An Empirical Study of Factors Influencing Australia's GDP

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Abstract

GDP is currently the most comprehensive and effective indicator of the national economic situation in the world. Macroeconomic indicators are used to analyze the development trend and operation of the national economy. When analyzing economic growth and macroeconomic operation, GDP plays a great role. In some situations, it is used to identify factors of economic growth and their impacts. This paper takes data from 1981 to 2019 and investigates the impact of five variables (Gross Saving; Consumer Price Index; Unemployment; Population and Real Interest Rate) on Australia's GDP growth using multiple linear regression methods. From the paper, Gross Saving and Interest Rate have produced positive and statistically significant results in Australia's GDP growth. However, the Consumer Price Index, Unemployment, and Population are quite the opposite (refer to formula 2). According to the results of the study, the government should do its best to maintain the stability of GS, CPI, UNEMP, POP and IR to maintain sustained and healthy economic development.

Keywords: *GDP, Multiple Regression, Australia.*

1. INTRODUCTION

Gross domestic product (GDP) is the total social output under the system of national accounts (SNA). It refers to the sum of the market value of all final products produced by the economic society (a country or region) using factors of production in a certain period of time. GDP is an important indicator to measure the economic situation and national development level, the core indicator of national accounts, and an important indicator of concern to the world economy. Many countries use GDP to measure the potential and competitiveness of economic development and have an impact on the formulation of economic policies and the regulation of social resource allocation. At this stage, GDP has a deeper connotation and extension. Green GDP is to deduct the cost of economic losses caused by environmental pollution, degradation of natural resources, poor education, out-of-control population and mismanagement from the current GDP, so as to obtain the real total amount of national wealth. Green GDP reflects humanity's new attitude toward the relationship between humans and nature.

Analyzing the influencing factors of economic growth has always been the focus of academic research on economic growth theory. Keynes used the expenditure method to calculate GDP of national income as: total income = total expenditure = consumption (C) + investment(I) + government purchases(G) + net export (NX), in which C, I, and NX are called “troika” that drive the economy [6]. Modern economic growth theory emphasizes the important role of capital accumulation and technological progress in economic growth.

The GDP of any country is influenced by different macroeconomic variables, and modern scholars have also conducted extensive research on this. General macroeconomic variables include interest rates, savings, unemployment, and international direct investment. Mehmood investigated the impact of 13 independent variables on the GDP of Pakistan and Bangladesh [12]. The return of the panel shows that gross national spending, merchandise exports, gross savings and final consumption spending have a positive impact on Pakistan's GDP, while

G. Vilas Bhau et al. (Eds.): MSEA 2022, ACSR 101, pp. 581–586, 2023.
https://doi.org/10.2991/978-94-6463-042-8_83

gross national spending, total external debt stock, and merchandise imports and exports have a positive impact on Bangladesh's GDP. Anghelache and Anghel argued that employees, labor productivity, skill levels, investment and international direct investment, imports, exports or net exports, and total consumption all influence the evolution of GDP [3].

Of course, there is also some literature that studies the significant extent to which a single or mere variable has a macroeconomic impact. Jangili examined the relationship between savings, investment and economic growth in India from 1951 to 2008 at aggregate and sectoral levels, using the Granger causal test [10]. The conclusion was drawn that there was a reciprocal relationship between savings and investment in the private sector and economic growth. But Budha used annual time series data from 1975 to 2010 to study the relationship between gross domestic savings, investment and growth in Nepal, arguing that there is no short-term causal relationship between domestic savings and GDP [2]. In a number of country-specific studies, Anghelache et al. analyzed Romanian GDP using a multiple regression model and concluded that GDP was significantly affected by changes in final consumption and total investment [4]. Villanueva analyzed the factors that affected Romania's GDP between 1994 and 2014 [1]. The results show that final consumption and total investment are the main influencing factors during this period. Khan and Chhapra used data from 30 years of Pakistan's economy to analyze the influence of GDP and macroeconomic variables on Pakistan's economic growth [13]. The results show that there is a long-term relationship between unemployment, inflation and other factors and GDP. But when Singh studied the impact of inflation on India's GDP and unemployment rate based on data from 2011 to 2018, he argued that the correlation between unemployment and GDP was not significant, arguing that the unemployment rate was insignificant among the macro factors affecting the economy [11].

Sher et al. study empirically examined the impact of population growth on Pakistan's economic development between 1975 and 2008 [14]. Demographic shifts have helped to maximize the use of the country's demographic potential. It can be concluded that the impact of population growth is divided into two parts: direct and indirect. The direct impact is positive for economic development, but if indirect analysis leads to unemployment, the opposite is true. Alana et al. used data from seven countries since 1820, the findings suggest that the two sequences of GDP and population growth are highly persistent and have a long-term equilibrium relationship [8]. Giovanni and Shambaugh studied the relationship between the interest rate level of some industrial countries and the annual real output growth of other countries [7]. The results show that in countries with fixed exchange rates, high foreign interest rates will shrink the annual real GDP growth of the domestic economy. Previous studies have shown that the factors influencing GDP are complex, that the same factor may have different effects on the macroeconomic conditions of different countries, and that different research methods may lead to different conclusions. This article will examine the factors that may affect Australia's GDP based on the state of its economy.

Australia is the most economically developed country in the southern hemisphere, the world's fourteenth largest economy, and the world's fourth-largest exporter of agricultural products [5]. Its GDP plays a pivotal role in the world.

Although its GDP output is rising year by year, its share of the world's total GDP is on a downward trend. Studying the factors that affect Australia's GDP will be more useful for us to understand the overall economic situation in Oceania and the main drivers of Australia's economic growth. Exploring the reasons why Australia's economic growth is slower than the global economy can provide a theoretical basis for the formulation of Australia's macroeconomic policy.

2. METHODOLOGY

In this section, the paper describes our sample, variables and the model used in determining the impact of the independent variables on Gross Domestic Product in Australia. The sample used is of 5 variables (Gross Saving, Consumer Price Index, Unemployment, Population and Real Interest Rate) covering the period 1981-2019 [9].

2.1. Data and Variable Descriptions

All the time series data are from 1981 to 2019 and measured annual. The dependent variable GDP is real GDP measured by annual growth rates. The independent variables are the variables unemployment and interest rates measured in annual percentages. While Gross Saving is our measure for Australian savings measured as million’s dollars. The variable CPI represent Consumer Price Index measured as an annual percentage growth rate, and Population is measured as thousand. More detailed to describe information is shown in table 1:

TABLE 1. DESCRIPTION OF DATA

Variables	Abb	Resources	Unit
Gross Domestic Product	GDP	ABS	percent
Gross Saving	GS	ABS	$ Millions
Consumer Price Index	CPI	ABS	percent
Unemployment	UNEMP	ABS	percent
Population	POP	ABS	thousand
Interest Rate	IR	World Bank	percent

NOTE: ABS means Australian Bureau of Statistics; na means do NOT make any transformation

The table clearly shows that all the seven variables except Interest Rate are derived from ABS, and the data

of Interest Rate is collected from the World Bank website. The value of Gross Savings and Population was too large, the author performed do log transformation on these two variables to make the regression results better.

In Figure 1, Population and Gross Savings show an increasing trend from the year 1981 to 2019, while the Unemployment rate, Real Interest rate and CPI are trending downward in general. GDP showed a large fluctuation range before 2000, and then gradually stabilized at around 2.5%.

2.2. Model Specification

This paper uses simple multiple regression analysis to test GDP as the dependent variable against the above-mentioned independent variables. The model used in our study is as follows:

$$GDP_t = \beta_0 + \beta_1 \ln(GS)_t + \beta_2 CPI_t + \beta_3 UNEM_t + \beta_4 \ln(POP)_t + \beta_5 IR_t + \mu_t \quad (1)$$

Where t means time; $\beta_0, \beta_1, \ldots \beta_5$ are the estimated coefficient of independent variables; and μ is the error term.

In this study, we managed to measure how those variables such as GS, CPI, UNEMP, POP and IR affect the growth of GDP. Sibanda (2009) stated that numerical data can be used for mathematical models, theories and description phenomena in this study. Since all data in this study were in numerical form, a quantitative study was used to run the test.

2.3. Hypothesis

To identify the effect of the selected determinants on GDP and the study used five hypotheses which are presented below:

H1: GS has a positive relationship with GDP.

H2: Population has a positive relationship with GDP.

H3: The inflation rate is negatively related to GDP.

H4: Unemployment is negatively correlated with GDP growth.

H5: The real interest rate is positively related to the GDP growth rate.

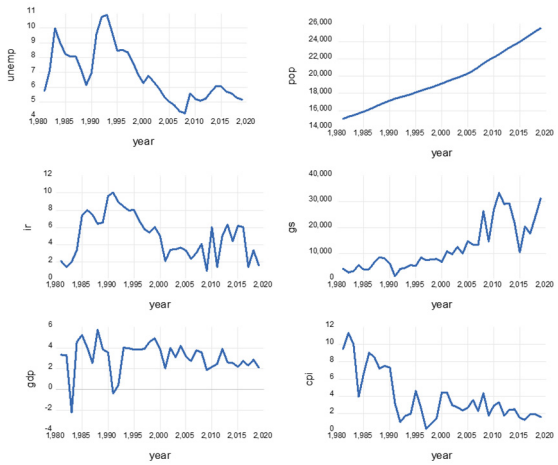

Figure 1. All variables' trends

2.4. Descriptive Statistics

In part C, we made bold assumptions about the relationship between variables based on a rule of thumb. In this section, we measure the strength and direction of the linear relationship between variables to determine whether the relationship between variables is positive or negative.

TABLE 2. CORRELATION COEFFICIENTS

	GDP	GS	CPI	UNEM	POP	IR
GDP	1.0000	-0.0819	-0.0387	-0.1499	-0.1472	0.1411
GS	-0.0819	1.0000	-0.4129	-0.6966	0.8403	-0.3839
CPI	-0.0387	-0.4129	1.0000	0.1488	-0.6563	-0.0210
UNEM	-0.1499	-0.6966	0.1488	1.0000	-0.6527	0.5739
POP	-0.1472	0.8403	-0.6563	-0.6527	1.0000	-0.3356
IR	0.1411	-0.3839	-0.0210	0.5739	-0.3356	1.0000

Note: Using 5% critical value

Table 2 shows the correlation between the explanatory variables specifically with respect to GDP. We could see that GDP is positively correlated with IR (14.11%). However, it is also demonstrated that GDP has a negative relationship with GS (8.19%), CPI (3.87%), UNEM (28.9 per cent) and POP (14.72%).

3. RESULTS AND DISCUSSION

Multiple regression analysis and ordinary least squares were used to estimate Australia's GDP growth model. Since most time series contain unit root, it will have an impact on our linear regression results. We choose

Augmented Dickey-Fuller (ADF) to do a unit root test for the stationarity of all time series. To test whether the regression model fulfils the Classical Linear Regression Model (CLRM) assumption or not, VIF Test was used to test the model. The techniques described above allow us to test the availability of multicollinearity, autocorrelation, and heteroskedasticity assumptions in the model.

3.2. Ordinary Least Square Method

The estimated regression model:

$$GDP_t = 136.49 + 1.18 * \ln(GS)_t - 0.33 * CPI_t - 0.62 * UNEM_t - 14.15 * ln(POP)_t + 0.21 * IR_t \quad (2)$$

Table 3 shows some of the statics of the regression model. R squared and Adjusted R squared is one of the reference indicators used to measure how well the model fits. R-square equal to 0.431 indicates that about 43.1 per cent of the variability of GDP could be explained by the five independent variables. The adjusted R-square is 34.5 per cent. Although both results show lower R-squared values, it still gives us more information and examines the significant relationship between GDP and other variables. In view of the results (Table 3), the p-value indicated in parentheses it can be concluded that the model is significant since F-statistic fall in the rejection region at 1% significance level. The p-values in parentheses can be concluded whether the model is significant. Since F statistic falls into the rejection region at the 1% significance level, our model is significant. (The abbreviations of all variables are shown in Table 1. Such as GS means gross saving.)

TABLE 3. R SQUARE AND F STATISTIC RESULTS

Results	Value
R^2	0.715
Adjusted R^2	0.685
F Statistic	5.000*** (df = 5; 33)

Note: *** - 1% significant; ** - 5% significant; * - 10% significant;

Thus, the regressor is significant in explaining the dependent variable, CPI, POP and UNEMP have a significant effect on GDP in Australia as it is statistically significant as the P-value is less than 0.01. And the p-value of GS and IR is less than 0.05 at 5% level of significance which means that they also have a significant effect on GDP. It also can be noticed that the factors of GS and Real Interest Rate have a positive impact on GDP growth in Australia which is the same as what we expected. While CPI, POP and UNEMP is correlated negatively with the GDP. Based on our previous hypothesis, we find that our assumptions are basically met, except for the population.

TABLE 4. OLS REGRESSION RESULT

Results	Estimates	SE
Constant	136.487***	30.365
ln(GS)	1.181**	0.576
CPI	-0.326***	0.112
UNEM	-0.617***	0.207
ln(POP)	-14.151***	3.241
IR	0.206**	0.095

Note: *** - 1% significant; ** - 5% significant; * - 10% significant;

The coefficient of $ln\,(GS)$ is 1.18, indicating the reliability of the country's GDP to $ln\,(GS)$, if GS changes by 1 percentage point, then Australia's GDP will increase by 0.0118 units. The coefficient of the CPI parameter is -0.33, indicating the dependence of the country's GDP on the CPI. If the CPI parameter changes by one unit, then Australia's manufacturing industry will decrease by 0.33 units. The UNEM parameter has a coefficient of -0.62, which means that if UNEM changes by one unit, Australia's GDP will decrease by -0.62 units. The coefficient of $ln\,(POP)$ is 14.15, indicating the reliability of the country's GDP to $ln\,(POP)$, if POP changes by 1%, then Australia's GDP will decrease by 0.1415 units. The IR parameter has a coefficient of 0.21, which means that if UNEM changes by one unit, Australia's GDP will increase by 0.21 units.

TABLE 5. UNIT ROOT TESTS

Variables	Level		First Difference	
	Constant	*Constant & Trend*	*Constant*	*Constant & Trend*
GDP	0.0001	0.0006	0.0028	0.0163
ln(GS)	0.4063	0.0076	0.0000	0.0000
CPI	0.1185	0.0423	0.0000	0.0000
UNEM	0.5059	0.0518	0.0012	0.0079
ln(POP)	0.8951	0.0947	0.0397	0.0198
IR	0.3309	0.2138	0.0000	0.0000

3.2. Stationarity and Correlation

Many economic and financial time series exhibit trends or non-stationarity. It is known that most of the time series macroeconomic data contain unit roots caused by random trends, even though in some cases the trends follow a random walk process. If a time series is non-stationary, that may produce invalid results in most empirical studies. In linear regression analysis, unit root detection is a very important step. The results of the unit root test based on the ADF test are shown in Table 4.

As shown in the table above, if the unit root test result shows that the p-value is less than 5%, the null hypothesis is rejected, indicating that the variable is stationary. It is clear that those six variables are stationary at the first difference, based on ADF tests.

3.3. Multicollinearity

Since the variables may be correlated, this can lead to multicollinearity among the variables. And the Variance Inflation Factor (VIF) is often used to test for multicollinearity problems. This paper uses VIF to test whether our regression model has multicollinearity. We obtained the Variance Inflation Factor to check if multicollinearity exists among the independent variables.

TABLE 6. MULTICOLLINEARITY ANALYSIS OF SELECTED VARIABLES

Tes	$ln(GS)$	CPI	$UNEMP$	$ln(POP)$	IR
VIF	5.2913	2.722	3.6143	6.5554	1.526

As a rule of thumb, a VIF greater than 10 indicates detrimental collinearity. Table 5 shows that VIF for all the variables is less than 10 which means that our regression model does not exist with multicollinearity problems and is reliable.

3.4. Correlation

In some models, when we check the error term after doing the regression, we will find that the variance of the error term is non-constant. This is heteroscedasticity. The presence of heteroscedasticity can lead to model inefficient. Therefore, it is necessary to detect heteroscedasticity. The most common method for detecting heteroscedasticity is the White Heteroscedasticity Test.

TABLE 7. WHITE HETEROSCEDASTICITY TEST

Test	F-statistic	Obs*R-squares
P-value	0.0004	0.0267

In Table 4, p-value is less than 0.05 which means that there is an existence of heteroscedasticity. And it also means that the variance of the error term is not stable.

To solve the heteroscedasticity problem in our original model, the author chooses to revise the model, and get the revised model in which heteroscedasticity issues are fixed.

TABLE 8. ADJUSTED OLS RESULT

Results	Estimates	SE
Constant	136.487***	31.056
ln (GS)	1.181	0.801
CPI	-0.326***	0.134
UNEM	-0.617***	0.297
ln(POP)	-14.151***	3.517
IR	0.206**	0.121

Note: *** - 1% significant; ** - 5% significant; * - 10%

Our research shows that CPI, unemployment, and population play an important role in boosting Australia's economic growth. Therefore, when a country designates relevant economic policies, it should fully consider these relevant factors that affect the stable growth of the country's economy.

4. CONCLUSION

Most countries attach great importance to sustained and stable economic growth. Because a sustained and steady growth of the economy has a profound impact on a country's overall national strength. In other words, if a country's economy is in a long-term sustained and stable growth, then the country's comprehensive strength must be very strong. Therefore, it is particularly important to study the influencing factors of national economic growth.

This paper studies the factors that affect Australia's GDP growth through multivariate analysis and econometric regression models. Our findings have important implications for economic policy reform in Australia. Compared with previous studies, the influencing factors studied here are more comprehensive and diverse, establishing that economic growth is significantly affected by various factors. According to the analysis of the regression results, it is suggested that the rulers should maintain the stability of GS, CPI, UNEMP, POP and IR by implementing appropriate monetary means or corresponding policies. This is because these factors directly affect a country's level of economic growth. For example, citizens are encouraged to increase their savings appropriately to cope with the impact of force majeure factors such as unknown epidemics and wars on national life.

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