621.30
Adjusted R-squared	0.164514	S.D. dependent var	2524.181
S.E. of regression	2307.226	Akaike info criterion	18.56880
Sum squared resid	37263044	Schwarz criterion	18.65958
Log likelihood	-89.84402	Hannan-Quinn criter.	18.46922
F-statistic	1.886085	Durbin-Watson stat	1.445586
Prob(F-statistic)	0.221198		

Sample-2012-2021 Number of observation-10 after adjustment

Figure 9 Least square method, GDP as the dependent variable, GFC, DGNS as the independent variable

In this study, the DOLS approach is also applied to identify dynamic long-run cointegration between GDP and its independent variables. Here, the p values of GFC and DGNS are greater than 0.05, so the result is insignificant, and we accept the null hypothesis that there is no cointegration among GDP, DGNS, and GCF. Even the value of R, which is 0.3, is not much and does not count for GDP. value of f-statistics 1.8860,

which is above 0.05, which shows that we accept the null hypothesis that GDP, DGNS, and GFC do not co-integrate and affect GDP much. So, we can conclude that capital formation and saving do not explain GDP at the current price in the Oman economy as per the last 11 years of data. Both tests provide the same decision, which means there is no long-term integration between GDP, DGNS, and GFC.

The finding of the study

Table 3: Hypotheses and their related decision

Objectives	Hypothesis	P value is greater than 0.05	Decision
1	H0(1)-GDP does not cause GNS	Yes	Accept
	H0(2)-GNS does not cause GDP	Yes	Accept
	H0(3)-GDP does not cause GCF	Yes	Accept
	H0(4)-GCF does not cause GDP	Yes	Accept
	H0(5)-GNS does not cause GCF	Yes	Accept
	H0(6)-GCF does not cause GNS	Yes	Accept
2	H(0)-There is no long-run cointegration among GNS, GCF, and GDP	Yes	Accept
	H(1)-There is long-run cointegration among GNS, GCF, and GDP	Yes	Reject

level of significance 5% (0.05)

The result shows that Oman's economic growth (GDP at current prices) does not cause GNS or GCF, and neither gross capital formation nor gross national saving cause gross domestic product as per 2010–2021 data at current prices. and also, there is no long-run correlation between growth, saving, and capital formation at the current price.

Conclusion

We investigate the causal relationship of GDP, GCF, and GNS and the long-run impact of GNS and GCF on GDP, and for this, the last 11 years of time series were used. It has been concluded that there is no causal relationship among the GNS. GDP and DGNS mean that the behavior of GDP, national savings, and capital formation cannot be forecasted with each other at the current price level. As a result of objective number - 2, it was explained that economic growth is not co-integrated with saving and capital formation with the application of both the model of Eagle Granger residual-based cointegration and the ordinary least squares method. There is no combined effect of GNS and GCF on GDP at the current price of the country in the long run.

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