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Research Article

The impact of Macroeconomic Variables on Economic Growth of Pakistan

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Abstract:
The influence of macroeconomic variables on the growth of Pakistan's economy is investigated in this study by considering GDP as the representative of Economic Growth. In addition, Government Expenditure, Household Consumption, Inflation, Investment, and Net Export are selected to represent the macroeconomic variables from 1991 to 2020. To understand the behavior of study variables, descriptive statistics have been analyzed. The results of descriptive statistics indicate that the independent variables (Household consumption, Investment, Government expenditure, Inflation, and Net export) are meant to influence the economic growth (Dependent Variables) in Pakistan. To know the stationarity of time series data, the model ADF has been used. The results of ADF showed that independent and dependent variables were non-stationarity at level except inflation, but as the 1st difference has been taken then all the variables became stationarity. The test of Johansen Cointegration has been performed to check the integrating equation in the given model and six co-integrated equations were found. Further to prove or disprove the hypotheses the technique of OLS (Ordinary Least Square) has been performed. The results of OLS showed that Govt. Expenditure, Household Consumption, and Net export have a positive and significant influence on Economic Growth. The significant but negative influence of Inflation on Economic Growth was found. Further, the influence of investment on economic growth is positive and significant at 10%. By seeing these results, this study has concluded that there is a significant influence of macroeconomic variables on the economic growth of Pakistan.

Keywords: Economic Growth (EG), Government Expenditure (GE), Household Consumption (HC), Inflation (INF), Investment (INV), and Net Export (NX).

1. Introduction

If any country has stable and strong Economic Growth (EG), it leads to improving the quality of life as well as earnings, and also it decreases the unemployment level in countries that are underdeveloped (Hasan & Ali, 2019; Oudat, & Ali, 2020). Due to many EG benefits, this subject is focused on heavy literature (Koyuncu, & Unver, 2020; Croes; Ridderstaat, Bąk, &Zientara, 2021). The main objective of macroeconomic policy is EG and on the other hand, GDP is considered the most important factor of EG (Semuel, & Nurina, 2014). When the population is less than Per capita GDP, then it can be

concluded that people's living standard is increasing in that particular country. Various variables have a huge impact on GDP such as Government Expenditure (GE), Household Consumption (HC), Inflation (INF), Investment (INV), and Net Export (NX), etc, (Jakob, 2016); (Kibria et al., 2014); (Tapsin, & Hepsag, 2014); (Mamo, 2012); (Anaripour, 2011). INF has a lot of implications in an economy, and most of the countries are trying to maintain a low level of INF so that high EG is sustained (Ayyoub, Chaudhry, & Farooq, 2011). In the condition of INF, the prices of services and goods are increased; which creates difficulties in the economy of that country. It deteriorates the money value and purchasing power of money and EG as well. The higher the prices of goods and services (INF) means the higher the rates of interest and rates of interest are opposite to GDP. It means the increase of interest rates decreases the EG and vice versa (Kibria et al., 2014).
EG can be increased with the help of export, but the volatility of the exchange rate can decrease it as it decreases the trade. GE, HC, INV, and NE are also the primary factor of EG. It is observed that so many macroeconomic variables impact on the EG of a country. But the magnitude and direction of that impact may be different depends upon the particular economy. This research attempts to know the influence of GE, HC, INF, INV, and NX on the EG of Pakistan.

2. Literature Review

The study was conducted on the dynamic causal relations between EG and GE. This study was conducted for the South African economy and found that in the short and long run, both variables are causally related to each other (Odhiambo, 2015). A study was conducted to know the causal relationship between GE and EG in Nigeria and found that there is no causal relationship between GE and EG (Ajayi & Aluko, 2016). The co-relation between GE and EG was investigated between 1995 and 2014 in Eastern European countries. The results showed the long-term integration between the variables in all countries (Lupu and Asandului, 2017). The study examined oil-producing countries to investigate the relationship among GE, the revenue of nonoil, and EG from 1981 to 2015. The results showed the negative effects of GE on EG in both the short and long run (Olayungbo and Olayemi, 2018).

The research was conducted on the topic “the relationship between EG, fixed investment, and HC” in Malaysia. The positive impact of HC and foreign direct investment on GDP was found (Abdul Karim et al., 2010). Tapsin and Hepsag studied the GDP and HC on the EA-18 countries' data from 2000 to 2012. In this study, a positive correlation was found between GDP and HC (Tapsin, & Hepsag, 2014).

The Pakistan economy was investigated from 1980 to 2013. In this study, the impact of the exchange rate, interest rate, foreign direct investment (FDI), and INF on GDP growth was investigated. The results showed that INF, interest rate, the exchange rate is negatively and significantly co-related with GDP, while Foreign Direct Investment is positively and significantly co-related with GDP (Kibria et al., 2014). The study regarding the effects of INF on Nigeria’s EG was conducted in 2020. The significantly negative impact of INF on EG has been found (Adaramola & Dada, 2020). The inflationary trend has been examined to determine its impact on the GDP of Nigeria. In this study, the negative impact was concluded of the current inflationary trend on sustainable growth (Idris & Bakar 2017). Another study was conducted on the economy of Ghana from 1980 to 2010 to check the influence of interest and INF on GDP. In this study strong positive relationship among interest rate, INF and GDP were found (Agalega, & Antwi, 2013).

The research was carried out from 2000 to 2019 to evaluate the trade output in Liberia. In this study, macroeconomic variables are used to check the effects on EG. A positive relationship was found between export, FDI, population, and EG (Dukuly, & Huang, 2020). The correlation between GDP,

export, and INV was examined in Iran from 1991 to 2008 and the results showed the significant positive impact of INV and export on GDP (Mofrad, 2012).

From the above discussion on related literature, it can be understood that the study of macroeconomic variables and EG has received enormous attention. But, no research can be taken as conclusive in defining this relationship. So, there are ample opportunities to explore this relationship comprehensively. This study aims to acquire this opportunity by studying the impact of macroeconomic variables on EG in Pakistan.

3. Research Methodology

In this study, the technique of time series has been used. In starting descriptive statistics has been conducted then ADF (Augmented Dicky Fuller) test has been conducted to see the stationarity of data. Based on the results of ADF, the Johansen cointegration technique has been used to know the long-run cointegration between independent variables (GE, HC, INF, INV, and NE) and dependent variables (EG). To check the long-run impact the Ordinary Least Square (OLS) has been used.

3.1 Data

Time-series data based on years was used from 1991-2020 in this study, to investigate the co-relations between explanatory variable (EG) and independent variables (GE, HC, INF, INV, and NE). Data of GDP were taken at market price (mp) on current factor cost as a representative of EG. Data of HC were taken at current prices. Data of gross domestic fixed capital formation at current prices were taken as data of INV because investment and gross domestic fixed capital formation are treated as synonyms. Data of GE were taken at current prices, Data of INF were taken at consumer price indices at national, and data of NX were taken from the statement of the balance of payment. The data of above all variables were obtained from the economic survey of Pakistan.

3.2 Descriptive Statistics

In this study, the effects of GE, HC, INF, INV, and NE on EG in Pakistan were investigated. To understand the behavior of study variables, the descriptive statistics have been analyzed in table 1. Which shows the Mean, Median, Maximum, Minimum, Std. Dev., Skewness, Kurtosis, Jarque-Bera results.

3.3 Augmented Dickey and Fuller Model (ADF Model)

There are so many macroeconomic variables of time-series data that are non-stationary variables such as money consumption, income, trade-in real-life and price, etc. Phillips conducted a research study in (1986). In this study, he treated the non-stationarity data with OLS. Approximately deceptive results were obtained to achieve economic analysis through OLS. Various confusions and problems can be created by the model such as bogus regression along with high R squared, significant F-statistics, approximately unity, and t (Newbold- Granger, 1974). If the difference has not been found in the stationary series then it will be incorporated as order zero (0) stationary at level. If after differences the data becomes in series and stationary then it will be incorporated as order one (1). The ADF model has been given by Dickey and Fuller "1979-1981". The test that is performed in this study in the ADF model is mostly performed in the economic literature to examine and evaluate the stationary data of time series. Based on the Monte-Carlo (M-C model) model, the ADF model has been formed. In the M-C model, the time series unit root has been calculated under the null hypotheses and the critical value of $t\delta$ it is called (tau) τ statistic have been calculated in 2 steps: in the first step, the ADF unit root test applies OLS to make the calculation based on the following equations as well as to accumulate the normal value of $t\delta$.

$$\Delta X_t = \delta X_{t-1} + \sum_{j=1}^{q} \gamma_j \Delta X_{t-j} + \in_{1t}$$

$$\Delta X_t = \alpha + \delta X_{t-1} + \sum_{j=1}^{q} \gamma_j \Delta X_{t-j} + \in_{2t}$$

$$\Delta X_t = \alpha + \beta t_1 + \delta X_{t-1} + \sum_{j=1}^{q} \gamma_j \Delta X_{t-j} + \in_{3t}$$

Where

$$\Delta X_t = X_t - X_{t-1}$$

In the second step, the unit root existence is determined based on the hypotheses below:

H_0: d = (0) non-stationary if tδ≥ τ step

H_a: d < 0 for stationary if tδ < τ

Where tδ signifies t statistics of d and τ (tau) are critical values tabulated by Dickey and Fuller in 1979.

Table 2 shows the results of the ADF test of all variables. This ADF test is performed separately on each variable.

3.4 Johansen Cointegration Test

In time-series data, the long-run relationship should be tested between the variables when the data series is non-stationary. To check the long-run relationship so many cointegration techniques have been proposed by the econometricians. Johansen (1988, 1991) and Johansen and Juselius (1990) cointegration are used when the data is integrated in the same order. In this study, all the data is integrated on order one therefore Johansen Cointegration Test (1988, 1991) is used.

The Johansen Cointegration technique is relied upon the null hypothesis i.e., "H0: there is no cointegrating equation." Though the null hypothesis can be rejected if the Probability value is greater than 5%, as well as if the probability value is less than 5% then the null hypothesis can be accepted. (Table 3).

3.5 Ordinary Least Squares Method (OLS)

The simple OLS technique has been used to analyze the data in long run (Table 4). OLS is a technique in the model of linear regression, which is always used in finding the unknown parameters. The method OLS has been used in the reduction of the sum of the squared vertical distance between the observed response and the predicted response in linear proximity in the given dataset. When the regressor is on the right-hand side then estimators can be shown by a simple formula. If there is no perfect multi co-linearity in the exogenous regressor then OLS will be reliable to be used. Errors are serially not correlated homoscedastic with the class of linear unbiased estimators. In that situation, the method OLS is providing very low variance which will be considered as unbiased estimation in the error containing limited variance situation. OLS has been a greater estimating factor for further assumptions to normally distribute the error. Wide implications of OLS have been found in so many science branches especially in econometrics, control theory, signal processing, and political science.

So many frameworks are designed to make the OLS technique useful. In these frameworks, linear regression models are used. Through these all settings, the same formulas and results can be generated. On the other hand, the variance can occur in assumptions and interpretations that must be correctly used for a significant result. The valid framework has been selected according to the availability of data and based on interference the performing task will be decided. Whereas interpreting the mainline for differentiation either the regressor is treated as constant or as a random variable. In the study of the experiment, the initial stage is a random design in which regressor x_i is random and sample along with the Y_i's from the total population, that perspective permit for more study of the estimator's asymptotic property. In the fixed design, which is the second interpretation the X regressor is called constant by design, and y is conditionally sampled with so many X values. For practical objectives, this is the most insignificant distinction. Therefore, estimations and inference is done through the conditioning on *X*. In this research study all defined results are within the framework of random design.

3.6 Model

$$\mathbf{EG = \beta_0 + \beta_1 GE + \beta_2 HC + \beta_3 INF + \beta_4 INV + \beta_5 NX + \mu_t}$$

The above model indicates the impact of Government Expenditure, Household Consumption, Inflation, Investment, and net exports on Economic growth. In this model, Economic growth is the dependent variable, and Government Expenditure, Household Consumption, Inflation, Investment, and Net Export are explanatory variables.

Where,
EG = Economic growth
GE = Government Expenditure
HC = Household Consumption
INF = Inflation
INV = Investment
NX = Net Export
β_0 = Intercept
μ_t = Error Term

3.7 Hypotheses

After the evaluation of the literature, the following hypotheses have been formed.

H_1: There is a positive impact of GE on EG

There are so many studies found regarding the GE on EG which showed the general results that if the GE increases so that EG will also increase (Chirwa & Odhiambo 2019); (Williams & Abere 2019); (Bagdıgen & Beser 2012); (Odhiambo, 2015).

H_2: There is a positive impact of HC on EG

The research was conducted in Malaysia on the topic “the relationship between EG, fixed investment, and HC”. In this study, it was found the positive impact of HC and FDI on GDP (Abdul Karim et al., 2010). Tapsin and Hepsag studied the GDP and HC on the EA-18 countries' data from 2000 to 2012. In this study, a positive correlation was found between GDP and HC (Tapsin, & Hepsag, 2014).

H_3: There is a negative impact of INF on EG

The research was conducted from 1972-73 to 2009-10 to check the correlation between INF and the EG of Pakistan. It was concluded INF and EG have a significant and negative relationship with each

other (Ayyoub, Chaudhry, and Farooq in 2011). The research was carried in Nigeria from 1970 to 2005. The results showed that INF is not cointegrated with EG (Chimobi, 2010). The study was conducted on the secondary data of 1969 to 2009 in 13 Sub-Saharan African Countries. The results showed a significant and negative correlation of INF with EG (Mamo, 2012). Further, the significant and negative correlation of INF with EG was founded by (Adaramola & Dada 2020); (Idris & Bakar 2017); (Agalega, & Antwi, 2013).

H_4: There is a positive impact of INV on EG

The Pakistan economy was investigated from 1980 to 2013. In this study, the impact of the exchange rate, interest rate, foreign direct investment (FDI), and INF on GDP growth was investigated. The results showed that INF, interest rate, the exchange rate is negatively and significantly co-related with GDP, while Foreign Direct Investment is positively and significantly co-related with GDP (Kibria et al., 2014). The research study was conducted in Malaysia on the topic "the relationship between EG, fixed investment, and HC". In this study, a positive impact was found of household consumption and FDI on GDP (Abdul Karim et al., 2010).

H_5: There is a positive impact of NX on EG

The research on the correlation between GDP, export, and INV was conducted in Iran from1991 from 2008. The results showed a significant and positive correlation between INV, export, and GDP growth (Mofrad, 2012). Many studies have declared positive results regarding the influence of NX on EG, e.g. (Dukuly & Huang 2020); (Okyere & Jilu 2020); (Bakari & Krit 2017).

4. Estimation of Data and Empirical Results

In this research E-views (9.2) software has been used to accomplish econometric analysis. To assess the overall model fitness in econometric analysis has been used. If R^2 is near to (1) it means the model is fit or it confirms more fitness of the model. If the R^2 value is near to (0) it suggests that the model does not fit. It confirms the weak co-relation among the variables. F and T Statistic test is used to know the model significance. To reject the H_0, the value of P is measured with the critical value of 0.05. If the value of P is above 0.05 then the null hypotheses cannot be rejected but if the value of P is below 0.05 then null hypotheses cannot be rejected.

Table 1

Descriptive Statistics

In this table, descriptive statistics of all variables have been conducted. Column 1 shows the descriptive variables. Column 2 to 7 shows the descriptive results of the variables.

Variables	LOGGDP	LOGGE	LOGHC	LOGINF	LOGINV	LOGNX
Mean	15.810	13.575	15.546	2.011	13.958	13.627
Median	15.765	13.382	15.493	2.111	14.091	13.729
Maximum	17.542	15.486	17.310	2.834	15.556	15.030
Minimum	13.835	11.888	13.455	1.050	12.087	11.837

Std. Dev.	1.169	1.163	1.217	0.505	1.094	0.989
Skewness	-0.078	0.170	-0.089	-0.448	-0.094	-0.244
Kurtosis	1.690	1.583	1.695	1.932	1.648	1.746
Jarque-Bera	2.174	2.652	2.167	2.433	2.328	2.263
Probability	0.337	0.265	0.338	0.296	0.312	0.322
Sum	474.321	407.269	466.405	60.359	418.768	408.830
Sum Sq. Dev.	39.679	39.286	42.995	7.404	34.722	28.415
Observations	30	30	30	30	30	30

Table 1 show that the values of mean and median are not too away from each other. This indicates that the variables are standard to analyze. The values of the standard deviation of each variable rapidly move forward towards normal distribution. Further, the statistics of skewness, Kurtosis, and Standard deviation showed the differences among the variables are not too significant. The results of Jarque-Bera show that data of all variables are normally distributed. The descriptive statistics indicate that the independent variables (GE, HC, INF, INV, and NX) are meant to influence the dependent variable (EG) in Pakistan over the period 1991 to 2020 can be significant after being normalized.

Table 2
ADF Unit Root Test

In this table, the ADF unit root test has been performed. Column 1 shows the names of the variables, Columns 2 and 3 shows ADF intercept results at Level and 1st difference whereas Columns 5 and 6 show the results of ADF intercept and trend performed at Level and 1st difference.

	Intercept		**Intercept and Trend**	
Variable	**Level**	**1st difference**	**Level**	**1st difference**
LOGGDP	-1.722	-4.363	-0.607	-4.580
	(0.409)	(0.001)	(0.970)	(0.005)
LOGGE	0.528	-5.353	-2.523	-4.709
	(0.984)	(0.000)	(0.314)	(0.000)
LOGHC	-1.889	-4.099	-0.734	-4.349
	(0.332)	(0.003)	(0.960)	(0.009)
LOGINF	-3.812	-4.760	-3.623	-4.749
	(0.008)	(0.000)	(0.048)	(0.003)
LOGINV	-1.155	-4.680	-1.957	-4.634
	(0.679)	(0.000)	(0.599)	(0.004)
LOGNX	-1.722	-4.427	-1.373	-4.510
	(0.409)	(0.001)	(0.847)	(0.006)

The above-calculated ADF values at “Intercept” and “Intercept and Trend” are greater than the critical values at five percentage significant levels except for inflation because inflation seemed to be

stationary at level or order zero (0). Therefore, H_o cannot be rejected. It shows that the unit root problem has been faced by all variables except inflation.

After taking 1st difference with the constant plus trend the above-calculated ADF values are less than the critical values at five percentages significant level. Therefore, H_o can be rejected. It shows that the unit root problem has not been faced by the variables and all the variables are integrated at the order I (1).

Table 1 showed that all variables (GE, HC, INF, INV, and NX, and GDP) are significant and stationarity at first differences. Therefore, it can be preceded by Johansen co-integration.

Table 3

Johansen Cointegration Test

In this table, Johansen Cointegration has been performed. Column 1 shows that how many equations are cointegrated "Number of Cointegrating Equations". Number 2 Column shows the Eigenvalue, Number 3 Column shows the Trace statistic, Column 4 shows the Critical value (5%) and Column 5 shows the probability.

No. of CE(s)	Eigenvalue	Trace Statistic	Critical - V (5%)	Prob.**
None *	0.894	167.150	95.753	0.000
At most 1 *	0.818	104.246	69.818	0.000
At most 2 *	0.546	56.404	47.856	0.006
At most 3 *	0.466	34.290	29.797	0.014
At most 4 *	0.330	16.701	15.494	0.032
At most 5 *	0.177	5.484	3.841	0.019

Trace test indicates 6 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

The results show that 6 equations are cointegrated. The null hypothesis stating the no cointegrated equations is rejected because the Probability value is less than 5%; on the other hand, an alternative hypothesis of the cointegrating equation is accepted. The results of Table 3 show the long-run relationship between GE, HC, INF, INV, and NX and GDP in Pakistan is valid.

Table 4

Ordinary Least Square (OLS)

The Following table column first shows the variables, column second shows the coefficient of each variable separately, column third shows the standard error possibility of each variable separately, the fourth column shows the values of t-statistic and the fifth and last column shows the probability values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGGE	0.104	0.024	4.259	0.000
LOGHC	0.723	0.050	14.343	0.000
LOGINF	-0.030	0.007	-4.208	0.000
LOGINV	0.049	0.026	1.885	0.071
LOGNX	0.112	0.034	3.240	0.003
C	0.980	0.052	18.532	0.000

R-squared	0.999	Mean dependent variable	15.810
Adjusted R-squared	0.999	S.D. dependent variable	1.169
S.E. of regression	0.015	Akaike info criterion	-5.293
Sum squared resid	0.005	Schwarz criterion	-5.013
Log-likelihood	85.407	Hannan-Quinn criteria.	-5.204
F-statistic	32202.15	Durbin-Watson stat	2.042
Prob(F-statistic)	0.000		

In the above table, the OLS method is used to know the long-run correlation between the GDP and other explanatory variables. The positive and significant impact of GE on the GDP was found. If GE increases by one unit, then the GDP also increases by 0.104 units. The Positive link between GE and the GDP is verified by (Chirwa & Odhiambo 2019); (Williams & Abere 2019); (Odhiambo, 2015); (Bagdıgen & Beser 2012).

There is also a positive and significant impact of HC on GDP. If HC increases by one unit, then the GDP also increases by 0.723 units. The positive link between HC and GDP is verified by (Tapsin, & Hepsag, 2014); (Abdul Karim et al., 2010).

The negative and significant impact of INF on GDP was found. If INF increases by one unit, then the GDP also increases by -0.030 units. The negative link between INF and GDP is verified by (Adaramola & Dada 2020); (Idris & Bakar 2017); (Agalega, & Antwi, 2013); (Mamo, 2012); (Ayyoub, Chaudhry and Farooq in 2011); (Chimobi, 2010).

A positive but significant impact of INV on GDP was found at the level of 10%. If INV increases by one unit, then the GDP also increases by 0.049 units. The positive link between INV and GDP is verified by (Kibria et al., 2014); (Abdul Karim et al., 2010).

There is also a positive and significant impact of NX on GDP. If NX increases by one unit, then the GDP also increases by 0.112 units. The positive link between NX and GDP is verified by (Dukuly & Huang 2020); (Okyere & Jilu 2020); (Bakari & Krit 2017); (Mofrad, 2012).

R^2 is used to know the model's overall fitness and the results showed that out of total variation the number of explained variations independent variable is 99%.

5.0 Conclusion and Policy Implication

This research examined the impact of GE, HC, INF, INV, and NX on EG. To understand the behavior of study variables, descriptive statistics have been analyzed. The descriptive statistics indicate that the

independent variables (GE, HC, INF, INV, and NX) are meant to influence the dependent variable (EG) in Pakistan over the period 1991 to 2020 can be significant after being normalized. The ADF is used to check the stationarity of data. The ADF model concluded that all the variables were non-stationarity at level except inflation, but as the 1st difference has been taken then all the variables became stationarity. The Johansen Cointegration test has been used to check the integrating equation in the given model and six co-integrated equations were found. Further to prove or disprove the hypotheses the Ordinary Least Square (OLS) technique has been used. The results of OLS showed the positive and significant impact of GE, HC, and NX on EG were found. The negative and significant impact of INF on EG was found. Further, the impact of INV on EG is positive and significant at 10%.

Pakistan is included in developing countries; it needs to enhance its Expenditure, Household consumption, Net export, and Investment so that economic growth must be boosted. On the other hand, Pakistan needs to control Inflation to boost Economic growth because inflation harms Economic Growth.

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